

TRAINING, EXAMINATION, AND ASSESMENT PROGRAMME (TEAP) PART – B
FOR
MERCHANT SHIPPING (STANDARDS OF TRAINING, CERTIFICATION AND
WATCHKEEPING FOR SEAFARERS) RULES, 2014



DIRECTORATE GENERAL OF SHIPPING
MUMBAI

TRAINING, EXAMINATION & ASSESSMENT PROGRAMME

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“TRAINING COURSE FOR TRAINERS AND ASSESSORS”

1.0 COURSE AIM AND OBJECTIVES

Maritime lecturers chosen for the conduct of Certificate of Competency and modular courses will be fully qualified in the subject matter of the courses which they are going to teach. They may however be less familiar with training techniques and the effective conduct of training courses.

Each certificate of competency and modular course package contains some advice to the lecturer in the form of references and guidelines which will assist in the conduct of the course. In addition, the guidelines on the implementation of IMO Model Courses provide valuable references of lectures and presentations and general course conduct. Nevertheless, it is considered necessary to offer a full course for maritime lecturers and assessors, which would not only review current training techniques but also actually provide experience of course management and training techniques to lecturers. While it is specifically concerned with those skills which are required for efficient implementation of the IMO model courses it is believed to be of general benefit for the conduct of other courses as well.

Participants successfully completing the training course for trainers and assessors should be capable of understanding the processes and objectives of learning and training and have a sound comprehension of assessing participants and course evaluation.

They should be fully capable of undertaking lecturers' responsibilities within their field of substantive qualifications, and conduct courses effectively.

This course also fulfils the requirements of the 2010 amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW2010), Regulation I/6 Training and Assessment and Section A-I/6 of the STCW Code and partial requirements of Regulation I/8, Quality Standards and Section A-I/8 of the STCW Code.

2.0 COURSE PARTICIPANTS

The participants for this course would be marine and academic personnel working as lecturers in maritime education and training institutions and assessors. The number of participants would be restricted to 16 per course as there are a number of practical exercises to be conducted, both on an individual basis and in small working groups.

3.0 COURSE LECTURERS

The lecturers for this course are experienced Master Mariners, Marine Engineers, Shipping Managers and other experts in the field of education and training who have experience in shipping industry, training, assessment and communication skills.

4.0 COURSE CERTIFICATE

At the end of the course, participants would be required to make a final presentation and they will be assessed. Those who successfully complete the course, including the final presentation, would be issued with a course certificate.

Participants, who are unable to successfully complete the course, would be recalled for assessment and for repeating their individual presentation, after a certain interval of time say at least one month, during this period the participant shall be expected to enhance his skills of presentation.

5.0 COURSE DURATION

The duration of the course is two weeks (12 working days).

6.0 COURSE MATERIAL

The course material consists of:

- Compendium for IMO Model Course 6.09, Training Course for Instructors.
- Guidance on the implementation of IMO Model Courses.

In addition, the course lecturers are expected to issue further handouts.

The course participants are required to have access to a number of publications on the subject and the IMO Model Courses, which should be available in the institute.

7.0 COURSE CONTENTS

.1	Introduction
.2	Elements of a Training Package
.3	Development of a Learning System
.4	Development of an Instructional Strategy
.5	Review of Instructional Aids
.6	Review of Teaching Methods
.7	Lecture-cum-Presentation by Participants
.8	Conducting Group discussions/Case Studies/Exercises/Role Plays
.9	Workshop/Laboratory Practices
.10	Computer Applications to Training
.11	Simulators for Training and Assessment
.12	Training Effectiveness/Assessment
.13	Evaluation of Learning Systems
.14	Planning and Conducting the Training Programme
.15	Final Presentation by Participants
.16	Evaluation of Course

8.0 COURSE PLAN

Day 1

(i)	Introduction : – To IMO – To course	40 mts. 20 mts.	} 1 hour
(ii)	Exercise - PILOT case - Preparation - Presentation/Discussion	1½ hours 1½ hours	} 3 hours
(iii)	Elements of a Training Package	1 hour	} 2 hours
(iv)	Development of a Learning system Training Need Analysis (Nine phases of training development - preliminary analysis-job analysis population analysis)	1 hour	

Day 2

(i)	Development of a Learning System	} 2 hours
(ii)	Design of curriculum Design of Modules Production of materials	
(iii)	Validation and Revision Implementation Evaluation	
(iv)	Exercises	4 hours

Day 3

(i)	Development of an Instructional strategy	} 1 hour
(ii)	Define Instructional Aids Instructional Methods Instructional Strategy Relates various learning methods to trainee participation and involvement.	
(iii)	Preparation of training materials Preparation of handouts Preparation for lecture	} 1½ hours
(iv)	Exercises (on course materials & strategy)	3 ½ hours

Day 4

(i)	Communication skills & Speaking skills, Imparting skills	} 2 hours

(ii)	Exercises (on presentation/speaking skills)	4 hours

Day 5

(i)	Review of Instructional aids Advantages and disadvantages of - – Chalk boards/derivatives – O.H. transparencies – Film strips/slides (with/without audio) – Films/videos – Computers – Factors affecting choice of media	1 hour
(ii)	Computer Aided Training & Application of computer for development of training material	2 hours
(iii)	Exercises	3 hours

Day 6

(i)	Review of teaching methods – describes passive/active interactive methods, class-room configurations	1 hour
(ii)	Reading hand-outs – Lectures – Demonstration/lab/workshop/field work – Group work – Case studies, projects/exercises – Role plays/simulation games	2 hours
(iii)	Exercises (on use of case studies, role plays, simulations)	3 hours

Day 7

(i)	Lecture presentation by participants (15 minutes each) (16 x 15 = 240 minutes) followed by - Comments by Listeners (16 x 7 minutes = 112 minutes) (say 2 hours)	4 hours 2 hours

Day 8

(i)	Conducting group discussion, Conducting meetings Conducting Case Studies/Exercises, Preparation of case studies, Simulation game/Role plays	1 hour
(ii)	Workshop/laboratory practices	1 hour
(iii)	Simulators for Training and Assessment	1 hour
(iv)	Exercises :	3 hours

	Developing a case study conducting group discussion/case study	

Day 9

(i)	Training Effectiveness – Define training effectiveness – Explain performance criteria for training effectiveness – Define training efficiency – Compare the effectiveness of passive/active/interactive teaching methods.	1 hour
(ii)	Evaluation of a Learning System (Partially covered under course design) – Assessment of participants – Evaluation of the course – Evaluation of the training strategy – Evaluation of Trainers Details of Evaluation/Assessment – Define assessment of participant – Describe the purpose of Assessment – Describe subjective/objective Assessment – Principles and Technique of Assessment – Consideration of circumstances for choice of assessment – Design an assessment plan and construct objective questions for assessment. Define evaluation of course * on line evaluations * terminal evaluations Purpose of Evaluation Principles and Techniques of Evaluation Modify Courses Post Course Evaluations Evaluation of Faculty/Training Strategy Criteria for Judgement How to modify	2 hours
(iii)	Exercises	3 hours

Day 10

(i)	Planning and Conducting the course	}	1 hour
(ii)	Prepare a comprehensive list of required actions - (A check list including approvals, venue, participants, faculty, evaluation)		
(iii)	Time Management of the Course scheduling/sequencing of topics Management skills for the course - film on time management	}	1 hour
(iv)	Films	}	4 hours
(v)	Exercises : Planning & organising an international seminar/basic courses		

Day 11

(i)	Preparations by participants for presentations	3 hours
(ii)	Presentations	3 hours

Day 12

(i)	Presentations & evaluations	}	3 hours
(ii)	Evaluation of course		
(iii)	Distribution of certificate	}	1 hour
(iv)	Course break-up		
	TOTAL		70 Hours

“TRAINING FOR INSTRUCTORS”

1.0 AIMS & OBJECTIVES

The instructors imparting training in Maritime Institutions will be fully conversant and qualified in their respective fields. However, it has been observed that their pedagogic skills are to be updated in order to enable them to acquire the current training techniques.

Participants successfully completing this training course “Training for Instructors” should be capable of ascertaining the training objectives and conducting the training, evaluation and assessment conforming to the specific training needs.

This course fulfils the requirements of the 2010 amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW-2010), Regulation I/6, Training and Assessment and Section A-I/6 of the STCW Code to the level applicable and partial requirements of Regulation I/8, Quality Standards and Section A-I/8 of the STCW Code.

2.0 COURSE PARTICIPANTS

The participants for this course would be Instructors imparting training and/or conducting evaluation/assessment in the field of Maritime Education and Training who possess adequate qualifications and experience in their respective fields. Marine personnel with adequate qualification and experience who aspire to be instructors would also be required to undergo this training programme.

The number of participants would be restricted to 20 per course as there will be a series of practical exercises to be conducted, both on individual basis & in small working groups.

3.0 COURSE LECTURERS

The lecturers for this course are experienced Master Mariners, Marine Engineers and Shipping Managers who have experience in shipping industry, training, communication skills and assessment.

4.0 CONDUCT OF THE COURSE

The course is a mix of lectures, self study, individual exercises/presentations & group work.

5.0 COURSE CERTIFICATE :

At the end of the course, participants would be required to make a final presentation/ demonstration. The assessment is based on the class performance and final presentation/ performance. Those who successfully complete the course, including the final presentation, would be issued with a course certificate. Participants who are unable to successfully complete the course, would be recalled for assessment for repeating their individual presentation, after a certain interval of time say at least one month, during this period the participant shall be expected to enhance his skills of presentation.

6.0 COURSE DURATION

5 days.

7.0 COURSE CONTENTS

- 7.1 Introduction to IMO and the Course
- 7.2 Elements of Training Package
- 7.3 Training need Analysis and Developing a Learning System
- 7.4 Developing Instructional Strategy
- 7.5 Skills in Lecturing, Demonstrating and Communication
- 7.6 Individual/Group work
- 7.7 Discipline (on-board & classroom), counselling, housekeeping, safety and hygiene
- 7.8 Training Effectiveness, Assessment and Evaluation
- 7.9 Planning and Organising Training
- 7.10 Demonstration by Trainee-trainers

8.0 COURSE PLAN

Each institution shall develop course plan based on course contents.

“TRAINING FOR WORKSHOP INSTRUCTORS (MARINE ENGINEERING)”**1.0 AIMS & OBJECTIVES**

Instructors in Marine Workshops and Institutions are fully conversant and qualified in their respective fields. However, it has been observed that their pedagogic skills are to be updated in order to enable them to acquire the current training techniques.

Participants successfully completing this training course “Training for Workshop Instructors” should be capable of ascertaining the training objectives and conducting the workshop training, evaluation of workshop training including assessment of trainees.

This course fulfils are requirements of the 2010 amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW-2010), Regulation I/6 Training and Assessment and Section A-I/6 of the STCW Code to the level applicable and partial requirements of Regulation I/8, Quality Standards and Section A-I/8 of the STCW Code.

2.0 COURSE PARTICIPANTS

The participants for this course would be workshop instructors from Marine Engineering Workshops/Laboratories and /or institutions imparting workshop training, who possess adequate qualifications and experience in their respective fields. Marine personnel with adequate qualification and experience who aspire to be Workshop Instructors would also be required to undergo this training programme.

The number of participants would be restricted to 20 per course as there will be a series of practical exercises to be conducted, both on individual basis and in small working groups.

3.0 COURSE LECTURERS

The lecturers for this course are experienced Marine Engineers and Maritime Lecturers who have experience in shipping industry, workshop training, communication skills and assessment.

4.0 CONDUCT OF THE COURSE

The course is a mix of lectures, self study individual exercises/presentations and group work.

5.0 COURSE CERTIFICATE

At the end of the course, participants would be required to make a final presentation when they will be assessed. Those who successfully complete the course, including the final presentation, would be issued with a course certificate. Participants who are unable to successfully complete the course, would be recalled for assessment for repeating their individual presentation, after a certain interval of time say at least one month, during this period the participant shall be expected to enhance his skills of presentation.

6.0 COURSE DURATION

5 days

7.0 COURSE CONTENTS

7.1	Introduction to IMO and the Course
7.2	Elements of Training Package
7.3	Training need Analysis and Developing a Learning System
7.4	Developing Instructional Strategy
7.5	Skills in Lecturing, Demonstrating and Communication
7.6	Individual/Group Work
7.7	Workshop Discipline, Housekeeping, Safety and Hygiene
7.8	Training Effectiveness, Evaluation and Assessment
7.9	Planning and Organising Training
7.10	Review of Syllabi of Marine Engineering
7.11	Demonstration by Trainee-Trainers

8.0 COURSE PLAN

Each institution shall develop course plan based on course contents.

**UPGRADATION TRAINING COURSE (STCW 2010) FOR DECK OFFICERS, CHIEF MATES AND
MASTERS (FG AND NCV) HOLDING STCW 1995 COCS**

PART A: THEORETICAL TRAINING- OPERATIONAL LEVEL

Duration: 5 working days

Contact hours: 35 hours

NO.	TOPIC	FACULTY	DURATION
1.	Standards of Training, Certification and Watchkeeping (STCW) 78 as amended in 2010 (specimen presentation attached as Annex 1)	Master Mariner / Chief Engineer / Expert in this field	2 hours
2.	a) Overview of recent amendments to SOLAS (last five years and expected in near future) b) Amendments to Merchant Shipping (MS) Act 1958 (last five years and expected in near future) and outline of Rules framed thereunder	Master Mariner / Chief Engineer / Expert in this field	1 hour 1 hour
3.	Amendments to SOLAS- Chapter V (Safety of Navigation) including Long Range Identification and Tracking (LRIT), Ship's Routeing- Ship Reporting Systems, Vessel Traffic Services (VTS) procedures. Blind Pilotage Techniques, Bridge Navigation Watch Alarm System (BNWAS) and Ship's Manning. Dangers of over reliance on GPS and satellite derived positions.	Master Mariner / Expert in this field	2 hours
4	International Aeronautical and Maritime Search and Rescue (IAMSAR)	Master Mariner / Coast Guard Officer / Expert in this field	2 hours
5.	Amendments to Ship Security Officer (SSO) course - Piracy and Armed Robbery Gulf of Aden- Patrolling by Naval ships	Master Mariner / Indian Naval Officer/ Expert in this field	2 hours
6.	Additions to Personal Safety and Social Responsibility (PSSR) Course (a) Pollution (b) Communication (c) Fatigue	Master Mariner / Chief Engineer / Expert in this field	3 hours

7.	Bridge Resource Management (BRM): Knowledge of bridge resource management principles including allocation, assignment, prioritization of resources, effective communication, assertiveness, leadership and obtaining and maintaining situational awareness.	Master Mariner / Expert in this field	6 hours
8.	Inspection, reporting and assessment of reported defects and damages to cargo spaces, hatch covers, and ballast tanks and take appropriate action.	Master Mariner / Chief Engineer / Naval Architect expert in this field	3 hours
9.	Refresher Training in Medical First Aid as per MLC requirements	Approved Medical Practitioner	3 hours
10.	a) Recent Amendments to MARPOL, proactive measures to protect the marine environment	Master Mariner / Chief Engineer / Expert in this field	2 hours
11.	Leadership and Team-working skills: Working knowledge of shipboard personnel management and training; Knowledge of related international maritime conventions and recommendations, and national legislation; Ability to apply task and workload management including planning and co-ordination, personnel assignment, time and resource constraints, prioritization; Knowledge and ability to apply effective resource management including allocation, assignment, and prioritization of resources, effective communication onboard and ashore, decisions reflect consideration of team experiences, assertiveness and leadership, including motivation, and obtaining and maintaining situational awareness; Knowledge and ability to apply decision-making techniques including situation and risk assessment, identify and consider generated options, selecting course of action and evaluation of outcome effectiveness.	Expert in this field	6 hours
TOTAL			33 hours

	Assessment for operational level personnel	Assessor	2 hours

PART B: THEORETICAL TRAINING- MANAGEMENT LEVEL – PHASE I**Duration:** 3 working days**Contact hours:** 21 hours

1.	Amendments to SOLAS Chapter IX and ISM Code Exercises and case studies related to Risk Assessment.	Master Mariner / Chief Engineer / Expert in this field	2 hours
2.	International Maritime Solid Bulk Cargoes (IMSBC) Code	Master Mariner / Expert in this field	2 hours
3.	Dangerous Goods (IMDG Code)	Master Mariner / Expert in this field	3 hours
4.	Cargo Securing Manual, Container code, Use of stability and trim diagrams, stress calculation equipment including automatic data based (ADB) equipment.	Master Mariner / Expert in this field	3 hours
5.	Leadership and Managerial skills: Knowledge of shipboard personnel management and training; Knowledge of related international maritime conventions and recommendations, and national legislation; Ability to apply task and workload management, including planning and co-ordination, personnel assignment, time and resource constraints, and prioritization; Knowledge and ability to apply effective resource management including allocation, assignment, and prioritization of resources, effective communication on board and ashore, decisions reflect consideration of team experiences, assertiveness and leadership, including motivation, obtaining and maintaining situation awareness; Knowledge and ability to apply decision-making techniques including situation and risk assessment, identify and generate options, selecting course of action, evaluation of outcome effectiveness; Development, implementation, and	Faculty Members having appropriate background	9 hours

	oversight of standard operating procedures		
		Total	19 hours

	Assessment for management level-phase I personnel	Assessor	2 hours

PART B: THEORETICAL TRAINING- MANAGEMENT LEVEL – PHASE II

Duration: 3 working days

Contact hours: 21 hours

1.	Emergency Towing Arrangement.	Master Mariner / Expert in this field	1 hour
2.	Intact Stability Code 2008, Wind and Weather Heeling criteria, Synchronous and Parametric rolling and precautions.	Master Mariner / Naval Architect / Expert in this field	2 hours
3.	Wreck removal convention	Master Mariner / Expert in this field	1 hour
4.	Recycling Convention	Master Mariner / Chief Engineer / Expert in this field	1 hour
5.	Carriage of Goods by Sea - Rotterdam Rules	Master Mariner / Expert in this field	2 hours
6.	Annex VI, Low Sulphur fuel, Volatile Organic Compounds, Green House Gases, Chlorofluorocarbon (CFC), Carbon Credits, and Climate Change	Chief Engineer / Expert in this field	2 hours
7.	Refresher Training in Medical Care as per MLC requirements	Approved Medical Practitioner	3 hours
8.	Casualty Investigation Code	Master Mariner / Chief Engineer / Expert in this field	1 hour
9.	Maritime Labour Convention (MLC) – 2006 (Documentary evidence of having undergone the training as required under MLC 2006)	Master Mariner / Expert in this field	6 hours
		Total	19 hours

	Assessment for management level phase II personnel	Assessor	2 hours

PART C - PRACTICAL TRAINING (Applicable to operational as well as management level personnel holding STCW 1995 CoC in the Deck department)

a	ECDIS (See Note 1)	DGS approved Training Course	5 days (40 hours)	As per IMO Model Course No. 1.27 revised
b	Refresher Training in Personal Survival Techniques and Proficiency in Survival Crafts and Rescue Boats	Practical Training at DGS approved institute for PSCRB Course	1 day (6 hours)	Identified items under STCW 2010
c	Refresher Training in Fire Prevention and Fire Fighting and Advanced Fire Fighting	Practical Training at DGS approved institute for AFF Course	1 day (6 hours)	Identified items under STCW 2010

Note:

- 1) Training and assessment in the use of ECDIS is not required for those who serve exclusively on ships not fitted with ECDIS. This limitation shall be reflected in the certificate of competency.
- 2) Officers who have not undergone Ship Security Officer (SSO) training are required to undergo approved training course for Seafarers with Designated Security Duties in accordance with Regulation VI/6-2 latest by 31st Dec 2013.

Specimen

Annexure- III

Institute's
LOGO

NAME and ADDRESS of the D.G. Approved Training Institution

INDoS No:

Tel:

Fax:

E-Mail:

Certificate No: _____

THIS IS TO CERTIFY THAT *[full name of candidate]*

Date of Birth

Holder of C.D.C. No.

Passport No.

Certificate of Competency, Grade No.

Indian National Database of Seafarers (INDoS) No.

has successfully completed:

**REFRESHER & UPDATING TRAINING (UPGRADATION COURSE) FOR
DECK OFFICERS (OPERATIONAL LEVEL, MANAGEMENT LEVEL Phase I and Phase II
)***

held from to at this institute

The course is approved by the Directorate General of Shipping and meets the requirements laid down in: STCW'2010 Regulation I/11 Paras 4 & 5 and STCW Code Section A-I/11 Para 2 (Details overleaf).

This certificate is issued under the authority of the Directorate General of Shipping, Ministry of Shipping, Government of India.

Signature of Candidate

Name and Signature of Course Incharge

Date of Issue : _____

Colour Photograph
(35 mm X 35 mm)

Official
Seal

Name and Signature of Dean/Principal

* Delete whichever is not applicable

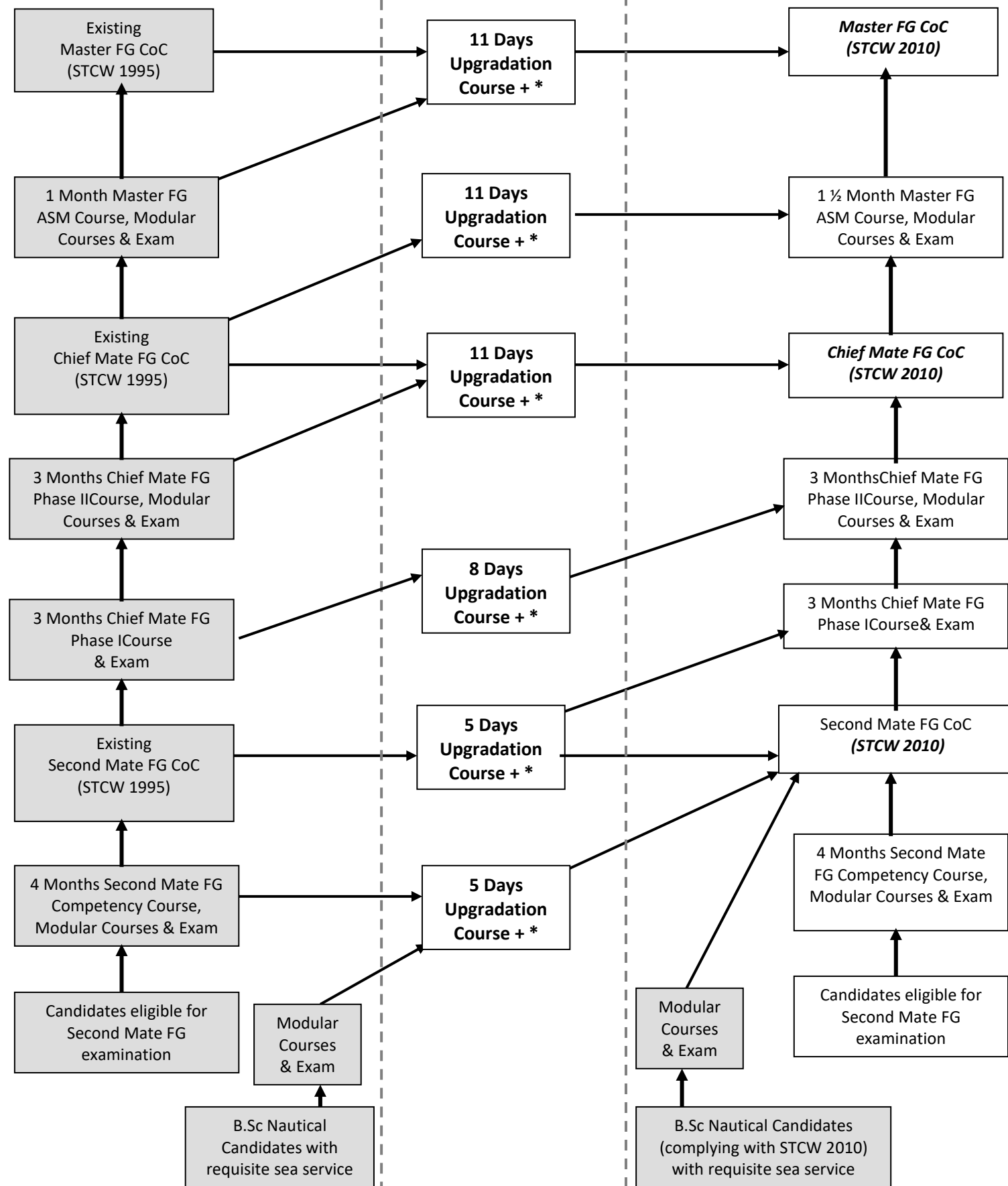
Operational Level
1. Changes in Personal Safety and Social Responsibilities Course 2. STCW 2010 3. Blind Pilotage Techniques 4. Ship Reporting Systems 5. VTS Procedures 6. Bridge Resource Management 7. Leadership and Team-working Skills 8. IAMSAR 9. Proactive measures to protect the marine environment 10. Amendments to SOLAS and MARPOL 11. Piracy and Armed Robbery 12. Refresher Training in Medical First Aid as per MLC 2006 requirements
Management Level – Phase I
13. Risk Assessment 14. International Maritime Solid Bulk Cargoes (IMSBC) Code 15. Dangerous Goods (IMDG Code) 16. Cargo Securing Manual 17. Container code, 18. Use of stability and trim diagrams 19. Stress calculation equipment including automatic data based (ADB) equipment 20. Leadership and Managerial skills
Management Level – Phase II
21. Emergency Towing Arrangement. 22. Statical Stability Code 2008, Wind and Weather Heeling criteria, Synchronous and Parametric rolling and precautions. 23. Wreck removal convention, Recycling Convention 24. Annex VI to MARPOL 25. Carriage of Goods by Sea - Rotterdam Rules 26. Casualty Investigation Code 27. Refresher Training in Medical Care as per MLC requirements 28. Maritime Labour Convention (MLC) –

(*) In addition to the Upgradation course, candidates are required to undergo modules on refresher training for PST, PSCRB, FPFF and AFF. Candidates are also required to undergo Security Training for designated persons, or Ship Security Officer Course and ECDIS course where applicable.

Existing certification scheme under STCW 1995

TRANSITION

New certification scheme under STCW 2010



UPGRADATION COURSE FROM STCW 1995 TO STCW 2010

PART B: 36 hrs (5 Days) Management level for class II MEO & class I MEO

PART B : 36 hrs (5 Days)(Management level)			
13	Tribology in Marine Applications - Lubrication	Chief Engineer / Expert in the field	2
14	Current Status of Fuel Technology, current version of ISO 8217 fuel standards.	Chief Engineer	2
15	Propulsion plant and auxiliary machinery: Design features, operative mechanism & operation of machinery & associated auxiliary. Surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery. Functions and mechanism of automatic control for Main Engine & auxiliary machinery. Dual fuel diesel engines.	Chief Engineer	4
Sr. No.	TOPIC	FACULTY	DURATION (Hrs)
16	Advanced Technology in Shipbuilding Materials, developments in ship building, ship repair, yard practices and ship board requirements. Detection of machinery malfunction, location of faults and action to prevent damage, Inspection and adjustment of equipment, Non-destructive examination.	Chief Engineer	2
17	Instrumentation & Control Systems: Manage operation, maintenance, trouble shooting restoration of electrical, electronic and control & monitoring equipment to operating conditions - including PLC controls. High voltage system developments, Electrical propulsion etc. Design features & system configuration of automatic control equipments & safety devices for main & auxiliary machinery including hydraulic & pneumatic control equipments & Electrical motors. Planning maintenance & repair safely.	Expert in the field & Chief Engineer	6
18	Maritime Labour Convention (MLC) 2006	Master Mariner / Chief Engineer/ Expert in the field	3
19	Leadership & Managerial skills - Knowledge of shipboard personnel management and training. Stress & Fatigue management: Ability to apply task and workload management, including: planning and coordination, personnel assignment, time and resource constraints prioritization. Knowledge and ability to apply effective resource management: allocation, assignment, and prioritization of resources, effective communication on board and ashore, decisions reflect consideration of team experience, assertiveness and leadership, including motivation, obtaining and maintaining situation awareness. Risk Assessment and Management: Knowledge and ability to apply decision-making techniques: situation and risk assessment, identify and generate options, select course of action, evaluation of outcome effectiveness, development, implementation, and oversight of standard operating procedures. Risk assessment & Management during machinery o'haul can be	Expert in the field & Chief Engineer	9

	discussed.		
20	Certification and Surveys/Close up Surveys for all types of ships - Planning maintenance including statutory and class verifications.	Chief Engineer / Expert in the field	2
21	Case studies / PSC detention / Grounding etc	Chief Engineer	3
22	Evaluation, Assessment, Feedback, Documentation & Certification	Assessor	3
	Total No of hours:		76

In addition candidates are required to undertake a 2 days Refresher Training for Basic and Advanced Safety Courses with the requirements of the STCW 2010 amendments every five years.

Officers are also required to undertake "Security Training for Designated Persons" if they have not undergone SSO Course.

REFRESHER & UPDATING TRAINING (UPGRADATION COURSE) FOR BASIC SAFETY TRAINING

1. BASIC SAFETY TRAINING

1.1 Personal Survival Techniques ----- 2 Hrs

1.2 Fire Prevention & Fire Fighting ----- 3 Hrs

1.1 Personal Survival Techniques (PST)

1.1.1 Survive at sea in the event of ship abandonment:

1.1.1 Don and use an immersion suit

1.1.2 Safely jump from a height into the water (while wearing a lifejacket)

1.1.3 Right an inverted life raft while wearing a lifejacket

1.1.4 Swim while wearing a lifejacket

1.1.5 Keep afloat without a lifejacket

1.2 Fire Prevention and Fire Fighting (FPFF)

1.2.1 Fight and extinguish fires:

1.2.2 Use various types of portable fire extinguisher

1.2.3 Extinguish smaller fires, e.g., electrical fires, oil fires, propane fires

1.2.4 Extinguish extensive fires with water, using jet and spray nozzles

1.2.5 Extinguish fires with foam, powder or any other suitable chemical agent

1.2.6 Enter and pass through, with lifeline but without breathing apparatus, a compartment into which high-expansion foam has been injected

1.2.7 Fight fire in smoke-filled enclosed spaces wearing self-contained breathing apparatus

1.2.8 Extinguish fire with water or any other suitable fire-fighting agent in an accommodation room or simulated engine-room with fire and heavy smoke

1.2.9 Extinguish oil fire with fog applicator and spray nozzles, dry chemical powder or foam applicators

1.2.10 Effect a rescue in a smoke-filled space wearing breathing apparatus

1.2.11 Augmentation of Fire Prevention & Fire Fighting Course (FPFF) (Tanker Fire Fighting Competencies)

a) Specification of minimum standard of competence in basic training for oil and chemical tanker cargo operations

Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence
Carry out fire-fighting operations	Tanker fire response organization and action to be taken Fire hazards associated with cargo handling and	Practical exercises and instruction conducted under approved and truly realistic training conditions (e.g.,	Initial actions and follow-up actions on becoming aware of fire on board conform with established practices and procedures

	transportation of hazardous and noxious liquids in bulk Fire-fighting agents used to extinguish oil and chemical fires Fixed fire-fighting foam system operations Portable fire-fighting foam operations Fixed dry chemical system operations Spill containment in relation to fire-fighting operations	simulated shipboard conditions) and, whenever possible and practicable, in darkness	Action taken on identifying muster signal is appropriate to the indicated emergency and complies with established procedures Clothing and equipment are appropriate to the nature of the fire-fighting operations The timing and sequence of individual actions are appropriate to the prevailing circumstances and conditions Extinguishment of fire is achieved using appropriate procedures, techniques and fire-fighting agents

b) Specification of minimum standard of competence in basic training for liquefied gas tanker cargo operations

Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence
Carry out fire-fighting operations	Tanker fire organization and action to be taken Special hazards associated with cargo handling and transportation of liquefied gases in bulk Fire-fighting agents used to extinguish gas fires Fixed fire-fighting foam system operations Portable fire-fighting foam operations Fixed dry chemical system operations Basic knowledge of spill containment in relation to fire-fighting operations	Practical exercises and instruction conducted under approved and truly realistic training conditions (e.g. simulated shipboard conditions) and, whenever possible and practicable, in darkness	Initial actions and follow-up actions on becoming aware of an emergency conform with established practices and procedures Action taken on identifying muster signals is appropriate to the indicated emergency and complies with established procedures Clothing and equipment are appropriate to the nature of the fire-fighting operations The timing and sequence of individual actions are appropriate to the prevailing circumstances and conditions Extinguishment of fire is achieved using appropriate

REFRESHER & UPDATING TRAINING (UPGRADATION COURSE) FOR ADVANCED SAFETY TRAINING

2. ADVANCED

2.1 Proficiency in Survival Techniques & Rescue Boat-----	4.5 Hrs
2.2 Advanced Fire Fighting -----	4 Hrs
2.3 Medical First Aid -----	3 Hrs
2.4 Medical Care-----	3 Hrs
1.5 Refresher Training in PSCRB including PST -----	6 Hrs'
1.6 Refresher Training in Advanced fire fighting, including FPFF-	7 Hrs.

1.1 Proficiency in Survival Craft and Rescue Boat other than Fast Rescue Boats (PSCRB)

1.1.1 Take charge of a survival craft or rescue boat during and after launch:

- 1.1.1.1 Right an inverted liferaft while wearing a lifejacket
- 1.1.1.2 Operated off-load and on-load release devices
- 1.1.1.3 Proper resetting of both off-load and on-load release devices

(using: inflatable liferaft and open or enclosed lifeboat with inboard engine)

1.1.2 Operate a survival craft engine:

- 1.1.2.1 Ability to start and operate an inboard engine fitted in an open or enclosed lifeboat

1.1.3 Use locating devices, including communication and signaling apparatus and pyrotechnics:

- 1.1.3.1 Use signaling equipment, including pyrotechnics

1.2 Advanced Fire Fighting (AFF)

1.2.1 Control fire-fighting operations aboard ships:

- 1.2.1.1 Use of water for fire-extinguishing, the effect on ship stability, precautions and corrective procedures
- 1.2.1.2 Fire fighting involving dangerous goods

1.2.2 Organise and train fire parties:

- 1.2.2.1 Preparation of contingency plans
- 1.2.2.2 Composition and allocation of personnel to fire parties
- 1.2.2.3 Strategies and tactics for control of fires in various parts of the ship

(Practical exercises and instruction conducted under approved and truly realistic training conditions, e.g., simulated shipboard conditions)

1.2.3 Inspect and service fire-detection and fire-extinguishing systems and equipment:

1.2.3.1 Fire-detection systems; fixed fire-extinguishing systems; portable and mobile fire-extinguishing equipment, including appliances, pumps and rescue, salvage, life-support, personal protective and communication equipment

1.2.3.2 Requirements for statutory and classification surveys

(Practical exercises, using approved equipment and systems in a realistic training environment)

1.2.4 Investigate and compile reports on incidents involving fire:

1.2.4.1 Assessment of cause of incidents involving fire

(Practical exercises in a realistic training environment)

1.3 Medical First Aid:

1.3.1 Dressing Wounds, Care of Cuts, wounds, burns and scalds.

1.3.2 Temporary immobilization in case of fractures/dislocations.

1.3.3 Treatment and care in case of eye injury.

1.3.4 Immediate care in case of accidents involving Dangerous Goods.

1.4 Medical Care:

1.4.1 Cardio Pulmonary resuscitation (CPR)

1.4.2 Handling of Oxygen cylinders and Apparatus

1.4.3 Intravenous and Intra-muscular injections.

1.4.4 Make use of Medical advice by Radio or satellite communication and to participate effectively in co-ordinated schemes for medical assistance at sea.

1.5 REFRESHER TRAINING IN PSCRB INCLUDING PST		
Sr.No	Areas to be Covered	Time in Min.
1.	Survive at sea in the event of ship abandonment	
	i. Don and use an immersion suit	20
	ii. Safely jump from a height into the water	20
	iii. Right an inverted liferaft while wearing a lifejacket	40
	iv. Swim while wearing a lifejacket	20
	v. Keep afloat without a lifejacket	20
2.	Take charge of a survival craft or rescue boat during and after launch.	
	i. Operated off-load and on-load release devices	120
	ii. Proper resetting of both off-load and on-load release devices	
3.	Operate a survival craft engine	
	i. Ability to start and operate an inboard engine fitted in an open or enclosed lifeboat	60
4.	Use locating devices, including communication and signalling apparatus and pyrotechnics	
	i. Use signalling equipment, including pyrotechnics	60
	TOTAL	360 min
		(06 Hrs)

1.6 REFRESHER TRAINING IN ADVANCED FIRE FIGHTING, INCLUDING FPFF

Sr.No	Areas to be covered	Time in Min.
1.	Fight and Extinguish Fire:	
	i. Use various types of portable fire extinguishers	40
	ii. Extinguish smaller fires e.g. electrical fires, oil fires, propane fires.	
	iii. Extinguish fires with water, using jet and spray nozzles.	30
	iv. Extinguish fires with foam, powder or any other suitable chemical agent.	
	v. Enter and pass through, with lifeline but without breathing apparatus, a compartment into which high expansion foam has been injected.	10
	vi. Fight fire in smoke filled enclosed spaces wearing SCBA	30
	Vii Extinguish fire with water or any other suitable fire fighting agent in an accommodation or simulated engine room with fire and heavy smoke.	20
	Viii. Extinguish oil fire with fog applicator and spray nozzles, dry chemical powder or foam applicator	30
	ix. Effect rescue in a smoke filled space wearing breathing apparatus	20
2.	Control fire fighting operations aboard ships:	
	i. Use of water for fire extinguishing, the effect on ship's stability, precautions and corrective measures	30
	ii. Fire fighting involving dangerous goods	15
3.	Organize and train the fire parties	
	i. Preparation of contingency plans	10
	ii. Composition and allocation of personnel to fire parties	10
	iii. Strategies and tactics for control of fires in various parts of ship	15
4.	Inspect and service fire detection and fire extinguishing systems and equipments	
	i. Fire detection system, fixed fire extinguishing systems, portable and mobile fire extinguishing equipment, including appliances, pumps and rescue, salvage, life support, personal protective and communication equipment.	80
	ii. Requirements for statutory and classification surveys(practical exercises using approved equipment and systems in a realistic training environment)	20
5.	Investigate and compile reports on incidents involving fire	
	i. Assessment of cases of incidents involving fire(practical exercises in a realistic training environment)	60
	TOTAL	420 min. (07 Hrs)



NAME and ADDRESS of the D.G. Approved Training Institution

INDOS No:

Tel:

Fax:

E-Mail:

Certificate No: _____

THIS IS TO CERTIFY THAT *[full name of candidate]*

Date of Birth

Holder of C.D.C. No.

Passport No.

Indian National Data base (INDOS No.)

has successfully completed "REFRESHER TRAINING" approved by the Directorate General of Shipping as per the requirement laid down in Paragraphs 5 and 6 of Section A-VI/3 & in Paragraphs 3 and 4.2 of Section A-VI/1 of the STCW Code, as amended in 2010, in

ADVANCED FIRE FIGHTING & FIRE PREVENTION AND FIRE FIGHTING

held on and has provided evidence of having maintained the required standard of competence, to undertake the tasks, duties and responsibilities listed in column 1 of table A-VI/3 & A-VI/1-2 of STCW Code, as amended in 2010.

This certificate is issued under the authority of the Directorate General of Shipping, Ministry of Shipping, Government of India.

Signature of Candidate

Name and Signature of Course Incharge

Date of Issue : _____

Date of Expiry: _____ *[Five years from the date of issue]*

Colour Photograph
(35 mm X 35 mm)



Name and Signature of Dean/Principal



NAME and ADDRESS of the D.G. Approved Training Institution

INDOS No:

Tel:

Fax:

E-Mail:

Certificate No: _____

THIS IS TO CERTIFY THAT *[full name of candidate]*

Date of Birth

Holder of C.D.C. No.

Passport No.

Indian National Data base (INDOS No.)

has successfully completed “REFRESHER TRAINING” approved by the Directorate General of Shipping as per the requirement laid down in Paragraphs 5 and 6 of Section A-VI/2 & Paragraphs 3 and 4.1 of Section A-VI/1 of the STCW Code, as amended in 2010, in

**PROFICIENCY IN SURVIVAL CRAFT AND RESCUE BOAT OTHER
THAN FAST RESCUE BOATS & PERSONAL SURVIVAL
TECHNIQUES**

held on and has provided evidence of having maintained the required standard of competence, to undertake the tasks, duties and responsibilities listed in column 1 of table A-VI/2-1 & A-VI/1-1 of STCW Code, as amended in 2010.

This certificate is issued under the authority of the Directorate General of Shipping, Ministry of Shipping, Government of India.

Signature of Candidate

Name and Signature of Course Incharge

Date of Issue : _____

Date of Expiry: _____ *[Five years from the date of issue]*

Colour Photograph
(35 mm X 35 mm)

Name and Signature of Dean/Principal

Official
Seal

Additional TRAINING AND CERTIFICATION REQUIREMENTS UNDER STCW 2010 AND MLC 2006 * [COOKS NEED A CERTIFICATE under MLC] * Rev. 05.03.2015

Annex - I

Type of Training	(1) Refresher Training in Medical First Aid, if Certificate more than 5 years old	(2) Refresher Training in Medical Care, if Certificate more than 5 years old	(3) Familiarisation Training in Maritime Labour Convention (MLC), 2006	(4) Upgradation Training for Ship Security Officer (SSO), for holders of STCW/95 SSO Certificates	(5) Security Training for Seafarers with Designated Security Duties (STSDSD)	(6) Upgradation of PSSR, for those holding STCW/95 PSSR Certificates	(7) Upgradation Course (STCW/95 to STCW 2010) for COC	(8) DGS Approved ECDIS Course	(9) Refresher Training in Personal Survival Techniques (PST), if > 5 years old	(10) Refresher Training in Proficiency in Survival Crafts & Rescue Boats (PSCRB) including PST, if > 5 years old	(11) Refresher Training in Fire Prevention and Fire Fighting (FPFF), if > 5 years old	(12) Refresher Training in Advanced Fire Fighting including FPFF, if > 5 years old
Duration	3 hours	6 Hours	6 Hours	3 Hours	9.5 Hours (1.5 days)	3 Hours	72 Hours (11 days)	40 Hours (5 days)	3 Hours (Half Day)	6 Hours (Full Day)	3 Hours (Half Day)	7 Hours (Full Day)
Compliance Date	20 th Aug. 2013	20 th Aug. 2013	20 th Aug. 2013	31 st Dec. 2013	31 st Dec. 2013	31 st Dec. 2016	31 st Dec. 2016	31 st Dec. 2016	31 st Dec. 2016	31 st Dec. 2016	31 st Dec. 2016	31 st Dec. 2016
Master FG / NCV	NO	YES	YES	YES	NO, if complying with (4)	YES	YES, then (2) to (6) NOT required	YES	NO	YES	NO	YES
Chief Mate FG / NCV	NO	YES	YES	YES	NO, if complying with (4)	YES	YES, then (2) to (6) NOT required	YES	NO	YES	NO	YES
Second Mate FG / NWKO NCV	YES	NO	NO	YES	If complying with (4) then NO, otherwise YES	YES	YES, then (1) to (6) NOT required	YES	NO	YES	NO	YES
MEO Class I	YES	NO	NO	YES, if holding SSO Certificate	If complying with (4) then NO, otherwise YES	YES	YES, then (1) to (3) & (6) NOT required	NO	NO	YES	NO	YES
MEO Class II / MEO Class III CEO / SEO	YES	NO	NO	YES, if holding SSO Certificate	If complying with (4) then NO, otherwise YES	YES	YES, then (1) to (3) & (6) NOT required	NO	NO	YES	NO	YES
MEO Class IV	YES	NO	NO	YES, if holding SSO Certificate	If complying with (4) then NO, otherwise YES	YES	YES, then (1) to (3) & (6) NOT required	NO	NO	YES	NO	YES
Electrical Officer / ETO	YES	NO	NO	YES, if holding SSO Certificate	If complying with (4) then NO, otherwise YES	YES	Bridging Course of 3 weeks, if wanting to obtain ETO COC	NO	NO	YES	NO	YES
Deck Ratings	NO	NO	NO	NO	YES	NO	NO	NO	YES, only if not holding PSCRB	YES, if holding PSCRB Certificate	YES	NO
All other Ratings	NO	NO	NO	NO	YES	NO	NO	NO	YES	NO	YES	NO
Trainees	NO	NO	NO	NO	YES	NO	NO	NO	YES	NO	YES	NO

Ref. Training Circular no.17 of 2013 dated 12/8/2013.

These courses (Addition to Medical Care & Addition to Medical First Aid) are included in “Upgradation and Revalidation course from STCW 1995 to 2010 “ for Masters, Officers and Engineers. Those who have attended above course will get their Medical Care and Medical first Aid certificates endorsed accordingly.

Those who have not attended above course need to complete the Module on Additions to Medical Care Course as per Syllabus given below

Addition to Medical Care Course as per MLC 2006

Duration 3 Hours

- A) Cardio Pulmonary resuscitation (CPR)
- B) Intravenous and Intra-muscular injections.
- C) Make use of Medical advice by Radio or satellite communication and to participate effectively in co-ordinate schemes for medical assistance at sea.

Addition to Medical First Aid as per MLC 2006

(Duration of 3 Hours)

- A) Dressing wounds, Care of cuts, wounds, burns and scalds.
- B) Temporary immobilization in case of fractures / dislocations.
- C) Treatment and care in case of eye injury
- D) Immediate care in case of accidents involving dangerous Goods.

Ref. Training Circular no.19 of 2013 dated 11/10/2013.

This course is included in “Upgradation and Revalidation course from STCW 1995 to 2010 “for Masters, Officers. Those who have attended above course will get their SSO certificates endorsed accordingly.

Those who have not attended above course need to complete the Module on “Robbery and Anti Piracy” from any DG Shipping approved Institute conducting training for SSO course.

Revalidation and Up-gradation of Certificates(Including Refresher Training for Tankers)

Requirements:

In addition to successful completion of revalidation course, candidate is required to fulfill any of the following criteria:

A-1

"Approved seagoing service" of One year; performing functions appropriate to the certificate held, in the five years preceding the date of application for revalidation.

A-2

Service [other than sea service (Ref. to Para 4.2)] in marine related industry as equivalent to sea service, in the five years preceding the date of application for revalidation.

A-3

Pass (orals) examination for revalidation,

A-4

Successful completion of an approved course [Preparatory course + simulator course (for the Grade of CoC for which revalidation is sought)]

A-5)

3 months of "Approved seagoing service" performing functions appropriate to the certificate held in Supernumerary Capacity. (Dispensation needs to be obtained in case CoC is not valid)

A-6

3 months of "Approved seagoing service" in one rank lower to which the Certificate is held (Dispensation need to be obtained in case CoC is not valid).

Procedure for Assessment:

Case A-1 above:

In five years preceding the date of application for revalidation. [Approved One year seagoing service]

This has to be undertaken before expiry of their CoC.

Case A-2 above:

In five years preceding the date of application for revalidation. [Service (other than sea service) in marine related industry as equivalent to sea service] This has to be available on the date of application for revalidation.

In preceding five years on the date of Application for revalidation, the following service will be considered as equivalent to sea service.

Maritime Surveyors

Full time technical surveyors for a period of at least Two Years with a maritime administration or with an organization recognized by the Indian maritime administration and engaged in work related to survey, inspection / certification of ships, examination of candidates for Certificate of Competency.

[Independent/individual surveyors, non-exclusive surveyors, undertaking/part-time, survey/inspection are not covered in this category]

2 Lecturers -

(a) Full time Lecturers for a period of at least Two years at a DG approved training institute who have been teaching revalidation courses/Preparatory Courses continuously for a period of two years at management level i.e. MEO Class-II and MEO Class-I. Non-Government Institute Lecturer's must have DG/MMD faculty approval to teach the above courses in their institutes. [Institute should have conducted these courses during the period and mere approval to conduct the course will not be acceptable]

(b) Full time Lecturers for a period of at least Three Years at a DG approved training institute who have been teaching Pre Sea Four Year Course / One Year Pre-Sea Graduate Entry course/ Certificate of Competence revalidation courses at operational level / preparatory courses at operational level. Non-Government Institute Lecturer's must have DG/MMD faculty approval to teach the above courses in their institutes. [Institute should have conducted these courses during the period and mere approval to conduct the course will not be acceptable]

.3 Superintendents

Full Time Technical Superintendents / Designated Persons (ISM Code) for a period of at least Three Years with companies who are responsible for the technical operation of vessels of more than 750 KW for MEO-CI-II / IV and of vessels more than 3000 KW for MEO-CI-I.

[Service in the Marine field not listed above to be put up to the Chief Examiner of Engineers for his consideration on a case-to-case basis. The applicant in his own interest must justify, why his past service (i.e. service rendered in the preceding five years) can be considered as equivalent to the aforesaid options]

Case A-3 above:

[Pass (orals) examination for revalidation]

This can be undertaken before or after expiry of their CoC.

The candidates can appear for a viva voce at the respective examination centers, provided they have completed the prescribed refresher and updating course (4 days) followed by a revalidation course for (10 days) prior to application. Courses attended more than 12 months before applying for the revalidation will not be acceptable.

The candidate opting for orals to be charged for the oral fees as mentioned in META manual Vol I (or as amended from time to time) for the particular grade. The 'Form 15' should be used for applying for orals. The result should be suitably endorsed in the form and DGS final register by the examiner and should be forwarded to the Directorate along with recommendations for upgradation if any. All other documents e.g. Form 1, 2 and 37 BC etc should accompany the DGS final register. The orals shall in general be mainly composed of matters relating to safety consisting functions MEP, SSEP and recent technical / legal developments in the field of Marine Engineering as commensurate with the grade of revalidation sought. The examiner approved for the particular grade will conduct the orals

Case A-4 above:

Attend an approved course [Preparatory course + simulator course (for the Grade of CoC)] This has to be undertaken after expiry of their CoC.

The candidates can attend an approved course [Preparatory course + simulator course (for the Grade of CoC)] and complete it successfully, provided they have completed the prescribed refresher and updating course (4 days) followed by a revalidation course for (10 days) prior to application. Courses attended more than 12 months before applying for the revalidation will not be acceptable.

Case A-5 above:

[3 months of "Approved seagoing service" in Supernumerary Capacity performing functions appropriate to the certificate held (On dispensation after expiry of CoC)] This has to be undertaken after expiry of their CoC.

The candidates can complete their required sea time on coastal vessels of more than 750 KW for MEO-CI-II / IV ; and of vessels more than 3000 KW for MEO-CI-I, serving in Supernumerary rank (Same rank as CoC held), provided they have completed the prescribed refresher and updating course (4 days) followed by a revalidation course for (10 days) prior to this sailing.

The candidates, who have opted for sailing in Supernumerary capacity performing functions appropriate to the certificate held, will have to take special permission from the Directorate and will need to forward the employer's letter showing willingness to employ them onboard. The fees as applicable for dispensation (DGS fee structure) should be paid in form of draft drawn in favor of "Directorate General of Shipping, Mumbai". The fees will have to be paid at the time of Dispensation application. The application is to be made by the company to DGS, along with application of candidate.

Following documents will need to be submitted at the time of special permission

- i) Accommodation availability (Accommodation Plan)
- ii) Approved LSA capacity.
- iii) Details of Number of Persons on board.

Following documents will need to be submitted at the time of special permission

- i) Sign On / Sign off Documents at the time of Application for Revalidation.

Case A-6 above:

[3 months of "Approved seagoing service" in one rank lower to which the certificate is held. (On dispensation after expiry of CoC)] This has to be undertaken after expiry of their CoC.

The candidates can complete their required sea time on coastal vessels of more than 750 KW for MEO-CI-II / IV ; and of vessels more than 3000 KW for MEO-CI-I, serving in lower rank (included in MSMD) than the certificate is held, provided they have completed the prescribed refresher and updating course (4 days) followed by a revalidation course for (10 days) prior to this sailing.

The candidates who have opted for sailing one rank lower (included in MSMD) than the CoC held, will have to take special permission from this Directorate and will have to forward the employer's letter showing willingness to employ them onboard. The fees as applicable for dispensation (DGS fee structure) should be paid in form of draft drawn in favor of "Directorate General of Shipping, Mumbai". The fees will have to be paid at the time of Dispensation application and the application is to be made by the company to DGS, along with application of candidate. (Such applications to be forwarded to the Directorate)

1 Cases of Part sea service or Part shore service or any other cases not covered above will be decided by the Chief Examiner of Engineers at the Directorate.

2 Service in the Marine field (in-case of A-2) not listed above to be put up to the Chief Examiner of Engineers for his consideration on a case-to-case basis.

Refresher training for tankers

Tanker endorsement, Level 1 (Operational level)

- 1 Officers holding tanker endorsement, level 1 (operational level) and has not served for at least three months on the appropriate type of tanker during the last five years, would be required to undertake appropriate refresher training in order to revalidate his/her endorsement. The appropriate refresher training would consist of repeating the tanker familiarisation course for the appropriate type of tanker (oil/chemical/liquefied gas).

Tanker endorsement, Level 2 (Management level)

- 2 A Master or officer who is a holder of a tanker endorsement, level 2 (management level) and has not served for at least three months on the appropriate type of tanker during the last five years, would be required to undertake appropriate refresher training in order to revalidate his/her endorsement. The appropriate refresher training would consist of the following;
 - Attending the second week of the appropriate specialised training programme on oil/chemical/liquefied gas tanker operations at an approved training institution conducting tanker courses;
 - Revising the course material and viewing the course films;
 - Attending lectures covering new developments in tanker safety and pollution prevention;
 - Participating in the discussion held at the end of the course and successfully completing the course test.

On successful completion of the test the institute would issue a letter stating that the candidate has completed the appropriate tanker refresher training in order to enable the candidate to submit the appropriate tanker endorsement for revalidation.

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	II/1C	1-year Diploma in Nautical Science (D.N.S.) Course	59
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II/14	II/14	6-month Pre-sea Education and Training Course for Deck / G.P. Ratings	254-313
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3-YEAR / 4-YEAR BACHELOR OF NAUTICAL SCIENCE / TECHNOLOGY DEGREE COURSE**ANNEXURE 1****CURRICULUM SHOULD INCLUDE THE FOLLOWING ACTIVITIES:**

A proper record of actual dates, times and duration spent on each of the following activities should be maintained, especially where the facility has been outsourced, and shown to the members of the academic council during inspections. When in doubt, crosschecking with the outsourced agency may be done.

1. PRACTICAL SEAMANSHIP**GENERAL**

Lectures 75 hrs; Practicals: 34 hrs; Total: 109 hours per year

Demonstrate and conduct practice on the use of various types of cordage, fibre and wire ropes used on ships.

Demonstrate and conduct practice on various types of whippings.

Demonstrate & conduct practice on various types of Knots, Bends & Hitches.

Demonstrate & conduct practice on types of splices on fibre and wire ropes.

Demonstrate the use of bulldog grips and bottlescrews/turnbuckles in joining wires.

& Explain the care & maintenance of fibre and wire ropes including uncoiling, coiling, stowing, etc.

Conduct practical exercises on the use of blocks, snatch blocks and the differential pulley (chain blocks).

Different types of tackles & purchases and the power gained in each case.

Conduct practical exercises on the maintenance of various types of blocks, tackles, shackles and bottle-screws/turnbuckles, including opening, greasing, etc.

Explain mooring arrangements. Explain the use of a mooring shackle.

Conduct practical exercises on throwing heaving lines, use of rope & chain stoppers, mooring shackle and handling of mooring ropes. Use of slip-ropes.

Explain Anchor Work. Explain the parts of a windlass.

Explain the following terms in connection with anchor work: Cable, Link, Swivel, Joining Shackle, Shackle as a term of length, Bitter End.

Parts of a stockless anchor.

Demonstrate the ability to use a sledgehammer.

Conduct practical exercises on opening a lug and a lugless shackle.

Explain the uses of an anchor, how it is dropped, hoisted and secured.

Demonstrate the ability to climb a ship's mast

Demonstrate ability in rope climbing.

Types of paints, painting procedures and defects

Conduct practical exercises on chipping and painting. Demonstrate all tools and gear available for the maintenance steel parts of a ship.

Explain the various cargo gear used. Explain SWL and Breaking Stress. Conduct simple exercises on cargo gear rigging.

Conduct practical exercises on rigging and climbing pilot ladders and Jacob's ladders. Maintenance of the same.

Demonstrate the use of the bosun's chair.

Demonstrate the use of overside staging for shipside maintenance.

Demonstrate the use of the safety belt and safety harness during the earlier two operations.

Explain the methods of dealing with an oil spill on deck.

Explain the plugging of scuppers during bunkering, loading and discharging of oil cargo.

Explain the use and construction of a cement box to stop leaks.

Explain Magnetic compass points.

Explain steering and helm orders.

2. BOATWORK

Lectures Nil; Practicals 40 hrs; Total 40 hours per year

Explain the necessity to muster and ensure that each member of the boat crew wears boiler suit, safety shoes, helmet & life jacket.

The importance of checking that life jackets are worn correctly.

Explain the purpose of gravity davits and other arrangements for launching a lifeboat.

Practice procedure for preparation and launching.

Demonstrate ability to take charge, muster the crew, check life jackets, allot duties and give instructions for launching. To ensure that all crew carryout their duties correctly.

Practice rowing with proper co-ordination.

Practice and then demonstrate the ability to pick up a buoy (representing a man overboard).

3. SHIP VISITS

Lectures Nil; Practicals 30 hrs; Total 30 hours per year

Practical familiarisation visits to merchant ships

4. WORKSHOP PRACTICALS -

Theory 75 hours Practical: 25 hrs Total 100 hrs per year

Carpentry workshop: Various types of tools and their uses e.g., nails, wood screws, screwdrivers, hammers (including claw, ball-pane, sledge, mallet), crowbars, saws, chisels, wood files, drills, vice, clamps, jack-planes, etc. Repairs to fibreglass surfaces such as boats, etc. Uses of various adhesives in joining of materials.

Plumbing workshop: Proper use of tools - spanners, wrenches, hacksaws, files, etc. The use of T-joints, bends and couplings in pipelines. Dismantling and joining various types of pipelines.

Repair of water taps. Types of pipes, pipelines, their sizes, joints, cutting of simple gaskets/packing for pipe flanges, treatment leaks, use of various sealants for stopping small leaks in pipelines, pipe clamps, cutting of threads in pipelines, clearing of choked water pipelines.

Machine workshop: Familiarisation with, and proper use of, various tools e.g., open spanners, ring

spanners, socket spanners, ratchet spanners, torsion spanners, Allen keys, screw drivers, files, hammers, chisels, punches, reamers, vice, taps and dies, etc. Special practice to be given on use of a sledgehammer. Types of nuts and bolts, studs; methods of freeing rusted nuts and bolts; proper use of the grinding machine, drilling machine (portable and mounted); use of coolants such as water, oil, etc., during drilling. Use of measuring devices - feeler gauges, callipers, screw gauges, etc. Overhauling of gate valves, butterfly valves and hydrants. The importance of lubricating oil and grease in reducing friction in machines.

Electrical workshop: Precautions when using electrical appliances; fuses and circuit breakers and their uses; danger of loose or improper connections; use of insulated hand tools, insulation tape, insulated footwear; danger of wet surfaces; proper connections (line, neutral and earth) in various joints. Types and specifications of electrical wire when making indentations for purchase. Theory & practical of soldering.

Hotwork workshop: Basic theory and practical experience of gas cutting, gas welding and electric arc welding. Gas heating to free rusted nuts and bolts. The proper precautions to be taken during each of these processes.

BASIC COMPUTER TRAINING

Lectures 75; Practicals 25 hrs; Total 100 hours in 2nd year only

The cadet should learn & demonstrate his proficiency in the operation of the following:

Introduction to Computers and Windows (7 hours):

Handling the Computer and peripherals

Booting

Keyboard layout and functions of different keys

Proper shut down

Windows Operating System

Desktop features

Managing files and folders

Opening files and folders

Finding files and folders

Renaming files and folders

Deleting files and folders

Handling of Windows

Help

Shutting down the computer

MS Word (5 hours)

MS Excel (5 hours)

MS Access (5 hours)

MS Power Point (5 hours)

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<http://www.dgshipping.gov.in/Content/viewNotice.aspx?noticeid=548> 07-01-2015

Proficiency in the above four programmes should include opening/ creating files/worksheets/databases/presentations, recording, editing, transferring, printing out, closing files, etc.

5. GENERAL

Parade training

Physical training

Rope climbing

Swimming

Athletics

Outdoor games such as football, volleyball, etc

Indoor games

Extra curricular activities to develop officer like qualities such as Debating, Dramatics, etc.

Educational trips to shipping related organizations such as IRS, NIO, Goa, NSDRC, VIZAG etc

FAMILIARISATION WITH SHIPBOARD EQUIPMENT

Instructional visits to GMDSS Simulator.

Instructional visits to Radar & ARPA Simulator.

ANNEXURE 2

F. Y. B.Sc. (NAUTICAL SCIENCES)

GRR NO	GRR NO	TITLE OF THE GROUP SUBJECT	DUR OF EXAM	PAS PERIODS FOR	MAX MARKS	MARKS	YEAR	TH. PR	TH. PR	TOTAL	TH. PR	TH. PR	TOTAL
I.		SCHOLASTIC GROUP											
1.		ENGLISH & COMMUNICATION SKILLS	3	3	75	25	100	30	10	75	25	100	
2		APPLIED MATHEMATICS PAPER- I	3		-	100	-	100	40	-	100	-	100
3		APPLIED MATHEMATICS PAPER – II	3		-	100	-	100	40	-	100	-	100
4.		NAUTICAL PHYSICS & ELECTRONICS PAPER- I	3		3	75	25	100	30	10	75	25	100
5.		NAUTICAL PHYSICS & ELECTRONICS PAPER- II	3		3	75	25	100	30	10	75	25	100
6.		CORE GROUP NAVIGATION PAPER I (A) PRINCIPLES OF NAVIGATION (30T) (B) PRACTICAL NAVIGATION (45 T+25P)	3		3	75	25	100	52	18	75	25	100
7.		VOYAGE PLANNING & COLLISION PAPER – I (A) VOYAGE PLANNING (25T+25P) (B) COLLISION PREVENTION (25T+25P)	3		3	50	50	100	35	35	50	50	100
8.		SHIP OPERATION TECHNOLOGY PAPER- I CARGO WORK & MARINE COMMUNICATION	3		3	75	25	100	45	15	75	25	100

S. Y. B. Sc. (NAUTICAL SCIENCES)

GRR NO	TITLE OF THE GROUP SUBJECT	DUR OF EXAM	PAS		PERIODS FOR		MAX MARKS		MARKS		YEAR	
			TH. PR	TH. PR	TOTAL	TH. PR	TH. PR	TOTAL	TH. PR	TH. PR	TOTAL	TOTAL
PAPER ? III (A)	CORE GROUP NAVIGATION											
	PRINCIPLES OF NAVIGATION (30 T) (B) PRACTICAL NAVIGATION (45 T+25 P)	3 3	75	25	100	30	10	75	25	120		
2	VOYAGE PLANNING & COLLISION PREVENTION PAPER ?- III (A) VOYAGE ' PLANNING (25 T + 25P) (B) COLLISION PREVENTION (25 T +25 P)	3 3	50	50	100	35	35	60	60	120		
3.	NAVIGATION PAPER ? IV	3 3	75	25	100	45	15	75	25	120		
4.	SHIP OPERATION TECHNOLOGY PAPER ? III (A) CARGO WORK (60 T) (B) MARINE COMMUNICATION (15 T+ 25P)	3 3	75	25	100	45	15	75	25	120		
5.	SHIP OPERATION TECHNOLOGY PAPER ? IV (A) SEAMANSHIP & WATCHKEEPING (60T + 25P) (B) MAINTENANCE (15T)	3 3	75	25	100	45	15	75	25	120		
6.	NAVAL ARCHITECTURE PAPER ? III (A) SHIP STABILITY (50 t) (B) SHIP CONSTRUCTION (50 T)	3 -	100	-	100	-	100	60	-	120		
2.	APPLIED GROUP											
7.	SHIPPING MANAGEMENT (A) MARINE MANAGEMENT (50 T) (B) MARITIME COMMERCE (50 T)	3 -	100	-	100	-	100	60	-	120		
8.	MARITIME LAW	3 -	100	-	100	-	100	60	-	120		
9.	ENVIRONMEN TAL SCIENCE PAPER ? III (A) METEOROLOG Y & OCEANOGRAP	3 75	25	100	30	10	75	25	120			

	HY (50 T + 25 P) (B) ENVIRONMEN TAL PROTECTION (25 T)											
10.	MARINE ENGINEERING & CONTROL SYSTEMS PAPER ? III	3	3	75	25	100	30	10	75	25	120	

ANNEXURE 3

Format of passing out certificate

Note: Available separately as a Degree issued by Universities.

ANNEXURE 4

List of equipment for laboratories & workshops.

Navigation laboratory equipment to include:

1. Layout of bridge with dummy instrument panels including steering wheel, Echo Sounder, etc.
2. Working GPS receiver
3. Steering Simulator
4. Sextant
5. Chronometer
6. Wet card magnetic compass in a binnacle
7. Dummy Gyro Compass with repeaters
8. Azimuth Circle
9. Binoculars (7 x 50)
10. Telescope
11. Some Indian and British Charts
12. Parallel Rulers
13. Set squares
14. Drawing compass and dividers
15. Aneroid barometer
16. Mason's hygrometer in a Stevenson's screen
17. Whirling Psychrometer
18. Glass-mounted or wall-mounted device for simulated Load-line and reading of the Draft
19. Beaufort scale wind and State of Sea Chart
20. International cloud atlas
21. Ship's Weather Code
22. A set of recent (not necessarily current) nautical publications carried on ships.
23. Various plans of ships as supplied by shipyards.
24. Ship's oil record book
25. Ship's garbage management plan and garbage record book.
26. Ship's ballast water management plan
27. Register of lifting appliances & loose gear
28. Deck logbook
29. Meteorology record book
30. Chronometer logbook.
31. Safety placards to be displayed at suitable places.
32. Line throwing apparatus
33. MOB Marker
34. Navigation Lights
35. International Code Flags
36. International Code of Signals
37. Daylight signalling lamp
38. Morse key for signal practice class

Seamanship laboratory equipment to include:

1. Anchor work: Lugged & lug-less joining shackles. Sledgehammer, lead pellets, spile pin, anchorshackle rod punch. Models or photographs or slides of various types of anchors, markings of anchor cable.
2. Boatwork: Already covered by DGS Rule no: 1 of 2003.
3. Rigging: Manila ropes (various sizes), Synthetic ropes (various types & sizes), Steel wire ropes (various types & sizes), Seizing twine and seizing wire, Heaving line, Rope and chain stoppers, Single, double & triple sheave blocks, Snatch block, chain block; Bottle screws and turnbuckles, Bulldog grips, Hand leadline, Marlin spikes, Wooden spikes, Pilot ladder rigged up for practice, Jacob's (coolie) ladder rigged up for practice, Rope ready for rope climbing.
4. Lifting gear: Photographs or slides or models of various types of cargo gear Derricks, Velle derricks, Jumbo derricks, Stulken derricks, cranes, cargo slings, cargo hooks, etc.
5. Maintenance: Chipping hammers, scrapers and wire brushes, Paint brushes (various sizes and types), De-scaling (chipping) machine, Bosun's chair, Over side stage, Sounding rod.

Carpentry workshop equipment to include:

1. Bench vices
2. Crow bars
3. Saws straight, hack and fret

4. Hammers claw, ball-pein, sledge, mallet, etc
5. Various wood chisels
6. Various wood files
7. Nail extractors
8. Breast braces and other clamps
9. Hand drilling machine with hand drill bits
10. Masonry punches
11. Portable electric drill and its bits including masonry bits
12. Various types and sizes of screw drivers
13. Wood screw and nails
14. Jackplane.

Plumbing workshop equipment to include: Spanners, wrenches, Stilson wrench, hacksaws, metal files, Teflon thread tape, water taps with washers, gasket material, plumbers vice, taps & dies for cutting threads on pipes, etc.

Machine workshop equipment to include:

1. Grinding machine
2. Drilling machine (mounted)
3. Electric drill (portable)
4. Various spanners (open, ring, socket, ratchet, torsion, Allen keys, etc)
5. Various types and sizes of hammers (claw, ball-pane, sledge, etc.)
6. Various types and sizes of screwdrivers, files, chisels, punches, reamers, hacksaws, taps & dies, etc.
7. Precision measuring devices such as Vernier callipers, screw gauges, feeler gauges, etc.
8. Spouted oil can, hand-operated grease gun.

Electrical workshop equipment to include:

1. Insulated tools normally used by electricians
2. Various types of insulation tape
3. Multimeters and meggers
4. Fuses and circuit breakers
5. Various types of electrical connections
6. Soldering irons, solder, flux.
7. Hotwork workshop equipment to include:
8. Oxy-acetylene gas cutting/welding apparatus and its accessories
9. Electric arc welding machine and its accessories

Adequate metal pieces for Hotwork practice of cutting and welding

ANNEXURE- 5

Requirements and Specifications for the Officer Of the Watch -Ship Manoeuvring Simulator (OOW-SMS) for Maritime Training Institute imparting Pre-Sea Training to the Nautical and Polyvalent Cadets

1. Requirements Maritime Safety and high manpower efficiency is the utmost concern to the Directorate General of Shipping.
2. The Directorate General of Shipping has taken a policy decision that the Officer of the Watch - Ship Manoeuvring Simulator (OOW-SMS) training should be made mandatory for all pre-sea training institutes for nautical and polyvalent cadets. This training shall be mandatory in all nautical & polyvalent pre-sea courses w.e.f. 1st July 2006.
3. The Full Mission type, Officer of the Watch Ship Manoeuvring Simulator shall meet the following standards of simulation:-
 - (a) It should be suitable for the selective objectives and training tasks
 - (b) It should be capable of simulating the operating capabilities of shipboard equipment and include the capabilities, limitations and possible errors of such equipments.
 - (c) It should have sufficient behavioural realism to follow a trainee to require the skills appropriate to training objectives.
 - (d) It should provide a controlled operating environment, capable of producing a variety of conditions, which may include emergency, hazardous or unusual situations relevant to the training objectives.
 - (e) It should provide an interface through which a trainee can interact with equipments, the simulated environment and, as appropriate, the instructor.
 - (f) It should permit the instructor to control, monitor and record exercises for the effective debriefing of the trainees.
4. The Officer of the Watch - Ship Manoeuvring Simulator (OOW-SMS) shall meet the standards as stipulated in para 3 and the guidelines of specifications as per the Annexure attached.
5. The simulator shall have DGS approval.

2. Specification

1. **Simulator specifications:** The simulator consisting of a ship station with instruments of avigation as listed below, as well as display of target ships and surroundings as seen from a wheel house.
 - 1.1 Equipment and consoles to be installed, mounted and arranged in a ship-like manner.
 - 1.2 A separate control for instructor with equipment necessary to monitor the activities in the wheel house effectively.
 - 1.3 The equipment installed in the simulator shall have a similar functionality to corresponding equipment used on board.
 - 1.4 If any equipment does not correspond to the specific make, the applicable IMO performance standard (functionality requirement) for such equipment shall be followed.

- 1.5 If such a performance standard does not exist, then the functionality of equipment shall, as a minimum, be the same as for any recognized genuine equipment of that type, in use on board ships.
- 1.6 Equipment as fitted shall resemble the behavioral characteristic for example; accuracy, reaction time and other limitations, related to corresponding equipment in use on board ships.
- 1.7 User manuals for the simulator equipment and operational control shall be available to the learners for use during exercise.

2. Ship types and Areas:

- 2.1 The simulator shall include mathematical models of at least 4 types of own ship. The model shall resemble accurately the behavioural characteristic of an actual ship of that size, power and type, and realistically behave as per the hydrodynamic effects of wind, current and swell.
- 2.2 The simulator shall be able to present at least 10 different types of targets each equipped with mathematical models, which account for motion, drift and steering angle according to forces induced by current, wind and wave.
- 2.3 The simulator shall be able to provide at least 4 international geographical visual areas for exercise which include open sea and high density traffic areas.

3. Detailed Specification:

3.1 Visualization:

- 3.1.1 At least 3 channel visualization of high resolution SVGA/XGA graphics, about 60 degree horizontal field of view on each side.
- 3.1.2 The visual screen Plasma/LCD/Projector type of at least 40 inches diagonal size on each screen. The visual system shall present all navigation marks as displayed on paper charts for that area.
- 3.1.3. The visual system shall show objects with sufficient realism (detailed enough to be recognized as in real life) The visual system shall replicate movements of all own ships according to 6 degrees of motion freedom.
- 3.1.4 The simulator shall provide a realistic visual scenario by day, twilight or night, changing with time. It shall be possible to create a range of visual conditions ranging from clear to partial [rain, haze] to restricted [dense fog]".
- 3.1.5 It shall be possible to take reasonably accurate bearing of objects seen on the screen preferably using an azimuth mirror on the gyro compass or Pelorus for relative bearings.
- 3.1.6 It shall be possible to use magnified views of the observation.
- 3.1.7 The visual system shall present at least a total of 20 degrees of vertical field view.
- 3.1.8 There should be proper correspondence between the visual picture and radar.

3.2 Simulator Capabilities:

- 3.2.1 The model shall realistically simulate own ship hydrodynamics in open water conditions, including the effect of wind forces, wave forces, tidal stream and currents.
- 3.2.2 The model shall realistically simulate own ship hydrodynamics in restricted waterways including

shallow water and bank affects and interaction with other ships.

3.2.3 The simulator shall provide an own ship engine sound reflecting the power output.

3.2.4 The target ships shall be equipped with navigational lights, shapes, and sound signals according to the "Rules of the Roads". The signal should be individually controlled by the instructor and the sound signal shall be directional and vary with range.

3.2.5 The simulator shall be able to present at least 10 target ships. At the same time, where the instructor shall be able to program routes for each target ship individually.

3.2.6 The simulator shall be capable of providing environmental sound (for example; wind) according to condition simulated.

3.2.7 The simulator shall include the depth according to chart used, indicating water depth according to tidal heights.

3.2.8 The simulator shall provide waves, variable in direction and strength.

3.3 Own Ship Control Station:

The following shall be provided, installed, mounted and arranged in a manner that it would physically resemble the front panel of a ship's navigating bridge. The hardware panel should have operational resemblance to actual ship-board equipment.

3.3.1 Propulsion control for controlling own ship's engine ahead and stern.

3.3.2 Steering control: There shall be provision for the following, at or near the console

.1 Steering wheel

.2 steering motor

.3 hand steering

.4 compass repeater able to depict gyro and / or magnetic headings

.5 gyro failure alarm

.6 auto-pilot (Basic auto-pilot for setting headings)

3.3.3 Engine Alarms: Giving audible and visual alarm in the case of:

.1 start fail

.2 shut-down

4. Radar set and automatic radar plotting aides (ARPA):

4.1. ARPA

4.1.1 250mm effective diameter of PPI screen with the facility to simulate Radar. The radar shall be capable of being operated in sea stabilized relative motion mode and sea and ground stabilized true motion modes.

4.1.2 The Radar Simulation Equipment shall be capable of generation of interface, noise, radar / ARPA failure, yawing, clutter, spurious echoes, blind sector, parallel index lines.

4.1.3 The ARPA simulation equipment shall incorporate the facilities for:

- .1 manual and automatic target acquisition
- .2 past track information
- .3 use of exclusion areas
- .4 vector / graphic time and data display
- .5 trial manoeuvres

5 Chart table with paper chart and publications: Chart table will resemble a ship's chart table with minimum dimension of 4 X 3 ft. Paper chart and publications provided shall be appropriate for the areas in use.

6 Indicators:

6.1 Own ship station shall have at least the following indicators:

- i) Wind direction and speed indicator
- ii) Rudder angle indicators
- iii) RPM indicator

7 Ship's horn: To be provided on the wheel house consol as a push button.

8 The following equipment shall be simulated:

9.1 Electronic Navigation Aide: Global position system. Simulation of all facilities of a standard GPS receiver shall be available. This shall include display in latitude, longitude, course and speed over ground by the own ship, UTC, normal navigational calculation functions such as; great circle, rhumb line sailing, way points, alarms for X-track error, etc.

9.2 Echo-sounder: Simulation of complete echo-sounder shall be provided.. Facility to change gain adjustment, change over from depth below keel to total depth and vice versa etc., shall be provided. Alarm for shallow water depth shall be provided.

9.3 Sound Signal Generator :Ship's whistle and fog signals. Facilities shall be provided to general fog signals manually or automatically operated by own ships independently, as well as for each target separately by the instructor console. The fog signals should be interactive and the intensity and the direction at own ship station shall correspond to relative range and position of the station generating the sound signal. The fog signal shall be capable of generating the sound signals of the following:

- i) vessel making way through water
- ii) vessel making no way through water
- iii) vessel restricted in her ability to maneuver
- iv) vessel at anchor
- v) vessel aground
- vi) vessel not under command

9.4 Navigation lights and shapes display: Full set of navigation, Christmas tree lights and shapes shall be made available, which the own ship can select for display depending upon the prevailing circumstances.

10 **Instructor:** The instructor and the assessor shall be able to:

10.1 Start, halt, reset in time and place, and restart an exercise

10.2 Change the operating environment during the running of an exercise, viz. shall be able to alter the wind (direction and force), swell (direction and height), current (direction and rate), cloud cover, and state of visibility.

10.3 Observe and supervise the trainees

10.4 A Display (minimum 19" monitor) providing a global view of the criteria simulation scenario The display plots ship's tracks, target movements and also provides a tool for altering the parameters of the various ships.

10.5 Activate simulation of failures in real time in the following equipment:

i) Navigation lights

ii) Gyro compass including insertion of error

iii) Speed log failure or insertion of error

iv) Echo sounder

v) Radar

vi) ARPA

vii)GPS (including degrading of signal quality)

viii) Auto pilot

ix) Engine

10.6 It shall be possible to replay a full exercise showing the actions performed by the trainees.

10.7 Instructor shall be able to create exercises where one or more own ship stations can be interactive within the exercise or to be able to run them independently and in differing areas, if so required.

3-YEAR / 4-YEAR POLYVALENT MARINE DEGREE COURSE

Note: Available separately from Marine Engineering Research Institute (MERI), Mumbai or University of Mumbai.

APPROVED ONE-YEAR DIPLOMA IN NAUTICAL SCIENCES (LEADING TO NAUTICAL SCIENCE DEGREE)

Note: Available separately from Indian maritime University or other Universities as approved by Directorate.

6-MONTH PRE-SEA EDUCATION AND TRAINING COURSE FOR SCIENCE / ENGINEERING GRADUATES**ANNEXURE -1**

Six Months Pre Sea Course				
Sr. No.	Subject / Paper	Duration of Exam	Max Marks	Pass Marks
1	Terrestrial Navigation Part 1. Terrestrial Navigation Part 2: Chartwork	3 Hours	100	70
2	Celestial Navigation Part 1. Navigation Principles Part 2. Navigation Practicals Part 3. Spherical trigonometry	3 Hours	100	70
3	Electronic Navigational Equipment, Meteorological Equipment, Bridge Watchkeeping, Signals and Communications Part 1. Bridge Equipment, Watchkeeping, Collision Regulations Part 2. Meteorology Part 3. Signals And communications	3 Hours	100	50
4	Cargo Handling and Stowage Part 1. Cargo Gear, Cargo Handling and Stowage Part 2. Oil, Gas and Chemical Tanker Familiarisation Part 3. Passenger Ship Familiarisation	3 Hours	100	60
5	Ship Construction and Ship Stability Part 1. Ship Construction Part 2. Ship Stability	3 Hours	100	60
6	Safety, Legislation, Pollution Prevention and Ship Operation Part 1. Safety and Legislation Part 2. Pollution Prevention Part 3. Ship Operations	3 Hours	100	50

OUTLINE FOR THE SIX MONTHS COURSE FOR GRADUATE ENTRY DECK CADETS					
		Lectures	Practicals/Numericals	Total	
Introduction		6	0	6	Hours
<u>Navigation Function</u>	-	Lectures	Practicals/Numericals	Total	
Spherical Trigonometry		9	9	18	Hours
Meteorology		15	6	21	Hours
Celestial Navigation		36	12	48	Hours
Terrestrial Nav (Chartwork)		21	29	50	Hours
Bridge Equipment And Watchkeeping		30	12	42	Hours
Signals (Morse Code)		0	18	18	Hours
Single letter Flags		0	12	12	Hours
GMDSS		25	0	25	Hours
VHF and Walkie talkies		5	0	5	Hours
		141	98	239	
<u>Cargo Handling and Stowage</u>	-	Lectures	Practicals/Numericals	Total	
Cargo Gear, Cargo Handling and Stowage		36	6	42	Hours
Oil Tanker Familiarisation Course		27	3	30	Hours
Gas Tanker Familiarisation Course		27	3	30	Hours
Chemical Tanker Familiarisation Course		27	3	30	Hours
			0		Hours
		117	15	132	
<u>Ship Operation, Safety & Care of Persons</u>	-	Lectures	Practicals/Numericals	Total	
Naval Architecture	Ship Construction	15	9	24	Hours
	Ship Stability	15	9	24	Hours
Practical Seamanship	General	30	60	90	Hours
	Boatwork	0	10	10	Hours
	Shipvisits	0	15	15	Hours
Safety and Pollution Prevention	Safety & Legislation	15	0	15	Hours
	Pollution prevention	15	0	15	Hours
		90	103	193	
<u>Miscellaneous Function</u>	<u>Internal Assessment</u>	Lectures	Practicals/Numericals	Total	

Workshop practicals		10	59	69	Hours
Basic Computer Training		6	18	24	Hours
HRD progr.(Tr.Circ.24/05)		15		15	
TOTALS		31	77	108	
		Lectures	Practicals/Numericals	Total	
Introduction		6	0	6	
Navigation Function		141	98	239	
Cargo Handling and Stowage		132	15	147	
Ship Operation, Safety & Care of Persons		90	103	193	
Miscellaneous Function		16	77	93	
TOTALS		385	293	678	Hours
Hours per day	6			113	Days
Days Per Week (excl.Sundays)	6			18.83	Weeks
Modular Courses	-				
PST		18	3 days	18	Two Weeks
PSSR		18	3 days	18	
FPFF		18	3 days	18	
EFA		15	2 days	15	
Instructional Weeks				19	Weeks
Modular courses				2	weeks
Joining Day/ Passing out/ Public Holidays				1	week
Internal Tests/ Exam preparation				1	week
Written, Practical and Orals Examinations				1	week
Semester break (home leave)				2	weeks
		Total		26	weeks

Terrestrial Navigation

Paper No 1
Max. Marks 100

Theory 21 hours Practical: 29 hours
Pass Marks: 70

Part 1: Terrestrial Navigation

Principles

1. Shape of the Earth, Axis of Rotation, Pole, Equator, Parallel of Latitude, Latitude, Meridian & Longitude. D'lat&D'long. Departure and the relationship between Departure, D'long& Latitude. Mean Latitude & Mid-Latitude. Nautical Mile, geographic mile, Statute mile. Great Circle, Spherical Triangle.
2. Ship's Log, Log Distance, Dead Reckoned and Estimated Positions.
3. Mercator Projection. Meridional Parts & DMP.

Practicals

4. Exercises in determining Departure, D'long&D'lat between two points on the earth's surface. Plane Sailing Formulae & exercises on their use.
5. Traverse Tables - Course & Distance between two points on the earth's surface.
6. Exercises on Day's Work.
7. Mercator Sailing Formulae and exercises on their use.

Part 2: Chart work

8. The Mercator chart - Natural scale, Latitude scale, Longitude scale, and the relation between latitude & longitude scales. Determination of distance on a Mercator chart. Chart reading. Transferring position lines and courses on Mercator charts. Plotting ship's position on a Mercator chart, the use of parallel ruler, set square, compass, divider. Care & maintenance of charts. Symbols & abbreviations used on Nautical Charts. Familiarisation with B.A. NP 5011.
9. The Compass Rose. Compass, Magnetic & True Course and Bearing. Deviation, Variation & Deviation Card. Exercises on the conversion of Courses & Bearings between Compass, Magnetic & True.
10. Dead Reckoned and Observed positions and the symbols used for indicating them on the chart. Fixing vessel's position using terrestrial cross-bearings and bearing and range. Course steered, course made good, engine speed, speed made good, current, leeway, counteracting current & leeway, estimated position (EP) and the symbol used to denote EP.
11. Admiralty Chart Catalogue & the Admiralty Chart Folio System. Layout of the ship's chart outfit.
12. Admiralty List of Lights. Characteristics of lights.
13. Buoyage System in use worldwide with special emphasis on the IALA system.
14. Tide Tables at Standard Ports. Admiralty Sailing Directions and other publications.
15. Conduct exercises in above chart work techniques.

Books recommended for reference

Practical Navigation Plus Nautical Almanac	Capt. H. Subramaniam
Ship's Magnetic Compass	Capt. H. Subramaniam
Nories Nautical Tables	
Principles Of Navigation	Capt. Joseph & Capt. Rewari
Chartwork	Capt. S. S. Chaudhary
Chartwork for Mariners	Capt. S. K. Puri

Pattern of Question Paper**Terrestrial Navigation**

Duration: 3 hours

Max Marks 100. Pass marks 70

Note:**Use of scientific calculator, Nories Tables and Nautical Almanac IS PERMITTED****Part 1: Terrestrial Navigation**

Principles	(25 marks)	
Question 1a OR 1b (answer any one)		15
Question 2a OR 2b (answer any one)		10
Practicals	(25 marks)	
Question 3a OR 3b (answer any one)		15
Question 4a OR 4b (answer any one)		10

Part 2: Chart work

Theory	(10 marks)	
Question 5a OR 5b (symbols and abbreviations) (answer any one)		05
Question 6a OR 6b (answer any one)		05
Practicals	(40 marks)	
Question 7a OR 7b (answer any one)		10
Question 8a OR 8b (answer any one)		10
Question 9a OR 9b (answer any one)		10
Question 10a OR 10b (ON TIDES) (answer any one)		10

Celestial Navigation

Paper No 2
Max. Marks 100

Theory: 45 hours. Practical: 21 hours
Pass Marks: 70

Part 1: Principles of Navigation (Theory 36 hours)

1. Solar system. Revolution of the Earth and the position of the solstices and equinoxes. Seasons. Keplers Laws of Planetary motion.
2. Concept of Time and its relationship with Longitude on the earth's surface. Explain GMT, Zone Time, Standard Time & Apparent Time.
3. Rational Horizon, Visible Horizon & Sensible Horizon. Ecliptic system, Equinoctial system, and horizon system of describing positions of celestial bodies. Zenith, Nadir, Vertical Circles, Prime Vertical, True Altitude, Zenith Distance, Declination, Polar Distance, Hour Angles, Aries & Azimuth.
4. Correction of altitudes using Dip, Refraction & SD separately and also using total correction tables. Latitude by Meridian Altitude. Amplitude & Azimuth.
5. Nautical Almanac. Method of obtaining times of Twilight, Rising, Setting, & Meridian Passage from the Nautical Almanac.
6. Latitude by meridian altitude, amplitude and azimuth.

Part 2: Practical Navigation (Practical 12 hours)

7. Exercises in drawing figures, reasonably to scale, on the plane of rational horizon.
8. Exercises in observing the altitude of the Sun. Exercises on obtaining Compass Error using the above using nautical tables. Exercises of obtaining times of Twilight, Rising, Setting, & Meridian Passage from the Nautical Almanac.
9. Stargazing - the identification of stars with reference to the main constellations.
10. Fixing the position of the ship using the sun – longitude by chronometer and intercept methods.
11. Longitude by chronometer and intercept methods.

Part 3:Spherical Trigonometry (Theory 09 hours; Practicals 09 hours)

12. Great circle, small circle, pole, spherical angle, spherical triangle. Properties of spherical angles and spherical triangles.
13. Sine & Cosine formulae and the possible ambiguities due to their use.
14. Haversine formula and its advantage over the Sine & Cosine formulae.
15. Right-angled spherical triangles and their properties. Exercises in the solution of right-angled spherical triangles using Napier's Rules.
16. Quadrantal spherical triangles and their properties. Exercises on the solution of quadrantal spherical triangles using Napier's Rules.
17. Polar triangles and their use in the solution of spherical triangles. Exercises on the solution of spherical triangles.

Books recommended for reference

Practical Navigation Plus Nautical Almanac	Capt. H. Subramaniam
Spherical Trigonometry	Capt. H. Subramaniam
Ship's Magnetic Compass	Capt. H. Subramaniam
Principles Of Navigation	Capt. Joseph & Capt. Rewari
Nories Nautical Tables	

Pattern of Question Paper

Celestial Navigation

Duration: 3 hours

Max Marks 100. Pass marks 70

Note:

Use of scientific calculator, Nories Tables and Nautical Almanac IS PERMITTED

Part 1: Principles of Navigation

(40 marks)

Question 1 (Compulsory)	10
Question 2a OR 2b (answer any one)	10
Question 3a OR 3b (answer any one)	10
Question 4a OR 4b (answer any one)	10

Part 2: Practical Navigation

(40 marks)

Question 5 (Compulsory)	10
Question 6a OR 6b (answer any one)	10
Question 7a OR 7b (answer any one)	10
Question 8a OR 8b (answer any one)	10

Part 3: Spherical Trigonometry

(20 marks)

Question 9a OR 9b (answer any one)	10
Question 10a OR 10b (answer any one)	10

**Electronic Navigational Equipment, Meteorological
Equipment and Watch-keeping**

Paper No 3
Max. Marks 100

Theory: 75 hours Practical: 48 hours
Pass Marks: 50

Part 1: Bridge Equipment & Watch-keeping (Theory 30hrs; Practical 12 hrs)

1. Collision Regulations with specific emphasis on Rules: 3, 5, 7, 8, 13, 14, 15, 16, 17, 18, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30 & Annexure IV.
2. Sextant. Use of a Sextant for vertical and horizontal angles. Correctable errors of a sextant and methods of correction.
3. Marine Chronometer. Chronometer error log. Exercises on accumulated rates.
4. Wet Card Magnetic Compass. Gyrocompass, Repeaters, and Course Recorder.
5. Echo Sounder and Depth Recorder. Depths below the ship.
6. Basic working of Marine Radar.
7. Overview of use of following Bridge Equipments –
 - a. GPS
 - b. AIS
 - c. VDR
 - d. Speed log
 - e. Auto Pilot and Course recorder
8. Watch keeping duties at anchor and at sea. Duties associated with preparing a vessel to proceed to sea. Procedure of testing controls. Procedure of taking over watch at sea. Recording all relevant information in Logbooks. Duties prior to arrival port. Procedure of embarking and disembarking a pilot. Methods to call the Master and the circumstances under which he should be called.

Part 2: Meteorology (Theory 15 hrs; Practicals 6 hrs)

9. The atmosphere: Layers, atmospheric temperature: adiabatic changes, DALR, SALR, diurnal variation of atmospheric pressure - semi-diurnal variation, atmospheric temperature, barometric tendency.
10. Heat: Conduction, convection, radiation; insolation; why cloudy nights are warmer than clear-sky nights; green-house effect; the seasons; why polar regions are colder than equatorial regions; temperature zones of the world.
11. Water vapour in the atmosphere: Humidity, absolute humidity, relative humidity, saturation, dew point, and meteorological application to hold ventilation. Hydrological cycle: Evaporation, condensation, precipitation; general idea of the hydrological cycle; condensation near the ground - dew, hoar frost, glazed frost, rime; types of precipitation - drizzle, rain, freezing rain/drizzle, snow flakes, snow pellets, sleet, ice pellets, hail. Visibility: Mist, fog, haze, spray and their differences; judging and reporting visibility, types of fog - radiation fog, advection fog, smog, arctic sea-smoke, Orographic fog.
12. Clouds: Classification & description of the ten basic types of clouds; formation due to turbulence, Orographic lifting, convection currents & frontal lifting. International Cloud Atlas - identify various types of clouds.
13. Pressure gradient, wind and waves: Isobars, pressure gradient, Coriolis force (geostrophic force); sea, swell, gust, squall, veering, backing; Buys Ballot's Law; Beaufort wind scale and Beaufort weather notation; descriptive terms to use to describe sea and swell; true and apparent wind -their meaning and difference.
14. Judging wind: Estimating direction and force of wind at sea by the appearance of the sea and the use of the 'State of sea card'. Difference between true & apparent wind. Exercises involving true and apparent wind.
15. Meteorological instruments Aneroid barometer: Principle, construction, corrections, errors, maintenance and precautions. Exercises on reading the aneroid barometer and obtaining barometric tendency. Principle, construction, corrections, errors, maintenance and precautions for the thermometer, the wet and dry bulb hygrometer, the Stevenson screen, the whirling psychrometer. Practical exercises on reading the thermometer, the wet and dry bulb hygrometer and the whirling psychrometer.
16. The 'Ship's Weather Code': Exercises in coding and decoding of ship's weather reports.

Part 3: Signals and Radio Communications – (Theory 30 hrs; Practicals 30 hrs).

17. Basic working knowledge of the GMSSS equipment and INMARSAT (25 hours). VHF, VHF DSC and walkie-talkie use. (5 hours)
18. Use of the Signaling Lamp. Exercises on visual signaling using the Morse code. (18 hours)
19. Exercises on the recognition and single letter meanings of International Code Flags. (12 hours)

Books recommended for reference

Marine Meteorology Plus Ship's Weather Code	Capt. H. Subramaniam
Nautical Watchkeeping	Capt. H. Subramaniam
Marine Sextant	Capt. H. Subramaniam
Marine Chronometer	Capt. H. Subramaniam
Marine Radar	Capt. H. Subramaniam
Ship's Magnetic Compass	Capt. H. Subramaniam
Regs For Prevention Of Collisions At Sea (Rules Of The Road)	Bhandarkar Publications
Nories Nautical Tables	
Bridge Equipment & Watchkeeping	Capt. E. Fernandes
Ror Set Of Cards	Bhandarkar Publications

Pattern of Question Paper

Electronic Navigational and Meteorological Equipment and Watch-keeping

Duration: 3 hours

Max Marks 100. Pass marks 50

**Note: Use of scientific calculator, Nories Tables,
Nautical Almanac and Ships Weather Code IS PERMITTED**

Part 1: Bridge Equipment and Watch keeping (40 marks)

Question 1 (Compulsory)	10
Question 2a OR 2b (answer any one)	10
Question 3a OR 3b (answer any one)	10
Question 4a OR 4b (answer any one)	10

Part 2: Meteorology (40 marks)

Question 5 (Compulsory)	10
Question 6a OR 6b (answer any one)	10
Question 7a OR 7b (answer any one)	10
Question 8a OR 8b (answer any one)	10

Part 3: Signals and Communications (20 marks)

Question 9 – Meaning of 5 single letter flags	05
Question 10a, 10b and 10c - GMDSS, INMARSAT, VHF, VHF DSC OR Question 11a, 11b, and 11c - GMDSS, INMARSAT, VHF, VHF DSC (answer any one)	15

Cargo Gear, Cargo Handling and Stowage

Paper No 4
Max. Marks 100

Theory: 132 hours. Practical: 15 hours
Pass Marks: 60

Part 1: Cargo Gear Cargo Handling And Stowage (Theory 36 hours; Practicals 06 hours)

1. Use of derricks, cranes on ships.
2. Principal of the eductor system.
3. Role of longshoremen, stevedores, foreman, ship's agent, supervisor.
4. Overall procedure of loading, stowing and discharging of general cargoes.
5. Procedure of preparing the hold for loading general cargo and bulk cargo. Necessity and procedure for segregation of various types of dry cargoes.
6. Various types of dunnage used. Securing of various types of cargo.
7. Cargo sweat, ship sweat, atmospheric sweat. Precautions against cargo damage by sweat.
8. Unitisation of cargo by palletisation and Containerisation. Container ships.
9. Carriage of Refrigerated Cargo.
10. Stowage Factor and Load Density.
11. Classification and Labeling of dangerous Goods.
12. Procedure of keeping cargo watch in port.

Part 2: Oil, Gas and Chemical Tanker Familiarisation (30 + 30 + 30 hours each)

13. Tank arrangements. Piping and pumping arrangements. Tank cleaning, crude oil washing. Safety precautions, safety check lists.
14. Pollution prevention – (Marpol Annexes I and II)

Part 3: Passenger Ship Familiarisation (15 hours)

15. Disasters involving passenger ships. Emergency procedures. Passenger safety, cargo safety, hull integrity. Communications. Crowd management.

NOTE: The Institutes that have formal DGS approval for the Oil, Gas and Chemical tanker Familiarization Courses and for the Passenger Ship Familiarisation Course may issue certificates for the respective courses. Institutes that do not have formal approval may teach the subject concerned as per the guidelines of the respective familiarisation courses.

Books recommended for reference

Nories Nautical Tables

Cargo Work

Seamanship - Theory and Practice

IMO model course 1.01 (Old number)

IMO model course 1.03 (Old number)

IMO model course 1.05 (Old number)

IMO model course 1.01 (New number)

IMO model course 1.29

IMO model course 1.28

Capt. E. Fernandes

Danton

Oil tanker familiarisation

Chemical Tanker Familiarisation

Gas Tanker familiarisation

Oil, Gas and Chemical tanker familiarisation

Crisis management

Crowd management

Pattern of Question Paper

Cargo Gear, Cargo Handling and Stowage

Duration: 3 hours

Max Marks 100. Pass marks 60

Note: Use of scientific calculator, Norries Tables IS PERMITTED

Part 1: Cargo Gear, Cargo Handling and Stowage (50 marks)

Question 1a OR 1b (on cargo gear, SWL, BS,) (answer any one)	10
Question 2a OR 2b (on preparation of a hold for various cargo) (answer any one)	10
Question 3a OR 3b (on cargo watch keeping / Sweat) (answer any one)	10
Question 4a OR 4b (on IMDG cargo, hazardous bulk cargo) (answer any one)	10
Question 5a OR 5b (on containers / unitisation) (answer any one)	10

Part 2: Oil, Gas and Chemical Tankers (40 marks)

Question 6a OR 6b (on oil tankers loading/discharging/cargo watch)(answer any one)	10
Question 7a OR 7b (on oil tankers venting/gas freeing/tank cleaning)(answer any one)	10
Question 8a OR 8b on gas tankers (answer any one)	10
Question 9a OR 9b on chemical tankers (answer any one)	10

Part 3: Passenger Ships (10 marks)

Question 10a OR 10b on passenger ships (answer any one)	10

Ship Construction and Stability

Paper No 5
Max. Marks 100

Theory: 30 hours Practical: 18 hours
Pass Marks: 60

Part 1: Ship Construction (Theory 15 hrs; Practicals 9 hrs)

1. Basic types of ships, i.e. General Cargo, Bulk Carrier, Container and Oil Tanker.
2. Principal dimensions of a ship - LOA, LBP, EB, MB, MD, GT, NT.
3. Principal parts of ship including Peak Tanks, Double Bottom Tanks, Deep Tanks, Cargo Tanks, Ballast Tanks, etc.
4. Ship plans: General Arrangement, Fire-fighting Appliances, Life-Saving Appliances, Pumping & Piping Arrangements.
5. Parts of a ship: Beam, Frame, Bulkhead, Hatch, Tank, Coaming, Hatch-Cover, Rudder, Deck, Hull, Bilge, Sounding Pipe, Air Pipe and Ventilator. Location of these on a ship.
6. Draft Marks & Load Lines. Method of reading draft marks in feet and in metres. Practical exercises on reading draft by use of a suitable model.
7. Causes and simple methods of prevention of corrosion in a ship's structure. Brief notes on paint technology & anti-corrosion techniques.
8. Dry Dock, the reasons for dry docking a vessel. A general idea of the activities in a dry dock.

Part 2: Ship Stability (Theory 15 hrs; Practicals 9 hrs)

9. Principle of flotation. Meaning of terms: Displacement, Deadweight, Form Coefficients, Reserve Buoyancy, Light Ship, Draft, Air Draft and Freeboard.
10. TPC. Formula for TPC.
11. Effect of density on the draft of a vessel.
12. Meaning of the terms Fresh Water Allowance and Dock Water Allowance. State the formulae for FWA and DWA.
13. Centre of Gravity and KG of a ship. Factors that affect KG.
14. Centre of Buoyancy and KB. Factors that affect KB.
15. Practical exercises in calculations based on the above topics.

Books recommended for reference

Ship Stability I
Ship Construction
Norries Nautical Tables
m.v. HINDSHIP and tables

Capt. H. Subramaniam
Kemp & Young

Pattern of Question Paper

Ship Construction and Stability

Duration: 3 hours

Max Marks 100. Pass marks 60

Note: Use of scientific calculator, Norries Tables and “Hindship” tables IS PERMITTED

Part 1: Ship Construction

Theory and Definitions (30 marks)

Question 1a OR 1b (answer any one)	10
Question 2a OR 2b (answer any one)	10
Question 3a OR 3b (answer any one)	10

Diagrams / Sketches (20 marks)

Question 4a OR 4b (answer any one)	10
Question 5a OR 5b (answer any one)	10

Part 2: Ship Stability

Theory and Definitions (20 marks)

Question 6a OR 6b (answer any one)	10
Question 7a OR 7b (answer any one)	10

Numerical (30 marks)

Question 8a OR 8b (answer any one)	10
Question 9a OR 9b (answer any one)	10
Question 10a OR 10b (answer any one)	10

Safety, Legislation, Pollution Prevention & Ship Operation

Paper No 6

Theory: 60 hours Practical:
Max. Marks 100 Pass Marks: 50

85 hours

Part 1: Safety and Legislation (Theory 15 Practicals nil)

1. Brief description of the functions of IMO, DG Shipping, MMD, Shipping Office, Coast Guard and Port State Control. Brief idea of Merchant Shipping Act and Safety Conventions of IMO. Brief idea of Articles of Agreement.
2. SOLAS - Outline knowledge of the contents and layout of SOLAS.
3. Brief description of the Management for the safe operation of ships
4. Outline knowledge of the ISPS Code.

Part 2: Pollution Prevention (Theory 15 hours; Practicals nil)

5. Marpol Annexes III to VI (Note: Annexes I and II are to be covered in the Oil, Gas and Chemical Tanker Familiarisation Courses). Anti-fouling Paint Pollution, Ballast Water Pollution.

Part 3: Ship Operation (Theory 30 hrs Practical 60 hrs, Boat work 10 hrs, Ship visit 15 hrs)

6. Types of cordage, fibre and wire ropes used on ships. Types of whippings. Types of Knots, Bends & Hitches. Types of splices on fibre and wire ropes. Use of bulldog grips and bottle screws/turnbuckles in joining wires.
7. Care & maintenance of fibre and wire ropes including uncoiling, coiling, stowing, etc. Practical exercises on use of blocks, snatch blocks and the differential pulley (chain blocks). Different types of tackles & purchases and the power gained in each case. Practical exercises on the maintenance of various types of blocks, tackles, shackles and bottle-screws/turnbuckles, including opening, greasing, etc.
8. Mooring arrangements, use of mooring shackle. Exercises on throwing heaving lines, use of rope & chain stoppers, mooring shackle. Handling of mooring ropes. Use of slip-ropes.
9. Anchor Work. Parts of a windlass. Cable, Link, Swivel, Joining Shackle, Shackle as a term of length, Bitter End. Parts of a stockless anchor. Practical exercises on opening a lug and a lugless shackle. Uses of an anchor, how it is dropped, hoisted and secured.
10. Use of a sledgehammer. Ability to climb a ship's mast. Ability in rope climbing. Exercises on rigging and climbing pilot ladders and Jacob's ladders. Maintenance of the same. Use of the bosun's chair. Use of over side staging for shipside maintenance. Use of the safety belt and safety harness during the earlier two operations.
11. Types of paints, painting procedures and defects. Exercises on chipping/ painting. Tools and gear available for maintenance steel parts of a ship.
12. Cargo gear. SWL and Breaking Stress.
13. Methods of dealing with an oil spill on deck. Plugging scuppers during bunkering, loading and discharging of oil cargo. Use and construction of a cement box to stop leaks.
14. Magnetic compass points. Steering and helm orders.
15. Boat work: (10 hours): Mustering, Use of proper clothing & proper donning of life jackets. Purpose of gravity davits and other arrangements for launching a lifeboat. Practice procedure for preparation and launching. Ability to take charge, muster the crew, check life jackets, allot duties and give instructions for launching. Practice rowing with proper co-ordination. Practice steering with tiller and proper use of oars. Practice picking up a buoy (representing a man overboard).

Ship visits (15 hours): Practical Familiarisation visits to merchant ships.

Books recommended for reference

Seamanship - Theory and Practice

Danton

Nories Nautical Tables

SOLAS, MARPOL, ISPS Code, ISM Code.

Pattern of Question Paper

SAMPLE PAPER 1:

Safety, Legislation, Pollution Prevention Ship Operation

Duration: 3 hours Max Marks 100. Pass marks 60

Note: Use of scientific calculator, Nories Tables IS PERMITTED

Part 1: Safety and Legislation	(20 marks)
Questions 1, 2 and 3: Three questions, answer any two.	(10 marks each)
Part 2: Pollution Prevention	(30 marks)
Questions 4, 5, 6 and 7: Four questions (answer any three)	(10 marks each)

Part 3: Ship operations	(50 marks)
Questions 8, 9, 10, 11 12 and 13: Six questions (answer any five)	(10 marks each)
=====	

SAMPLE PAPER 2:

Safety, Legislation, Pollution Prevention Ship Operations

Duration: 3 hours Max Marks 100. Pass marks 60

Note: Use of scientific calculator, Nories Tables IS PERMITTED

Part 1: Safety and Legislation	(20 marks)
Question 1a OR 1b (answer any one)	10
Question 2a OR 2b (answer any one)	10
Part 2: Pollution Prevention	(30 marks)
Question 3a OR 3b (answer any one)	10
Question 4a OR 4b (answer any one)	10
Question 5a OR 5b (answer any one)	10
Part 3: Ship operations	(50 marks)
Question 6a OR 6b (answer any one)	10
Question 7a OR 7b (answer any one)	10
Question 8a OR 8b (answer any one)	10
Question 9a OR 9b (answer any one)	10
Question 10a OR 10b (answer any one)	10

Workshop Practices and Computers Theory (16 hours) Practical (77 hours)
(Internal Assessment)

Hydraulics **Theory (5 hours – classroom time) Practical (7 hours)**

- 1. Advantages of Hydraulic System - State the advantages of hydraulic system**
- 2. Fundamentals of Hydraulics**
 - 2.1. State Pascal's and Bernoulli's Principle
 - 2.2. Define pressure, work, energy and flow rate
 - 2.3. Explain how hydraulic pressure is used to carry out various jobs on a ship.
 - 2.4. Explain how a heavy load can be lifted by a small force by use of Hydraulics.
- 3. Hydraulic Fluid**
 - 3.1. Explain the characteristics of hydraulic fluid.
 - 3.2. Explain Chemical Hazard of hydraulic fluid
- 4. Components & Circuit Symbols**
 - 4.1. List the various components used in hydraulic system
 - 4.2. Explain with sketch the purpose and symbols of direction control valves and methods of their operation
 - 4.3. Describe symbols of accessories used in hydraulics - heater, cooler and filters
 - 4.4. Describe symbols & purpose of pressure control valves & flow control valves
 - 4.5. Explain with sketch the symbols of components like actuators and pumps
 - 4.6. State the importance of Accumulators and Expansion tanks.
- 5. Operation & Maintenance of Hydraulic System**
 - 5.1. State the safety precautions to be observed while working on hydraulic system
 - 5.2. Explain the routine maintenance of hydraulic system
 - 5.3. State cavitations and aeration in pumps and its effect in hydraulic systems.
 - 5.4. Explain the common fault finding and rectification in hydraulic system.
- 6. Reservoir, Filters & Accumulator**
 - 6.1. Demonstrate the procedure to clean and replace filters in the system
- 7. Hydraulic Equipments**
 - 7.1. Demonstrate the ability to prepare and start a hydraulic power pack system
 - 7.2. Demonstrate the understanding of working of hydraulic watertight door

Pneumatics Theory (5 hours – classroom time) Practical (7 hours)

- 8. Air Compressor**
 - 8.1. State the safety precautions to be used while working with compressed air.
 - 8.2. Lists and explains hazards that can occur from compressed air
- 9. Advantages Of Pneumatics & Accessories Used**
 - 9.1. State the advantage and disadvantages of pneumatics
 - 9.2. List various equipment operated by pneumatics such as pneumatics wrench.
 - 9.3. List the various accessories used in pneumatics.
- 10. Nomenclature & Symbols Used In Pneumatics**
 - 10.1. Explain nomenclature used in pneumatics as per New ISO and Old Letting System
 - 10.2. Describe symbols used in pneumatics. Show how they are different from those used in hydraulics.
- 11. Circuit Tracing Maintenance & Fault Finding**
 - 11.1. Trace the simple pneumatic circuits

- 11.2. Explain the common faults occur in pneumatics and rectifications
- 11.3. State the care and maintenance of pneumatic system

12. **Pneumatic Equipment & Accessories**

- 12.1. Demonstrate ability clean system compressed air filters
- 12.2. Demonstrate ability to overhaul pneumatic tools / equipment such as pneumatic torque wrench

Fitting Work Shop

Practical (7 hours)

13. **Fitting Work Shop**

- 13.1. Demonstrate the ability to perform a basic fitting job of given dimension by using proper hand tools such as files, hacksaw, chisel, hammer, etc.
- 13.2. Demonstrate use of feeler gauge, screw gauge, vernier calipers on above job.
- 13.3. Identify various nuts and bolts, studs and demonstrates their use.
- 13.4. Demonstrate use of grinding machine and drilling machine on the above job.
- 13.5. Demonstrate the ability to make internal threads by using appropriate tap
- 13.6. Identify the parts of the lathe machine and demonstrates the safety precautions to be observed while working on lathe machine

Welding Shop

Practical (7 hours)

14. **Welding Shop**

- 14.1. Demonstrate the safety precautions to be observed while welding
- 14.2. Identify the arc and gas welding tools and welding kits.
- 14.3. Identify ferrous and non-ferrous metals.
- 14.4. Demonstrates the ability to carry out oxyacetylene gas cutting.
- 14.5. Connects arc welding kit & selects current / electrode to carry out arc welding.
- 14.6. Demonstrate the ability to carry out arc bead welding.

Electrical Shop

Practical (7 hours)

15. **Electrical Shop**

- 15.1 Identify electrical insulated hand tools.
- 15.2 Identify electrical measuring instruments such as multimeter, tongue tester, megger and demonstrates their use.
- 15.3 Demonstrate ability to identify electrical conductors and their gauge / specifications using wire gauge and differentiate wires and cables.
- 15.4 Demonstrate the ability to identify phase and neutral by using test lamp and multimeter. Identifies the colour codes given to phase, neutral and earth and differentiates between the single phase and three phase power supplies.
- 15.5 Demonstrate the safe working practices while working electrical circuits / appliances.
- 15.6 Identify the electrical accessories such as fuse, circuit breakers, choke, starters, etc. and demonstrates the use of it in electrical circuits.
- 15.7 Assemble a tube light fitting by using tube fittings and tests it.
- 15.8 Demonstrate the ability to carry out battery maintenance.
- 15.9 Knowledge of how a person gets shock
- 15.10 Identifies safety precautions to take to avoid shock and to rescue a person from electrical shock location.
- 15.11 Knowledge of First Aid to be administered.

Plumbing Shop Practical (12 hours)

16. **Plumbing**

- 16.1 Identify plumbing hand tools such as pipe wrench, dies, pipe benders, hacksaw, pipe vice, spanners, etc.
- 16.2 Identify leak stopping material such as Teflon, sealant, araldite, jubilee clips, etc. and demonstrate their use.
- 16.3 Demonstrate procedures to cut threads on pipes by selecting appropriate die.
- 16.3 Demonstrate the ability to identify different pipes, pipe material and methods to join the pipes.
- 16.5 Identify various taps, cocks and valves used in sanitary system demonstrate ability to repair them.
- 16.4 Identify various plumbing accessories such as 'T' joint, socket, reducer, adapter, etc. used in pipe fitting and demonstrate its use.
- 16.5 Cut the gasket as per sketch by selecting appropriate material and tools.
- 16.6 Join the pipes as per drawing by using appropriate tools and accessories.
- 16.7 Make fitting of working water closets / wash basin.
- 16.8 Demonstrate ability to identify water showers, mixers, and their repair.
- 16.9 Demonstrate the ability to clear choked pipes by using appropriate tool / choke clearing material.

Carpentry Shop Practical (12 hours)

17 Carpentry

- 17.1 Identify carpentry hand tools (chisel, jack plane, augur, mortise gauge, etc.)
- 17.2 Identify various woods and plywood, veneers and wood treatment materials.
- 17.3 Identify various wood jointing materials such as Fevicol, nails, screws, etc.
- 17.4 Demonstrate the ability to make various wood jointing methods such as mortise joint, dovetail joints, scarf joint, etc.
- 17.5 Demonstrate the ability to make a wooden box as per drawing by using appropriate tools, wood jointing method and wood jointing material / adhesives and a cement box.
- 17.6 Use clamps to stop a leak.

Computers

Theory - 6 hours – classroom

Practical: (18 hours)

- 1. Basic Hardware Familiarisation
 - 1.1. Handling the computer and its peripherals.
 - 1.2. Booting. Common start-up errors and remedies. Connecting – keyboard, mouse, monitor, power cables, UPS to the computer and checking all connections.
 - 1.3. Keyboard layout and functions of different keys.
 - 1.4. Proper shut down of PC, precautions to avoid an improper shut down.
 - 1.5. Identifying the different hardware parts in the PC.
 - 1.6. Determining the configuration of the PC.
- 2. Operating System
 - 2.1. The Windows Operating System
 - 2.2. Handling files and folders. Creating, opening, renaming and deleting files and folders. Performing searches for specific files and folders.
 - 2.3. Using common keyboard shortcuts to speed up operations.
 - 2.4. Using Windows' help.
 - 2.5. Installing / uninstalling software.
 - 2.6. Copying and burning of CDs.
 - 2.7. Using Winzip software.
 - 2.8. Internet and using a browser like Explorer.
 - 2.9. Using email application program
 - 2.10. Antivirus software and removal of virus from PC.
- 3. MS-Word
 - 3.1. Creating and saving documentation in MS-Word.
 - 3.2. Opening, finding, renaming files and folders.

- 3.3. Using “Page Setup”, “Print Preview” and “Print” commands.
 - 3.4. Using “Paragraph” options, Bullets” and “Numbering”
 - 3.5. Format text using various options in “Formatting Toolbar”.
 - 3.6. Checking spelling and grammar in the document.
 - 3.7. Using “Headers and Footers”.
 - 3.8. Inserting symbols and pictures.
 - 3.9. Creating tables in MS-Word.
- 4. MS-Excel
 - 4.1. Creating workbooks, working with rows, columns, cells and worksheets.
 - 4.2. Inserting pictures and graphics.
 - 4.3. Formatting of cells.
 - 4.4. Using conditional formatting on data in cells

ANNEXURE- I

Requirements and Specifications for the Officer of the Watch -Ship Manoeuvring Simulator (OOW-SMS) for Maritime Training Institute imparting Pre-Sea Training to the Nautical and Polyvalent Cadets

1. Requirements

Maritime Safety and high manpower efficiency is the utmost concern to the Directorate General of Shipping.

2. The Directorate General of Shipping has taken a policy decision that the Officer of the Watch - Ship Manoeuvring Simulator (OOW-SMS) training should be made mandatory for all pre-sea training institutes for nautical and polyvalent cadets. This training shall be mandatory in all nautical & polyvalent pre-sea courses w.e.f. 1st July 2006.

3. The Full Mission type, Officer of the Watch Ship Manoeuvring Simulator shall meet the following standards of simulation:-

(a) It should be suitable for the selective objectives and training tasks

(b) It should be capable of simulating the operating capabilities of shipboard equipment and include the capabilities, limitations and possible errors of such equipments.

(c) It should have sufficient behavioural realism to follow a trainee to require the skills appropriate to training objectives.

(d) It should provide a controlled operating environment, capable of producing a variety of conditions, which may include emergency, hazardous or unusual situations relevant to the training objectives.

(e) It should provide an interface through which a trainee can interact with equipments, the simulated environment and, as appropriate, the instructor.

(f) It should permit the instructor to control, monitor and record exercises for the effective debriefing of the trainees.

4. The Officer of the Watch - Ship Manoeuvring Simulator (OOW-SMS) shall meet the standards as stipulated in para 3 and the guidelines of specifications as per the Annexure attached.

5. The simulator shall have DGS approval.

2. Specification

1. Simulator specifications: The simulator consisting of a ship station with instruments of avigation as listed below, as well as display of target ships and surroundings as seen from a wheel house.

1.1 Equipment and consoles to be installed, mounted and arranged in a ship-like manner.

1.2 A separate control for instructor with equipment necessary to monitor the activities in the wheel house effectively.

1.3 The equipment installed in the simulator shall have a similar functionality to corresponding equipment used on board.

1.4 If any equipment does not correspond to the specific make, the applicable IMO performance standard (functionality requirement) for such equipment shall be followed.

- 1.5 If such a performance standard does not exist, then the functionality of equipment shall, as a minimum, be the same as for any recognized genuine equipment of that type, in use on board ships.
- 1.6 Equipment as fitted shall resemble the behavioral characteristic for example; accuracy, reaction time and other limitations, related to corresponding equipment in use on board ships.
- 1.7 User manuals for the simulator equipment and operational control shall be available to the learners for use during exercise.

2. Ship types and Areas:

- 2.1 The simulator shall include mathematical models of at least 4 types of own ship. The model shall resemble accurately the behavioural characteristic of an actual ship of that size, power and type, and realistically behave as per the hydrodynamic effects of wind, current and swell.
- 2.2 The simulator shall be able to present at least 10 different types of targets each equipped with mathematical models, which account for motion, drift and steering angle according to forces induced by current, wind and wave.
- 2.3 The simulator shall be able to provide at least 4 international geographical visual areas for exercise which include open sea and high density traffic areas.

3. Detailed Specification:

3.1 Visualization:

- 3.1.1 At least 3 channel visualization of high resolution SVGA/XGA graphics, about 60 degree horizontal field of view on each side.
- 3.1.2 The visual screen Plasma/LCD/Projector type of at least 40 inches diagonal size on each screen. The visual system shall present all navigation marks as displayed on paper charts for that area.
- 3.1.3. The visual system shall show objects with sufficient realism (detailed enough to be recognized as in real life) The visual system shall replicate movements of all own ships according to 6 degrees of motion freedom.
- 3.1.4 The simulator shall provide a realistic visual scenario by day, twilight or night, changing with time. It shall be possible to create a range of visual conditions ranging from clear to partial [rain, haze] to restricted [dense fog]".
- 3.1.5 It shall be possible to take reasonably accurate bearing of objects seen on the screen preferably using an azimuth mirror on the gyro compass or Pelorus for relative bearings.
- 3.1.6 It shall be possible to use magnified views of the observation.
- 3.1.7 The visual system shall present at least a total of 20 degrees of vertical field view.
- 3.1.8 There should be proper correspondence between the visual picture and radar.

3.2 Simulator Capabilities:

- 3.2.1 The model shall realistically simulate own ship hydrodynamics in open water conditions, including the effect of wind forces, wave forces, tidal stream and currents.
- 3.2.2 The model shall realistically simulate own ship hydrodynamics in restricted waterways including

shallow water and bank affects and interaction with other ships.

3.2.3 The simulator shall provide an own ship engine sound reflecting the power output.

3.2.4 The target ships shall be equipped with navigational lights, shapes, and sound signals according to the "Rules of the Roads". The signal should be individually controlled by the instructor and the sound signal shall be directional and vary with range.

3.2.5 The simulator shall be able to present at least 10 target ships. At the same time, where the instructor shall be able to program routes for each target ship individually.

3.2.6 The simulator shall be capable of providing environmental sound (for example; wind) according to condition simulated.

3.2.7 The simulator shall include the depth according to chart used, indicating water depth according to tidal heights.

3.2.8 The simulator shall provide waves, variable in direction and strength.

3.3 Own Ship Control Station:

The following shall be provided, installed, mounted and arranged in a manner that it would physically resemble the front panel of a ship's navigating bridge. The hardware panel should have operational resemblance to actual ship-board equipment.

3.3.1 Propulsion control for controlling own ship's engine ahead and stern.

3.3.2 Steering control: There shall be provision for the following, at or near the console

- .1 Steering wheel
- .2 steering motor
- .3 hand steering
- .4 compass repeater able to depict gyro and / or magnetic headings
- .5 gyro failure alarm
- .6 auto-pilot (Basic auto-pilot for setting headings)

3.3.3 Engine Alarms: Giving audible and visual alarm in the case of:

- .1 start fail
- .2 shut-down

4. Radar set and automatic radar plotting aides (ARPA):

4.1. ARPA

4.1.1 250mm effective diameter of PPI screen with the facility to simulate Radar. The radar shall be capable of being operated in sea stabilized relative motion mode and sea and ground stabilized true motion modes.

8.1.2 The Radar Simulation Equipment shall be capable of generation of interface, noise, radar / ARPA failure, yawing, clutter, spurious echoes, blind sector, parallel index lines.

8.1.3 The ARPA simulation equipment shall incorporate the facilities for:

- .1 manual and automatic target acquisition
- .2 past track information
- .3 use of exclusion areas
- .4 vector / graphic time and data display
- .5 trial manoeuvres

5 Chart table with paper chart and publications: Chart table will resemble a ship's chart table with minimum dimension of 4 X 3 ft. Paper chart and publications provided shall be appropriate for the areas in use.

6 Indicators:

6.1 Own ship station shall have at least the following indicators:

- i) Wind direction and speed indicator
- ii) Rudder angle indicators
- iii) RPM indicator

7 Ship's horn: To be provided on the wheel house consol as a push button.

8 The following equipment shall be simulated:

8.1 Electronic Navigation Aide: Global position system. Simulation of all facilities of a standard GPS receiver shall be available. This shall include display in latitude, longitude, course and speed over ground by the own ship, UTC, normal navigational calculation functions such as; great circle, rhumb line sailing, way points, alarms for X-track error, etc.

8.2 Echo-sounder: Simulation of complete echo-sounder shall be provided.. Facility to change gain adjustment, change over from depth below keel to total depth and vice versa etc., shall be provided. Alarm for shallow water depth shall be provided.

8.3 Sound Signal Generator :Ship's whistle and fog signals. Facilities shall be provided to general fog signals manually or automatically operated by own ships independently, as well as for each target separately by the instructor console. The fog signals should be interactive and the intensity and the direction at own ship station shall correspond to relative range and position of the station generating the sound signal. The fog signal shall be capable of generating the sound signals of the following:

- i) vessel making way through water
- ii) vessel making no way through water
- iii) vessel restricted in her ability to maneuver
- iv) vessel at anchor
- v) vessel aground
- vi) vessel not under command

8.4 Navigation lights and shapes display: Full set of navigation, Christmas tree lights and shapes shall be made available, which the own ship can select for display depending upon the prevailing circumstances.

9 Instructor: The instructor and the assessor shall be able to:

- 9.1 Start, halt, reset in time and place, and restart an exercise
- 9.2 Change the operating environment during the running of an exercise, viz. shall be able to alter the wind (direction and force), swell (direction and height), current (direction and rate), cloud cover, and state of visibility.
- 9.3 Observe and supervise the trainees
- 9.4 A Display (minimum 19" monitor) providing a global view of the criteria simulation scenario The display plots ship's tracks, target movements and also provides a tool for altering the parameters of the various ships.
- 9.5 Activate simulation of failures in real time in the following equipment:
 - i) Navigation lights
 - ii) Gyro compass including insertion of error
 - iii) Speed log failure or insertion of error
 - iv) Echo sounder
 - v) Radar
 - vi) ARPA
 - vii)GPS (including degrading of signal quality)
 - viii) Auto pilot
 - ix) Engine
- 9.6 It shall be possible to replay a full exercise showing the actions performed by the trainees.
- 9.7 Instructor shall be able to create exercises where one or more own ship stations can be interactive within the exercise or to be able to run them independently and in differing areas, if so required.

PRO-FORMA OF TRAINING RECORD BOOK (TRB) FOR DECK CADETS

2-MONTH FOUNDATION COURSE (PCME) FOR 2ND MATE (F.G.) EXAM**FOUNDATION COURSE PAPER 1 – NAUTICAL MATHEMATICS**

Time: 2 hours

Maximum Marks: 100

Pass Mark: 50

Note:

- 1 In this syllabus, emphasis will be laid on the applications of the relevant formulae, specially to problems in technical subjects and not on the theoretical proofs of such formulas.
- 2 Non-Programmable Scientific Calculator may be used.

(A) CALCULUS

Differentiation: The formulae for the derivations of algebraic, trigonometric, inverse, exponential and logarithmic, inverse, exponential and logarithmic functions (to be assumed) and their applications in examples. Derivation of second order.

Integration: Integration as a reverse process of differentiation. Standard forms. Integration by substitution. Integration by parts. Partial fractions.

(B) COORDINATE GEOMETRY

Circle: Standard and general equations.

Conics: Focus directory property. Standard forms of equations of parabola, hyperbola and ellipse (to be assumed). Summitry of these curves about their axis and center. Properties of conics for application to navigation.

(C) SPHERICAL TRIGONOMETRY

Properties of a spherical triangle. Polar triangles and applications of their properties. Solution of spherical triangles by haversine formula, sine formula and Napier's Rules for right angled triangles and quadrantal triangles.

FOUNDATION COURSE PAPER 2 – NAUTICAL PHYSICS

Time: 2 hours

Maximum Marks: 100

Pass Mark: 50

Note:

- 1 In this syllabus, emphasis will be laid on the applications of the relevant formulae, specially to problems in technical subjects and not on the theoretical proofs of such formulas.
- 2 Non-Programmable Scientific Calculator may be used.

(A) MECHANICS

Newton's law of universal gravitation: Variations in 'g' due to rotation of the earth and due to latitude and elevation.

Rotation: Moment of inertia and radius of gyration. Precession. The top and the gyroscope. Stability with rotation.

(B) HEAT

Expansion: Coefficient of real expansion of fresh water and sea water. Anomalous expansion of water. Change of state: Melting point of ice and factors affecting melting point. Boiling point of water and effects of pressure and impurities. Effects of high latent heat of water.

Transference of heat: Theory of conduction, convection and radiation.
Entropy and enthalpy.

(C) SOUND

Velocity of sound in water: Effects of pressure, temperature and salinity on velocity of sound in water. Determination of velocity of sound in sea water.
Characteristics of sound: Intensity and loudness. Decibel. Siren. Pitch and frequency. Doppler effect.

FOUNDATION COURSE PAPER 3 – NAUTICAL CHEMISTRY

Time: 2 hours

Maximum Marks: 100

Pass Mark: 50

Note:

- 1 In this syllabus, emphasis will be laid on the applications of the relevant formulae, specially to problems in technical subjects and not on the theoretical proofs of such formulas.
- 2 Non-Programmable Scientific Calculator may be used.

(A) PHYSICAL CHEMISTRY

1. Structure of the atom, molecules, chemical bond and formation of compounds: Protons, electrons and neutrons. atomic number, electronic configurations of atoms, atomic mass and isotopes, definition of valency, the electrovalent bond and the coordinate bond.
2. The periodic table, atomic behavior and atomic structure. The periodic law and its relationship to the electronic structure of the atoms: Properties of atoms.
3. Physical properties of chemicals" Appearance, odour, Melting point, Effect of pressure Lower and upper flammable limits, Relation between boiling point, vapour pressure and flammability, Effervescence, Solubility, Flash point, closed cup method for determining Flash point, auto ignition temperature, Pour point, Viscosity, volatile and non volatile cargoes.
4. Properties of gases: Gas laws
5. Relevance of gas laws to LPG carriers and Reefer Ships.
6. Principal uses of selected chemicals
7. Compatibility between normal chemicals carried on board.
8. Cargo containment: materials and coating
9. Health hazards/Biochemical aspects of some of the cargo carried toxicity, corrosively
10. Construction and chemical reaction in storage batteries/cells used on ships.

(B) INORGANIC CHEMISTRY

1. Matter and its properties: Solids, liquids and gases; Elements and compound and Mixtures; Law of indestructibility of matter.
2. Chemical reactions and products: Physical change, information conveyed by equations, evolution and absorption of energy in chemical reactions-endothermic and exothermic reactions.
3. Types of chemical reactions: displacement reactions, decomposition reaction, double decomposition reactions, polymerization, role of catalyst, role of inhibitors.
4. Metals and non-metals: Properties of metals and non-metals, preparation of non-metals and metallurgy.
5. Chemistry of Groups **0-VIII**: General features and applications.
6. Hazards of Inorganic cargoes carried on board vessels with respect to Flammability, toxicity, Reactivity and Solubility.

7. Extraction and manufacturing processes of Iron, Copper and Aluminum etc.

8. Manufacturing process of stainless steel, cast and forged iron/steel.

(C) ORGANIC CHEMISTRY

1. Nomenclature, Empirical formula, Molecular formula & molecular weight.
2. Sources and uses of organic compounds: Recovery of benzene, toluene, naphtha, phenol etc. from coal, cellulose derivatives from plants, starch derivatives and petroleum derivatives including LPG
3. Properties & applications of:
 - **Alkanes:** Methane, Butane, Propane, n-butane, iso-butane, n-pentane, iso-pentane, n-hexane.
 - **Alkenes:** Ethyne, propylene, butylene's, propylene, pentylene hexylene.
 - **Alkynes:** Ethyne, propyne, butyne.
 - **Halogenated hydrocarbons:** Methyliodide, ethyliodide, propyliodide.
 - **Alcohol's & phenols:** Methyl alcohol, ethyl alcohol, ethylene glycol, glycerol.
 - **Aldehydes:** Formaldehyde, acetaldehyde, propionaldehyde, butyraldehyde, Acetone, ethyl methyl ketone.
 - **Aliphatic carboxylic acids:** Formic acid, acetic acid, propionic acid, oxalic acid.
 - **Aliphatic ethers:** Diethyl ether, ethyl methyl ether.
 - **Aliphatic amines:** Methanamine, ethanamine.
4. Associated Hazards of above cargoes with respect to Flammability, Toxicity, Reactivity and Solubility.

FOUNDATION COURSE PAPER 4 – ELECTRICITY & ELECTRONICS

Time: 2 hours

Maximum Marks: 100

Pass mark: 50

Note:

1. In this syllabus, emphasis will be laid on the applications of the relevant formulae, specially to problems in technical subjects and not on the theoretical proofs of such formulae.
2. Non-Programmable Scientific Calculator may be used.

(A) ELECTRICITY:

Definitions & relationship between electric current, EMF, power and energy.

Related numerical examples.

Ohm's law, concept of resistance, simple circuits (series and parallel). Effect of temperature on conductors, insulators and semi-conductors.

Related numerical examples.

Kirchhoff's laws and its applications

Related numerical examples.

Properties of electric current – Heating & Magnetic with special reference to straight conductor, parallel conductors, coil and solenoid.

Related numerical examples.

Concept of Inductance – Self/Manual: - Definitions, formulae related to Self/Mutual inductance, series and parallel combinations of inductors. Formula of energy stored in inductor.
Related numerical examples.

Concept of capacitance. Capacitance between two parallel plates. Series and parallel combination. Formula for energy stored in a capacitor.
Related numerical examples.

DC supply: Acid Battery/Alkali Battery construction and working.
CD generator: Principle, construction and working.

AC supply: Definition of sinusoidal supply, frequency, peak, RMS value,
AC generator: Principle, construction and working.
Transformer: Principle, construction, working.

Measurement of electrical quantities: Galvanometer (moving coil and moving iron), construction, principle and working,
Conversion of a galvanometer into ammeter/voltmeter.

Safety & Control: Switches, fuses, relays, electric bell, buzzer, motor starters, navigation lights.

(B) RADIO & ELECTRONICS:

Electron Emission: Thermionic, field, photo & secondary.

Semiconductors: Doping P and N type, PN, PNP & NPN semiconductor devices.
 α and β current gains and relationship between them. (Related numerical examples).

Use of PN diodes in rectification. (Half wave rectifier, Full wave rectifier, Bridge rectifier).
Related numerical examples.

Use of filter circuits in power supply. Use of capacitors, inductors in filter circuits.

Amplification: Use of transistors in amplifier circuits.
CE Mode, CB mode, CC mode.
Related numerical examples.

Oscillator: LC tank circuit, use of transistors in oscillator circuits.
Piezo electric effect and use of crystal in frequency control.
Modulation circuits (AM and FM).
Related numerical examples.
PN diode in AM demodulation circuit.

Working of a transmitter with block diagram.

Working of receiver with block diagram.

Antenna: Straight, loop, Yagi.

Electro-Magnetic waves, Ionosphere, Ground waves, Sky waves.

Sensors and Transducers for temperature, pressure, level, flow, speed etc.

CRT: Construction & application in visual display.

Raster screens and their application to ship's Radar.

4-MONTH COMPETENCY COURSE FOR 2ND MATE (F.G.) EXAM

SECOND MATE (F.G.) - SUMMARY OF EXAMINATION (FUNCTION - WISE) (REFERENCE: TABLE A- II/1)

FUNCTION: NAVIGATION AT OPERATIONAL LEVEL

PAPE R NO.	SUBJECT	COMPETENCIE S COVERED	MODE OF EXAMINATIO N	DURATION OF EXAM	MAXIMU M MARKS	PASS MARKS
1	Terrestrial and Coastal navigation	1.1	Written	3 Hours	200	140
2	Celestial Navigation	1.2	Written	3 Hours	200	140
3	Meteorology	1.4	Written	2 Hours	100	50
4	Bridge Equipment, Watchkeeping & Emergencies	1.3,2,5,6,9	Written	2 Hours	100	50
5	Radar Observer and ARPA Simulator Course	3	Modular	2+1 Weeks Course		
6	ECDIS Course*	4	Modular	1 Week Course		
7	Communications** and Signals	7,8	Visual Signalling	1 Hour	100	70
8	Orals for navigation function	1-9	Oral			

(*) Training and assessment in the use of ECDIS is not required for those who serve exclusively on ships not fitted with ECDIS. This limitation shall be reflected in the endorsement issued to the seafarer concerned.

(**) No Lectures or exercises required since proficiency in English Language is established at the entry level itself, and SMCP is part of pre-sea training and on-board training (Competence no.7).

FUNCTION: CARGO HANDLING & STOWAGE AT OPERATIONAL LEVEL

PAPER NO.	SUBJECT	COMPETENCIES COVERED	MODE OF EXAMINATION	DURATION OF EXAM	MAXIMUM MARKS	PASS MARKS
1	Cargo Handling and Stowage	10,11	Written	3 Hours	200	120
2	Orals for Cargo function	10,11	Oral			

FUNCTION: CONTROLLING THE OPERATION OF THE SHIP & CARE FOR PERSONS ON BOARD AT THE OPERATIONAL LEVEL

PAPER NO.	SUBJECT	COMPETENCIES COVERED	MODE OF EXAMINATION	DURATION OF EXAM	MAXIMUM MARKS	PASS MARKS
1	Ship construction, stability, ship safety, team work and environmental protection	12, 13,17,18	Written	3 Hours	200	120
2	Advanced Fire Fighting (AFF) Course	14	Modular	5 days Course		
3	Proficiency in Survival Craft and Rescue Boat (PSC-RB) Course	15	Modular	5 days Course		
4	Medical First Aid	16	Modular	4 days Course		
5	Personal Survival Techniques (PST), Fire Prevention and Fire fighting (FPFF), Elementary First Aid (EFA), Personal Safety and Social Responsibility (PSSR) Courses.	19	Modular	As per respective IMO Model Courses		
6	Orals for ship operation function	12-19				

SUMMARY OF COURSES, TRAINING PROGRAMMES, EXAMINATION & ASSESSMENTRegulation: II/1 of STCW 2010 & Section: A-II/1 of STCW CodeDepartment: NauticalLevel: Operational LevelCapacity: Officer in charge of**Navigational Watch**

Duration of the Post Sea Training Course is 4 months excluding those competencies against which reference for IMO Model course has been indicated. These competencies are covered in separate additional Modular Courses.

FUNCTION I: Navigation at Operational Level

No.	Competence	Pre-Sea Training	On-board Training	Post Sea Training				Type of Assessment
				Lectures	Exercise	Practicals	Simulator	
1.	Plan & conduct a passage and determine position	Yes	Yes	99.5 hours	65 hours	0.5 hours		Internal assessment and written & Oral examination
2.	Maintain a safe navigational watch including BRM	Yes	Yes	45 hours	5 hours			Internal assessment and written & Oral examination
3.	Use of radar and ARPA to maintain safety of navigation	Yes	Yes					Based on IMO Model Course 1.07 & 1.08
4.	Use of ECDIS and maintain the safety of Navigation*	No	Yes					Based on IMO Model Course No. 1.27 as revised
5.	Respond to emergencies	Yes	Yes	20 hours				Internal assessment and written & Oral examination
6.	Respond to a distress signal at sea	Yes	Yes	10 hours				Internal assessment and written & Oral examination
7.	Use of Standard marine navigational vocabulary as replaced by the IMO standard marine communication phrases (SMCP) & use English in written and oral form.	Yes	Yes					No Lectures or exercises required since proficiency in English Language is established at the entry level itself, and SMCP is part of pre-sea training and on-

No.	Competence	Pre-Sea Training	On-board Training	Post Sea Training				Type of Assessment
				Lectures	Exercise	Practicals	Simulator	
								board training.
8.	Transmit & receive information by visual signaling and other means (Single Letter only and SOS, XXX, TTT)	Yes	Yes	6 hours		9 hours		Visual signalling examination
9	Manoeuvre the ship	Yes	Yes	13 hours				Internal assessment and written & Oral examination
	TOTAL HOURS			193.5	70	9.5		

(*) Training and assessment in the use of ECDIS is not required for those who serve exclusively on ships not fitted with ECDIS. This limitation shall be reflected in the endorsement issued to the seafarer concerned.

FUNCTION II: Cargo Handling and Stowage at Operational Level

No.	Competence	Pre-Sea Training	On-board Training	Post Sea Training				Type of Assessment
				Lectures	Exercise	Practicals	Simulator	
10.	Monitor the loading, stowage, securing and unloading of cargoes and their care during the voyage	Yes	Yes	48 hours	6 hours	-	-	Internal assessment and written & Oral examination
11.	Inspect and report defects and damage to cargo spaces, hatch covers and ballast tanks	No	Yes	6 hours	-	-	-	Internal assessment and written & Oral examination
	Total			54hours	6 hours			

FUNCTION III: Controlling the Operation of Ship and Care for Persons on Board at Operational Level

12.	Ensure compliance with pollution prevention requirements	Yes	Yes	20hours				Internal assessment and written & Oral examination
13.	Maintain sea	Yes	Yes	46 hours	14			Internal assessment

	worthiness of the ship				hours			and written & Oral examination
14.	Prevent, control and fight fires on board	Yes	Yes					As per STCW Code Table A-VI/3 and relevant IMO Model course.
15	Operate life saving appliances	Yes	Yes					As per STCW Code Table A-VI/2 and relevant IMO Model course.
16.	Apply medical first aid on board ship	Yes	Yes					As per STCW Code Table A-VI/4-1 and relevant IMO Model course.
17	Monitor compliance with legislative requirements	Yes	Yes	12 hours				Internal assessment and written & Oral examination
18.	Application of Leadership and Team working Skills	Yes	Yes	9 hours	4 hours			Internal assessment and written & Oral examination
19.	Contribute to the safety of personnel and ship	Yes	Yes					As per STCW Code Table A-VI/1-1, A-VI/1-2, A-VI/1-3, A-VI/1-4 and relevant IMO Model courses.
	TOTAL HRS			87	18			
	GRAND TOTAL			334.5	94	9.5		
				438 Hours				

- Notes :**
1. Total Teaching hours for above mentioned course is 438 hours = 14.6 weeks.
 2. 1.4 weeks for Assessments (internal and final assessment).
 3. 1 week to account for Public holidays.
 4. Grand Total: 17 weeks = 4 months.

Reference Table A-II/1

Standard of Competence for officer in charge of Navigational Watch (Second Mate of a Foreign Going Ship)

Function – Navigation at Operation level

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
Competence No. 1: Plan and conduct a passage and determine position 1.1 Terrestrial and Coastal Navigation 1.1.1 Shape of earth, great circle, spherical triangle, earth axis, poles, equator, meridians, latitude, parallels of latitude, prime meridian, longitude, difference of latitude and difference of longitude, geographical mile, statute mile, and comparison with kilometre, nautical mile, cable and knot. 1.1.2 Charts: Natural scale, Meridional parts, chart catalogue, and Gnomonic charts, plan charts, Mercator charts. Procedures for correction of charts and publications including T&P notices, using information from Notices to Mariners and corrections using tracings. Chart folio and Chart correction log (NP 131). 1.1.3 Datums: axis of rotation, directions by gyrocompass, magnetic compass. 1.1.4 Compass corrections: Deviation, Variation, and compass error. Transit bearings. 1.1.5 Distances: Measurement of distance between two positions on a Mercator chart. 1.1.6 Position lines and positions: Definition of a position line / circle, finding the position by range and bearings. 1.1.7 Plane and Mercator Sailings: Departure, D'lat and distance relationship, true course, rhumb line, parallel sailing formula, distance between two positions, use of traverse table, Days work exercises, Calculate slip. Mercator sailing. 1.1.8 Chartwork exercises: Allowing and counteracting current and leeway, tidal stream, running fix, (transfer of position lines / circles) , horizontal sextant angles, finding out actual set and rate of current, 1.1.9 Information from nautical charts, lists of lights and other publications: Publication 5011, Tide tables, IALA system of buoyage, geographical range, luminous	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate .4 approved laboratory equipment's training Using: chart catalogues, charts, nautical publications, radio navigational warnings, sextant, azimuth mirror, electronic navigation equipment, echo-sounding equipment, compass	The information obtained from nautical charts and publications is relevant, interpreted correctly and properly applied. All potential navigational hazards are accurately identified Calculations and measurements of navigational information are accurate The charts selected are the largest scale suitable for the area of navigation and charts and publications are corrected in accordance with the latest information available.

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
range, nominal range, raising / dipping, first / last sighting distances, „ 1.1.10 Tides: Range, duration of tide, height of tide, spring and neap tides, standard and secondary port, tide calculations, heights for intermediate times & visa-versa. Using tidal stream atlas. Obtaining current direction and rate from approach charts. 1.1.11 Keeping a log: Procedures for keeping log during ocean passages, coastal navigation and at anchor. 1.1.12 Passage Planning Plan a passage between two ports from berth to berth using the procedures for passage planning. → Appraisal – ascertain the charts and publication required for the voyage and whether they are corrected and up-to-date, Extract all relevant information from the publications and obtain weather prognosis. → Planning – Plot courses on the charts, both small and large scale, way points, no-go areas, contingency anchorages, alerts, abort points and other relevant marks. Prepare a Passage Plan document. → Execution – During the voyage, fix positions as indicated on the passage plan, maintain sufficient bridge manning levels, obtain Navigational and weather warnings, maintain lookout and navigate to keep clear of other vessels and navigational hazards. → Monitoring – Monitor frequently the traffic, position, weather, visibility and maintain a situational awareness at all times. Check the proper functioning of navigational instruments and fill up logs periodically during watch. 1.1.13 Great Circle sailing: Use gnomonic chart to plot a great circle track and transfer it to a Mercator chart. Obtain initial and final course and find vertex. Calculate the great circle distances.		
1.2 Celestial Navigation 1.2.1 Solar system: Celestial pole, perihelion and aphelion, Kepler’s laws of planetary motion, solstices and equinoxes, SHA,		

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
Declination of bodies and 'd' correction, twilights, earth-moon system, solar and lunar eclipses. 1.2.2 Celestial sphere and equinoctial system of co-ordinates: Celestial sphere, celestial poles, celestial meridians, equinoctial, obliquity of ecliptic. 1.2.3 Hour angle: GHA, LHA, SHA, 'v' correction, right ascension. 1.2.4 Daily motion and horizontal system of co-ordinates: Rational horizon, zenith, nadir, vertical circle, elevated pole, depressed pole, true altitude, azimuth, true zenith distance, PZX triangle, circumpolar bodies. 1.2.5 Sextant and altitude corrections: Errors of sextant. Reading a sextant, index error, visible, sensible and rational horizons, observed attitude, dip, apparent altitude, refraction, semi-diameter and parallax, 1.2.6 Amplitude: Theoretical and visible sunrise and sun set, calculation of true amplitude. 1.2.7 Time: Relationship between LHA (sun) and LAT, mean solar day, equation of time, GMT, LMT and longitude relationship, zone and standard times, 1.2.8 Nautical Almanac: Information in Nautical Almanac and using it for celestial observations. 1.2.9 Latitude by meridian altitude: Calculation of latitude by meridian altitude (of sun only) 1.2.10 Pole Star observations: Identification of Polaris, a_0, a_1, a_2 corrections and calculation of azimuth and position line & a position through which it passes. 1.2.11 Position fixing: Ex-Meridian of sun. Long by chron and intercept methods of sight calculation, true azimuth of a body, position finding by simultaneous & staggered observations. 1.2.12 Errors of compasses — Azimuths: Calculation of magnetic compass and gyro compass errors by observing heavenly bodies, (including the use of ABC tables).		

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
1.3 Electronic Systems of Position Fixing 1.3.1 Terrestrial Navigation systems : principle, block diagram, working, and errors of new terrestrial electronic position fixing systems, e.g. E-Loran (when functional) 1.3.2 Global Positioning System (GPS): Basic principle and errors of GPS system and DGPS. 1.3.3 Electronic Chart Display and Information System (ECDIS) : ECDIS, comparison of ECDIS and paper charts. Difference between Raster and Vector charts, and between ECS and ECDIS. 1.3.4 Automatic Identification System (AIS) - Purpose of AIS - information exchanged and types of messages - Information displayed on AIS screen - Limitations of AIS and precautions during use of AIS for collision avoidance. 1.3.5 LRIT (Long Range Identification and Tracking) - Purpose of LRIT, Data transmitted by LRIT - Authorised receivers/ users of LRIT - Difference between LRIT and AIS 1.3.6 VDR (Voyage Data Recorder)- Concept and purpose of VDR - Details of data recorded on VDR and the duration of data stored; modules of VDR, - Playback options S-VDR (Simplified VDR); Requirement of float-free arrangement. Echo-sounders and Speed Measurement 1.3.7 Echo sounders: Basic principle, block diagram, operation and errors of echo sounder. 1.3.8 Speed log: Basic principle of Electro magnetic log, Doppler speed logs, and their limitations. Janus configuration. Compass — Magnetic and gyro 1.3.9 The magnetism of the earth. Magnetic poles and variation. 1.3.10 The magnetic compass: Liquid and dry card magnetic compass, lubber line and ship's deviation. 1.3.11 The gyro-compass: Free gyroscope,	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate Assessment of evidence obtained from approved training course on ECDIS.	The primary method of fixing the ship's position is the most appropriate to the prevailing circumstances and conditions. The reliability of the information obtained from the primary methods of position fixing is checked at appropriate intervals. The position is determined within the limits of acceptable instrument /system errors. Performance checks and tests to navigation systems comply with manufacturer's recommendations And good navigational practice. Errors in magnetic and gyro- compasses are determined and correctly applied to courses and bearings The selection of the mode of steering is the most suitable for the prevailing weather, sea and traffic conditions and intended manoeuvres.

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
gyroscopic inertia and precession, tilt & drift, , North seeking ability of gyro compass, basic knowledge of the errors of gyro and application of course, latitude and speed errors, calculation of gyro error. 1.3.12 The automatic pilot: Principle, functions, auto pilot alarm,. Various settings of the auto-pilot for optimal performance. Steering control systems 1.3.13 Knowledge of steering control systems, operational procedures, and change over from manual to auto and vice-versa, procedure for testing of steering system. Use of Rate of Turn Indicator (ROTI).		
1.4 Meteorology The Meteorological Elements 1.4.1 Shipborne meteorological instruments: , Aneroid Barometer and barograph, Hygrometer and Stevenson's Screen, Whirling Psychrometer, Wind Sensors (anemometer),. 1.4.2 The atmosphere, its composition and physical properties: Troposphere, Tropopause, Stratosphere, Stratopause, Mesosphere, Mesopause, Thermosphere, Insolation, Water Vapour, Evaporation, Condensation, Latent Heat, Dew Point, Absolute Humidity, Relative Humidity and Vapour Pressure. 1.4.3 Atmospheric pressure: Definition of Pressure, Change of Pressure with Height, Average Pressure, Isobar, Isallobar, barometric tendency. 1.4.4 Wind: Beaufort scale of wind force, pressure gradient force, Coriolis force, Buys Ballot's law, apparent and true wind and its vector calculation. 1.4.5 Cloud and Precipitation: Formation of Clouds, the Different types of Clouds, Classification of Clouds as per height, Precipitation, Drizzle, Hail, Snow, Sleet 1.4.6 Visibility: Formation of Fog, Mist, Haze, different types of Fog, effect of Fog, Mist, Haze, and other meteorological conditions on Visibility. 1.4.7 Climatology: The Wind and Pressure systems over the oceans, Mean Surface Pressure and Wind distribution, Doldrums, Inter-tropical Convergence		Measurements and observations of weather conditions are accurate and appropriate to the passage.

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
Zones, Westerlies, Polar Easterlies, Monsoons, Land and Sea Breeze, Anabatic and Katabatic Winds. 1.4.8 Sea and Swell: Sea waves, swell, storm surge, tsunami, bore tides. Interpret wind rose. 1.4.9 Weather systems: Structure of Depressions, Air Mass, Source Region, Warm Front, Cold Front, , Anticyclone, Ridge, Col and other pressure systems. 1.4.10 Weather reports and forecasting: Types of Weather Services for shipping and Weather information available to Shipping, Weather routeing services. Meteorological offices. Weather Facsimile Receiver, Digital weather receivers, Recording and Reporting Weather observations: Meteorological Codes, Coding and Decoding of Weather messages, Weather Forecasting: Interpretation of Symbols and Isobaric Patterns on Weather Charts and Facsimile Charts. Identify the weather associated with the synoptic features.		Meteorological information is correctly interpreted and applied;
Competence No.2: Maintain a safe navigational watch Watch-keeping 2.1 Watch-keeping Arrangements and Procedures 2.1.1 The content, application and intent of COLREG 72: Rules 1 to 38 2.1.2 Keeping a safe navigational watch as per Section A-VIII/2 and B-VIII/2 of STCW: Principles observed in keeping safe navigational watch. Relieving of duties, procedure of taking over watches, action on receiving storm warning, entries in logbook, bridge manning levels. Bridge Procedures Guide and its contents, Bridge Navigation Watch Alarm System (BNWAS), Ship Security Alert System (SSAS). 2.1.3 Keeping an effective anchor watch: Relieving of duties, procedure of taking over watches, action on receiving storm warning, entries in logbook. 2.2 Thorough knowledge of effective bridge team work procedures and maintaining situational awareness. 2.3 The use of routeing in accordance with the General Provisions of Ship's	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate .4 approved laboratory equipment's training	The conduct, hand-over and relief of the watch conforms with accepted principles & procedures. A proper look-out is maintained at all times and in such a way as to conform to accepted principles & procedures. Lights, shapes & sound signals conform to the requirements contained in the International Regulations for Preventing Collisions at Sea and are correctly recognised. The frequency & extent of monitoring of traffic, the ship & the environment conform to accepted principles & procedures. A proper record is maintained of the movements and activities

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
Routeing 2.4 The effective use of information from navigational equipment for maintaining a safe navigational watch and regular checks to monitor their proper operation. 2.5 The use of reporting in accordance with general principles for ship reporting systems and with VTS reporting procedures. 2.6 Navigational Techniques used for safe navigation in restricted visibility (blind navigation / blind pilotage techniques). Bridge Resource Management 2.7 Knowledge of bridge resource management principles including: 2.7.1 allocation, assignment, and prioritization of resources 2.7.2 effective communication 2.7.3 assertiveness and leadership 2.7.4 obtaining and maintaining situational awareness	Assessment of evidence obtained from one or more of the following: .1 approved training .2 approved in-service experience .3 approved simulator training which includes use of BRM principles and techniques	relating to the navigation of the ship. Responsibility for the safety of navigation is clearly defined at all times, including periods when the master is on the bridge and while under pilotage. Resources are allocated and assigned as needed in correct priority to perform necessary tasks Communication is clearly and unambiguously given and received Questionable decisions and/or actions result in appropriate challenge and response Effective leadership behaviours are identified Team member(s) share accurate understanding of current and predicted vessel state, navigation path, and external environment
Competence No 3 : Use of Radar and ARPA to maintain safety of navigation 3.1 Fundamental Theory 3.1.1 Fundamental principles of radar: Block diagram, use of various controls and radar as range and bearing measuring instrument. 3.1.2 Safe distances: With respect to radar spares and magnetic compasses. 3.1.3 Radiation hazards and precautions: Safety precautions necessary in the	Assessment of evidence obtained from approved radar simulator and ARPA simulator training plus in-service experience	Information obtain& from radar and ARPA is correctly interpreted & analysed, taking into account the limitations of the equipment :& prevailing circumstances and conditions Action taken to avoid a close encounter or collision with other

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
vicinity of open equipment, radiation hazard near antennae and open waveguides. 3.1.4 The characteristics of radar sets: Bearing range accuracy, HBW. VBW, pulse length, pulse recurrence rate, maximum & minimum range of radar, range and bearing discrimination. 3.1.5 Factors external to the radar set affecting radar detection: Radar horizon, sub refraction, super refraction & ducting, effect of precipitation and sea on radar detection. 3.1.6 Factors that might cause faulty interpretation: Indirect echoes, side echoes, multiple echoes, second 'trace echoes. 3.2 Setting Up and Maintaining Displays 3.2.1 Function and adjustment of controls: Transmitter controls, reception controls, display controls, different types of display, performance monitor. 3.2.2 Measurement of range & bearing: Range & bearing accuracy, error in range & bearing. 3.3 Marine Radar Performance Specifications 3.3.1 Performance standards for radar equipment 3.3.2 Limitations of the radar X-band and S-band. 3.4 Plotting 3.4.1 The relative motion triangle: Drawing of relative motion triangle and identification of various vectors and angles 3.4.2 Plotting devices: Drawing the relative motion triangle on a plotting chart, 3.4.3 Course, speed and aspect of other ships in relative and true presentation. Set vector lengths based on own vessel speed and range scale in use. Advantages and limitations of use of relative and true vectors and when to use which for optimum efficiency 3.4.4 Closest point of approach (CPA) and time to closest point of approach (TCPA), bow pass, in relative and true presentation and plot. 3.4.5 The effect of course and speed changes on the display. Advantages of compass		vessels is in accordance with the International Regulations for Preventing Collisions at Sea Decisions to amend course and/or speed are both timely and in accordance with accepted navigation practice Adjustment made to the ship's course and speed maintain safety of navigation Communication is clear, concise: and acknowledged at all times in a sea-manlike manner Manoeuvring signals are made at the Appropriate time and are in accordance with the International Regulations for Preventing Collisions at Sea

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
stabilization of a relative display. 3.4.6 Standardized report format and reporting procedure: Elements of the two parts of a report (bearing and change, range and change, CPA, TCPA, course, aspect and speed) 3.4.7 Use of Trial manoeuvre and predictive motion vectors.		
3.5 The Use of Radar in Navigation : 3.5.1 Obtaining position fix by radar bearings and ranges, possible errors,. Reliability of fix. 3.5.2 Aids to radar navigation: Use of passive (trails, history) and active aids, RACONs and SARTs. Explain AIS overlay on radar / ARPA. 3.5.3 The use of parallel indexing technique in radar navigation:, wheel over positions and safety margins. 3.6 Radar and COLREG 1972 3.6.1 The relationship of COLREG 1972 to the use of radar: Lookout, safe speed, plotting of targets and actions to be taken to avoid collision in clear and bad visibility conditions. 3.7 Review of Plotting Techniques: Course, speed, aspect, CPA and TCPA determination, avoiding action. 3.8 Principal ARPA Systems: Vectors (relative and true), digital read-out, potential points of collision, predicted areas of danger. 3.9 IMO Performance Standards for Automatic Radar Plotting Aids (ARPA): Requirements for acquisition and tracking of targets, operation warnings, gyro and log inputs. 3.10 Acquisition of Targets: Manual and automatic acquisition of targets, guard rings and guard zones. 3.11 Tracking Capabilities and Limitations: Principle of tracking by ARPA, target swap. 3.12 Processing Delays: The reason for delay in display. 3.13 Setting Up and Maintaining Displays: Optimum display of echoes, use of echo referencing in the true motion mode. 3.14 Representation at Target Information:, results of trial manoeuvres, benefits and		

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
limitations of operational warnings. 3.15 Errors of Interpretation: Lost target, incorrect interpretation of ARPA data 3.16 Errors in Displayed Data: Errors in bearing by backlash, ship motion, asymmetrical antenna beam, azimuth quantization, error range by rolling of “own ship”, range quantization, effects of heading and speed errors on derived information. 3.17 System Operational Tests: Self-diagnostic routines. 3.18 Risks of Over-reliance on ARPA 3.19 Obtaining Information from ARPA Displays: Critical targets, relative and true course and speed of target, CPA and TCPA targets. 3.20 Application of COLREG 1972: Analysis of displayed situations, actions to avoid close quarter situations. 3.21 Ground stabilization: Errors involved, advantages and limitations of ground stabilization and sea stabilization. 3.22 Caution to be taken when used in conjunction with Doppler Log (Doppler feed to ARPA)		
Competence No. 4: Use of ECDIS to maintain the Safety of Navigation 4.1 Knowledge of the capability and limitations of ECDIS operations including: .1 a thorough understanding of Electronic Navigational Chart (ENC) data, data accuracy, presentation rules, display options and other chart data formats .2 the dangers of over reliance .3 familiarity with the functions of ECDIS required by performance standards in force 4.2. Proficiency in operation, interpretation, and analysis of information obtained from ECDIS, including: .1 use of functions that are integrated with other navigation systems in various installations, including proper functioning and adjustment to desired settings .2 safe monitoring and adjustment of information including own position, sea area display, mode and orientation, chart data displayed, route monitoring, user-created information layers,	Examination and assessment of evidence obtained from one or more of the following: .1 approved training ship experience .2 approved ECDIS simulator training	Monitors information on ECDIS in a manner that contributes to safe navigation Information obtained from ECDIS (including radar overlay and/or radar tracking functions, when fitted) is correctly interpreted and analyzed taking into account the limitations of the equipment, all connected sensors (including radar and AIS where interfaced), and prevailing circumstances and conditions Safety of navigation is maintained through

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
contacts (when interfaced with AIS and/or radar tracking) and radar overlay functions (when interfaced) .3 confirmation of vessel position by alternate means .4 efficient use of settings to ensure conformance to operational procedures, including alarm parameters for anti-grounding, proximity to contacts and special areas, completeness of chart data and chart update status, and backup arrangements .5 adjustment of settings and values to suit the present conditions .6 situational awareness while using ECDIS including safe water and proximity of hazards, set and drift, chart data and scale selection, suitability of route, contact detection and management, and integrity of sensors		adjustments made to the ship's course and speed through ECDIS-controlled track keeping functions (when fitted). Communication is clear, concise and acknowledged at all times in a seamanlike manner
Competence No. 5: Respond to emergencies 5.1 Contingency plans for response to emergencies: List the Contents of muster list, State that the duties are assigned to remote control operations, Describe the divisions of the crew into a command team, emergency team, back-up team and engine room team. State that good communication between command team and emergency teams are essential, Describe the actions taken in various emergencies 5.2. Measures which should be taken in emergencies for the protection and safety of the ship, passengers and crew 5.2.1. Actions to be taken on stranding. Initial damage, assessment and control, sounding of compartments, sounding depths all round the ship using hand-lead 5.2.2. State the Actions to be taken following a collision considering Initial damage, assessment and control, stoppage of engine, preparing life boat, sending distress or urgency signal 5.2.3. Precautions for the protection and safety of passengers in emergency situations: warning the passengers, evacuating all passengers, taking a roll call, instructing passengers during drills and supply of blankets.	Examination and assessment of evidence obtained from one or more of the following: 1 approved in-service experience 2 approved training ship experience 3 approved simulator training, where appropriate 4 practical training	The type and scale of the emergency is promptly identified Initial actions and, if appropriate, manoeuvring of the ship are in accordance with contingency plans and are appropriate to the urgency of the situation and nature of the emergency

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
5.2.4. Means of limiting damage and salving the ship following a fire or explosion: Cooling of compartment boundaries, inspection for damage. 5.2.5 Procedure for abandoning ship: Transmission of distress call until acknowledged, Extra food and blanket, EPIRB, SARTs and hand held VHF sets, warm clothing and life jackets, TPAs and Immersion suits, launching in heavy weather, use of rocket line-throwing appliances and breeches buoy. 5.2.6. Use of emergency steering : Arrangement of emergency steering, 5.2.7. Arrangements for towing and being taken in tow: Towing equipment and tools on board ship, methods of towing disabled ship and communication between two ships. 5.2.8. Rescue of persons from sea or from a vessel in distress: Waiting for day light, providing a lee, method of rescue when sea conditions are too dangerous to use boat.		
Competence No. 6 : Respond to distress signal at sea 6.1. Measures for assisting a vessel in distress: Knowledge of the contents of the IAMSAR, various search pattern and signals to be made by ships & aircraft. 6.2. Man-overboard procedures: Initial actions, use of man-overboard function in GPS for homing in to the man in the water, preparations for rescuing man, picking up man and picking up boat.	Examination and assessment of evidence obtained from practical instruction or approved simulator training, where appropriate	The distress or emergency signal is immediately recognized Contingency plans and instructions in standing orders are implemented and complied with
Competence No. 7: Use the IMO Standard Marine Communication Phrases and use English in written and oral form. 7.1 English language 7.1.1 Adequate knowledge of the English language to enable the officer: - to use charts and other nautical publications - to understand Meteorological information and messages concerning ships safety and operation - to communicate with other ships, coast stations and VTS centres	Examination and assessment of evidence obtained from practical instruction	English language nautical publications and messages relevant to the safety of the ship are correctly interpreted or drafted Communications are clear and understood

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
- to perform the officer's duties also with a multilingual crew 7.2 Standard Marine Communication Phrases 7.2.1 Use and understand the IMO Standard Marine Communication Phrases (SMCP)		
Competence No. 8: Transmit and receive information by visual signalling 8.1 Signalling by Morse Code (Transmission & reception): Morse symbols for the alphabet and numerals, transmit and receive single letter signals by Morse light (at the rate of 8 characters per minute), as specified in the International code of signals. Ability to transmit and receive the distress signal "SOS", urgency signal "XXX", and Safety signal "TTT", 8.2 Using International Code of Signals: Recognition of International codes flags and pendants, purpose of International code of signals, meanings of single-letter Flag signals, International Code Signal of distress.	Assessment of evidence obtained from practical instruction and / or simulation	Communications within the operator's area of responsibility are consistently successful
Competence No. 9: Manoeuvre the ship 9.1 The effects of various deadweights, draughts, trim, speed and under-keel clearance on turning circles and stopping distances. Manoeuvring Data of Ship: Advance, transfer, drift angle, tactical diameter, track reach, head reach, side reach, turning circles of a ship, directional stability. 9.2 Effect of wind and current on ship handling: Effect of wind on a given ship while moving and when making large turns, effect of current on the motion of the ship, 9.3 Manoeuvres for the rescue of a man overboard: Immediate action, delayed action, single turn, Williamson turn and Scharnow turn, sequence of actions when a person is seen to fall overboard. 9.4 Squat and shallow-water and similar effects: Shallow water, squat and bank effect. 9.5. Proper procedures for anchoring and mooring: Procedure for anchoring, and the	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate .4 approved training on a manned scaled ship model where appropriate	Safe operating limits of ship propulsion, steering and power systems are not exceeded in normal manoeuvres Adjustments made to the ship's course and speed maintain safety of navigation

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
precautions to be taken. Use the correct terminology for communication between bridge and anchor station crew Use of anchor buoys, Marking of the cable, sealing of spurling pipes, Joining of two mooring ropes, slip wire. Mooring plan of a ship, optimum mooring pattern and rope leads. Dangers of using different rope types in one mooring system. Rigging pilot ladder /combination ladder, making fast tugs, using fenders during berthing.		

FUNCTION II: CARGO HANDLING & STOWAGE AT THE OPERATION LEVEL

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
Competence No. 10: Monitor the loading, stowage, securing and unloading of cargoes and their care during the voyage 10.1. Dry Cargoes 10.1.1. Inspection and preparation of holds: General Inspection of Holds, items to be inspected, importance of cleaning holds, using dunnage, using spar ceiling, blanking of ballast lines to deep tanks. 10.1.2. Segregation and separation of cargoes: Segregation of different cargoes with reference to Dangerous Goods, dry, wet and Delicate Cargoes, separating adjacent parcels of cargo. 10.1.3. Securing cargoes: Lashing Code and Cargo Securing Manual. Methods of blocking, lashing, shoring and tomming cargo, methods of securing heavy loads and vehicles and trailers. 10.1.4. Ventilation and control of sweat: Control of sweat by ventilation, operation of ventilation system, cargoes requiring special ventilation 10.1.5. Deck cargo: Efficient securing of deck cargoes, proper battening of cargo before loading deck cargo, safe access to essential equipment and spaces, unobstructed view from navigating bridge, max permissible load, IMO code of safe practice for ships carrying timber deck cargo. 10.1.6. Refrigerated cargo: Preparation of holds for loading refrigerated cargo, inspections of the cargo, use of brine traps, purpose of temperature recording. 10.1.7. Container Cargo: Arrangement of a container ship, lashing and securing arrangements of containers, types and sizes of containers, stack weights. 10.1.8 RoRo Vehicles: Preparation of the car decks for the loading of trailers and vehicles, floating decks, and procedures for opening, closing, securing of bow, stern and side doors and ramps and to correctly operate, care and maintain the related systems. Maintaining water-tight integrity of the cargo decks. 10.2. Cargo Handling 10.2.1. Cargo-handling equipment: Care and maintenance of standing rigging, topping	Examination and assessment of evidence obtained from one or more of the following .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate	Cargo operations are carried out in accordance with the cargo plan or other documents and established safety rules / regulations, equipment operating instructions and shipboard stowage limitations. The handling of dangerous, hazardous and harmful cargoes complies with international regulations and recognized standards and codes of safe practice

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
lifts, cargo runners, cargo blocks and derrick heel fittings, rigging of derricks for loading and discharging of cargoes, ship rigging plan, use of slings, snotters, canvas slings, trays, pallets, nets, chain slings. 10.2.2 Cargo-handling safety: Safe working load of a gear, visual inspection before the start of cargo, mechanically or hydraulically operated hatches, precautions while doing cargo operations, effect of heavy lift on sea worthiness and stability of the ship, effective communication during loading and discharging. Dock Safety Regulations. 10.2.3 Deep tank cargoes: Cleaning and preparation of deep tanks for loading, securing of deep tank lids. 10.2.4 Keeping a safe deck watch in port 10.3 Dangerous, Hazardous and Harmful (Marine Pollutants) Cargoes 10.3.1 Dangerous goods in packaged form: Classification of IMDG cargo, use of IMDG code, precautions to be taken while working with IMDG cargo, MFAG, EmS, IMGS, segregation tables. 10.3.2 Keeping a safe deck watch in port when carrying hazardous cargo: Hazardous cargo, special requirements when carrying hazardous cargo, procedure for entry into enclosed spaces and permit to work. 10.3.3 Bulk cargoes (other than grain): IMO code of safe practice for solid bulk cargoes, angle of repose, flow moisture point, flow state, transportable moisture limit, preparations of holds prior to loading bulk cargoes, hazards associated with coal cargoes. 10.3.4 Bulk grain cargoes: Bulk cargo code, preparations of holds for the carriage of grain, insect or rodent infestation, and use of shifting boards. 10.4 Oil, Chemical and Gas Tanker Piping and Pumping Arrangements: 10.4.1 Tanker arrangement: Cargo tanks, pump rooms, slop tanks, cofferdams, deep tanks, tank coating, reliquefaction system. 10.4.2 Cargo piping systems: Direct pipe line and ring-main system, piping arrangement in pump room. 10.4.3 Cargo pumps: Different types of pumps for cargo operations, use of eductors. 10.4.4 Hazards of oil, chemical, gas cargoes including tank atmosphere control		

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
and tank cleaning procedures 10.5 Precautions before Entering Enclosed or Contaminated Spaces: Potentially dangerous spaces like cargo, fuel and ballast tanks, pump rooms, cofferdams, duct keels. Ensure oxygen content 21% by volume, need of thorough ventilation of space, need of preparing safety check list, use of various instruments to check the gases in a compartment. 10.6 Stowage Calculations 10.6.1 Cargo calculations and cargo plans: Stowage factor, broken stowage, load density, ullage, calculation of cargo to be loaded, extracts from cargo plans, making a cargo plan. Calculation on purchases and tackles . Simple calculations on liquid cargoes based on density, temperature and volume. 10.6.2 Knowledge of the effect of the cargo including heavy lifts on the seaworthiness and the stability of the ship.		
Competence No. 11: Inspect and report defects and damage to cargo spaces, hatch covers and ballast tanks 11.1 Knowledge and ability to explain where to look for damage and defects most commonly encountered due to: .1 loading and unloading operations .2 corrosion .3 severe weather conditions 11.2 Ability to state which parts of the ship shall be inspected each time in order to cover all parts within a given period of time. 11.3 Identity those elements of the ship structure which are critical to the safety of the ship. 11.4 State the causes of corrosion in cargo spaces and ballast tanks and the how corrosion can be identified and prevented. 11.5 Knowledge of procedures on how the inspections shall be carried out. 11.6 Ability to explain how to ensure reliable detection of defects and damages. 11.7 Understanding of the purpose of the “enhanced survey programme”.	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience. .2 approved training ship experience. .3 approved simulator training, where appropriate.	The inspections are carried out in accordance with laid-down procedures and defects and properly reported. Where no defects or damage are detected, the evidence from testing and examination clearly indicates adequate competence in adhering to procedures and ability to distinguish between normal and defective or damaged parts of the ship.

FUNCTION III: CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD AT THE OPERATION LEVEL

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
COMPETENCE No 12: Ensure compliance with pollution prevention requirements 12.1. Knowledge of the precaution to be taken to prevent pollution of the marine environment while bunkering, loading/discharging oil, chemicals and hazardous cargoes, tank cleaning, pumping out bilges 12.2. Knowledge of anti-pollution procedures & all associated equipment – Oil discharge monitoring and Control system (ODMCS). 12.2.1. The International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78). 12.2.2 Technical annexes: Annex I to VI, and other countries legislation like OPA – 90 and National Pollutant Discharge Elimination system (NPDES) of the U.S. Clean Water Act. 12.2.3. Annex – I: Oil discharge, monitoring and control system, oil and water mixture and particularly sensitive areas. 12.2.4 Annex II: Chemical discharge criteria, monitoring and control system. 12.2.5. Control of oil from machinery spaces: Discharge provisions for oil and oily waste from machinery spaces outside special areas, within special areas, bilge water holding tank, oil water separator 12.2.6 Oil record book (Part I, Machinery Space Operations) Part II (Cargo and ballast operations): Entries to be made in oil record books. 12.2.7. Precautions to be taken to prevent accidental pollution by oil. Checklist while bunkering and transferring in oil, precautions while carrying out any oil operations. Shipboard Oil Pollution Emergency Plan (SOPEP), Vessel Response Plan (VRP) 12.2.8. Procedure and arrangements for Chemical carriers, Record Book for Chemical Cargoes, SMPEP.	Examination and assessment of evidence obtained from one or more of the following: 1 approved in-service experience 2 approved training ship experience 3 approved training	Procedures for monitoring shipboard operations and ensuring compliance with MARPOL requirements are fully observed Actions to ensure that a positive environmental reputation is maintained

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
12.2.9 Operating procedures of anti-pollution equipment: Sewage plant, incinerator, comminutor, ballast water treatment plant. 12.2.10. Garbage Management System, Ballast Water Management and their discharge criteria. 12.2.11 Understanding contents of Annex VI - air pollution 12.3. Importance of proactive measures to protect the marine environment		
Competence 13: Maintain sea-worthiness of the ship 13.1. Ship construction(Including corrosion and maintenance of Hull and fittings) 13.1.1. Ship Dimensions and form: General arrangement general cargo, oil, chemical and gas tankers, bulk carriers, combination carriers, containers, ro – ro and passengers ships, definitions of camber, rise of floor, flare, shear, rake. 13.1.2. Ship stresses: Hogging, sagging, racking, panting and pounding, slamming, torsional stresses 13.1.3. Hull Structure: Proper names for various parts, standard steel sections 13.1.4. Bow and Stern: Stern frame, structural arrangement forward and aft to withstand painting and pounding. 13.1.5 Fittings: Water tightness of the hatches, opening in oil, chemical and gas tankers, chain lockers and attachment of cables, bilge piping system, ballast system, sounding and air pipes. 13.1.6 Rudders and propellers: Construction of rudders and propeller,. 13.1.7 Load lines and draught marks: Deck line, free board, Plimsoll line. 13.2 Stability: 13.2.1 Displacement: Displacement/draft curve and table, light displacement, load displacement, dead weight, TPC, MCTC, block co-efficient, water plane co-efficient. 13.2.2 Buoyancy: Meaning of buoyancy, reserve buoyancy. 13.2.3 Fresh water allowance: Calculation of TPC, FWA and DWA in various densities. 13.2.4 Statical stability: Centre of gravity, centre of buoyancy, righting lever, righting	Examination and assessment of evidence obtained from one or more of the following .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate .4 approved laboratory equipment's training	The stability conditions comply with the IMO intact stability criteria under all conditions of loading Actions to ensure and maintain the watertight integrity of the ship are in accordance with accepted practice

Knowledge, Understanding & Proficiency / Course covered	Methods demonstrating competence	of Criteria for evaluating competence
moment. 13.2.5 Initial stability: Stability up to 10° angle of heel, transverse metacentre, and hydrostatic curves. 13.2.6 Angle of loll: Definition and correction of angle of loll. 13.2.7 Curves of statical stability: KN curves, curve of statical stability, deriving information from the curve. 13.2.8 Movement of the centre of gravity: Change of centre of gravity of a ship by loading, discharging, shifting of weight. 13.2.9 List and its corrections: Calculation of list while loading, discharging or shifting weights, correction of list. 13.2.10 Effect of slack tanks: Free surface effect and its calculation, calculation of GM fluid. 13.2.11 Trim: Calculation of, forward and aft drafts using trim tables. 13.2.12 Actions to be taken in the event of partial loss of intact buoyancy: Closing of watertight doors, cross flooding arrangement. 13.2.13 Stress tables and stress calculating equipment — loadicator 13.2.14 Ships stability criteria,. 13.2.15 Use of stability booklet and calculations based on that		
Competence No. 14: Prevent, Control and Fight Fires on board <i>Fire prevention and fire-fighting appliances</i> Knowledge of fire prevention Ability to organise fire drills Knowledge of classes and chemistry of fire Knowledge of fire-fighting systems Knowledge of action to be taken in the event of fire, including fires involving oil systems	Assessment of evidence obtained from approved fire-fighting training course (Advanced Fire-Fighting Course) and experience.	The type and scale of the problem is promptly identified and initial actions conform to the emergency procedure and contingency plans for the ship. Evacuation, emergency shutdown and isolation procedures are appropriate to the nature of the emergency and are implemented promptly. The order of priority, and the levels and time-scales of making reports and informing personnel on board, are relevant to the nature of the emergency and reflect the urgency of the problem.

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
Competence No. 15: Operate Life-saving appliances <i>Life —saving</i> Ability to organize abandon ship drills and knowledge of the operation of survival craft and rescue boats, their launching appliances and arrangements, and their equipment, including radio life-saving appliances, satellite EPIRBs, SARTs, immersion suits and thermal protective aids. Knowledge of survival at sea techniques.	Assessment of evidence obtained from approved training course (Proficiency in Survival Craft and Rescue Boats Course) and experience.	Actions is responding to abandon ship and survival situations are appropriate to the prevailing circumstances and conditions and comply with accepted safety practices and standards.
Competence No.16 Apply medical first aid on board the ship <i>Medical aid</i> Practical application of medical guides and advice by radio, including the ability to take effective action based on such knowledge in the case of accidents or illnesses that are likely to occur on board ship.	Assessment of evidence obtained from approved training course (Medical First Aid Course).	The identification of probable cause, nature and extent of injuries or conditions is prompt and treatment minimises immediate threat to life.
Competence-No. 17: Monitor compliance with legislative requirements 17.1 To demonstrate basic working knowledge of the relevant IMO convention concerning SOLAS, MARPOL, Load Line, ISM Code, ISPS Code and STCW-2010 with regards to contents, objectives, application, amendments. 17.2 Code of Safe working practices for Merchant Seamen 17.3 Indian Merchant Shipping Act and Rules: Statutory surveys and certificates and preparations for the same. 17.4 Classification Society surveys and certificates - Preparations for the same.	Assessment of evidence obtained from examination or approved training course.	Legislative requirements relating to safety of life at sea and protection of the marine environment are correctly identified.
Competence No. 18: Application of Leadership and Team working Skills 18.1 Working knowledge of shipboard personnel management and training. 18.2 A knowledge of related international maritime conventions and recommendations, and national legislation. 18.3 Ability to apply task and workload management including: .1 planning and coordination .2 personnel assignment .3 time and resource constraints .4 prioritization	Assessment of evidence obtained from one or more of the following: .1 approved training .2 approved in-service experience .3 practical demonstration	The crew are allocated duties and informed of expected standards of work and behaviour in a manner appropriate to the individuals concerned. Training objectives and activities are based on assessment of current competence and capabilities and operational requirements. Operations are demonstrated to be in

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
18.4 Knowledge and ability to apply effective resource management: .1 allocation, assignment, and prioritization of resources .2 effective communication onboard and ashore .3 decisions reflect consideration of team experiences .4 assertiveness and leadership including motivation .5 obtaining and maintaining situational awareness. 18.5 Knowledge and ability to apply decision-making techniques: .1 situation and risk assessment .2 identify and consider generated options .3 selecting course of action .4 evaluation of outcome effectiveness		accordance with applicable Rules. Operations are planned and resources are allocated as needed in correct priority to perform necessary tasks. Communication is clearly and unambiguously given and received. Effective leadership behaviours are demonstrated. Necessary team member(s) share accurate understanding of current and predicted vessel and operational status and external environment. Decisions are most effective for the situation. Operations are demonstrated to be effective and in accordance with applicable rules.
Competence No.19: Contribute to the safety of personnel and ship 19.1 Knowledge of personal survival techniques. 19.2 Knowledge of fire prevention and ability to fight and extinguishing fires. 19.3 Knowledge of elementary first aid. 19.4 Knowledge of personal safety and social responsibilities.	Assessment of evidence obtained from approved trainings and experiences as set out in section A-VI/1, paragraph 2	Appropriate safety and protective equipment is correctly used. Procedures and safe working practices designed to safeguard personnel and the ship are observed at all times. Initial and follow-up actions on becoming aware of an emergency conform with established emergency response procedures.

Notes:

- 1) Upgradation of PSSR Course from STCW 1995 to STCW 2010 is required to be done for all candidates holding STCW 1995 PSSR Course (Duration 3 hours)

Topics to be covered: Conflict Resolution, Basic Knowledge of the impact of shipping on the marine environment, Basic Knowledge of complexity and diversity of the marine environment, Importance of obtaining the necessary rest, Effects of sleep, schedules, and the circadian rhythm on fatigue, Effects of physical stressors on seafarers, Effects of environmental stressors in and outside the ship and their impact on seafarers, Effect of schedule changes on seafarer fatigue.

- 2) Officers who have **not** undergone Ship Security Officer (SSO) training are required to undergo approved training course for Seafarers with Designated Security Duties in accordance with Regulation VI/6-2.
- 3) PST, PSC-RB, FPFF and AFF courses, if more than or nearing 5 years from the date of issue, will require refresher training of about half a day per course as notified separately.

10-DAY RADAR OBSERVER SIMULATOR COURSE (ROSC)

COURSE OUTLINE				
Sr. No.	Subject Area	Lecture	Demonstration using Radar	Exercise Using Radar
1.	Fundamental theory	Hours	Hours	Hours
	1.1 Fundamental principles of radar	4		
	1.2 Magnetic compass safe distances	0.25		
	1.3 Radiation hazards and precautions	0.25		
	1.4 Characteristics of radar sets	3.0		
	1.5 External factors affecting radar detection	1.5		
	1.6 Factors which might cause faculty interpretation	1.0		
		10.0	0.0	0.0
2.	Performance standards for Radar equipment			
	2.1 Performance standards as per IMO A 4779XII0	0.5		
	2.2 Range and Bearing accuracy	0.5	0.5	
	2.3 Range and bearing discrimination	0.5	0.5	
		1.5	1.0	0.0
3.	Setting up and operating displays			
	3.1 Function and adjustment of controls	2.0	1.0	1.0
	3.2 Measurement of range and bearing	1.0	1.0	1.0
		3.0	2.0	2.0
4.	Manual Plotting (Relative Motion)			
	4.1 The relative motion triangle	0.5		
	4.2 CPA and TCPA	1.0	0.5	0.5
	4.3 Course, speed and aspect of targets	1.0	1.0	0.5
	4.4 Reporting a target	0.5	0.5	0.25
	4.5 Set and drift of current	0.5	0.5	0.25
	4.6 Action taken by target	0.5	1.0	0.5
	4.7 Action taken by own ship	0.5	1.0	0.5
	4.8 Predict action to take by own ship	1.0	2.0	0.5
		5.5	6.5	3.0
5.	Manual Plotting (True Motion)			
	5.1 Basic difference between Relative Plot & True Plot	1.0		0.25
	5.2 Basic difference between Sea-stabilised True Plot & Ground -stabilised True Plot	1.0		0.25
	5.3 Courses & speeds of targets, aspect, action taken by targets directly from display	0.5		0.25
	5.4 CPA & TCPA by construction of relative triangle	0.5		0.25
		3.0	0.0	1.0

6.	The use of radar for navigation			
	6.1 The use of radar for position fixing	0.5	1.0	1.0
	6.2 Aids to radar navigation including Racon, Ramark, SART & AIS	0.5	0.5	
	6.3 Parallel indexing techniques in radar navigation	0.5	1.0	1.0
		1.5	2.5	2.0
7.	Radar and COLREGS			
	7.1 Importance of good lookout and frequent plotting	0.5		
	7.2 Factors affecting safe speed			
	7.3 Good plotting and avoidance of close quarters situations	0.5		
	7.4 Substantial actions to avoid close quarters situations	1.0		
	7.5 Use of Radar in various situations	1.0		
		4.0	0.0	0.0
8.	Review of Plotting Techniques			
	8.1 Revision of relative motion triangle	0.25		0.5
	8.2 Revision of obtaining course, speed and aspect of targets from true and relative plots	0.5		0.5
	8.3 Revision of obtaining CPA and TCPA from true and relative plots	0.25		0.5
	8.4 Revision of determining changes in CPA & TCPA due to alteration of course and/or speed of "own" or target ship	0.5		0.5
	8.5 Revision of determining the alteration of course and/or speed to achieve a desired CPA	0.5		0.5
	8.6 Revision of detection of alteration of course and/or speed of a target.	0.5		0.5
		2.5	0.0	3.0
	Sub total of each heading	31.0	12.0	11
	Total contact hours		54	
9	Review and Final Assessment		6	
	Grand total		60	

DETAILED TEACHING SYLLABUS

Learning Objectives

(The hours herein include lectures & demonstration on Radar set, but does not include exercises using Radar or assessment).

	Basic Theory and Operation of Marine Radar		10.0
1.1.	Fundamental principles of radar	4.0	
1.1.1.	explains the principles of range and bearing measurement		
1.1.2.	explains the function and siting of components		
1.2.	Safe distances	0.25	
1.2.1.	explains the importance of not storing radar spares nearer to magnetic compasses than the specified safe distances		
1.3.	Radiation hazards and precautions.	0.25	
1.3.1.	states the safety precautions necessary in the vicinity of open equipment and the radiation hazard near antennae and open wave-guides.		
1.4.	The characteristics of radar sets that affect performance	3.0	
1.4.1.	states the relationship between maximum range and pulse repetition frequency		
1.4.2.	states the relationship between detection range and transmitted energy (power and pulse length)		
1.4.3.	states the relationship between minimum range and pulse length		
1.4.4.	describes the effects on bearing and range accuracy of beam width, heading marker error, centring error, yawing, parallax, variable range marker, gyro error		
1.4.5.	describes the effects on bearing and range discrimination of beam width, spot size, plan position indicator tube size, pulse length, gain		
1.5.	External factors affecting radar detection	1.5	
1.5.1.	states the equation for the distance to the radar horizon and explains the relationship between antenna location and detection ranges		
1.5.2.	explains the effect of variations in refraction on radar detection range (super refraction, sub refraction, ducting, elevated duct)		
1.5.3.	explains the effect on radar detection ranges by rain, hail, snow, fog, haze.		
1.5.4.	identifies shadow areas, shadow sectors and blind sectors and their relationships to the antenna location		
1.5.5.	explains how the characteristics of targets influence their detection range (aspect, shape, composition, size)		
1.5.6.	explains how sea clutter and rain clutter may mask targets		
1.6.	Factors which might cause faulty interpretation	1.0	
1.6.1.	explains the cause and effect of interference		
1.6.2.	explains the cause and effect of side lobe echoes		
1.6.3.	explains the cause and effect of indirect echoes		
1.6.4.	explains the cause and effect of multiple echoes		
1.6.5.	explains the cause and effect of second trace echoes		
1.6.6.	states the effect on radar performance of power lines and bridges crossing rivers and estuaries		
1.6.7.	explains the effect of the ship in seaway		
2.	Performance standards for radar equipment		2.5
2.1.	lists the performance standards contained in IMO Res A. 477(XII)	0.5	
2.2.	states required accuracy (range and bearing measurement)	1.0	
2.3.	states required discrimination (range and bearing)	1.0	

3.	Setting up and operating displays		5
3.1.	Function and adjustment of controls	3	
3.1.1.	operates main controls (power, antenna)		
3.1.2.	operates transmitter controls (standby, transmit, pulse length, PRF)		
3.1.3.	adjusts receiver controls to give an optimal picture (tuning, gain, linear/logarithmic gain, sensitivity time control, fast time control)		
3.1.4.	adjusts display controls (brilliance, scale illumination, range selector, range rings, VRM, EBM, mechanical cursor, heading marker, clutter, anti-clutter)		
3.1.5.	demonstrates correct order of making adjustments and states the criteria for optimum setting of the controls		
3.1.6.	states that small or poor echoes may escape detection		
3.1.7.	describes the effects of saturation by receiver noise		
3.1.8.	explains the importance of frequent changes in range scale		
3.1.9.	explains the different types of display presentations - relative motion ' unstabilised; stabilised north-up, course-up; true motion		
3.1.10.	Explains sea-stabilised and ground stabilised true motion displays		
3.1.11.	explains the advantages and limitations of the different types of display modes		
3.1.12.	explains the need for compass input for relative stabilised display and compass and log input for true motion display		
3.1.13.	identifies the effects of compass error on stabilised and true motion displays		
3.1.14.	identifies the effects of transmitting log error on true motion display, manual speed input error		
3.1.15.	operates special controls (presentation, speed, re-set, course made good correction, compass repeater)		
3.1.16.	identifies maladjusted controls and explains their effects and dangers		
3.1.17.	detects and corrects maladjustments		
3.1.18.	states effects of incorrect speed setting and CMG correction on true motion displays		
3.1.19.	describes the purpose and use of the performance monitor		
3.1.20.	records radar data: (performance monitor readings, modifications, blind and shadow sector diagram)		
3.1.21.	explains how propagation conditions scan affect target detection		
3.2.	Measurement of range and bearing	2	
3.2.1.	states methods and accuracy of measuring ranges (fixed range markers, VRM)		
3.2.2.	measures ranges with emphasis on accuracy		
3.2.3.	explains the methods and accuracies of measuring bearings (rotatable cursor, EBL)		
3.2.4.	measures bearings with emphasis on accuracy		
3.2.5.	checks and corrects error in range and bearing		
4.	Manual Radar Plotting (Relative Motion)		12
4.1.	Construct relative motion triangle	0.5	
4.1.1.	explains a relative motion triangle various vectors and angles		
4.1.2.	constructs a relative motion triangle on a plotting chart		
4.1.3.	constructs a relative motion triangle on a reflection plotter, if provided on the display.		
4.2.	Closest point of approach (CPA) and time to closest approach (TCPA)	1.5	
4.2.1.	Determines CPA and TCPA with relative presentation		
4.2.2.	states the factors affecting the accuracy of CPA and TCPA obtained by plotting		

4.3.	Course, speed and aspect of other ships	2.0	
4.3.1.	determines course, speed and aspect of other ships from a relative presentation (stabilised and unstabilised)		
4.3.2.	takes range and bearings at frequent, regular intervals		
4.3.3.	states the factors affecting the accuracy of derived course, speed and aspect		
4.4.	Reporting a target	1.0	
4.4.1.	makes a report stating the bearing, range, CPA, TCPA, course, speed, aspect		
4.5.	Set and drift of current	1.0	
4.5.1.	determines set and rate of current from observations of fixed target		
4.5.2.	explains the track through water and over the ground by own ship		
4.6.	Action taken by target	1.5	
4.6.1.	recognises the effects of changes in the course and/or speed by other ships		
4.7.	Action taken by own ship	1.5	
4.7.1.	recognises the effects of changes in the course and/or speed by own ship		
4.8.	Predict action to be taken by own to achieve desired CPA	3.0	
4.8.1.	Determines the action (alteration of course, speed or both) to be taken at a given time by own ship to achieve a desired CPA		
5.	Manual Radar Plotting (True Motion)		3
5.1.	explains the basic difference between a relative plot and a true plot	1.0	
5.2.	explains the basic difference between a sea-stabilised true plot and a ground stabilised true plot	1.0	
5.3.	obtains course and speed of target, aspect, action taken by target (course and/ or speed) directly from the display	0.5	
5.4.	Obtains CPA and TCPA by construction of the triangle of relative velocities	0.5	
6.	Use Radar for navigation		4
6.1.	The use of radar for position fixing	1.5	
6.1.1.	states characteristics of good radar conspicuous objects		
6.1.2.	states the characteristics of objects which give poor radar response		
6.1.3.	fixes the position based on radar bearing and range		
6.1.4.	Explains possible errors and how to minimise them		
6.1.5.	Compares between visual and radar observations		
6.1.6.	cross checks the accuracy of radar against other navigational aids		
6.1.7.	compares features displayed by radar with charted features		
6.2.	Aids to radar navigation	1.0	
6.2.1.	recognition and use of passive aids (radar reflectors)		
6.2.2.	recognition and use of active aids (ramark, racon, transponders)		
6.2.3.	recognition and use of SART & AIS		
6.2.4.	explains the use of Automatic Identification System (AIS)		
6.3.	The use of parallel indexing technique in radar navigation	1.5	
6.3.1.	sets up and uses a PI line by electronic means		
6.3.2.	constructs and uses a PI line on a reflection plotter, if fitted		
6.3.3.	takes correct action when an echo departs from a PI line		
6.3.4.	uses more than one PI line		
6.3.5.	constructs and uses lines for two range scales		
6.3.6.	states the importance of "wheel over" position		
6.3.7.	demonstrates use of "wheel over"		
6.3.8.	states the importance of safety margins		
6.3.9.	demonstrates use of safety margins		
6.3.10.	interprets real motion of vessel from a tracked echo		

6.3.11.	takes appropriate action to counteract for current: on a straight course & when manoeuvring		
6.3.12.	demonstrates use of a line of turn		
6.3.13.	constructs and uses PI for radial turns		
7.	Radar and COLREGS		4
7.1.	uses radar as a means of lookout, and explains the importance of continuous plotting	0.5	
7.2.	lists factors that determine safe speed, with emphasis on factors related to radar	0.5	
7.3.	lists factors which provide a good plot to avoid collision/close quarter situation	1.0	
7.4.	makes substantial alteration of course or speed to avoid collision/close quarter situation	1.0	
7.5.	states times when radar is to be used in clear weather by day, at night when there are indications that visibility may deteriorate, and at all times in congested waters	1.0	
8.	Review of Plotting Techniques		2.5
8.1.	uses plotting sheet and reflection plotter to construct the relative motion triangle and identifies the sides and angles	0.25	
8.2.	determines course, speed and aspect of other ships from true and relative plots	0.5	
8.3.	determines CPA and TCPA from true and relative plots	0.25	
8.4.	determines changes in CPA and TCPA resulting from alteration of course or speed of "own" or target ship	0.5	
8.5.	uses a relative plot to determine the alteration of course or speed needed to achieve a required CPA	0.5	
8.6.	detects alteration of course or speed of a target and determines the alteration from a plot	0.5	

5-DAY ARPA COURSE**COURSE OUTLINE**

	Lecture hours	Simulator hours
Description an ARPA System		
ARPA Systems display characteristics	0.5	
IMO Performance Standards for ARPA	0.5	
Acquisition of targets	0.5	
Tracking Capabilities and Limitations	0.5	3
Processing Delays	1.0	
Operate an ARPA System		
Operate an ARPA System		1
Obtaining target information		1
Errors of Interpretation	1.0	
Errors in Displayed Data	1.5	1
System Operational Tests	0.5	1
Risks of Over-reliance on ARPA	1.0	
Obtaining Information from ARPA Displays		16
Application of COLREG 1972		
Total	7	23
Grand Total learning and practice	30	
Review and Final Assessment	03	
Total	33	

DETAILED TEACHING SYLLABUS

Learning Objectives (hours include lectures and simulator practicals)

1. Description an ARPA System (6 hours)

a. ARPA Systems display characteristics (0.5 hours)

describes different display characteristics:

Vectors

Graphics

digital read-out

potential points of collision (PPC)

predicted areas of danger (PAD)

describes the different ways in which targets may be acquired

b. IMO Performance Standards for ARPA (0.5 hours)

states IMO performance standards for ARPA relating to accuracy

states the requirements for acquisition and tracking of targets

lists the operational warnings required

lists data which should be available in alphanumeric form

describes the effects of sensor errors for ARPA equipment complying with IMO performance standards

states performance standards for gyro and log inputs

states performance standards for range and bearing accuracy and discrimination of radar

c. Acquisition of targets (1.5 hour)

states criteria for target acquisition

states that the criteria for automatic selection of targets are given in the set's instruction manual

lists the criteria to be used for manual acquisition of targets

states that maximum number of targets which may be acquired

states that targets may be deleted if not posing a potential threat (when tracking limit has been reached)

describes appropriate use of suppression of target acquisition over certain areas

states that targets first appearing closer than the pre-set guard ring are not acquired and do not actuate alarms

d. Tracking Capabilities and Limitations (1.5 hour)

describes target tracking by ARPA

describes how target are "lost" and alarm activated

states common circumstances leading to "target swap"

describes the effect of "target swap" on displayed data

e. Processing Delays (2 hour)

explains why there is a delay in the display of processed ARPA data after target acquisition

explains the delay in the display of new data when the target ship manoeuvres

states that full accuracy of derived information may not be attained for up to three minutes after acquisition or manoeuvre of the target

2. Operate an ARPA System (24 hours)

a. Setting Up and Maintaining Displays (1.0 hour)

sets up an appropriate display presentation for the required task and current situation (stabilised relative motion and true motion displays)

adjusts radar controls for the optimum display of echoes

uses log and gyro compass inputs

manually selects, acquires and monitors critical targets

sets up automatic acquisition and exclusion areas

uses the appropriate time scale for vectors or graphics to produce information required

identifies differences between information shown in sea stabilised mode and the ground stabilised mode

selects the appropriate mode for the circumstances

sets up echo-referencing in the true motion mode

b. Obtaining target information (1.0 hour)

operates display in true and relative modes to obtain true and relative vectors in each display mode

states the benefits of switching between true and relative vectors

uses the graphic display of PPC's and PAD's

determines threat of collision by forward extrapolation of vectors and by the use of PAD's

uses targets history display

uses trial manoeuvres are (approximations depending on the model of ownshipmanoeuvring characteristics)

refers to the equipment manual for a description of the manoeuvring characteristics model used

sets and acknowledges operational warnings

states benefits and limitations of operational warnings

sets area rejection boundaries to avoid spurious interference

c. Errors of Interpretation (1 hour)

identifies consistently vectors in the wrong mode (a common error)

derives information from vectors with numeric display

explains and re-acquired "lost target" may temporarily shown a course and speed suggesting an alteration when none has occurred

states data from PADs and PPCs displayed apply only to "own ship" and targets and do not indicate mutual threats between targets

states that the length of line from target to PAD or PPC is not an indicator of target speed

states that history displays may not be in same mode as vectors

states that a change of direction in the relative history display does not necessarily imply that the target has altered course

explains that the incorrect interpretation of ARPA can lead to a dangerous misunderstanding

d. Errors in Displayed Data (2.5 hours)

identifies bearing errors in the radar installation by:

Backlash

ship motion

asymmetrical antenna beam

azimuth quantisation

explains errors in range generated by:

rolling of "own ship"

range quantisation

explains that unreliable indications are given when smoothing filter in the tracker combined with alteration in "own ship's" course/speed

explains the effects of heading and speed errors on derived information

states that the smoothness of the displayed history track is an indication of satisfactory tracking by ARPA

e. System Operational Tests (1.5 hour)

uses self-diagnostic routines

operates test programmes to check performance against known solutions

demonstrates performance checks, including trial manoeuvre by manual plotting

takes correct action malfunction of ARPA

f. Risks of Over-reliance on ARPA (3 hour)

demonstrates the use of ARPA explains the need to comply with basic principles in keeping a navigational watch

reacts correctly to operational alarms

avoids small predicted passing distances (CPA and bow crossing ranges)

explains that sensor input alarms only operate on failure of input and do not respond to inaccurate input

g. Obtaining Information from ARPA Displays (6 hours)

obtains information in both true and relative modes

identifies critical targets

determines relative course and speed of target

determines CPA and TCPA of target

determines true course and speed of target

uses displays of past positions for detecting changes in course or speed of target

uses trial manoeuvre facility to check validity of intended alteration of course or speed

h. Application of COLREG 1972 (8 hours)

takes correct action to avoid close-quarters situations or potential collision situations

monitors subsequent situation and resumes original course and speed when safe to do so

3. Review and Final Assessment (3 hours)

Objective test on theory and principles

Test on manual plotting

Practical demonstration on simulator covering setting up of the display, plotting vessel's position, use of parallel indexing techniques, obtaining target information using ARPA

5-day ECDIS Course

FORMAT OF WATCH-KEEPING CERTIFICATE FOR DECK OFFICERS

6-MONTH COMPETENCY COURSE FOR CHIEF MATE (F.G.) PHASE 1 (3-MONTHS) AND PHASE 2 (3 MONTHS) EXAM**CHIEF MATE (F.G) - SUMMARY OF EXAMINATION (FUNCTION - WISE) (REFERENCE: TABLE A- II/2)****FUNCTION: NAVIGATION AT MANAGEMENT LEVEL**

PAPER NO.	SUBJECT	COMPETENCIES COVERED	MODE OF EXAMINATION	DURATION OF EXAM	MAXIMUM MARKS	PASS MARKS	PHASE
1	Terrestrial and Celestial Navigation	1 & 2.1	Written	3 Hours	200	140	I
2	Meteorology	8	Written	2 Hours	100	50	I
3	Navigational Aids including Compasses	2.2 & 3	Written	3 Hours	200	100	II
4	Bridge Watchkeeping, Search and Rescue, Ship Handling & Emergencies	4, 5, 9& 10	Written	2 Hours	100	60	II
5	Engineering knowledge, instruments & control systems	11	Written	3 Hours	200	100	II
6	Radar, ARPA & Navigation Simulator course including Search and Rescue Training	4 & 6	Modular	1 Week Course			
7	ECDIS Course*	7	Modular	1 Week Course			
8	Orals for navigation function	1 to 11	Oral		100	70	II

() Training and assessment in the use of ECDIS is not required for those who serve exclusively on ships not fitted with ECDIS. This limitation shall be reflected in the endorsement issued to the seafarer concerned.*

FUNCTION: CARGO HANDLING & STOWAGE AT MANAGEMENT LEVEL

PAPER NO.	SUBJECT	COMPETENCIES COVERED	MODE OF EXAMINATION	DURATION OF EXAM	MAXIMUM MARKS	PASS MARKS	PHASE
1	Cargo Handling and Stowage	12,13 & 14	Written	3 Hours	200	120	I
2	Orals for cargo function	12 to 14	Oral		100	60	I

FUNCTION: CONTROLLING THE OPERATION OF THE SHIP & CARE FOR PERSONS ON BOARD AT THE MANAGEMENT LEVEL

PAPER NO.	SUBJECT	COMPETENCIES COVERED	MODE OF EXAMINATION	DURATION OF EXAM	MAXIMUM MARKS	PASS MARKS	PHASE
1	Ship safety, emergencies, maintenance and managerial skills	17,18 &19	Written	3 Hours	150	75	I
2	Naval architecture paper I	15.1.1 & 15.2.1	Written	3 Hours	200	120	I
3	Naval architecture paper II	15.1.2 & 15.2.2	Written	3 Hours	200	100	II
4	Maritime legislation	16	Written	3 Hours	200	100	II
5	Medical care	20	Modular	2 weeks course			
6	Orals for ship operation function	15 to 20	Oral		100	60	II

SUMMARY OF COURSES, TRAINING PROGRAMMES, EXAMINATION & ASSESSMENT

Regulation: II/2 of STCW'2010 & Section: A-II/2 of STCW Code

Department: Nautical

Level: Management Level

Capacity: Chief Officer

FUNCTION: Navigation at Management Level

NO.	COMPETENCE	ON-BOARD TRAINING (18 Months)	POST-SEA TRAINING			TYPE OF ASSESSMENT
			Topics (Duration in Hours) and Phase No.	Lectures I + II	Exercise I + II	
1.	Plan a voyage and conduct navigation	In-service experience	Miscellaneous, coastal navigation and ocean voyages (8+ 20) – I	8 + 0	20 + 0	Internal assessment and written & Oral examination
2.	Determine position and the accuracy of resultant position fix by any means	In-service experience	Terrestrial Navigation (2+15) – I Celestial Navigation (5+20) – I Great and Composite Circle (5+15) – I Electronic Nav aids (14+6) – II	12 + 14	50 + 6	Internal assessment and written & Oral examination
3.	Determine and allow for compass errors	In-service experience	Magnetic Compass (5) – II Gyro Compass (4+1) – II	0 + 9	0 + 1	Internal assessment and written & Oral examination
4.	Co-ordinate search and rescue operations	In-service experience	Co-ordinate search and rescue operations- II	0+15	--	Internal assessment and written & Oral examination. Refer to IMO Model Course No. 2.02 for guidance
5.	Establish watchkeeping arrangements and procedures	In-service experience	Watchkeeping including COLREGS (18+13) – II	0 + 18	0+ 13	Internal assessment and written & Oral examination
6.	Maintain safe navigation through the use of information from navigation equipment and systems to assist command decision making.	In-service experience	Model Course (38) - M	--	--	IMO Model Course No. 1.09
7.	Maintain the safety of navigation through the use of ECDIS and associated navigation systems to assist command decision making	In-service experience	Model Course- 1.27- (40)- M	-	-	IMO Model Course No. 1.27 revised

NO.	COMPETENCE	ON-BOARD TRAINING (18 Months)	POST-SEA TRAINING			TYPE OF ASSESSMENT
			Topics (Duration in Hours) and Phase No.	Lectures I + II	Exercise I + II	
8	Forecast weather and oceanographic conditions	In-service experience	Meteorology (16) – I Oceanography (7) – I Weather Routeing (3) – I Tides (1+3) – I	27 + 0	3+0	Internal assessment and written & Oral examination
9	Respond to navigational emergencies	In-service experience	Contingency Plans (8) – II Protection in Emergency (24) – II	0 + 32	--	Internal assessment and written & Oral examination
10	Manoeuvre and handle a ship in all conditions	In-service experience	Ship Handling and Manoeuvring (62) – II	0 + 62	--	Internal assessment and written & Oral examination
11	Operate remote controls of propulsion plant and engineering systems and services	In-service experience	Engineering terms & Fuel consumption (3+4) – II Auxiliaries (26) – II Mariner Power Plants (22+3)– II Engine Room Watchkeeping (2) – II	0 + 53	0+7	Internal assessment and written & Oral examination
				47 + 203	73 + 27	

FUNCTION: Cargo handling and stowage at the management level

NO.	COMPETENCE	ON-BOARD TRAINING (18 Months)	POST-SEA TRAINING			TYPE OF ASSESSMENT
			Topics (Duration in Hours) and Phase No.	Lectures I + II	Exercise I + II	
12..	Plan and ensure safe loading, stowage, securing, care during the voyage & unloading of cargoes	In-service experience	Dry Cargoes (23 +4) – I Cargo Handling Gear and Hatch Covers (10) – I Watchkeeping in Port (4) – I	37 + 0	4 + 0	Internal assessment and written & Oral examination
13	Assess reported defects and damage to cargo spaces, hatch covers and ballast tanks and take appropriate action	In-service experience	Defects and damage to cargo spaces, hatch covers and ballast tanks (6)- I	6+0	0+0	Internal assessment and written & Oral examination

14	Carriage of dangerous cargoes	In-service experience	Tanker Operations (21) – I Solid Bulk Cargoes (12)- I Grain Cargoes (4+3)- I Safe deck watch (2)-I Dangerous Goods (11+2) – I Fumigation of Holds (2) – I Cargo Calculations (6+18) – I Stability and Trim diagrams (2)-I	60 + 0	23+0	Internal assessment and written examination
				103 + 0	27 + 0	

FUNCTION: Controlling the operation of the ship and care for persons on board at the management level

NO.	COMPETENCE	ON-BOARD TRAINING (18 Months)	POST-SEA TRAINING			TYPE OF ASSESSMENT
			Topics (Duration in Hours) and Phase No.	Lectures I + II	Exercise I + II	
15	Control trim, stability and stress	In-service experience	Ship Construction (20+ 20) – I & II Ship Stability and Stability in Damaged Condition (50+ 30) – I & II	35 + 23	35 + 27	Internal assessment and written & Oral examination

NO.	COMPETENCE	ON-BOARD TRAINING (18 Months)	POST-SEA TRAINING			TYPE OF ASSESSMENT
			Topics (Duration in Hours) and Phase No.	Lectures I + II	Exercise I + II	
16	Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea and the protection of the marine environment	In-service experience	Introduction (1) – II Law of the sea (2) – II Safety (11) – II Pollution (8) – II Passenger (2) – II Tonnage (1) – II MLC -2006 (6) – II Arrival documents and procedures (4) – II Collision (2) – II Assistance & Salvage (2) – II Limitations of Liability (1) – II Classification Societies (1) – II Cargo (4) – II General average and marine insurance (3) – II Certificates (1) – II National maritime legislations (1)-II	0 + 50	--	Internal assessment and written & Oral examination
17	Maintain safety and security of the ship's crew and passengers and the operational condition of life-saving, fire-fighting and other safety systems	In-service experience	Covered in PSCRB Course Covered in AFF Course Additionally Safety and Security (15) – I	15 + 0	--	IMO Model Course No. 1.23 and IMO Model Course No. 2.03 Internal assessment and written & Oral examination
18.	Develop emergency and damage control plans and handle emergency situations	In-service experience	Emergency situations (6) – I	6 + 0	--	Internal assessment and written & Oral examination
19.	Use of leadership and managerial skills	In-service experience	Use of leadership and managerial skills (19)- I	19+0	-	Internal assessment and written & Oral examination
20.	Organise and manage the provision of medical on board	--	Model Course (60) - M	--	--	IMO Model Course 1.15
				75 + 73	35 + 27	

GRAND TOTAL 225+ 276 135 + 54

PHASE I = 225+ 135 = 360 hours

NOTES: 1) Total Teaching hours for above mentioned course is 360 hours @ 30 hours per week = 12 weeks.
).
2) One week to account for Public holidays and contingencies.
3) Assessments to be catered for outside the allocated hours for lecture/ exercises.

Grand Total: 13 weeks

PHASE II = 276+ 54= 330 hours

NOTES: 1) Total Teaching hours for above mentioned course is 330 hours@ 30 hours per week = 11 weeks.
2) One week for Assessments (mid-course and final internal assessment).
3) One week to account for Public holidays and contingencies.

Grand Total: 13 weeks

CHIEF MATE- F.G

FUNCTION: NAVIGATION AT THE MANAGEMENT LEVEL

Knowledge, Understanding & Proficiency / Course Covered	Methods of demonstrating competence	Criteria for evaluating competence
Competence No. 1: Plan a voyage and conduct navigation 1.1 Voyage Planning and Navigation for all Conditions 1.1.1 Coastal Navigation: Position fixing by bearings and ranges, planning navigation and plotting courses taken into account restricted waters, meteorological conditions, ice, restricted visibility, traffic separation schemes, vessel traffic service (VTS) areas, area of extensive tidal effects, determine positions in all conditions. 1.1.2 Ocean voyage: Ocean passages for the world, sailing directions, routeing charts, and routeing in accordance with general provisions of ship's routeing, ability to choose best routes. Reporting procedures in accordance with general principles for ship reporting systems and with VTS procedures.	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved simulator training, where appropriate .3 approved laboratory equipment training Using: chart catalogues, charts, nautical publications and ship particulars.	The equipment, charts and nautical publications required for the voyage are enumerated and appropriate to the safe conduct of the voyage. The reasons for the planned routes are supported by facts and statistical data obtained from relevant sources and publications. Positions, courses, distances and time calculations are correct within accepted accuracy standards for navigational equipment. All potential navigational hazards are accurately identified.
Competence No. 2: Determine position and the accuracy of resultant position fix by any means 2.1 Position Determination 2.1.1 Terrestrial navigation: Ability to use appropriate charts, chart correction, Mercator sailing, errors in position lines, notices to mariners and other publications. 2.1.2 Great-circle sailing: Initial & final course, distance, napier's rules, position of vertex, composite sailing, transferring great circle course to mercator chart, chart projections. 2.1.3 Celestial navigation: Kepler's laws of motion, twilights, magnitude of stars, star identification and selection, correction of altitudes, circumpolar bodies, PZX triangle. Calculation of position line and position through which it passes by using sun, stars, moon, planet and using following	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved simulator training, where appropriate .3 approved laboratory equipment training	The primary method chosen for fixing the ship's position is the most appropriate to the prevailing circumstances and conditions The fix obtained by celestial observations is within accepted accuracy levels

methods- Meridian altitude, ex-meridian, long-by-chron, intercept and pole star. Position determination by combination of two or more celestial observations. (No calculations shall be based on ambiguity of time or date, incorrect application of chronometer error, index error or dip, etc.) 2.2 Electronic Systems of Position Fixing 2.2.1 Terrestrial electronic position fixing systems: E-Loran (when functional) Principle, operation and errors of E- Loran system. 2.2.2 Satellite electronic position fixing systems: Global Positioning System: Principle, operation and main sources of errors in GPS, Principle and accuracy of differential GPS, IMO performance standards GLONASS, GNSS (Galileo) 2.2.3 Other navigational aids: AIS, VDR, SVDR, LRIT, BNWAS, IMO Performance standards. 2.2.4 Radial steering (ROTI), IMO performance standards, procedure to execute constant radius turn, parallel indexing, and radar plotting 2.2.5 Echo sounders, speed logs: Sources of errors, IMO performance standards. 2.2.6 Course recorder and auto pilot – operation and precautions, settings of auto pilot, adaptive auto pilot systems and its functions, regulations regarding use of auto pilot.	Using: .1 charts, nautical almanac, plotting sheets, chronometer, sextant and a calculator .2 charts, nautical publications and navigational instruments (azimuth mirror, sextant, log, sounding equipment, compass) and manufacturers' materials .3 radar, terrestrial electronic position fixing systems, Satellite Navigation Systems and appropriate nautical charts and publication	The fix obtained by terrestrial observations is within accepted accuracy levels The accuracy of the resulting fix is properly assessed. The fix obtained by the use of electronic navigational aids is within the accuracy standards of the systems in use. The possible errors affecting the accuracy of the resulting position are stated and methods of minimising the effects of system errors on the resulting position are properly applied
Competence No. 3: Determine and allow for compass errors 3.1 Magnetic Compass Error and Correction: Ship's permanent magnetic field components P, Q, and R. methods of obtaining table of deviation, compass correction, ability to determine and allow the errors of the magnetic compass, knowledge of the principle of magnetic compass 3.2 Gyro-compass Errors and Corrections: Principle of gyro compass as north seeking instrument, errors of gyro compass, understanding of systems under the control of the master gyro, IMO performance standards for gyro compasses, method of gyro error determination and allowing same,	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved simulator training, where appropriate .3 approved laboratory equipment training Using: celestial observations, terrestrial bearings and comparison between magnetic and gyro- compass	The method and frequency of checks for errors of magnetic and gyro-compasses ensures accuracy of information
Competence No. 4: Co-ordinate search and rescue operations 4.1 A thorough knowledge of and ability to apply the procedures contained in the IMO International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual: IAMSAR Volume 3, Search	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service	The plan for co-ordinating search and rescue operations is in accordance with international

Patterns, MRCC, RCC, OSC	experience .2 approved simulator training, where appropriate .3 approved laboratory equipment training Using: relevant publications, charts, meteorological data, particulars of ships involved, radio communication equipment and other available facilities and one or more of the following: .1 approved SAR training course .2 approved simulator training where appropriate .3 approved laboratory equipment training	guidelines and standards Radio communications are established and correct communication procedures are followed at all stages of the search and rescue operations
Competence No. 5: Establish watchkeeping arrangement and procedures 5.1 Watchkeeping Arrangements and Procedures 5.1.1 The content, application and intent of COLREG 1972. 5.1.2 Ensuring the adequacy of a navigational watch: Factors deciding the composition of the watch on the bridge, efficiency of the watch.. 5.1.3 Information which should be exchanged between the master and the pilot. 5.1.4 Ensuring the adequacy of an engineering watch: Communication between chief engineer and master, factors deciding the composition of watch. 5.1.5 Vessel Traffic Management System, Ship Reporting System, IMO Ship's Routeing guide.	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved simulator training, where appropriate	Watchkeeping arrangements and procedures are established and maintained in compliance with international regulations and guidelines so as to ensure the safety of navigation, protection of the marine environment and safety of the ship and persons on board
Competence No. 6: Maintain safe navigation through the use of information from navigation equipment and systems to assist command decision-making (Radar, ARPA and Navigation Simulator course) 6.1 Familiarisation with the Simulator's "Own Ship" Characteristics, navigational equipment and Controls. 6.2 Review of Basic Radar and Plotting: An application of system errors and through understanding of	Examination and assessment of evidence obtained from approved ARPA simulator training and one or more of the following: .1 approved in-service experience .2 approved simulator training,	Information obtained from navigation equipment and systems is correctly interpreted and analysed, taking into account the limitations of the equipment and prevailing circumstances and

the operation aspects of Radar and ARPA. 6.3 Open Water Exercises in the Application of COLREG 1972. 6.4 Familiarisation with the modern navigational aids provided. 6.5 Exercises in Navigation and Collision Avoidance in Confined and congested waters in clear visibility. 6.6 Exercises in and near Traffic Separation Schemes. 6.7 Blind pilotage planning and techniques in above situations. 6.8 Evaluation of navigational information derived from all sources including Radar and ARPA in order to make and implement command decisions for collision avoidance and for directing the safe navigation of the ship. 6.9 The inter-relationship and optimum use of all navigational data available for conducting navigation: Feedback from navigational aids such as gyro and magnetic compasses, speed log, course recorder, echo-sounder, GPS, e-Loran, and their evaluation & interpretation.	where appropriate .3 approved laboratory equipment training	conditions. Action taken to avoid a close encounter or collision with another vessel is in accordance with the International Regulations for Preventing collisions at sea.
Competency No. 7: Maintain the safety of navigation through the use of ECDIS and associated navigation systems to assist command decision making <i>Note: Training and assessment in the use of ECDIS is not required for those who serve exclusively on ships not fitted with ECDIS. This limitation shall be reflected in the endorsement issued to the seafarer concerned</i> Electronic chart display information systems (ECDIS) 7.1 Management of operational procedures, system files and data, including 7.1.1 manage procurement, licensing and updating of chart data and system software to conform to established procedures; 7.1.2 system and information updating, including the ability to update ECDIS system version in accordance with vendor's product development 7.1.3 create and maintain system configuration and backup files; 7.1.4 create and maintain log files in accordance with established procedures; 7.1.5 create and maintain route plan files in accordance with established procedures; 7.1.6 use ECDIS log-book and track history functions for inspection of system functions, alarm settings	Assessment of evidence obtained from one of the following: .1 approved in-service experience .2 approved training ship experience .3 approved ECDIS simulator training	Operational procedures for using ECDIS are established, applied, and monitored Actions taken to minimize risk to safety of navigation

and user responses; 7.2 Use ECDIS playback functionality for passage review, route planning and review of system functions		
Competence No. 8: Forecast weather and oceanographic conditions 8.1 Meteorology 8.1.1 The atmosphere: Diurnal variation of temperature, relative humidity, lapse rate, adiabatic changes, diurnal variation of pressure, geostrophic wind, gradient and cyclostrophic winds, doldrums, ITCZ. 8.1.2 Climatology: General distribution of surface temperature, surface current, sea fog, pattern of clouds, global warming 8.1.3 Tropical revolving storms: Knowledge of the characteristic of tropical revolving storms and various weather systems, avoidance of storm centres and the dangerous quadrants, signs of approaching TRS, messages required to be sent as per SOLAS, typical and possible tracks of TRS, frontal and non frontal depressions- distribution of weather, synoptic patterns 8.1.4 Weather forecasting: Cold and warm front, occlusion on a synoptic chart, codes on synoptic charts and prognostic charts, isobars on the weather chart, analysis of synoptic chart, MARFOR, information received by weather fax, wave charts, ice charts, shipping forecast, structure of weather bulletin & use of International code. 8.2 Oceanography 8.2.1 Ocean currents: Causes of ocean currents, characteristics of ocean currents, weather associated with ocean currents, charting of the current and main currents in the world oceans. 8.2.2 Waves: Speed, length, period, height & significance of waves, difference between waves and swell, significant wave height, fetch, wave period, wind rose. 8.2.3 Ice on the sea: Different types of ice, icebergs, limits of icebergs, formation of ice, accumulation of ice, ice accretion on ships, International Ice Patrol, messages required to be sent as per SOLAS. 8.3 Weather Routeing: Information of current, wind and ice to select an optimum route, use of wave charts to select the best route, weather routeing services available to shipping, ship's performance curves. 8.4 Calculation of tides for standard and secondary ports 8.5 Use of all appropriate nautical publications on tides and currents: Routeing charts, tide tables, current and tidal stream atlases.	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved laboratory equipment training	The likely weather conditions predicted for a determined period are based on all available information Actions taken to maintain safety of navigation and to minimise any risk to safety of the ship Reasons for intended action are backed by statistical data and observations of the actual weather conditions

Competence No. 9: Respond to navigational emergencies 9.1 Contingency Plans for Response to Emergencies: Muster list, assignment of duties to personnel, composition of emergency team, drawing of plans to deal with heavy weather damage, excessive listing, bilging & flooding, fire in specific areas, stranding, abandoning ship, spillage of noxious substances, piracy & armed robbery and collision. 9.2 Measures which should be taken in emergencies for the protection and safety of the ship, passengers and crew 9.2.1 Precautions to be taken when beaching a vessel – Circumstances in which the vessel is to be beached, precautions to be taken and procedure to be obtained while beaching. 9.2.2 Actions to be taken on stranding: Actions to be taken if stranding is imminent and after stranding, distress or urgency signal, discharge of harmful substances, assessment of damage control, refloating by stranded ship with & without assistance. 9.2.3 Actions to be taken following a collision: Duties of Master if collision is imminent and following a collision or impairment of the water tight integrity of the hull, measures to limit damage, salving own ship, log book entries. 9.2.4 Precautions for the protection and safety of passengers in emergency situations: Duties of some crew members to assist and muster passengers, precautions for the protection and the safety of passengers in emergency situations. 9.2.5 Means of limiting damage and salving the ship following a fire or explosion: Cooling of compartment boundaries, inspection for damage, procedures for making a man entry, use of fixed fire fighting systems, rescue of persons from spaces, and continuous watch on damaged area. 9.2.6 Procedure for abandoning ship: Situations under which to abandon ship, duties of personnel, distress call transmission until acknowledgement, use of distress signal to attract attention, launching of boats and liferafts in heavy weather. 9.2.7 Use of auxiliary steering, and emergency steering gear - Change over bridge control to local control in the steering gear compartment, standard emergency steering procedures, proper communication from the bridge 9.2.8 Arrangements for towing and being taken in tow: Emergency Towing Booklet, permission from owners for towing, early communication with the vessel being towed, procedure for towing in good and rough weather conditions, towing speed, bollard pull, Emergency Towing Arrangements 9.2.9 Rescue of persons from a vessel in distress or from a wreck: Waiting for daylight, selection of rescue boats. 9.2.10 Man-overboard procedures: Recovering a person from the sea in heavy weather, action to take when a person is reported missing at sea. 9.2.11 Actions which can be taken when emergencies arise in port (at berth or at anchor). 9.2.12 Actions to be taken in case of ship threatened by pirates or armed robbers, IMB, PRC, UKMTO,	Examination and assessment of evidence obtained from practical instruction, in-service experience and practical drills in emergency procedures	The type and scale of any problem is promptly identified and decisions and actions minimise the effects of any malfunction of the ship's systems Communications are effective and comply with established procedures Decisions and actions maximise safety of persons on board

MSCHOA, national regulations.		
Competence No. 10: Manoeuvre and handle a ship in all conditions 10.1 Manoeuvring when Approaching a Pilot Vessel or Station, with due regard to Weather, Tide, Head reach and Stopping Distance: Preparation of passage plan, contact with the pilot, preparation for picking up the pilot, readiness of anchors for letting go, making a lee for the pilot boat, understanding of head reach and stopping distance of the vessel while picking up pilot, rudder cycling. 10.2 Handling a Ship in Rivers, Estuaries, having regard to the Effects of Current, Wind and Restricted Water on the Response to the Helm and Stopping Distance: Shallow water effect, turning radius, increased directional stability, slow response by the steering at reduced speeds, squatting, effect of current and wind on helm response. 10.3 Berthing and Un-berthing under Various Conditions of Wind, Current and Tide, with or without Tugs' assistance: Effect of wind, current on handling of the ship while berthing and unberthing with or without tugs, interaction between ships, ship-tug interaction, bank cushion, bank suction, advantages of controllable pitch propeller (CPP), manoeuvring with twin screws, use of lateral thrusters, use of anchors in manoeuvring, 10.4 Anchoring Distance: Choice of anchorage, swinging circle, direction and strength of current, procedure of anchoring with one or two anchors in limited anchorages, factors involved in determining the length of anchor cable, dragging anchor, clearing foul hawse/anchor, slipping of anchor; Running, standing, open and mediterranean moor 10.5 Lighterage at Sea: Ship to ship transfer guide, Lighterage preparations for both vessels, method of separating on completion of transfer operations. 10.6 Dry-docking: Information required by dry dock authorities, ship plans, stern trim, critical condition, use of bilge blocks, breast shores, precautions before flooding the dock, floating dry dock, critical period of floating dry dock. 10.7 Management and Handling of Ships in Heavy Weather: Assisting a ship or air craft in distress, pooping, broaching-to, precautions to be taken before onset of heavy weather, towing operations, synchronous and parametric rolling, rolling period, 10.8 Determining Manoeuvring and Propulsion Characteristics of Major Types of Ships, with special reference to Stopping Distances and Turning Circles at Various Draughts and Speeds: Manoeuvring characteristics, sea-trial turning circle, turning circle in shallow water at various speeds, effect of wind on the behaviour of the ship, trials of steering ability, handling vessels with inadequate stability. 10.9 Practical Measures to be Taken when Navigating in Ice or Conditions of Ice Accumulation on	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved simulator training, where appropriate .3 approved manned scale ship model, where appropriate	All decisions concerning berthing and anchoring are based on a proper assessment of the ship's manoeuvring and engine characteristics and the forces to be expected while berthed alongside or lying at anchor While under way, a full assessment is made of possible effects of shallow and restricted waters, ice, banks, tidal conditions, passing ships and own ship's bow and stern wave so that the ship can be safely manoeuvred under various conditions of loading and weather

Board: Types of ice, sources of information on ice condition, ice sterns, measures to be taken when navigating in or near ice, precautions in entering ice, ice accommodation on board, Polar code, master's obligation to report, freezing sprays. 10.10 The Use of, and Manoeuvring in, and near Traffic Separation Schemes and in vessel traffic service (VTS) areas. 10.11 Importance of navigating at reduced speed to avoid damage to other ships/structures in restricted waters caused by own ship's bow wave and stern wave 10.12 Precautions in manoeuvring the ship to be able to launch rescue boats in bad weather		
Competence No. 11: Operate remote controls of propulsion plant and engineering systems and services 11.1 Marine Engineering Terms and Fuel Consumption: 11.1.1 Marine engineering terms: Mass, force, work, power, energy, stress and strain, heat and their units, efficiency of a machine, indicated & shaft power, propeller power and thrust. 11.1.2 Fuel consumption: Admiralty coefficient, fuel coefficient, fuel consumption, thermal efficiency, propeller efficiency, indicator diagrams, displacement and speed of a ship and relationship between them, fuel economy. 11.2 Auxiliaries : 11.2.1 Auxiliary boilers: Water tube and fire tube boilers, exhaust-gas heat exchangers, priming, safety valve, treatment of feed water. 11.2.2 Distillation and fresh-water systems: operation of a flash evaporator, reverse osmosis, domestic water system, drinking water treatment. 11.2.3 Pumps and pumping systems: Different types of pumps and its uses,(reciprocating, gear, screw, centrifugal, submersible, deepwell pumps); typical bilge and ballast system for a dry cargo ship. 11.2.4 Steering gears: Different types of steering gears (ram, rotary vane, electrical), IMO requirements for steering gears, telemotor systems, IMO requirement for testing auxiliary and main steering gears 11.2.5 Generators, alternators and electrical distribution: Operation of an alternator, A. C. and D. C. distribution systems, use of circuit rackets & breakers. 11.2.6 Refrigeration, air-conditioning and ventilation: Properties of a refrigerant, vapour-compression cycle refrigeration plant, air conditioning plant, ventilation system for accommodation and ship holds. 11.2.7 Stabilisers: Construction and operation of fin stabiliser. 11.2.8 Sewage treatment plants: Operation of chemical and biological sewage treatment plants and regulations regarding discharge. 11.2.9 Oily-water Separators and oil filtering equipment: OWS; ODMCS; Proactive measures to prevent	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved simulator training, where appropriate	Plant, auxiliary machinery and equipment is operated in accordance with technical specifications and within safe operating limits at all times

pollution of marine environment. 11.2.10 Incinerators: functioning of a waste incinerator. 11.2.11 Deck machinery: Steam, electric and hydraulic drives, cargo winches, forward windlass, aft mooring winch. 11.2.12 Hydraulic systems: Ram & rotary-vane actuators, hydraulic accumulator, heating of oil. 11.3 Marine Power Plants : 11.3.1 Diesel engines: Types of diesel engines (2- stroke and 4- stroke), operation procedures, crankcase explosion, scavenge fire, and supercharging; F.O, L.O, and cooling water systems. 11.3.2 Steam turbine systems: Steam turbine and its gearing, working of an impulse and reaction turbine, 11.3.3 Propeller and propeller shaft: Sketch of a propeller, pitch, slip and efficiency of a propeller, indicated power, shaft power, delivered power and effective power; calculation of ship's speed, operation of controllable pitch propeller (CPP). 11.3.4 Bridge control: Bridge control system, bridge control of controllable pitch propeller, indicators and alarms, lateral thrusters. 11.4 Engine room watchkeeping 11.4.1 Arrangements necessary for appropriate and effective engineering watches to be maintained for the purpose of safety under normal circumstances and UMS operations. 11.4.2 Arrangements necessary to ensure a safe engineering watch is maintained when carrying dangerous cargo		

FUNCTION: CARGO HANDLING AND STOWAGE AT THE MANAGEMENT LEVEL

Knowledge, Understanding & Proficiency / Course Covered	Methods of demonstrating competence	Criteria for evaluating competence
Competence No. 12: Plan and ensure safe loading, stowage, securing, care during the voyage and unloading of cargoes 12.1 Dry Cargoes: 12.1.1 Timber deck cargoes: Code of safe practice for ships carrying timber deck cargoes, action if cargo is lost overboard, requirements when loading timber, stability information. 12.1.2 Loading, stowage and discharge of heavy weights: Load density, rigging of an heavy lift derrick, precautions while loading a heavy weight, 12.1.3 Procedures for receiving, tallying and delivering cargo: Special cargoes, tally sheets, mate's receipts, note of protest, parties to whom cargoes should be delivered. 12.1.4 Care of cargo during carriage: Crushing, chafing, ventilation of cargo, Code of safe practice for	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved simulator training, where appropriate Using: stability, trim and stress tables, diagrams and stress-calculating equipment	The frequency and extent of cargo condition monitoring is appropriate to its nature and prevailing conditions Unacceptable or unforeseen variations in the condition or specification of the cargo is promptly recognised and remedial action is immediately taken and designed to safeguard

cargo stowage and securing, Cargo Securing Manual 12.1.5 Container Carriers: Construction, types and marking of containers, Bay plans and stack weight, anti-heeling tanks, torsional stresses, lashing materials for securing containers, Container Code, Procedures for loading and carriage of refrigerated containers 12.1.6 Car Carriers, , Reefer ships and Ro-Ro Ships: General outline, precautions when working cargo with these types of ships. 12.2 Cargo-handling Gear and Hatch Covers : 12.2.1 Requirements applicable to cargo-handling gear: Competent person, authorised person, loose gear, national laws for cargo operations, marking beams and portable hatch covers, thorough examination of cargo gear, Register for ship's lifting appliances and cargo handling gear 12.2.2 Maintenance of cargo gear: Inspection of cargo gear, maintenance of cargo gear, annealing of loose gear, testing of lifting appliances 12.2.3 Maintenance of hatch covers: Side cleats and cross-joint wedge mechanism, tightness and hose testing before loading. 12.3 Keeping a Watch in Port 12.3.1 Arrangements necessary for appropriate and effective deck watches to be maintained for the purpose of safety under normal circumstances		the safety of the ship and those on board Cargo operations are planned and executed in accordance with established procedures and legislative requirements Stowage and securing of cargoes ensures that stability and stress conditions remain within safe limits at all times during the voyage
Competence No. 13: Assess reported defects and damage to cargo spaces, hatch covers and ballast tanks and take appropriate action: 13.1 Knowledge of the limitations on strength of the vital constructional parts of a standard bulk carrier and ability to interpret given figures for bending moments and shear forces. 13.2 Ability to explain how to avoid the detrimental effects on bulk carriers of corrosion, fatigue and inadequate cargo handling.	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved simulator training, where appropriate using stability, trim and stress tables, diagrams and stress-calculating equipment	Evaluations are based on accepted principles, well-founded arguments and correctly carried out. The decisions taken are acceptable, taking into consideration the safety of the ship and the prevailing conditions
Competence No. 14: Carriage of dangerous cargoes 14.1 Dangerous, Hazardous and Harmful Cargoes: 14.1.1 Dangerous goods in packages: SOLAS Ch. VII, IMDG code, MARPOL Annex III, dangerous cargo manifest, precautions when working with dangerous goods, port authority inspections before loading dangerous goods. 14.1.2 Solid bulk cargoes: IMSBC code, main hazards with the shipment of bulk solids, precautions to be taken, Bulk carrier loading and unloading (BLU) code, .precautions to be taken prior	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved simulator training, where appropriate	Planned distribution of cargo based on reliable information and is in accordance with established guidelines and legislative requirements Information on dangers, hazards

entering cargo holds. 14.1.3 Grain Cargoes: SOLAS Ch. VI, IMO grain code, securing free grain surface in partly failed compartment, grain loading stability booklet and related calculations 14.1.4 Arrangements necessary to ensure a safe deck watch is maintained when carrying hazardous cargo 14.2 Outline knowledge of Tanker Operations : 14.2.1 Terms and definitions: General knowledge of tankers, tanker arrangement, cargo piping systems, cargo pumps and tanker operation, crude oil, refined products, spiked crude, sour crude, Reid vapour pressure, upper flammable and lower flammable limit, flammability diagram 14.2.2 Contents and application of the International Safety Guide for Oil Tankers and Terminals (ISGOTT) 14.2.3 Oil tanker operations and related pollution-prevention regulations: Segregated ballast, clean ballast, dirty ballast, slop tank, inert gas system, COW, cleaning and gas freeing tanks, loading and discharging operations on a tanker. 14.2.4 Chemical tankers: SOLAS Ch VII, MARPOL Annex II, dedicated or parcel trades, rules regarding chemical tankers, IMO conventions covering the carriage of chemicals in bulk, BCH and IBC codes, categories of cargo, hazards, types of tank coatings, P & A manual, equipment for evaluation of tank atmosphere, pre-arrival check list, types of tanks, and tank arrangements with piping. 14.2.5 Tank cleaning and control of pollution in chemical tankers: Phases in tank cleaning operations, use of fixed or portable tank washing machines, hazards in tank cleaning, use of slop tanks, cycle of a tank washing system. Annex II of MARPOL 73/78. 14.2.6 Gas tankers: Ch. VII of SOLAS, SIGGTO, LNG, LPG, LEG and chemical gases, IGC code, certificate of fitness, various types of ships, various types of tanks, reliquefaction plant, deepwell pump, pre-arrival checklist 14.2.7 Cargo operations in gas tankers: Information needed before loading, various cargo operations, hazards with cargo operation with gas tankers. 14.3 Methods and Safeguards when Fumigating Holds: Reasons for the control of pest, International health regulations, and precautions when the vessel is fumigated. 14.4 Cargo Calculations: 14.4.1 Draft Survey and related Calculations. 14.4.2 Cargo Calculations: Use of ASTM tables for calculating cargo in a tank, excluding mixture/blend of cargoes. 14.5 Use of stability and trim diagrams and stress-calculating equipment, including automatic	.3 approved specialist training	and special requirements is recorded in a format suitable for easy reference in the event of an incident

data-based (ADB) equipment, and knowledge of loading cargoes and ballasting in order to keep hull stress within acceptable limits.		

FUNCTION: CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD AT THE MANAGEMENT LEVEL

Knowledge, Understanding & Proficiency / Course Covered	Methods of demonstrating competence	Criteria for evaluating competence
Competence No. 15: Control trim, stability and stress 15.1 Ship Construction: 15.1.1 - Welding: Down hand vertical and overhead welding, butt, lap, tack and fillet welds, chain and intermittent welding, weld faults, tests of welds, electric arc welding, TIG and MIG, resistance welding and submerged arc welding (SAW) - Bulkheads: Regulations, types of bulkheads, transverse bulkheads and racking stresses, margin line, weather tight, rule regarding penetration of collision bulkhead, testing of bulkheads for water tightness. - Watertight and weather-tight doors: Water tight and weather tight doors, categories of watertight doors, rules regarding water-tight doors, records of drills and inspections, ramp doors of Ro-Ro vessel, ship side doors, hinged and power operated doors,. - Corrosion and its prevention: corrosion, erosion and corrosion triangle, stress concentration, types of corrosion, galvanic actions, cathodic protection, impressed current system, structure and purpose of paint constituents, treatment of steel in a shipyard, preparing a surface for painting, Material Safety Data Sheets, typical paint schemes, wetted surface area. - Surveys, certification & dry-docking: Statutory and mandatory surveys, frequency of classification society surveys, items to examine in dry dock, cleaning preparation and painting of the hull in dry dock. Surveys and certification including Harmonised Ship Surveys and Enhanced Surveys, Condition Assessment Scheme and Condition Assessment Programme. 15.1.2 - Ship building materials: Use of high tensile steel and aluminium in shipbuilding, properties of steel, , stress and strain curve - Ship yard practice: General layout of a ship yard and co-operation between departments, ship's plans and test for ship building steel - Understands brief outline of	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate	Stability and stress conditions are maintained within safe limits at all times

.1 loadline convention: assignment of freeboard, multiple load lines, type A and type B ships, load line survey. .2 tonnage convention: GT, NT, excluded spaces, enclosed spaces .3 passenger ships subdivision: floodable length, permissible length, sub divisional load line .4 fire integrity of ships: types of bulkhead, standard fire test. - Midship section of ships and outline of constructional features of different types of ships. 15.2 Stability : 15.2.1 - Approximate calculation of areas and volumes: Simpson's rule to calculate areas, volumes and centroids. - Effects of density: TPC, FWA, DWA , fore and aft drafts, and calculations - Calculation of free Surface effect - Simplified stability data: Stability information supplied in simplified form, use of diagrams of dead weight moment, minimum permissible GM. - Trim and list: LCG, LCB and relationship with trim, trimming moment, MCTC and effect of change of density on MCTC, loading a given mass to produce a required trim, loading a mass to keep the aft draught constant, correction of draughts, forward aft and mid-ship, use of trim tables, KN curves, effect on GZ due to shift of weights, effect of change in length, breadth and freeboard on GZ curve, area under GZ curve. - Dynamical stability: Definition of dynamical stability and calculation of same. - Intact stability requirements for carriage of the grain, use of maximum permissible VHM curves; and related calculations - Dry-docking and grounding: Virtual loss of GM due to dry docking and grounding, critical instant, critical period, upthrust, calculation of residual GM and draft. 15.2.2 - Moments of inertia calculations, liquid pressure and centre of pressure, theorem of parallel axis, thrust due to liquid pressure, BM_i and BM_t. - Stability at moderate and large angles of heel: $GZ = GM \sin \theta$ for angles of heel up to 10°, $GZ = (GM + \frac{1}{2} BM \tan^2 \theta) \sin \theta$, $BM = I/V$, $KM = KB + BM$. - Approximate GM by means of rolling period tests - Inclining test: Procedure and precautions when carrying out inclining test and calculation of KG. - Recommendation on intact stability for passenger and cargo ships: Precautions against capsizing, recommended criteria for passenger and cargo ship, stability information, IMO wind criteria, heel while turning.		

- Rolling of ships: Effect of GM on rolling, effect of draught and displacement on rolling, function of bilge keels, synchronous and parametric rolling, anti-rolling tanks and stabiliser fins to reduce the amplitude of rolling. - Shear force, bending moments and torsional stress: Meaning of shear force, bending moments and torsional stresses, diagram of shear force and bending moments, maximum permissible torsional moments, draws a diagram of shear force and bending moment. - Flooding of compartments: Margin line, permeability of a space, floodable length, permissible length of compartment, factor of sub division, type A, type B ships. - Effect of flooding on transverse stability: Virtual loss of GM due to flooding, permeability of cargo, effect of bilging due to flooding of mid-ship compartments. - Effect of flooding on trim: Calculation of movement of centre of rotation, calculation of the reduction of MCTC, given the dimension of bilged space, calculates the draft in damaged condition.		
Competence No. 16 Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea and protection of the marine environment. 16.1 Introduction to Maritime Law 16.2 Law of the Sea: Conventions on the law of the sea, Territorial sea and the contiguous zone, International straits, Exclusive economic zone and continental shelf, High seas,. 16.3 Safety: Outline knowledge of the following safety conventions: 16.3.1 International Convention on Load Lines, 1966 (LL 1966), as amended 16.3.2 International Convention for the Safety of Life at Sea, 1974 as amended (SOLAS) 16.3.3 International Convention on Standards of Training, and Watchkeeping for Seafarers, 1978 (STCW) as amended 16.3.4 Convention for the suppression of unlawful act against the Safety of Maritime Navigation 1988 as amended 16.3.5 ITU Radio Regulations 16.4 Pollution: Outline knowledge of the following pollution conventions and their amendments: 16.4.1 International Convention for the Prevention of Pollution from Ships, 1973. 16.4.2 London Dumping Convention (LDC). 16.4.3 Intervention convention. 16.4.4 Civil Liability convention (CLC) and Fund Convention. 16.4.5 Oil Pollution Preparedness, Response & Co-operation Convention (OPRC) 16.4.6 Precautions, which should be taken by the master to prevent operational pollution: Use of oil	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate	Procedures for monitoring operations and maintenance comply with legislative requirements Potential non-compliance is promptly and fully identified Planned renewal and extension of certificates ensures continued validity of surveyed items and equipment

record book, IOPP certificate. 16.4.7 Precautions which should be taken by the master to prevent accidental pollution: Routine checking and maintenance of equipment, proper communication during oil operations, protection and preservation of the marine environment. 16.4.8 Reporting of incidents: need for prompt reporting, meaning of probability of discharge 16.5 Passengers 16.5.1 Special Trade Passenger Ships Agreement. 16.5.2 Protocol and Rules on Space Requirements for Special Trade Passenger Ships, 1973 16.5.3 Athens Convention relating to the Carriage of Passengers and their Luggage by Sea 16.6 Tonnage 16.6.1 International Convention On Tonnage Measurement of Ships, 1969 as amended. 16.7 ILO Maritime Labour Convention (MLC)-2006 a) Minimum requirements for seafarers to work on ships: minimum age, medical certificates, training and qualification, recruitment and placement. b) Conditions of Employment: Seafarers Employment Agreements, Wages, Hours of Work and Hours of Rest, Entitlement to Leave, Repatriation, Seafarer compensation for the ship's Loss or Foundering, Manning Levels, Career and Skill Development and Opportunities for Seafarers' Employment c) Accommodation, Recreational Facilities, Food and Catering d) Health Protection, Medical Care, Welfare & Social Security Protection: Medical Care on-board ship and Ashore, Ship-owners' Liability, Health & Safety Protection and Accident Prevention, Access to Shore-based Welfare Facilities, Social Security e) Compliance and Enforcement i) Flag State Responsibilities: General Principles, Authorization of Recognised Organizations, Maritime Labour Certificate and Declaration of Maritime Labour Compliance, Inspection and Enforcement, On-board Complaint Procedures, Marine Casualties ii) Port State Responsibilities: Inspections in Port, Detailed Inspection, Detentions, On-shore Seafarer Complaint Handling Procedures iii) Labour-supplying Responsibilities: Recruitment and Placement services, Social security 16.8 Arrival Documents and Procedures as amended: 16.8.1 International Health Regulations (IHR) 16.8.2 Convention on Facilitation of International Maritime Traffic, (FAL 1965) 16.8.3 Noting protests 16.9 Collision 16.9.1 International Convention for the Unification of Certain Rules of Law with respect to Collision between Vessels, and Relating to Penal Jurisdiction in Matters of Collision or other Incidents of		

Navigation 16.10 Assistance and Salvage 16.10.1 International Salvage Convention 16.10.2 Lloyd's Standard Form of Salvage Agreement (LOF) 16.11 Convention on Limitation of Liability for Maritime Claims 16.12 Classification Societies 16.12.1 Overview of all classification society rules 16.13 Cargo 16.13.1 International Convention for the Unification of Certain Rules of Law relating to Bills of Lading (Hague-Visby Rules), Hamburg Rules 16.13.2 Charter-parties- voyage, time, demise charter party; contract of affreightment; 16.14 General Average and Marine Insurance 16.14.1 The York-Antwerp Rules: General average act, sacrifice, rights to contribution. 16.14.2 Marine insurance: voyage, time and floating policy; perils covered. 16.15 Certificates and Documents required to be Carried by International Conventions and Agreements 16.16 National Maritime Legislation: 16.16.1 General provisions of Merchant Shipping Act & brief outline of Rules made thereunder		
Competence No. 17: Maintain safety and security of the ships crew and passengers and the operational condition of life-saving, fire fighting and other safety systems 17.1 A thorough knowledge of life-saving appliance regulations (International Convention for the Safety of Life at Sea) - LSA Code 17.2 Organisation of fire and abandon ship drills 17.3 Maintenance of operational condition of life-saving, fire-fighting and other safety systems 17.4 Actions to be taken to protect and safeguard all persons on board in emergencies 17.5 Actions to limit damage and save the ship following a fire, explosion, collision or grounding 17.6 Safety and Security of the ship's crew and passengers: Safety committee, maintenance of safety equipment, care and maintenance of rope wires, code of safe working practices, dock safety regulation, Reporting of accidents, ISPS code, security levels and duties, actions in case of piracy or armed robbery,.	Examination and assessment of evidence obtained from practical instruction and approved in-service training and experience	Procedures for monitoring fire-detection and safety systems ensure that all alarms are detected promptly and acted upon in accordance with established emergency procedures

17.7 Ship maintenance and repairs: Planned maintenance, maintenance of ropes, wires, accommodation ladders, pilot hoists/ ladders, W/T doors, mooring equipment, hatch covers and cargo handling equipment.		
Competence No. 18: Develop emergency & damage control plans & handle emergency situations 18.1 Emergency situations 18.1.1 Demonstrates the knowledge of preparation of contingency plans for response to emergencies: Drawing plans to deal with emergencies, legal aspects and seamanship practises. 18.1.2 Understands ship construction with regards to damage control 18.1.3 Explains methods and aids for fire prevention, detection and extinction: Fire prevention procedures, different types of fires and fire fighting equipment to be used, fighting fire on different types of ship. 18.1.4 Understands functions and use of life saving appliances: Different types of emergencies, actions taken, life saving appliances and instructions to use it.	Examination and assessment of evidence obtained from approved in-service training and experience	Emergency procedures are in accordance with the established plans for emergency situations
Competence No. 19: Use of leadership and managerial skills 19.1 Knowledge of shipboard personnel management and training 19.2 A knowledge of related international maritime conventions and recommendations, and national legislation 19.3 Ability to apply task and workload management, including 19.3.1 planning and co-ordination 19.3.2 personnel assignment 19.3.4 time and resource constraints 19.3.5 prioritization 19.4 Knowledge and ability to apply effective resource management 19.4.1 allocation, assignment, and prioritization of resources, 19.4.2 effective communication on board and ashore, 19.4.3 decisions reflect consideration of team experiences, 19.4.4 assertiveness and leadership, including motivation, 19.4.5 obtaining and maintaining situation awareness 19.5 Knowledge and ability to apply decision-making techniques 19.5.1 situation and risk assessment, 19.5.2 identify and generate options, 19.5.3 selecting course of action, 19.5.4 evaluation of outcome effectiveness	Assessment of evidence obtained from one or more of the following: .1 approved training .2 approved in-service experience .3 approved simulator training	The crew are allocated duties and informed of expected standards of work and behaviour in a manner appropriate to the individuals concerned. Training objectives and activities are based on assessment of current competence and capabilities and operational requirements. Operations are demonstrated to be in accordance with applicable rules Operations are planned and resources are allocated as

19.6 Development, implementation, and oversight of standard operating procedures		needed in correct priority to perform necessary tasks. Communication is clearly and unambiguously given and received. Effective leadership behaviours are demonstrated. Necessary team member(s) share accurate understanding of current and predicted vessel and operational status and external environment. Decisions are most effective for the situation. Operations are demonstrated to be effective and in accordance with applicable rules.
Competence No. : 20 Organise and manage the provision of medical care on board. Medical care course	Examination and assessment of evidence obtained from approved training course.	Action taken and procedures followed correctly apply and make full use of advice available. IMO Model Course No. 1.15 on Medical Care

Notes:

- 1) Upgradation Course (operational level) of 40 hours from STCW 1995 to STCW 2010 may be done before or after Chief Mates (F.G) Phase I or Phase II Competency course. Candidates who have undergone Second Mates function course on or after 15th Dec 2010 under the revised syllabus are exempted from attending this course.
- 2) In addition to the above, the candidates who have undergone Chief Mates (F.G) Phase I Course as per STCW 1995 (Phase I course before 15th Sept 2011) are required to do the 3 - day Upgradation Course (Management level- Phase I) before or after Phase II Competency course .
- 3) Moreover, other requirements as stated in the STCW Circular dealing with Upgradation of Masters and Deck Officers are in any case need to be complied with, where applicable.

SYLLABUS FOR ORAL EXAMINATION

Function: Navigation

A BRIDGE TEAM MANAGEMENT

- 1 Voyage planning and Navigation for various conditions such as in restricted Waters/Meteorological condition/Ice /TSS/Restricted visibility/Gross of extensive tidal effect/ Ship routing and reporting systems criteria
- 2 Position determination in all conditions by celestial terrestrial observations. Various publication of modern electronic aids with knowledge of principles/error/corrections etc. Knowledge of principles of Magnetic/ Gyro/Compass and Master Gyro System and care of allother navigation equipments on the Bridge.

B.TRAFFIC MANAGEMNET

- 3 Through knowledge and addition of collision Regulations/Buoyage system.
- 4 Through knowledge and application of the principles to be observed in keeping an effective navigation watch (Senior Officer duties).
- 5 Assist Master with Commend decision – making situations on bridge.

C.WEATHER MANAGEMENT

- 6 Ability to understand and interpret synoptic chart toforecast area weather taking into account local weather Condition and information received by Weather Fax and Weather Routing.
- 7 Knowledge of characterizes of various weather systemsincluding TRS avoiding actions in storm centers/ Dangerous quadrants.
- 8 Knowledge of ocean current systems/tidal calculations/publications relating to this.

D CRISIS MANAGEMENT

- 9 Handling of various emergencies beaching, grounding, collision / assessment of damage control / emergency Steering / emergency towing arrangements and towingprocedures.

Function: Cargo handling and stowage

A. GENERAL

1. Knowledge of cargo related terminology/load destiny/ stowage factor/ angle of repose and various plans used for cargo loading
- 1-a Knowledge and applications of international Regulations, Codes concerning safe handling, stowage, securing and transport of cargoes. Examples:- Bulk Codes, Grain Code, Lashing Code, IMDG Code, Timber Code, ISGOT, etc.
- 2 Knowledge and application of the effect on Trim & Stability of cargoes and its operations.

- 3 Use of stability and trim diagram and stress calculating equipment including Automatic data based equipment hull, stress calculation within acceptable limits.
- B DRY CARGO STOWAGE
- 4 Stowage and Securing/Trimming of various types of cargoes on various ships i.e. General Cargo (Steel plate, pulp, bagged cargo)/Bulk (Urea, MOP, Coal, Sulphur, Iron Containers including Refrigerated type Passenger (Duties relating to Pass/Cargo), Timber (Wood Pulp, Sawan Timber,lumber) RO-RO (various types Light/Heavy vehicles and knowledge of Livestock/pure Car Carrier, Refrigerated cargo ship).
- 5 Defination of Heavy Lifts Loading/Stowage & Securing of Heavy Lifts on a General Cargo/ Multi Container/Bulk Carrier.
- C SPECIALIZED CARGO STOWAGE
- 6 Knowledge of Oil/Chemical /LPG/Tanker Operations relating to ship operation, care of personnel and Stowage Tanker (various of heavy and light oil).
Chemical (various types of heavy and light oil)
LPG (various types of gases as per gas code
- 7 Carriage of IMDG/Dangerous, Hazarfous and harmful cargoes
- D Transit Care
- 8 Precautions during loading and unloading and care during voyage of said cargoes.
- E Doucuments
- 9 Knowledge and application of various cargo related documents such as stowage plan, shipping list, boat note Mate's receipt, B/L, shipping documents, DG Manifest.
- 10 Documents with regard to cargo claims, disputes, damage etc., note of protest and knowledge of collection of evidence.
- F CRISIS
- 11 Contingencies plan/Remedial action during loading /unloading of cargoes.

Example:-

Cargo Gear Breakdown/Power failure/Oil Spillage, Bilge Leakages into hold with cargo, concentrates becoming liquids

Function: OPEARTION AND CARE OF PERSONNEL

- A GENERAL ____
- 1 Definitions of Operation/ Environment protection.
- 1-a Knowledge of fundamental principles of ship construction, various ships plans/manuals used for operation ballasting and deballasting deck machinery.
- 2 Statutory Certificates requirements and their validity including various documents relating to Official Log Book, Oil Record Book, Chain Register thorough knowledge of Dock labour regulations.

- 3 Knowledge and application of Articles of Agreement and other Biparty /Triparty Agreements on board Indian/ Foreign ships. Knowledge of provisions for indiscipline on board under various Rules/Regulations.
- 4 Knowledge of ISM/STCW 95 code relating to the duties of chief mate.
- 4-a Knowledge of statutory certificate /class/port state control/ flag state/damage etc. surveys and inspection.

- B MAINTENANCE MANAGEMENT---
- 5 A thorough knowledge of LSA/FFA and L & SS (Screening of Navigation Lights) Regulations /Organization of Drills and maintenance of these appliances under SOLAS.
- 6 P.M.S. for hull deck machinery, accommodation emergency/steering gear and anchor cable.
- 7 Knowledge of personnel Management, Organization and Training on board as head of Deck Department.

- C EMERGENCIES—
- 8 Knowledge of occupational hazards on ship, crew welfare, social responsibility. In accordance with code of safe working practice for merchant seamen.
- 9 Preparation of contingency plans for response to various emergencies :-
Fire, Explosion, Collision or Grounding, Cargo shift, Flooding, Foundering, Piracy and Pilferage.
- D SEAMENSHIP ASPECT-
- 10 Anchoring /Mooring:-
Procedures for use of these equipments including slipping of cables, foul anchor, foul cable, anchor dragging and ground tackle.
- 11 brief knowledge on manouvering of ships in rivers & Harbours/Berthing Alongside under various conditions without Tugs.
- 12 Management of ship in adverse situation at sea, Heavy Weather duties /Handling of disabled ship.
- 13 preparations of Dry-docking /Undocking.Use of shores, Bilge blocks and bilge shores.
- 14 Measures to be taken to prevent the spillage of oil during cargo work. Bunkering or oil transfer. The keeping of records under the M.S (Prevention of Pollution of the Sea by oil) Rules.

Presentation of answers: clarity of mind

Personality: trusting, dependable and cooperative

ASSESSMENT OF ORAL:

6-day Radar and ARPA Navigation Simulator Course (RANSCO)**RADAR, ARPA & NAVIGATION SIMULATOR COURSE****COURSE OUTLINE**

Subject Area	Lecture Simulator	
	Hours	Hours
Knowledge, understanding and proficiency		
Operate ARPA and Navigation Controls	1.0	1.0
Demonstrate familiarity with own-ship characteristics and operate ARPA and navigation controls	1.0	1.0
Perform Radar Plotting		
Factors affecting radar plotting are identified correctly	2.0	-
Carry out radar plotting	-	4.0
	2.0	4.0
Use ARPA and Navigation Information to Control Safe Navigation and Collision Avoidance		
Apply COLREGS in open waters in restricted visibility	-	6.0
Plan and control navigation in confined waters	2.0	8.0
Control navigation in/near traffic separation schemes	1.0	5.0
Manage a bridge team	2.0	-
	5.0	19.0
Plan and Co-ordinate Search and Rescue		
Respond to a distress message	1.0	-
Co-ordinate search and rescue operation	1.0	-
Execute a search and rescue operation	-	4.0
	2.0	4.0
Total	10	28
Subject Total	38	

45-DAY ADVANCED SHIPBOARD MANAGEMENT (ASM) COURSE FOR MASTER (F.G.) EXAM**MASTER'S (F. G.) COURSE**

Duration – 45 days

SYLLABUS: ADVANCED SHIPBOARD MANAGEMENT

Examination:

Time: 3 hours

Marks: 200

Pass Marks: 100

S. No	Topic	Hours
1	<i>Indian Merchant Shipping Act</i>	13
a	Registration of ships: The certificate of registry and its legal significance. [2 hrs]	
b	Engagement, discharge and management of crew. Manning scales and certification. Contracts of employment, wages and other remuneration, advances, allotments, payment into bank accounts. Descriptions, deceased seamen, engagement of substitutes, repatriation, assisting and repatriating Indian seamen distressed abroad. [2 hrs]	
c	The official log book and the law relating to entries. Offences relating to misconduct, to endangering ship and against persons on board. Discipline and treatment of disciplinary offences. Civil liability for certain offences. Trade disputes involving seamen. The official log book entries and records in freeboard draft and allowances. [2 hrs]	
d	Crew accommodation. Hygiene of the ship and welfare of the crew. Outline knowledge of the regulations relating to medical stores. Inspection and reports. Fresh water and provisions. Procedures in cases of infectious disease, illness or accidents. Maritime declarations of health. Port health requirements. International agreements and measures to prevent the spread of disease by shipping. [2 hrs]	
e	The safety of the ship, crew and passengers. Assistance of vessels in distress and salvage. Master's duties in the case of collision or any other accident. Master's role in collecting evidence after an accident. Lodging protests etc. Inquiries and Investigation. [3 hrs]	
f	The law relating to the reporting of ice, derelict, tropical revolving storms and other dangers to navigation. [1 hr]	
g	Outline knowledge of the rules made under the Merchant Shipping Act. [1 hr]	
2	Documentation: Certificates and other documents required to be carried on Passenger ships, tankers, Gas carriers, Chemical carriers, Car/Truck carriers, Bulk carriers. Procedures to obtain the above mentioned certificates and the period of their validity. Other Trading certificates (Suez and Panama Canal certificate, CFR) that are required to be carried on board.	3
3	Custom house procedures: Inward and outward clearance, Immigration clearance, quarantine clearance (FAL Convention).	2
4	Methods of dealing with stowaways, hijacking of ships, armed robbery / piracy, smuggling and other custom offences, drug and alcohol policy and its enforcement	6
5	Master – Pilot relationship: Exchange of information, responsibilities. Compulsory and optional pilotage. Bridge Team Management while under pilotage. Legal implications if an incident occurs when under	4

16	<i>Lighterage operations, Ocean Towing. Duties and responsibilities of Towing & Towed vessel, Communications and exchange of information between towing and towed vessel. Emergency Towing arrangements; Maritime Assistance Service on Indian coast (when applicable)</i>	2
17	Emergency Response Procedures: <i>Fire in Port & at Sea, grounding, collision, collision mats, Pollution, Flooding, Engine failure, Listing, Beaching, Steering failure, refloating of vessel. Man-overboard, Helicopter Rescue Operation; Leakages and spills of dangerous cargo; Rescue of victims from enclosed spaces; Rescue of Survivors from another vessel or sea</i>	10
18	Case Studies: <i>(Recent casualties such as MSC Chitra and Khalijia 3, M.V.Tosa, Hebei Spirit and Samsung crane barge, Herald of Free Enterprise, Cosco Busan)</i>	8
19	<i>Anchoring & Berthing under the effect of tide / wind in shallow / deep waters, use of Anchors, squat, interaction between ships / shore, transverse Thrust & turning the ship short round, pivot point, dragging / dredging anchors; Different types of tugs and use/limitation of each; Berthing with/ without tugs under various conditions of wind, current and tide. Effectiveness of bow and stern thrusters.</i>	10
20	<i>Manoeuvring and handling of ship in all conditions; Ship's maneuvering characteristics; Wheelhouse poster; Emergency stopping manoeuvres, crash stop, rudder cycling. Synchronous rolling, Parametric rolling, wind heeling criteria for high freeboard ships; Picking up Pilot; Manoeuvring in and near Traffic Separation Schemes and VTS areas; STS Operations.</i>	10
21	Environmental Protection: <i>Marpol Annexes I to VI, SOPEP/SMPEP, Vessel Response Plan, oil record book. Ballast Water Management, OPA 90 & NPDES. (National Pollution Discharge Elimination System of U.S.A.)</i>	3
22	Operating in ice: <i>Basic ship handling in ice, sighting of ice / open water, working through ice, navigation in ice. High latitude Navigation – procedures & precaution. Polar Code. effects of ice accretion on stability of vessel</i>	4
23	Safety Management: <i>Case studies on Risk Assessment; Managing Risk on board; Briefings / debriefings and toolbox meetings;</i> <i>Case studies for Safety on deck in rough weather;</i> <i>On-board Training;</i> <i>Incidents related to Enclosed Space Entry Procedures; Hot Work Procedures;</i>	8
24	<i>Damage Stability Criteria and Damage stability booklet Proper assessment of damage stability condition – using ETAS (Emergency Technical Assistance Service) provided by classification societies. An understanding of the information required to be passed on for assessment of Damage Stability</i>	4
25	<i>Weather Routeing and Voyage Planning; Procedures for selection of an optimum route; Various weather routeing services available to shipping; Vessel Performance curves, hind-cast charts;</i>	4
26	<i>Various ship plans used in Cargo Loading / discharging, dry docking, Grounding, Dry-docking both intact and with damage; Preparation of Repair Specifications</i>	4
27	<i>COLREGS, related case studies and Interaction with participants</i>	16
28	<i>Ship Recycling Convention: Hazardous Materials inventory, Green Passport.</i>	2
29	<i>Global Warming and climate change, Greenhouse effect, Carbon</i>	3

	<i>credit, Kyoto protocol,</i>	
30	<i>Dangerous Goods: Recent amendments to IMDG code</i>	3
31	<i>Assessment & Feedback (including internal assessments)</i>	6

Total Duration: 198 hours = 33 working days (6.5 weeks or 45 calendar days)

Note:

- 1) In addition to the above ASM course, all existing Officers in possession of Certificate of Competency under STCW 1995 are required to undergo Upgradation Course for Chief Mates and Masters (STCW 1995 to STCW 2010) and practical training as in Note 2 before issuance of Master F.G Certification under STCW 2010.

2) PRACTICAL TRAINING

a	ECDIS (See Note 3)	Approved Training Course	40 hours	As per IMO Model Course No. 1.27 revised
b	Refresher Training in Personal Survival Techniques and Proficiency in Survival Crafts and Rescue Boats	Practical Training at institute approved for PSCRB Course	1 day (6 hours)	Identified items under STCW 2010
c	Refresher Training in Fire Prevention and Fire Fighting and Advanced Fire Fighting	Practical Training at institute approved for AFF Course	1 day (6 hours)	Identified items under STCW 2010

- 3) Training and assessment in the use of ECDIS is not required for those who serve exclusively on ships not fitted with ECDIS. This limitation shall be reflected in the certificate of competency.
- 4) Officers who have **not** undergone Ship Security Officer (SSO) training are required to undergo approved training course for Seafarers with Designated Security Duties in accordance with Regulation VI/6-2 (this does not form part of CoC Revalidation)

5-DAY SHIP MANOEUVRING SIMULATOR AND BRIDGE TEAMWORK COURSE**COURSE OUTLINE**

	Training Area	Hours	
		Lecture	Simulator
1.	Review of basic principles	2.0	
2.	Familiarization with the Bridge		1.0
3.	Standard Manoeuvres	0.5	2.0
4.	Human Factor in error ■ Attitude, Cultural Awareness, Communication, Briefing & Debriefing and Challenge & Response. ■ Authority – Assertiveness, Management on the bridge ■ Workload and Stress, Decision making	1.0	
5.	Passage Planning		0.5 (exercise)
6.	Wind and current effects	0.5	3.5
7.	Shallow-water effects and Bank, channel and interaction effects	0.5	4.0
8.	Anchoring	0.5	3.0
9.	Single – buoy mooring		2.0
10.	Picking up Pilot, Berthing / Unberthing, Use of tugs	0.5	8.0
11.	Crisis Management, Contingency Planning and carrying out a voyage in emergency situations	0.5	5.0
	TOTAL	6	29
	GRAND TOTAL	35	

COURSE TIMETABLE

TIME	SUBJECT	FACULTY	TIME	SUBJECT	FACULTY
	Group A			Group B	
DAY 1					
0900 - 1100	Course Entry formalities.		0900 - 1100	Course Entry formalities.	
	Review of Basic Principles (Lecture)			Review of Basic Principles (Lecture)	
1100-1115	Tea Break		1100-1115	Tea Break	
1115-1215	Familiarisation (simulator)		1115-1145	Standard manoeuvre (Lecture)	
1215-1245	Standard manoeuvre (Lecture)		1145-1215	Wind & Current (Lecture)	
1245-1315	Wind & Current (Lecture)		1215-1315	Familiarisation (simulator)	
1315-1400	Lunch Break		1315-1400	Lunch Break	
1400-1415	Standard manoeuvre (Plan & Brief)		1400-1500	Human Factor in Errors (Lecture)	
1415-1530	Standard manoeuvre Exercise (simulator)		1500-1515	Standard manoeuvre (Plan & Brief)	
1530-1545	Tea Break		1515-1530	Tea Break	
1545-1615	Standard manoeuvre (Debrief)		1530 - 1645	Standard manoeuvre Exercise (simulator)	
1615-1645	Ship handling-1 (Video)				
1645 - 1715	Wind & Current exercise (Plan & Brief)		1645-1715	Standard manoeuvre (Debrief).	
DAY 2					
0900-1045	Wind & Current exercise (simulator)		0900-0930	Ship handling-1 (Video)	
			0930-1000	Passage planning (Planning Exercise)	
			1000-1030	Wind & Current exercise (Plan & Brief)	

1045-1100	Tea Break		1030-1045	Tea Break	
1100-1130	Wind & Current exercise (debrief)		1045-1230	Wind & Current exercise (simulator)	
1130-1200	Passage planning (Planning Exercise)				
1200-1230	Anchoring (Lecture)				
1230-1300	Anchoring Exercise (Plan & Brief)		1230-1300	Wind & Current exercise (debrief)	
1300-1345	Lunch Break		1300-1345	Lunch Break	
1345-1515	Anchoring Exercise (simulator)		1345-1415	Ship Handling – 2 (Video)	
			1415-1445	Anchoring (Lecture)	
			1445-1515	Anchoring Exercise (Plan & Brief)	
1515-1530	Tea Break		1515-1530	Tea Break	
1530-1600	Anchoring Exercise (Debrief)		1530-1700	Anchoring Exercise (simulator)	
1600-1700	Human Factor errors (Lecture)				
1700-1730	Single Buoy Mooring Exercise (Plan & Brief)		1700-1730	Anchoring Exercise (Debrief)	
DAY 3					
0900-1000	Single Buoy Mooring Exercise (simulator)		0900-0930	Shallow water effect (Lecture) Bank channel & Interaction effects (Lecture)	
1000-1030	Single Buoy Mooring Exercise (Debrief)		0930-1000	Single Buoy Mooring Exercise (Plan & Brief)	
1030-1100	Shallow water effect (Lecture) Bank channel & Interaction effects (Lecture)		1000-1100	Single Buoy Mooring Exercise (simulator)	
1100-1115	Tea Break		1100-1115	Tea Break	
1115-1145	Shallow Water and Interaction Exercise (Plan & Brief)		1115-1145	Single Buoy Mooring Exercise (Debrief)	

1145-1315	Shallow and Interaction Exercise (simulator)		1145-1215	Shallow water and Interaction Exercise (Plan & Brief)	
			1215-1245	Voyage Planning (Video)	
1315-1400	Lunch Break		1245-1330	Lunch Break	
1400-1430	Shallow water and Interaction Exercise (Debrief)		1330-1500	Shallow water and Interaction Exercise (simulator)	
1430-1500	Berthing / Unberthing (Picking up Pilot Lecture)				
1500-1530	Berthing / Unberthing (Plan & Brief)		1500-1530	Shallow water and Interaction Exercise (Debrief)	
1530-1545	Tea Break		1530-1545	Tea Break	
1545-1730	Berthing / Unberthing Exercise 1 (simulator)		1545-1615	Berthing / Unberthing (Picking up Pilot Lecture)	
			1615-1645	Berthing / Unberthing (Plan & Brief)	
			1645-1715	Bridge Team Management (Video)	
DAY 4					
0900-0930	Berthing / Unberthing (Debrief)		0900-1045	Berthing / Unberthing Exercise 1 (simulator)	
0930-1000	Ship Handling 2 (Video)				
1000-1030	Berthing Exercise 2 (Plan + Brief)				
1030-1045	Tea Break		1045-1100	Tea Break	
1045-1230	Berthing Exercise 2 (simulator)		1100-1130	Berthing / Unberthing (Debrief)	
			1130-1200	Crisis Management (Lecture)	
			1200-1230	Berthing Exercise 2 (Plan + Brief)	
1230-1315	Lunch Break		1230-1315	Lunch Break	
1315-1345	Berthing Exercise 2 (Debrief)		1315-1500	Berthing Exercise 2 (simulator)	

1345-1415	Voyage Planning (Video)		1500-1530	Berthing Exercise 2 (Debrief)	
1415-1445	Unberthing Exercise (Plan + brief)				
1445-1500	Tea Break		1530-1545	Tea Break	
1500-1645	Unberthing Exercise (simulator)		1545-1615	Master-Pilot Relationship (Video)	
			1615-1645	Unberthing Exercise (Plan + brief)	
1645-1715	Unberthing Exercise (debrief)		1645-1715	Emergency Manoeuvres (Video)	
DAY 5					
0900-0930	Crisis Management (lecture)		0900-1045	Unberthing Exercise (simulator)	
0930-1000	Master-Pilot Relationship (Video)				
1000-1030	Crisis Management Exercise (Plan + Brief)				
1030-1045	Tea Break		1045-1100	Tea Break	
1045-1300	Crisis Management Exercise (simulator)		1100-1130	Unberthing Exercise (Debrief)	
			1130-1200	Crisis Management Exercise (Plan + Brief)	
			1200-1230	Case Study	
1300-1345	Lunch Break		1230-1315	Lunch Break	
1345-1415	Crisis Management Exercise (Debrief)		1315-1530	Crisis Management Exercise (simulator)	
1415-1445	Emergency Manoeuvres (Video)				
1445-1515	Case Study				
1515-1530	Tea Break		1530-1545	Tea Break	
1530-1615	Bridge Team Management (Video)		1545-1615	Crisis Management Exercise (Debrief)	
1615-1700	Assessment		1615-1700	Assessment	
1700-1715	Feedback & Certificates		1700-1715	Feedback & Certificates	

COURSE FOR EXTRA MASTER'S EXAM**Part- A**

Code	Name of Modules	Marks
EM101	Leadership, Management and Human Resources	200
EM102	Maritime Economics and Finance	200
EM103	Maritime Law	200
Total		600

Part B:

Code	Name of Modules	Marks
EM201	Advanced Navigation and Maritime Cyber Security	200
EM202	Advanced Naval Architecture	200
EM203	Commercial Engineering, Robotics and Alternate energy	200
Total		600

Part C

Code	Name of Modules	Marks
EM301	Marine Environment and Ocean Governance	200
EM302	Port Management	200
EM303	Commercial Shipping Management	200
Total		600

Part D

Code	Dissertation	Marks
EM401	Dissertation on any Marine topic using appropriate research methodologies. (12000 to 14000 words including Executive Summary)	200
Total		200

Note –

1. Each papers will be of 3 hrs duration with maximum/pass marks of 200/100.
2. Guide for dissertation is recommended but is not mandatory. However, topic of dissertation needs to be from the maritime domain and is required to be approved by the Chief Examiner of Master and Mates.

LEADERSHIP

1. Introduction to leadership: Distinguishing leadership functions (vis-à-vis leading, leader) concept of leadership (vision, mission, policies), key leadership theories (contingency theories, path goal theory, leader-member exchange theory, etc.); key leadership models (transformational, transactional and instrumental) individual factors and situational leadership and factors; management as a subset of leadership;
2. Approaches to defining leadership: (trait, behavioural approach, skills approach) individual attributes of leadership; integral leadership, styles of leadership (charismatic, visionary, autocratic, entrepreneurial, contingency leadership etc), meaning and significance of contemporary leadership, how our values influence others; key leadership behaviours;
3. Miscellaneous aspects of leadership: Ethical leadership and dark side of leadership; leaders role in crisis preparation and mitigation; emerging trends in leadership; global and Indian leaders;

MANAGEMENT

1. Introduction to organisation and management: What is organization? Types of organisations, organisation design and behaviour, management function in organisation, shipping industry summary and types of organisation in it;
2. Essentials of management functions: Definition and introduction to management and managerial functions (planning, organizing, controlling, decision making); project, program and portfolio management; communication management; time management; delegation & resource management; motivation methods; team management; vendor management, change management, process management; quality management & tools (ishikawa, pareto chart, histogram, scatter diagram, etc), cost management (EVM: earned value management); risk and issue management; contract management;
3. Financial management: Definition and purpose of financial management; types of estimation process (PERT software, WBS method, use-case point method, 3-point estimation, wideband delphi technique); allotment of funds and capital structure; types of source of funds; procurement of funds; utilization of funds; accounting concepts on profit and loss; management practice, types of reserve, management of liquidity, financial control methods and tools;
4. Operations management: Definition and purpose of operations management, finance, operation (planning, organising, directing and controlling of all activities in organisation), strategy, design of product, forecasting methods, supply chain configuration, quality assessment and quality control;
5. Marketing management: Definition and purpose of marketing; five marketing concepts (production concept, product concept, selling concept, marketing concept, difference between marketing and sales function), marketing functions (market research, product development and management, promotion of product or service, sales and distribution, storage, standardization and testing, after sales and customer service, financing, market risk taking, market information), popular marketing methods and principles;
6. Sales management: Definition and purpose of sales management, goal setting and planning of resource, designing sales strategy, different sales approach, sales analysis and reporting, sales team structure;

7. Strategic management: Nature and scope of strategic management (strategic intent, vision, mission, objectives and policies, risk and rewards); process of strategic planning and implementation (environmental analysis and internal analysis, SWOT analysis); tools and techniques for strategic analysis (impact matrix: the experience curve, BCG matrix, GEC mode); concept of value chain; strategic profile of organizations; analysing competition; growth strategies (expansion, integration and diversification); concept of core competence, strategic flexibility; strategic alliances, mergers and acquisitions;
8. Entrepreneurship concepts: Definition and purpose of entrepreneur, types of entrepreneur, functions of entrepreneur, entrepreneurial process, idea generation, value creation, creation of organisation;
9. Information technology management: Definition and purpose of information technology management, basic concepts of IT (ITIL, ITSM concepts, ISO 27001 information security management); types of software licenses; basics of IT infrastructure and network management; software development lifecycles (introduction to Agile, Devops, Waterfall) some maritime specific software (e.g. JOT, JIBE, SHIPMATE, etc), enterprise resource planning (ERP); trends in information technology; managing and organising data resources

HUMAN RESOURCES

1. Definitions, objectives and responsibilities: Functions and objectives of human resource management, personnel policies and principles; internal and external factors affecting HRM; principle of management and organisational behaviour (individual behaviour in organisation; group behaviour in organisation);
2. HR responsibilities and role: Competitive challenges influencing HR; meeting competitive challenges; business models & strategies; strategic formation & implementation; meeting competitive challenges via HRM practices; management of human resources; sociology of organisations; theory and design; business communication; learning and development; reward management; business research and statistical techniques; employees' welfare and benefits administration; organisational behaviour; labour economics; industrial relations; employee counselling; conflict management and negotiation skills; organisational development and changes;
3. Legal issues in HR: International legal systems & equal opportunities; employment laws; types of discrimination; legal issue related to harassment & employee safety; work flow analysis & organizational structure; job analysis; job design; employee benefits (historical trends & mandated programs, non-mandated programs); collective bargaining & labour unions (goals, structure & trends; legal framework & organizing process);
4. Compensation: developing pay levels (external equity & market surveys; internal equity & job evaluation; current challenges); employee pay (merit systems & incentive plans; organizational & group plans; managerial pay & strategic fit)
5. Planning and Selection: manpower forecasting (steps in forecasting, demand forecasting techniques, forecasting accuracy); goal setting; manpower planning & resourcing (factors affecting manpower planning, 5 steps in manpower planning, controlling manpower costs); competency based management; recruiting; standards for selection methods; interviews, application blanks, & references; tests & personality inventories;
6. Employee development & retention: career & development planning; approaches to employee career development; mentoring, coaching, training (designing training programs, cross-cultural & diversity training and socialization programs), succession planning; measuring performance; employee

turnover (introduction, causes & remedies, cost of employee turnover, importance of employee turnover); managing involuntary turnover; managing voluntary turnover; measuring & monitoring job satisfaction; employee exit process, managing redundancy;

7. Stress management: nature of stress; occupational stressors; stress and thought process; stress & personality (behavioral & situational modifiers); verbal and non-verbal indicators of stress; assessment of stress; stress and conflict; stress and motivation; decision making under stress; burnout; stress and social support;
8. Conflict management: Definition, models of conflict (process & structural), sources of conflict, relationship between conflict & performance in team; individual differences, personalities & abilities, interpersonal conflict, group conflict, organizational conflict, dealing with difficult subordinates & boss, technique to resolve team conflict, strategies to resolve organizational conflict,
9. Challenges of HRM: major challenges; balancing work with life; attitudes towards unions; changing demographics of work force; changing employee expectations; globalization; motivation (concepts of motivation – early theories, contemporary theories, content theories, process theories); ethical issues in HR; managing ethics; resolving ethical issues; difficulties in decision making; international human resource management, managing diversity & strategic contexts;

EM102: MARITIME ECONOMICS AND FINANCE

- Economic concepts: basic concepts, principles and terminologies; theories of economic growth (growth across time, growth in different countries, accounting for growth), economic calculation, capital and rental cost, profit, scale and substitution, production function and aggregation; factors of production, utility and price, opportunity cost, price mechanism and the relationship between demand, price and quantity; competitive models and demand factors; Keynesian model vs classical models; economies of scale; interpret economic data;
- Macroeconomics, microeconomics and information economics: macroeconomics (introduction to macroeconomics, basic macroeconomic equation system, fiscal policy, macroeconomic policy challenges, theoretical controversies, as an endogenous variables - investment, trade balance, real exchange rate, real interest rate); microeconomics (introduction to markets, consumers and utility, relative prices, demand elasticity and leisure, borrowing, lending, human capital, producers and profit maximization, efficiency, supply and demand, markets clearing, gains from trade, tariffs and quotas, monopoly, public goods, some classic policy issues, money vs barter); information economics (moore's law, moore's law and economic growth, asymptotically free goods, network effects, asymmetric information);
- International trade, exchange rates and balance of payments: international trade (basic trade and mechanisms; international trade theories; product cycle and strategic trade theories; comparative advantage; terms of trade and offer curve; different forms of trade; reasons for international trade; benefits of international trade; commodities in world trade; free trade v/s protected trade, WTO); Exchange rates and balance of payments (how exchange rates are determined; free-floating and regulated markets; relationship between exchange rates and the factors affecting their fluctuations and a country's balance of payments; components of a balance of payments with particular reference to shipping; effect of exchange rate fluctuations on shipping; the modes of payment & receipts in shipping; role of different stake holders; role of different currencies balance of trade and balance of payments);
- Maritime economics : linkage between economy, trade and shipping; organization of shipping market, 4 shipping markets, shipping market cycles (trough, recovery, peak/plateau and collapse), supply, demand and freight rates, costs, revenue and cash-flow, risk, returns and shipping company economics, economics of ship building and scrapping, demand & supply in shipping; economics of manning (factors influencing manning costs, controlling manning costs); fuel economics & bunker management: (different aspects of fuel management viz. technical aspects, operational aspects, purchasing aspects and chartering aspects); economics of scrapping and laying-up of ships (circumstances & decision of ship-owner; options, influencing factors, etc); economics of claims & damage compensation (collision, pollution, accidents, wreck- removal etc.); e-business (e-commerce, importance & limitation in shipping business, financial risk management, investment management, procurement & sales of vessels)
- Shipping costs, revenue and operational economics: Classification of costs; cost structure in shipping; cost evaluation of different charters/voyages; choice of appropriate runs in cost effectiveness for different ships; responsibilities/sharing of cost by ship-owner & charterer; revenue analysis; different types of charter hire, economics of tramp and liner shipping; conferences and conference rate making; economics of time charter & voyage charter; final Accounts; process of preparing final accounts; Statement of facts; concepts of freight surcharge, CAF, BAF etc.

Finance

1. Management Accounting: Basic Accounting concepts, accounting principles; accounting process and procedures, evaluation of assets, liabilities, depreciation, investments, bad debts, accruals, prepayments, capital account, profit & loss statements, trial balance, balance sheet, stock, obsolete stock / scrap, costing, bad debts, preparation of financial statements with special reference to analysis of a balance sheet and measurement of business income, inventory valuation and depreciation, financial statement analysis, fund flow analysis, the statement of cash flows;
2. Cost accounting: records and processes, cost ledger and control accounts, reconciliation and integration between financial and cost accounts; overhead cost and control, job and process costing, budget and budgetary control, performance budgeting, zero-base budgeting, relevant costing and costing for decision-making, standard costing and variance analysis, marginal costing and absorption costing
3. Financial management: Financing of companies; shares; debentures and other methods of raising capital; cost of capital; optimum capital structure; working capital; kinds of working capital; working capital management; time value of money; risk and return; capital budgeting; analysis of risk and uncertainty in capital budgeting; capital structure theories; profitability aspect; liquidity aspect; long term sources of finance (equity, term loans, debentures, bonds, securitisation, hybrid finance instruments, venture capital, lease finance and hire purchase); principles of public offerings and initial public offerings (IPO); valuation of bonds and shares; management of cash, receivables, inventory and current liabilities;
4. Trading finance: Types of Transactions (bills of exchange, letters of credit, bill of sale, etc.); Type of cost (fixed, variable, direct, indirect, etc); principal characteristics of the main international stock exchanges on which shipping equity is traditionally listed, including the New York Stock Exchange, the Oslo Bourse and NASDAQ; implications of the US Sarbanes-Oxley Act 2002 for shipping companies looking to list on US stock exchanges;
5. International finance: institutional structure of international finance; history of exchange rate regimes (classical gold standard system, Bretton woods, post-Bretton woods era; different exchange rate regimes; monetary unions; balance of payment and foreign exchange market; exchange rate theories; exchange rate models with uncertainty; international capital flow and financial crisis;
6. Significance of debt-equity structure for shipping company: the history, purposes, and composition of the main international body concerned with the setting of capital adequacy ratios for banks; the Basel Committee; the effects of the Basel regulations on shipping finance including the significance of the capital adequacy ratio; the basic composition of the Basel capital adequacy ratio in terms of tiers and asset weighting;
7. Financial management for shipping: historical context of ship finance (over the past four decades) and the significance of wider economic phenomena in shipping finance business; methods of financing ship purchase and fleet renewal; historical reasons why it has been difficult to attract external equity financing into the shipping business (volatility of the sector, secretiveness of ship-owners, single ship company, international jurisdictional and enforcing issues of court orders); principal sources of security for ships to lenders; valuation of ships; negotiating working capital loans from banks; mortgage of ships and terms of payment; cash flow forecasting; discounted cash flows for investment appraisal; elements of management accounting; general idea of corporate taxation; foreign currency transactions, advantages & disadvantages of currency & freight hedging, disbursements, daily running costs, bunker costs, etc. freight and hire-calculation & collection etc.;

8. Lender's perspective in ship financing: proper evaluation of asset to be financed, cash flow to be generated; significance of 'name' or 'reputation'; ship mortgages, and their importance as a source of bank security; legal rights of mortgagees in the event of default by borrower; assignment of insurances and earnings as sources of banker's security in a loan agreement; charges or liens over shares; guarantees from parent companies in respect of loans made to subsidiary companies; standard terms in the documentation of a guarantee provided by parent company in respect of loan made to its subsidiary; value of maintenance clauses in ship finance loan agreements; 'banks' and lenders' credit risk analysis of borrowers (6 'C' of credit risk analysis); characteristics and structure of special purpose companies;
9. Debt financing and Bond markets: differences between debt and equity financing (payment of mandatory interest versus payment of discretionary dividends); different forms of bonds and significance of different payment schedules; basic features of convertible bond issues; structure and purposes of convertible bonds; attractions and implications of conversion of convertible bonds from the issuer's (i.e. ship-owner) and investor's perspectives; significance of phases of the shipping cycle for the timing of issuance of convertible bonds; predicting the likelihood or otherwise of an investor to convert from debt into equity; principal consequence of conversion of a convertible; prohibition of reconversion from equity back into debt; functions and characteristics of sinking funds; use of high yield bonds in shipping finance.
10. Securitisation: basic objective of securitisation and the objectives of ship-owners in securitisation; bundling together of homogenous cash flows and their use as collateral for bond issue; basic structure of a securitisation, and the role of all participants; procedural steps in a securitisation;
11. Types of loans used in shipping finance: characteristics of the different types of loans used in shipping finance (plain vanilla loans, moratorium loans, bullet repayment loans, balloon repayment loans, back/front-ended loans, revolving credit facility loans); rationale for syndicating a loan, and the principal responsibilities of all parties to bond syndications; the structure and use of mezzanine finance and its suitability in shipping-finance;
12. Alternative sources of ship finance: principles and characteristics of shipyard credit as a source of finance; principles, structure and purpose of government subsidies; role and importance of export credit agencies in ship finance; the principles, structure and use of leasing-finance and operating; off-balance sheet finance; capital lease structure finance; advantages & disadvantages of Kg (German) Ship Financing and Ks (Norwegian) ship finance; Islamic finance in shipping (basic principles, characteristics of Shariah-compliant financial instruments found in shipping finance, including Mudharabah, Murabaha, Ijara, and Sukuk); new finance products such as baby bonds;

EM103: MARITIME LAW

1. Overview of different types of Constitutions & Legal systems of the world (common law jurisdictions, civil law jurisdictions, etc.)
2. Overview of civil law and commercial law and Civil Procedures Code.
 - 2.1 Law of Contract: Contract Act 1872; General principles/essential features/types of contract, What is Contract, Proposal, Acceptance, Consideration, Privity of contract, Agreement, Capacity to contract, Free consent, Object & consideration, Void agreements, Performance of contract, Remedies for breach of contract, Quasi contracts.
 - 2.1.1 Contract of Indemnity: Characteristics; Rights of Indemnity-holder.
 - 2.1.2 Contract of Guarantee: Essentials of Contract of Guarantee; Distinction between Contract of Indemnity & Guarantee [letters of Indemnity and Letters of Guarantee]; Continuing Guarantee; Invalid Guarantee;
 - 2.1.3 Surety: Right of Surety; Liability of Surety; Discharge of Surety.
 - 2.1.4 Bailment: Definition; Essentials of bailment; Duties of Bailor; Liabilities of Bailee; Rights of Bailee; [e.g. Ports as bailee of cargo etc.]
 - 2.1.5 Pledge: Definition; Essentials of Pledge; Bottomry & Respondentia Bonds.
 - 2.2 Different types of agreements and contracts used in maritime sector
 - 2.2.1 Employment contracts (Articles of Agreement etc)
 - 2.2.2 Commercial contracts (Different charter parties and Indian Carriage of Goods by Sea Act, 1925; Bills of lading and Indian bills of lading Act, 1856; claused bills of lading etc)
 - 2.2.3 Ship managers' agreement (Different types of management contracts (e.g.: technical, crew etc.)
 - 2.3 Law of agency: General principles, types/creation of agency, legal relationship between the parties involved, rights & duties of Agent & Principal; breach of warranty of authority; Termination of Agency; Personal liability of agents.
 - 2.4 Overview of the Banking Law & Negotiable Instruments
 - 2.5 Arbitration and Dispute Resolution; process & procedure involved. Relevance of LMAA, ICA and other bodies.
3. Overview of criminal law (*Actus reus*, *Mens rea*, etc.)
 - 3.1 International criminal law with respect to Piracy, Armed robbery, Criminal trespass, Crimes against humanity etc
 - 3.2 National criminal law with respect to maritime sector from Indian Penal Code and Criminal Procedures Code
4. National Maritime legislations [The Merchant Shipping Act 1958, Admiralty Act, Carriage of goods by sea Act, 1925; Indian Bills of lading Act, 1856; Multimodal transport of goods Act; Inland vessels Act, 1917; Indian Ports Act, 1908; Major ports Act Maritime Labour Laws, etc]
5. International agreements and overview of the Vienna Convention on Law of Treaties.
6. United Nations, its specialized agencies [IMO, ILO, UNCTAD, UNCITRAL, UNDP, WMO, WHO, WTO etc] and other International Associations like IALA, IHO, etc.

7. International conventions [UNCLOS; IMO Conventions; ILO conventions; Rotterdam rules, Brussels conventions including convention on maritime liens, collision liability and arrests, International agreements and measures to prevent the spread of diseases by shipping, International organisation for medical advice & assistance at sea..etc], International Health Rules.
8. Maritime frauds: The modus operandi of maritime frauds in the past. Methods of investigation, detection and prevention of maritime frauds; the role of the international Maritime Bureau.
9. Law of torts

EM201: ADVANCED NAVIGATION AND MARITIME CYBER SECURITY

1. Limitations of various formulae for the following:
Earth as a spheroid-compression, geographical and geocentric latitudes; Meridional part; Earth's orbit (eccentricity and applications, length of seasons); Theory of refraction (dips and distance of sea and shore horizons with and without refraction and related applications); Diurnal parallax and augmentation of moon's semi-diameter; Rates of change of azimuth; altitude and hour angle; Maximum and meridian altitudes; A-B-C tables; Ex- meridian tables; Pole-star tables for determination of latitude & azimuth; The equation of equal altitudes (above and below pole, etc.)
2. Laws of planetary motion : Theory and application to orbital motions, Sidereal and synodic periods and applications, Moon's orbit and nodes. Ecliptic limits.
3. Positional errors in fixes: Errors in terrestrial observations, position line and in fixes, the theory of the cocked hat and the three bearing formula and their applications, Errors in astronomical observations, position line and in fixes, Errors in fixes by vertical and horizontal sextant angles.
4. Stellar magnitudes and distances : Variable stars & binary systems; Annual parallax; Aberration; Mean place of a star.
5. Co- ordinate Universal time and time signals :
6. The theory and general appreciation of projections : Mercator; Transverse Mercator; Gnomonic; Lambert's-conical orthomorphic and Stereographic
7. Special problems in navigation including : High latitude navigation; High speed surface craft; Sub-surface craft.
8. Latest advancement in navigational equipments : (Fibre optic gyroscope, satellite compass, GPS compass, Laser beams, Infra-red techniques, Sub- marine acoustic transponders, Split beam channel guidance systems, Ship identification etc.,)
9. Latest advancement in aids to navigation : (Virtual Aids of Navigation, Berthing aids, etc.,)
10. Special navigation systems : The basic principle and use of (Integrated Navigation System; Dynamic Positioning Systems; The Inertial Navigation Systems.
11. Research and development : An outline knowledge of systems under development such as (Maritime Autonomous surface ships (MASS) etc.); Future challenges.
12. Magnetism : Magnetic compass and magnetism; Properties of magnets; "hard" and "soft" iron, magnetic induction and permeability; magnetic fields; position of equilibrium; Molecular theory of magnetism; Magnetic effects of electrical currents; Errors of magnetic compass; Effects of magnets

on a compass needle under varying conditions; Correcting errors of magnetic compass; Shipboard magnetic compass adjustment.

13. Terrestrial and ship's magnetism : variation, dip, total force, horizontal force, vertical force, local attraction; geographical variation and its effect on deviation; effects of permanent and induced magnetism; Components P, Q and R; the rods a, b, c, d, e, f, g, h and k. Sub-permanent magnetism and its effects at sea;
14. Compass construction and siting : IMO Resolution A382(X); General principles (size and relative position; soft iron correctors; types of correctors used on ships; etc.,) Magnetic screening;
15. Compass adjustment : General principles of compass correction and the methods of finding and compensating for A, B, C, D and E types of deviation; different methods of swinging ship to obtain a deviation table; relation of components P, Q and R and the rods a, b, c, d, e, f, g, h and k to the various coefficients and to heeling error; sextantal and octantal deviations; use of the Kelvin deflector; principle of the deflector method and its limitation; rules to be followed with regard to the placing of correctors; "wiping" and degaussing; construction of a curve of deviations and its practical use in coefficient analysis; constant, semi-circular, and quadrantal deviation; analysis of a ship's deviation book to determine causes of irregular deviations and suggest measures for their removal; analysis of a table of deviations; obtaining and explaining the approximate coefficients A, B, C, D and E; types of transmitting magnetic compass bowls and repeaters.
16. Cyber Security: Definitions, general, security overview, digital security, cyber security awareness, different areas that are top priorities for security organizations, where threats are coming from in current global environment, reality of cyber attacks in our current global environment, National cyber security policy 2013, National Cyber Safety and Security Standards (NCSSS), National Cyber Defence Research Centre (NCDRC); Information Technology Act;
17. Maritime Security on ships : Cyber security and safety management; Malware, viruses and spyware; identification of theft and compromise of classified data; dangers associated with emails (dangerous attachments, hoaxes, etc.); phishing, risks regarding removable media; USB stick dangers; File sharing and copyright issues (international regulations in usage of pirated and pornographic material); dangers related to mobile devices; dangers of unsecured wireless networks; desktop security; risks of social networking; unauthorized system access and characteristics of a strong password;
18. Steps for maritime cyber security : Network security; malware prevention; risk management regime; secure configuration; managing user privileges; employees education and awareness; incident management; monitoring; removable media controls; remote system access risks associated with information; communication; navigation and automation systems on board; Maritime Cyber Security Risk Assessment (identify threats; identify vulnerabilities; assess risk exposure; develop protection and detection measures; establish contingency plans; respond to and recover from cyber security incidents; Identify vulnerabilities : Ship to shore interface; assess risk exposure; risk assessment made by the company; third-party risk assessments; risk assessment process; Develop protection and detection measures (Technical protection measures; procedural protection measures; establish contingency plans (Maritime Cyber Security Incident Response); respond to and recover from cyber security incidents (effective response; recovery plan; investigating cyber incidents; losses arising from a cyber incident); target systems; equipment and technologies; onboard networks;
19. Cyber security in ports : important of cyber security for ports; cyber security standards, guidance and good practice; port cyber security assessment and plan (CSA & CSP); review, monitoring and auditing of CSP;
20. Managing cyber security : Role of the CSO; port cyber-security committee; security operations centre (SOC); provision of information to third parties; handling security breaches and incidents;

21. Case studies and incident response procedures.

EM202: ADVANCED NAVAL ARCHITECTURE

1. Revision on fundamentals of Naval Architecture: ship lines, coefficients of form, hull form characteristics, Bonjean curves, wetted surface, hydrostatic curves, cross curves of stability, inclining experiment, submerged equilibrium, stability when grounded, intact stability of unusual ship forms, subdivision and damage stability, intact stability and their parameters, stability criteria for damaged stability
2. Resistance and propulsion: review of fluid dynamics concepts, frictional resistance, wave making resistance and other components of resistance (viscous and wave resistance; Air resistance; Resistance due to roughness and fouling), ITTC friction formulation and extrapolation procedure, theory of propeller action, law of similitude for propellers, hull-propeller interaction, wake, model self-propulsion tests, blade element and lifting line; propeller characteristics and open water efficiency, screw propeller geometry, propeller thrust and torque, hull efficiency elements, ITTC performance prediction method, cavitation, other propulsion devices (jet propulsion, air propulsion, paddle wheels, vertical axis propellers) , Propeller design using standard series data;
3. Stress and strain: review of basics of stress and strain; simple bending theory, sectional modulus, their application to beams and ships. Stresses in still water and in a seaway. Murray's method; shear force and bending moment curves of ship shapes; stress indicators; understanding deck strength calculations; loading of break bulk cargoes & project cargoes;
4. Ship motion: general concept of waves experienced in a seaway, six degrees of freedom, wave spectral density, rigid body dynamics of vessels and structures, ship response to regular and irregular waves, manoeuvring and control of ship motions, assessing ship's performance in a seaway, cause and methods of reducing each motion of ship; effect of ship motions on the stability and safety of vessel; capsizing of ship due to beam seas, following and quartering seas;
5. Ship designs : preliminary design methods, weight and cost estimate, general principles of powering, power requirement estimation, Powering performance calculations; Ship trials and trial data analysis; selection of principal design characteristics, general understanding of the design features contribution to the safety of the various types of ships including passenger car ferries, tankers, bulk carriers, OBOs, chemical tankers, LNG/LPG carriers, container ships, dredgers, hydrofoils, hovercraft, submersibles, nuclear ships etc.
6. Manoeuvring trials: The measured mile. Evaluation of steering characteristics and application to the design of hull & rudder, Angle of heel when turning, shallow water effect, interaction; manoeuvring, directional stability and control, manoeuvring devices, rudder area, forces and torques, ship handling, general predictions of manoeuvrability, modifying ship's manoeuvring performance;
7. Stability: stability of submerged vessels and semi-submerged vessels; longitudinal stability to a greater depth than done for Master; change in draft due to change in density; self righting life-boats; understanding the aspect of stability while Ro-Ro and Lo-Lo operation for heavy project cargo; comprehensive knowledge of the use of stability and stress data supplied to

various types of ships including container vessels (LNG/LPG carriers, fishing vessels, dredgers, offshore support vessels, MODUsetc.)

8. Stability at large of heel: concept of righting moments and excitation moments; limitations of the wall-sided Formula and Attwood's Formula; limitations of GM as the stability criterion; cross curves of stability – Isocline curves – GZ curves and their significance;
9. Dynamic stability: dynamical stability and method of determination; residual dynamical stability and its use in determining the ability of a ship to survive dangerous situation such as wind and wave effects, passenger crowding, etc.; effect of trim, wind, gusts and turning on dynamical stability.
10. Damaged stability: flooding of ships and its effect on static & dynamical stability, resulting heel and trim; application to box-shaped and ship-shaped vessels; damage stability data;
11. Dry-docking: problems concerning block pressures, tripping of blocks, loaded ships, damaged ships, grounding etc.; problems of launching from a slipway; launching ways, poppets stopping a ship launching; launching diagram.
12. Ship vibration: general knowledge of structural vibration in a ship; prevention and reduction of vibration;
13. Application of various integration formulae & methods used in ship calculations; Approximate formula to obtain KB of ship-shapes; fluid thrust on plane and curved surfaces; centre of pressure;

EM203:COMMERCIAL ENGINEERING, ROBOTICS AND ALTERNATE ENERGY

1. Basic features and operation:
 - 1.1 Boilers: basic principles and major components; feed-water and circulation; generating tubes; drums and headers; Super-heaters; furnaces; Casings and support; Safeties; Boiler operations: Preparation and lighting off; Raising steam and cutting in on the line; Routine operation; Emergency procedures; Securing; Boiler accessories: Internal fittings and mountings; External fittings and mountings; Burners; Instrumentation and automation;
 - 1.2 Diesel plant:Preparation and starting of diesel engines; Manoeuvring; Running in after an overhaul; Routine operation; Emergency operation; Maintenance; Safeties: Trip , slow-down and Alarms;
2. Pumps:Fundamentals; Fundamentals of fluid flow; Types of pumps; Centrifugal pumps; Reciprocating pumps; Rotary pumps; Jet pumps; Blowers and fans; Compressors; Pump operation; starting procedure (centrifugal pump; positive-displacement pump);
3. Electrical systems:Fundamentals of electricity; Electrical power; Alternators and generators; Electric motors; electrical components and instruments; Shipboard electrical systems including synchronising and power sharing of alternators; electric propulsion; different frequency of electrical power used on ships (50 Hz, 60 Hz etc); problems in sourcing spares for vessels operating on different frequencies including spares for lighting, air conditioning etc;
4. Shafting systems and Propeller: Propeller shafts and stem-tube shafts; Line-shaft bearings; Stem tubes; Strut bearings, Propellers (fixed-pitch and controllable-pitch); Withdrawal of propeller and stem-tube shafts;
5. Heating, Ventilation, and Air-Conditioning:Fundamentals of air conditioning; Categories of air-conditioning systems; Direct vs. indirect expansion; Compressors, chillers, and condensersSystem Componentsofrefrigeration(compressor, evaporator, condenser, expansion devices, Refrigerants);Operation of refrigeration systems;
6. Auxiliaries (Principle, operation, maintenance and checks: Fresh water Generator; Purifier; Oily water separator and oil discharge and monitoring systems; Incinerator; Sewage Treatment Plant; CO₂ system; Fixed-Foam System; Hyper Mist System; I G System; I G Generator; Deck machinery and cranes; Hydraulic systems; Steering gear; Windlasses, winches, and capstansPipe and tubing; Valves; Basic valve maintenance; Vent and sounding tubes;
7. Budgeting: preparing budget estimates for the annual operation of different types of vessels (passenger, bulk carrier, tanker, LPG, LNG, High speed crafts etc.); preparing estimates for routine repairs of vessel as well as dry-docking of different types of vessels;
8. Procurement of spares: different makes of main engines, auxiliary engines, boilers, pumps, refrigeration systems, air-condition systems, deck machinery etc. currently in use; items that generally require replacement; process for sourcing spares for these items and the expected lead time;
9. Energy efficiency: Energy Efficiency Operational Indicator (EEOI) and hoe it works to improve energy efficiency; Energy Efficiency Design Index (EEDI); IMO fuel consumption data collection system for ships; relevance of ship design in improving energy efficiency; importance of good hull design including bow shape and coating of hull; how propeller design can affect energy management; various propulsion techniques and energy management devices used in improving efficiency; Energy saving devices; waste heat recovery; different alternative energy methods of propulsion, e.g. wind and solar power; Innovative technologies and future ship concepts:new battery technologies are being used in shipping;Dual fuel engines; different types of exhaust cleaning systems and how they work; Abatement technologies (Sulphur Oxide (SO_x) Scrubbers; Nitrogen Oxide (NO_x) selective catalytic reduction (SCR); Engine EGR;

10. Maritime robotics including artificial intelligence: introduction to different types and applications of Maritime Robotic Systems including AUVs, ASVs, ROVs, underwater gliders and Argo floats; Navigation strategies and sensors for maritime robotic systems including SLAM; Path planning algorithms and line of sight guidance strategies
11. Emerging technology: Introduction to block chain, cloud computing, internet of things, costing for installation of new systems like (sulphur reduction, ballast water etc)

1. International Conventions: United Nations Convention on Human Environment, 1972; United Nations Environment Programme (UNEP); Convention on the Prevention of Marine Pollution by dumping of wastes or other matter, 1972 (London dumping Convention); United Nations Convention on Law of Seas, 1982 (UNCLOS); MARPOL; Basel Convention on the control of Transboundary Movement of Hazardous Wastes and their Disposal, 1989 (Basel Convention); United Nations Convention on Environment and Development, 1992 (Earth Summit); Agenda 21; United Nations Convention on Biological Diversity, 1992; United Nations Framework Convention on Climate Change, 1992 (UNFCCC); UNFCCC, Kyoto protocol, 1997; 2002 & 2012 Earth Summit on Sustainable Development (Rio +10 and Rio +20); Commission on Sustainable development; Global Environment Facility (GEF); UNFCCC, Paris 2015; Regional Seas Programme; intergovernmental conference on biological diversity areas beyond national jurisdictions;
2. Meteorology: Meteorological Observing Systems (conventional and recent systems) [Synoptic weather observations, Synoptic representation of pressure field, contour and thickness charts, stream line and isotach analysis, stability analysis, techniques of weather forecasting including elementary ideas numerical weather prediction]; Wind effects [Divergence, convergence, diffluence, confluence, vorticity, Coriolis and centrifugal effects balance motion, geostrophic and gradient wind, cyclostrophic wind, elementary ideas of general circulation and jet streams]; cyclonic storms: (formation, intensification, movement and weakening); methods of cyclone forecasting; cyclone warning bulletins of merchant ships; el-nino; la-nina;
3. Satellite Meteorology: Historical development, Indian programme, remote sensing techniques, visual and infra-red Channels, synoptic cloud patterns and their interpretation, application of satellite data for tropical storm analysis, quantitative estimation of sea surface temperature and vertical profiles of temperature and humidity from satellite pictures.
4. Geology and Oceanography: The Earth-its status & age; Active geological processes (volcanoes, earthquakes, erosion, glaciations); Genesis of rocks, types of rocks, distribution of rocks in the continents and oceans; Plate tectonic model- critical assessment of various views; Bathymetric studies in understanding the oceans- PDR, SOPAR, Mohole project, and Preparation of submarine atlas; Oceanic features (continental shelf-floor slope ridges, oceanic sedimentation, and understanding of modern terminology); General characteristics of the seas, bottom topography, coastline and beaches; Physical properties of seawater, light penetration and colour of the sea; heat budget of the oceans, distribution of salinity, temperature and density, water masses; Causes of ocean currents, surface & sub-surface circulation; Ice formation and decay, distribution and movement of ice;
5. Marine Resources :
 - a. Fishing: Types of fish, geographical location of fishing grounds, conservation of resources; Modern demersal and pelagic fishing methods; Factory vessels; Marine fish farming.
 - b. Minerals: Methods of extracting minerals from sea water; Desalination processes; Sand and gravel dredging; Extraction of minerals from the seabed, Sub-sea mining; seismic and sonar profiling; Seabed sampling;
 - c. Oil and Gas: Types of drilling rigs, drill ships, well head production platforms; storage facilities; Types of sea terminals; General ideas on drilling; Pipe laying and the use of submersibles;
 - d. Power: general ideas on harnessing energy from the sea; Tidal power stations.

6. Ocean Governance: ocean governance includes the processes, agreements, rules, institutions, etc. developed to organise the way in which humans use the ocean and its resources. ocean governance relates to the High Seas and international seabed “Area” which support vital biological resources; known also as ‘Areas Beyond National Jurisdiction’ (ABNJ); because they are beyond the remit of any single government to protect, they are subject to overexploitation, pollution and habitat degradation, which together are undermining vital Earth support systems; conservation and management of resources in ABNJ; UN agreement on conservation and management of Straddling Fish Stocks and Highly Migratory Fish Stocks; FAO Code of Conduct for Responsible Fisheries; intergovernmental conference on biological diversity areas beyond national jurisdictions; international seabed authority; commission on the limits of the continental shelf; sustainable development;
7. Hydrographical Surveying: Basic techniques of surveying; Control; Position fixing including use of short-range high accuracy radio systems; Theory of preparation of navigation charts;
8. The Earth’s tides:
 - a. Tidal theory : General knowledge of tides (Tide raising forces, The equilibrium tide, Modern tidal theory);
 - b. Classifications of tides. Principal harmonic components Method of analysis and prediction
 - c. Determination of mean Sea Level.
 - d. Establishment of datums. Methods of transfer of datums along coasts.
 - e. The use of co-tidal charts.
 - f. Tidal streams and currents and their measurement
9. Seismic & Meteorological surveys, seiches, bores and related phenomena. Seasonal and long term changes in Mean sea Level.
10. Satellite remote sensing: Basic theory and its application to be marine environment.

EM302: PORT MANAGEMENT

1. Introduction to ports: the geographic reasons for port location and the extent to which this may depend on the nature of hinterland and natural resources; different types of ports and access to ports (natural, man-made, river, estuary); different functions of ports (hub ports, feeder/transshipment ports, intermodal interfaces); different forms of the ownership structure of ports and of port services (public/private, landlord only, full or part service provider, terminal facilities within ports); governing structure and conservancy of ports; location of major world ports in liner, dry bulk and liquid trades; main places of origin and trade routes of important cargoes & seasonal variations; effect of globalisation on port choice; how changes in logistics and distribution patterns influence the development or decline of ports; the use of free port/free trade zones as an economic tool;
2. Port planning: Economics of Port Location (Factors to be considered for selecting location of a port; Facilities of a port; Formulation of a port pricing; Organization of a port); port development policy including the role of government, regional needs and competition; planning principles and project planning; principles behind port layout, physical constraints, terminal planning, specialised terminals, multipurpose terminals and support operations; requirements of break-bulk, neo-bulk, special cargoes, dry bulk and liquid bulk commodities; flow analysis of cargo in a terminal and environmental factors and constraints; role of traffic forecasts; analysis of demand factors; implications for marketing; involvement of users; port capacity; Basic Knowledge of Navigation Channel Designing (PIANC Guidelines, Canadian Guidelines etc.); Regulation related to designing of Break Water etc.; Dredging Requirement; Different types of Dredgers (Trailer Suction, Cutter Suction, Water injection, Rock Dredger etc); importance of safety management; importance of security to prevent terrorism, illegal immigration, theft and smuggling; advantages of mechanization and automation of ports; different types of port equipments (Top Side Equipments (Equipments for loading /unloading of Cargo) such as Gantry Cranes, Mobile Harbour Cranes, Loading Arms (for Liquid Cargo); Storage Equipments Conveyor System, Stacker Reclaimer, RTGS, RMC, Wagon Tripper; Forklifts, Pyloaders, Excavators, etc.; Harbour Crafts: Requirement of Tugs (Bollard Pull Requirement for Vessel Size), Pilot Launch, Mooring Boats); Cargo Evacuation (Road & Rail); financing of port development.
3. Port regulatory environment: nature of port constitutions and legal framework; Indian Ports Act 1908; major Port trusts Act, 19__; Dock labour Board regulations; State Maritime Boards; explosive Act and Rules; Petroleum Act and Rules; Knowledge of IMSBC; OISD, ISGOTT; PIANC; Guidelines for port infrastructure; requirement for handling hydrocarbons (Liquid and Gas); Knowledge of Environment & Coastal Regulatory Zone (CRZ) Regulations 2011 for Port & Harbour; Regulations Related to handling Hydrocarbons, explosives and IMDG cargo in ports; Regulations related to Port Limit and Port Conservancy; quality management systems (ISO 9001, 14001, 18001, Integrated Management System); ISPS (Regulations related to Port Security Assessment & Security Plan); Navigational Safety in Ports Committee (NSPC); Rules for Navigation Channel Marking and Lighting; Rules for Port Charts and Bathymetric Surveys; Regulations Related to Oil Spill Contingency Plan (OSCP) for the Port; Various plans for Port Management such as Waste Management, Disaster Management Plan;; Basic Knowledge of Customs Act 1961; Regulations Related to Customs Cargo Service Provider (CCSP); Rules related to Customs Notified Area and Warehousing rules; role of trade unions and other labour organisations including ITF; role of statutory bodies (customs, immigration, port health, marine safety etc.); laws and regulations relating to the employment of dockworkers:
4. Managing port operations and conservancy: Insurance for Ports; basic rationale of port business; ports structure, delivery of services and the relationship between infrastructure, conservancy, navigation

and handling facilities; typical port organisational structure; Port Performance Parameters (Pre-berthing delay, Berth Occupancy, Vessel Turn-around time, Throughput per day per berth); UNCTAD Guidelines for Berth Occupancy and justification for increase in berth length in a port; calculations and the relationship between berth occupancy, service time and waiting time, and also berth throughput; nature of marine operations (conservancy, dredging, navigation aids, navigation control etc.) management of cargo operations ashore; importance of avoiding traffic and cargo congestion; requirement for regular interaction with port users (ship-owners and operators, ship agents, forwarders, truckers, rail and barge operations); information flow requirements of the port, statutory bodies and port users; port community systems; port performance indicators (PPI) and key performance indicators (KPI); berth planning; cargo planning (storage & evacuation); quay transfer operations; storage, receipt and delivery operations; use of KPI for future planning in ports and terminals; proper container terminal capacity (PCTC); automated container terminals;

5. Port Competition, Marketing and Business Development: nature of port competition (national and international); need for market information (trade growth, hinterland Traffic, vessel development, commercial needs and financial viability); relevance of geographic location with reference to transit time and port rotation; role of ship-owners/ship-operators, shippers/receivers, freight contractors, forwarders and other transport interests (for example, railways, road hauliers) in competitiveness of port; various techniques of port promotion and how they assist with identification of potential users; impact of inland transportation and inland depot/handling facilities; scope for collaboration on through transport;
6. Port Pricing: the nature and types of port charges including those incorporating statutory navigational services, services to vessels, services to cargoes; difference between Vessel Related Charges (e.g. Port Dues, Berth hire, VTMS , Pilotage, Towage, ILH dues etc.) and Cargo Related Charges (e.g. Terminal Handling Charges (THC), Wharfage Charges, Storage Charges etc.) cost factors in pricing (e.g. infrastructure, navigation services, equipment, staff & labour, marketing, security and safety, environmental services); pricing policy ('not for profit', government influenced, fully commercial); effects of competition on pricing policy and how pricing is used as a tool to influence demand; various factors used in establishing pricing structures (e.g. lengths of time included in base charge for vessels and cargo); units on which charges are based; simplicity of application and transparency; volume rebates; various regulatory mechanisms including user appeals against charges; integration of port charges with charges of other port operators and inland transport organisations and through transport charges.
7. Port Finance: importance of financial management in port operating (budgets, capital and revenue expenditures and investment appraisal); importance of financial and commercial objectives including the analysis and monitoring of costs and port cost accounting; corporate analysis of financial data and for budgetary planning and control; project evaluation, review techniques and capital budgeting; financial and economic appraisal of port investment proposals and traffic forecasting; joint venture opportunities for financing or management and policies for both common and sole user terminals.
8. Port Ownership: different types of ownership including national- or local government-owned and managed, public sector-owned ports and port trusts and the trend towards deregulation of ports; transfer of party from state to private ownership; methods of privatisation, sale of shares, management and employee buyouts; private sector-owned ports; different types of ownership (outright, public sector ownership of port infrastructure combined with private sector provision, public ownership of port superstructure with private management and/or operation and the associated issues of lease contracts and joint ventures); development, ownership and control of free ports and free zones;

9. Port Agency: Role of a Port Agency , Customs House Agent (CHA)

10. Port labour, health, safety , security and the environment

EM303: COMMERCIAL SHIPPING MANAGEMENT

1. Commercial shipping: international chartering market (London, New York, Hong Kong; Tokyo, Singapore); The Baltic Exchange; ship-broker; brokers responsibility to the principal; remedies for broker in case of breach; procedure of negotiation; cargo circulars; indications & firm offers; financial elements of charter parties (freight – per ton , or lump sum); hire calculations; dry cargo chartering; Tanker chartering; Differences and similarities between dry cargo and tanker chartering; charter party disputes; laytime calculations; deductions from freight; excepted periods; time charter (off-hire periods; final voyage; payment of hire; bunkers; performance clauses); frustration of charter party; calculation of demurrage; voyage estimate and calculations; container operations; passenger operations; bills of lading; post-fixture actions;
2. Sale and purchase of ships: shipbuilding contracts; functions of sale and purchase broker; prior-purchase inspection; interpretation of ship's classification records; valuation (duties of valuer); memorandum of agreement; vendor's and buyer's responsibilities; bill of sale; insurance; transfer of flag & ownership and documents required;
3. Port Agency: relationship between port agent and their principals, method of appointment (directly by ship-owner, by ship-owner as per nomination of charterer, by time charterer); scope of port agents work; disbursement account;
4. Liner agency: additional duties over and above those of a port agent; relationship with exporters, shippers, receivers, forwarders, NVOCs etc;
5. Shipping management: Overview of modern shipping management; ship management structures, measurement of strategic performance; identifying strategic challenges; analyse application of risk management methods including shipping derivatives in business practice;
6. Marine insurance: History and evolution of marine insurance; principles of marine insurance; fixed premium; concept of mutuality; P&I associations (difference between protection and indemnity); marine insurance companies and its organisational structure; Protection & Indemnity associations (P&I Clubs) and their organizational structure, (constitution of modern P&I Clubs; Committee's/Board's responsibilities; Management of the Club; Rating of Risks & Fixing of Calls; Premium rating system; Advance & Supplementary calls; Release calls; risks insured under P&I cover; limitation to Club's cover); Lloyds market and its organizational structure; role and function of an insurance broker; different types of risk covered (Hull & Machinery, Freight & Hire, Cargo Liability, Employee Liability; War Risk; Diversion liability; stowaways/refugees/quarantine; Third party liabilities (collision, damage to other property, death and personal injury, pollution liability); liabilities arising out of international Conventions like CLC, Bunker, Wreck removal and MLC; Risks and cover available for professionals service providers [surveyors, brokers; contractual carriers / freight forwarders]; International Underwriting Association; Marine Insurance Act, 1963; Basis of Underwriting/rating; Important Institute clauses (Hull, Time, Voyage, Cargo, War, Strike, Inland transit); Excluded perils (3/4th collision liability); Duty to act as prudent un-insured; pay to be paid clause; marine re-insurance
7. Types of policies: Types of policies – Specific policy, Open policy, Open cover & Cover note; Advantages of an open cover; Certificate of insurance; Annual policies; Duty Insurances; Increased value insurance; Sellers contingency policy; Annual sales turnover policy only; Multimodal transport policy;
8. Cargo Insurance – Basis of Rating : Underwriting factors; Information essential for proper assessment of the risk; Factors considered in acceptance & rating of the risk; Payment of premium; Exchange

control regulations regarding payment of premiums on cargo policies covering exports & imports called GIM (General Insurance Memorandum).

9. Cargo Insurance Claims : Types of Losses/Expenses; ATL, CTL, PA, GA Loss, Salvage and Sue & Labour expenses; Forwarding charges, Extra charges; Cargo claims — Procedure; Legal Aspects of recovery against the carrier.
10. Indian Insurance: Government of India Scheme of War Risk Insurance of Main Hull; War risk insurance (Applicability, Features, Scope of cover; Detainment); War Risk Trading Warranty under war risk insurance scheme; Current exclusions; Indian Insurance and re-insurance companies;
11. Average adjustment: York Antwerp Rules and average adjustments including its practical application and methodology of adjustments
12. Cabotage: Concept of cabotage, principle of cabotage in other modes of transport; the Jones Act and Navigation acts; Cabotage in other countries and in India;
13. Risk Management: Introduction (historical context); concept (Definitions of risk, safety and hazard), process & practice; Types of Risks; Risk identification; Risk Evaluation, Risk Control; Risk Handling; Formal Safety assessment; Risk Matrix.
14. Risk assessment fundamentals: Basic definitions and concepts; Risk identification – hazard evaluation - underlying causes – consequences of potential incidents – risk estimation – frequency of incidents – examples, case studies – risk evaluation – risk acceptance criteria – the “ALARP” principle
15. Risk control options (RCO's): Probability reducing RCO's; Land-based safety systems – passive systems (fairways, lights, TSS) – active systems (pilotage, VTS) – on-board safety systems – alert systems – observation systems – communication equipment – measures to influence subjective behaviour – legal sources – IMO instruments (conventions, ISM, ISPS) – national legislation – training
16. Consequence limiting RCO's: Technical (naval architectural) systems – passive systems (structural fire protection, cargo securing) – active systems (redundancy, separation etc.) – organizational measures (fire fighting, evacuation etc.) – administrative measures (SAR, salvage, places of refuge)

PRO-FORMA OF TRAINING RECORD BOOK (TRB) FOR NCV CADETS

Training record book for NCV Deck cadets

Note: Training record book for deck cadets approved by Directorate General of Shipping is available as a separate publication.

4-MONTH COMPETENCY COURSE FOR NWKO-NCV EXAM**NWKO (NCV) - SUMMARY OF EXAMINATION (FUNCTION - WISE) (REFERENCE: TABLE A- II/1)****FUNCTION: NAVIGATION AT OPERATIONAL LEVEL**

PAPER NO.	SUBJECT	COMPETENCIES COVERED	MODE OF EXAMINATION	DURATION OF EXAM	MAXIMUM MARKS	PASS MARKS
1	Terrestrial and Coastal navigation	1.1	Written	2 Hours	150	105
2	Practical Navigation	1.2	Written	3 Hours	150	105
3	Meteorology	1.4	Written	2 Hours	100	50
4	Bridge watchkeeping and Emergencies	1.3,2,5,6,9	Written	3 Hours	200	100
5	Radar Observer and ARPA Simulator Course	3	Modular	2+1 Weeks Course		
6	ECDIS Course*	4	Modular	1 Week Course		
7	Communications** and Signals	7,8	Visual Signaling	1 Hour	100	70
8	Orals for navigation function	1-9	Oral		100	70

(*) Training and assessment in the use of ECDIS is not required for those who serve exclusively on ships not fitted with ECDIS. This limitation shall be reflected in the endorsement issued to the seafarer concerned.

(**) No Lectures or exercises required since proficiency in English Language is established at the entry level itself, and SMCP is part of pre-sea training and on-board training (Competence no.7).

FUNCTION: CARGO HANDLING & STOWAGE AT OPERATIONAL LEVEL

PAPER NO.	SUBJECT	COMPETENCIES COVERED	MODE OF EXAMINATION	DURATION OF EXAM	MAXIMUM MARKS	PASS MARKS
1	Cargo Handling and Stowage	10,11	Written	3 Hours	200	120

2	Orals for Cargo function	10,11	Oral		100	60

FUNCTION: CONTROLLING THE OPERATION OF THE SHIP & CARE FOR PERSONS ON BOARD AT THE OPERATIONAL LEVEL

PAPER NO.	SUBJECT	COMPETENCIES COVERED	MODE OF EXAMINATION	DURATION OF EXAM	MAXIMUM MARKS	PASS MARKS
1	Ship construction, stability, ship safety, team work and environmental protection	12, 13,17,18	Written	3 Hours	200	120
2	Advanced Fire Fighting (AFF) Course	14	Modular	5 days Course		
3	Proficiency in Survival Craft and Rescue Boat (PSC-RB) Course	15	Modular	5 days Course		
4	Medical First Aid	16	Modular	4 days Course		
5	Personal Survival Techniques (PST), Fire Prevention and Firefighting (FPFF), Elementary First Aid (EFA), Personal Safety and Social Responsibility (PSSR) Courses.	19	Modular	As per respective IMO Model Courses		
6	Orals for ship operation function	12-19	Oral		100	60

SUMMARY OF COURSES, TRAINING PROGRAMMES, EXAMINATION & ASSESSMENT

Regulation: II/1 of STCW 2010 & Section: A-II/1 of STCW Code

Department: Nautical

Level: Operational Level

Capacity: Officer in charge of Navigational Watch (NCV)

Duration of the Post Sea Training Course is 4 months excluding those competencies against which reference for IMO Model course has been indicated. These competencies are covered in separate additional Modular Courses.

FUNCTION I: Navigation at Operational Level

No.	Competence	Pre-Sea Training	On-board Training	PostSea Training				Type of Assessment
				Lectures	Exercise	Practical's	Simulator	
1.	Plan & conduct a passage and determine position	Yes	Yes	115 hours	101 hours	3 hours		Internal assessment and written & Oral examination
2.	Maintain a safe navigational watch including BRM	Yes	Yes	40 hours				Internal assessment and written & Oral examination
3.	Use of radar and ARPA to maintain safety of navigation	Yes	Yes					Based on IMO Model Course 1.07 & 1.08
4.	Use of ECDIS and maintain the safety of Navigation*	No	Yes					Based on IMO Model Course No. 1.27 as revised
5.	Respond to emergencies	Yes	Yes	17 hours				Internal assessment and written & Oral examination
6.	Respond to a distress signal at sea	Yes	Yes	10 hours				Internal assessment and written & Oral examination
7.	Use of Standard marine navigational vocabulary as replaced by the IMO standard marine communication phrases (SMCP) & use English in written and oral form.	Yes	Yes					No Lectures or exercises required since proficiency in English Language is established at the entry level itself, and SMCP is part of pre-sea training and on-board training.
8.	Transmit & receive information by visual signaling and other means (Single Letter only and SOS, XXX, TTT)	Yes	Yes	25 hours		52 hours		Visual signaling examination
9	Maneuver the ship	Yes	Yes	8 hours				Internal assessment and written & Oral examination

No.	Competence	Pre-Sea Training	On-board Training	PostSea Training				Type of Assessment
				Lectures	Exercise	Practical's	Simulator	
	TOTAL HOURS			215	101	55		

(*) Training and assessment in the use of ECDIS is not required for those who serve exclusively on ships not fitted with ECDIS. This limitation shall be reflected in the endorsement issued to the seafarer concerned.

FUNCTION II: Cargo Handling and Stowage at Operational Level

No.	Competence	Pre-Sea Training	On-board Training	PostSea Training				Type of Assessment
				Lectures	Exercise	Practical's	Simulator	
10.	Monitor the loading, stowage, securing and unloading of cargoes and their care during the voyage	Yes	Yes	40 hours	2 hours	-	-	Internal assessment and written & Oral examination
11.	Inspect and report defects and damage to cargo spaces, hatch covers and ballast tanks	No	Yes	5 hours	-	-	-	Internal assessment and written & Oral examination
	Total Hours			45	2			

FUNCTION III: Controlling the Operation of Ship and Care for Persons on Board at Operational Level

12.	Ensure compliance with pollution prevention requirements	Yes	Yes	12 hours				Internal assessment and written & Oral examination
13.	Maintain sea worthiness of the ship	Yes	Yes	40 hours	22 hours			Internal assessment and written & Oral examination
14.	Prevent, control and fight fires on board	Yes	Yes					As per STCW Code Table A-VI/3 and relevant IMO Model course.
15.	Operate lifesaving appliances	Yes	Yes					As per STCW Code Table A-VI/2 and relevant IMO Model course.
16.	Apply medical first aid on board ship	Yes	Yes					As per STCW Code Table A-VI/4-1 and relevant IMO Model course.
17.	Monitor compliance with legislative requirements	Yes	Yes	21 hours				Internal assessment and written & Oral examination
18.	Application of Leadership and Team working Skills	Yes	Yes	4 hours				Internal assessment and written & Oral examination
19.	Contribute to the safety	Yes	Yes					As per STCW Code Table A-VI/1-1,

	of personnel and ship							A-VI/1-2, A-VI/1-3, A-VI/1-4 and relevant IMO Model courses.
	TOTAL HRS			77	22			
	GRAND TOTAL			337	125	55		
				517 Hours				

- Notes:**
1. Total Teaching hours for above mentioned course is 517 hours = 17.3 weeks.
 2. 1.4 weeks for Assessments (internal and final assessment).
 3. 1 week to account for Public holidays.
 4. Grand Total: 20 weeks = 5 months.

Reference Table A-II/1 (NCV)

Standard of Competence for officer in charge of Navigational Watch on ships operating on near coastal voyages

Function – Navigation at Operation level

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
Competence No. 1: Plan and conduct a passage and determine position 1.1 Terrestrial and Coastal Navigation 1.1.1 Shape of earth, earth axis, poles, equator, meridians, latitude, parallels of latitude, prime meridian, longitude, difference of latitude and difference of longitude, nautical mile, cable and knot. 1.1.2 Charts: Natural scale, chart catalogue, plan charts, Mercator charts. Procedures for correction of charts and publications including T&P notices, using information from Notices to Mariners and corrections using tracings. Chart folio and Chart correction log (NP 131). 1.1.3 Directions by gyrocompass, magnetic compass. 1.1.4 Compass corrections: Deviation, Variation, and compass error. 1.1.5 Distances: Measurement of distance between two positions on a Mercator chart. 1.1.6 Position lines and positions: Definition of a position, finding the position by range and bearings. 1.1.7 Plane Sailings: Departure, D'lat and distance relationship, true course, rhumb line, parallel sailing formula, distance between two positions, use of traverse table. 1.1.8 Chartwork exercises: Allowing and counteracting	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate .4 approved laboratory equipment's training Using: chart catalogues, charts, nautical publications, radio navigational warnings, sextant, azimuth mirror, electronic navigation equipment, echo-sounding equipment, compass	The information obtained from nautical charts and publications is relevant, interpreted correctly and properly applied. All potential navigational hazards are accurately identified Calculations and measurements of navigational information are accurate The charts selected are the largest scale suitable for the area of navigation and charts and publications are corrected in accordance with the latest information available.

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
current and leeway, tidal stream, running fix, (transfer of position lines / circles) , horizontal and vertical sextant angles, finding out actual set and rate of current, 1.1.9 Information from nautical charts, lists of lights and other publications: Publication 5011, Tide tables, IALA system of buoyage, rising/dipping, first/last sighting distances, raising / dipping, first / last sighting distances, passage planning. Use of Indian charts and nautical publications. 1.1.10 Tides: Range, duration of tide, height of tide, spring and neap tides, standard and secondary port, tide calculations, heights for intermediate times & visa-versa. 1.1.11 Keeping a log: Procedures for keeping log during ocean passages, coastal navigation and at anchor. 1.1.12 Passage Planning Plan a passage between two ports from berth to berth using the procedures for passage planning. → Appraisal – ascertain the charts and publication required for the voyage and whether they are corrected and up-to-date, Extract all relevant information from the publications and obtain weather prognosis. → Planning – Plot courses on the charts, both small and large scale, way points, no-go areas, contingency anchorages, alerts, abort points and other relevant marks. Prepare a Passage Plan document. → Execution – During the voyage, fix positions as indicated on the passage plan, maintain sufficient bridge manning levels, obtain Navigational and weather warnings, maintain lookout and navigate to keep clear of other vessels and navigational hazards. → Monitoring – Monitor frequently the traffic, position, weather, visibility and maintain a situational awareness at all times. Check the proper functioning of navigational instruments and fill up logs periodically during watch.		

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
1.2 Celestial Navigation 1.2.1 Solar system: Celestial sphere, celestial pole, celestial meridians, equinoctial, declination of bodies. Nautical almanac. 1.2.2 Hour angle: GHA, LHA, SHA, 'v' & 'd' correction. 1.2.4 Daily motion and horizontal system of co-ordinates: Rational horizon, zenith, nadir, vertical circle, elevated pole, depressed pole, true altitude, azimuth, true zenith distance, PZX triangle, circumpolar bodies. 1.2.5 Sextant and altitude corrections: Errors of sextant. Reading a sextant, index error, visible, sensible and rational horizons, observed altitude, dip, apparent altitude, refraction, semi-diameter and parallax, 1.2.6 Amplitude: Theoretical and visible sunrise and sun set, calculation of true amplitude. 1.2.7 Time and equation of time: Relationship between LHA (sun) and LAT, mean solar day, equation of time, GMT, LMT and longitude relationship, zone and standard times, 1.2.8 Nautical Almanac: Information in Nautical Almanac and using it for celestial observations. 1.2.9 Latitude by meridian altitude: Calculation of latitude by meridian altitude. 1.2.10 Pole Star observations: Identification of Polaris, a_0, a_1, a_2 corrections and calculation of azimuth and position line & a position through which it passes. 1.2.11 Position fixing: Ex-Meridian of sun. Long by chron and intercept methods of sight calculation, true azimuth of a body, position finding by simultaneous & staggered observations. 1.2.12 Errors of compasses — Azimuths: Calculation of magnetic compass and gyro compass errors by observing heavenly bodies, (including the use of ABC tables).		

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
1.3 Electronic Systems of Position Fixing 1.3.1 Terrestrial Navigation systems : principle, block diagram, working, and errors of new terrestrial electronic position fixing systems, e.g. E-Loran (when functional) 1.3.2 Global Positioning System (GPS): Basic principle and errors of GPS system and DGPS. 1.3.3 Electronic Chart Display and Information System (ECDIS) : ECDIS, comparison of ECDIS and paper charts. Difference between Raster and Vector charts, and between ECS and ECDIS. 1.3.4 Automatic Identification System (AIS) - Purpose of AIS - information exchanged and types of messages - Information displayed on AIS screen - Limitations of AIS and - precautions during use of AIS for collision avoidance. 1.3.5 VDR (Voyage Data Recorder)- Concept and purpose of VDR - Details of data recorded on VDR and the duration of data stored; modules of VDR, - Playback options S-VDR (Simplified VDR); Requirement of float-free arrangement. Echo-sounders and Speed Measurement 1.3.7 Echo sounders: Basic principle, block diagram, operation and errors of echo sounder. 1.3.8 Speed log: Basic principle of Electromagnetic log, Doppler speed logs, and their limitations. Janus configuration. Compass — Magnetic and gyro 1.3.9 The magnetism of the earth. Magnetic poles and variation. 1.3.10 The magnetic compass: Liquid and dry card magnetic compass, lubber line and ship's deviation. 1.3.11 The gyro-compass: Free gyroscope, gyroscopic inertia and precession, basic knowledge of the errors of gyro and application of course, latitude and speed errors, calculation of gyro error.	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate Assessment of evidence obtained from approved training course on ECDIS.	The primary method of fixing the ship's position is the most appropriate to the prevailing circumstances and conditions. The reliability of the information obtained from the primary methods of position fixing is checked at appropriate intervals. The position is determined within the limits of acceptable instrument /system errors. Performance checks and tests to navigation systems comply with manufacturer's recommendations And good navigational practice. Errors in magnetic and gyro-compasses are determined and correctly applied to courses and bearings The selection of the mode of steering is the most suitable for the prevailing weather, sea and traffic conditions and intended maneuvers.

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
1.3.12 The automatic pilot: Principle, functions, auto pilot alarm,. Various settings of the auto-pilot for optimal performance. Steering control systems 1.3.13 Knowledge of steering control systems, operational procedures, and change over from manual to auto and vice-versa, procedure for testing of steering system. Use of Rate of Turn Indicator (ROTI).		
1.4 Meteorology The Meteorological Elements 1.4.1 Shipborne meteorological instruments: , Aneroid Barometer and barograph, Hygrometer and Stevenson's Screen, Whirling Psychrometer, Wind Sensors (anemometer),. 1.4.2 The atmosphere, its composition and physical properties: Troposphere, Water Vapour, Evaporation, Condensation, Latent Heat, Dew Point, Absolute Humidity, Relative Humidity and Vapour Pressure. 1.4.3 Atmospheric pressure: Definition of Pressure, Change of Pressure with Height, Average Pressure, Isobar, Isallobar, barometric tendency. 1.4.4Wind: Beaufort scale of wind force, pressure gradient force, Coriolis force, Buys Ballot's law, apparent and true wind and its vector calculation. 1.4.5Cloud and Precipitation: Formation of Clouds, the Different types of Clouds, Classification of Clouds as per height, Precipitation, Drizzle, Hail, Snow, Sleet 1.4.6Visibility: Formation of Fog, Mist, Haze, different types of Fog, effect of Fog, Mist, Haze, and other meteorological		

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
conditions on Visibility. 1.4.7 Climatology: The Wind and Pressure systems over the oceans, Mean Surface Pressure and Wind distribution, Doldrums, Inter-tropical Convergence Zones, Westerlies, Polar Easterlies, Monsoons, Land and Sea Breeze, Anabatic and Katabatic Winds. 1.4.8 Sea and Swell: Sea waves, swell, storm surge, tsunami, bore tides. Interpret wind rose. 1.4.9 Weather systems: Structure of Depressions, Air Mass, Source Region, Warm Front, Cold Front, Anticyclone, Ridge, Col and other pressure systems. 1.4.10 Weather reports and forecasting: Types of Weather Services for shipping and Weather information available to Shipping, Weather routing services. Meteorological offices. Weather Facsimile Receiver, Digital weather receivers, Recording and Reporting Weather observations: Meteorological Codes, Coding and Decoding of Weather messages, Weather Forecasting:		Measurements and observations of weather conditions are accurate and appropriate to the passage. Meteorological information is correctly interpreted and applied;
Competence No.2: Maintain a safe navigational watch Watch-keeping 2.1 Watch-keeping Arrangements and Procedures 2.1.1 The content, application and intent of COLREG 72: Rules 1 to 38 2.1.2 Keeping a safe navigational watch as per Section A-VIII/2 and B-VIII/2 of STCW: Principles observed in keeping safe navigational watch. Relieving of duties, procedure of taking over watches, action on receiving storm warning, entries in logbook, bridge manning levels. Bridge Procedures Guide and its contents, Bridge Navigation Watch Alarm System (BNWAS), Ship Security Alert System (SSAS). 2.1.3 Keeping an effective anchor watch: Relieving of	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate .4 approved laboratory equipment's training	The conduct, hand-over and relief of the watch conforms with accepted principles & procedures. A proper look-out is maintained at all times and in such a way as to conform to accepted principles & procedures. Lights, shapes & sound signals conform to the requirements contained in the International Regulations for Preventing

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
duties, procedure of taking over watches, action on receiving storm warning, entries in logbook. 2.2 Thorough knowledge of effective bridge team work procedures and maintaining situational awareness. 2.3 The use of routeing in accordance with the General Provisions of Ship's Routeing 2.4 The effective use of information from navigational equipment for maintaining a safe navigational watch and regular checks to monitor their proper operation. 2.5 The use of reporting in accordance with general principles for ship reporting systems and with VTS reporting procedures. 2.6 Navigational Techniques used for safe navigation in restricted visibility (blind navigation / blind pilotage techniques). Bridge Resource Management 2.7 Knowledge of bridge resource management principles including: 2.7.1 allocation, assignment, and prioritization of resources 2.7.2 effective communication 2.7.3 assertiveness and leadership 2.7.4 obtaining and maintaining situational awareness	Assessment of evidence obtained from one or more of the following: .1 approved training .2 approved in-service experience .3 approved simulator training which includes use of BRM principles and techniques	Collisions at Sea and are correctly recognized. The frequency & extent of monitoring of traffic, the ship & the environment conform to accepted principles & procedures. A proper record is maintained of the movements and activities relating to the navigation of the ship. Responsibility for the safety of navigation is clearly defined at all times, including periods when the master is on the bridge and while under pilotage. Resources are allocated and assigned as needed in correct priority to perform necessary tasks Communication is clearly and unambiguously given and received Questionable decisions and/or actions result in appropriate challenge and response Effective leadership behaviours are identified Team member(s) share accurate understanding of current and predicted vessel state, navigation path, and external

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
		environment
Competence No 3 : Use of Radar and ARPA to maintain safety of navigation 3.1 Fundamental Theory 3.1.1 Fundamental principles of radar: Block diagram, use of various controls and radar as range and bearing measuring instrument. 3.1.2 Safe distances: With respect to radar spares and magnetic compasses. 3.1.3 Radiation hazards and precautions: Safety precautions necessary in the vicinity of open equipment, radiation hazard near antennae and open waveguides. 3.1.4 The characteristics of radar sets: Bearing range accuracy, HBW. VBW, pulse length, pulse recurrence rate, maximum & minimum range of radar, range and bearing discrimination. 3.1.5 Factors external to the radar set affecting radar detection: Radar horizon, sub refraction, super refraction & ducting, effect of precipitation and sea on radar detection. 3.1.6 Factors that might cause faulty interpretation: Indirect echoes, side echoes, multiple echoes, second 'trace echoes. 3.2 Setting Up and Maintaining Displays 3.2.1 Function and adjustment of controls: Transmitter controls, reception controls, display controls, different types of display, performance monitor. 3.2.2 Measurement of range & bearing: Range & bearing accuracy, error in range & bearing. 3.3 Marine Radar Performance Specifications 3.3.1 Performance standards for radar equipment 3.3.2 Limitations of the radar X-band and S-band. 3.4 Plotting	Assessment of evidence obtained from approved radar simulator and ARPA simulator training plus in- service experience	Information obtain& from radar and ARPA is correctly interpreted & analysed, taking into account the limitations of the equipment :& prevailing circumstances and conditions Action taken to avoid a close encounter or collision with other vessels is in accordance with the International Regulations for Preventing Collisions at Sea Decisions to amend course and/or speed are both timely and in accordance with accepted navigation practice Adjustment made to the ship's course and speed maintain safety of navigation Communication is clear, concise: and acknowledged at all times in a sea-manlike manner Maneuvering signals are made at the Appropriate time and are in accordance with the International Regulations for Preventing Collisions at Sea

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
3.4.1 The relative motion triangle: Drawing of relative motion triangle and identification of various vectors and angles 3.4.2 Plotting devices: Drawing the relative motion triangle on a plotting chart, 3.4.3 Course, speed and aspect of other ships in relative and true presentation. Set vector lengths based on own vessel speed and range scale in use. Advantages and limitations of use of relative and true vectors and when to use which for optimum efficiency 3.4.4 Closest point of approach (CPA) and time to closest point of approach (TCPA), bow pass, in relative and true presentation and plot. 3.4.5 The effect of course and speed changes on the display. Advantages of compass stabilization of a relative display. 3.4.6 Standardized report format and reporting procedure: Elements of the two parts of a report (bearing and change, range and change, CPA, TCPA, course, aspect and speed) 3.4.7 Use of Trial manoeuvre and predictive motion vectors.		
3.5 The Use of Radar in Navigation : 3.5.1 Obtaining position fix by radar bearings and ranges, possible errors,. Reliability of fix. 3.5.2 Aids to radar navigation: Use of passive (trails, history) and active aids, RACONs and SARTs. Explain AIS overlay on radar / ARPA. 3.5.3 The use of parallel indexing technique in radar navigation:, wheel over positions and safety margins. 3.6 Radar and COLREG 1972 3.6.1 The relationship of COLREG 1972 to the use of radar: Lookout, safe speed, plotting of targets and actions to be taken to avoid collision in clear and bad visibility conditions. 3.7 Review of Plotting Techniques: Course, speed, aspect, CPA and TCPA determination, avoiding action. 3.8 Principal ARPA Systems: Vectors (relative and true), digital read-out, potential points of collision, predicted areas of danger. 3.9 IMO Performance Standards for Automatic Radar Plotting		

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
Aids (ARPA): Requirements for acquisition and tracking of targets, operation warnings, gyro and log inputs. 3.10 Acquisition of Targets: Manual and automatic acquisition of targets, guard rings and guard zones. 3.11 Tracking Capabilities and Limitations: Principle of tracking by ARPA, target swap. 3.12 Processing Delays: The reason for delay in display. 3.13 Setting Up and Maintaining Displays: Optimum display of echoes, use of echo referencing in the true motion mode. 3.14 Representation at Target Information: results of trial maneuvers, benefits and limitations of operational warnings. 3.15 Errors of Interpretation: Lost target, incorrect interpretation of ARPA data 3.16 Errors in Displayed Data: Errors in bearing by backlash, ship motion, asymmetrical antenna beam, azimuth quantization, error range by rolling of "own ship", range quantization, effects of heading and speed errors on derived information. 3.17 System Operational Tests: Self-diagnostic routines. 3.18 Risks of Over-reliance on ARPA 3.19 Obtaining Information from ARPA Displays: Critical targets, relative and true course and speed of target, CPA and TCPA targets. 3.20 Application of COLREG 1972: Analysis of displayed situations, actions to avoid close quarter situations. 3.21 Ground stabilization: Errors involved, advantages and limitations of ground stabilization and sea stabilization. 3.22 Caution to be taken when used in conjunction with Doppler Log (Doppler feed to ARPA)		

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
Competence No. 4: Use of ECDIS to maintain the Safety of Navigation 4.1 Knowledge of the capability and limitations of ECDIS operations including: .1 a thorough understanding of Electronic Navigational Chart (ENC) data, data accuracy, presentation rules, display options and other chart data formats .2 the dangers of over reliance .3 familiarity with the functions of ECDIS required by performance standards in force 4.2. Proficiency in operation, interpretation, and analysis of information obtained from ECDIS, including: .1 use of functions that are integrated with other navigation systems in various installations, including proper functioning and adjustment to desired settings .2 safe monitoring and adjustment of information including own position, sea area display, mode and orientation, chart data displayed, route monitoring, user-created information layers, contacts (when interfaced with AIS and/or radar tracking) and radar overlay functions (when interfaced) .3 confirmation of vessel position by alternate means .4 efficient use of settings to ensure conformance to operational procedures, including alarm parameters for anti-grounding, proximity to contacts and special areas, completeness of chart data and chart update status, and backup arrangements .5 adjustment of settings and values to suit the present conditions .6 situational awareness while using ECDIS including safe water and proximity of hazards, set and drift, chart data and scale selection, suitability of route, contact detection and management, and integrity of sensors.	Examination and assessment of evidence obtained from one or more of the following: .1 approved training ship experience .2 approved ECDIS simulator training	Monitors information on ECDIS in a manner that contributes to safe navigation Information obtained from ECDIS (including radar overlay and/or radar tracking functions, when fitted) is correctly interpreted and analyzed taking into account the limitations of the equipment, all connected sensors (including radar and AIS where interfaced), and prevailing circumstances and conditions Safety of navigation is maintained through adjustments made to the ship's course and speed through ECDIS-controlled track keeping functions (when fitted). Communication is clear, concise and acknowledged at all times in a seamanlike manner

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
Competence No. 5: Respond to emergencies 5.1 Contingency plans for response to emergencies: List the Contents of muster list, State that the duties are assigned to remote control operations, Describe the divisions of the crew into a command team, emergency team, back-up team and engine room team. State that good communication between command team and emergency teams are essential, Describe the actions taken in various emergencies 5.2. Measures which should be taken in emergencies for the protection and safety of the ship, passengers and crew 5.2.1. Actions to be taken on stranding. Initial damage, assessment and control, sounding of compartments, sounding depths all-round the ship using hand-lead 5.2.2. State the Actions to be taken following a collision considering Initial damage, assessment and control, stoppage of engine, preparing life boat, sending distress or urgency signal 5.2.3. Precautions for the protection and safety of passengers in emergency situations: warning the passengers, evacuating all passengers, taking a roll call, instructing passengers during drills and supply of blankets. 5.2.4. Means of limiting damage and salving the ship following a fire or explosion: Cooling of compartment boundaries, inspection for damage. 5.2.5 Procedure for abandoning ship: Transmission of distress call until acknowledged, Extra food and blanket, EPIRB, SARTs and hand held VHF sets, warm clothing and life jackets, TPAs and Immersion suits, launching in heavy weather, use of rocket line-throwing appliances and breeches buoy. 5.2.6. Use of emergency steering : Arrangement of emergency steering, 5.2.7. Arrangements for towing and being taken in tow: Towing equipment and tools on board ship, methods of towing disabled ship and communication between two ships. 5.2.8. Rescue of persons from sea or from a vessel in	Examination and assessment of evidence obtained from one or more of the following: 1 approved in-service experience 2 approved training ship experience 3 approved simulator training, where appropriate 4 practical training	The type and scale of the emergency is promptly identified Initial actions and, if appropriate, manoeuvring of the ship are in accordance with contingency plans and are appropriate to the urgency of the situation and nature of the emergency

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
distress: Waiting for day light, providing a lee, method of rescue when sea conditions are too dangerous to use boat.		
Competence No. 6 : Respond to distress signal at sea 6.1. Measures for assisting a vessel in distress: Knowledge of the contents of the IAMSAR, various search pattern and signals to be made by ships & aircraft. 6.2. Man-overboard procedures: Initial actions, use of man-overboard function in GPS for homing in to the man in the water, preparations for rescuing man, picking up man and picking up boat.	Examination and assessment of evidence obtained from practical instruction or approved simulator training, where appropriate	The distress or emergency signal is immediately recognized Contingency plans and instructions in standing orders are implemented and complied with
Competence No. 7: Use the IMO Standard Marine Communication Phrases and use English in written and oral form. 7.1 English language 7.1.1 Adequate knowledge of the English language to enable the officer: - to use charts and other nautical publications - to understand Meteorological information and messages concerning ships safety and operation - to communicate with other ships, coast stations and VTS centres - to perform the officer's duties also with a multilingual crew 7.2 Standard Marine Communication Phrases 7.2.1 Use and understand the IMO Standard Marine Communication Phrases (SMCP)	Examination and assessment of evidence obtained from practical instruction	English language nautical publications and messages relevant to the safety of the ship are correctly interpreted or drafted Communications are clear and understood
Competence No. 8: Transmit and receive information by visual signaling 8.1 Signaling by Morse Code (Transmission & reception): Morse symbols for the alphabet and numerals, transmit and receive single letter signals by Morse light (at the rate of 8 characters per	Assessment of evidence obtained from practical instruction and / or simulation	Communications within the operator's area of responsibility are consistently successful

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
minute), as specified in the International code of signals. Ability to transmit and receive the distress signal “SOS”, urgency signal “XXX”, and Safety signal “TTT”, 8.2 Using International Code of Signals: Recognition of International codes flags and pendants, purpose of International code of signals, meanings of single-letter Flag signals, International Code Signal of distress.		
Competence No. 9: Maneuver the ship 9.1 The effects of various deadweights, draughts, trim, speed and under-keel clearance on turning circles and stopping distances. Maneuvering Data of Ship: Advance, transfer, drift angle, tactical diameter, track reach, head reach, side reach, turning circles of a ship, directional stability. 9.2 Effect of wind and current on ship handling: Effect of wind on a given ship while moving and when making large turns, effect of current on the motion of the ship, 9.3 Manoeuvres for the rescue of a man overboard: Immediate action, delayed action, single turn, Williamson turn and Scharnow turn, sequence of actions when a person is seen to fall overboard. 9.4 Squat and shallow-water and similar effects: Shallow water, squat and bank effect. 9.5. Proper procedures for anchoring and mooring: Procedure for anchoring, and the precautions to be taken. Use the correct terminology for communication between bridge and anchor station crew Use of anchor buoys, Marking of the cable, sealing of spurling pipes, Joining of two mooring ropes, slip wire. Mooring plan of a ship, optimum mooring pattern and rope leads. Dangers of using different rope types in one mooring system. Rigging pilot ladder /combination ladder, making fast tugs, using fenders during berthing.	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate .4 approved training on a manned scaled ship model where appropriate	Safe operating limits of ship propulsion, steering and power systems are not exceeded in normal manoeuvres Adjustments made to the ship’s course and speed maintain safety of navigation

FUNCTION II: CARGO HANDLING & STOWAGE AT THE OPERATION LEVEL

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
Competence No. 10: Monitor the loading, stowage, securing and unloading of cargoes and their care during the voyage 10.1. Dry Cargoes 10.1.1. Inspection and preparation of holds: General Inspection of Holds, items to be inspected, importance of cleaning holds, using dunnage, using spar ceiling, blanking of ballast lines to deep tanks. 10.1.2. Segregation and separation of cargoes: Segregation of different cargoes with reference to Dangerous Goods, dry, wet and Delicate Cargoes, separating adjacent parcels of cargo. 10.1.3. Securing cargoes: Lashing Code and Cargo Securing Manual. Methods of blocking, lashing, shoring and tommying cargo, methods of securing heavy loads and vehicles and trailers. 10.1.4. Ventilation and control of sweat: Control of sweat by ventilation, operation of ventilation system, cargoes requiring special ventilation 10.1.5. Deck cargo: Efficient securing of deck cargoes, proper battening of cargo before loading deck cargo, safe access to essential equipment and spaces, unobstructed view from navigating bridge, max permissible load, IMO code of safe practice for ships carrying timber deck cargo. 10.1.6. Refrigerated cargo: Preparation of holds for loading refrigerated cargo, inspections of the cargo, use of brine traps, purpose of temperature recording. 10.1.7. Container Cargo: Arrangement of a container ship, lashing and securing arrangements of containers, types and sizes of containers, stack weights. 10.1.8 RoRo Vehicles: Preparation of the car decks for the loading of trailers and vehicles, floating decks, and procedures for opening, closing, securing of bow, stern and side doors and ramps and to correctly operate, care and maintain the related systems. Maintaining water-tight integrity of the cargo decks. 10.2. Cargo Handling 10.2.1. Cargo-handling equipment: Care and maintenance of standing rigging, topping lifts, cargo runners, cargo blocks and derrick heel fittings, rigging of derricks for loading and discharging of cargoes, ship rigging plan, use of slings, snotters, canvas slings, trays, pallets, nets,	Examination and assessment of evidence obtained from one or more of the following .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate	Cargo operations are carried out in accordance with the cargo plan or other documents and established safety rules / regulations, equipment operating instructions and shipboard stowage limitations. The handling of dangerous, hazardous and harmful cargoes complies with international regulations and recognized standards and codes of safe practice

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
chain slings. 10.2.2 Cargo-handling safety: Safe working load of a gear, visual inspection before the start of cargo, mechanically or hydraulically operated hatches, precautions while doing cargo operations, effect of heavy lift on sea worthiness and stability of the ship, effective communication during loading and discharging. Dock Safety Regulations. 10.2.3 Deep tank cargoes: Cleaning and preparation of deep tanks for loading, securing of deep tank lids. 10.2.4 Keeping a safe deck watch in port 10.3 Dangerous, Hazardous and Harmful (Marine Pollutants) Cargoes 10.3.1 Dangerous goods in packaged form: Classification of IMDG cargo, use of IMDG code, precautions to be taken while working with IMDG cargo, MFAG, EmS, IMGS, segregation tables. 10.3.2 Keeping a safe deck watch in port when carrying hazardous cargo: Hazardous cargo, special requirements when carrying hazardous cargo, procedure for entry into enclosed spaces and permit to work. 10.3.3 Bulk cargoes (other than grain): IMO code of safe practice for solid bulk cargoes, angle of repose, flow moisture point, flow state, transportable moisture limit, preparations of holds prior to loading bulk cargoes, hazards associated with coal cargoes. 10.3.4 Bulk grain cargoes: Bulk cargo code, preparations of holds for the carriage of grain, insect or rodent infestation, and use of shifting boards. 10.4 Oil, Chemical and Gas Tanker Piping and Pumping Arrangements: 10.4.1 Tanker arrangement: Cargo tanks, pump rooms, slop tanks, cofferdams, deep tanks, tank coating, reliquefaction system. 10.4.2 Cargo piping systems: Direct pipe line and ring-main system, piping arrangement in pump room. 10.4.3 Cargo pumps: Different types of pumps for cargo operations, use of eductors. 10.4.4 Hazards of oil, chemical, gas cargoes including tank atmosphere control and tank cleaning procedures.		

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
10.5 Precautions before Entering Enclosed or Contaminated Spaces: Potentially dangerous spaces like cargo, fuel and ballast tanks, pump rooms, cofferdams, duct keels. Ensure oxygen content 21% by volume, need of thorough ventilation of space, need of preparing safety check list, use of various instruments to check the gases in a compartment. 10.6 Stowage and stability Calculations 10.6.1 Cargo calculations and cargo plans: Stowage factor, broken stowage, load density, ullage, calculation of cargo to be loaded, extracts from cargo plans, making a cargo plan. Calculation on purchases and tackles . Simple calculations on liquid cargoes based on density, temperature and volume. 10.6.2 Knowledge of the effect of the cargo including heavy lifts on the seaworthiness and the stability of the ship.		
Competence No. 11: Inspect and report defects and damage to cargo spaces, hatch covers and ballast tanks 11.1 Knowledge and ability to explain where to look for damage and defects most commonly encountered due to: .1 loading and unloading operations .2 corrosion .3 severe weather conditions 11.2 Ability to state which parts of the ship shall be inspected each time in order to cover all parts within a given period of time. 11.3 Identify those elements of the ship structure which are critical to the safety of the ship. 11.4 State the causes of corrosion in cargo spaces and ballast tanks and the how corrosion can be identified and prevented. 11.5 Knowledge of procedures on how the inspections shall be carried out. 11.6 Ability to explain how to ensure reliable detection of defects and damages. 11.7 Understanding of the purpose of the “enhanced survey programme”.	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience. .2 approved training ship experience. .3 approved simulator training, where appropriate.	The inspections are carried out in accordance with laid-down procedures and defects and properly reported. Where no defects or damage are detected, the evidence from testing and examination clearly indicates adequate competence in adhering to procedures and ability to distinguish between normal and defective or damaged parts of the ship.

FUNCTION III: CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD AT THE OPERATION LEVEL

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
COMPETENCE No 12: Ensure compliance with pollution prevention requirements 12.1. Knowledge of the precaution to be taken to prevent pollution of the marine environment while bunkering, loading/discharging oil, chemicals and hazardous cargoes, tank cleaning, pumping out bilges 12.2. Knowledge of anti-pollution procedures & all associated equipment – Oil discharge monitoring and Control system (ODMCS). 12.2.1. The International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78). 12.2.2 Technical annexes: Annex I to VI, and other countries legislation like OPA – 90 and National Pollutant Discharge Elimination system (NPDES) of the U.S. Clean Water Act. 12.2.3. Annex – I: Oil discharge, monitoring and control system, oil and water mixture and particularly sensitive areas. 12.2.4 Annex II: Chemical discharge criteria, monitoring and control system. 12.2.5. Control of oil from machinery spaces: Discharge provisions for oil and oily waste from machinery spaces outside special areas, within special areas, bilge water holding tank, oil water separator 12.2.6 Oil record book (Part I, Machinery Space Operations) Part II (Cargo and ballast operations): Entries to be made in oil record books. 12.2.7. Precautions to be taken to prevent accidental pollution by oil. Checklist while bunkering and transferring in oil, precautions while carrying out any oil operations. Shipboard Oil Pollution Emergency Plan (SOPEP), Vessel Response Plan (VRP) 12.2.8. Procedure and arrangements for Chemical carriers, Record Book for Chemical Cargoes, SMPEP. 12.2.9 Operating procedures of anti-pollution equipment: Sewage plant, incinerator, comminutor, ballast water treatment plant. 12.2.10. Garbage Management System, Ballast Water Management and their discharge criteria.	Examination and assessment of evidence obtained from one or more of the following: 1 approved in-service experience 2 approved training ship experience 3 approved training	Procedures for monitoring shipboard operations and ensuring compliance with MARPOL requirements are fully observed Actions to ensure that a positive environmental reputation is maintained

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
12.2.11 Understanding contents of Annex VI - air pollution 12.3. Importance of proactive measures to protect the marine environment		
Competence 13: Maintain sea-worthiness of the ship 13.1. Ship construction(Including corrosion and maintenance of Hull and fittings) 13.1.1. Ship Dimensions and form: General arrangement general cargo, oil, chemical and gas tankers, bulk carriers, combination carriers, containers, ro – ro and passengers ships, definitions of camber, rise of floor, flare, shear, rake. 13.1.2. Ship stresses: Hogging, sagging, racking, panting and pounding, slamming, torsional stresses. 13.1.3. Hull Structure: Proper names for various parts, standard steel sections. 13.1.4. Bow and Stern: Stern frame, structural arrangement forward and aft to withstand painting and pounding. 13.1.5 Fittings: Water tightness of the hatches, opening in oil, chemical and gas tankers, chain lockers and attachment of cables, bilge piping system, ballast system, sounding and air pipes. 13.1.6 Rudders and propellers: Construction of rudders and propeller,. 13.1.7 Load lines and draught marks: Deck line, free board, Plimsoll line. 13.2 Stability: 13.2.1 Displacement: Displacement/draft curve and table, light displacement, load displacement, dead weight, TPC, MCTC, block co-efficient, water plane co-efficient. 13.2.2 Buoyancy: Meaning of buoyancy, reserve buoyancy. 13.2.3 Fresh water allowance: Calculation of TPC, FWA and DWA in various densities. 13.2.4 Statical stability: Centre of gravity, centre of buoyancy, righting lever, righting moment.	Examination and assessment of evidence obtained from one or more of the following .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate .4 approved laboratory equipment's training	The stability conditions comply with the IMO intact stability criteria under all conditions of loading Actions to ensure and maintain the watertight integrity of the ship are in accordance with accepted practice

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
13.2.5 Initial stability: Stability up to 10° angle of heel, transverse metacentre, and hydrostatic curves. 13.2.6 Angle of loll: Definition and correction of angle of loll. 13.2.7 Curves of statical stability: KN curves, curve of statical stability, deriving information from the curve. 13.2.8 Movement of the centre of gravity: Change of centre of gravity of a ship by loading, discharging, shifting of weight. 13.2.9 List and its corrections: Calculation of list while loading, discharging or shifting weights, correction of list. 13.2.10 Effect of slack tanks: Free surface effect and its calculation, calculation of GM fluid. 13.2.11 Trim: Calculation of, forward and aft drafts using trim tables. 13.2.12 Actions to be taken in the event of partial loss of intact buoyancy: Closing of watertight doors, cross flooding arrangement. 13.2.13 Stress tables and stress calculating equipment — loadicator 13.2.14 Ships stability criteria,. 13.2.15 Use of stability booklet and calculations based on that		
Competence No. 14: Prevent, Control and Fight Fires on board <i>Fire prevention and fire-fighting appliances</i> Knowledge of fire prevention Ability to organise fire drills Knowledge of classes and chemistry of fire Knowledge of fire-fighting systems Knowledge of action to be taken in the event of fire, including fires involving oil systems	Assessment of evidence obtained from approved fire-fighting training course (Advanced Fire-Fighting Course) and experience.	The type and scale of the problem is promptly identified and initial actions conform to the emergency procedure and contingency plans for the ship. Evacuation, emergency shutdown and isolation procedures are appropriate to the nature of the emergency and are implemented promptly. The order of priority, and the levels and time-scales of making reports and informing personnel on board, are relevant to the nature of the emergency and reflect the urgency of the problem.

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
Competence No. 15: Operate Life-saving appliances <i>Life —saving</i> Ability to organize abandon ship drills and knowledge of the operation of survival craft and rescue boats, their launching appliances and arrangements, and their equipment, including radio life-saving appliances, satellite EPIRBs, SARTs, immersion suits and thermal protective aids. Knowledge of survival at sea techniques.	Assessment of evidence obtained from approved training course (Proficiency in Survival Craft and Rescue Boats Course) and experience.	Actions is responding to abandon ship and survival situations are appropriate to the prevailing circumstances and conditions and comply with accepted safety practices and standards.
Competence No.16 Apply medical first aid on board the ship <i>Medical aid</i> Practical application of medical guides and advice by radio, including the ability to take effective action based on such knowledge in the case of accidents or illnesses that are likely to occur on board ship.	Assessment of evidence obtained from approved training course (Medical First Aid Course).	The identification of probable cause, nature and extent of injuries or conditions is prompt and treatment minimises immediate threat to life.
Competence-No. 17: Monitor compliance with legislative requirements 17.1 To demonstrate basic working knowledge of the relevant IMO convention concerning SOLAS, MARPOL, Load Line, ISM Code, ISPS Code and STCW-2010 with regards to contents, objectives, application, amendments. 17.2 Code of Safe working practices for Merchant Seamen 17.3 Indian Merchant Shipping Act and Rules: Statutory surveys and certificates and preparations for the same. 17.4 Classification Society surveys and certificates - Preparations for the same.	Assessment of evidence obtained from examination or approved training course.	Legislative requirements relating to safety of life at sea and protection of the marine environment are correctly identified.
Competence No. 18: Application of Leadership and Team working Skills 18.1 Working knowledge of shipboard personnel management and training. 18.2 A knowledge of related international maritime conventions and recommendations, and national legislation. 18.3 Ability to apply task and workload management including: .1 planning and coordination .2 personnel assignment	Assessment of evidence obtained from one or more of the following: .1 approved training .2 approved in-service experience .3 practical demonstration	The crew are allocated duties and informed of expected standards of work and behaviour in a manner appropriate to the individuals concerned. Training objectives and activities are based on assessment of current competence and

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
.3 time and resource constraints .4 prioritization 18.4 Knowledge and ability to apply effective resource management: .1 allocation, assignment, and prioritization of resources .2 effective communication onboard and ashore .3 decisions reflect consideration of team experiences .4 assertiveness and leadership including motivation .5 obtaining and maintaining situational awareness. 18.5 Knowledge and ability to apply decision-making techniques: .1 situation and risk assessment .2 identify and consider generated options .3 selecting course of action .4 evaluation of outcome effectiveness		capabilities and operational requirements. Operations are demonstrated to be in accordance with applicable Rules. Operations are planned and resources are allocated as needed in correct priority to perform necessary tasks. Communication is clearly and unambiguously given and received. Effective leadership behaviours are demonstrated. Necessary team member(s) share accurate understanding of current and predicted vessel and operational status and external environment. Decisions are most effective for the situation. Operations are demonstrated to be effective and in accordance with applicable rules.
Competence No.19: Contribute to the safety of personnel and ship 19.1 Knowledge of personal survival techniques. 19.2 Knowledge of fire prevention and ability to fight and extinguishing fires. 19.3 Knowledge of elementary first aid. 19.4 Knowledge of personal safety and social responsibilities.	Assessment of evidence obtained from approved trainings and experiences as set out in section A-VI/1, paragraph 2	Appropriate safety and protective equipment is correctly used. Procedures and safe working practices designed to safeguard personnel and the ship are observed at all times. Initial and follow-up actions on becoming aware of an emergency conforms with

Knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
		established emergency response procedures.

Notes:

4) Upgradation of PSSR Course from STCW 1995 to STCW 2010 is required to be done for all candidates holding STCW 1995 PSSR Course (Duration 3 hours)

Topics to be covered: Conflict Resolution, Basic Knowledge of the impact of shipping on the marine environment, Basic Knowledge of complexity and diversity of the marine environment, Importance of obtaining the necessary rest, Effects of sleep, schedules, and the circadian rhythm on fatigue, Effects of physical stressors on seafarers, Effects of environmental stressors in and outside the ship and their impact on seafarers, Effect of schedule changes on seafarer fatigue.

5) Officers who have not undergone Ship Security Officer (SSO) training are required to undergo approved training course for Seafarers with Designated Security Duties in accordance with Regulation VI/6-2.

PST, PSC-RB, FPFF and AFF courses, if more than or nearing 5 years from the date of issue, will require refresher training of about half a day per course as notified separately.

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6 MONTH COMPETENCY COURSE FOR CHIEF MATE NCV PHASE 1 & PHASE 2 EXAM

CHIEF MATE (NCV) - SUMMARY OF EXAMINATION (FUNCTION - WISE) (REFERENCE: TABLE A- II/2)

FUNCTION: NAVIGATION AT MANAGEMENT LEVEL

PAPER NO.	SUBJECT	COMPETENCIES COVERED	MODE OF EXAMINATION	DURATION OF EXAM	MAXIMUM MARKS	PASS MARKS	PHASE
1	Terrestrial and Celestial Navigation	1 & 2.1	Written	3 Hours	200	140	I
2	Meteorology	8	Written	2 Hours	100	50	I
3	Navigational Aids including Compasses	2.2 & 3	Written	3 Hours	200	100	II
4	Bridge Watchkeeping, Search and Rescue, Ship Handling & Emergencies	4, 5, 9& 10	Written	2 Hours	100	60	II
5	Engineering knowledge, instruments & control systems	11	Written	3 Hours	200	100	II
6	Radar, ARPA & Navigation Simulator course including Search and Rescue Training	4 & 6	Modular	1 Week Course			
7	ECDIS Course*	7	Modular	1 Week Course			
8	Orals for navigation function	1 to 11	Oral		100	70	II

() Training and assessment in the use of ECDIS is not required for those who serve exclusively on ships not fitted with ECDIS. This limitation shall be reflected in the endorsement issued to the seafarer concerned.*

FUNCTION: CARGO HANDLING & STOWAGE AT MANAGEMENT LEVEL

PAPER NO.	SUBJECT	COMPETENCIES COVERED	MODE OF EXAMINATION	DURATION OF EXAM	MAXIMUM MARKS	PASS MARKS	PHASE
1	Cargo Handling and Stowage	12,13 & 14	Written	3 Hours	200	120	I
2	Orals for cargo function	12 to 14	Oral		100	60	I

FUNCTION: CONTROLLING THE OPERATION OF THE SHIP & CARE FOR PERSONS ON BOARD AT THE MANAGEMENT LEVEL

PAPER NO.	SUBJECT	COMPETENCIES COVERED	MODE OF EXAMINATION	DURATION OF EXAM	MAXIMUM MARKS	PASS MARKS	PHASE
1	Ship safety, emergencies, maintenance and managerial skills	17,18 &19	Written	3 Hours	150	75	I
2	Naval architecture paper I	15.1.1 & 15.2.1	Written	3 Hours	200	120	I
3	Naval architecture paper II	15.1.2 & 15.2.2	Written	3 Hours	200	100	II
4	Maritime legislation	16	Written	3 Hours	200	100	II
5	Medical care	20	Modular	2 weeks course			
6	Orals for ship operation function	15 to 20	Oral		100	60	II

SUMMARY OF COURSES, TRAINING PROGRAMMES, EXAMINATION & ASSESSMENT

Regulation: II/2 of STCW'2010 & Section: A-II/2 of STCW Code

Department: Nautical

Level: Management Level

Capacity: Chief Officer

FUNCTION: Navigation at Management Level

NO.	COMPETENCE	ON-BOARD TRAINING (18 Months)	POST-SEA TRAINING			TYPE OF ASSESSMENT
			Topics (Duration in Hours) and Phase No.	Lectures I + II	Exercise I + II	
1.	Plan a voyage and conduct navigation	In-service experience	Miscellaneous, coastal navigation and ocean voyages (8+ 20) – I	13 + 0	26 + 0	Internal assessment and written & Oral examination
2.	Determine position and the accuracy of resultant position fix by any means	In-service experience	Terrestrial Navigation (2+15) – I Celestial Navigation (5+20) – I Great Circle (5+15) – I Electronic Nav aids (14+6) – II	19 + 26	39 + 0	Internal assessment and written & Oral examination
3.	Determine and allow for compass errors	In-service experience	Magnetic Compass (5) – II Gyro Compass (4+1) – II	0 + 23	0 + 12	Internal assessment and written & Oral examination
4.	Co-ordinate search and rescue operations	In-service experience	Co-ordinate search and rescue operations- II	0+15	--	Internal assessment and written & Oral examination. Refer to IMO Model Course No. 2.02 for guidance
5.	Establish watchkeeping arrangements and procedures	In-service experience	Watchkeeping including COLREGS (18+13) – II	0 + 18	0+ 13	Internal assessment and written & Oral examination
6.	Maintain safe navigation through the use of information from navigation equipment and systems to assist command decision making.	In-service experience	Model Course (38) - M	--	--	IMO Model Course No. 1.09
7.	Maintain the safety of navigation through the use of ECDIS and	In-service experience	Model Course- 1.27- (40)- M	-	-	IMO Model Course No. 1.27 revised

NO.	COMPETENCE	ON-BOARD TRAINING (18 Months)	POST-SEA TRAINING			TYPE OF ASSESSMENT
			Topics (Duration in Hours) and Phase No.	Lectures I + II	Exercise I + II	
	associated navigation systems to assist command decision making					
8	Forecast weather and oceanographic conditions	In-service experience	Meteorology (16) – I Oceanography (7) – I Weather Routing (3) – I Tides (1+3) – I	27 + 0	3+0	Internal assessment and written & Oral examination
9	Respond to navigational emergencies	In-service experience	Contingency Plans (8) – II Protection in Emergency (24) – II	0 + 32	--	Internal assessment and written & Oral examination
10	Manoeuvre and handle a ship in all conditions	In-service experience	Ship Handling and Manoeuvring (62) – II	0 + 62	--	Internal assessment and written & Oral examination
11	Operate remote controls of propulsion plant and engineering systems and services	In-service experience	Engineering terms & Fuel consumption (3+4) – II Auxiliaries (26) – II Mariner Power Plants (22+3)– II Engine Room Watchkeeping (2) – II	0 + 53	0+7	Internal assessment and written & Oral examination
				59 + 229	68 + 32	

FUNCTION: Cargo handling and stowage at the management level

NO.	COMPETENCE	ON-BOARD TRAINING (18 Months)	POST-SEA TRAINING			TYPE OF ASSESSMENT
			Topics (Duration in Hours) and Phase No.	Lectures I + II	Exercise I + II	
12..	Plan and ensure safe loading, stowage, securing, care during the voyage & unloading of cargoes	In-service experience	Dry Cargoes (23 +4) – I Cargo Handling Gear and Hatch Covers (10) – I Watchkeeping in Port (4) – I	40 + 0	24 + 0	Internal assessment and written & Oral examination
13	Assess reported defects and damage to cargo spaces, hatch covers and ballast tanks and take appropriate action	In-service experience	Defects and damage to cargo spaces, hatch covers and ballast tanks (6)- I	6+0	0+0	Internal assessment and written & Oral examination

14	Carriage of dangerous cargoes	In-service experience	Tanker Operations (21) – I Solid Bulk Cargoes (12)- I Grain Cargoes (4+3)- I Safe deck watch (2)-I Dangerous Goods (11+2) – I Fumigation of Holds (2) – I Cargo Calculations (6+18) – I Stability and Trim diagrams (2)-I	60 + 0	23+0	Internal assessment and written examination
				106 + 0	47 + 0	

FUNCTION: Controlling the operation of the ship and care for persons on board at the management level

NO.	COMPETENCE	ON-BOARD TRAINING (18 Months)	POST-SEA TRAINING			TYPE OF ASSESSMENT
			Topics (Duration in Hours) and Phase No.	Lectures I + II	Exercise I + II	
15	Control trim, stability and stress	In-service experience	Ship Construction (20+ 20) – I & II Ship Stability and Stability in Damaged Condition (50+ 30) – I & II	53 + 21	19 + 22	Internal assessment and written & Oral examination

NO.	COMPETENCE	ON-BOARD TRAINING (18 Months)	POST-SEA TRAINING			TYPE OF ASSESSMENT
			Topics (Duration in Hours) and Phase No.	Lectures I + II	Exercise I + II	
16	Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea and the protection of the marine environment	In-service experience	Introduction (1) – II Law of the sea (2) – II Safety (11) – II Pollution (8) – II Passenger (2) – II Tonnage (1) – II MLC -2006 (6) – II Arrival documents and procedures (4) – II Collision (2) – II Assistance & Salvage (2) – II Limitations of Liability (1) – II Classification Societies (1) – II Cargo (4) – II General average and marine insurance (3) – II Certificates (1) – II National maritime legislations (1)-II	0 + 66	--	Internal assessment and written & Oral examination
17	Maintain safety and security of the ship's crew and passengers and the operational condition of life-saving, fire-fighting and other safety systems	In-service experience	Covered in PSCRB Course Covered in AFF Course Additionally, Safety and Security (15) – I	0 + 15	--	IMO Model Course No. 1.23 and IMO Model Course No. 2.03 Internal assessment and written & Oral examination
18.	Develop emergency and damage control plans and handle emergency situations	In-service experience	Emergency situations (6) – I	0 + 13	--	Internal assessment and written & Oral examination
19.	Use of leadership and managerial skills	In-service experience	Use of leadership and managerial skills (19)- I	19+0	-	Internal assessment and written & Oral examination
20.	Organise and manage the provision of medical on board	--	Model Course (60) - M	--	--	IMO Model Course 1.15
				72 + 115	19 + 22	

GRAND TOTAL 237+ 344 134 + 54

PHASE I = 237 + 134 = 371 hours = 3 Months

NOTES: 1) Total Teaching hours for above mentioned course is 371 hours @ 30 hours per week = 12.3 weeks.

2) One week to account for Public holidays and contingencies.

3) Assessments to be catered for outside the allocated hours for lecture/ exercises.

Grand Total: 13 weeks

PHASE II = 344 + 54 = 398 hours = 3 months

NOTES: 1) Total Teaching hours for above mentioned course is 398 hours@ 30 hours per week = 13.2 weeks.

2) One week for Assessments (mid-course and final internal assessment).

3) One week to account for Public holidays and contingencies.

Grand Total: 15 weeks

**REFERENCE: TABLE A-II/2
CHIEF MATE- NCV**

FUNCTION: NAVIGATION AT THE MANAGEMENT LEVEL

Knowledge, Understanding & Proficiency / Course Covered	Methods of demonstrating competence	Criteria for evaluating competence
Competence No. 1: Plan a voyage and conduct navigation 1.1 Voyage Planning and Navigation for all Conditions 1.1.1 Coastal Navigation: Position fixing by bearings and ranges, planning navigation and plotting courses taken into account restricted waters, meteorological conditions, restricted visibility, traffic separation schemes, vessel traffic service (VTS) areas, area of extensive tidal effects, determine positions in all conditions. 1.1.2 Ocean voyage: Ocean passages for the world, sailing directions, routeing charts, and routeing in accordance with general provisions of ship's routeing, ability to choose best routes. Reporting procedures in accordance with general principles for ship reporting systems and with VTS procedures including INSPIRES/INDSAR/ISLEREP. Routing in BIMMS area.	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved simulator training, where appropriate .3 approved laboratory equipment training Using: chart catalogues, charts, nautical publications and ship particulars.	The equipment, charts and nautical publications required for the voyage are enumerated and appropriate to the safe conduct of the voyage. The reasons for the planned routes are supported by facts and statistical data obtained from relevant sources and publications. Positions, courses, distances and time calculations are correct within accepted accuracy standards for navigational equipment. All potential navigational hazards are accurately identified.
Competence No. 2: Determine position and the accuracy of resultant position fix by any means 2.1 Position Determination 2.1.1 Terrestrial navigation: Ability to use appropriate charts, chart correction, Mercator sailing, errors in position lines, notices to mariners and other publications. 2.1.2 Celestial navigation: magnitude of stars, correction of altitudes. Calculation of position line and position through which it passes by using sun, stars, moon, planet and using following methods- Meridian altitude, ex-meridian, long-by-chron, intercept and pole star. Position determination by combination of two or more celestial observations. (No calculations shall be based on ambiguity of time or date, incorrect application of chronometer error, index error or dip, etc.)	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved simulator training, where appropriate .3 approved laboratory equipment training	The primary method chosen for fixing the ship's position is the most appropriate to the prevailing circumstances and conditions The fix obtained by celestial observations is within accepted accuracy levels

2.2 Electronic Systems of Position Fixing 2.2.1 Terrestrial electronic position fixing systems: E-Loran (when functional) Principle, operation and errors of E- Loran system. 2.2.2 Satellite electronic position fixing systems: Global Positioning System: Principle, operation and main sources of errors in GPS, Principle and accuracy of differential GPS, IMO performance standards GLONASS, GNSS (Galileo) 2.2.3 Other navigational aids: AIS, VDR, SVDR, LRIT, BNWAS, IMO Performance standards. 2.2.4 procedure to execute constant radius turn, parallel indexing, and radar plotting 2.2.5 Echo sounders, speed logs: Sources of errors, IMO performance standards. 2.2.6 Course recorder and auto pilot – operation and precautions, settings of auto pilot, adaptive auto pilot systems and its functions, regulations regarding use of auto pilot.	Using: .1 charts, nautical almanac, plotting sheets, chronometer, sextant and a calculator .2 charts, nautical publications and navigational instruments (azimuth mirror, sextant, log, sounding equipment, compass) and manufacturers' materials .3 radar, terrestrial electronic position fixing systems, Satellite Navigation Systems and appropriate nautical charts and publication	The fix obtained by terrestrial observations is within accepted accuracy levels The accuracy of the resulting fix is properly assessed. The fix obtained by the use of electronic navigational aids is within the accuracy standards of the systems in use. The possible errors affecting the accuracy of the resulting position are stated and methods of minimising the effects of system errors on the resulting position are properly applied
Competence No. 3: Determine and allow for compass errors 3.1 Magnetic Compass Error and Correction: Ship's permanent magnetic field components, constants. Induced magnetic field, methods of obtaining table of deviation, compass correction, ability to determine and allow the errors of the magnetic compass, knowledge of the principle of magnetic compass 3.2 Gyro-compass Errors and Corrections: Principle of gyro compass as north seeking instrument, errors of gyro compass, understanding of systems under the control of the master gyro, IMO performance standards for gyro compasses, method of gyro error determination and allowing same. Operation and care of main types of gyro compass.	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved simulator training, where appropriate .3 approved laboratory equipment training Using: celestial observations, terrestrial bearings and comparison between magnetic and gyro- compass	The method and frequency of checks for errors of magnetic and gyro-compasses ensures accuracy of information
Competence No. 4: Co-ordinate search and rescue operations 4.1 A thorough knowledge of and ability to apply the procedures contained in the IMO International	Examination and assessment of evidence obtained from one or more of the following:	The plan for co-ordinating search and rescue operations is in accordance

Aeronautical and Maritime Search and Rescue (IAMSAR) Manual: IAMSAR Volume 3, Search Patterns, MRCC, RCC, OSC	.1 approved in-service experience .2 approved simulator training, where appropriate .3 approved laboratory equipment training Using: relevant publications, charts, meteorological data, particulars of ships involved, radio communication equipment and other available facilities and one or more of the following: .1 approved SAR training course .2 approved simulator training where appropriate .3 approved laboratory equipment training	with international guidelines and standards Radio communications are established and correct communication procedures are followed at all stages of the search and rescue operations
Competence No. 5: Establish watchkeeping arrangement and procedures 5.1 Watchkeeping Arrangements and Procedures 5.1.1 The content, application and intent of COLREG 1972. 5.1.2 Ensuring the adequacy of a navigational watch: Factors deciding the composition of the watch on the bridge, efficiency of the watch. 5.1.3 Information which should be exchanged between the master and the pilot. 5.1.4 Ensuring the adequacy of an engineering watch: Communication between chief engineer and master, factors deciding the composition of watch. 5.1.5 Vessel Traffic Management System, Ship Reporting System.	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved simulator training, where appropriate	Watchkeeping arrangements and procedures are established and maintained in compliance with international regulations and guidelines so as to ensure the safety of navigation, protection of the marine environment and safety of the ship and persons on board
Competence No. 6: Maintain safe navigation through the use of information from navigation equipment and systems to assist command decision-making (Radar, ARPA and Navigation Simulator course) 6.1 Familiarisation with the Simulator's "Own Ship" Characteristics, navigational equipment and Controls.	Examination and assessment of evidence obtained from approved ARPA simulator training and one or more of the following: .1 approved in-service experience	Information obtained from navigation equipment and systems is correctly interpreted and analysed, taking into account the limitations of the equipment and prevailing

6.2 Review of Basic Radar and Plotting: An application of system errors and through understanding of the operation aspects of Radar and ARPA. 6.3 Open Water Exercises in the Application of COLREG 1972. 6.4 Familiarisation with the modern navigational aids provided. 6.5 Exercises in Navigation and Collision Avoidance in Confined and congested waters in clear visibility. 6.6 Exercises in and near Traffic Separation Schemes. 6.7 Blind pilotage planning and techniques in above situations. 6.8 Evaluation of navigational information derived from all sources including Radar and ARPA in order to make and implement command decisions for collision avoidance and for directing the safe navigation of the ship. 6.9 The inter-relationship and optimum use of all navigational data available for conducting navigation: Feedback from navigational aids such as gyro and magnetic compasses, speed log, course recorder, echo-sounder, GPS, e-Loran, and their evaluation & interpretation.	.2 approved simulator training, where appropriate .3 approved laboratory equipment training	circumstances and conditions. Action taken to avoid a close encounter or collision with another vessel is in accordance with the International Regulations for Preventing collisions at sea.
Competency No. 7: Maintain the safety of navigation through the use of ECDIS and associated navigation systems to assist command decision making <i>Note: Training and assessment in the use of ECDIS is not required for those who serve exclusively on ships not fitted with ECDIS. This limitation shall be reflected in the endorsement issued to the seafarer concerned</i> Electronic chart display information systems (ECDIS) 7.1 Management of operational procedures, system files and data, including 7.1.1 manage procurement, licensing and updating of chart data and system software to conform to established procedures; 7.1.2 system and information updating, including the ability to update ECDIS system version in accordance with vendor's product development 7.1.3 create and maintain system configuration and backup files; 7.1.4 create and maintain log files in accordance with established procedures; 7.1.5 create and maintain route plan files in accordance with established procedures;	Assessment of evidence obtained from one of the following: .1 approved in-service experience .2 approved training ship experience .3 approved ECDIS simulator training	Operational procedures for using ECDIS are established, applied, and monitored Actions taken to minimize risk to safety of navigation

7.1.6 use ECDIS log-book and track history functions for inspection of system functions, alarm settings and user responses; 7.2 Use ECDIS playback functionality for passage review, route planning and review of system functions		
Competence No. 8: Forecast weather and oceanographic conditions 8.1 Meteorology 8.1.1 The atmosphere: Diurnal variation of temperature, relative humidity, lapse rate, adiabatic changes, diurnal variation of pressure, geostrophic wind, gradient and cyclostrophic winds, doldrums, ITCZ. 8.1.2 Climatology: General distribution of surface temperature, surface current, sea fog, pattern of clouds in BIMMS area, global warming. 8.1.3 Tropical revolving storms: Knowledge of the characteristic of tropical revolving storms and various weather systems, avoidance of storm centres and the dangerous quadrants, signs of approaching TRS, messages required to be sent as per SOLAS, typical and possible tracks of TRS. 8.1.4 Weather forecasting: Cold and warm front, occlusion on a synoptic chart, codes on synoptic charts and prognostic charts, isobars on the weather chart, analysis of synoptic chart, MARFOR, information received by weather fax, wave charts, ice charts, shipping forecast, structure of weather bulletin & use of International code. 8.2 Oceanography 8.2.1 Ocean currents: Causes of ocean currents, characteristics of ocean currents, weather associated with ocean currents, charting of the current and main currents in the world oceans including BIMMS. 8.2.2 Waves: Speed, length, period, height & significance of waves, difference between waves and swell, significant wave height, fetch, wave period, wind rose. 8.3 Weather Routeing: Information of current, wind to select an optimum route IN BIMMS area, use of wave charts to select the best route, weather routeing services available to shipping, ship's performance curves. 8.4 Calculation of tides for standard and secondary ports in BIMMS Area. Use of Indian tidal tables. 8.5 Use of all appropriate nautical publications on tides and currents: Routeing charts, tide tables, current and tidal stream atlases.	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved laboratory equipment training	The likely weather conditions predicted for a determined period are based on all available information Actions taken to maintain safety of navigation and to minimise any risk to safety of the ship Reasons for intended action are backed by statistical data and observations of the actual weather conditions

Competence No. 9: Respond to navigational emergencies 9.1 Contingency Plans for Response to Emergencies: Muster list, assignment of duties to personnel, composition of emergency team, drawing of plans to deal with heavy weather damage, excessive listing, bilging & flooding, fire in specific areas, stranding, abandoning ship, spillage of noxious substances, piracy & armed robbery and collision. 9.2 Measures which should be taken in emergencies for the protection and safety of the ship, passengers and crew 9.2.1 Precautions to be taken when beaching a vessel – Circumstances in which the vessel is to be beached, precautions to be taken and procedure to be obtained while beaching. 9.2.2 Actions to be taken on stranding: Actions to be taken if stranding is imminent and after stranding, distress or urgency signal, discharge of harmful substances, assessment of damage control, refloating by stranded ship with & without assistance. 9.2.3 Actions to be taken following a collision: Duties of Master if collision is imminent and following a collision or impairment of the water tight integrity of the hull, measures to limit damage, salving own ship, log book entries. 9.2.4 Precautions for the protection and safety of passengers in emergency situations: Duties of some crew members to assist and muster passengers, precautions for the protection and the safety of passengers in emergency situations. 9.2.5 Means of limiting damage and salving the ship following a fire or explosion: Cooling of compartment boundaries, inspection for damage, procedures for making a man entry, use of fixed firefighting systems, rescue of persons from spaces, and continuous watch on damaged area. 9.2.6 Procedure for abandoning ship: Situations under which to abandon ship, duties of personnel, distress call transmission until acknowledgement, use of distress signal to attract attention, launching of boats and liferafts in heavy weather. 9.2.7 Use of auxiliary steering, and emergency steering gear - Change over bridge control to local control in the steering gear compartment, standard emergency steering procedures, proper communication from the bridge. 9.2.8 Arrangements for towing and being taken in tow: Emergency Towing Booklet, permission from owners for towing, early communication with the vessel being towed, procedure for towing in good and rough weather conditions, towing speed, bollard pull, Emergency Towing Arrangements 9.2.9 Rescue of persons from a vessel in distress or from a wreck: Waiting for daylight, selection of rescue boats. 9.2.10 Man-overboard procedures: Recovering a person from the sea in heavy weather, action to take when a person is reported missing at sea. 9.2.11 Actions which can be taken when emergencies arise in port (at berth or at anchor). 9.2.12 Actions to be taken in case of ship threatened by pirates or armed robbers, IMB, PRC, UKMTO,	Examination and assessment of evidence obtained from practical instruction, in-service experience and practical drills in emergency procedures	The type and scale of any problem is promptly identified and decisions and actions minimise the effects of any malfunction of the ship's systems Communications are effective and comply with established procedures Decisions and actions maximise safety of persons on board

MSCHOA, national regulations.		
Competence No. 10: Manoeuvre and handle a ship in all conditions 10.1 Manoeuvring when Approaching a Pilot Vessel or Station, with due regard to Weather, Tide, Head reach and Stopping Distance: Preparation of passage plan, contact with the pilot, preparation for picking up the pilot, readiness of anchors for letting go, making a lee for the pilot boat, understanding of head reach and stopping distance of the vessel while picking up pilot, rudder cycling. 10.2 Handling a Ship in Rivers, Estuaries, having regard to the Effects of Current, Wind and Restricted Water on the Response to the Helm and Stopping Distance: Shallow water effect, turning radius, increased directional stability, slow response by the steering at reduced speeds, squatting, effect of current and wind on helm response. 10.3 Berthing and Un-berthing under Various Conditions of Wind, Current and Tide, with or without Tugs' assistance: Effect of wind, current on handling of the ship while berthing and unberthing with or without tugs, interaction between ships, ship-tug interaction, bank cushion, bank suction, advantages of controllable pitch propeller (CPP), manoeuvring with twin screws, use of lateral thrusters, use of anchors in manoeuvring, 10.4 Anchoring Distance: Choice of anchorage, swinging circle, direction and strength of current, procedure of anchoring with one or two anchors in limited anchorages, factors involved in determining the length of anchor cable, dragging anchor, clearing foul hawse/anchor, slipping of anchor; Running, standing, open and Mediterranean moor. 10.5 Lighterage at Sea: Ship to ship transfer guide, Lighterage preparations for both vessels, method of separating on completion of transfer operations. 10.6 Dry-docking: Information required by dry dock authorities, ship plans, stern trim, critical condition, use of bilge blocks, breast shores, precautions before flooding the dock, floating dry dock, critical period of floating dry dock. 10.7 Management and Handling of Ships in Heavy Weather: Assisting a ship or air craft in distress, pooping, broaching-to, precautions to be taken before onset of heavy weather, towing operations, synchronous and parametric rolling, rolling period, 10.8 Determining Manoeuvring and Propulsion Characteristics of Major Types of Ships, with special reference to Stopping Distances and Turning Circles at Various Draughts and Speeds: Manoeuvring characteristics, sea-trial turning circle, turning circle in shallow water at various speeds, effect of wind on the behaviour of the ship, trials of steering ability, handling vessels with inadequate stability. 10.9 Practical Measures to be Taken when Navigating in Ice or Conditions of Ice Accumulation on	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved simulator training, where appropriate .3 approved manned scale ship model, where appropriate	All decisions concerning berthing and anchoring are based on a proper assessment of the ship's manoeuvring and engine characteristics and the forces to be expected while berthed alongside or lying at anchor While under way, a full assessment is made of possible effects of shallow and restricted waters, ice, banks, tidal conditions, passing ships and own ship's bow and stern wave so that the ship can be safely manoeuvred under various conditions of loading and weather

Board: Types of ice, sources of information on ice condition, ice sterns, measures to be taken when navigating in or near ice, precautions in entering ice, ice accommodation on board, Polar code, master's obligation to report, freezing sprays. 10.10 The Use of, and Manoeuvring in, and near Traffic Separation Schemes and in vessel traffic service (VTS) in BIMMS areas. 10.11 Importance of navigating at reduced speed to avoid damage to other ships/structures in restricted waters caused by own ship's bow wave and stern wave 10.12 Precautions in manoeuvring the ship to be able to launch rescue boats in bad weather		
Competence No. 11: Operate remote controls of propulsion plant and engineering systems and services 11.1 Marine Engineering Terms and Fuel Consumption: 11.1.1 Marine engineering terms: Mass, force, work, power, energy, stress and strain, heat and their units, efficiency of a machine, indicated & shaft power, propeller power and thrust. 11.1.2 Fuel consumption: Admiralty coefficient, fuel coefficient, fuel consumption, thermal efficiency, propeller efficiency, indicator diagrams, displacement and speed of a ship and relationship between them, fuel economy. 11.2 Auxiliaries: 11.2.1 Auxiliary boilers: Water tube and fire tube boilers, exhaust-gas heat exchangers, priming, safety valve, treatment of feed water. 11.2.2 Distillation and fresh-water systems: operation of a flash evaporator, reverse osmosis, domestic water system, drinking water treatment. 11.2.3 Pumps and pumping systems: Different types of pumps and its uses, (reciprocating, gear, screw, centrifugal, submersible, deep well pumps); typical bilge and ballast system for a dry cargo ship. 11.2.4 Steering gears: Different types of steering gears (ram, rotary vane, electrical), IMO requirements for steering gears, telemotor systems, IMO requirement for testing auxiliary and main steering gears 11.2.5 Generators, alternators and electrical distribution: Operation of an alternator, A. C. and D. C. distribution systems, use of circuit rackets & breakers. 11.2.6 Refrigeration, air-conditioning and ventilation: Properties of a refrigerant, vapour-compression cycle refrigeration plant, air conditioning plant, ventilation system for accommodation and ship holds. 11.2.7 Stabilisers: Construction and operation of fin stabiliser. 11.2.8 Sewage treatment plants: Operation of chemical and biological sewage treatment plants and regulations regarding discharge. 11.2.9 Oily-water Separators and oil filtering equipment: OWS; ODMCS; Proactive measures to prevent	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved simulator training, where appropriate	Plant, auxiliary machinery and equipment is operated in accordance with technical specifications and within safe operating limits at all times

pollution of marine environment. 11.2.10 Incinerators: functioning of a waste incinerator. 11.2.11 Deck machinery: Steam, electric and hydraulic drives, cargo winches, forward windlass, aft mooring winch. 11.2.12 Hydraulic systems: Ram & rotary-vane actuators, hydraulic accumulator, heating of oil. 11.3 Marine Power Plants: 11.3.1 Diesel engines: Types of diesel engines (2- stroke and 4- stroke), operation procedures, crankcase explosion, scavenge fire, and supercharging; F.O, L.O, and cooling water systems. 11.3.2 Steam turbine systems: Steam turbine and its gearing, working of an impulse and reaction turbine, 11.3.3 Propeller and propeller shaft: Sketch of a propeller, pitch, slip and efficiency of a propeller, indicated power, shaft power, delivered power and effective power; calculation of ship's speed, operation of controllable pitch propeller (CPP). 11.3.4 Bridge control: Bridge control system, bridge control of controllable pitch propeller, indicators and alarms, lateral thrusters. 11.4 Engine room watchkeeping 11.4.1 Arrangements necessary for appropriate and effective engineering watches to be maintained for the purpose of safety under normal circumstances and UMS operations. 11.4.2 Arrangements necessary to ensure a safe engineering watch is maintained when carrying dangerous cargo		

FUNCTION: CARGO HANDLING AND STOWAGE AT THE MANAGEMENT LEVEL

Knowledge, Understanding & Proficiency / Course Covered	Methods of demonstrating competence	Criteria for evaluating competence
Competence No. 12: Plan and ensure safe loading, stowage, securing, care during the voyage and unloading of cargoes 12.1 Dry Cargoes: 12.1.1 Timber deck cargoes: Code of safe practice for ships carrying timber deck cargoes, action if cargo is lost overboard, requirements when loading timber, stability information. 12.1.2 Loading, stowage and discharge of heavy weights: Load density, rigging of an heavy lift derrick, precautions while loading a heavy weight, 12.1.3 Procedures for receiving, tallying and delivering cargo: Special cargoes, tally sheets, mate's receipts, note of protest, parties to whom cargoes should be delivered.	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved simulator training, where appropriate Using: stability, trim and stress tables, diagrams and	The frequency and extent of cargo condition monitoring is appropriate to its nature and prevailing conditions Unacceptable or unforeseen variations in the condition or specification of the cargo is promptly recognised and remedial action is immediately

12.1.4 Care of cargo during carriage: Crushing, chafing, ventilation of cargo, Code of safe practice for cargo stowage and securing, Cargo Securing Manual 12.1.5 Container Carriers: Construction, types and marking of containers, Bay plans and stack weight, anti-heeling tanks, torsional stresses, lashing materials for securing containers, Container Code, Procedures for loading and carriage of refrigerated containers 12.1.6 Car Carriers, Reefer ships and Ro-Ro Ships: General outline, precautions when working cargo with these types of ships. 12.2 Cargo-handling Gear and Hatch Covers: 12.2.1 Requirements applicable to cargo-handling gear: Competent person, authorised person, loose gear, national laws for cargo operations, marking beams and portable hatch covers, thorough examination of cargo gear, Register for ship's lifting appliances and cargo handling gear 12.2.2 Maintenance of cargo gear: Inspection of cargo gear, maintenance of cargo gear, annealing of loose gear, testing of lifting appliances. 12.2.3 Maintenance of hatch covers: Side cleats and cross-joint wedge mechanism, tightness and hose testing before loading. 12.3 Keeping a Watch in Port 12.3.1 Arrangements necessary for appropriate and effective deck watches to be maintained for the purpose of safety under normal circumstances	stress-calculating equipment	taken and designed to safeguard the safety of the ship and those on board Cargo operations are planned and executed in accordance with established procedures and legislative requirements Stowage and securing of cargoes ensures that stability and stress conditions remain within safe limits at all times during the voyage
Competence No. 13: Assess reported defects and damage to cargo spaces, hatch covers and ballast tanks and take appropriate action: 13.1 Knowledge of the limitations on strength of the vital constructional parts of a standard bulk carrier and ability to interpret given figures for bending moments and shear forces. 13.2 Ability to explain how to avoid the detrimental effects on bulk carriers of corrosion, fatigue and inadequate cargo handling.	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved simulator training, where appropriate using stability, trim and stress tables, diagrams and stress-calculating equipment	Evaluations are based on accepted principles, well-founded arguments and correctly carried out. The decisions taken are acceptable, taking into consideration the safety of the ship and the prevailing conditions
Competence No. 14: Carriage of dangerous cargoes 14.1 Dangerous, Hazardous and Harmful Cargoes: 14.1.1 Dangerous goods in packages: SOLAS Ch. VII, IMDG code, MARPOL Annex III, dangerous cargo manifest, precautions when working with dangerous goods, port authority inspections before loading dangerous goods.	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience	Planned distribution of cargo based on reliable information and is in accordance with established guidelines and legislative requirements

14.1.2 Solid bulk cargoes: IMSBC code, main hazards with the shipment of bulk solids, precautions to be taken, Bulk carrier loading and unloading (BLU) code, precautions to be taken prior entering cargo holds. 14.1.3 Grain Cargoes: SOLAS Ch. VI, IMO grain code, securing free grain surface in partly failed compartment, grain loading stability booklet and related calculations 14.1.4 Arrangements necessary to ensure a safe deck watch is maintained when carrying hazardous cargo 14.2 Outline knowledge of Tanker Operations: 14.2.1 Terms and definitions: General knowledge of tankers, tanker arrangement, cargo piping systems, cargo pumps and tanker operation, crude oil, refined products, spiked crude, sour crude, Reid vapour pressure, upper flammable and lower flammable limit, flammability diagram 14.2.2 Contents and application of the International Safety Guide for Oil Tankers and Terminals (ISGOTT) 14.2.3 Oil tanker operations and related pollution-prevention regulations: Segregated ballast, clean ballast, dirty ballast, slop tank, inert gas system, COW, cleaning and gas freeing tanks, loading and discharging operations on a tanker. 14.2.4 Chemical tankers: SOLAS Ch VII, MARPOL Annex II, dedicated or parcel trades, rules regarding chemical tankers, IMO conventions covering the carriage of chemicals in bulk, BCH and IBC codes, categories of cargo, hazards, types of tank coatings, P & A manual, equipment for evaluation of tank atmosphere, pre-arrival check list, types of tanks, and tank arrangements with piping. 14.2.5 Tank cleaning and control of pollution in chemical tankers: Phases in tank cleaning operations, use of fixed or portable tank washing machines, hazards in tank cleaning, use of slop tanks, cycle of a tank washing system. Annex II of MARPOL 73/78. 14.2.6 Gas tankers: Ch. VII of SOLAS, SIGGTO, LNG, LPG, LEG and chemical gases, IGC code, certificate of fitness, various types of ships, various types of tanks, reliquification plant, deep well pump, pre-arrival checklist 14.2.7 Cargo operations in gas tankers: Information needed before loading, various cargo operations, hazards with cargo operation with gas tankers. 14.3 Methods and Safeguards when Fumigating Holds: Reasons for the control of pest, International health regulations, and precautions when the vessel is fumigated. 14.4 Cargo Calculations: 14.4.1 Draft Survey and related Calculations. 14.4.2 Cargo Calculations: Use of ASTM tables for calculating cargo in a tank, excluding mixture/blend	.2 approved simulator training, where appropriate .3 approved specialist training	Information on dangers, hazards and special requirements is recorded in a format suitable for easy reference in the event of an incident

of cargoes. 14.5 Use of stability and trim diagrams and stress-calculating equipment, including automatic data-based (ADB) equipment, and knowledge of loading cargoes and ballasting in order to keep hull stress within acceptable limits.		

FUNCTION: CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD AT THE MANAGEMENT LEVEL

Knowledge, Understanding & Proficiency / Course Covered	Methods of demonstrating competence	Criteria for evaluating competence
Competence No. 15: Control trim, stability and stress 15.2 Ship Construction: 15.1.1 - Welding: Down hand vertical and overhead welding, butt, lap, tack and fillet welds, chain and intermittent welding, weld faults, tests of welds, electric arc welding, TIG and MIG, resistance welding and submerged arc welding (SAW) - Bulkheads: Regulations, types of bulkheads, transverse bulkheads and racking stresses, margin line, weather tight, rule regarding penetration of collision bulkhead, testing of bulkheads for water tightness. - Watertight and weather-tight doors: Water tight and weather tight doors, categories of watertight doors, rules regarding water-tight doors, records of drills and inspections, ramp doors of Ro-Ro vessel, ship side doors, hinged and power operated doors. - Corrosion and its prevention: corrosion, erosion and corrosion triangle, stress concentration, types of corrosion, galvanic actions, cathodic protection, impressed current system, structure and purpose of paint constituents, treatment of steel in a shipyard, preparing a surface for painting, Material Safety Data Sheets, typical paint schemes, wetted surface area. - Surveys, certification & dry-docking: Statutory and mandatory surveys, frequency of classification society surveys, items to examine in dry dock, cleaning preparation and painting of the hull in dry dock. Surveys and certification including Harmonised Ship Surveys and Enhanced Surveys, Condition Assessment Scheme and Condition Assessment Programme. 15.1.2 - Ship building materials: Use of high tensile steel and aluminium in shipbuilding, properties of steel, stress and strain curve - Ship yard practice: General layout of a ship yard and co-operation between departments, ship's plans and test for ship building steel	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate	Stability and stress conditions are maintained within safe limits at all times

- Understands brief outline of
 - .1 load line convention: assignment of freeboard, multiple load lines, type A and type B ships, load line survey.
 - .2 tonnage convention: GT, NT, excluded spaces, enclosed spaces
 - .3 passenger ships subdivision: floodable length, permissible length, sub divisional load line
 - .4 fire integrity of ships: types of bulkhead, standard fire test.
- Midship section of ships and outline of constructional features of different types of ships.

15.2 Stability:

15.2.1

- Approximate calculation of areas and volumes: Simpson's rule to calculate areas, volumes and centroids.
- Effects of density: TPC, FWA, DWA, fore and aft drafts, and calculations
- Calculation of free Surface effect
- Simplified stability data: Stability information supplied in simplified form, use of diagrams of dead weight moment, minimum permissible GM.
- Trim and list: LCG, LCB and relationship with trim, trimming moment, MCTC and effect of change of density on MCTC, loading a given mass to produce a required trim, loading a mass to keep the aft draught constant, correction of draughts, forward aft and mid-ship, use of trim tables, KN curves, effect on GZ due to shift of weights, effect of change in length, breadth and freeboard on GZ curve, area under GZ curve.
- Dynamical stability: Definition of dynamical stability and calculation of same.
- Intact stability requirements for carriage of the grain, use of maximum permissible VHM curves; and related calculations
- Dry-docking and grounding: Virtual loss of GM due to dry docking and grounding, critical instant, critical period, up thrust, calculation of residual GM and draft.

15.2.2

- Moments of inertia calculations, liquid pressure and centre of pressure, theorem of parallel axis, thrust due to liquid pressure, BM_i and BM_t .
- Stability at moderate and large angles of heel: $GZ = GM \sin \theta$ for angles of heel up to 10° , $GZ = (GM + \frac{1}{2} BM \tan^2 \theta) \sin \theta$, $BM = I/V$, $KM = KB + BM$.
- Approximate GM by means of rolling period tests
- Inclining test: Procedure and precautions when carrying out inclining test and calculation of KG.
- Recommendation on intact stability for passenger and cargo ships: Precautions against capsizing, recommended criteria for passenger and cargo ship, stability information, IMO

wind criteria, heel while turning. - Rolling of ships: Effect of GM on rolling, effect of draught and displacement on rolling, function of bilge keels, synchronous and parametric rolling, anti-rolling tanks and stabiliser fins to reduce the amplitude of rolling. - Shear force, bending moments and torsional stress: Meaning of shear force, bending moments and torsional stresses, diagram of shear force and bending moments, maximum permissible torsional moments, draws a diagram of shear force and bending moment. - Flooding of compartments: Margin line, permeability of a space, floodable length, permissible length of compartment, factor of sub division, type A, type B ships. - Effect of flooding on transverse stability: Virtual loss of GM due to flooding, permeability of cargo, effect of bilging due to flooding of mid-ship compartments. - Effect of flooding on trim: Calculation of movement of centre of rotation, calculation of the reduction of MCTC, given the dimension of bilged space, calculates the draft in damaged condition.		
Competence No. 16 Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea and protection of the marine environment. 16.1 Introduction to Maritime Law 16.2 Law of the Sea: Conventions on the law of the sea, Territorial sea and the contiguous zone, International straits, Exclusive economic zone and continental shelf, High seas. 16.3 Safety: Outline knowledge of the following safety conventions: 16.3.1 International Convention on Load Lines, 1966 (LL 1966), as amended 16.3.2 International Convention for the Safety of Life at Sea, 1974 as amended (SOLAS) 16.3.3 International Convention on Standards of Training, and Watchkeeping for Seafarers, 1978 (STCW) as amended 16.3.4 Convention for the suppression of unlawful act against the Safety of Maritime Navigation 1988 as amended 16.3.5 ITU Radio Regulations 16.4 Pollution: Outline knowledge of the following pollution conventions and their amendments: 16.4.1 International Convention for the Prevention of Pollution from Ships, 1973. 16.4.2 London Dumping Convention (LDC). 16.4.3 Intervention convention. 16.4.4 Civil Liability convention (CLC) and Fund Convention. 16.4.5 Oil Pollution Preparedness, Response & Co-operation Convention (OPRC)	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate	Procedures for monitoring operations and maintenance comply with legislative requirements Potential non-compliance is promptly and fully identified Planned renewal and extension of certificates ensures continued validity of surveyed items and equipment

16.4.6 Precautions, which should be taken by the master to prevent operational pollution: Use of oil record book, IOPP certificate. 16.4.7 Precautions which should be taken by the master to prevent accidental pollution: Routine checking and maintenance of equipment, proper communication during oil operations, protection and preservation of the marine environment. 16.4.8 Reporting of incidents: need for prompt reporting, meaning of probability of discharge 16.5 Passengers 16.5.1 Special Trade Passenger Ships Agreement. 16.5.2 Protocol and Rules on Space Requirements for Special Trade Passenger Ships, 1973 16.5.3 Athens Convention relating to the Carriage of Passengers and their Luggage by Sea 16.6 Tonnage 16.6.1 International Convention On Tonnage Measurement of Ships, 1969 as amended. 16.7 ILO Maritime Labour Convention (MLC)-2006 a) Minimum requirements for seafarers to work on ships: minimum age, medical certificates, training and qualification, recruitment and placement. b) Conditions of Employment: Seafarers Employment Agreements, Wages, Hours of Work and Hours of Rest, Entitlement to Leave, Repatriation, Seafarer compensation for the ship's Loss or Foundering, Manning Levels, Career and Skill Development and Opportunities for Seafarers' Employment c) Accommodation, Recreational Facilities, Food and Catering d) Health Protection, Medical Care, Welfare & Social Security Protection: Medical Care on-board ship and Ashore, Ship-owners' Liability, Health & Safety Protection and Accident Prevention, Access to Shore-based Welfare Facilities, Social Security e) Compliance and Enforcement i) Flag State Responsibilities: General Principles, Authorization of Recognised Organizations, Maritime Labour Certificate and Declaration of Maritime Labour Compliance, Inspection and Enforcement, On-board Complaint Procedures, Marine Casualties iv) Port State Responsibilities: Inspections in Port, Detailed Inspection, Detentions, On-shore Seafarer Complaint Handling Procedures v) Labour-supplying Responsibilities: Recruitment and Placement services, Social security 16.8 Arrival Documents and Procedures as amended: 16.8.1 International Health Regulations (IHR) 16.8.2 Convention on Facilitation of International Maritime Traffic, (FAL 1965) 16.8.3 Noting protests 16.9 Collision 16.9.1 International Convention for the Unification of Certain Rules of Law with respect to Collision		

between Vessels, and Relating to Penal Jurisdiction in Matters of Collision or other Incidents of Navigation 16.11 Assistance and Salvage 16.10.1 International Salvage Convention 16.10.2 Lloyd's Standard Form of Salvage Agreement (LOF) 16.11 Convention on Limitation of Liability for Maritime Claims 16.12 Classification Societies 16.12.1 Overview of all classification society rules 16.13 Cargo 16.13.1 International Convention for the Unification of Certain Rules of Law relating to Bills of Lading (Hague-Visby Rules), Hamburg Rules and Rotterdam rules. 16.13.2 Charter-parties- voyage, time, demise charter party; contract of affreightment; 16.14 General Average and Marine Insurance 16.14.1 The York-Antwerp Rules: General average act, sacrifice, rights to contribution. 16.14.2 Marine insurance: voyage, time and floating policy; perils covered. 16.15 Certificates and Documents required to be Carried by International Conventions and Agreements 16.16 National Maritime Legislation: 16.16.1 General provisions of Merchant Shipping Act & brief outline of Rules made thereunder		
Competence No. 17: Maintain safety and security of the ship's crew and passengers and the operational condition of life-saving, firefighting and other safety systems 17.1 A thorough knowledge of life-saving appliance regulations (International Convention for the Safety of Life at Sea) - LSA Code 17.2 Organisation of fire and abandon ship drills 17.3 Maintenance of operational condition of life-saving, fire-fighting and other safety systems 17.4 Actions to be taken to protect and safeguard all persons on board in emergencies 17.5 Actions to limit damage and save the ship following a fire, explosion, collision or grounding 17.6 Safety and Security of the ship's crew and passengers: Safety committee, maintenance of safety equipment, care and maintenance of rope wires, code of safe working practices, dock safety regulation, Reporting of accidents, ISPS code, security levels and duties, actions in case of piracy	Examination and assessment of evidence obtained from practical instruction and approved in-service training and experience	Procedures for monitoring fire-detection and safety systems ensure that all alarms are detected promptly and acted upon in accordance with established emergency procedures

or armed robbery, 17.7 Ship maintenance and repairs: Planned maintenance, maintenance of ropes, wires, accommodation ladders, pilot hoists/ ladders, W/T doors, mooring equipment, hatch covers and cargo handling equipment.		
Competence No. 18: Develop emergency & damage control plans & handle emergency situations 18.1 Emergency situations 18.1.1 Demonstrates the knowledge of preparation of contingency plans for response to emergencies: Drawing plans to deal with emergencies, legal aspects and seamanship practises. 18.1.2 Understands ship construction with regards to damage control 18.1.3 Explains methods and aids for fire prevention, detection and extinction: Fire prevention procedures, different types of fires and firefighting equipment to be used, fighting fire on different types of ship. 18.1.4 Understands functions and use of life saving appliances: Different types of emergencies, actions taken, lifesaving appliances and instructions to use it.	Examination and assessment of evidence obtained from approved in-service training and experience	Emergency procedures are in accordance with the established plans for emergency situations
Competence No. 19: Use of leadership and managerial skills 19.1 Knowledge of shipboard personnel management and training 19.2 A knowledge of related international maritime conventions and recommendations, and national legislation 19.3 Ability to apply task and workload management, including 19.3.1 planning and co-ordination 19.3.2 personnel assignment 19.3.4 time and resource constraints 19.3.5 prioritization 19.4 Knowledge and ability to apply effective resource management 19.4.1 allocation, assignment, and prioritization of resources, 19.4.2 effective communication on board and ashore, 19.4.3 decisions reflect consideration of team experiences, 19.4.4 assertiveness and leadership, including motivation, 19.4.5 obtaining and maintaining situation awareness 19.5 Knowledge and ability to apply decision-making techniques 19.5.1 situation and risk assessment, 19.5.2 identify and generate options, 19.5.3 selecting course of action,	Assessment of evidence obtained from one or more of the following: .1 approved training .2 approved in-service experience .3 approved simulator training	The crew are allocated duties and informed of expected standards of work and behaviour in a manner appropriate to the individuals concerned. Training objectives and activities are based on assessment of current competence and capabilities and operational requirements. Operations are demonstrated to be in accordance with applicable rules

19.5.4 evaluation of outcome effectiveness 19.6 Development, implementation, and oversight of standard operating procedures		Operations are planned and resources are allocated as needed in correct priority to perform necessary tasks. Communication is clearly and unambiguously given and received. Effective leadership behaviours are demonstrated. Necessary team member(s) share accurate understanding of current and predicted vessel and operational status and external environment. Decisions are most effective for the situation. Operations are demonstrated to be effective and in accordance with applicable rules.
Competence No.: 20 Organise and manage the provision of medical care on board. Medical care course	Examination and assessment of evidence obtained from approved training course.	Action taken and procedures followed correctly apply and make full use of advice available. IMO Model Course No. 1.15 on Medical Care

Notes:

- 4)** The requirement as stated in the DG Circular's dealing with Upgradation of Masters and Deck Officers are in any case need to be complied with, where applicable.

1-MONTH ADVANCED SHIPBOARD MANAGEMENT (ASM)
COURSE FOR MASTER NCV EXAM

**MASTER'S OF NEAR COASTAL VOYAGES COURSE
(NCV)**

Duration – 45 days

SYLLABUS: ADVANCED SHIPBOARD MANAGEMENT

Examination:

Time: 3 hours

Marks: 200

Pass Marks: 100

S. No	Topic	Hours
1	<i>Indian Merchant Shipping Act</i>	13
a	Registration of ships: The certificate of registry and its legal significance. [2 hrs]	
b	Engagement, discharge and management of crew. Manning scales and certification. Contracts of employment, wages and other remuneration, advances, allotments, payment into bank accounts. Descriptions, deceased seamen, engagement of substitutes, repatriation, assisting and repatriating Indian seamen distressed abroad. [2 hrs]	
c	The official log book and the law relating to entries. Offences relating to misconduct, to endangering ship and against persons on board. Discipline and treatment of disciplinary offences. Civil liability for certain offences. Trade disputes involving seamen. The official log book entries and records in freeboard draft and allowances. [2 hrs]	
d	Crew accommodation. Hygiene of the ship and welfare of the crew. Outline knowledge of the regulations relating to medical stores. Inspection and reports. Fresh water and provisions. Procedures in cases of infectious disease, illness or accidents. Maritime declarations of health. Port health requirements. International agreements and measures to prevent the spread of disease by shipping. [2 hrs]	
e	The safety of the ship, crew and passengers. Assistance of vessels in distress and salvage. Master's duties in the case of collision or any other accident. Master's role in collecting evidence after an accident. Lodging protests etc. Inquiries and Investigation. [3 hrs]	
f	The law relating to the reporting of ice, derelict, tropical revolving storms and other dangers to navigation. [1 hr]	
g	Outline knowledge of the rules made under the Merchant Shipping Act. [1 hr]	
2	Documentation: <i>Certificates and other documents required to be carried on</i>	3

	<i>Passenger ships, tankers, Gas carriers, Chemical carriers, Car/Truck carriers, Bulk carriers. Procedures to obtain the above-mentioned certificates and the period of their validity. Other Trading certificates (Suez and Panama Canal certificate, CFR) that are required to be carried on board.</i>	
3	Custom house procedures: <i>Inward and outward clearance, Immigration clearance, quarantine clearance (FAL Convention).</i>	2
4	<i>Methods of dealing with stowaways, hijacking of ships, armed robbery / piracy, smuggling and other custom offences, drug and alcohol policy and its enforcement</i>	6
5	Master – Pilot relationship: <i>Exchange of information, responsibilities. Compulsory and optional pilotage. Bridge Team Management while under pilotage. Legal implications if an incident occurs when under pilotage.</i>	4
6	<i>Economics of sea transport theory of international trade, general structure of shipping industry relationship between ship-owner, agent, stevedore, charterer, shipper and broker. Detailed knowledge of voyage estimates including cargo calculations involving deadweight, loadline zones, consumables and constants taking into account various charges, receipts and establishing economic viability</i>	12
7	<i>A general knowledge of shipping practice and documents with particular reference to charter parties and its Main clauses, bills of lading and its Main clauses and mates' receipts for various types of ships and trades including tanker practice, meaning of the terms used in chartering practice such as AFRA, WORLDSCALE, INCOTERMS</i> <i>An understanding of the main clauses in a contract of affreightment including freight, deviation, always afloat, ice, lay days, demurrage and dispatch including calculations involving lay days, charter party, etc. The law relating to the carriage of cargo and ship-owners', liabilities and responsibilities. Protests, cargo surveys, certificates of seaworthiness. Hague rules, Hague – Visby rules, Hamburg rules, Rotterdam Rules COGSA, Multimodal Transport Act. Handling of claims and disputes related to Charter parties.</i>	3 16
8	<i>Outline knowledge of the expressed and implied conditions and statutory terms contained in a contract of marine insurance. Institute clauses. An understanding of principles and practice of the terms; particular average, general average. Procedure at a port of refuge. Lloyd's agents. Average adjusters. P & I clubs, LOF 2000, LOF 2011, Scopic clause. Warranties, CLC, Fund convention, York-Antwerp rules.</i>	15
9	International institutions: <i>IMO, ILO, WHO, ISF, IACS, BIMCO, ICS, OCIMF, SIGTTO, INTERTANKO, INTERCARGO, WTO, IMCA, IFSMA, WMU,</i>	2

	<i>IMLI and classification societies.</i>	
10	<i>Latest changes in national and international maritime legislation pertaining to SOLAS, MARPOL, Load line and STCW</i>	6
11	Control procedures: <i>Classification surveys, Flag State Control, Port State Control, Charterer's vetting inspections, inspections by port terminal authorities, Condition surveys.</i> Port State Control: <i>Working and targeting by various MOUs; "Clear grounds" to conduct detailed inspection; Identification of sub-standard ships; "Detention" of ships. Common deficiencies observed as reported by the various MOUs annually.</i>	3
12	<i>Principles and practice of modern ship management -ISPS Code, ISM Code, methods to prevent human errors on ship, Human Resource Development</i>	6
13	<i>Casualty Investigation Code (Guidelines on fair treatment of seafarers in event of a maritime accident). Criminalisation of seafarers: Seafarers Rights under a Casualty investigation. Case Studies. Reporting procedures for Incidents. Writing Reports.</i>	4
14	<i>Musters and drills, distress/urgency/safety messages. Avoidance of False distress alerts and action in case of false distress alert. Search and Rescue, steps to be taken when disabled & in distress, assisting a ship or aircraft in distress. IAMSAR</i>	3
15	<i>Place of refuge procedures. Wreck, Salvage and their legal implications.</i>	3
16	<i>Ligherage operations, Ocean Towing. Duties and responsibilities of Towing & Towed vessel, Communications and exchange of information between towing and towed vessel. Emergency Towing arrangements; Maritime Assistance Service on Indian coast (when applicable)</i>	2
17	Emergency Response Procedures: <i>Fire in Port & at Sea, grounding, collision, collision mats, Pollution, Flooding, Engine failure, Listing, Beaching, Steering failure, refloating of vessel. Man-overboard, Helicopter Rescue Operation; Leakages and spills of dangerous cargo; Rescue of victims from enclosed spaces; Rescue of Survivors from another vessel or sea</i>	10
18	Case Studies: <i>(Recent casualties such as MSC Chitra and Khalijia 3, M.V.Tosa, Hebei Spirit and Samsung crane barge, Herald of Free Enterprise, Cosco Busan)</i>	8
19	<i>Anchoring & Berthing under the effect of tide / wind in shallow / deep waters, use of Anchors, squat, interaction between ships / shore, transverse Thrust & turning the ship short round, pivot point, dragging / dredging anchors; Different types of tugs and use/limitation of each; Berthing with/ without tugs under various conditions of wind, current and</i>	10

	<i>tide. Effectiveness of bow and stern thrusters.</i>	
20	<i>Manoeuvring and handling of ship in all conditions; Ship's maneuvering characteristics; Wheelhouse poster; Emergency stopping manoeuvres, crash stop, rudder cycling. Synchronous rolling, Parametric rolling, wind heeling criteria for high freeboard ships; Picking up Pilot; Maneuvering in and near Traffic Separation Schemes and VTS areas; STS Operations.</i>	10
21	Environmental Protection: <i>Marpol Annexes I to VI, SOPEP/SMPEP, Vessel Response Plan, oil record book. Ballast Water Management, OPA 90 & NPDES. (National Pollution Discharge Elimination System of U.S.A.)</i>	3
22	Operating in ice: <i>Basic ship handling in ice, sighting of ice / open water, working through ice, navigation in ice. High latitude Navigation – procedures & precaution. Polar Code. effects of ice accretion on stability of vessel</i>	4
23	Safety Management: <i>Case studies on Risk Assessment; Managing Risk on board; Briefings / debriefings and toolbox meetings;</i> <i>Case studies for Safety on deck in rough weather;</i> <i>On-board Training;</i> <i>Incidents related to Enclosed Space Entry Procedures; Hot Work Procedures;</i>	8
24	<i>Damage Stability Criteria and Damage stability booklet Proper assessment of damage stability condition – using ETAS (Emergency Technical Assistance Service) provided by classification societies. An understanding of the information required to be passed on for assessment of Damage Stability</i>	4
25	<i>Weather Routeing and Voyage Planning; Procedures for selection of an optimum route; Various weather routeing services available to shipping; Vessel Performance curves, hind-cast charts;</i>	4
26	<i>Various ship plans used in Cargo Loading / discharging, dry docking, Grounding, Dry-docking both intact and with damage; Preparation of Repair Specifications</i>	4
27	<i>COLREGS, related case studies and Interaction with participants</i>	16
28	<i>Ship Recycling Convention: Hazardous Materials inventory, Green Passport.</i>	2
29	<i>Global Warming and climate change, Greenhouse effect, Carbon credit, Kyoto protocol,</i>	3
30	<i>Dangerous Goods: Recent amendments to IMDG code</i>	3
31	<i>Assessment & Feedback (including internal assessments)</i>	6

**Total Duration: 198 hours = 33 working days (6.5 weeks
or 45 calendar days)**

Note:

- 1) In addition to the above ASM course, all existing Officers in possession of Certificate of Competency under STCW 1995 are required to undergo Upgradation Course for Chief Mates and Masters (STCW 1995 to STCW 2010) and practical training as in Note 2 before issuance of Master F.G Certification under STCW 2010.

2) PRACTICAL TRAINING

a	ECDIS (See Note 3)	Approved Training Course	40 hours	As per IMO Model Course No. 1.27 revised
b	Refresher Training in Personal Survival Techniques and Proficiency in Survival Crafts and Rescue Boats	Practical Training at institute approved for PSCRB Course	1 day (6 hours)	Identified items under STCW 2010
c	Refresher Training in Fire Prevention and Fire Fighting and Advanced Fire Fighting	Practical Training at institute approved for AFF Course	1 day (6 hours)	Identified items under STCW 2010

- 3) Training and assessment in the use of ECDIS is not required for those who serve exclusively on ships not fitted with ECDIS. This limitation shall be reflected in the certificate of competency.
- 4) Officers who have **not** undergone Ship Security Officer (SSO) training are required to undergo approved training course for Seafarers with Designated Security Duties in accordance with Regulation VI/6-2 (this does not form part of CoC Revalidation)

6-MONTH PRE-SEA EDUCATION AND TRAINING COURSE
FOR DECK / G.P. RATINGS

***PRE-SEA TRAINING COURSE FOR GENERAL PURPOSE
(GP) RATINGS IN COMPLIANCE WITH STCW
CONVENTION AS AMENDED IN 2010***

Annexure 1

COURSE OUTLINE

Total Duration of the Course – 25 weeks (on the basis of 42 contact hours per week)

Parts/Title	Theory Hrs	Practical's Hrs	Total contact	Weeks
Part 1 Induction, personality & communication skills development, general knowledge about shipping and ships, and introduction to computers	92	102	194	4
Part 2 General Ship Knowledge (Seamanship and Navigation) at Support Level	58	146	204	5
Part 3 Marine Engineering Knowledge and Practice at Support Level	99	257	356	9
Sub Total of Part 1 + Part 2 + Part 3	249	505	754	18
Part 4 Mandatory STCW Courses and Ship Visit				
A. Proficiency in Survival Techniques (TC 31 of 2004)	10	5	15	
B. Elementary First Aid (TC 30 of 2004)	10	5	15	
C. Fire Prevention and Fire Fighting	13	5	18	
D. Personal Safety and Social Responsibility (STCW2010 TC13 of 2012)	18	0	18	
E. Oil Tanker Familiarization	30	0	30	
F. Security Training for Seafarers with Designated Security Duties (STCW 2010 TC 27 Of 2012)	13	1	14	
G. Port/Dock/Harbour/Ship Visit	01	7	08	
Total of Part 4	95	23	118	3
Part 5 Revision/Assessment (Internal and External)	40	43	83	2
Total of Part 1 to Part 5	384	571	955	23
Part 6 Upkeep of the campus (three hours per week for 13 weeks) (Supervised by Instructors)			39	1
Part 7 Holidays/passing out/etc.			42	1
GRAND TOTAL (Part 1 to Part 7)			1036	25

Annexure 2

Outline of each part of the course

Annexure 2 A

Title	T Hrs	P Hrs	Total Hrs	Wks
Part 1 – General Aspects: Induction to the course, personality and communication skills development, general knowledge about shipping and ships, and introduction to computers.	92	102	194	4

(Please see Appendix 1A Specific Learning Objectives)

S. No.	Topics & sub topics	Theory	Practical
1.1	English speaking, reading, writing (using topics 1.5 and 1.6 and charts and reading material)	20	40
1.2	Computers (Familiarization)	6	30
1.3	Discipline, etiquettes and Gender Sensitization	3	8
1.4	Health and Hygiene	4	4
1.5	General Aspects of Shipping 1.5.1 Importance of Shipping in the National and International Trade & International Routes 1.5.2 Types of Ships and Cargoes 1.5.3 Shipboard Organization	8	0
1.6	Nautical Terms – Parts of the Ship (Using ship models and video) 1.6.1 Hull 1.6.2 Ships Decks 1.6.3 Fore Castle 1.6.4 Poop Deck 1.6.5 Accommodation: - (Teaching Aid: Video) 1.6.6 Bridge: - (Teaching Aid: Video) 1.6.7 Monkey Island 1.6.8 Cargo Spaces (Cargo Holds, Tanks) 1.6.9 Cargo Handling Gear (Derricks, Cranes, Grabs, Pumps) 1.6.10 Machinery Space (Engine Room/Pump room)	10	0
1.7	General Shipboard Safety and Health 1.7.1 Personal Protection and Personal Protection Equipment 1.7.2 Safe working practices for merchant seaman (including permit to work system, and fire prevention aspects, Safety Precautions when working aloft, Safety Precautions when working over side) 1.7.3 Risk Assessment (Basics) 1.7.4 Emergencies 1.7.5 Safe Access to the Ship 1.7.6 Safe Working Practices during Berthing / Unberthing, and Anchoring	20	16
1.8	Protection of Environment 1.8.1 Sources of pollution at Sea from ship & Damage to the environment 1.8.2 Importance of prevention of pollution of the sea 1.8.3 Ways and means of preventing pollution 1.8.4 Pollution prevention equipment on board	8	4
1.9	National Shipping Organization - Documents for seafarers, logbooks, disciplinary procedures, rights of a seaman, Seaman's Identity Document, INDoS No., Certificates for ratings, Recruitment and Placement of Seafarers Rules, Collective bargaining agreement contract of employment.	6	0

1.10	International Organizations and Conventions	7	0
	Total	92	102

Title	T Hrs	P Hrs	Total Hrs	Wks
Part 2 General Ship knowledge (Seamanship and Bridge duties at Support Level)	58	146	204	5

Annexure 2 B

General Ship Knowledge
(Seamanship and Bridge duties at Support Level)
(Please see Appendix 1B Specific Learning Objectives)

S. No.	Topics & sub topics (indicative hours Theory + Practical)	Theory	Practical
2.1.	Seamanship 2.1.1 Ropes & Rope work 2.1.2 Blocks and Tackles 2.1.3 Rigging of 'Pilot ladder', 'Bosun's Chair', 'Stage', Climbing a Mast 2.1.4 Cargo Gear, Derricks, Cranes, Grabs, Gantry, spreaders, Cargo Pumps, 2.1.5 Cargo Spaces, Opening & closing of hatches, Cargo lashing equipments 2.1.6 Safe handling, stowage & securing of cargoes & stores 2.1.7 Preparing a ship for departure/ rough weather/arrival 2.1.8 Berthing & unberthing of a ship (mooring) Anchor operation, anchor work	25	88
2.2.	Ship Maintenance 2.2.1 Preparation of surface Using mechanical/pneumatic equipment 2.2.2 Painting 2.2.3 Lubrication and Greasing of Deck equipment	4	30
2.3.	Basic Navigation, Operate emergency equipment & apply emergency procedures 2.3.1 Navigation Terms 2.3.2 Rules of the Road (elementary) & Buoyage 2.3.3 Navigational aids on the Bridge of a Modern Cargo ship 2.3.4 International Code of Signal & Flags 2.3.5 Knowledge of emergency duties & alarm signals 2.3.6 Knowledge of pyrotechnics & distress signals, EPIRBs & SARTs, avoidance of false distress alerts & action to be taken in event of actual activation	17	6
2.4.	Look Out Duties, other bridge duties and reporting system 2.4.1 Responsibilities of a lookout & reporting (day/night, clear/Restricted visibility by degrees & points) including relieving	4	10
2.5.	Duties of a Gangway Watch in Port (introduction to ISPS Code)	4	0
2.6.	Steer the ship & comply with Helm orders 2.6.1 Compass & Errors	4	12

	2.6.2 Helm Orders & change over auto to hand & vice versa		
	Total	58	146

Title	T Hrs	P Hrs	Total Hrs	Wks
Part 3 Marine Engineering knowledge and Practice (at Support Level	99	257	356	9

Annexure 2 C
Marine Engineering Knowledge and Practice
(Please see Appendix 1C for Specific Learning Objectives)

	Marine Engineering Knowledge & Practice (at support Level)	Suggested (Hrs)	
S.No.	Topic & Sub topics	Theory	Practical
3.1	Familiarization with duties and Engine Room environment ➤ Duties of a Trainee Rating in the Engine Room ➤ Engine Room Space ➤ Engine Room Machinery ➤ Auxiliary Machinery ➤ Symbols used in the engine room ➤ Engine Room watch keeping procedures	7	0
3.2	Instruments (Thermometers, pressure gauges, level gauges)	2	0
3.3	Safe working procedures, Tools & instruments ➤ Hand Tools, Measuring instruments ➤ Lifting devices and equipment, Basic fitting, Fasteners ➤ Safety precautions while working in the engine room ➤ Safety precautions during bad weather ➤ Safety precautions during hot work ➤ Safety precautions while working on electrical equipments ➤ Safety precautions before entering enclosed spaces ➤ Safety precautions during dry dock ➤ Cleaning of engine room bilges, disposal of engine room waste ➤ Bilge pumping system ➤ Ballasting & de-ballasting system, bunkering procedures ➤ Maintenance work & preservation	12	86
3.4	Auxiliary Equipment & maintenance work ➤ Valves ➤ Pumps and Pumping Systems including ballasting & Deballasting ➤ Joints and gland packing ➤ Filters ➤ Centrifugal separators ➤ Other Auxiliaries ➤ Boiler and Steam System & watch keeping duties ➤ Propeller & shafting ➤ Preservation of equipment in good condition	26	25
3.5	Identify components of diesel engines listed below: ➤ Generator Engines ➤ Main Engine	8	12
3.6	Compressed air for auxiliary purposes	2	0
3.7	Machines: Grinder, Drill, Lathe	3	60
3.8	Basic welding and cutting: Arc welding, gas welding, gascutting	3	60
3.9	Lubricants and lubrication	2	4
3.10	Level measuring devices and techniques	1	0
3.11	Lagging and insulation	1	0
3.12	Safe use of electrical equipment ➤ Hand tools for electrical maintenance ➤ Electrical Components & Equipment ➤ Electrical instruments & electrical safety	4	6
3.13	Chemicals on board	1	4

3.14	Steering Gear ➤ Function of steering gear, check to be made while taking a round in the steering gear compartment ➤ Bow thruster location & importance	3	0
3.15	Storage tanks ➤ Types of storage tanks in the engine room ➤ Purpose & operation of quick closing valves	2	0
3.16	Emergencies in the engine room ➤ Various emergencies in the engine room ➤ Types of audio-visual alarms ➤ Action to be taken on hearing/seeing alarms ➤ Emergency escape routes	4	0
3.17	Fire extinguishing equipment in the engine room ➤ Portable fire fighting appliances in the engine room ➤ Fixed firefighting equipment i.e CO₂, Foam, Water Sprinkler, Hyper Mist, Emergency Fire Pump	4	0
3.18	Basic Marine Engineering at Support Level ➤ Engineering Materials & Special Tools used for maintenance of Engine Room main & auxiliary machineries ➤ Watch keeping duties on main & auxiliary machineries including boilers ➤ Working of Diesel engine, air compressor, evaporator, oily bilge separator, AC & fridge plant ➤ Remote operations & internal communications system	14	0
	Total	99	257

Annexure 2 D

Title	T Hrs	P Hrs	Total Hrs	Wks
Part 4				
Mandatory STCW Courses and Ship Visit				
• Proficiency in Survival Techniques	10	5	15	
• Elementary First Aid	10	5	15	
• Fire Prevention and Fire Fighting	13	5	18	
• Personal Safety and Social Responsibility	18	0	18	
• Oil Tanker Familiarization	30	0	30	
• Security Training for Seafarers with Designated Security Duties	13	1	14	
• Port/Dock/Harbour/Ship Visit	1	7	8	
Total	95	23	118	3
Part 5 Assessment (Internal and External)/ revision Details in Annexure 4	40	43	83	2
Part 6 Upkeep of the campus (three hours per week for 13 weeks) (Supervised by Instructors)			39	1
Part 7 Holidays/passing out/etc.			42	1

Annexure 3
List of approved accessories and recommended books and accessories for Pre
Sea Courses for GP Ratings

S. No	Accessories	Quantity
1.	Boiler Suits	4
2.	White Uniform Shirt, Half Sleeves	2
3.	White Uniform Shorts	2 pairs
4.	Black Leather Belt with Buckle	1
5.	Blue Stockings	2 pairs
6.	Soft, Blue Peak Cap with emblem of institute	1
7.	White “T” shirts with the emblem of institute	2
8.	Sports Shirt – coloured	1
9.	Black socks	2
10.	Pugree (Blue Cotton) for Sikhs only	1
11.	Coloured swimming trunks	1
12.	Black Shoes (without toe caps with laces)	1 pair
13.	White Canvas Shoes	1 pair
14.	Black Safety Shoes (ISI standard)	1 pair
15.	Leather Safety Gloves	1 pair
16.	Geometrical Instrument Box with Pencils, Erasers and Coloured Pencils	1
17.	Exercise Books as specified by the institute	-
18.	Black Shoe Polish	-
19.	Blanco for white shoes	-
20.	White Handkerchief	4
21.	Game Shorts	2 pairs

Text Books

01. Basic Seamanship Marine Engineering and Human Relations for Seafarers Vol. 1 & Vol. 2 (Board of Examinations for seafarers Trust)

Reference Books

02. Seamanship Primer by Capt. J. Dinger
03. Safe Working Practices (MCA - UK) publication
04. Seamanship Techniques 1 Shipboard Practice, D.J. House
05. Admiralty Manual of Seamanship (HMSO)

STRUCTURE OF ASSESSMENT

Internal Assessment:

Each institute is expected to have an internal assessment scheme to monitor the progress of each trainee and effectiveness of teaching inputs.

Ideally, formal assessment at the end of each month should suffice; however, institutes can introduce 'continuous assessment' system that monitors the progress of each candidate at appropriate intervals. Institutes need to create and document their scheme and maintain records of assessment.

Internal assessment should also include elements such as discipline, attendance, attitudes, extra curricular activities, seamanship, teamwork and similar traits.

Institutes should specify disciplinary norms, and disqualify any trainee who fails to reach minimum standards. Such a trainee should be barred from taking All India Exit Examination. Such an action must be communicated to the authorised examination body, and DGS, immediately.

Practical Training Record Book

Each trainee will be issued a DG approved 'Practical Training Record Book' developed and periodically revised by the authorised examination body. When a trainee can perform the listed tasks to a satisfactory level, Record Book to be signed by instructor in-charge, and counter signed by the Course in-charge. Practical record books including ship visit reports must be sent to the authorised examination body after completion of the exit practical exam.

External Assessment:

All India Exit Examination to be conducted by the Examination Authority as per the guidelines issued and revised from time to time. The assessment scheme shall be as follows:

S.No.	Subject	Marks	Pass Marks	Mode	Duration
1.	General Aspects & General Ship Knowledge including navigational watch- keeping and safety.	50	30	Online & Written	1 hour 45 mins
2.	Marine Engineering, Knowledge of Machinery equipment and watch keeping procedure and safety	50	30		
3.	Seamanship, watch keeping, helms skills, and safety, personal survival techniques, and protection of environment	50	30	Practical	Approx. 2 hours
4.	Work shop practice, fitting, basic welding, use of machines, safety, and fire fighting techniques and first aid.	50	30		
5.	General Aspects & General Ship Knowledge including navigational watch- keeping and safety.	50	30	Oral	Average duration 20 minutes
6.	Marine Engineering, Knowledge of Machinery equipment and watch keeping procedure and safety	50	30		

The external examination will be conducted during the months of June and December. Additional examination, for only repeater candidates, will be conducted in the month of March and September.

Annexure 5

RULE FOR ISSUE OF PASSING OUT CERTIFICATE BY THE INSTITUTE (Format in annexure 7)

The training institute shall award a Passing out Certificate (in the format shown in Annexure 7) to only those candidates who have passed the All India Exit Examination

Annexure 6

Rules for the conduct of All India Exit Examination Rules for Ratings Exit Examination

1. Definitions:

- A. Fresh Candidate (FC)** – A person appearing for the first time at the end of the training period.
- B. Repeater Candidate (RC)** – A person who has failed any one of the previous examination.
- C. Deferred Candidate (DC)** – A person who did not appear at the end of the training period but appearing at subsequent examination.

2. Eligibility criteria:

Candidate attending a training programme at a DGS approved training institute.

Applying through the training institute, and satisfying other criteria of admissions, discipline, attendance, and internal assessment at the institute.

Possession of an INDoS No. The institute must furnish INDoS No. to the Examination Authority within ten weeks from the commencement of the Course.

3. Attendance & Conduct:

The minimum classroom attendance required is 90%. However, attendance of 75% and above will be acceptable if the head of the institute is satisfied about the overall in-course performance, conduct and discipline of the trainee.

Any other criteria that may be applicable at that time.

Should any candidate fail to satisfy the above criteria, the institute must intimate the name to the Directorate General of Shipping (Training Branch) and to the Examination Authority before the commencement of the All India Exit Examination.

4. Procedures to be followed by the institute:

Within first 10 days of the commencement of the course – the training institute shall send complete list of candidates enrolled to the authorised examination body. The institute will be required to forward complete details of the candidates before sending application forms for the examination. This will be treated as final record of enrolled candidates at any time in the future.

If any of the enrolled trainees is not appearing for the immediate examination, for any reason, the training institute must inform Examination Authority at the time of sending application forms of candidates of that batch.

5. Eligibility of Repeater Candidates(Resit):

Any candidate who has failed in any of the previous examination or missed an examination should follow instructions given in DGS Training circular No. 13 of 2013.

Repeater candidates if they desire, may choose to forward the application form to the Examination Authority through the candidates/ Training institutes within the dates specified on the website of the Examination Authority.

6. Cases related to cheating in examination:

During any part of the examination, should there be any evidence to indicate that candidate has attempted to copy or cheat in the examination, the Examination Authority shall forward the case to the Directorate. Any candidate who attempts to copy or is helping others to copy will be treated equally. Results of such candidates will be 'withheld' and case will be referred to the DGS. A disciplinary action will be taken in line with the procedure detailed under '**Guidelines for disciplinary action against candidates**'.

7. Appeal for review of Answer Script:

Any candidate will be allowed to appeal a review of the answer script by a panel of **two** moderators to be appointed by the authorised examination body.

Application for appeal should be made through the training institute within 15 days from the date of results. To be addressed to the authorised examination body.

Result of the review will be declared within 15 days of the closing date of appeal. This result will be submitted to the Directorate General of Shipping (Training Branch), and institute will be informed accordingly.

Annexure 6 (continued)

Guidelines for disciplinary action against candidates

Guidelines for disciplinary action in cases of unlawful act of any candidate during 'All India Exit Examination for Ratings' conducted by the examination authority.

Definition: Examples of 'Unlawful act'.

- (A) Possession of prohibited material
- (B) Exchanging anything with other candidates
- (C) Attempt to copy from a candidate from an adjacent seat
- (D) Causing disturbance in the examination hall,
- (E) or any similar means.

I) If the candidate is caught at the venue of the examination:

The invigilator would collect the evidence, as far as possible, and report the matter to the Examination Coordinator immediately.

The invigilator shall write a report of the incidence and submit it to the Examination Coordinator. The candidate should be asked to sign the statement.

In case of no physical evidence, and a candidate refuses to sign, the Examination Coordinator shall make a remark on the report and forward the report, with or without the evidence, to the Chief Coordinator of the authorised examination body.

II) In case the copying is noticed at the time of marking of answer scripts.

The examiner or the moderator finding any evidence of copying shall report the matter to the Chief Coordinator as soon as possible.

III) Further action:

Such incidents to be presented to the Directorate General of Shipping at the time of submission of results. Results of such candidates to be with-held till further inquiry is completed as detailed below.

An enquiry to be conducted by authorised examination body, and candidate's to be given an opportunity to express their position, accept or decline the act. The inquiry to be conducted in presence of the Head of the Institute, and two representatives of Examination Authority. (A format for report of such an enquiry is attached.)

Examination Authority in consultation with DGS shall decide a further action on the basis of enquiry. Once the unlawful act is established, the minimum penalty will be to fail the candidate for that attempt. Examination Authority may bar the candidate for additional number of attempts should the act of the candidate merit such a decision.

Examination Enquiry Report (Sample)
(Incase of unlawful act during the Exit Examination)

Date, place & time of Event:

Persons involved:

Name & Roll No:

Name & Roll No:

Name of the institute:

Allegation: Details of 'unlawful act'.

Evidence:

Statement from the candidates: (Add or delete as applicable)

The evidence presented is true/.....

I agree to have adopted unfair means during the examination as stated above.

I disagree to have adopted unfair means during the examination as stated above. (Agree or disagree to be written by the individual candidate in signature column.)

Names	Signature
Head of Institution	
Remarks (if any)	
Representatives of Examination Authority 1. 2.	

Date:

Place:

Annexure 7
FORMAT OF PASSING OUT CERTIFICATE

NAME OF THE ACADEMY
ADDRESS

Phone:(+91xx)_____ Fax:(+91xx)_____ E-mail:_____

**PRE SEA TRAINING COURSE
FOR GENERAL PURPOSE (GP) RATINGS**

This is to certify that _____ Roll No. _____ D.O.B. (DD,MMM,YYYY)*INDos No. _____ has successfully completed a 25 weeks Pre Sea Training Course for Rating forming part of the Navigational and Engineering Watch from _____ to _____. This course is an integral part of the overall planned and structured training programme for the prospective Rating of a Sea going Ship of 500 gross tonnage or more and is designed to assist him in achieving the minimum standards of competence as specified in Regulation II/4 and III/4 of STCW convention as amended in 2010, and includes mandatory familiarization and basic safety training as stipulated in Tables A-VI/1-1, A-VI/1-2, A-VI/1-3, A-VI/1-4, A-VI/6-2 and Oil Tanker Familiarization Training as stipulated section A-V/1 of STCW convention as amended in 2010. This training programme was conducted in English language and is approved by the Directorate General of Shipping, Ministry of Shipping, Government of India.

Colour
Photograph
40 mm X 30 mm

Embossed
seal of
Institute

Rubber Stamp
of Institute

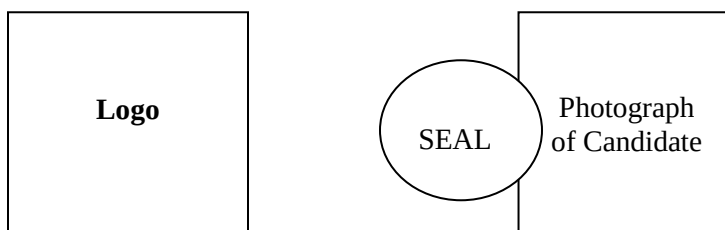
Rating's Signature

Date of Issue CAPTAIN SUPERINTENDENT/PRINCIPAL

* Indian National Database of Seafarers

All enquiries concerning the certificate should be addressed to the issuing authority above.

Sample of a Certificate to be issued on passing the All India Exit Examination



(Examination Authority)

Under the authority of the Directorate General of Shipping, Ministry of Shipping,
Government of India

Awards this

Certificate

Certificate No.: Candidates Code/year/Roll No.

This is to certify that SSSS KKKK YYYY

Roll No. XXXX **INDOS No.**YYYY **Date of Birth** DD-MMM-YY

has undergone an approved six months Pre-sea training Course for

General Purpose Rating

at: (Name of Training institute)

From MM-YY to MM-YY , **and has successfully passed the All India Exit Examination**
held in (Month – Year) and has been awarded grade - on the basis shown below:

A	B	C
Above 80% marks	70-79.99 % marks	60-69.99 % marks

Position in the merit list of first 25% -

Dated: DD-MMM-YY

Signature of the Candidate

Sd/
Head of Examination Authority
(Name)
(Name of Examination Authority)

Address

Sample of Endorsement at the back of GP Rating Certificate

The All India Exit Examination is conducted in accordance with Training Circular xx of 2014 in compliance with regulations II/4, II/5, III/4 and III/5 of STCW'2010

The curriculum for 25 weeks pre-sea training programme includes following components:

Part 1	Induction, personality and communication skills development, general knowledge about shipping and ships, and introduction to computers
Part 2	General Ship Knowledge (Seamanship and Navigation – at support Level)
Part 3	Marine Engineering Knowledge and Practice (at support Level)
Part 4	Mandatory STCW Courses and Ship Visit
	A. Proficiency in Survival Techniques *
	B. Elementary First Aid *
	C. Fire Prevention and Fire Fighting *
	D. Personal Safety and Social Responsibility *
	E. Oil Tanker Familiarisation *
	F. Security Training for Seafarers with Designated Security Duties *
	G. Ship Visit / Harbour Visit (Two) *

*Mandatory courses for General Purpose Rating pre-sea training .

Under the All India Exit Examination, conducted by the Board of Examination for Seafarer Trust each candidate is evaluated through a online, written, practical and oral test for General Ship Knowledge and Marine Engineering Knowledge. To pass the examination, a candidate must obtain a minimum of 60% marks in each component. Results are evaluated by the Directorate General of Shipping prior to issue of this certificate to successful candidates.

Annexure 8

Uniforms for faculty members

1. Epaulettes

- 1.1. Instructor: One Stripe.
- 1.2. Senior Instructor: Two stripes.
- 1.3. Nautical Officer: A diamond and four stripes.
- 1.4. Engineer Officer: A diamond and four stripes with purple in between.
- 1.5. Senior Nautical Officer, if post exists in institute: A diamond and a broad stripe.
- 1.6. Senior Engineer Officer, if post exists in institute: A diamond and a broad stripe with purple in between.
- 1.7. Course in charge (If Master Mariner) – Title: Captain Superintendent: A diamond, one stripe and a broad stripe.
- 1.8. Course in charge (If MEO Class I) – Title: Engineer Superintendent: A diamond, one stripe and a broad stripe with purple in between.

Note 1: Each stripe to be approximately 10 mm broad. The broad stripe to be approximately 45 mm broad.

Note 2: The diamond shape on the epaulette is only for an officer who possesses a Certificate of Competency granted or recognised by the Government of India.

2. Caps

- 2.1. All faculty members: White peak Cap.
- 2.2. Senior Nautical Officer and Senior Engineer Officer: White peak cap with one row of golden laurels.
- 2.3. Captain Superintendent: White peak cap with two rows of golden laurels.

3. Uniform

- 3.1. White half-sleeve shirt with epaulettes, white trousers, white belt, white socks and black shoes.
- 3.2. In cold weather, black trousers, black belt and black socks may be substituted for white.
- 3.3. White full-sleeve shirt may be worn after sunset in mosquito prone areas.

-o0o-

Annexure 9
List of Equipment (GP Rating)
Infrastructure, Equipment and teaching aids for Seamanship-Navigation-Engineering

The following facilities of suitable area commensurate with the number of trainees at a time:

- Navigation
- Seamanship
- Marine Engineering
- Carpentry
- Plumbing
- Machine
- Electrical
- Hot work

Open air demonstration, and practice area keeping in mind convenience of assessment

(Specifications for work benches, size of vices, ventilation, safe movement, and lighting)

1. General Equipment to include:	For 40	For 80	For 120
1.1 World Maps (one in each Class Room and one in the library)	1	1	1
1.2 Models of Ships	1	2	3
1.3 Wall-mounted Photographs of Ships and Ports	10	10	10
1.4 Mate's Log Book	2	4	4
1.5 Official Log Book	2	4	4
1.6 Articles of Agreement	2	4	4
1.7 Muster List (one in each class room and one in the corridor)	2	4	4
1.8 Various plans of ships (GA/Fire control/LSA)	1 each	1 each	2each
2. Video Cassettes/CD's/DVDs to include:			
2.1 Personal Safety on Deck	1	1	1
2.2 Personal Safety in Galley	1	1	1
2.3 Personal Safety in Accommodation	1	1	1
2.4 Personal Safety in Engine room	1	1	1
2.5 Shipboard Maintenance and Painting Systems	1	1	1
2.6 Anchors and Cables	1	1	1
2.7 Safe Mooring Practice	1	1	1
2.8 Good Bunkering Practices	1	1	1
2.9 Tank Cleaning	1	1	1
2.10 Entry into enclosed spaces	1	1	1
2.11 Use of Breathing Apparatus	1	1	1
2.12 Operation and maintenance of hatch covers	1	1	1
2.13 Pollution Prevention	1	1	1
2.14 Shipboard Oil Spill Contingency Planning	1	1	1
2.15 Waste and Garbage Management	1	1	1
2.16 Bridge Watch Keeping Procedures and Routine	1	1	1
2.17 Understanding English on Board - Normal Operations	1	1	1
2.18 Understanding English on Board - Emergencies	1	1	1

3. Navigation Equipment to include:				
3.1	Wet Card Magnetic Compass in a binnacle	1	1	1
3.2	Gyro Compass with repeaters	1	1	1
3.3	Model of Steering Wheel with Helm Indicator	1	1	2
3.4	Beaufort Scale Wind and state of Sea Chart	2	4	4
3.5	Binoculars.	2	4	4
3.6	Azimuth Circle	1	2	2
3.7	Aneroid Barometer	1	1	1
3.8	Mason's Hygrometer in a Stevenson's Screen	1	1	1
3.9	Whirling Psychrometer	1	2	2
3.10	VHF model	1	1	1
3.11	MOB Marker (dummy)	1	1	2
3.12	Navigation Lights Sentinel	1	1	1
3.13	Walkie-Talkie	1	2 sets	2 sets
3.14	Steering Simulator (PC based)	1	1	1
3.15	International Code of Signals Flags (B, G, H, P, & Q)	2 sets	2 sets	2 sets
4. Seamanship Equipment to include:				
4.1	A ship-type mast as per DGS order no: 2 of 2007.			
4.2	Manila Ropes [various sizes]			
4.3	Synthetic Ropes [various sizes]			
4.4	Steel wire Ropes [various sizes]			
4.5	Seizing twine and seizing wire			
4.6	Heaving Lines	4	8	8
4.7	Rope and chain stoppers	4	8	8
4.8	Anchor Shackle	2	4	4
4.9	Lugless joining shackle for anchor chain	2	4	4
4.10	Mooring Shackle	2	4	4
4.11	Mooring Hawser (30 fathoms)	2	4	4
4.12	Mooring Wire (30 fathoms)	2	4	4
4.13	Bollards & Bits	2	4	4
4.14	Single, double and triple sheave blocks	2 each	4 each	6 each
4.15	Cargo Block, gin block 5 ton	1	2	3
4.16	Snatch Block	1	2	3
4.17	Bottle screws and turn buckles	4	8	12
4.18	Bulldog Grips	12	24	36
4.19	Differential Pulley (chain block)	1	2	2
4.20	Container fittings including lashings	1 lot	1 lot	2 lots
4.21	Chipping hammers, scrapers and wire brushes	20 sets	40 sets	40 sets
4.22	Paint Brushes, roller brushes [various sizes and types]	12	24	36
4.23	Paint trays	12	12	12
4.24	Spray painting machine (with set of nozzles), and self-contained compressor, hose and attachment. (face mask, gloves, goggles)	2 set	4 set	4 set
4.25	Paints for practice (primer, enamel, polymer)			
4.26	Chipping machine, chipping gun with accessories with compressed air supply system	2 set	2 set	3 set
4.27	Life-jackets and life-buoys of approved type (in working condition)	12+2	12+2	24+2
4.28	Set of dummy distress signals	2	2	2

4.29	Pilot ladder rigged up for practice	1	2	2
4.30	Jacob's ladder rigged up for practice	1	2	2
4.31	Bosun's Chair (with self-lowering arrangement)	2	4	4
4.32	Overside Stage (with paint brush & ladder)	2	4	4
4.33	Safety Harness	4	8	12
4.34	Marline Spikes	4	8	8
4.35	Wooden Spikes	4	8	8
4.36	Slings, Snotter, net sling	2	2	2
4.37	Sounding Rod with line	2	3	4
4.38	UTI tape	1	1	1
4.39	One ullage tape	1	1	1
4.40	Sounding tapes (Steel)	2	2	3
4.41	Fabricated manhole and its cover	2	2	2
4.42	Safety shoes, helmets, gloves	40 each	80 each	120 each
4.43	Scupper plugs	2	2	2
4.44	Garbage bins for different items as on board			
4.45	SOPEP Locker equipment	1 set	1 set	1 set

Engineering Workshop Equipment

List of equipment given below is with assumption that only half the number (20) from each batch of 40 will be in the engineering workshop at one time, remaining 20 will be involved in other activities.

	For 40	For 80	120
1 Fitting Shop			
1.1 Work Bench 1200-2400-900 without vice	2	4	4
1.2 Work Bench 1200-2400-900 with four vices of two different sizes (100 mm to 200 mm wide jaw)	2	4	4
2 Hand Tools			
2.1 Hammers (ball pen) 1.5 kg	8	12	12
2.2 Claw Hammer	3	6	8
2.3 Sledge Hammer	3	3	3
2.4 Files flat – bastard, medium cut (30 mm) (with wooden handles)	6 each	12 each	18 each
2.5 Files flat – medium cut (20 mm) (with wooden handles)	6	12	18
2.6 Files half round; triangular, square	2 each	3 each	3 each
2.7 Needle files	1 set	2 sets	2 sets
2.8 Flat Chisels 200 mm	12	18	18
2.9 Chisel – caulking, diamond	2 each	2 each	2 each
2.10 Spanners double open ended	4 sets	6 sets	6 sets
2.11 Ring Spanners	4 sets	6 sets	6 sets
2.12 Adjustable spanners	4	6	6
2.13 Box Spanners	2 sets	2 sets	2 sets
2.14 Ratchet Spanner	2	2	3
2.15 Allen Keys	2 sets	2 sets	2 sets
2.16 Screw drivers (various sizes)	12	18	18
2.17 Hack Saw Frame (standard)	4	6	8
2.18 Hack Saw frame small	2	3	4
2.19 Reamers	1 set	1 set	1 set
2.20 Hole Punch	2 sets	2 sets	3 sets
2.21 Center Punch	6	6	6
2.22 Letter Punch	2 sets	2 sets	2 sets
2.23 Thread Extractor	3	3	3
2.24 Measuring Tape	2	2	2
3 Instruments			
3.1 Steel Scales	10	10	10
3.2 Try Squares	6	8	12
3.3 Straight edge	2	2	3
3.4 Vernier calipers	4	6	6
3.5 Micrometer (Outside)	3	4	4
3.6 Micrometer (inside)	1	1	1
3.7 Simple calipers (inside and outside type)	4 each	8 each	10 each
3.8 Dividers	6	9	9
3.9 Thread cutting die	2 sets	2 sets	2 sets
3.10 Die Nuts	1 set	1 set	1 set
3.11 Taps	2 sets	2 sets	2 sets
3.12 Screw gauge	2	2	2
3.13 Feeler Gauge small	2	2	2
3.14 Feeler Gauge large	2	2	2
4 Machines			

4.1	Pedestal grinder or a bench grinder independently mounted	2	2	2
4.2	Vertical Drill Machine	2	2	2
4.3	Electric Portable Drill	2	2	3
4.4	Drill bits up to 10 mm	3 sets	3 sets	3 sets
4.5	Lathe complete with basic accessories (in working condition)	2	3	3
4.6	Lathe tools for turning, cutting, and paring	4 each	6 each	6 each
5	Plumbing Tools to include:			
5.1	Grip pliers	3	4	4
5.2	Pipe Vice	2	3	3
5.3	Pipe Wrench, (large and small)	2 each	3 each	3 each
5.4	Water taps with washers,	2	4	6
5.5	Taps and dies for cutting threads on pipes, etc.	1 set	1 set	1 set
5.6	Unions, bends, couplings	24 pcs	36 pcs	36 pcs
5.7	Pipes for practice various lengths	20 m	30 m	40m
5.8	Valve packing material			
5.9	Teflon thread tape			
6	Lubrication			
6.1	Oiling can with a hand pump	2	2	2
6.2	Spouted oil cans three sizes	1 set	1 set	1 set
6.3	Grease gun with different types of adapters	2	2	2
7	Electrical Tools to include:			
7.1	Insulated tools normally used by electricians	1 each	2 each	2 each
7.2	Multimeter and megger	1 each	1 each	1 each
7.3	Fuse cartridges, and circuit breakers samples	3 each	3 each	3 each
7.4	Various types of electrical connections - samples			
7.5	Soldering irons, solder, flux.	2	2	2
7.6	Tester	2	2	2
8	Hot work equipment to include: (Working condition)			
8.1	Oxy-acetylene gas cutting/welding apparatus and its accessories (including personal protective gear) (approved type)	2 sets	4	4
8.2	Electric arc welding machine and its accessories (including personal protective gear)	4 sets	6	6
8.3	Adequate mild steel material for practice of cutting and welding. (3mm, 6mm plates, angle iron,)			
8.4	Electrodes in stock for use by candidates			
9	Pumps and Valves			
9.1	Centrifugal Pump (vertical & horizontal), (mounted)	1 each	2	2
9.2	Centrifugal pump multi stage	1	2	2
9.3	Reciprocating Pump	1	1	1
9.4	Gear Pump	1	2	2
9.5	Vane Pump	Optional		
9.6	Screw Pump	1	2	2
9.7	Hand pump (rotary)	2	2	2
9.8	Globe Valve a) Return b) Non Return	2 each	2 each	2 each
9.9	Sluice Valve	2	2	2
9.10	Butterfly Valve	2	2	2
9.11	Quick Closing Valve	2	2	2
9.12	Storm Valve	1	1	1
9.13	Safety Valve	1	1	1
9.14	Reducing Valve	1	1	1
9.15	Ball Valve	1	1	1

9.16	Float valve	1	1	1
9.17	Tapered Cock (small and medium size)	2 each	2 each	2 each
9.18	Cylindrical cock	2	2	2
10 Filters				
10.1	Fuel Oil Filter (M/E) (complete)	1	2	2
10.2	Fuel oil filter (felt type) (complete)	1	2	2
10.3	Lube Oil Filter (M/E) (duplex) (complete)	1	2	2
10.4	Lube oil filter for auxiliary engine (complete)	1	2	2
10.5	Air Filter of Turbo charge	1	2	2
11 Gauges				
11.1	Level gauge for tanks	1	1	1
11.2	Pressure gauge	3	3	3
11.3	Thermometer of various sizes and range	6	6	6
11.4	Pyrometers	3	3	3
11.5	Sounding tape	2	2	3
11.6	Sounding rod	2	2	3
11.7	Boiler Gauge Glass (mounted model)	1	1	1
11.8	Boiler Gauge Glass (for practice of dismantling)	1	1	1
12 Diesel Engine Components				
12.1	Fuel Injector (M/E)	1	1	1
12.2	Fuel Pump (M/E)	1	1	1
12.3	Cylinder Relief Valve (M/E)	1	1	1
12.4	Air Starting Valve (M/E)	1	1	1
12.5	Air Distributor (M/E)	1	1	1
12.6	Indicator Cock (M/E)	1	1	1
12.7	Cylinder Lubricator (M/E)	1	1	1
12.8	Cylinder Lubricator Quill (M/E)	1	1	1
12.9	Piston Rod Stuffing Box (M/E)	1	1	1
12.10	C/Case Relief Valve (M/E)	1	1	1
12.11	Scavenge Valve (M/E)	1	1	1
12.12	Cylinder Liner (Aux/E)	1	1	1
12.13	Cylinder Head (Aux/E)	1	1	1
12.14	Piston with Rings (Aux/E)	1	1	1
12.15	Connecting Rod (Aux/E)	1	1	1
12.16	Bottom End Bearing with (Aux/E) Bolts and Nuts	1	1	1
12.17	F.W/Lub. Oil Cooler	1	1	1
12.18	Aux. Air Receiver	1	1	1
13 Compressor, Centrifugal Separator, etc.				
13.1	Main Air Compressor (marine type)	1	1	1
13.2	Lub. Oil/D.O/H.O. Separator	1	1	1
13.3	Boiler safety valve (complete)	1	1	1
13.4	Bilge Strum Box (complete)	1	1	1
13.5	Hydraulic Jacks, 500 Kg, 1000 kg, 2000 kg,	1 each	1 each	1 each
14 Carpentry Tools to include:				
14.1	Bench Vices (mounted on table)	2	4	4
14.2	Crow Bars	4	2	2
14.3	Saws - straight, hack and fret	4	4	4
14.4	Hammers - claw, ball-pane, sledge, mallet, etc.	2 each	2	2
14.5	Various Wood Chisels	6	8	8

14.6	Various Wood Files	2	4	4
14.7	Nail Extractors	2	2	2
14.8	Breast braces and other clamps	4	4	4
14.9	Hand drilling machine with hand drill bits	2	2	2
14.10	Masonry Punches	1 set	1 set	1 set
14.11	Portable electric drill and its bits including masonry bits	2	2	2
14.12	Various types and sizes of screw drivers	4	6	6
14.13	Wood screws and nails different sizes			
14.14	Jackplane	2	3	3
15	Posters for tools, instruments, engines, pumps, valves, protective gear, safety signs,	One each	One each	One each
16	Models			
16.1	Marine Boiler	1	1	1
16.2	Diesel Engine	1	1	1

ANNEXURE 10

Additional in-house safety equipment required where the modular courses are outsourced:

1. Demonstration Table
2. One inflated liferaft on display.
3. Complete set of Life Raft Equipment
4. Complete set of Life Boat Equipment
5. Two Immersion Suits
6. 10 lifejackets
7. 2 Thermal Protective Aids
8. Retro reflective Tapes
9. 1 Hydrostatic Release Unit (HRU)
10. 4 Lifebuoys
11. 2 Man Overboard Markers
12. 2 Self igniting Lights
13. EPIRB (Model)
14. SART (Model)
15. Neil Robertson Stretcher
16. First Aid Kit
17. Various splints & bandages
18. Resuscitation Kit
19. One Emergency Escape Breathing Apparatus (EEBD)
20. Ten earmuffs
21. Four dust masks
22. One Explosimeter
23. One Oxygen analyser
24. One Hydrocarbon detector.
25. One UTI tape.
26. One ullage tape.
27. Two dummies for search and rescue procedures
28. Four fire hoses – 64 mm
29. Four nozzles (2 jet, 2 dual purpose)
30. Two mechanical foam guns
31. Four pressurized water extinguishers
32. Four foam extinguishers
33. One 4.50 kg. D.C.P. extinguisher
34. One 10 kg D.C.P. extinguishers
35. Two 6.8 kg CO₂ extinguishers
36. Sufficient refills for all types of extinguishers
37. A working model of fire & general alarm
38. Two sets of self contained breathing apparatus, complete with spare cylinders, spare parts and maintenance tools
39. Two sets of protective clothing for firemen
40. Four life lines

Appendices - Training Circular XX of 2014

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Appendix 1A

General Purpose Ratings

Total Duration of the Course – 25 weeks (on the basis of 42 contact hours per week)

Parts/Title	Theory Hrs	Practical Hrs	Total contact hrs	Weeks
Part 1 Induction, personality & communication skills development, gender sensitization, general knowledge about shipping and ships, and introduction to computers	92	102	194	4
Part 2 General Ship Knowledge (Seamanship and Navigation – at Support Level)	58	146	204	5
Part 3 Marine Engineering Knowledge and Practice (at Support Level)	99	257	356	9
Sub Total of Part 1 + Part 2 + Part 3	249	505	754	18
Part 4 Mandatory STCW Courses and Ship Visit				
A Proficiency in Survival Techniques (TC 31 of 2004)	10	5	15	
B Elementary First Aid (TC 30 of 2004)	10	5	15	
C Fire Prevention and Fire Fighting	13	5	18	
D Personal Safety and Social Responsibility (STCW 2010 TC 13 of 2012)	18	0	18	
E Oil Tanker Familiarisation	30	0	30	
F Security Training for Seafarers with Designated Security Duties (STCW 2010 TC 27 of 2012)	13	1	14	
G Port/Dock/Harbour/Ship Visit	1	7	08	
Total of Part 4	95	23	118	3
Part 5 Revision/Assessment (Internal and External)	40	43	83	2
Total of Part 1 to 5	384	571	955	23
Part 6 Upkeep of the Campus (three hours per week for 13 weeks) (supervised by instructors)			39	1
Part 7 Holidays/passing out/etc.			42	1
Total weeks			1036	25

Port/Dock/harbour/Ship Visit: Instructors should explain in elementary detail, the basic functions of the following spaces & equipment, and also in elementary detail, the operations listed below:

- Windlass / Mooring Winch
- Berthing & Unberthing Operations – Handling of ropes on stations.
- Mooring Ropes / Wires
- Cargo Work. – Very basic ideas only.
- Operations of Cranes & Derricks.
- Gangway, Pilot Ladders.
- Crew Accommodation, Cabins, Galleys , Pantry
- Flag Hoisting, Courtesy Flags.
- Engine Room Main engines, propeller shaft, propeller, generators, control rooms, bilges, pumps, etc.

Trainees will write an essay on the visit, and show it to the external examiner on demand.

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Appendix 1A

Title	T Hrs	P Hrs	Total Hrs	Wks
Part 1 – General Aspects: Induction to the course, personality and communication skills development, gender sensitization, general knowledge about shipping and ships, and introduction to computers.	92	102	194	4

(Specific Learning Objectives)

S. No.	Topics & sub topics	T	P
1.1	English speaking, reading, writing (using topics 1.5 and 1.6, charts and reading material)	20	40
1.2	Computers (Familiarisation)	6	30
1.3	Discipline, etiquettes and Gender Sensitization	3	8
1.4	Health and Hygiene	4	4
1.5	General Aspects of Shipping Importance of Shipping in the National and International Trade International Routes Types of Ships and Cargoes Shipboard Organization	8	0
1.6	Nautical Terms – Parts of the Ship (Using ship models) Hull Ships Decks Fore Castle Poop Deck Accommodation Bridge Monkey Island Cargo Spaces (Cargo Holds, Tanks) Cargo Handling Gear (Derricks, Cranes, Grabs, Pumps) Machinery Space (Engine Room/Pump room)	10	0
1.7	General Shipboard Safety and Health Personal Protection and Personal Protection Equipment Safe working practices for merchant seaman (including permit to work system, and fire prevention aspects, Safety Precautions when working aloft, Safety Precautions when working over side) Risk Assessment (Basics) Emergencies Safe Access to the Ship Safe Working Practices during Berthing / Unberthing, and Anchoring	20	16
1.8	Protection of Environment Sources of pollution at Sea from ship Damage to the environment Importance of prevention of pollution of the sea Ways and means of preventing pollution Pollution prevention equipment on board	8	4
1.9	National Shipping Organisation and Documents for seafarers, log books, disciplinary procedures, rights of a seaman, Seaman's Identity Document, Recruitment and Placement of Seafarers Rules, contract of employment.	6	0
1.10	International Organizations and Conventions	7	0
		92	102

Specific Learning Objectives – General Aspects of Shipping

1.1	English speaking, reading, writing (using topics 1.5 and 1.6 and charts and reading material)	20	40

The trainee will be able to:

1.1.1 Oral communication:

Comprehend and answer questions related to his duties, types of ships, action in emergencies, terms related to parts of the ship, machinery in the engine room, and as expected in a visit of a Port State Control officer in a ship inspection.

1.1.2 Ability to read:

Read given handouts and instructions related to his duties on board ship.

1.1.3 Ability to write:

Copy and write legibly the given text from the text book or handouts for the course. Answers questions given in the written examination. (Spelling of simple terms, and basic grammar is expected.)

1.1.4 Ability to draw

Sketch simple components of equipment used on board, such as: anchor, bollard, spindle, piston, etc.

1.1.5 Additional Sessions:

The Institute should conduct special classes / use special means / interactive sessions / Videos / Power-point presentations / Multi-media sessions particularly for those students who are weak in written or spoken English. **This shall be outside the normal Class Hours.**

1.2	Computers (Familiarisation)	6	30

The trainee will be able to: (minimum expected learning).

Identify basic components of a PC: CPU, Monitor, keyboard, mouse, and state their purpose.

Identify keys on the keyboard and their functions: space bar, shift, return, ctrl, arrows, caps lock, Start and log on a computer

Demonstrate use of a keyboard and mouse for given tasks, using a self learning module, starting and stopping a power point programme and a video.

Take a simple assessment on a computer (multiple choice questions).

Using Microsoft Word, Excel, and Power Point or their equivalents.

Learn to send e-mails, Use Internet, Fill up on-line forms(e.g. Seafarers Profile on DGS Website)

1.3	Discipline, etiquette and Gender Sensitization	3	8

The trainee will be able to:

1. Demonstrate aspects of discipline and etiquettes in performance of duties, routines, given tasks.
2. Change behavior & instill empathy into his views about his own & the other gender.

1.4	Health and Hygiene	4	4

The trainee will be able to:

- 1.4.1 State importance of maintaining personal health and hygiene.
- 1.4.2 States ways and means of maintaining good health.
- 1.4.3 State personal habits and conditions that lead to illness of an individual on board.
- 1.4.4 Maintenance of Cleanliness and hygiene on Board ships in the accommodation, Cabins, alleyways, toilets, Galleys, Pantries, Mess-rooms and provision stores.

1.5	General Aspects of Shipping	8	0
	1.5.1 Importance of Shipping in the National and International Trade		
	1.5.2 International Routes		
	1.5.3 Types of Ships and Cargoes		
	1.5.4 Shipboard Organization		

1.5.1 Importance of Shipping in the National and International Trade

The trainee will be able to:

- I State the role of shipping in the national and international trade.

1.5.2 International Routes

The trainee will be able to:

- I Using a WorldMap (without labels) or Globe, name and identify location of continents, and oceans.
- II State international sea routes for ships.

1.5.3 Types of Ships and Cargoes:

Trainee will be able to:

- Differentiate between Types of Merchant Vessels as mentioned below:
- State the use of each Type
- State the Type of Cargo carried by each Type of Vessel.

Basically 2 types of Ships exist namely Passenger & Cargo. Cargo Ships are further subdivided into Dry Cargoes and Wet Cargoes as per Table below:

Types of Ships				
Cargo Ships				Passenger Ships
Dry Cargo		Liquid Cargo		Cruise Liner
		Type of Ship / Type of Cargo		
General Cargo	General Cargo (eg:) Boxes, Machinery, etc	Oil Tankers	Oil	Ferries
Container Vessel	Containers	Chemical Tankers	Chemicals	
Bulk Carriers	Bulk Cargoes, (Ore, Grain, Coal, Cement, etc)	Gas Tankers	Liquefied Gases	
Roll On –Roll Off Vessel	Trucks, trailers, Cars and other vehicles			
Other ships: Tug Boats, Offshore supply vessels				

1.5.4 Shipboard Organization

Trainee will be able to state that:

- There are two Distinct Departments on the Ship
- These Departments are **Nautical Department** and **Engineering Department**.
- Nautical Department is responsible for Cargo Operations, Navigation of the vessel and General Maintenance of the Ship and Administration
- Engineering Department is responsible for Upkeep and Maintenance of all Machinery onboard Ship and the propulsion system.
- Each Department consists of Officers and ratings.
- Nautical Department consists of Master, Chief Officer, 2/O, 3/O, Cadet or Apprentices and Able Seafarers (Deck), Watch-keeping deck ratings or GP ratings.
- Engineering Department consists of Chief Engineer, 2/E, 3/E, 4/E, Electro-Technical Officer, Electrical Officer, Electro-Technical Rating, Electricians or Fitter and Able Seafarers (Engine), Watch-keeping engine ratings or GP ratings.
- Master is overall in charge of the ship.
- Catering Department includes Catering Officer, Chief Cook & General Steward (G.S.) who are responsible for cooking food for Officers and Crew and general cleanliness in accommodation.

1.6	Nautical Terms – Parts of the Ship (Using ship models and video)	10	0
	1.6.1. Hull		
	1.6.2. Ships Decks		
	1.6.3. Fore Castle		
	1.6.4. Poop Deck		
	1.6.5. Accommodation		
	1.6.6. Bridge		
	1.6.7. Monkey Island		
	1.6.8. Cargo Spaces (Cargo Holds/Tanks)		
	1.6.9. Cargo Handling Gear (Derricks, Cranes, Grabs, Pumps etc.)		
	1.6.10. Machinery Space (Engine Room, Pump room etc)		

1.6 Nautical Terms – Parts of the Ship:

Trainee will be able to Name / Identify a part of the Ship given in the following sketches and state its purpose:-

1.6.1 Hull:

Shipside, Name of the Ship, Port of Registry, Stern, Propeller, Rudder, Draft marks, Load-line Marks, Bulbous Bow marks, Bow Thruster marks, Stem, Forecastle, Anchor, Hawse Pipe, Poop Deck,

1.6.2 Ships Deck:

Forward, Aft, Amidships, Portside, Starboard Side, Forecastle, Poop Deck, Derricks, Cargo Winches, Cranes, Cargo Holds, Hatches, Bulwarks, Railings, Sounding Pipes, Air Pipes, Filling Pipes, Bollards, Main Mast, Fore Mast, After Mast, Hold Ventilators, Gangway, Pilot Ladder, Scuppers, Tank domes, manhole & Covers, Cargo & Ballast lines.

1.6.3 Fore Castle:

Windlass, Brake Handle, Warping Drum, Spurling Pipe, Hawse Pipe, Bow Stopper, Devil's Claw, Chain Stopper, Rope Stopper, Heaving Line, Mooring Hawsers, Mooring Wires, Headline, Back-Spring, Breast Rope, Fair Leads, Panama Lead, forepeak stores, Rat guards, Jack staff, Ship's Bell, Anchor Ball, Anchor, Anchor Shackle, Joining Shackle, Chain-locker, Walkie-talkie

1.6.4 Poop Deck:

Mooring Winch, Stern Line, After Back Spring, Breast Rope, Chain Stopper, Rope Stopper, Mooring hawser, Mooring Wires, After Peak, Steering Flat, and Accommodation, Walkie-talkie

1.6.5 Accommodation

Bridge Front Bulkhead, Port holes, Alleyways, Officer's cabins, Passenger's cabins, crew cabins, Dining Rooms, Smoke rooms, Washrooms, Toilets, Pantry, Galley, Laundry, Storeroom, Cold storage, water-tight doors, Boat deck, Lifeboats, Life raft, Railing, Ship's funnel.

1.6.6 Bridge

Steering Wheel, Gyro Compass, Magnetic Compass, Radar, V.H.F, Engine Room Telegraph, Rudder Angle Indicator, Anemometer, Whirling-Psychrometer, R.P.M Indicator, Ship Whistle/Siren, Light Sentinel, Man Overboard Marker, Chart Room, Side Lights, Clear-View Screen, General Alarm, P.A. System (Public Address), Radio room – Equipment, EPIRB.

1.6.7 Monkey Island

Magnetic Compass, RADAR Scanner, Flag Mast, Halyards, Funnel, Ship's Whistle / Siren or Whistle.

1.6.8 Cargo Spaces:

Cargo Holds, Hatch Coamings, Hatch Openings, Hatch Covers, Hatch Boards, Hatch Beams, Tween Decks, Hold Bilges, Tank Top, Double-bottom Tanks, Manhole Covers, Cargo Tanks.

1.6.9 Cargo Handling Gear:

Derrick, Cargo Winch, Cranes, Grabs, Gentries, Spreaders, Slings, Cargo Pumps

1.6.10 Machinery Spaces (Engine Room, Pump Room)

Location of Engine Room: Existence of Entrance doors, Emergency escape routes. Location of steering gear. Location of pump room on tankers.

1.7 General Shipboard Safety and Health

1.7	General Shipboard Safety and Health	20	16
2.3.1	Personal Protection and Personal Protection Equipment		
2.3.2	Safe working practices for merchant seaman (including permit to work system, and fire prevention aspects, Safety Precautions when working aloft, Safety Precautions when working over side)		
2.3.3	Risk Assessment (Basics)		
2.3.4	Emergencies		
2.3.5	Safe Access to the Ship		
2.3.6	Safe Working Practices during Berthing / Unberthing, and Anchoring		

1.7.1 Personal Protection Equipment

Trainee will be able to list the different items of equipment as:-

Equipment	Protection of
Safety Shoes	Feet
Safety Helmet	Head
Safety Goggles	Eyes
Hand Gloves	Hands
Ear Muffs	Ears
Boiler Suit	Body
Safety Harness	Working Aloft/overside
Face Mask	Nose, Mouth & Face

Trainee will be able to:

- Give examples, when & where to use each of the above equipment.
- Maintain the above equipment in clean, good, working condition ready for immediate use.
- State that safety of the ship and its crew would be his first priority.
- list the precautions necessary before lifting any heavy loads manually, Safe working procedures, Tools & instruments

1.7.2 Safe working practices (general)

Trainee will be able to:

- State importance of safety at Work
- Define accident as an 'unplanned, undesirable and uncontrollable event leading to injuries, loss of life, damage to property and environment'.
- States that accidents are avoidable by being aware and due diligence.
- State importance of using senses in recognising hazardous situation.
- State incidents that lead to injury such as Impacts, Slips, Falls, Entanglement, Burns (heat, chemical, radiation), Electric shocks, Cuts, Foreign particles in eyes, or lungs, or ingestion (through mouth), Inhalation of toxic vapour, or lack of breathable air, Sprains and other physical injuries
- Create a list of safe working practices

1.7.3 Risk Assessment (Basic)

Trainee will be able to

Describe the concept of 'risk assessment' and basic approach

1.7.4 Permit to Work System

Trainee will be able to:

State purpose of 'work Permit', types of work permits.

Name various types of 'Permit to Work' as

- Hot Work Permit
- Tank Entry Permit
- Enclosed Space Entry Permit
- Working Aloft / Overside Permit

1.7.5 Work-Permits

Trainee will be able to state that 'Work Permits' are required prior doing any of the following jobs on the ship:-

- 'Man entry' into tanks.
- 'Hot work', anywhere on the ship.
- 'Enclosed space entry'
- 'Working aloft'
- 'Working Over the side'

1.7.6 Emergencies

Trainee will be able to:

- Define an emergency
- Enumerate different types of emergencies he may encounter on a ship.
- State the emergency signal to be made to inform the ship's crew about the emergency.
- State the action to be taken by a crew member on hearing an emergency signal.
- Explain, what is 'Muster list' and what it used for?
- State that immediately after joining the ship, he will get himself familiarized with the Ship, and understand the location of LSA & FFA equipment onboard the ship, muster stations and duty.
- State that he will always follow the 'Safe Working Practices' onboard.

1.7.7 Safe Access to the Ship

Trainee will be able to state that:

- Access to the ship will be either from a shore gangway or from the ship's gangway (also called Accommodation ladder.)
- The gangway will be well secured on the ship,
- A safety net will be fixed below the gangway to protect someone falling accidentally
- Gangway will be lowered / hoisted during the rising / falling tide.
- A lifebuoy and a Heaving-line will be kept ready near the gangway for emergency use.
- Gangway will have railing and taut ropes on the sides.
- There will be a platform at the bottom end of the ship's gangway.

1.7.8 Safe Working Practices during Berthing / Unberthing, and Anchoring

Trainee will be able to state that:

- All crew should be properly dressed up in suitable clothes, depending upon the weather.
- All crew should be wearing Safety helmet, safety shoes, hand gloves, safety goggles (when anchoring)
- Crew should not stand in the bights of mooring ropes or wires.
- Crew should be careful not to stand too close to fairleads, to avoid the back-lash of parting mooring ropes.

1.7.9 Safety Precautions, when working aloft

For working aloft, the Trainee will be able to list the following safety precautions:

- Take permission from Master, for working aloft.
- Be properly clad in Boiler suit, safety Helmet, Safety Harness, Safety shoes, Hand gloves
- Have necessary equipment for working aloft (e.g. Chipping hammers, scrapers, Paints, brushes etc) in a bucket with a heaving line.
- Have a Person standing by on deck for any assistance or emergency
- Before starting work aloft, fix the safety harness in position.

1.7.10 Safety Precautions, when working over side

For working over the side, the Trainee will be able to list the following safety precautions:

- Take permission from the Master, for working over the side.
- Be properly clad in Boiler suit, safety Helmet, Life-Jacket, Safety shoes, Hand gloves etc.
- Have a 'stage' rigged up on the shipside, where work has to be carried out.
- Have a rope ladder fixed up securely close to the stage.
- Have necessary equipment for working over the side (e.g. Chipping hammers, Scrapers, Paints, Brushes etc) in a bucket with a heaving line.
- Have a Person standing by on deck for any assistance or emergency

1.8	Protection of Environment 1.8.1. Sources of pollution at Sea from ship 1.8.2. Damage to the environment 1.8.3. Importance of prevention of pollution of the sea 1.8.4. Ways and means of preventing pollution 1.8.5. Pollution prevention equipment on board	8	4

Marine Pollution:

1. State different sources of pollutants in the engine room (oily rags, general garbage, plastics, soot and dust, oils, paints, chemicals)
2. States methods of managing each of the pollutants and its disposal
3. State importance of prevention of pollution of the environment
4. States possibilities of fines and possibilities of arrest of an individual found to be polluting the environment deliberately.

1.8 Protection of Environment:

Trainee will be able to List the causes of pollution at Sea being discharge from the ships of the following:

- Oil

- Chemicals
- Hazardous Goods
- Sewage
- Garbage including Plastics
- Air Pollutants
- Ballast Water Pollution

Trainee will be able to:

- State the consequences of Pollution at Sea
- List the precautions necessary in ships to avoid sea pollution
- List the precautions necessary in ships to avoid Air pollution
- List the steps to take for disposal of ship's garbage and plastics from the ship.
- Explain about the 'SOPEP' Locker, and its utility.

1.9	National Shipping Organisation and Documents for seafarers, log books, disciplinary procedures, rights of a seaman, Seaman's Identity Document, INDoS No. Certificates for Ratings, Recruitment and Placement of Seafarers Rules, Collective Bargaining Agreement, Contract of employment.	6	0

1.9. Shipping Organisation (National) & documents for seafarers

Trainee will be able to state the major role of the following:

- Directorate General of Shipping (DGS)
- Mercantile Marine Department (MMD)
- Shipping Master
- Seamen's Provident Fund Organisation
- Seamen's Welfare Fund Society

Trainee will be aware of the existence, and able to explain the purpose of a Ship's

- Official Log Book
- Deck Log Book
- Engine Room Log Book

Trainee will be able to explain the contents of 'Articles of Agreement' of a ship and what it is used for?

Trainee will be able to:

- Explain what is meant by C.D.C and what it is used for?
- Explain the contents of C.D.C.
- Explain that offences against discipline are recorded in ship's official log-book and suitable penalties are awarded.
- Explain the importance of Contract of Employment, Collective Bargaining Agreement.
- Explain the need and contents of Seafarers Identity Document (SID).
- Explain function of Recruitment and Placement Agencies (RPS).
- Understand and be aware of Recruitment and Placement Rules and contents.
- Explain the purpose of articles of Agreement and its contents relating to Indian flag and Foreign Flag ships.
- Explain the importance of INDoS No.
- Understand and be aware of rights of a seaman.

1.10	International Organizations and Conventions	7	0

1.10 International Organizations and Conventions

Trainee will be able to expand the following abbreviations and explain the purpose of these organizations and Conventions:

IMO	International Maritime Organization
STCW (STW)	(International) Standard of Training, Certification, and Watch Keeping
SOLAS	Safety of Life at Sea
ISM	International Safety Management Code
MARPOL	International Convention for the Prevention of Pollution from Ships
PSC	Port State Control
ISPS code	International Ship and Port Security Code
ILO	International Labour Organization
MLC	Maritime Labour Convention
PHO	Port Health Officer
	Customs and Immigration

Trainee will be able to state the role of the following:

- a. Port State Control(PSC)
- b. Flag State Inspections (FSI)
- c. Port Health
- d. Customs
- e. Immigration

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Appendix 1B

Specific Learning Objectives

General Ship Knowledge (Seamanship and Bridge duties at Support Level)

Title	T Hrs	P Hrs	Total Hrs	Wks
Part 2 General Ship Knowledge (Seamanship and Bridge duties at Support Level)	58	146	204	5

S. No.	Topics & Sub topics	T	P
2.1	Seamanship 2.1.1 Ropes & Rope work (5+18) 2.1.2 Blocks and Tackles (2+10) 2.1.3 Rigging of 'Pilot ladder', 'Bosun's Chair', 'Stage', Climbing a Mast (2+42) 2.1.4 Cargo Gear, Derricks, Cranes, Grabs, Gantry, Spreaders, Cargo Pumps (5) 2.1.5 Cargo Spaces, opening & closing of hatches, Cargo lashing equipment (1+8) 2.1.6 Safe Handling, stowage & securing of cargoes & stores (6) 2.1.7 Preparing a ship for departure/rough weather/arrival (1) 2.1.8 Berthing & unberthing of a ship (mooring) (1+10) 2.1.9 Anchor operation, anchor work (2)	25	88
2.2	Ship Maintenance 2.2.1 Preparation of surface using mechanical/pneumatic equipment, (1+16) 2.2.2 Painting (3+12) 2.2.3 Lubrication and Greasing of Deck equipment (0+2)	4	30
2.3	Basic Navigation, Operate emergency equipment and apply emergency procedures 2.3.1 Navigational Terms (2) 2.3.2 Rules of the Road (elementary) & Buoyage (5) 2.3.3 Navigational aids on the Bridge of a Modern Cargo ship(2) 2.3.4 International Code of Signal & Flags (4) 2.3.5 Knowledge of emergency duties and alarm signals(1) 2.3.6 Knowledge of pyrotechnics and distress signals, EPIRBs and SARTs, avoidance of false distress alerts and action to be taken in event of accidental activation.(3)	17	6
2.4	Look Out Duties, other bridge duties and reporting system Responsibilities of a lookout & reporting (day/Night, Clear/Restricted visibility by degrees or points) including relieving.	4	10
2.5	Duties of a Gangway Watch in Port (introduction to ISPS Code)	4	0
2.6	Steer the ship & comply with Helm orders	4	12
	Total	58	146

Part 2B Specific Learning Objectives – General Ship Knowledge

2.1	Seamanship 2.1.1 Ropes & Rope work (5+18) 2.1.2 Blocks and Tackles (2+10) 2.1.3 Rigging of ‘Pilot ladder’, ‘Bosun’s Chair’, ‘Stage’, Climbing a Mast (2+42) 2.1.4 Cargo Gear, Derricks, Cranes, Grabs, Gantry, Spreaders, Cargo Pumps(5) 2.1.5 Cargo Spaces, opening & closing of hatches, Cargo lashing equipment(1+8) 2.1.6 Safe Handling, stowage & securing of cargoes & stores (6) 2.1.7 Preparing a ship for departure/rough weather/arrival (1) 2.1.8 Berthing & unberthing of a ship (mooring) (1+10) 2.1.9 Anchor operation, anchor work (2)	25	88

2.1 Seamanship

2.1.1 Ropes & Rope Work (5+18)

Trainee will be able to:

- List the kind of ropes used onboard the ship.
- Explain the construction and lay of the ropes.
- Explain the care and maintenance of the vegetable/ synthetic/ wire ropes.
- List the precautions necessary, when opening a new coil of rope or wire rope.
- Demonstrate his ability to make various knots, bends and hitches used onboard the ship and explain their uses.
- Demonstrate his ability to coil a rope.
- Demonstrate his ability to make various kinds of ‘Whipping’ on the ends of ropes and explain its uses.
- Demonstrate his ability to do a short-splice, long-splice and eye-splice of ropes.
- Identify ropes by their diameter, lay, strands, etc.

2.1.2 Blocks and Tackles (2+10)

Trainee will be able to:

- Explain the purpose of using the blocks and tackles on the ships.
- State that Blocks, may be Single sheave Block, Double-sheave blocks or triple-sheave Blocks.
- Differentiate the Standing part, Hauling part, Running parts, Standing block, Moving – blocks of a tackle.
- Differentiate between various blocks and tackles.
- Explain the SWL of each block and where is it marked.
- Demonstrate overhauling of the blocks.
- State that sheaves of the block are measured by its diameter.

2.1.3 Rigging of ‘Pilot ladder’, ‘Bosun’s Chair’, ‘Stage’, & climb a mast (2+42)

Trainee will be able to rig the following with all its accessories & safety measures:

- Pilot ladder
- A ‘Stage’ on Shiplside for painting
- Self-Lowering / Hoisting ‘Bosun’s chair’
- Jacob’s ladder or Rope ladder
- Gangway

2.1.4 Cargo Handling equipment (Derricks, Cranes, Grabs, Gantry, Spreaders, Pumps) (5)

Trainee will be able to state that:

- Cargo can be loaded/ discharged from the ships by use of ship's Derricks.
- Derricks can be used to load / discharge by a single derrick (swinging derrick)
- Cargo runner wires of both derricks can be joint together (Union Purchase)
- Now a day's cranes are replacing the derricks on the ships.
- Gantry cranes & spreaders are used on container ships
- Safe working Load is marked on the cranes and derricks.
- SWL should never be exceeded.
- There should be a signal-man to guide the winch / crane operator.
- Winch / crane operator, should be thoroughly proficient in handling controls.
- Cargo gear must be examined and overhauled frequently.

2.1.5 Cargo Spaces, Opening & Closing of Hatches, Cargo lashing Equipment (1+8)

Trainee will be able to:

- Cargo is carried in the holds of the ship.
- Each hold has a coaming about one meter high, to prevent water going in the hold.
- Each Hold has an opening in the center called 'Hatch'
- Cargo is loaded / unloaded through this 'hatch'
- 'Hatch Cover' is a steel platform that makes the hatch a watertight compartment.
- State cargo lashing equipment

2.1.6 Safe Handling, Stowage and Securing of Cargoes and Stores. (6)

Trainee will be able to state basic:

- Procedures for safe handling, stowage and securing of Cargoes and stores
- Procedures for safe handling, stowage and securing of dangerous, hazardous and harmful substances and liquids.
- Knowledge and precautions to be observed in connection with particular types of Cargo and identification of IMDG Labels.

2.1.7 Preparing a ship for departure/rough weather/arrival (1)

Trainee will be able to explain:

Procedures for preparing a ship for departure/rough weather/arrival

2.1.8 Berthing / Unberthing of ships/ Anchor work (3+10)

When the ship is berthing or unberthing, trainee will be able to:

- Name the mooring ropes used in the forecastle as Headline, breast rope, back spring.
- Name the mooring ropes used aft as Stern-line, breast rope, back spring.
- List the equipment necessary for berthing operation forward and aft as, Heaving Lines, rope stopper, chain stopper, mooring ropes and wires, windlass, mooring winch, walky-talky etc.
- State that tugs are sometimes used to assist the ship in berthing / unberthing.

Anchor-work

Trainee will be able to State that:

- Each vessel has two anchors in the Forecastle, one on each side.(Port & Starboard)
- The anchors pass through Hawse Pipe and are housed against the shipside.
- Bow Stopper is fixed in the forecastle, close to the hawse pipe, to secure the anchor, against running out.
- Anchor chain (also called cable) is connected to the anchor by joining shackle.
- Anchor-chain passes over the gypsy of the windlass and goes into the chain-locker through spurling pipe.
- Each length of cable is 15 fathoms or 90 feet.

2.2	Ship Maintenance	4	30
	2.2.1 Preparation of surface using mechanical/pneumatic equipment, (1+16)		
	2.2.2 Painting (3+12)		
	2.2.3 Lubrication and Greasing of Deck equipment (0+2)		

Ship Maintenance

Painting:-

Trainee will be able to explain that:

- Steel plates must be protected against exposure to air & moisture, to prevent corrosion.
- This is done by painting the steel plates or structures.
- Prior to painting, the surface of the plates must be thoroughly chipped of rust, or old paint, then washed, cleaned and dried.
- Tools used for chipping are, chipping hammers, scrapers, wire brushes, chipping Machines, etc.
- After cleaning, first coat of paint should be anti-corrosive paint or Primer paint.
- Second coat should also be the same, but after the first coat has dried.
- Final coat of the paint should be the 'Finishing paint'.
- Where finishing paint is White, one additional coat of undercoat is applied.
- Boottopping paint is applied to shipside plates near the ship's waterline.
- Anti-fouling paint is applied to the underwater shipside plates in the dry-dock.
- Anti-fouling paint does not allow the marine growth to take place on the shipside.
- Tools used for painting on the ship, are paint brushes, roller Brushes, and spray machines.
- Paint brushes must be cleaned after every use, dried and then stored for future use.
- Paints give off combustible gases, therefore the paint locker must be well ventilated before entry.

2.3	Basic Navigation, Operate emergency equipment and apply emergency procedures	17	6
	2.3.1 Navigational Terms (2)		
	2.3.2 Rules of the Road (elementary) & Buoyage (5)		
	2.3.3 Navigational aids on the Bridge of a Modern Cargo ship(2)		
	2.3.4 International Code of Signal & Flags (4)		
	2.3.5 Knowledge of emergency duties and alarm signals(1)		
	2.3.6 Knowledge of pyrotechnics and distress signals, EPIRBs and SARTs, avoidance of false distress alerts and action to be taken in event of accidental activation.(3)		

2.3 Basic Navigation:

Trainee will be able to State that:

2.3.1 Navigational Terms

- Position of a Vessel is found by intersection of Latitude & Longitude on a chart.
- Latitude is measured from 0° to 90° North or South
- Latitude 0° is called Equator
- Latitude 90° North is called North Pole
- Latitude 90° South is called South Pole
- Latitude lines run East –West and are parallel to each other
- Latitude is expressed in degree and minutes North or South
- Each degree consists of 60 minutes
- Each minute of Latitude on Equator is one Nautical Mile
- Longitude is measured 0° to 180° E and 0° to 180° W
- Longitude is expressed in degrees East or West
- Longitude lines run North and South, and are parallel to each other

2.3.2 Rules of the Road (elementary) & Buoyage

Trainee will be able to recognize navigational lights & shapes, identify buoys

2.3.3 Navigational Aids available on the Bridge of a Modern Cargo ship

Trainee will be able to recognize Navigational Aids on the Bridge and explain its usage.

2.3.4 International Code of Signal & Flags

Trainee will be able to:

- Hoist any combination of Flags on the Halyards
- Identify and state the meaning / usage of the Single letter Flags

Trainee will be able to explain that:

- Courtesy flag is the Flag of the Foreign Country, in which the ship is presently situated.
- Courtesy Flag is hoisted outboard on the starboard yard arm of the main mast.
- House Flag is the flag of the Shipping Company and is hoisted on the Main Mast.
- The Ensign Flag is the flag of the Country where Ship is registered
- In port the Ensign Flag is hoisted on Ensign Staff, which is right aft.
- Flag clips are used to join two or more flags, to hoist on a halyard.
- Emergency duties and alarm signals, use of pyrotechnics and distress signals, EPIRBs and SARTs, avoidance of false distress alerts and action to be taken in event of accidental activation

2.4	Look Out Duties, other bridge duties and reporting system Responsibilities of a lookout & reporting (day/Night, Clear/Restricted visibility by degrees or points) including relieving.	4	10

Trainee will be able to state the duties of a lookout man

2.4.1 Look Out Duties:

A Lookout man on duty will:

- Stand in the Bridge Wings in an assigned place.
- Be appropriately dressed for the weather, by warm clothes, gloves, rain coat etc.
- Keep an all round look out by sight & hearing.
- Report any sighting and hearing of any sound signals to the Officer on duty.

2.4.2 The Sighting to Report will be:

By Day: All Ships, Boats, Floating Objects, Land and the relative direction in which sighted.

By Night: All Lights with their colour, and the relative direction in which sighted.

2.4.3 The Hearing to Report will be:

By Day or Night: All Sounds and the external relative direction from which emanating.

Example:

- Points on Port Bow
- Points on Stbd Bow

Examples of Reports to be made by the Look Out Man would be as Follows:

- A White flashing light, two points forward / abaft the Starboard Beam, Sir.
- A Boat, 2 points on the Port Bow, Sir.
- A Ship Right Ahead, Sir.
- A Buoy, 3 points on the Starboard Bow, Sir.
- Loom of a White flashing light, Right Ahead Sir.
- Red lights on the Port Bow, Sir
- Several White lights Right Ahead, Sir
- Sound signal 4 points on Port Bow.

2.4.4 Relieving the Look-Out Man:

Trainee will state that before relieving the previous lookout Man he would do the following:

- Be appropriately dressed to suit the weather (Rain Coat, Caps ,Woolens, Gloves etc)
- Arrive on the bridge 15 minutes before time
- Get acclimatized to the weather and the darkness
- Check the courses being steered and report to Duty Officer
- Compare the Gyro Compass & Magnetic Compass
- See what Ships / Lights / Buoys are in sight.
- Receive any special instruction if any, from previous lookout man
- Inform Duty officer that you have taken charge.

2.4.5 Other Bridge Duties:

Trainee will be able to explain the Arc of visibility and Colors of:

- Masthead Lights
- Side Light Port
- Side Light Starboard
- Stern Light
- Anchor Lights

Trainee will be able to identify various Navigational Shapes:

- Ball
- Cylinder
- Diamond
- Cone

2.5	Duties of a Gangway Watch in Port (introduction to ISPS Code)	4	0

The trainee will be able to:

- 2.5.1 State duties of a person on the Gang Way Watch.
- 2.5.2 State the importance verification of identity of any person coming on board.
- 2.5.3 State procedures for reporting any abnormal movement of persons on board trespassers.

2.6	Steer the ship & comply with Helm orders Compass & Errors (3) Helm orders & change over auto to hand & vice versa (1 +12)	4	12

2.6 Steer the Ship & Comply with Helm Orders:

Trainee will be able to State that:

- All Ships carry Gyro Compasses & Magnetic Compasses
- The Gyro Compass runs on Electricity
- Magnetic Compasses do not need electricity, but are directed by the Earth's magnetism.
- Gyro repeaters are fixed at steering platform, bridge wings, etc
- Change over from Hand Steering to Auto Pilot and vice versa
- Applying Gyro Error

Trainee will be able to:

- Name the Cardinal Points
- Name the Inter Cardinal Points
- Name the Three letter Points
- Name the By Points
- Box the Compass from One Point to Another.
- Convert Degree to Points & Vice Versa

Trainee will be able to:

- Understand the Helm Orders given to him
- Repeat the Orders given to him
- Implement/Carry out the orders given to him
- Confirm that the Orders have been carried out / implemented
- List the Helm Orders As Follows:-

Starboard	Port
Starboard Easy	Port Easy
Starboard 5	Port 5
Starboard More	Port More
Starboard 10	Port 10
Starboard 20	Port 20
Hard Starboard	Hard Port
Ease the Helm	Ease the Helm
Mid Ship	Mid Ship
Steady	Steady
Steady as she goes	Steady as she goes
Nothing to Starboard	Nothing to Port

Trainee will be able to explain in detail the procedure for 'Relieving a Helmsman'

Appendix 1C
Part 3 – SLOs - Marine Engineering Knowledge and Practice
(With reference to Annexure 2C)

Title	T Hrs	P Hrs	Total Hrs	Wks
Part 3 Marine Engineering Knowledge and Practice (at Support Level)	99	257	356	9

Marine Engineering Knowledge and Practice

Marine Engineering Knowledge & Practice (at support Level)		Suggested (Hrs)	
S.No.	Topic & sub topics	Theory	Practical
3.1	Familiarisation with duties and Engine Room environment ➤ Duties of a Trainee Rating in the Engine Room ➤ Engine Room Space ➤ Engine Room Machinery ➤ Auxiliary Machinery ➤ Symbols used in the engine room ➤ Engine room watch keeping procedures	7	0
3.2	Instruments (Thermometers, pressure gauges, level gauges)	2	0
3.3	Safe working procedures, Tools & instruments ➤ Hand tool, measuring instruments ➤ Lifting devices and equipment, basic fittings and fasteners ➤ Safety Precautions while working in the engine room ➤ Safety Precautions during bad weather ➤ Safety Precautions during hot work ➤ Safety Precautions while working on electrical equipment ➤ Safety Precautions before entering enclosed spaces ➤ Safety Precautions during dry dock ➤ Cleaning of engine room bilges disposal of engine room waste ➤ Bilge pumping system ➤ Ballasting and de-ballasting system bunkering procedures ➤ Maintenance work & preservation	12	86
3.4	Auxiliary Equipment & maintenance work ➤ Auxiliary equipment –general description ➤ Valves ➤ Pumps and Pumping Systems including ballasting and de-ballasting ➤ Joints and gland packing ➤ Filters ➤ Centrifugal separators ➤ Other Auxiliaries ➤ Boiler and Steam System and watch keeping duties ➤ Propeller & Shafting ➤ Preservation of equipment in good condition	26	25
3.5	Identify components of diesel engines listed below: ➤ Generator Engines ➤ Main Engine	8	12
3.6	Compressed air for auxiliary purposes	2	0
3.7	Machines: Grinder, Drill, Lathe	3	60
3.8	Basic welding and cutting: Arc welding, gas welding, gas cutting	3	60
3.9	Lubricants and lubrication	2	4
3.10	Level measuring devices and techniques	1	0
3.11	Lagging and insulation	1	0
3.12	Safe use of electrical equipment ➤ Hand tools for electrical maintenance ➤ Electrical Components & Equipment	4	06

	➤ Electrical instruments and electrical safety		
3.13	Chemicals on board	1	4
3.14	Steering Gear ➤ Function of steering gear, Checks to be made while taking a round in the steering gear compartment ➤ Bow thruster - Location and importance	3	0
3.15	Storage tanks ➤ Types of Storage Tanks in the Engine Room ➤ Purpose and Operation of Quick Closing Valves	2	0
3.16	Emergencies in the engine room ➤ Various emergencies in the engine room ➤ Types of audio-visual alarms ➤ Action to be taken on hearing / seeing the alarms ➤ Emergency escape routes	4	0
3.17	Fire extinguishing equipment in the engine room ➤ Portable Fire Fighting Appliances in the Engine Room ➤ Fixed Fire Fighting Equipment, i.e. CO ₂ , Foam, Water Sprinkler, Hyper Mist, Emergency Fire Pump	4	0
3.18	Basic Marine Engineering at Support Level ➤ Engineering materials & Special Tools used for maintenance of Engine Room main and auxiliary Machineries ➤ Watch-keeping duties on main and auxiliary Machineries, including Boilers ➤ Working of Diesel engine, air compressor, evaporator, oily bilge separator, AC & fridge plant ➤ Remote operations & internal communications system	14	0
	Total	99	257

Trainee will be able to: (To be used as a prefix to each of the statement of Specific Learning Objective)

3.1	Familiarisation with duties and Engine Room environment	7
3.1.1	Duties of a Trainee Rating in the Engine Room	
3.1.2	Engine Room Space	
3.1.3	Engine Room Machinery	
3.1.4	Auxiliary Machinery	
3.1.5	Symbols used in the engine room	
3.1.6	Engine room watch keeping procedures	

3.1.1	Duties of a Trainee Rating: (1)	
1.	States duties of a rating in the Engine room for assisting in maintenance and watch keeping	
2.	State the person to report to while working in the Engine room.	
3.1.2	Engine Room Space (1)	
1.	Describe engine room spaces – platforms (levels) – boiler – main engine – generator – bottom, funnel trunking, tank top, pipe tunnel, emergency escapes, steering flat, workshop, ventilation, and engine control room.	
3.1.3	Engine Room Machinery (1)	
1.	State major items of machinery and their purpose (Main Engine, Shafting, Auxiliary Engines, Auxiliaries, Boilers,).	
3.1.4	Auxiliary Machinery (1)	
1.	State function of each of auxiliary machinery (pumps, valves, fresh water generator, oil separators - purifiers, hydrophores, air compressors and their importance.	
3.1.5	Symbols used in the engine room (1)	
1.	Identify different signs and symbols commonly found in the engine room (danger, no smoking, emergency escape, electrical safety, no entry).	
3.1.6	Engine room watch keeping procedures(2)	
1.	To understand orders & Communicate with OOW.	
2.	State procedures for relief, maintenance & handover of a watch.	

3.2	Instruments (2)	2
1.	Identify and name instruments in the engine room: pressure gauges, thermometers, pyrometers, level gauges.	
2.	Read different type of instruments in the engine room: pressure gauges, thermometers, pyrometers, level gauges.	

3.3	Safe working procedures, Tools & instruments	12
3.3.1	Hand Tools & Measuring instruments (1)	
3.3.2	Lifting devices and equipment, Basic fitting, Fasteners (1)	
3.3.3	Safety precautions while working in engine room(1)	
3.3.4	Safety precautions during bad weather(1)	
3.3.5	Safety precautions during hot work(1)	
3.3.6	Safety precautions while working on electrical equipments(1)	
3.3.7	Safety precautions before entering enclosed space(1)	
3.3.8	Safety precautions during dry dock(1)	
3.3.9	Cleaning of engine room bilges, disposal of engine room waste(1)	
3.3.10	Bilge pumping system(1)	
3.3.11	Ballasting & Deballasting system, Bunkering procedures(1)	
3.3.12	Maintenance work & Preservation (1)	

3.3.1	Hand Tools & Measuring Instruments	1
1.	Identify and name each of hand tools listed below: (on a given diagram, and actual tool). Hammers, chisels, files, hack saw, screw drives, spanners, pliers, adjustable spanners, box spanners, wrench, crow bars, shears, type punches, center punch, hole punch, and marking tools.	
2.	Use each of the tools listed below properly and safely –Hammers, chisels, files, hack saw, screw drives, spanners, pliers, adjustable spanners, box spanners, wrench, crow bars, shears, type punches, center punch, hole punch, and marking tools.	
3.	Identify and name each of the measuring instruments (steel scales,	

inside and outside calipers, thread gauge, feeler gauge) 4. Use the following measuring instruments properly on given tasks. (steel scales, inside and outside calipers)	
3.3.2 Lifting devices and equipment, Basic Fitting, Fasteners: 1. Identify lifting devices and associated components (Slings, pulleys, eye bolts, shackles, pulleys, chain blocks, and engine room crane if available). 2. State checks to be made before using each of the (slings, pulleys, eye bolts, shackles, pulleys, chain blocks, and engine room crane if available). 3. State Risks involved in moving and lifting heavy objects using slings, pulleys, eye bolts, shackles, pulleys, chain blocks, (engine room crane if available). 4. Move and shift equipment manually 5. Move and shift machinery item using lifting devices such as slings, pulleys, eye bolts, shackles, pulleys, chain blocks, (engine room crane if available). Basic fitting: 1. Demonstrate procedure for dismantling and assembling pipes and valves using hand tools. 2. State procedures for assembling the same. 3. State safety precautions to be taken before dismantling, while working, and at the time of assembly. Fasteners 1. Identify and name each types of fasteners list (bolts, studs, nuts, common screw, common lock nuts and devices, and common types of washers) 2. Demonstrate proper methods of using fasteners and features. 3. Demonstrate ways and means of releasing rusted nuts, opening rounded nuts, removing broken studs, releasing nuts seized on a stud, securing studs back on a body of valves and similar locations. 4. State the tools that can be used to repair damaged internal or external threads.	1
3.3.3 Safety Precautions while working in the engine room .1 State safety precautions while working in the engine room	1
3.3.4 Safety precautions during bad weather .1 State Safety precautions during bad weather	1
3.3.5 Safety precautions during hot work .1 State Safety precautions during hot work	1
3.3.6 Safety precautions while working on electrical equipment's .1 State Safety precautions while working on electrical equipment's	1
3.3.7 Safety precautions before entering enclosed space .1 State Safety precautions before entering enclosed space	1
3.3.8 Safety precautions during dry dock .1 State Safety precautions during dry dock	1
3.3.9 Cleaning of engine room bilges, disposal of engine room waste .1 Describe Cleaning of engine room bilges & disposal of engine room waste	1
3.3.10 Bilge pumping system .1 Describe bilge pumping system	1
3.3.11 Ballasting & Deballasting system & Bunkering procedures .1 Describe Ballasting & Deballasting system & Bunkering procedures	1

3.3.12 Maintenance work & Preservation 1. Assist in maintenance tasks on auxiliary diesel engines, heat exchangers, pumps 2. Clean diesel engine components such as pistons, piston rings, bearings, 3. Clean components using diesel oil, chemicals. Protection and preservation: (also in GSK) 1. Use chipping hammers, wire brushes, and power tools in removing rust. 2. Prepare surface for painting – cleaning and degreasing. 3. Paint surfaces using paint brushes, roller 4. Identify components and function of air spray machine 5. Explain advantages of using air spray machines 6. State risks involved in using air spray machines.	1
3.4 Auxiliary Equipment & maintenance work 3.4.1 Auxiliary Equipment-general description(2+4) 3.4.2 Valves (4+8) 3.4.3 Pumps and Pumping Systems including ballasting/deballasting (4+6) 3.4.4 Joints and gland packing (1+4) 3.4.5 Filters (2+8) 3.4.6 Centrifugal separators (1+8) 3.4.7 Other Auxiliaries (3+0) 3.4.8 Boiler and Steam System including watch keeping (7+0) 3.4.9 Propeller & shafting (1+0) 3.4.10 Preservation of equipment in good condition(1+2)	30
3.4.1 Auxiliary Equipment-general description 1. Identify and state function of strainers, filters, heat exchangers – coolers and heaters. 2. Name major parts of strainers, filters, heat exchangers – coolers and heaters	2
3.4.2 Valves 1. Identify common types of valves and cocks used on board (globe, sluice or gate, butterfly, spring loaded, non return globe, float valve, taper cock, and ball cocks. 2. Identify major components of each type of valve and cock. 3. State procedures for opening and closing of valves for operation (globe valves, gate valve, butterfly valve, using a wheel spanner) 4. State function of drain valves and drain cocks for air bottles, oil fuel tanks, expansion tanks and level gauges.	4
3.4.3 Pumps and Pumping Systems including ballasting/deballasting 1. Identify common types of pumps in the Engine Room (centrifugal, reciprocating, gear, screw pump) 2. State the pumps that come under the category of ‘positive displacement pump’ and their peculiarity. 3. State precautions necessary before starting any pump 4. List major pumping systems in the engine room (Bilge, ballast, deck wash and fire supply, domestic fresh water, domestic sea water, expansion tanks, hot wells, compressed air system) 5. State the purpose of each of the pumping system (Bilge, ballast, deck wash and fire supply, domestic fresh water, domestic sea water, expansion tanks, hot wells, compressed air system) 6. State observations to be made on a operating pump and air compressor	4
3.4.4 Joints and gland packing 1. Identify types of joints used for pipe line and equipment having water, oil, air, steam, exhaust gases, and hot water. 2. Identify type of packing material used for packing glands of vales or pumps for sea water, steam, and oil. 3. Cut rubber or of stiff material suited for round or square flanges. 4. Demonstrate procedures for cutting packing and for packing a gland. 5. State precautions to be taken before commencing repair work on a pipeline or components in situ. 6. Identify soft metal joints and ‘O’ rings and state care to be taken on these during maintenance 7. Carry out temporary repair to a leaky pipe using clamps or jubilee clip.	1
3.4.5 Filters 1. Identifying name oil filters, and air filters used on board.	2

2. Identifies parts of a bucket type filter and a duplex type filter		
3. States risks involved in cleaning filters on a running machinery		
4. Lists precautions to be taken before opening a filter on a stand by machine.		
5. States checks to be made on a filter during cleaning and re-assembly.		
6. State precautions to be taken while working on a hot filter.		
3.4.6 Centrifugal separators		1
1. Identify and state purpose of a centrifugal separator		
2. Assist in opening up purifiers and cleaning disc stack.		
3.4.7 Other Auxiliaries		3
1. State functions of other auxiliaries and services such as sewage system, incinerators, refrigeration and air conditioning,		
3.4.8 Boiler and Steam System & watch keeping duties		7
1. State uses of steam on board.		
2. State major mountings on the water and steam side (Main steam stop valve, gauge glasses, safety valves, feed valve, blow down valve, air vent, pressure gauge connection)		
3. State basic operation of boiler (fuel supply, air supply, feed water supply, water level regulators, fuel control and cut outs)		
4. State observations to be made on an operating boiler		
5. State risks involved in operating an oil fired boiler		
6. State the meaning of 'back fire', 'over pressure', 'low water level'		
7. State procedures for keeping watch		
3.4.9 Propeller & Shafting		1
1. State the use of propeller & shafting		
3.4.10 Protection and preservation of equipment in good condition		1
1. Use chipping hammers, wire brushes, and power tools in removing rust.		
2. Prepare surface for painting, cleaning and degreasing.		
3. Paint surfaces using paint brushes, roller		
4. Identify components and function of air spray machine		
5. Explains advantages of using air spray machines		
6. States risks involved in using air spray machines.		
3.5	Identify components of diesel engines listed below:	8
	3.5.1 Generator Engines	
	3.5.2 Main Engine	
Identify components of diesel engines listed below:		8
3.5.1 Generator Engines		
1. Identify and state function of major components of an auxiliary (generator) diesel engine		
2. State important systems needed for operation of a auxiliary diesel engine (Lubrication, fuel, cooling water, starting, air charging and exhaust, safety system, governor)		
3. List safety devices on an auxiliary diesel engine		
4. Describe preparation needed for starting a auxiliary diesel engine		
5. State instruments fitted on an auxiliary diesel engine for monitoring its operating parameters.		
6. State checks to be made on an operating auxiliary engine.		
3.5.2 Main Engine:		
1. Identify major components of Main Engine (Cylinder head, exhaust valves, indicator valve, fuel injectors, fuel pump, piston, piston rod, connecting rod, cross head and guide, main bearing, cam shaft, crank shaft, crank case, crankcase relief valve.)		
2. State important systems necessary for operation of a Main Engine (Lubrication, fuel, cooling water, starting, air charging and exhaust, safety system)		
3.6 Compressed air for auxiliary purposes		2
1. State different uses of compressed air for auxiliary purposes. (cleaning components and portable machines)		
2. State risks involved in working with compressed air for auxiliary purposes.		
3. Demonstrates use of compressed in cleaning filters and other components		
4. State the fitting provided for draining the water from the air bottle		

3.7	Machines 1. Identify and name major parts of a pedestal drill machine, and pedestal or a bench grinder: 2. Drill holes using a fixed and portable drill machine 3. Use fixed grinding machine for grinding plates, chisels, and scrapper hand tools. 4. Use hand grinder for grinding plates or parts. 5. Use buffing or brush attachments for hand grinder. 6. Lathe machine: Identify parts and common tools, 7. Explain common tasks that can be performed on a lathe 8. Explain risks involved while working with machines : Drill, Grinder and Lathe 9. Carry out basic turning and facing operation on lathe.	3
3.8	Basic welding and cutting: Arc welding, gas welding, gas cutting 1. State risks involved in using and working with welding equipment – Arc Welding and Gas welding 2. Identify components of arc welding machine used on board, personal protective equipment, tools and accessories used for welding. 3. Arc welding: Perform welding of butt joints and lap joints using arc welding machine. Demonstrate basic procedures and techniques 4. Take precautions while performing tasks 5. Soldering ferrous and non-ferrous metal plates using gas welding equipment 6. Use a gas cutting torch for cutting a plate or rusted part.	3
3.9	Lubricants and lubrication 1. State type of oils and greases used on board in ER and on Deck. (cylinder oil, crankcase oil, gear oil, hydraulic oil) 2. States different methods of lubrication used on machinery and components 3. Identify grease nipples, greasing and oiling equipment 4. Demonstrates use of grease guns 5. Use oil can for filling in oil in crankcase of a machine 6. State precautions to be taken while working on or near an operating machinery. 7. State risks involved if oil or grease falls on hot surfaces	2
3.10	Level measuring devices and techniques 1. Identify and name different level measuring devices and equipment listed below: 2. Dip sticks, sounding rods, sounding tapes, gauge glass and sight glass. 3. Demonstrate use of dip sticks, sounding rods, sounding tapes, in sounding a level of liquid in a tank. 4. Read level gauges to check oil and water levels in tanks 5. State the type of fitting on a sounding pipe for a double bottom tank. 6. State the importance of leaving the gauge in a working condition if cocks, air vents have been tried while testing a gauge.	1
3.11	Lagging and insulation 1. State purpose of lagging and insulation material on pipes and components in the engine room. 2. State importance of maintaining lagging and insulating material, and prevention of contact with oil. 3. State the common material used for lagging 4. State precaution to be taken while handling a torn lagging.	1
3.12	Safe use of electrical equipment 3.12.1 Hand tools for electrical maintenance 3.12.2 Electrical Components & Equipment in ER	4
3.12.1	Hand tools for electrical maintenance 1. Identify basic tools and their safety aspects 2. State precautions to be taken prior commencing work or repair of electrical equipment 3. State isolation & emergency procedures 4. State different voltages on board	2
3.12.2	Electrical Components and Equipment in ER 1. Electrical Equipment in ER (generators, motors, switch boards, lighting, switches, starters, starter panels	2

2. Identify electrical components - plugs, sockets, bulbs and tubes, cluster lights, and portable lamps 3. Carry out basic electrical maintenance: changing plugs, replacing bulbs and tubes, rigging up cluster lights and portable lamps 4. States importance of taking care of wires against chaffing			
3.13	Chemicals on board 1. State chemicals used for different purposes on board: Air cooler cleaners; Boiler water treatment, fuel oil treatment 2. State precautions to be taken while using and handling chemicals on board	1	
3.14	Steering Gear 1. State function of a steering gear & its importance for trouble free operation & checks to be made while taking a round in the steering flat. 2. State functions of bow thruster, its location and importance	3	
3.15	Storage tanks 1. State types of storage tanks – wing tanks, double bottom tanks, tanks within the engine room such as lube oil storage, expansion tank oil sump) 2. State liquids stored in tanks: Fuel, lubricating oil, and fresh water. 3. State the purpose & operation of a ‘quick closing valve’. 4. Identify a quick closing valve.	2	
3.16	Emergencies in the engine room	4	
3.16	Emergencies in the engine room 1. State emergencies that can occur in the engine room (fire, flooding, black out, oil spill, injuries, electric shocks, burns,) 2. State the difference between, machinery failure alarm, general alarm, CO ₂ flooding alarm). 3. State action to be taken on hearing each type of alarm 4. State that all alarms in the ER are of Audio Visual Type 5. State the importance of emergency escape routes	4	
3.17	Fire extinguishing equipment in the engine room	4	0
3.17	Fire extinguishing equipment in the engine room 1. List fire extinguishing equipment found in the engine room (Portable extinguishers, non-portable extinguishers, fire hydrants, hoses and nozzles) 2. State methods of detecting fire in the engine room (smoke type, heat type, flame type) 3. State methods of raising alarm on finding a fire in the ER. 4. State the function of fixed firefighting installation :CO ₂ , foam, water sprinkler, hyper mist 5. State the purpose and location of Emergency fire pump that supplies water in emergency.	4	
3.18	Basic Marine Engineering at Support Level	14	
Basic Marine Engineering at Support Level 1. Describe engineering materials & Special Tools used for maintenance of Engine Room main and auxiliary Machineries. 2. State Watch-keeping procedures on main and auxiliary Machineries, including Boilers. 3. Describe working of Diesel engine, air compressor, evaporator, oily bilge separator, AC & fridge plant. 4. Describe Remote operations & internal communications system.		14	

Appendix 1D
General Ship Knowledge (Seamanship and Bridge duties at Support Level)
Recommended Practical Skills (GP Rating Pre-Sea Training)
(Practical Record Book)
(With reference to Annexure 2 B)

Hours against each heading are suggestive hours for each candidate to be on the job. Total hours of work in the workshop should be about 140-150 hours. Some of tasks may be grouped as a project, and for the sake of logistics. All practical tasks need to be completed within first 20 weeks of course to allow for revision, and schedule for practical examination.

Ref.	Imp.	Task and Sub-tasks Importance (Imp.) E-Essential D-Desirable	Signature of the Instructor on assessment of proficiency of the trainee, and date
		1. Surface Preparation and maintenance (24 hrs.)	
1.	E	Chip the surface as per prescribed safety guideline	
2.	E	Clean the surface as per safety guidelines	
3.	E	Prepare the surface for painting	
4.	E	Demonstrate usage of a Chipping Machine.	
5.	E	Identify common types of brushes and demonstrate their use	
6.	D	Paint the surface by using various methods	
		2. Work with Bosun's chair, ladders, stages and gangway (42 hrs.)	
1.	E	Demonstrate donning of a Safety Belt / Harness.	
2.	E	Rig Bosun's chair and lower himself using self lowering hitch observing safety guidelines	
3.	E	Rig the stage for working and painting over-side, complying to safety guidelines	
4.	E	Rig the Pilot ladder, Embark and disembark using the same observing safety guidelines	
5.	E	Rig a Coolie / Jacob's ladder for working overside, embark and disembark the ladder complying with safety guidelines	
		3. Rope work (18 hrs.)	
1.	E	Make a Bend, Hitch and a Knot for temporarily joining two ropes /temporary joining a rope to a structure.	
2.	E	Make a temporary eye using a bulldog grip on a wire rope.	
3.	E	Identify manila, polypropylene and other synthetic ropes and the precautions to be taken in using each.	
4.	E	Lay out a rope from a new coil	
5.	E	Secure the ends of a Rope using a Twine – Whipping	
6.	E	Seize the rope complying with the prescribed procedures.	
7.	E	Fetch equipment of various types.	
8.	E	Splice a permanent Eye on the end of a Fibre Rope; join two fibre ropes by a short splice & a long splice	
		4. Mooring (8 hrs.)	
1.	E	Make / prepare and throw the heaving line conforming to safety guidelines	
2.	E	Put the Stopper on berthing hawser and wire as per safety guidelines	
3.	E	Secure mooring ropes on bollards & bits.	
4.	E	Demonstrate joining of 2 mooring hawsers with a Carrick bend.	
5.	E	Demonstrate usage & fitting of Rat Guards.	

		5. Cargo stowage and handling (20 hrs.)	
1.	E	Identify slings and their uses.	
2.	E	Rig the single sheave tackle complying with Safety guidelines	
3.	E	Identify and use bulldog grips, demonstrate joining of 2 wires with bulldog grips, bottle screws, and wire lashings for securing cargo, use of Container lashing materials such as twistlocks, bridges, bars etc.	
4.	E	Demonstrate lifting / moving of heavy weights physically.	
5.	E	Identify various tackles and purchases and their use in cargo work.	
6.	E	Identify the lifting gear and know its S.W.L.	
7.	E	Demonstrate seizing of a shackle.	
8.	E	Demonstrate mousing of a hook.	
9.	E	Fetch the correct size of block for a specific SWL.	
10.	D	Oil & grease the wire rope winch as per safety guideline.	
11.	D	Identify various cargo gears used on board and related safe working practices.	
		6. Navigational Watch (12 hrs)	
1.	E	Keep lookout duties, recognize and report the lights of lighthouse, buoys and ships navigation lights (identify types of navigation lights)	Orals
2.	E	Identify signals used for indicating distress and describe procedures to use them	
3.	E	Identify the basic parts of a magnetic compass	
4.	E	Recognize the cardinal and inter-cardinal points of a compass	
5.	E	Understand Helm orders and steer the ship	
6.	E	Bend flags on the halyards for single letter signal (Five flags).	
		7. Miscellaneous (30 hrs)	
1.	E	Climb the Mast with appropriate safety measures	
2.	E	Use sounding tape, sounding rod and ullage tape.	
3.	E	Demonstrate usage of Staghorns and Cleats.	
4.	E	Identify the MOB marker.	
5.	E	Identify SART & EPIRB.	
6.	E	Identify Jubilee Clips and explain their usage.	
7.	E	Demonstrate usage of Scupper plugs.	
8.	E	Identify Jubilee Clips and explain their usage	
9.	E	Identify Garbage Bins and indicate correct procedures for disposal of garbage.	
		8. Port / Dock / Harbour / Ship Visit (8 hrs)	
1.	E	Write a brief report for one of the visits (List equipment and parts seen with date of visit, ships name, type of ship, port, etc.	

	Additional assignments:	
1.		
2.		
3.		

Appendix 1E
Recommended Practical Skills (GP Rating Pre-Sea Training)
(Practical Record Book)

Marine Engineering at Support Level

Hours against each heading are suggestive hours for each candidate to be on the job. Total hours of work in the workshop should be 240-260 hours. Some of tasks may be grouped as a project, and for the sake of logistics. All practical tasks need to be completed within first 20 weeks of course to allow for revision, and schedule for practical examination.

Ref	Imp	Task and Sub-tasks	
		Importance (Imp.) E - Essential D - Desirable	
		1. Personal Protection (2 hrs.)	
1.	E	Identify personal protection gear and demonstrate their use.	
		2. Hand tools and measuring instruments (24 hrs.)	
1.	E	Identify different spanners by type and size. Use appropriate spanner as per the requirement	
2.	E	Identify different types of hammers. Use appropriate hammers in required jobs	
3.	E	Identify nuts and bolts and their usage. Identity stud and demonstrate how to fit and remove a stud	
4.	E	Use a joint cutter to cut joint for a pipe flange.	
5.	E	Identify measuring instruments and their use, Callipers, Scale, Tri-square, Divider, Vernier callipers, Micrometer.	
		3. Bench Vice (4 hrs.)	
1.	E	Identifies a bench vice and uses of it.	
2.	E	Demonstrate proper and safe procedures for holding different types of job in a bench vice. (Use soft jaws for holding a delicate job to prevent damage, handling odd and heavy items, personal protection)	
		4. Using Chisels (6 hrs.)	
1.	E	Identify different types of chisels and their uses	
2.	E	Use a flat chisel for chipping a mild steel block or cutting a sheet taking specific safety precautions.	
3.	E	Demonstrate technique of removing a rusted nut	
		5. Using hacksaw (6 hrs.)	
1.	E	Identify different types of hacksaw frames	
2.	E	Fit a hacksaw blade correctly in a frame	
3.	E	Carry out cutting work for a given job (a plate, or a rod or a pipe)	
		6. Filing (8 hrs.)	
1.	E	Identify different types of files and their uses	
2.	E	Use flat file on a plate or a mild steel block to meet the given dimension	
		7. Marking (2 hrs.)	
1.	E	Identify various types of marking tools.	
2.	E	To carry out marking a plate or a block as per given details on a diagram.	
		8. Grinding (4 hrs.)	
1.	E	Identify major components of a pedestal grinding machine	
2.	E	Identify major components of a hand grinder and how to change wheels.	
3.	E	Carry out grinding operation on a given job taking specific safety precautions related to grinding.	

		9. Drilling (4 hrs.)	
1.	E	Identify different components of a vertical drill machine.	
2.	E	Fit and remove a drill bit in drilling machine	
3.	E	Carry out drilling operation on a given job taking specific safety precaution related to drilling	
		10. Tapping (for making internal threads) (2 hrs.)	
1.	E	Identify a tap by type and size (metric, BSP, mm, inch etc)	
2.	E	Demonstrate use of a tap in sequence by making internal threads on a metal piece	
		11. Valves and pipe work (14 hrs.)	
1.	E	Identify different types of valves with respect to their common use on board (globe, gate/sluice, butterfly, ball, spring loaded, fire hydrant and float valve)	
2.	E	Demonstrate proper techniques for opening and closing each type of valve mentioned above, and how to read the indicators where fitted.	
3.	E	Identify major components of globe valve, gate valve and butterfly valve.	
4.	E	Demonstrate proper techniques for dismantling and assembling a globe valve	
5.	E	Demonstrate techniques of removing a flanged pipe from a pipeline	
6.	E	Make joints for a pipe or valve flange.	
7.	D	Demonstrate procedures for lapping a valve and seat of a globe valve.	
8.	D	Remove a packing from a valve gland and replace with new one	
		12. Auxiliary Machinery- pumps (7 hrs.)	
1.	E	Identify Types of Pumps (centrifugal, reciprocating, gear and screw type)	
2.	E	Remove and place a pump from its foundation	
3.	D	Identify the parts of a centrifugal pump	
4.	D	Carry out checks before starting a centrifugal pump	
		13. Auxiliary Machinery-air compressor (4 hrs.)	
1.	E	Identify parts of a reciprocating air compressor	
2.	E	Carry out relevant checks before starting and while it is running	
3.	E	Demonstrate procedures for cleaning heat exchanger tubes using appropriate tube cleaning brush	
4.	E	Uses compressed air hose for cleaning components such as filters, heat exchangers, etc.	
		14. Lifting tools, equipment and techniques (14 hrs.)	
1.	E	Identify equipment used for lifting heavy machinery items. (eye bolts, slings, shackles, ratchet block, and chain block)	
2.	E	Demonstrate safe practices of using eye bolts, slings, shackles, ratchet block, and chain block for lifting and moving heavy machinery item.	
3.	E	Uses simple hydraulic jacks	
4.	D	Identify tools and jigs commonly used for lifting cylinder heads and pistons	
		15. Diesel Engines (12 hrs.)	
1.	E	Identify the major components of a diesel engine. (Structure and running gear)	
2.	E	Indicate the parts of the engine that require external cleaning	
3.	E	Identify instruments such as Pressure gauges and thermometers	
4.	E	Demonstrate ability to read pressures and temperatures.	
5.	E	Demonstrate techniques of cleaning of the engine parts such as pistons, ring grooves, and cylinder head.	
		16. Lubrication (4 hrs.)	
1.	E	Identify various methods of lubrication (grease guns, nipples, grease cups, oil cups, splash and forced)	

2.	E	Ascertain level of lubricating oil using sight glass, dip stick, sounding tape, overflow plug in different machines	
3.	E	Carry out lubrication /Oiling /Greasing of machinery such as diesel engines, purifiers, compressors, electric motors & pumps	
		17. Plumbing tools and practices (6 hrs.)	
1.	E	Identify different tools and jigs for plumbing work	
2.	E	Identify different components of pipes (elbows, unions, nipples, taps, cocks, glands, packing and joints)	
3.	E	Demonstrate use of different plumbing tools such as wrenches, hand saw, and thread cutting. Make external threads on a pipe.	
4.	E	Demonstrate practices for joining plumbing components such as unions, bends, and nipples using sealing tapes and compounds.	
5.	E	Dismantle and assemble a cock	
6.	E	Replace the washer of a tap	
7.	E	Demonstrate use of a circlip for repairing a pipe	
		18. Carpentry (4 hrs.)	
1.	E	Identify and define the use of basic carpentry tools	
		19. Gas welding kits and welding methods /procedures (20 hrs.)	
1.	E	Identify components of gas welding equipment.	
2.	E	Demonstrate safety precautions while using a gas welding equipment	
3.	D	Demonstrate basic approach to brazing and gas cutting	
		20. Arc welding kit and welding methods /procedures (10 hrs.)	
1.	E	Identify components of arc welding equipment used on board.	
2.	E	Identify tools and apparel used for arc welding	
3.	E	Describe arc welding method	
		21. Arc welding practice (30 hrs.)	
1.	E	Prepare two plates for joining by arc welding in simplest way (single butt)	
2.	E	Carry out arc welding to join two plates (butt weld)	
		22. Hand tools and safe working practices electrical shop (4 hrs.)	
1.	E	Identify hand tools used for electric maintenance	
2.	E	Adopt safe working practice while working with electrical appliances	
3.	E	Identify the basic safety devices such as fuses and trips in electrical systems	
		23. Electric cable and wires (2 hrs.)	
1.	D	Identify different types of cables with respect standard colour codes for three core cable.	
		24. Cleaning agents and boiler chemicals (4 hrs.)	
1.	E	Demonstrate proper techniques for handling chemicals.	
		25. Lathe Machine (60 hrs.)	
1.	E	Identify major parts of a lathe machine and operating levers and switches.	
2.	E	Demonstrate specific safety precautions while working on a lathe machine.	
3.	E	Center a circular section MS rod in the lathe	
4.	E	Identify use of common cutting tools and measuring instruments used in machining.	
5.	E	Use appropriate cutting tools and face a job and take a straight cut.	
		Additional Tasks, if any	
1.			
2.			
3.			
4.			

PRO-FORMA OF TRAINING RECORD FOR DECK RATINGS (RTRB)

Pro-forma of Training Record for Deck Ratings (RTRB)

Note: Approved book available as a separate document

TRAINING COURSE FOR ABLE SEAFARER (DECK)

Able seafarers Deck Course - (REFERENCE: TABLE A- II/5)

Note: Able seafarers' Deck training course guidelines are under development.

Chapter III – Engine Department- Pg 316-856			
III/1	III/1A	Marine Engineering Training for Operational Level Certification (MEO Class IV)	318-337
	III/1A.1	4 Years Pre Sea course for HSC (10+2)	338-348
	III/1A.1.1	Syllabus for 4 years course	349-364
	III/1A.2	2 Years Pre Sea course for Diploma in Mechanical/ Shipbuilding Engineering	365-375
	III/1A.2.1	Syllabus for 2 years Course	376-389
	III/1A.3	18 Months Pre Sea course for Graduates in Electrical/Electronic Engineering	390-398
	III/1A.4	12 Months Pre Sea course for Graduates in Mechanical Engineering/Naval Architecture	399-409
	III/1A.4.1	Syllabus for 12 months course	410-418
	III/1A.5	12 Months Workshop Training for Graduates in Mechanical Engineering (8 months Institute + 4 months afloat)	419-428
	III/1A.5.1	Syllabus for 12 months (8+4) months course	429-437
	III/1A.6A	Alternate Training Scheme for HSC (10+2) – Phase I – 12 Months Training at Institution	438-446
	III/1A.6B	Alternate Training Scheme for HSC (10+2) – Phase II – 9 Months Training at Sea	447-453
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Marine Engineering Training for Operational Level Certification (MEO Class-IV)

Marine Engineering Training for Operational Level Certification (STCW Code, Table A-III/1)

This section contains tasks to be performed and the criteria for satisfactory performance for all the schemes of marine engineering training for operational level certification contained in this appendix before appearing MEO CLASS IV "Part B". The training consists of workshop training, followed by onboard training and MEO CLASS IV course.

Sr. No.	TASK	CRITERIA FOR SATISFACTORY PERFORMANCE
Function: Marine Engineering at the operational level		
Competence 1: Maintain a safe engineering watch		
1.01	List or orally explain the reasons an officer in charge of the engineering watch shall not hand over the watch to the relieving officer.	Explanation is consistent with requirements in section A-VIII/2, paragraph 96, of the STCW Code.
1.02	Explain the standing orders and special instructions of the chief engineer officer relating to the operation of the ships systems and machinery.	Explanation is satisfactory to the assessor.
1.03	Explain the nature of all work being performed on machinery and systems, the personnel involved and potential hazards.	Explanation is satisfactory to the assessor.
1.04	Determine the level and, where applicable, the condition of water or residues in bilges, ballast tanks, slop tanks, reserve tanks, fresh water tanks, sewage tanks and any special requirements for use or disposal of the contents thereof.	Determinations are accurate.
1.05	Determine the condition and level of fuel in the reserve tanks, settling tank, day tank, and other fuel storage facilities.	Determinations are correct.
1.06	Determine any special requirements relating to sewage system disposals and the acceptable alternatives for such disposals for the duration of the voyage.	Ability to correctly explain acceptable alternative for sewage system disposals.
1.07	Determine the condition and mode of operation of the various main and auxiliary systems, including the electrical power distribution system.	Determinations are correct.
1.08	Determine, where applicable, the condition of monitoring and control console equipment, and which equipment is being operated manually.	Determinations are correct.

1.09	Describe potential adverse conditions that could result from bad weather, ice, contaminated water, or shallow water.	Descriptions are complete and accurate.
1.10	Determine, where applicable, the condition and mode of operation of automatic boiler controls such as flame safeguard control systems, limit control systems, combustion control systems, fuel supply control systems, and other equipment related to the operation of steam boilers and explain the function of each.	Correct determination and satisfactory explanation.

Sr. No.	TASK	CRITERIA FOR SATISFACTORY PERFORMANCE
1.11	Determine any special modes of operation dictated by equipment failure or adverse ships conditions and describe how various equipment failures or adverse ship condition could potentially dictate special modes of operation.	Correct determination and satisfactory explanation.
1.12	Receive reports from engine-room ratings relating to their assigned duties and describe the reports to the assessor.	Description of reports from ratings accurately reflects conditions reported.
1.13	Determine the availability of fire-fighting appliances and describe procedures to be undertaken in case of fire.	Correct determination and satisfactory explanation.
1.14	Describe the established watchkeeping arrangements and the functions of ratings forming part of the engineering watch.	Description is accurate.
1.15	Operate the propulsion equipment in response to needs for changes in direction or speed.	Capability for operation is satisfactory.
1.16	Determine and describe all preventive maintenance, damage control, or repair operations to be performed during the engineering watch. Describe how all Machinery to be worked on is isolated, bypassed, or adjusted. Record all work carried out on the watch.	Determinations are complete; descriptions are satisfactory; and work performed is properly recorded.
1.17	Inspect the machinery in the charge of the officer in charge of the engineering watch. Describe the condition of all such machinery.	Condition is accurately described.
1.18	Make rounds of the machinery and steering-gear spaces for the purpose of observing and reporting equipment malfunctions or breakdowns and performing routine adjustments, required upkeep, and other necessary tasks under direction. Describe potential malfunctions and breakdowns.	Performance is satisfactory and accurate. Explanation is consistent with requirements in section A-VIII/2, paragraph 103, of the STCW Code.
1.19	Describe special watch-keeping precautions to be taken under adverse conditions in rough seas, restricted visibility, coastal and congested waters, and at anchor.	Descriptions are satisfactory.
1.20	Describe the procedure for taking over the engineering watch in port.	Description includes the requirements of section A-VIII/2, Part 5, of the STCW Code.

1.21	Describe the procedures for performing the engineering watch in port.	Description includes the requirements of section A-VIII/2, Part 5, of the STCW Code.
1.22	Review the engine-room log and describe its contents.	Explanation is satisfactory.
1.23	Record all events related in the main and auxiliary machinery which have occurred during the engineering watch.	Records are suitable.
1.24	Describe duties associated with handing over watch.	Explanation is satisfactory.
1.25	Describe safety and emergency procedures; change-over of remote/automatic to local control of all systems	Explanation is satisfactory.

Sr. No.	TASK	CRITERIA FOR SATISFACTORY PERFORMANCE
1.26	Describe action that would be necessary in case of damage resulting from equipment breakdown, fire, flooding, rupture, collision, grounding, or other cause in order to contain the effects.	Descriptions are satisfactory.
1.27	Describe safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems.	Explanation is satisfactory.

The above should be in consistency with the principles of watchkeeping as enumerated in Section A-VIII/2 Part 4-2, 5-2 and 5-4 of the STCW Code.

	<i>Engine-room resource management</i>	
1.28	Describe the organizational structure of engine room manning with the assigned duties	Concept of E/R resource management and Safe Manning Requirement
1.29	Appreciate the use of necessary engine room resources allocation in correct priority	Job assignment and Workload Management
1.30	Describe communication identifying barriers and breakdowns in communication while onboard.	Effective communications
1.31	Describe assertiveness and leadership, role of leader, followers, situation while working in engine room.	Work Planning, Co-operation and Teamwork
1.32	Describe present state of associated systems and external environment effecting operational efficiency of engine room	Consideration of team experience. Crisis Management and Human Behavior in crisis. Working in multi & cross cultural environment
1.33	Use Case studies related to situational awareness and team experience in engine room operation.	Lessons to learn from case studies

Competence 2: Use English in written and oral form

2.01	Use engineering publications, operational manuals and fault finding instructions written in English.	The publications and manuals relevant to the engineering duties are correctly interpreted.
2.02	Fill in standard engineering reports and forms in English.	All reports and forms relevant to engineering duties are correctly filled.
2.03	Communicate with members of the watch, in a multilingual crew, in safety related duties.	All orders and information related to watchkeeping duties are correctly understood and acted upon by those

		concerned.
Competence 3: Use internal communication systems		
3.01	Use appropriate intercommunication system which would include ship's telephone system, communication system between engine room and wheel house, two-way communication system and public address systems.	Established procedures are followed.
3.02	Identify all escape routes from the machinery spaces.	All escape routes are properly identified.
3.03	Describe the various engine-room alarm systems and distinguish between the various alarms, especially the fire-extinguishing media alarm.	Description is accurate.

Sr. No.	TASK	CRITERIA FOR SATISFACTORY PERFORMANCE
Competence 4: Operate main and auxiliary machinery and associated control systems		
4.01	Understand and solve mathematical problems on Complex Numbers, Matrices, Differential Calculus, Integral Calculus, Fourier Series, Ordinary Differential Equations, Partial Differential Equations, Laplace Transforms, Vector Calculus, Calculus of Finite Differences, Probability, Probability Distributions and Probability Densities, Special Probability Densities, Sampling Theory, Regression and Correlation, Reliability theory;	Demonstrate the analytical ability of various components
4.02	Understand thermodynamic theory including Thermodynamic Definitions, Properties of Gases, The Second Law of Thermodynamics, Steam and Two Phase System, Ideal Gas Cycles, Fundamentals of Heat Transfer, Gas Dynamics, Gas Turbine Plants, Reciprocating Compressors, Rotary Compressors, Steam cycle, Application of Heat Transfer; and solve problems based on above	Demonstrate the analytical ability of various components
4.03	Describe the basic construction and operating principle of Marine Diesel Engine including classification of engines, two & four stroke cycles, spark & compression ignition engines, general description & constructional details of Diesel engines and its parts.	Construction and operating mechanisms can be understood and explained with drawings /instructions
4.04	Prepare main machinery for departure.	All checks and actions are carried out in accordance with laid down instructions and all main auxiliary and control systems are functioning properly. All relevant checks and actions are recorded.
4.05	Describe the basic construction and operating principle of Marine Steam Turbine including Impulse & Reaction Turbine, Compounding, Efficiencies, Marine turbine plant.	Construction and operating mechanisms can be understood and explained with drawings /instructions
4.06	Describe the basic construction and operating principle of Marine Gas Turbine including Gas dynamics, Gas cycles, Efficiency, Marine Gas Plant.	Construction and operating mechanisms can be understood and explained with drawings /instructions
4.07	Describe the basic construction and operating principle of Marine Boilers including Types of Boilers, Construction and operation of boilers and associated systems, mountings, water treatment.	Construction and operating mechanisms can be understood and explained with drawings /instructions
4.08	Operate steam boilers, including combustion control and burner management system	The equipment is operated in accordance with instructions and good practice. All instruments are monitored, necessary adjustments

		made and required actions taken on and properly recorded.

Sr. No.	TASK	CRITERIA FOR SATISFACTORY PERFORMANCE
4.09	Control steam boiler water level.	Water level is checked in accordance with instruction manual and good practice and necessary action is taken when water level is abnormal.
4.10	Describe the basic construction and operating principle of Shafting installations and propellers including types of shafting, bearings, alignment, removing and fitting of propeller, Thrusters.	Construction and operating mechanisms can be understood and explained with drawings /instructions
4.11	Describe the basic construction and operating principle of other auxiliaries including various pumps, air compressors, purifiers, Fresh Water generator, Heat Exchanger, Refrigeration, Air Conditioning and ventilation systems.	Construction and operating mechanisms can be understood and explained with drawings /instructions
4.12	Prepare auxiliary machinery for operation.	Pre-calibration of measuring equipments as per norm. All checks and actions are carried out in accordance with laid down instructions and all auxiliary and control systems are functioning properly. All relevant checks and actions are recorded.
4.13	Describe the basic construction and operating principle of different types of Steering gears including regulatory requirements.	Construction and operating mechanisms can be understood and explained with drawings /instructions. Require knowledge from SOLAS
4.14	Prepare and test steering gear for departure.	All checks and actions are carried out in accordance with laid down instructions and all control systems are functioning properly. All relevant checks and actions are recorded. Documents of port state control.
4.15	Describe the basic construction and operating principle of various automatic control systems.	Construction and operating mechanisms can be understood and explained with drawings /instructions. Calibration/Characteristics of various equipments.

4.16	Describe and explain the fluid flow and characteristics of lubricating oil, fuel oil and cooling systems including viscosity, hydrostatics, and kinematics of fluid flow, dynamics of fluid flow, flow through pipes, laminar and turbulent flow.	Theoretical understanding of various properties of Lubricating and Fuel Oils used onboard.
4.17	Describe the basic construction and operating principle of various deck machineries including deck cranes, mooring/anchor handling equipment, hatch covers, lifeboat davit and their associated hydraulic systems.	Construction and operating mechanisms can be understood and explained with drawings /instructions
4.18	Describe the safety and emergency procedures for operation of propulsion plant machinery and control systems.	Operations are planned and carried out in accordance with operating manuals, established rules and procedures to ensure safety of operations and avoid pollution of the marine environment

Sr. No.	TASK	CRITERIA FOR SATISFACTORY PERFORMANCE
4.19	Describe the preparation, operation, fault detection and necessary measures to prevent damage to the main engine, associated auxiliaries and control systems,	Monitoring various parameters for machinery to run up to rated condition. Identify the parameters deviating from normal conditions. Various causes of machinery malfunctions are understood and actions are designed to ensure the overall safety of the ship and the plant, having regard to the prevailing circumstances and conditions
4.20	Describe the preparation, operation, fault detection and necessary measures to prevent damage to the steam boilers, associated auxiliaries, steam systems and control systems.	
4.21	Describe the preparation, operation, fault detection and necessary measures to prevent damage to the Auxiliary Prime Movers, associated systems and control systems.	Monitoring various parameters for machinery to run up to rated condition. Identify the parameters deviating from normal conditions. Various causes of machinery malfunctions are understood and actions to ensure the overall safety of the ship and the plant, having regard to the prevailing circumstances and conditions
4.22	Describe the preparation, operation, fault detection and necessary measures to prevent damage to the auxiliaries including refrigeration, air conditioning and ventilation systems.	
Competence 5: Operate fuel, lubrication, ballast and other pumping systems and associated control systems		

5.01	Understand mechanics of fluids covering Properties; Hydrostatics; Kinematics & dynamics of fluid flow; Flow through pipes; Laminar & turbulent flow	Analytical and Theoretical demonstration of various characteristics of fluid.
5.02	Describe Operational characteristics of pumps and piping systems including control systems of different types of pumps. Analytical proof of Characteristics of Hydro-dynamic and positive displacement pumps	The operations are planned and carried out in accordance with operating manuals, established rules and procedures to ensure safety of operations and avoid pollution of the marine environment. Deviations from the norm are promptly identified and appropriate action taken.
5.03	Knowledge of different pumping systems and operations including regulatory requirements and procedures.	Describe by sketches of bilge and ballast pumping systems. Operations are planned and carried out in accordance with established rules and procedures to ensure safety of operations and avoid pollution of the marine environment.
5.04	Operate fuel-pumping, including transfer system.	
5.05	Describe cargo pumping systems on board liquid cargo ship.	
5.06	Operate bilge and ballast pumping systems.	

Sr. No.	TASK	CRITERIA FOR SATISFACTORY PERFORMANCE
5.07	Describe requirements and operation of oily water separator and other similar equipment.	Describe the constructional and operational details of oily water separator. Operations are planned and carried out in accordance with established rules and procedures to ensure safety of operations and avoid pollution of the marine environment.
Function: Electrical, electronic and control engineering at the operational level		
Competence 6 : Operate electrical, electronic and control systems		
6.01	Understand the principle of generation of EMF and Distribution of Power	Analytical proof.
6.02	Describe the process of preparing, Starting, paralleling and changing over of generators,	Operations are planned in accordance with established procedures and instructions.

6.03	Understand the principle of rotating magnetic field and application to various types of motors. Describe the starting methodologies of various types of motors	Analytical proof of rotating magnetic field. Sketch and describe of various starting methodologies.
6.04	Describe HV switch gear, distribution and equipments. List precautions required for operation of HV system	Code of safe working practice. Ship's manuals and rules by classification societies.
6.05	Describe the sequential control of various circuits & associated system devices	Ship's manuals and class rules.
6.06	Understand the characteristics of basic electronic circuit elements	Analytical proof.
6.07	Prepare flowcharts for automatic control systems	Analytical proof.
6.08	Describe the various methodologies of automatic control systems. Understand the theories of various control methodologies.	Analytical proof.
6.09	Describe the PID control characteristics and associated system devices for process control	Analytical proof. Descriptions of equipments with the help of sketches
6.10	Describe main engine throttle control system.	Sketch and describe major components by block diagram and explanation of operation individual equipments including alternate means of controlling throttle.
6.11	Describe electronic steering gear control system.	Sketch and describe of major components and explanation of operation including alternate means of controlling steering. SOLAS requirements of steering system.

Sr. No.	TASK	CRITERIA FOR SATISFACTORY PERFORMANCE
Competence 7: Maintenance and repair of electrical and electronic equipment		
7.01	Describe the safety requirements for working on shipboard electrical systems including safe isolation of electrical equipment required before personnel are permitted to work on such equipment	Selection and use of hand tools , measuring instruments, testing equipment are appropriate and interpretation of results is

		accurate
7.02	Carry out maintenance and repair of electrical system equipment, switchboards, electric motors, generator and DC electrical systems and equipment	Dismantling, inspecting, repairing and reassembling equipment are in accordance with manuals and good practice
7.03	Carry out detection of electric malfunction, location of faults and measures to prevent damage	Demonstration the ability of fault detection.
7.04	Describe construction and operation of electrical test and measuring equipment	Analytical assessment.
7.05	Describe the function and performance tests and configuration of monitoring systems, automatic control devices and protective devices	Reassembling and performance testing is in accordance with manuals and good practice
7.06	Reading and understanding of electrical and simple electronic drawings	Demonstration the ability of identifying the symbols and reading of drawings.
Function: Maintenance and repair at the operational level		
Competence 8: Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board		
8.01	Describe the characteristics and limitations of materials used in construction and repair of ships and\equipment	Theoretical proof for the requirement of various materials used onboard. Selection of material is appropriate Fabrication is to designated tolerances Use of equipment, and hand tools, machine tools and measuring instruments is appropriate and safe
8.02	Select and use appropriate material.	Properties and characteristics of various materials.
8.03	Describe the characteristics and limitations of processes used for fabrication and repair	Understanding demonstrated
8.04	Describe/Practice the properties and parameters considered in the fabrication and repair of systems and components	Understanding demonstrated
8.05	Describe the application of safe working practices in the workshop environment	Understanding of Code of Safe Working Practice
8.06	Describe the methods for carrying out safe emergency / temporary repairs	Understanding of Code of Safe Working Practice
8.07	Describe the safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools and measuring instruments	Understanding of Code of Safe Working Practice

Sr. No.	TASK	CRITERIA FOR SATISFACTORY PERFORMANCE
8.08	Describe the use of hand tools, machine tools and measuring instruments	Demonstration and Practice of hand tools.
8.09	Select and use hand tools for Dismantling, inspecting, repairing & reassembling equipment.	Demonstrate the suitability of various tools for various functions like disassembly, reassembly repair.
8.10	Select and use special tools for work on specific machinery & equipment i.e., pumps, purifiers, reducers.	Demonstrate and analytical reasons of using special tools for various equipments.
8.11	Use machine tools and equipment for fabrication and repairs.	Demonstration of matching, fitting, drilling etc.
8.12	Select and use general and special measuring equipment.	Understanding and demonstration of calibration of measuring tools. Describe the various terms of measuring tools.
8.13	Locate and use relevant manuals and interpret drawings, diagrams, sketches and instructions.	The instructions, drawings and diagrams relevant for the job are quickly identified and properly used.
8.14	Locate and interpret relevant manuals.	The selected manuals, drawings and diagrams are appropriate and quickly located.
8.15	Select test and use measuring equipment.	Selection of test and measuring equipment is appropriate and safe.
8.16	Use and interpret test and measuring equipment reading.	Use of test and measuring equipment is appropriate and interpretation of results is accurate.
8.17	Evaluate the necessity for taking corrective action with or without assistance.	Selection of proper equipment and procedures for the conduct of repair and maintenance is in accordance with manuals and good practice.
8.18	Repair faults and correct malfunctions.	The situation is assessed correctly and the action taken is acceptable. Commissioning and performance testing of equipment and systems brought back into service after

		repair is in accordance with manuals and good practice.
8.19	Describe the use of various types of sealants and packing's	Description of various seals and packing's. Understanding the effectiveness and limitation of various seals and pickings.

Sr. No.	TASK	CRITERIA FOR SATISFACTORY PERFORMANCE
Competence 9: Maintenance and repair of shipboard machinery and equipment		
9.01	Locate and use relevant manuals and interpret drawings, sketches and instructions.	The instructions and drawings relevant for the job are quickly identified and properly used.
9.02	Select and use special tools for work on machinery and equipment.	Correct tools are chosen and used without causing any damage to machinery or equipment.
9.03	Use machine tools and equipment for fabrication and repairs.	The selected tools and material are suitable for the parts to be fabricated and the work is carried out within the designed tolerances.
9.04	Ensure safety for all persons working on plant or equipment.	Isolation, dismantling and re-assembly of plant and equipment are in accordance with accepted practices and procedures to ensure safety of operations.
9.05	Use turning gear, place notice, record and take all safety precautions.	Safe Working Practice
9.06	Carry out a crank case inspection of main engine and make a written report.	Work is carried out with manufactures recommendation or acceptable practices.
9.07	Take readings of crankshaft deflections of main engine.	Work is carried out with manufactures recommendation or acceptable practices.

9.08	Change, inspect, check condition, wear and clearances, overhaul and test fuel injectors and high pressure pumps, air starting, relief and exhaust valves, of main engine	Work is carried out according to the instructions of the manufacture's manual and the necessary safety criteria.
9.09	Overhaul and change, if necessary of all diesel engine components.	Work is carried out according to the instructions of the manufacturers' manual and the necessary safety criteria. The clearances are correctly adjusted.
9.10	Take a boiler out of service. Blow a boiler down. Open up a boiler, inspection of internals and externals, testing of mountings, raising of steam.	Task is carried out in accordance with the manufacturer's instructions and accepted practices. Necessary safety criteria are taken care of.
9.11	Undertake overhauling of all deck mounted machinery and survival equipment.	The work is carried out in accordance with the instructions of the manufacturer's manual and the necessary safety precautions.
9.12	Undertake routine checks and tests steering gear.	Perform in accordance with manufacturer's recommendations. Follow manufacturer's recommendations or acceptable engineering practice.
9.13	Describe safety measures to be taken for repair and maintenance including safe isolation of shipboard machinery and equipment required before personnel are permitted to work on such machinery or equipment	Safety Working Practice

Sr. No.	TASK	CRITERIA FOR SATISFACTORY PERFORMANCE
9.14	Describe appropriate basic mechanical knowledge and skills	Analytical proof of Engineering Mechanics and Material science
9.15	Maintenance and repair such as dismantling, adjustment and reassembling of machinery and equipment	Safety Working Practice

9.16	Describe the use of appropriate specialized tools and measuring instruments	Understand the requirement of various special tools and safe working practice
9.17	Describe the design characteristics and selection of materials in construction of equipment	Selection of materials as required by the system considering the physical properties and design aspects.
9.18	Demonstrate the interpretation of machinery drawings and handbooks. The interpretation of piping, hydraulic and pneumatic diagrams	Understanding the basics of engineering drawing, and assembly machinery drawing.
<i>Function: Controlling the operation of the ship and care for persons on board at the operational level</i>		
Competence 10: Ensure compliance with pollution prevention requirements		
10.01	Understand the importance of preserving marine environment; describe sources of marine pollution, including accidental and operational.	Understanding is demonstrated
10.02	Ensure that procedures are agreed and observed and all scuppers are blocked before bunkering.	The operations are fully observed, all scuppers are blocked and pipes and hoses inspected before bunkering takes place.
10.03	Carry out bilge, ballast and bunkering operations as per the applicable rules and regulations and record the activities appropriately.	All operations are carried out in accordance with MARPOL requirements and due regard paid to Shipboard Oil Pollution Emergency Plan (SOPEP).
10.04	During relevant drills initiate immediate investigation to detect the source of pollution.	All available resources are utilized to detect the source and the master or appropriate authorities are informed.
10.05	During relevant drills stop or prevent leakages and spills of harmful liquids and solid substances.	The situation is thoroughly assessed and the actions taken are well organized and exercised with due consideration taken to the extent of the pollution.
10.06	Have all tanks and compartments sounded if any damage is suspected.	The soundings are readily available and the results immediately reported to

		the master.
10.07	Describe all anti-pollution equipment and related procedures.	According to national regulations and international conventions.
10.08	Appreciate the importance of initiating proactive measures to protect the marine environment	Actions to ensure that a positive environmental reputation is maintained

Sr. No.	TASK	CRITERIA FOR SATISFACTORY PERFORMANCE
Competence 11: Maintain seaworthiness of the ship		
11.01	Calculate stability, trim and stresses using stability trim, and stress tables, diagrams and stress calculating equipment.	Ensure that stability conditions comply with the IMO intact stability criteria under all conditions of loading.
11.02	Understand the theories of Resistance, Powering and Propeller. Describe the various types of propellers	Speed Resistance characteristics, definitions of various resistances, theories of propeller thrust, types of propellers used in marine
11.03	Understand fundamentals of watertight integrity	Lost Buoyancy and effect on stability
11.04	During relevant drills take actions to ensure and maintain the watertight integrity of the ship.	Actions to ensure and maintain the watertight integrity of the ship are in accordance with accepted practice.
11.05	Inspect hull and hull openings, compartments, hatch covers, equipment and complement and take action if any defects are detected.	The inspection is properly carried out, due regards paid to the prevailing circumstances and areas where defects are most likely to occur. Any defect is immediately reported and recorded and the suggested or executed action is adequate for the situation.

11.06	Ensure that all loose objects are securely fastened to avoid damage.	Inspection is carried out at regular intervals and more frequently in heavy weather or if other incidents occur. Heavy or otherwise dangerous objects are given the highest priority and good seamanship exercised.
11.07	Arrange for regular control measures to ensure watertight integrity.	Peaks, bilges, tanks and other compartments are sounded regularly, the results recorded and any irregularities reported and examined further.
11.08	Knowledge of fundamental actions to be taken in the event of partial loss of intact buoyancy.	Remedial measures to regain lost buoyancy
11.09	List general knowledge of the principal structural members of a ship and the proper names for the various parts	Name the various structural members
Competence 12: Prevent, control and fight fires on board		
12.01	Demonstrate ability to act and organize fire drills in accordance with the fire-fighting plan.	During debriefing after an exercise or a real fire extinguishing action the reasons for each action taken, including the priority in which they were taken, are explained and accepted as the most appropriate.
Sr. No.	TASK	CRITERIA FOR SATISFACTORY PERFORMANCE
12.02	During relevant drills carry out rescue operations wearing breathing apparatus.	The breathing apparatus is tested and used in accordance with manufacturers manual and the operation is successful.
12.03	Ensure that all persons on watch are able to detect and correct hazardous situations and actions and keep the ship clean and tidy.	Watch personnel make regular inspections in areas exposed to ignition. Easily inflammable material is put in safe places. The watch demonstrate an attitude of alertness and readiness to respond to fires.

12.04	Make the watch locate and use fire-fighting appliances and emergency escape routes and sounds alarm.	Every person on watch can use portable or otherwise adequate fire extinguishers for small fires, demonstrate ability to find emergency escape routes and raise the alarm.
12.05	Describe classes of fire and chemistry of fire.	Reasons of dividing the fire in various classes and chemical reactions
12.06	Acquire knowledge of fixed and portable fire fighting systems	description and operation of various fire fighting systems
12.07	Operate fire and smoke detecting equipment.	The equipment is tested and operated in accordance with manufacturer's manuals and ship-specific instructions.
12.08	Locate fire-stations and demonstrate proper use of fixed installations and other fire-fighting appliances and agents.	All stations are located and the most suitable one selected in the event of a fire. Proper equipment and extinguishing agents selected for the various materials on fire.
12.09	Locate and use fire-protective equipment (fireman's outfit, including breathing apparatus)	The equipment is quickly donned and use in a way that no accidents are likely to occur.
12.10	Demonstrate actions that have to be taken in the event of fire, including fires involving oil systems	Appropriate actions are taken
Competence 13 : Operate life-saving appliances		
13.01	Organize abandon ship drills.	On sounding the alarm all persons meet at the designated life-boat station wearing life jackets or immersion suits and carry out their duties on request.
13.02	Demonstrate the ability to organize and supervise the launching, handling and recovery of lifeboat.	Correct orders for embarkation, launching, immediately clearing the ship's side, safely handling the boat under motor, oars

		or sail as appropriate, and safe boat recovery.
13.03	Demonstrate the ability to organize and supervise the launching or throwing overboard a life raft and maneuver it clear of ship's side.	The duties for the persons designated for the rafts are clearly allocated and orders efficiently executed.
13.04	Demonstrate proper use of radio life-saving appliances, satellite EPIRB's and SARTs.	Equipment is operated in accordance with manufacturer's instruction.
Sr. No.	TASK	CRITERIA FOR SATISFACTORY PERFORMANCE
13.05	Ensure rations on board survival craft are adequate.	Food and water are sufficient for the survival craft designated complement.
13.06	Ensure that equipment on board survival craft is adequate.	Equipment such as pyrotechnics, signaling equipment, all meet regulatory requirements.
Competence 14 : Apply medical first aid on board ship		
14.01	During relevant drill stop excessive bleeding, ensure breathing and put injured persons in proper position.	The actions demonstrated are in compliance with accepted recommendations given in international medical first aid guidance.
14.02	During relevant drills detect signs of shock and heat stroke and act accordingly.	The treatment recommended or given is adequate. Ability to request Radio Medico for advice is demonstrated.
14.03	During relevant drills treat burns, scalds, fractures and hypothermia.	Recommended guidelines for proper actions are explained and the basic principles for avoiding hypothermia are demonstrated.
14.04	During relevant drills, locate and access shipboard medicine and equipment.	Ability to access the medical cabinet in a timely way.

Competence 15 : Monitor compliance with legislative requirements		
15.01	Describe organization and function of International Maritime Organization and International Labour Organization	List functions of organizations and documents released.
15.02	Describe organization and function of Indian Maritime Administration and its role in shipping	List functions of DG Shipping and Mercantile Marine Department.
15.03	Appreciate the role of flag state and port state.	Difference between flag and post state
15.04	Describe rules and regulations concerning ship safety, operation and pollution prevention as enumerated in different conventions and other instruments.	The statement given is correct and includes relevant bodies or organizations, which may be contacted to attain special information or guidance, which is not easily accessible.
15.05	Use legislation to ascertain due approach to solve questions encountered during onboard operations.	Legislative requirements relating to safety of life at sea and protection of the marine environment are correctly identified.
Competence 16 : Application of leadership and team working skills		
16.01	State the shipboard organizational structures including training responsibilities of personnel onboard	Operations are demonstrated to be in accordance with applicable rules
16.02	Acquire knowledge of international maritime conventions and recommendations, and national legislation	Training objectives and activities are based on assessment of current competence and capabilities and operational requirements.
16.03	Appreciate different functions of management applicable onboard including planning, decision making, allocation of resources, co-ordination and controlling. Case study for point mentioned above and to also indicate prioritization of resources.	Necessary team member(s) share accurate understanding of current and predicted vessel and operational status and external environment
Sr. No.	TASK	CRITERIA FOR SATISFACTORY PERFORMANCE
16.04	Case studies related to teamwork.	Effective participation
16.05	Understand the importance of effective allocation, assignment and prioritization of resources onboard.	Effective participation
16.06	Describe Risk Assessment and risk handling techniques used on ships	Carry out risk evaluation exercise

16.07	Understand and appreciate need of effective communication onboard and with authority on ashore realizing possible barriers to communication and means to overcome.	Communication is clearly and unambiguously given and received
16.09	Facilitating effective decision making by identifying different courses of action assigning probability of success to each course of action to arrive at the optimal decision taking into consideration the environmental impact and risks involved.	Decision making exercise
Competence 17 : Contribute to the safety of personnel and ship		
17.01	Knowledge of personal survival techniques	Appropriate safety and protective equipment is correctly used
17.02	Knowledge of fire prevention and ability to fight and extinguishing fires	Procedures and safe working practices designed to safeguard personnel and the ship are observed at all times
17.03	Knowledge of elementary first aid	Procedures designed to safeguard the environment are observed at all times
17.04	Knowledge of personal safety and social responsibilities	Initial and follow-up actions on becoming aware of an emergency conforms with established emergency response procedures
Competency No. 18 : Maintain the conditions set forth in a ship security plan, Recognition of security risks and threats, Undertake regular security inspections of the ship and proper usage of security equipment if any		
18.01	Demonstrate working knowledge of the requirements of the ISPS Code and information in national and international rules and regulations.	Knowledge of ISPS Code
18.02	Demonstrate knowledge of techniques for monitoring restricted areas, controlling access to the ship and to restricted areas onboard; methods for effective monitoring; various types of security equipment and systems, requirements for testing and calibrating.	Taking necessary actions as per established guidelines.

18.03	Acquire knowledge techniques used to circumvent security measures, recognition of potential security threats; crowd management and control techniques;; handling security related information and security related communications; methods for physical searches.	Taking necessary actions as per established guidelines.

FOUR YEARS DEGREE COURSE IN MARINE ENGINEERING

COMPETENCY AND COURSE SUBJECTS		Hrs of training	Assessment		
		Classroom	Lab	Workshop / Afloat	
FUNCTION : Marine Engineering at the operational and management level					
Competency No.1 : Maintain a safe Engineering watch (Table A-III/ 1)					
1.1	Thorough knowledge of Principles to be observed in keeping an Engineering watch, including:	10		70	Written Examination and skill test Examination
1.1.1	duties associated with taking over and accepting a watch				
1.1.2	routine duties undertaken during a watch				
1.1.3	maintenance of the machinery space logs and the significance of the readings taken				
1.1.4	duties associated with handing over a watch				
1.2	Safety and emergency procedures; change-over of remote/automatic to local control of all systems				
1.3	Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems				
1.4	<i>Engine-room resource management</i>	32		10	Written Examination and skill test Examination
1.4.1	Knowledge of engine-room resource management principles, including:				
1.4.1.1	allocation, assignment, and prioritization of resources				
1.4.1.2	effective communication				
1.4.1.3	assertiveness and leadership				
1.4.1.4	obtaining and maintaining situational awareness				
1.4.1.5	consideration of team experience				
Competency No. 2 : Use English in written and oral form (Table A-III/ 1)					
2.1	Adequate knowledge of the English language to enable the officer to use Engineering publications and to perform Engineering duties				
2.1.1	Oral Communication	17		2	Written Examination
2.1.2	Written Communication and Grammar	10		3	
2.1.3	Comprehension and speech	10		2	

2.1.4	Technical report writing	17		3	and skill test Examination
Competency No. 3 : Use internal communication systems (Table A-III/ 1)					
3.1	Operation of all internal communication systems on board	10		10	Written Examination and skill test Examination
Competency No. 4 : Operate main and auxiliary machinery and associated control systems (Table A-III/ 1)					
4.0	Applied Mathematics	100			Written examination
4.1	Basic construction and operation principles of machinery systems, including:			72	Written and Oral Examination (continuous assessment)
4.1.1	marine diesel engine	150			
4.1.2	marine steam turbine	16			Written Examination
4.1.3	marine gas turbine	10			Written Examination
4.1.4	marine boiler	30		30	Written Examination and skill test Examination
4.1.5	shafting installations, including propeller	10		16	Written Examination and skill test Examination
4.1.6	other auxiliaries, including various pumps, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, air-conditioning and ventilation systems	54		26	Written Examination and skill test Examination
4.1.7	steering gear				
4.1.8	automatic control systems				

4.1.9	fluid flow and characteristics of lubricating oil, fuel oil and cooling systems	54			Written Examination
4.1.10	deck machinery	44		62	Written Examination and skill test Examination
4.2	Safety and emergency procedures for operation of propulsion plant machinery, including control systems	72		48	Written Examination and skill test Examination
4.3	Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems:				
4.3.1	main engine and associated auxiliaries	10			Written Examination
4.3.2	steam boiler and associated auxiliaries and steam systems	8			Written Examination
4.3.3	auxiliary prime movers and associated systems	10			Written Examination
4.3.4	other auxiliaries, including refrigeration, air conditioning and ventilation systems	34		25	Written Examination and skill test Examination
	Competency as per Table A-III/ 2: Manage the operation of propulsion plant machinery. Plan and schedule operations. Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery.				
4.4	Design features, and operative mechanism of the following machinery and associated auxiliaries: marine diesel engine, marine steam turbine, marine gas turbine, marine boiler	34			Written & Oral Examination
4.5	Theoretical knowledge: Thermodynamics and heat transmission, Mechanics and hydromechanics Propulsive characteristics of diesel engines, steam and gas turbines, including speed, output and fuel consumption Heat cycle, thermal efficiency and heat balance of marine diesel engine, marine steam turbine, marine gas turbine, marine steam boiler. Refrigerators and refrigeration cycle, Physical and	50			

	chemical properties of fuels and lubricants & Technology of materials				
4.6	Practical knowledge:				Written & Practical Examination
	Start up and shut down main propulsion and auxiliary machinery, including associated systems, Operating limits of propulsion plant & The efficient operation, surveillance, performance assessment	20		25	
	and maintaining safety of propulsion plant and auxiliary machinery				
Competency No. 5 : Operate fuel, lubrication, ballast and other pumping systems and associated control systems (Table A-III/ 1)					
5.1	Operational characteristics of pumps and piping systems, including control systems	54	18		Written and Oral Examination (continuous assessment)
5.2	Operation of pumping systems:				Written Examination and skill test Examination
5.2.1	routine pumping operations	30		40	
5.2.2	operation of bilge, ballast and cargo pumping systems				Written Examination and skill test Examination
5.3	Oily-water separators (or-similar equipment) requirements and operation	16		45	
	Competency as per Table A-III/ 2: Manage fuel, lubrication and ballast operations.				
5.4	Operation and maintenance of machinery, including pumps and piping systems.	8		5	Written & Oral Examination

FUNCTION : Electrical, electronic & Control Engineering at the operational and management level					
Competency No. 6 : Operate electrical, electronic and control systems (Table A-III/ 1)					
6.1	Basic configuration and operation principles of the following electrical, electronic and control equipment:	35	36	18	Written , Skill test and Oral Examination (continuous assessment)
6.1.1	electrical equipment:				
6.1.1.a	generator and distribution systems				
6.1.1.b	preparing, starting, paralleling and changing over generators				
6.1.1.c	electrical motors including starting methodologies	100	32	64	Written , Skill test and Oral Examination (continuous assessment)
6.1.1.d	high-voltage installations	4			Written Examination
6.1.1.e	sequential control circuits and associated system devices	172	72		Written and Oral Examination (continuous assessment)
6.1.2	electronic equipment:				
6.1.2.a	characteristics of basic electronic circuit elements				
6.1.2.b	flowchart for automatic and control systems				
6.1.2.c	functions, characteristics and features of control systems for machinery items, including main propulsion plant operation control and steam boiler automatic controls	55	30		Written and Oral Examination (continuous assessment)
6.1.3	control systems:				
6.1.3. a	various automatic control methodologies and characteristics				
6.1.3. b	Proportional–Integral–Derivative (PID) control characteristics and associated system devices for process control				
6.2	Computer Applications (PMS, E learning, LAN network etc)	20			
	Competency as per Table A-III/ 2: Manage operation of electrical and electronic control equipment. Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery.				
6.3	Theoretical knowledge: Marine electro technology, electronics, power electronics, automatic control engineering and safety devices. Design features and system configurations of	15			Written & Oral Examination

	automatic control equipment and safety devices for main engine, generator and distribution system, steam boiler.				
6.3.1	Design features of high-voltage installations	2			
6.3.2	Features of hydraulic and pneumatic control equipment	5			
6.4	Practical knowledge: Functions and mechanism of automatic control for main engine & auxiliary machinery including generator distribution systems, steam boilers, oil purifier, refrigeration system, pumping and piping systems, steering gear system, cargo-handling equipment and deck machinery.	10	6		Written & Practical Examination
Competency No. 7 : Maintenance and repair of electrical and electronic equipment (Table A-III/ 1)					
7.1	Safety requirements for working on shipboard electrical systems, including the safe isolation of electrical equipment required before personnel are permitted to work on such equipment	48	36	70	Written , Skill test and Oral Examination (continuous assessment)
7.2	Maintenance and repair of electrical system equipment, switchboards, electric motors, generator and DC electrical systems and equipment				
7.3	Detection of electric malfunction, location of faults and measures to prevent damage				
7.4	Construction and operation of electrical testing and measuring equipment	36	36	10	Written , Skill test and Oral Examination (continuous assessment)
7.5	Function and performance tests of the following equipment and their configuration:	40	20	8	Written , Skill test and Oral Examination (continuous assessment)
7.5.1	monitoring systems				
7.5.2	automatic control devices				
7.5.3	protective devices				
7.6	The interpretation of electrical and simple electronic diagrams	10		36	Written Examination and skill test Examination
	Competency as per Table A-III/ 2: Manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition.				

7.7	Practical knowledge: Troubleshooting of electrical and electronic control equipment & monitoring systems. Function test of electrical, electronic control equipment and safety devices.	6		14	Written & Practical Examination
7.8	Software version control.	2		2	
FUNCTION : Maintenance & repair at the operational and management level					
Competency No. 8 : Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board (Table A-III/ 1)					
8.1	Characteristics and limitations of materials used in construction and repair of ships and equipment	48		416	Written Examination and skill test Examination
8.2	Characteristics and limitations of processes used for fabrication and repair				
8.3	Properties and parameters considered in the fabrication and repair of systems and components				
8.4	Methods for carrying out safe emergency/temporary repairs				
8.5	Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools and measuring instruments				
8.6	Use of hand tools, machine tools and measuring instruments				
8.7	Use of various types of sealants and packings				
Competency No. 9 : Maintenance and repair of shipboard machinery and equipment (Table A-III/ 1)					
9.1	Safety measures to be taken for repair and maintenance, including the safe isolation of shipboard machinery and equipment required before personnel are permitted to work on such machinery or equipment	125	30	50	Written , Skill test and Oral Examination (continuous assessment)
9.2	The use of appropriate specialized tools and measuring instruments				
9.3	Appropriate basic mechanical knowledge and skills				
9.4	Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment	30		135	Written Examination and skill test Examination
9.5	Design characteristics and selection of materials in construction of equipment	250	72		Written and Oral Examination (continuous assessment)

9.6	Interpretation of machinery drawings and handbooks.	170			Written Examination
9.7	The interpretation of piping, hydraulic and pneumatic diagrams	10		70	Written Examination and skill test Examination
	Competency as per Table A-III/ 2: Manage safe and effective maintenance and repair procedures. Detect and identify the cause of machinery malfunctions and correct faults. Ensure safe working practices.				
9.8	Theoretical knowledge: Marine engineering practice Practical knowledge: Manage safe and effective maintenance and repair procedures, Planning maintenance & repairs including statutory and class verifications.	20		10	Written & Practical Examination
9.9	Practical knowledge: Detection of machinery malfunction, location of faults and action to prevent damage Inspection and adjustment of equipment. Non-destructive examination.	4		13	Written & Practical Examination
9.10	Practical knowledge: Safe working practices	25		10	
FUNCTION : Controlling the operation of the ship and care for persons on board at the operational and management level					
Competency No. 10: Ensure compliance with pollution prevention requirements (Table A-III/ 1)					
10.1	Prevention of pollution of the marine environment	54		24	Written Examination and skill test Examination
10.1.1	Knowledge of the precautions to be taken to prevent pollution of the marine environment				
10.1.2	Anti-pollution procedures and all associated equipment				
10.1.3	Importance of proactive measures to protect the marine environment (+ Marine Environmental awareness)				
Competency No. 11 : Maintain seaworthiness of the ship (Table A-III/ 1)					
11.1	<i>Ship stability</i>	100			Written Examination
11.1.1	Working knowledge and application of stability, trim and stress tables, diagrams and stress-calculating equipment				
11.1.2	Understanding of the fundamentals of watertight integrity				
11.1.3	Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy				
11.1.4	Resistance propulsion & Powering of Ships.				
11.2	<i>Ship construction</i>	45		32	Written

11.2.1	General knowledge of the principal structural members of a ship and the proper names for the various parts				Examination and skill test Examination
	Competency as per Table A-III/ 2: Control trim, stability and stress.				
11.3	Understanding of fundamental principles of ship construction and the theories and factors affecting trim and stability and measures necessary to preserve trim and stability	8			Written Examination
11.4	Knowledge of the effect on trim and stability of a ship in the event of damage to, and consequent flooding of, a compartment and countermeasures to be taken	9			
Competency No. 12 : Prevent, control and fight fires on board (Table A-III/ 1)					
12.1	<i>Fire prevention and fire-fighting appliances</i>	54		60	Written Examination and skill test Examination
12.1.1	Ability to organize fire drills				
12.1.2	Knowledge of classes and chemistry of fire				
12.1.3	Knowledge of fire-fighting systems				
12.1.4	Action to be taken in the event of fire, including fires involving oil systems				
Competency No. 13 : Operate life-saving appliances (Table A-III/ 1)					
13.1	<i>Life-saving</i>	18		42	Written Examination and skill test Examination
13.1.1	Ability to organize abandon ship drills and knowledge of the operation of survival craft and rescue boats, their launching appliances and arrangements, and their equipment, including radio life-saving appliances, satellite EPIRBs, SARTs, immersion suits and thermal protective aids				
Competency No. 14 : Apply medical first aid on board ship (Table A-III/ 1)					
14.1	<i>Medical aid</i>				
14.1.1	Practical application of medical guides and advice by radio, including the ability to take effective action based on such knowledge in the case of accidents or illnesses that are likely to occur on board ship				
Competency No. 15: Monitor compliance with legislative requirements (Table A-III/ 1)					
15.1	Basic working knowledge of the relevant IMO conventions concerning safety of life at sea, security and protection of the marine environment	48			Written and Oral Examination
15.2	ISM Code and Quality management system				
15.3	Classification societies and their role in shipping				
15.4	Role of National Government in control of ships				

Competency No. 16 : Application of leadership and teamworking skills (Table A-III/ 1)					
16.1	Working knowledge of shipboard personnel management and training	5			Written Examination
16.2	A knowledge of related international maritime conventions and recommendations, and national legislation	5			Written Examination
16.3	Ability to apply task and workload management, including:	5			Written Examination
16.3.1	planning and coordination				
16.3.2	personnel assignment				
16.3.3	time and resource constraints				
16.3.4	prioritization				
16.4	Knowledge and ability to apply effective resource management:	5			Written Examination
16.4.1	allocation, assignment, and prioritization of resources				
16.4.2	effective communication on board and ashore				
16.4.3	decisions reflect consideration of team experiences				
16.4.4	assertiveness and leadership, including motivation				
16.4.5	obtaining and maintaining situational awareness				
16.5	Knowledge and ability to apply decision-making techniques:	5			Written Examination
16.5.1	situation and risk assessment				
16.5.2	identify and consider generated options				
16.5.3	selecting course of action				
16.5.4	evaluation of outcome effectiveness				
Competency No. 17 : Contribute to the safety of personnel and ship (Table A-III/ 1)					CONDUCTED AS MODULAR COURSE TRAINING AS PER SEPARATE DGS APPROVED TRAINING COURSE
17.1	Knowledge of personal survival techniques				
17.2	Knowledge of fire prevention and ability to fight and extinguish fires				
17.3	Knowledge of elementary first aid				
17.4	Knowledge of personal safety and social responsibilities				

Competency No. 18 : Maintain the conditions set forth in a ship security plan; Recognition of security risks and threats; Undertake regular security inspections of the ship; and proper usage of security equipment if any.					
18.1	Working knowledge of maritime security terms and definitions, maritime security levels; security reporting procedures; procedures and requirements for drills and exercises under relevant conventions, codes and IMO circulars; procedures for conducting inspections and surveys and monitoring of security activities specified in a ship security plan; security related contingency plans.	8		3	Written Examination and skill test Examination
18.2	Knowledge of security documentation; Knowledge enabling recognition of potential security threats; Knowledge enabling recognition of weapons, dangerous substances and devices and awareness of the damage they can cause; crowd management and control techniques; handling security related information and security related communications; methods for physical searches and non-intrusive inspections.				
18.3	Knowledge of techniques for monitoring restricted areas: Knowledge of controlling access to the ship and to restricted areas onboard; methods for effective monitoring of deck areas and areas surrounding the ship; methods for controlling the embarkation, disembarkation and access while onboard of persons and their effects; General				
	knowledge of various types of security equipment and systems, including their limitations; need for testing, calibrating and maintaining security systems and equipment.				
	TOTAL:	2531	460	1509	
	GRAND TOTAL:	4500			

Syllabus for Four Years Degree Course in Marine Engineering

1) Laws of Thermodynamics:

Thermodynamics and Heat Transmission - Thermodynamic Fundamentals, Perfect Gas, Second Law, Gas Cycles/ Engine Analysis, Properties of Vapours, Steam Cycles, Steam Turbine Velocity Diagrams, Refrigeration, Combustion Compressors, Heat Transfer, Air Conditioning.

Basic thermodynamic principles. Properties, energy, the First Law of Thermodynamic, flow and non-flow processes. Constant pressure process, Steady flow process. Second law of thermodynamics & T-S diagrams.

2) Ideal Gas cycles:

Constant volume cycle. Dual cycle. Air standard efficiency.

I.C. Engines, Elementary Principles and cycles of operation, Actual indicator diagrams. Mean effective pressure. Work done, power developed, indicated and brake thermal efficiencies, mechanical efficiency, overall efficiency. Fuel consumption. Heat balance.

3) Properties of pure substances:

Heat, Temperature and its measurement. Absolute temperature, pressure and its measurement. Specific heat capacity. Specific entropy. Specific enthalpy of evaporation and fusion. Problems involving changes of phase and not more than three substances.

4) Heat and work transfer:

Qualitative treatment of heat transfer by conduction convection and radiation. Laws of conduction and thermal conductance and applications to problems.

Cases Boyle's and Charles laws for perfect gases. Characteristics equation. Constant R and its use in simple problems. Isothermal, adiabatic and polytropic process. Relationships between pressure, temperature and volume. Work done. Changes in internal energy.

Specific heat C_p and C_v and the relationship between them.

Heat engine cycle, Ideal gas cycles (Otto cycle, Diesel cycle, Dual cycle, Joule cycle).

Heat Cycle, Thermal Efficiency and Heat Balance of the Following - Marine diesel engine, Marine steam turbine, Marine gas turbine, Marine steam boiler.

5) Applied Thermodynamics:

Air compressors, Elementary principles and cycles of operation. Calculation of work done. Indicator diagrams.

Properties of steam. Saturated steam, dry, wet. Dryness fraction. Super-heated steam. Internal energy. Enthalpy. Specific volume. Steam tables. Throttling.

Steam plant. Advantages of using steam expansively. Rankine cycles. Operation principle, Basic construction and materials of Steam Turbine, Impulse Turbine, Reaction turbine, Bleeder turbine (extraction turbine), Regenerative turbine, Reheat turbine. Thermal, mechanical and overall efficiencies of prime movers. Steam cycle with economiser, air heater. Regenerative feed heating. Boiler efficiency, heat balance for engine and boiler trials. Change in dissolved solids in boilers and evaporators due to contaminated feed and effect of blowing down. Elementary principles of steam turbines including simple velocity diagrams for impulse and reaction turbines. Force and work done on blades.

Combustion. Solid and liquid fuels. Calorific value. Chemical equations for complete combustion. Theoretical minimum air required. Excess air.

Refrigerators and Refrigeration Cycle - Refrigeration and Air conditioning system design, operation and maintenance. Refrigeration. Vapour-compression cycle. Refrigerating effect. Cooling load. Use of tables of properties of refrigerants.

Coefficient of performance.

Gas dynamics, Gas nozzles and steam nozzles. One dimension flow of gases through varying cross section, critical pressure ratio, convergent nozzle, convergent-divergent nozzle,
Gas turbine Open cycle gas turbine, Operation principle & Basic construction. Effect on thermal efficiency due to change in pressure ratio, inclusion of inter-cooler, re-heaters and heat exchanger.

6) Mechanics and Hydromechanics - Statics, Dynamics, Friction, Balancing, Simple Harmonic Motion, Stress & Strain, Bending of Beams, Torsion, Struts, Combined Stress, Stresses in Thick Shells, Fluid Mechanics.

a) Statics:

Force as a vector. Triangle and polygon of forces. Resultant and equilibrium of a system of concurrent coplanar forces. Lami's Theorem, Concurrent Forces in a Plane, Parallel forces in a Plane, General Case of forces in a Plane. Couples, Method of Moments, Plain Trusses (Method of Joints, Method of Sections, Method of Members),

b) Friction: Necessary force applied parallel to an inclined plane to pull up or down the plane or to hold it stationary (including effect of friction). Work done at uniform speed up the plane Coefficient of friction, Friction angle. Energy and power lost due to friction in simple bearings. Kinematics. Linear motion. Graphs and equations for displacement speed, velocity and uniform accelerations. Velocity as a vector. Relative velocities in one plane only. Angular motion. Equations for displacement, velocity and uniform acceleration. Coefficient of friction, Friction angle.

Energy and power lost due to Friction in simple bearings, Friction in belt drive, Efficiency of Screw jack (Square and V-Thread).

Centroids of composite body, Area & Volume (Pappus Theorem)

Simple lifting machine. Graphics of load-effort and load-efficiency. Linear law. Velocity ratio, mechanical advantages and efficiency of the following machines: Wheel and Axle, Differential Wheel and Axle, Rope Pulley blocks, Differential Pulley blocks, Warwick screw, worm-driven chain blocks and single and double purchase crab winches.

Virtual Work, Moment of Inertia of Plane figures, Moment of Inertia of Material Bodies.

c) Dynamics:

Linear motion. Graphs and equations for displacement, speed, velocity and uniform accelerations. Velocity as a vector. Relative velocities in one plane only. Angular motion. Equations for displacement, velocity and uniform acceleration. Kinematics of particle & rigid bodies, Impulse and Momentum principle, Work and Energy principle, Rectilinear Motion, Curvilinear Motion, Motion of Projectiles, Work and Energy, Use of D'Alembert's formula, Instantaneous Center, Problems with constant force or force with linear variation. Energy Potential energy. Kinetic energy of translation Newton's laws of motion. Conservation of momentum. Centrifugal force and its application to conical pendulum, unloaded governor, curved tracks and machine parts. Stress in thin rim due to centrifugal action. Periodic motion (SHM).

Stress in thin rim due to centrifugal action Acceleration of connected bodies. Effect of simple air resistance on motion under the effect of gravity. Kinetic energy of translation and of rotation. Flywheels. Impulsive forces. Governors including sleeve friction. Simple harmonic motion. Simple pendulum. Simple vibrations. Dynamic balancing of masses rotating in one plane. Basic dynamics of the engine mechanism.

d) Strength of Material:

Stress and strain. Direct stress and strain. Modulus of elasticity. Shear stress and strain. Modulus of rigidity. Factor of safety. Stress due to restricted expansion or contraction of single members. Hydrostatic stresses and the corresponding strains. Relationship between three elastic constants. Thermal stress; Axial stresses in composite materials. Strength of welded joints.

Torsion. Strength and stiffness of solid or hollow shafts. Stress due to torsion. Power transmitted by shafts and coupling bolts. Torsion applied to stepped shafts, compound shafts and partial hollow shafts, Torsion applied to closely coiled springs, Plastic yielding of materials in Torsion. Torsion of shaft fitted with liner.

Thin shells. Circumferential and longitudinal stress in thin cylindrical shells subject to internal pressure. Thick cylinders, Lamé's theory, compound cylinders,
Struts. Euler's theory and Euler's buckling load. Struts with both ends pin joined, both ends fixed, one end fixed and one end free. Rankine-Gordon Formula. Applied problems. Eccentric loading of short columns. Use of strut formulae.

Springs. Springs with axial load, Calculations for mean diameter of springs, wire diameter & number of coils. Closed coiled helical spring.

Concept of Strain Energy; Strain Energy due to normal and Shear Stresses; Strain Energy due to impact loads; Resilience.

Compound Stress and strain. Stresses on an oblique section, General two dimensional stress system, Principal planes and principal stresses, Strain on an oblique section, Determination of principal strains, Principal strain in three dimensions, Principal stresses determined from principal strains, Mohr's Diagram for stress and strain, Combined bending and twisting, Equivalent Bending Moment and Twisting Moment, Shear, bending and torsion, Theories of failure.

Beams. Simply supported beams, Cantilevers, Shearing force and bending moment diagrams for cantilevers, simply supported beams with concentrated and uniformly distributed loads. Stress due to bending. Strain energy due to bending, Application of impact. Deflection of Built-in beams and Continuous beams by integration and Macaulay's Method. Moment area Methods of deflection co-efficient. Deflection due to shear, Deflection by graphical method. Clapeyron's three moment theorem. Applied problems.
Thin Curved bar, Strain energy due to bending. Castigliano's theorem, and its application to curved bars, strain energy due to twisting. Applied problems.

e) Fluid Mechanics:

Properties of fluid-density, compressibility, vapour pressure, capillarity, Cavitation phenomena viscosity & measurement- rotating viscometer.

Euler's Formula, Bernoulli's Formula, Energy equations & applications, Flow rate measurement-Venturimeter, Orificemeter & Pilot tube.

Impact of jets-force exerted by jet on a flat, curved plates & pipe bend. Surge pressure and control.

Equilibrium of floating bodies. Variation of fluid pressure with depth. Total force due to liquid pressure on immersed plane surfaces horizontal or vertical. Centre of pressure on a rectangular vertical plane surface or triangular plane surface, both with one edge parallel to the surface of the liquid. Coefficient of velocity, contraction of area and discharge.

7) Hydraulics.

Full bore flow of liquid through pipes under constant head. Flow through orifice. Flow through pipes, Flow through parallel concentric pipes, Flow through parallel plates, Coefficient of velocity, contraction of area and discharge.

Bernoulli's equation and applications. Venturi-meter. Force exerted by a jet. Blade diagrams for a centrifugal pump.

Control: Simple flow and control problems.

8) Differential Calculus:

Differentiation of algebraic, circular, exponential and logarithmic functions, of products, quotients functions of a function and simple implicit functions.

Successive differentiation - intro. and notation, nth order derivatives of std. Functions, nth order derivatives using (a) trig. Identities and std. fns.(b) partial fractions, Leibnitz' Theorem, Maclaurin's Theorem and std. Expansions, Expansions using std. Expansions, Taylor's Theorem, Indeterminate forms and L'Hospital's rule, Curve tracing of cartesian and polar curves.

Functions of several variables, limits and continuity, Partial derivatives - def., geometrical interpretation and rules of partial differentiation, Higher order partial derivatives, Homogeneous fns. and Euler's Theorem,

Total derivatives and chain rules, Implicit fns. and composite fns., Errors and approximations, Maxima and minima, Lagrange's multipliers.

9) Integral Calculus:

Integration of standard forms by substitution and by parts. The definite integral as the limit of a sum. Application of integration to area under curve; volume of revolution; First moment of area and the position of a centroid of an area; Work done by variable forces; mean values, Root mean square values of $\sin nx$ and $\cos nx$. The rules of Guldinus.

Theorems of parallel and perpendicular axes. Second moments of area and moments of inertia of a rectangular and circular laminas.

Multiple Integrals. Double and Triple Integrals. Region of integration and change of order of integration. Spherical Polar and Cylindrical Co-ordinates. Applications –Area, Volume, Mass of wire, lamina and solid. Centre of Gravity of wire, lamina and solid. Moment of Inertia using multiple integrals.

10) Ordinary Differential Equations:

Def., order and degree, formation of differential equation. Solution of first order, first degree equations in variable separable form, homogeneous equations. other substitutions, Equations.

Reducible to homogeneous and exact differential equations.

Equations reducible to exact, IF, Linear differential equation. Of first order first degree, reducible to linear, Applications to electrical circuits and orthogonal trajectories, nth order LDE - def. and complementary solution, Methods of obtaining PI, Method of variation of parameters, Method of undetermined coefficients, Cauchy's homogeneous LDE and Legendre's equation., System of Ordinary differential equations.

Simultaneous equations. in symmetrical form,

Applications to deflection of beams, struts and columns, Applications to electrical circuits and coupled circuits.

11) Calculus of Finite Differences:

Difference operators and relation between them, Algebra of finite difference operators, Newton's forward and backward interpolation formulae, Sterling's interpolation formula Lagrange's interpolation formula, Numerical differentiation, Numerical integration, Difference equations - def., formation and solution, Linear difference equation. with constant coefficients.

12) Basic electricity - Electric current & Electromagnetic induction:

Explain the composition of an atom. Describe the flow of current subjected to a potential difference referring to Electron flow conventional flow.

Explain materials in terms of Conductors, Insulators with examples.

Explain potential difference and electromotive force stating the symbols and units used and difference between them.

Explain what is (a) Direct current (b) Alternating current

Describe Ohm's Law.

List the factors which govern the variation of resistance of conductors Explain the effect of internal resistance to supply source and it affects (a) emf (b) terminal potential difference. , Work energy and power.

State Kirchhoff's law and network theorems (a) Current law (b) Voltage law. Calculate the current flowing and voltage drop across resistors in simple circuits. Magnetism and electromagnetism, MMF, Magnetic, Flux, Reluctance, permeability, magnetic Hysteresis.

Electromagnetic Induction, Self Inductance, Mutual inductance, Faraday Laws of Electromagnetic Induction

State Flemings hand rules to determine the direction of magnetic field motion and current.

13) Basic electronics – Electron Theory:

Basic Electronic Circuit Elements – Semi conductor, Thruster, Integrated Circuit (IC) and Large scale Integrated Circuit (LSI).

Transducers and transmitters suitable for measurement of temperature, pressure, flow, level, speed, torque, vibration, humidity and water content with calibration.

Theoretical knowledge of semi conductor components, Diodes, Transistor, Thrusters their function and operation. Laboratory testing and familiarization of each electronic component mentioned above.
Transistor as an amplifier, switch and oscillator.
Integrated Circuits. (IC)- IC555 based timers.
Large scale Integrated circuits. Examples and applications.
Construction and functioning of LED, LCD, 7 segment display.
Study basics of digital electronics.

14) Marine Engineering Materials:

Characteristics and limitations of materials used in construction and repair of ships and equipment - Basic Metallurgy, Metals and Processes, Properties and Uses, Non-Metallic Materials.
Characteristics and limitations of process used for fabrication and repair - Process, Heat Treatment of Carbon Steel.
Properties and parameters considered in the fabrication and repair of systems and components - Materials Under Load, Vibration, Self-Secured Joints, Permanent Joints, Bonding Plastics, Adhesives and Bonding, Pipe work.
Iron Carbon Equilibrium Diagram, Non Ferrous alloys, Welding, Gas cutting, Materials under load, Vibrations. Mechanical testing of Materials, Failure modes viz plastic deformation, fracture, fatigue, creep. Design characteristics and selection of materials in construction of equipment.

Technology of Material - Metallurgy of Steel and Cast Iron, Properties and application of material used in machinery on board ships, Engineering processes used in construction and repair,
Materials and welding - Destructive and non-destructive testing of material.
Non-Destructive Examination - Different types of non-destructive examination.

15) Fabrication, Welding, Joining and Cutting:

Permanent joints, Riveting, Soldering, Self secured joints, Safety and health when welding, Principles of electrical arc welding, Principles of gas welding, Welded joints and low carbon steels, Common faults in welded joints, Plate work-marking out, Thermal Cutting, Mechanical Cutting, Forming, Bending Plates, Inspection, Pipe work. Non-destructive testing's.
Manufacture of components. Gauges, deck machinery, gearing, clutches.

16) Industrial Chemistry:

Fundamentals, Acidity/Alkalinity, Corrosion, Water testing/treatment, Introduction to fuels and lubricants, toxic and other ill effects of cargoes on human and environment.

17) Corrosion Control on Board Ship:

Thermodynamics & Kinetics of corrosion, various forms of corrosion, corrosion prevention methods.

18) Types of Technical Drawings, Lettering, Dimensioning, Limits and fits, Geometrical tolerance Line work,

Pictorial Projection, Development of Surface, Isometric Projection / Views, Orthographic Projection, Missing Views, Machine Parts, Screw threads and fasteners, Locking and retaining devices, Riveted type fastenings, Welded connections, Design Characteristics of Bearings, Seals, Lubrication arrangement, ball and roller bearings. Machinery Components and Assembly drawings, and Blue Print Reading.

Interpretation of machinery drawings and handbooks marine engineering drawing and design. The interpretation of piping, hydraulic and pneumatic diagrams.

19) Sample List drawings:

{Air Inlet Valve, Automatic Valve, Ballast Chest, Bilge Suction Strainer, Burner Carrier, Connecting Road and Bearings, Control Valve, Crosshead and Guide Shoe, Cylinder Relief Valve, Feed Check Valve, Flow Regulator, Full Bore Safety Valve, Gauge Glass (Plate Type), Gear Pump, High Lift Safety Valve, Oil Strainer, Parallel Slide Stop Valve, Pedestal Bearing, Piston (4 Stroke), Piston (Upper and Rod), Piston Type Stop Valve, Reducing Valve, Starting Air Valve, Starting Air Pilot Valve, Stern Tube and Tail Shaft, Telemeter Receiver, Tunnel Bearing, Valve Actuator.}

20) English language:

Ability to communicate in oral form & write technical reports: understand and use technical/engineering publications.

21) Internal communication systems:

Operation of all internal communication systems on board and maintain Statutory communication Records. The systems would include ship's telephone system, communication system between engine room and wheel house, two-way communication system and public address systems. Operation and maintenance at respective control station for all alarms and indicators. Record keeping of all communication systems.

22) Engine Room Resource Management:

ERM - Allocation, assignment and prioritization of the resources, effective communication, assertiveness and leadership, obtaining and maintaining situational awareness, consideration of team experience.

ERM principles based on Bridge Resource Management, Necessity of ERM - ERM in terms of maintaining the safe engineering watch, Resources considered in ERM - Resource management eg, personnel management, information management and management of installations/ equipment, Necessity to practice ERM - Allocation, assignment and prioritization of the resources, effective communication, assertiveness and leadership, obtaining and maintaining situational awareness, consideration of team experience.

23) Introduction to ship and ship's Routines:

Sensing and monitoring devices associated with marine equipment; Propulsion transmission systems, including thrust and shaft bearings, stern tubes and propellers, Shafting Installations and Propeller – Equipment constructing shafting, Types of propeller and features, Material of construction and definitions, Cavitations.

Steering and stabilizing systems, including bow thrusters, Steering gear principles - Operation, Principles, Types, Material of construction, Steering gear electric control, Hydraulic power operated rudder systems, Hydraulic power rotary pumps, Automatic control systems.

Refrigeration machinery and air conditioning systems; Safe and efficient operation in the UMS mode, Refrigeration - Marine refrigeration cycle, Principles of refrigeration, Refrigerating compressors and system components, Refrigerating system brines, Cold storage spaces and insulation, Air conditioning and ventilation system.

Deck Machinery - Operation, Principles, Types, Material of construction, Windlass/ mooring winch, Winch, Boat winch.

24) Auxiliary steam boilers and Auxiliary steam plant:

Steam boiler mountings and feed water systems; Auxiliary steam boilers and associated equipment, Boiler water testing and conditioning. Operation of auxiliary steam plant, pipelines, condenser, drain cooler. Auxiliary boiler fuel and air blower system.

Methods of checking water level in steam boilers and action necessary if water level is abnormal.

Marine Boiler- Steam boiler fuel atomization and combustion, Marine boiler fundamentals, Marine Boiler construction, Boiler mountings and steam distribution, Marine boiler operation.

25) Safe Engineering Watch-keeping:

Procedures to be adopted in safe watch keeping. Procedures for taking over and handing over watches. Routine work during watch keeping such as soot blowing, cleaning of filters, pumping out of bilges through oily bilge separator, routine pumping operations of fuel oil, ballast water, fire pump and cargo pumping system, remote operation of pumping system and associated controls, purification and clarification of fuel oil, purification of lubricating oil. Construction and characteristics of Separators, Purifiers and Clarifier, Purifier and fuel oil treatment - Operation, Principles, Types, Material of construction.

Location of common faults in machinery and plant in engine and boiler rooms and action necessary to prevent damage. Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems - Main Engine and Associated Auxiliaries, Boiler and Associated Auxiliaries, and Steam Systems, Auxiliary Prime Movers and Associated Systems (Diesel engine, Steam Turbine), Other Auxiliaries – Purifiers and Fuel oil treatment, Air compressors, Evaporators and distillers, Refrigerator.

Interpretation of functional tests on communication and control system. Maintenance of machinery space log book and the significance of readings taken.

26) Ship Bilge/ Ballast/ oil – Pumps and pumping system. Hydrosphere system:

Various types of pumps, construction, operation, Principles and characteristics.

Operational characteristics of pumps and piping systems including control systems.

Operation of pumping systems - Routine Pumping Operation, Operation of bilge, ballast and cargo pumping systems.

Fluid flow and characteristics of major systems – Description of all fluid flow systems on board, Operation and material construction of devices/ equipment in the system.

Air compressor and system principles - Material of construction, Compressors construction, operation, Principles and characteristics & Types. Compression process, Inter and after coolers.

Compressed air system. Air bottles, construction, mountings and associated system.

Oily water separator/ similar equipment and operation – Prevention of pollution, Requirements, Principles, Construction and operation.

27) Fresh water generators and vacuum evaporators:

Evaporators and distillers – Operation, Principles, Types, Material of construction - Flash evaporators, Multiple effect evaporation.

Construction, characteristics and operation of fresh water generators and vacuum evaporators.

28) Physical and Chemical Properties of Fuels and Lubricants - Production of Oils from Crude Oil, Properties and characteristics of fuels and lubricants, Shore side and shipboard sampling and testing, Interpretation of test results, Contaminants including microbiological infection, Treatments of fuels and lubricants including storage, centrifuging, blending, pretreatment and handling.

29) Safety & emergency procedures:

Change over of remote/automatic to local control of all main and auxiliary systems.

Safe working practices. Safe practices in carrying out hot work and welding. Procedure to be taken while handling heavy machinery parts and overhauling of engines. Cleaning, man-entry and hot work in enclosed compartments. Emergency procedures such as actions to be taken in case of fire including fire drill, flooding of engine room compartment, rescue operation of injured persons, actions to be taken in case of stoppage of main engine, auxiliary engine and associated system.

30) Practical Knowledge - Ensure Safe Working Practices - Risk assessment, Safety officials, Personal protective equipments, Work equipment, Safety induction, Fire precautions, Emergency procedures, Safe movement, Safe system of works, Entering enclosed or confined spaces, Permit to work systems, Manual

handling, Use of work equipment, Lifting plants, Maintenance of machineries, Hot work, Painting, Hazardous substances, Noise and vibrations.

Main Engine Auto-slow Down and Shut Down, Main Boiler Auto shut Down, Power Failure, Emergency Procedures for Other Equipment/ Installations – Emergency steering, Back out operations and restoration and Propulsion plant operation.

Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools, appropriate specialized tools and measuring instruments - Hand Tools, Powered Hand Tools, Machine Tools (Centre Lathe, Soldering, Principles of art welding and gas welding, Thermal cutting, Inspection, Safety and health when welding), Measuring Instruments.

Use of various types of sealants and packing's.

31) Design of Marine machinery:

Design features and operating mechanisms of marine diesel engines, marine gas turbines and marine steam boilers.

32) Marine Plant Operation:

Construction, characteristics and operation of large bore and medium speed Diesel Engine parts.

Performance characteristics of diesel engines by taking indicator cards. Steering gear, Auxiliary Boilers.

Basic construction and operation principles of machinery systems - Marine Diesel Engine, Marine Steam Turbine, Marine Gas Turbine, Marine Boiler, Shafting Installations and Propeller, Other Auxiliaries, Steering Gear, Automatic Control Systems, Fluid Flow and Characteristics of Major Systems, Deck Machinery.

Propulsive Characteristics of Diesel Engines, Steam and Gas Turbines, Including Speed, Output and Fuel Consumption - Engine layout and load diagrams.

Operating Limits of Propulsion Plants.

33) Operation of Marine Machinery, Equipments and Diesel Engines:

Marine Diesel engines, Aux. steam boilers, construction and details of all parts and fittings, Fuel and combustion systems, Marine diesel engine, marine gas turbines (trunk and cross-head types) gearing systems and clutches; Starting and reversing systems; Cooling and lubricating systems; Fuel oil preparation systems; Auxiliary diesel engine and associated equipment;

Control and alarm systems associated with automatic operation of a diesel plant; Assessment of engine power, the running adjustments to maintain performance; Safe and efficient operation and maintenance of marine diesel engines/Steam turbines.

Crank case inspection, depth gauge and crank shaft deflection. UMS operations. Governors. Turbo chargers. Supercharging and Scavenging system.

34) Practical knowledge: Start Up and Shut Down Main and Auxiliary Machinery, Including Associated System - Engine components, engine lubrication, fuel injection, scavenging and supercharging, starting and reversing, cooling systems, diesel engine control and safety, diesel engine emergency operation, multi-engine propulsion arrangement, air compressors and compressed air systems, hydraulic power system,

Steam boilers, mountings, feed water systems and lubricating oil system. Gland sealing system. Assessment of plant efficiencies, types of auxiliary boilers, auxiliary steam system, safety valves, boiler water level indicators, use of sea water in boilers, use of fresh water in boilers, boiler water testing, boiler water treatment, auxiliary steam turbines, boiler defects, boiler survey and repairs, evaporators, thermal fluid heating system.

The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery - diesel engines, Steam turbines, boilers and gas turbines.

Steam turbines, Gearing and Lubricating systems, Steam distribution systems, and associated equipment, condensers, ejectors, heat exchangers and feed heaters, air heaters and economizers and draining system

of turbine and plants including steam traps. Heat exchangers – Operation, Principles, Types, Material of construction.

Maneuvering system including Astern running.

35) Electrical machines and troubleshooting:

a) Theoretical Knowledge - Marine Electro technology, Electronics, Power Electronics, Automatic Control Engineering And Safety Devices - Marine Electro technology, Electronics, Power Electronics, Automatic Control Engineering and Safety devices.

b) DC machines: The principles, constructional details and protection of DC series, shunt and compound wound motors and generators. Self excitation, generation of back e.m.f and load/ voltage characteristics. Methods of voltage control, paralleling procedures and load sharing for DC generators. Types of starters, characteristics between speed and torque, speed control of DC motors.

c) AC machines: Theory of rotating magnetic fields. Relation between frequency and number of poles and speed of a machine. Relation between slip, rotor e.m.f. and frequency, torque-speed characteristics. Theory of synchronous and induction motors. Constructional details of synchronous machines and induction motors. Coupling, load sharing and changing over generators.

Electrical Motors – A.C. & D.C. Motor. Generators – A.C. & D.C. generators.

Design features and system configuration of operational control equipment for electrical motors - three phase A. C. motor, three phase synchronous motors, effect of varying frequency and voltage of A. C. motors, Motor control and protection, insulated gate bipolar transistor (IGBT) motor speed control, motor speed control by thrusters, three phase generators, three phase transformers, distribution, emergency power.

d) Transformers: Theory of transformers and their onboard usage, specifications of coolant.

e) Distribution systems: Various means of starting AC machines, motor speed control, HV and LV switch gear, distribution and equipment. Coupling and breaking connection between switchboard and distribution panels. Basics of Electrical Propulsion System. Power Distribution Systems – Distribution, Insulation, Transformer, Types.

f) Basic electrical engineering

Electrical Theory – Ohm's Law, Kirchhoff's Law, Electrical circuits, Impedance and inductance.

Fundamentals of Alternating Current – Alternating current, Electro-magnetic induction, Work energy and power.

Electrical Motor Starting Methodologies, High-Voltage Installations, Lighting, Cables, Batteries.

Design features of high-voltage installations.

Mandatory requirements for electrical installations. Ships lighting. Safe working practice. Electric protective devices. Specification and installation of cables for various shipboard uses. Electrical and electronic systems operating in flammable areas. The hazards and precautions required for the operation of power systems of above 1.000 volts. Shore supply.

36) Electronics:

Transistor as an amplifier, switch, oscillator. IC 555 based timers, audio-visual alarms. Photo Electric Devices e.g. LED, LCD, 7 Segment Display. Basics of digital electronics.

Basic electronics – Electron Theory

Basic Electronic Circuit Elements – Semi conductor, Thruster, Integrated Circuit (IC) and Large scale Integrated Circuit (LSI).

Electronic Control Equipment – Control mechanism of PLC (Programmable Logic Controller), Integrated Automation Control and Monitoring System (IACMS), Computer programmable Controller, Relay Circuit unit, Digital Sequential Control devices.

Flowchart for Automatic and Control System – Depiction and understanding of flowcharts, Symbols utilization and processes involved.

37) Instrumentation & Control Systems:

Static and dynamic characteristics of measuring instruments. Construction and operation of electrical testing and measuring equipment. Filters, Regulated Power Supply. Transducers and transmitters suitable for measurement of temperature, pressure, flow, level, speed, torque, vibration, humidity and water content with calibration.

Theory and characteristics of PID control and its tuning. V-I, I-V, P-I & I-P convertors. Basics of Programmable Logic Control.

38) Basic control engineering: Fundamentals of Automatic Control, Various Automatic Control, ON-OFF Control, Sequential Control, Proportional-Integral-Derivative (PID) Control.

Measurement of Process Value – Temperature (Mechanical, Electrical), Pressure, Level (Direct methods and Inferential methods), Flow, General measurement and process.

Transmission of Signals – Transmitters, Controlling elements (Pneumatic, Electrical, Receivers).

Manipulator Elements – Principles, Operation, Application, Pneumatic, Electrical Servomotor, Hydraulic Servomotor.

Functions and mechanism of automatic control for main engines and auxiliary machinery - Generator distribution system, Steam boiler, Oil purifier, Refrigeration system, Pumping and piping system, Steering gear system, Cargo-handling equipment and deck machinery.

Design features and system configuration of automatic control equipment and safety devices for the following - General Requirements, Main Engine, Generator and distribution system, Steam boiler.

Features of Pneumatic and Hydraulic Control Equipment.

Maintenance and repair of electrical and electronic equipment: Safety requirements for working on ship board electrical systems, including isolation of all electrical plants and equipment required before personnel are permitted to work on such plant and equipment.

Maintenance and repair - Principles of Maintenance, Generator, Switchboard, Electrical Motors, Starters, Distribution System – Transformer, Distribution, Cables, D.C Electrical Systems and Equipment – Battery system, Remote automatic control equipment.

Detection of electric malfunction and measures to prevent damage - Essential requirements for Fault Protection, Fault Location.

39) Manage Trouble Shooting Restoration of Electrical and Electronic Control Equipment to Operating Condition Practical Knowledge:

Trouble Shooting Of Electrical and Electronic Control Equipment

Electrical safety, Test equipment, Interpretation of circuit symbols, Logical six step trouble shooting procedure, Generation, Prime mover electrical control, Main air circuit breaker, Protection of generators, Electrical distribution systems, Motors, Electrical survey requirements, Calibrate and adjust transmitters and controllers, Control system fault finding.

Function test of electrical, electronic control equipment and safety devices

Trouble Shooting Of Monitoring Systems - Test and calibration of sensors and transducers of monitoring system.

Software Version Control - Programmable logic controllers (PLC), Microcontrollers, Digital techniques.

Construction and operation of electrical testing and measuring equipment – Construction, Operation & Principles of insulation tester, Continuity tester, Multi tester, Clamp meter.

Function and performance test and configuration - Monitoring Systems, Automatic Control Devices (Process control & system control), Protective Devices.

Electrical and simple electronic diagrams – Electric and Electronic symbols and Interpretations of Flow diagrams and Circuits.

40) Marine Engineering Maintenance:

Maintenance and repair such as dismantling, adjustment and reassembling of machinery and equipment. Fastening, Preparation for work on machinery, heat exchangers etc., General maintenance procedure of Centrifugal Pumps fitted with a means of air extraction, reciprocating pumps. Screw and Gear Pumps, pipes, valves, air compressors, heat exchanger. Maintenance and repair of diesel engine, auxiliary steam engine, petrol engine, turbocharger, diesel engine components, wear and tear, alignment of machinery components, correction of defects, breakdown repairs, steering gear. Maintenance and repair of oil fuel burners, propulsion shafting, refrigeration, deck machinery. Maintenance and repair of Auxiliary Boilers; Maintenance and repairs of deck machinery and hydraulic equipments; Hull inspection, maintenance and repairs of vessel in dry dock.

Methods for carrying out safe emergency/ temporary repairs.

Knowledge of:

Classification society and class certificates

Statutory certification of ships/ Class verification

Surveys for maintenance and renewal of class and statutory certificates

Planned maintenance system as per ISM code- Planning repairs. .

Maintenance and repairs of main boilers, turbines and steam plants.

Safety and emergency procedures, safe isolation of all main and auxiliary machineries required before personnel are permitted to work on such plant and equipment. Safe trials and commissioning after repairs and trials.

41) Detect and Identify the Cause of Machinery Malfunctions and Correct Faults - Practical Knowledge - Detection of machinery malfunctions, location of faults and action to prevent damage, unplanned maintenance.

Inspection and adjustment of all relevant equipment.

42) Maintenance and Repair at the Management Level

a) Theory of maintenance:

Theoretical knowledge of Marine engineering practice and maintenance of machinery.

Methods of dealing with wear and tear of machinery, both electrical and mechanical. Alignment of machinery components. Correction of defects. Temporary or permanent repairs in the event of breakdown.

Detection of machinery malfunction, location of faults and action to prevent damage.

b) Practice of maintenance:

Management and conduct of ship maintenance by planned maintenance and preventive maintenance.

Theory of condition monitoring and its application onboard ships. Principles of tribology and its practices.

Planning and execution of dry docking and other major repairs.

Manageable breakdowns and emergency repairs.

Planning and execution of safe maintenance activity and repair procedures taking into account technical, legislative, safety procedural specification, appropriate plan, specification of materials and equipment available for maintenance and repairs.

Risk assessment and evaluation before commencement of maintenance activity.

Destructive and non destructive testing.

Trials and restoration of the plant after repairs.

Safe working practices.

43) Ship construction:

Common terms used in the measurement of steel ships. e.g. length between perpendiculars, breadth overall, moulded depth, draught and freeboard. Definitions of shipbuilding terms in general use.

Descriptions and sketches of structural members in ordinary types of steel ships. Load Lines, Deck line, Free board, Plimsol line, Watertight doors. Hatches, Rudders, Bow-thrusters. Propellers, Watertight bulkheads. Double bottoms. Anchors and cables. Descriptive treatment of the effect of free surface of liquids on stability. Arrangements for the carriage of dangerous goods in bulk.

Ventilation arrangements (natural and mechanical) for pump rooms in tankers and for holds and oil fuel tanks.

Fore and aft peak tanks, double bottom and deep tank filling and pumping arrangements. Compartmental drainage. Levelling arrangements for damaged side compartments.

Ship dimensions and form: General arrangement of General cargo, tankers, bulk carriers, combination carriers, containers, ro-ro and passenger ships, definitions of camber, rise of floor, flare, sheer, rake etc., Ship stresses: Hogging, sagging, racking, panting, pounding, slamming etc, Hull structure: Proper names for the various parts, standard steel sections etc., Bow and stern: Stern frame, structural arrangement forward and aft to withstand panting and pounding etc., Fittings: Water tightness to the hatches, opening in oil tankers, chain lockers and attachment of cables, bilge piping system, ballast system, sounding and air pipes etc., Rudders and propellers: Construction of rudders and propeller, controllable pitch propeller, stern tube arrangement etc.,
Process of welding.

44) Naval Architecture:

General. Displacement, Wetted surface, block midsection, prismatic and water-plane area coefficient. Bonjean Curves, Body Plan, Tonne per centimetre immersion. Application of Simpson's 1st and 2nd Rules to areas, moments of areas, volumes and moments of volumes, 2nd Moment of area, Application of 3, -8, 1 rule,

Displacement, Laws of Floatation, TPC, Coefficient of Form, Calculation of area, volume & moments. Transverse Stability of ships, Working knowledge and application of stability, trim and stress tables, diagrams and stress calculating equipment, fundamentals of water tight integrity, actions to be taken in the event of partial loss of intact stability, List and Its Correction, Effect of slack tanks.

IMO recommendations concerning Ship Stability.

Draught and buoyancy. Alteration of mean draught due to change in density of water, Buoyancy and reserve buoyancy. Effect of bilging amid ship compartments.

Transverse stability Centre of gravity. Centre of buoyancy. Metacentre. Shift of centre of gravity due to addition or removal of mass, transverse movement of mass. Stability at small angles of heel, KB, BM, Angle of loll and Hydrostatic Curves, Initial stability, Moments of static stability. The inclining experiment.

Resistance and propulsion. Comparison of skin frictional resistance of hull with model at different speeds. $R = f.s.v^n$ and residual resistance. Admiralty and Fuel coefficients. Relation between speed of vessel and fuel consumption with constant displacement and assuming that resistance varies as (speed)ⁿ.

Theoretical knowledge of Naval Architecture and Ship Construction including damage control.

45) National & International Legislation:

National Legislation for implementing International agreements and Conventions.

(a) Safety related –

Precautions against fire and explosions, fire prevention, detection and extinction in all parts of a ship

Personal survival techniques and life saving appliances on ship, Medical Care:

Theory of fire; Fire control aboard ships; Ship fire fighting organizations; Training of seafarers in fire fighting; Procedures for fire fighting; Inspection and servicing of fire appliances and equipment; Fire fighting process

hazards; First aid; Fire investigations and reporting; Case studies; Safety; Safe Working Practices; Emergency situations; Principles of survival; Use of survival equipment; Survival craft and rescue boat; Methods of helicopter rescue; Launching arrangements; Lifeboat engine and accessories; Evacuation; Signaling equipment and pyrotechnics; First aid; Radio equipment; Launching and handling survival craft in rough weather.

Knowledge of relevant international maritime law embodied in international agreements and applicable conventions. Requirements and responsibilities under Safety of Life at Sea Convention, 1974; Load Lines Convention, 1966 and Standards of Training, Certification & Watch keeping Convention, 1978.

Surveys and audits, certification and their validity. Certificates and other documents that are required to be on board ships

Operations and maintenance of life-saving, fire-detection, fire-fighting and other safety equipment on board ships.

International Conventions, as amended from time to time:

Safety of Life at Sea Convention, 1974; Load Lines Convention, 1966; Tonnage Convention, 1969; Standards of Training, Certification & Watch keeping Convention, 1978; Responsibilities under the relevant requirements of the International Convention for the safety of life at sea

1. Brief description of International Convention for the safety of life at sea
2. Obligation to carry out surveys and maintain validity of certificates
3. Obligation to maintain records
4. Obligation and rights of master

(b) Pollution related –

Marine environment:

Marine environmental awareness; marine ecology, seas and coastal areas; discharges to sea and their environmental impact; accidental & operational discharges; emissions to air from ships; other pollutants; proactive measures to control pollution and maintain environment.

Precaution to be taken to prevent pollution of the Marine environment:

During bunkering, loading/ discharging oil cargo, tank cleaning, pumping out bilges, and knowledge of construction and operation of Oil pollution prevention equipment in engine room and on other specialized ships.

MARPOL, 73/78 (all Annexes, equipment requirements and their operations, documentation, including necessary record books); Ballast Water Management Convention, 2004; Antifouling Convention, 2001; National legislations of other countries like Oil Pollution Act, 1990.

Responsibilities under the relevant requirements of the International Convention for the prevention of Pollution from Ships - Annex I, Annex II, Annex III, Annex IV, Annex V, Annex VI.

Requirements and responsibilities under MARPOL, 73/78 (all Annexes, equipment requirements and their operations, documentation, including necessary record books); Ballast Water Management Convention, 2004; Antifouling Convention, 2001; National legislations of other countries like Oil Pollution Act, 1990.

Environmental impact of accidental & operational discharges; emissions to air from ships; other pollutants; proactive measures to control pollution and maintain environment.

Emergency situations; actions to be taken for protecting and safeguarding environment.

- (c) **Security related** – Security awareness; identification of security threats; security related duties; ISPS Code and its requirements - ship security plan; levels of security; controlling measures; drills & exercises; documentation; audits and certification.
- (d) **Liability related** – Concept of Liability & Compensation as related to Marine Pollution.
- (e) **ISM Code and its requirements** - Safety management system, Documentation and Certification.
- (f) **National Legislation** – Merchant Shipping Act, 1958; Role of Maritime Administration (Directorate General of Shipping) and its functions; DGS Rules and MS Notices; Flag State requirements; Statutory surveys and certification; Port State Control.

46) Other aspects:

- (a) **International Organizations** – International Maritime Organization (IMO) and its functions; International Labour Organization (ILO) and Maritime Labour Convention, 2006.
- (b) **Classification Societies** – Classification; role of societies; surveys and certification; International Association of Classification Societies.

International health regulations; Understands practical applications of medical guides; Understands process of radio medical advice; Demonstrates knowledge of actions to be taken in case of accidents or illnesses that are likely to occur on board ships.

Knowledge of Relevant International Maritime Law Embodied In International Agreements and Conventions

1. United Nations Convention on the Law of Sea (UNCLOS)
2. Treaties, conventions, protocols, rules and regulations
3. International Maritime Organisation (IMO)
4. List of IMO Conventions
5. Introduction to International Labour Organisation (ILO)
6. World Health Organisation (WHO)
7. Authorities & Regulations

Certificates and other documents to be carried on board ships by International Conventions, how they may be obtained and period of their legal validity

1. List of Certificates and documents to be carried on board ships as per SOLAS Annex 1, how they are obtained and their period of validity
2. Additional certificates and documents required on board ships

Maritime Declarations of Health and the requirements of the International Health Regulations

1. WHO's International Health Regulations 2005 (IHR)
2. International Medical Guide for ships (IMGS)
3. IMO's Medical First Aid Guide (MFAG)
4. WHO's Guidelines for drinking water quality

Responsibilities under International Instruments Affecting the Safety of the Ships, Passengers, Crew or Cargo

1. ILO's Maritime Labour Convention 2006 (MLC 2006)
2. Convention on the International Regulation for Preventing Collisions at Sea (COLREG) 1972
3. International Convention on Salvage 1989; Lloyd's Standard Form of Salvage Agreement (LOF 2000)
4. Convention on Limitation of Liability of Maritime Claims 1976
5. International Convention for the Unification of certain Rules of Law relating to Bills of Lading (Hague-Visby Rules)
6. Charter parties

7. Marine Insurance, General Average and P & I Club

Methods and Aids to Prevent Pollution of the Environment by Ships

1. List of Conventions – Refer to 4.2.1.4
2. Sources of Marine Pollution
3. Effects of Marine oil spills
4. Regulations for prevention of oil pollution as per Annex I of MARPOL 73/78
5. Regulations for control of pollution from Noxious liquid substances carried in bulk as per Annex II of MARPOL 73/78
6. Regulations for the Prevention of Pollution by Harmful substances carried by sea in packaged form as per Annex III of MARPOL 73/78
7. Requirements covering the carriage of dangerous goods by sea as per Chapter VII of the SOLAS Convention
8. Regulations for the Prevention of Pollution by Sewage from Ships as per Annex IV of MARPOL 73/78
9. Regulations for the Prevention of Pollution by Garbage from Ships as per Annex V of MARPOL 73/78
10. Regulations for the Prevention of Air Pollution as per Annex VI of MARPOL 73/78
11. International Convention for the Control and Management of Ship's Ballast Water and Sediments
12. International Convention for the Control of Harmful Anti-Fouling Systems on Ships (AFS) 2001
13. Noise

47) Maintain Safety And Security Of The Vessel, Crew And Passengers And The Operational Condition Of The Life Saving, Fire Fighting And Other Safety Systems:

Life Saving Appliances Regulations (SOLAS) - Life-Saving appliances and arrangements (Chapter III of SOLAS) and life-saving appliance code.

Organization of fire and abandon ship drill.

Maintenance of life-saving, fire-fighting and other safety systems.

Actions to be taken to protect and safeguard all persons on board in emergencies - Rescue of persons from a vessel in distress or from a wreck; and Man-overboard procedures.

Action to Limit Damage and Salvage the Ship Following Fire, Explosion, Collision or Grounding - Contingency plans for response to emergencies, Means of limiting damage and salvaging the ship following a fire or explosion, Procedures for abandoning ship.

48) Leadership and team working skills:

Introduction to Management, Related Conventions and National Legislations, applies task and workload management, applies effective resource management and decision making.

Engine room resource management, effective corrections, allocation of resources. Planning and coordination, work load management, time and resource constraints. Personal relationship on board ship, working in multicultural environment.

49) Leadership and Managerial Skills:

Knowledge of Shipboard Personnel Management and Training - Engineer and Manager, Human Resource Management, Training and Development, Maintenance Management.

Ability to Apply Task and workload management – Communication, Team building, Planning and co-ordination, Personal assignments, Time and resource constraints, Prioritization.

Knowledge and ability to apply effective Resource Management - Allocation, assignment and prioritization of resources, Effective communication on board and ashore, Decisions reflect consideration of team experience.

Knowledge and ability to apply Decision-Making Techniques - Management processes and functions, Negotiating skills, Situation and risk assessment, Identify and generate options, Select course of action, Evaluation of outcome effectiveness.

Development, Implementation, and Oversight of Standard Operating Procedures - Project planning and controlling.

2 Years Marine Engineering Course for Diploma holders

COMPETENCY AND COURSE SUBJECTS		Hrs of training			Assessment
		Theory	Practical		
		Classroom	Lab	Workshop/ Afloat	
FUNCTION : Marine Engineering at the operational and management level					
Competency No.1 : Maintain a safe Engineering watch (Table A-III/ 1)					
1.1	Thorough knowledge of Principles to be observed in keeping an Engineering watch, including:	4		4	Written & Practical Examination
1.1.1	duties associated with taking over and accepting a watch				
1.1.2	routine duties undertaken during a watch				
1.1.3	maintenance of the machinery space logs and the significance of the readings taken				
1.1.4	duties associated with handing over a watch				
1.2	Safety and emergency procedures; change-over of remote/automatic to local control of all systems	11		4	
1.3	Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems				
1.4	Engine-room resource management	7			Written Examination
1.4.1	Knowledge of engine-room resource management principles, including:				
1.4.1.1	allocation, assignment, and prioritization of resources				
1.4.1.2	effective communication				
1.4.1.3	assertiveness and leadership				
1.4.1.4	obtaining and maintaining situational awareness				
1.4.1.5	consideration of team experience				
Competency No. 2 : Use English in written and oral form (Table A-III/ 1)					
2.1	Adequate knowledge of the English language to enable the officer to use Engineering publications and to perform Engineering duties				Written & Oral Examination

2.1.1	Oral Communication	14			
2.1.2	Written Communication and Grammar	10			
2.1.3	Comprehension and speech	10			
2.1.4	Technical report writing	20			
Competency No. 3 : Use internal communication systems (Table A-III/ 1)					
3.1	Operation of all internal communication systems on board	3		2	Written & Practical Examination
Competency No. 4 : Operate main and auxiliary machinery and associated control systems (Table A-III/ 1)					
4.1	Mathematics	80			Written Examination
4.2	Applied Mechanics	75			
4.3	Basic construction and operation principles of machinery systems, including:				
4.3.1	Marine Diesel Engine (Main & Aux)	20		85	Written & Practical Examination
4.3.2	Marine Steam Turbine	30			Written Examination
4.3.3	Marine Gas Turbine	15			
4.3.4	Marine Boiler	20		20	Written & Practical Examination
4.3.5	Shafting Installations, including propeller	12		5	
4.3.6	other auxiliaries, including various pumps and their operational characteristics including control systems, pipings, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, air-conditioning and ventilation systems	50		40	
4.3.7	steering gear	10		5	
4.3.8	automatic control systems	10		5	
4.3.9	fluid flow and characteristics of lubricating oil, fuel oil and cooling systems	10		5	
4.3.10	deck machinery	5		5	
4.4	Safety and emergency procedures for operation of propulsion plant machinery, including control systems	30			Written Examination
4.5	Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems:	10		70	Written & Practical Examination
4.5.1	main engine and associated auxiliaries				
4.5.2	steam boiler and associated auxiliaries and steam systems				
4.5.3	auxiliary prime movers and associated systems				
4.5.4	other auxiliaries, including refrigeration, air-				

	conditioning and ventilation systems				
	Competency as per Table A-III/ 2: Manage the operation of propulsion plant machinery. Plan and schedule operations. Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery.				
4.6	Design features, and operative mechanism of the following machinery and associated auxiliaries: marine diesel engine, marine steam turbine, marine gas turbine, marine boiler	30			Written & Oral Examination
4.7	Theoretical knowledge: Thermodynamics and heat transmission, Mechanics and hydromechanics Propulsive characteristics of diesel engines, steam and gas turbines, including speed, output and fuel consumption Heat cycle, thermal efficiency and heat balance of marine diesel engine, marine steam turbine, marine gas turbine, marine steam boiler. Refrigerators and refrigeration cycle, Physical and chemical properties of fuels and lubricants & Technology of materials	115			
4.8	Practical knowledge: Start up and shut down main propulsion and auxiliary machinery, including associated systems, Operating limits of propulsion plant & The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery	10		20	Written & Practical Examination
Competency No. 5 : Operate fuel, lubrication, ballast and other pumping systems and associated control systems (Table A-III/ 1)					
5.1	Operational characteristics of pumps and piping systems, including control systems	10			Written Examination
5.2	Operation of pumping systems:				
5.2.1	Routine pumping operations	2		5	Written & Practical Examination
5.2.2	Operation of bilge, ballast and cargo pumping systems	15		30	
5.3	Oily-water separators (or-similar equipment) requirements and operation	4		5	
	Competency as per Table A-III/ 2: Manage fuel, lubrication and ballast operations.				

5.4	Operation and maintenance of machinery, including pumps and piping systems.	5		5	Written & Oral Examination
FUNCTION : Electrical, electronic & Control Engineering at the operational and management level					
Competency No. 6 : Operate electrical, electronic and control systems (Table A-III/ 1)					
6.1	Basic configuration and operation principles of the following electrical, electronic and control equipment:				
6.1.1	electrical equipment:	40		30	Written & Practical Examination
6.1.1. a	generator and distribution systems	20	10	20	
6.1.1. b	preparing, starting, paralleling and changing over generators	5		5	
6.1.1.c	electrical motors including starting methodologies	5		25	
6.1.1. d	high-voltage installations	5			Written Examination
6.1.1. e	sequential control circuits and associated system devices	5		15	
6.1.2	electronic equipment:				Written & Practical Examination
6.1.2. a	characteristics of basic electronic circuit elements	15		12	
6.1.2. b	flowchart for automatic and control systems	4		10	
6.1.2.c	functions, characteristics and features of control systems for machinery items, including main propulsion plant operation control and steam boiler automatic controls	8	10	10	
6.1.3	control systems:				
6.1.3. a	various automatic control methodologies and characteristics	18	20	20	
6.1.3. b	Proportional–Integral–Derivative (PID) control characteristics and associated system devices for process control	8	10		
6.2	Computer Applications (PMS, E learning, LAN network etc)		20		Practical Examination
Competency as per Table A-III/ 2: Manage operation of electrical and electronic control equipment. Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery.					

6.3	Theoretical knowledge: Marine electro technology, electronics, power electronics, automatic control engineering and safety devices. Design features and system configurations of automatic control equipment and safety devices for main engine, generator and distribution system, steam boiler.	20		15	Written & Oral Examination	
6.3.1	Design features of high-voltage installations	2				
6.3.2	Features of hydraulic and pneumatic control equipment	2				
6.4	Practical knowledge: Functions and mechanism of automatic control for main engine & auxiliary machinery including generator distribution systems, steam boilers, oil purifier, refrigeration system, pumping and piping systems, steering gear system, cargo-handling equipment and deck machinery.	4			Written & Practical Examination	
Competency No. 7: Maintenance and repair of electrical and electronic equipment (Table A-III/ 1)						
7.1	Safety requirements for working on shipboard electrical systems, including the safe isolation of electrical equipment required before personnel are permitted to work on such equipment	5		5	Written & Practical Examination	
7.2	Maintenance and repair of electrical system equipment, switchboards, electric motors, generator and DC electrical systems and equipment	20		30		
7.3	Detection of electric malfunction, location of faults and measures to prevent damage	10		10		
7.4	Construction and operation of electrical testing and measuring equipment	5		5		
7.5	Function and performance tests of the following equipment and their configuration:	10		15		
7.5.1	monitoring systems					
7.5.2	automatic control devices					
7.5.3	protective devices					
7.6	The interpretation of electrical and simple electronic diagrams	3		2		
	Competency as per Table A-III/ 2: Manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition.					

7.7	Practical knowledge: Troubleshooting of electrical and electronic control equipment & monitoring systems. Function test of electrical, electronic control equipment and safety devices.	5			Written & Practical Examination
7.8	Software version control.	2			
FUNCTION : Maintenance & repair at the operational and management level					
Competency No. 8 : Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board (Table A-III/ 1)					
8.1	Characteristics and limitations of materials used in construction and repair of ships and equipment	4	15		Written & Practical Examination
8.2	Characteristics and limitations of processes used for fabrication and repair	10			Practical Examination
8.3	Properties and parameters considered in the fabrication and repair of systems and components	20			Written Examination
8.4	Methods for carrying out safe emergency/temporary repairs	4		10	Written & Practical Examination
8.5	Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools and measuring instruments	5			Written Examination
8.6	Use of hand tools, machine tools and measuring instruments	20		350	Written & Practical Examination
8.7	Use of various types of sealants and packings	3		3	
8.8	Theory of Machines	25			Written Examination
Competency No. 9 : Maintenance and repair of shipboard machinery and equipment (Table A-III/ 1)					
9.1	Safety measures to be taken for repair and maintenance, including the safe isolation of shipboard machinery and equipment required before personnel are permitted to work on such machinery or equipment	5			Written & Practical Examination
9.2	Appropriate basic mechanical knowledge and skills	5			Written Examination
9.3	Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment	60	5	430	Written & Practical Examination
9.4	The use of appropriate specialized tools and measuring instruments	5		5	
9.5	Design characteristics and selection of materials in construction of equipment	8	25		
9.6	Interpretation of machinery drawings and	235			Written

	handbooks				Examination
9.7	The interpretation of piping, hydraulic and pneumatic diagrams	5			
	Competency as per Table A-III/ 2: Manage safe and effective maintenance and repair procedures. Detect and identify the cause of machinery malfunctions and correct faults. Ensure safe working practices.				
9.8	Theoretical knowledge: Marine engineering practice Practical knowledge: Manage safe and effective maintenance and repair procedures, Planning maintenance & repairs including statutory and class verifications.	20		10	Written & Practical Examination
9.9	Practical knowledge: Detection of machinery malfunction, location of faults and action to prevent damage Inspection and adjustment of equipment. Non-destructive examination.	5		10	Written & Practical Examination
9.10	Practical knowledge: Safe working practices	5			
FUNCTION : Controlling the operation of the ship and care for persons on board at the operational and management level					
Competency No. 10: Ensure compliance with pollution prevention requirements (Table A-III/ 1)					
10.1	<i>Prevention of pollution of the marine environment</i>				
10.1.1	Knowledge of the precautions to be taken to prevent pollution of the marine environment	5			Written Examination
10.1.2	Anti-pollution procedures and all associated equipment	6		4	Written & Practical Examination
10.1.3	Importance of proactive measures to protect the marine environment (+ Marine Environmental awareness)	12			Written Examination
Competency No. 11 : Maintain seaworthiness of the ship (Table A-III/ 1)					
11.1	<i>Ship stability</i>				
11.1.1	Working knowledge and application of stability, trim and stress tables, diagrams and stress-calculating equipment	55			Written Examination
11.1.2	Understanding of the fundamentals of watertight integrity	30			

11.1.3	Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy	5			
11.1.4	Resistance propulsion & Powering of Ships.	30			
11.2	<i>Ship construction</i>				
11.2.1	General knowledge of the principal structural members of a ship and the proper names for the various parts	20			
	Competency as per Table A-III/ 2: Control trim, stability and stress.				
11.3	Understanding of fundamental principles of ship construction and the theories and factors affecting trim and stability and measures necessary to preserve trim and stability	10			Written Examination
11.4	Knowledge of the effect on trim and stability of a ship in the event of damage to, and consequent flooding of, a compartment and countermeasures to be taken	10			
	Competency No. 12 : Prevent, control and fight fires on board (Table A-III/ 1)				
12.1	<i>Fire prevention and fire-fighting appliances</i>				
12.1.1	IMO approved Model Course				Written Examination
12.1.2	Knowledge of classes and chemistry of fire	5			
12.1.3	Knowledge of fire-fighting systems	15		5	Written & Practical Examination
12.1.4	Action to be taken in the event of fire, including fires involving oil systems	5			Written Examination
	Competency No. 13 : Operate life-saving appliances (Table A-III/ 1)				
13.1	<i>Life-saving</i>				
13.1.1	IMO approved Model Course				
13.1.2	Knowledge of alarms & signals on board	3			
13.1.3	Knowledge of life saving appliances & equipments	2		5	
	Competency No. 14 : Apply medical first aid on board ship (Table A-III/ 1)				
14.1	<i>Medical aid</i>				
14.1.1	IMO approved Model Course				
14.1.2	Seafarers Health Information Programme	6			
	Competency No. 15: Monitor compliance with legislative requirements (Table A-III/ 1)				

15.1	Basic working knowledge of the relevant IMO conventions concerning safety of life at sea, security and protection of the marine environment	40			Written Examination
15.2	ISM Code and Quality management system	3		1	Written & Oral Examination
15.3	Classification societies and their role in shipping	3		1	
15.4	Role of National Government in control of ships	2			
15.5	Recruitment & Placement of Indian Seafarers	3			
Competency No. 16 : Application of leadership and teamworking skills (Table A-III/ 1)					
16.1	Working knowledge of shipboard personnel management and training	5			Written Examination
16.2	A knowledge of related international maritime conventions and recommendations, and national legislation	5			
16.3	Ability to apply task and workload management, including:	5			
16.3.1	planning and coordination				
16.3.2	personnel assignment				
16.3.3	time and resource constraints				
16.3.4	prioritization				
16.4	Knowledge and ability to apply effective resource management:	5			
16.4.1	allocation, assignment, and prioritization of resources				
16.4.2	effective communication on board and ashore				
16.4.3	decisions reflect consideration of team experiences				
16.4.4	assertiveness and leadership, including motivation				
16.4.5	obtaining and maintaining situational awareness				
16.5	Knowledge and ability to apply decision-making techniques:	5			
16.5.1	situation and risk assessment				
16.5.2	identify and consider generated options				
16.5.3	selecting course of action				

16.5.4	evaluation of outcome effectiveness				
Competency No. 17 : Contribute to the safety of personnel and ship (Table A-III/ 1)					
17.1	Knowledge of personal survival techniques				CONDUCTED AS MODULAR COURSE TRAINING AS PER SEPARATE DGS APPROVED TRAINING COURSE
17.2	Knowledge of fire prevention and ability to fight and extinguish fires				
17.3	Knowledge of elementary first aid				
17.4	Knowledge of personal safety and social responsibilities				
Competency No. 18 : Maintain the conditions set forth in a ship security plan; Recognition of security risks and threats; Undertake regular security inspections of the ship; and proper usage of security equipment if any					
18.1	Working knowledge of maritime security terms and definitions, maritime security levels; security reporting procedures; procedures and requirements for drills and exercises under relevant conventions, codes and IMO circulars; procedures for conducting inspections and surveys and monitoring of security activities specified in a ship security plan; security related contingency plans.	8		3	Written & Skill Test Examination
18.2	Knowledge of security documentation; Knowledge enabling recognition of potential security threats; Knowledge enabling recognition of weapons, dangerous substances and devices and awareness of the damage they can cause; crowd management and control techniques; handling security related information and security related communications; methods for physical searches and non-intrusive inspections.				
18.3	Knowledge of techniques for monitoring restricted areas: Knowledge of controlling access to the ship and to restricted areas onboard; methods for effective monitoring of deck areas and areas surrounding the ship; methods for controlling the embarkation, disembarkation and access while onboard of persons and their effects; General knowledge of various types of security equipment and systems, including				

	their limitations; need for testing, calibrating and maintaining security systems and equipment.				
	TOTAL	1615	115	1381	
	GRAND TOTAL	3111			

Syllabus for Two Years Marine Engineering Course

1) Safe Engineering Watchkeeping:

Principles to be observed in keeping a Safe Engineering Watch, Duties associated with taking over and accepting a watch including Watch keeping at sea, Watch keeping at Anchorage, Watch keeping during Maneuvering, Watch keeping during Bad Weather and when passing through restricted water, Recording special Instructions received from Bridge / Chief Engineer, Routine duties undertaken during a watch including checks on running parameters of Main Engine & Auxiliaries, Maintenance of machinery spaces logs and the significance of readings taken. Duties associated with handing over watch. Reason for not taking over watch, Safety and Emergency Procedures during Watchkeeping, Safety Precautions to be observed during a watch, Change over to Remote / Automatic to local control of all systems Safety precautions to be observed during a watch, Immediate action to be taken in the event of a fire or accident with reference to oil system.

2) Preparing Main Engine and associated auxiliaries for departure / Arrival. Starting up / Shutting off a steam Boiler and associated steam systems: Starting Auxiliary prime movers and associated systems, Starting and putting in operation refrigeration, air conditioning & ventilating systems.

3) Engine Room Resource Management:

Allocation, assignment, and prioritization of resources, Why ERM necessary, Resources included for ERM, Effective communication, Assertiveness and leadership, Obtaining and maintaining situational awareness, Consideration of team experience.

4) Use of English in Written and Oral Form:

Oral Communication, Written Communication and Grammar, Comprehension and Speech, Technical Report writing.

5) Use of Internal Communication Systems:

Operation of all Internal Communication system on board such as Walkie Talkie, VHF, Telephones and other systems

6) Thermodynamics & Heat Engine:

Heat, Temperature and its measurement. Absolute temperature. Specific heat capacity. Specific enthalpy of evaporation and fusion. Problems involving changes of phase and not more than three substances. Linear, superficial and volumetric expansion due to temperature changes. Coefficients and the relationship between them. Basic thermodynamic principles. Properties, energy, the First Law of Thermodynamic, flow and non-flow processes. Heat and work transfer. Qualitative treatment of heat transfer by conduction convection and radiation. Laws of conduction and thermal conductance and applications to problems. Cases Boyle's and Charles laws for perfect gases. Characteristics equation. Constant R and its use in simple problems. Isothermal, adiabatic and polytropic process. Relationship between pressure, temperature and volume. Work done. Changes in internal energy. Specific heat C_p and C_v and the relationship between them. Ideal Gas cycles. Constant volume cycle. Dual cycle. Air standard efficiency. I.C. Engines, Elementary Principles and cycles of operation, Actual indicator diagrams. Mean effective pressure. Work done, power developed, indicated and brake thermal efficiencies, mechanical efficiency, overall efficiency. Fuel consumption. Heat balance. Air compressors, Elementary principles and cycles of operation. Calculation of work done. Indicator diagrams. Properties of steam. Saturated steam, dry, wet. Dryness fraction. Super- heated steam. Internal energy. Enthalpy.

Specific volume. Steam tables. Throttling. Separating and throttling calorimeters. Steam plant. Advantages of using steam expansively. Rankine cycles. Thermal, mechanical and overall efficiencies of prime movers. Boiler efficiency, heat balance for engine and boiler trials. Change in dissolved solids in boilers and evaporators due to contaminated feed and effect of blowing down. Elementary principles of steam turbines including simple velocity diagram for impulse and reaction turbines. Force and work done on blades. Combustion. Solid and liquid fuels. Calorific value. Chemical equations for complete combustion. Theoretical minimum air required. Excess air. Refrigeration. Vapour- compression cycle. Refrigerating effect. Cooling load. Use of tables of properties of refrigerants. Coefficients of performance.

Heat cycle, thermal efficiency and heat balance of marine diesel engine, marine steam turbine, marine gas turbine, and marine steam boiler.

7) Applied Mechanics:

Statistics. Force as a vector. Triangle and polygon of forces. Resultant and equilibrant of a system of concurrent coplanar forces. Equilibrium of three coplanar forces, moment of a force. Couples. Moments of areas and volumes. Centroids and centre's of gravity (limited to geometrical shapes). Conditions of equilibrium of solids. Necessary force applied parallel to an inclined plane to pull up or down the plane or to hold it stationary (including effect of friction). Work done at uniform speed up the plane. Friction, Coefficient of friction, Friction angle. Energy and power lost due to friction in simple bearings. Kinematics. Linear motion. Graphs and equations for displacement, speed, velocity and uniform accelerations. Velocity as a vector. Relative velocities in one plane only. Angular motion. Equations for displacement, velocity and uniform acceleration. Dynamics, work and power. Problems with constant force or force with linear variation. Energy Potential energy. Kinetic energy of translation Newton's laws of motion. Conservation of momentum. Centrifugal force and its application to conical pendulum, unloaded governor, curved tracks and machine parts. Stress in thin rim due to centrifugal action. Machine. Simple lifting machine, Graphics of load-effort and load-efficiency. Linear law. Velocity ratio, mechanical advantages and efficiency of the following machines: wheel and axle, differential wheel and axle, rope pulley blocks, differential pulley blocks, screw jack. Warwick screw, hydraulic jack, worm-driven chain blocks and single and double purchase crab winches. Reduction gearings. Stress and strain. Direct stress and strain. Modulus of elasticity. Shear stress and strain. Modulus of rigidity. Factor of safety. Stress due to restricted expansion or contraction of single members. Beams. Shearing force and bending moment diagrams for cantilevers and simply supported beams with concentrated or uniformly distributed loads. Stress due to bending. Torsion. Strength and stiffness of solid or hollow shafts. Stress due to torsion. Power transmitted by shafts and coupling bolts. Thin shells. Circumferential and longitudinal stress in thin cylindrical shells subject to internal pressure. Hydrostatics. Equilibrium of floating bodies. Variation of fluid pressure with depth. Total force due to liquid pressure on immersed plane surfaces horizontal or vertical. Centre of pressure on a rectangular vertical plane surface or triangular plane surface, both with one edge parallel to the surface of the liquid. Hydraulics. Full bore flow of liquid through pipes under constant head. Flow through orifice, Coefficient of velocity, contraction of area and discharge.

8) Mathematics:

Indices, Surds, Logarithms. Quadratic equations. Partial Fractions. Arithmetical progression. Geometric Progression. Binomial theorem and its applications. Simple relations between trigonometrically ratios. Compound Angles, inverse trigonometrically functions, trigonometrically equations. Relations between angles and sides of a triangle. Solution of triangle, sum of a cosine curve and sign curve. Plane and coordinate Geometry co-ordinates of a point, changing of axes, the circle and the parabola. Empirical laws. Determination of empirical laws by plotting functions of a data. Calculus. Differentiation of algebraic, circular, exponential, logarithmic functions of products, quotients functions, of a function, simple implicit function. Examples of maxima and minima. Partial differentiation (1st order only) Examples of motion of a body. Simple Harmonic motion, deflection of beams. Integration of standard

forms by substitution and by parts. Application of integration to area under curve, volume of revolution. First moment of area and position of centroid of an area. Work done by variable forces, mean values, Root mean square values of $\sin nx$ and $\cos nx$. Rules of Guidelines. Theorem of parallel and perpendicular axes, second moment of area and moment of inertia of rectangular and circular laminae.

9) Construction and Operating principles of Main and Auxiliary machinery:

Construction of a 2- stroke Cross head Type and 4 stroke Diesel Engine, main parts of diesel engine i.e Cylinder head, Liner, Piston oil cooled & water cooled, Piston Rod, Connecting Rod, Cross head & bearing, Bottom end bearing, Connecting Rod, Bolts, Piston cooling arrangement, Bed plates, holding down arrangement, choking, resin chokes, tie rods, structure, Construction of crank shaft, different types of crank shaft, cylinder heads, fuel injectors, air starting valve, relief valve, exhaust valve, air distributor, fuel pumps, Turbo charger, Scavenge pumps and valves Systems :- Air starting & reversing, fuel oil, jacket cooling, piston cooling, Nozzle cooling, Crank case lub oil, Cylinder lubrication, Scavenging systems, types of supercharging,

10) Marine Steam Turbine Layout of a main propulsion turbine. Construction & PV diagram of an Impulse Turbine, Construction & PV diagram of a Reaction Turbine, Construction of blades/ Roots, Sealing arrangements, Blade Tip clearance of Reaction Turbine, Layout of a 2 stage turbine with Astern Turbine for main propulsion, Operation of main propulsion turbine, Lubrication system. Types of seals used,

11) Marine Gas Turbine: Types of Gas Turbines, Turbo shaft type of gas turbine for marine applications, Pressure/Temperature diagrams,

Functions and mechanism of automatic control for Main Engines, generator distribution systems, steam boilers, refrigeration system, pumping and piping systems and other auxiliary machineries.

Design features, and operative mechanism of marine diesel engine, marine steam turbine, marine gas turbine, marine steam boiler and associated auxiliaries.

12) Marine Boiler Main and Auxiliary including Economizer: Theoretical knowledge of construction & operation of water tube / smoke tube / exhaust gas marine boilers including materials used, services provided by boilers and the typical pressures, why one type of boiler is preferred over other, path of water circulation and gas paths in boilers. boiler mountings: a) on shell b) Internal and their purposes, Explain purpose and working of a) reducing valves b) steam traps c) drains. Explain a) how lengths of steam pipes are joined b) how the pipes are supported c) how expansion is allowed for, correct procedure of raising steam and coupling them to steam system, check correctly the water level in steaming boiler and the dangers of low level and high level and corrective actions required in either case, water treatment, why is it necessary.

13) Shafting Installations, including propellers: Propeller , Rope Guard, Stern tube, Stern tube bearing, Shaft seal, Propeller shaft, Intermediate shaft, Aft bearing, Plumber block, Thrust Bearing, oil shaft seal and stern tube bearing, Thrust Bearing, Propellers Various types, Materials used, Diameter , Pitch, Pitch ratio, Pressure side, action side, leading edge, following edge, How Propellers fitted on Propeller shaft, Controller Pitch Propeller.

14) Other Auxiliary Machinery. Pumps: Classification of pumps, Rotodynamic pump, Positive displacement pump, Construction and working of centrifugal pump, gear pump, screw pump, reciprocating pumps, various heads of a pump, Losses in centrifugal pump. Multistage in centrifugal pump, Net positive Suction Head (NPSH) Cavitation. Central priming system and individual priming system, Air vessels, Slip of the pump, Starting up a centrifugal /other pumps.

15) Air Compressors: Classification, Construction and working of reciprocating compressor. Theoretical and Actual PV diagram of single stage compressor, Volumetric efficiency, Effect of clearance volume, Free Air Delivery, Multistage compression, Comparison of single stage with multistage compression, Tandem compressor, Intercooler Safeties, Compressor characteristics, Surging and chocking, Comparison of centrifugal, Axial, Reciprocating compressors, Starting up an air compressor.

16) Centrifuges: Principles of Purification by use of centrifuges. Construction of a Purifier and Clarifier. Manual / Automatic Desludging System. Operation of Purifier / Clarifier.

17) Fresh Water Generator: Principles of fresh water generation on board. Construction of different types of F.W. generators. Operation i.e. starting up and shutting down.

18) Heat Exchangers: Construction and working of shell & Tube type and plate type Heat Exchanger. Materials used for various parts of the heat exchanger.

19) Refrigeration / Air Conditioning and Ventilation Systems: Principles of Refrigeration / Air Conditioning. Layout of the system for Refrigeration. Description of various components such as Compressor, Condenser, Oil Separator / drier; Expansion valve; Evaporator, various cooled rooms for storage of meats/vegetables etc. How different temperatures maintained in different rooms. Refrigerants used; their properties. Compressor lubrication system. Method of charging and purging refrigerant in the system, various safeties, cutouts used in the system. Air conditioning and Ventilation system-Basic principles and construction. Layout of Air Conditioning system. Layout of Ventilation system.

20) Steering Gear: Layout of an Electro hydraulic steering system. Description of various components such as Telemotor Transmitter & Receiver. 2 Ram / 4 Rams / Rotary Vane steering gear. Charging the system. Heleshaw pump / Swash plate type pump / valves etc. used in the system. Fail safe steering system. Emergency steering system.

21) Deck Machinery: Construction & operation of Windlass, Morning Winch, Cargo Winch, and Boat Winch.

22) Safety and Emergency procedures for operation of propulsion plant machinery, including control systems: Briefly describe: Main Engine Auto-slow down and shutdown. Main Boiler Auto shut down. Power failure (Black out). Emergency steering – how can it be controlled from local position, Explain precautions to be taken for the following: Cooling sea water system in case of air ingress, Operation of purifiers in case of black out. Preparation of machinery for sailing and fault detection,

23) Fuel, lubrication, ballast and other pumping systems and associated control systems.

Characteristics of various types of pumps and their interpretations, Requirement of piping system to suit the pumping system. Manage fuel, lubrication and ballast operations -Operation and maintenance of machinery, including pumps and piping systems.

24) Fluid flow and Characteristics of lubricating oil, fuel oil and cooling systems: Different piping systems for fuel oil, lubricating oil, cooling fresh water, sea water steam, condensate, feed water, colour coding of pipes for various systems, means by which lengths of pipes are joined together naming material used for jointing for a) Steam pipes b) Sea water pipes c) Starting air pipes d) Oil pipes, how pipes are supported to reduce vibration, expansion and contraction of pipes is catered for and different valves used in the piping system relief valve and quick closing valves, how pipe lines are blanked off. Describe a mud box.

Physical and chemical properties of fuels and lubricants.

25) Routine pumping operations Operation of Bilge, Ballast, cargo, fuel oil transfer, hydrophore systems, oily water separator. Construction and characteristics of pumps and pumping systems.

26) Geometrical & Engineering Drawings:

Curves of Intersection. Interpretation of drawing notations and symbols of machining drawing. Draw free hand sketches of machine parts. Orthographic projection. Various views of machine drawing.

27) Marine Equipment Drawings: Linework, Pictorial Projection, Development, Symbols Dimension. Marine Machinery. Isometric views and Assembly drawings.: Air Inlet Valve, Automatic Valve, Ballast Chest, Bilge Suction Strainer, Burner Carrier, Connecting Rod And Bearings, Control Valve, Crosshead And Guide Shoe, Cylinder Relief Valve, Feed Check Valve, Flow Regulator, Full Bore Safety Valve, Gauge Glass (Plate Type), Gear Pump, High Lift Safety Valve Oil Strainer, Parallel Slide Stop Valve, Pedestal Bearing, Piston (4 Stroke), Piston (Upper And Rod), Piston Type Stop Valve, Reducing Valve, ,Starting Air Valve, Starting Air Pilot Valve, Stern Tube And Tail Shaft, Telemotor Receiver, Tunnel Bearing, Valve Actuator.

28) Electrical, Electronic and Control Systems- Theoretical knowledge

a) Basic Electrical Engineering and Electrical Equipment: - Marine electro technology. The composition of an atom in terms of electrons, protons & neutrons, the effect of applying energy to an atom, the flow of current subjected to a potential difference referring to: Electron flow - conventional flow, potential difference, electromotive force symbols and units used, Direct current, Alternating current, Ohm's Law, current flows, resistance values, and voltages in Parallel circuit Series circuit, factors which govern the variation of resistance of conductors, effect of temperature on it, effect of internal resistance to supply source and it effects emf terminal potential difference. State Kirchhoff's law, Current law Voltage law, current flowing and voltage drop across resistors in simple circuits, Wheatstone bridge. The implication of power dissipated in a resistor transfer of heat energy to electrical energy and vice versa. Static electricity and its effects, Capacitance its units, capacitor in series and parallel. Magnetism and electromagnetism, MMF, Magnetic. Flux, Reluctance, permeability, magnetic Hysteris. Electromagnetic Induction, Self Inductance, Mutual inductance, Faraday Laws of Electromagnetic Induction. Flemings hand rules, how alternating current is produced in a simple loop rotating in magnetic field. Fundamentals of alternating current. Equation for alternating voltage, cycle, Frequency, Amplitude, RMS value, Average Value. Form factor. Alternating current through Resistance, inductance and Capacitance, impedance and compose it with resistance of a DC circuit, relation between impedance, voltage, current and power facto, why shipboard installations produced power demand with a lagging power factor, effects of varying power factor on power consumed.

b) Generators and distribution system: Identify the parts and explain their functions difference in (a) Shunt coil (b) Series coil and name the two types of windings used on armatures types of DC Generator, factors controlling EMF, Equation for finding EMF. Armature Reaction. Alternators principle. Type of alternators. Main parts and their functions. EMF equation of alternator and explain the factors controlling the emf. Polyphase circuits. Advantages of three phase systems. Star and Delta connection. Transformer working principle, EMF equation of transformer. Voltage Transformation ratio diagram of a typical distribution system showing main generator, emergency generators, shore supply, 440V supply, 220 V supply, circuit breakers and transformers, AC generator with three phase windings stating the phase difference and explain star and delta connections. How excitation of a motor in produced and supplied, automatic voltage regulator, Types of switches, circuit breakers and fuses. Layout of a typical main switch board, dangers in the vicinity of bus bars, reverse power protection, under voltage protection of generators and motors, preferential tripping, Explain how status indicator lamps are usually supplied with power, tripping of circuit breakers, purpose of interlocks.

29) Lighting System: difference between lamps for general lighting and for rough service, tungsten, halogen lamps, how the fluorescent tubes are started up, location, colour and power of navigation lights and how the uninterrupted working ensured.

30) Emergency lights, how they are marked, which lights are connected to emergency power supply system. What intervals should they be tested, care necessary when maintaining Exposed watertight fittings,

31) Paralleling of generators synchronizing sequence to bring a generator into service in parallel with running one being synchroscope, lamps, how load sharing is adjusted,

32) Emergency Power purpose of emergency power supply, Emergency Generator, Machinery and devices connected emergency generator and its reasons, Safety devices on emergency switch board, Interconnection between the MSB and emergency switch board, starting up of generator after Black out.

33) Batteries Chemical process of a lead acid and alkaline battery, ship board use of batteries.

34) Electrical Motors common types of motors used on board ship and give their application, meanings of all information displayed on motor / generator name plate, Identify function of the following Rotor, Stator, Bearing, Fan, Field windings, terminal, methods of lubrication. Principle of DC motors, types of motors, Back emf. Voltage equation. Equation for finding the Torque of motor. Factor deciding the speed of motor. Various methods of speed control. Power losses in DC Motors. Types of DC Motors and their application. Starters for D.C Motor. Circuit explanation Induction Motors, how driving torque is produced in induction motor. Synchronous speed. Slip. Single phase induction motor. Single phasing and its effect on motor. Synchronous motors. Construction and working principle. Necessity of starters for AC motors. Principle of Auto transformer starter and Star – Delta Starter. Draw graphs showing the following relationships. Speed and load, current and load between full load and no load, means of producing variable speed. Why starting current is high compared to the load current. Design features and system configurations of operational control equipment for electrical motors

35) High Voltage: States that more than 1000V is usually called High voltage Why high voltage Installations used on a ship Special characteristics and features of high voltage installations in comparison with less than 1000 V System. Safety precautions to be strictly observed while working on high voltage system.

36) Sequential Control Circuits Explain what a sequential control means Characteristics of sequential control, how a sequential control utilized Components comprising of sequential control system Examples of sequential control.

37) Electronics Characteristics of basic electronic circuit elements Theoretical knowledge of semi conductor components, Diodes, Transistor, Thyristors their function and operation. Laboratory testing and familiarization of each electronic component mentioned above. Amplifiers and Oscillators. Circuit diagram and explanation. Communication system, Modulation and Demodulation, their necessity and circuit explanation. Describe Electrical steering gear system. Various Sensors used onboard ship Pressure Sensors, Temperature Sensors, Level Sensors, RPM Sensors, Photo Sensors, and Water Salinometer.

38) Automation and Controls. Symbol marks used in flow charts such as terminal, processing, determination input / output etc. flow charts indicating automatic control systems for main engine, generator control system, and major components in relation to the function found in flow charts.

39) Automatic Control Systems: Describe a) On-off control b) Sequential Control c) PID Control d) Program Control. Describe which control methodologies can be applied to which control system. Such as automatic motor, start / stop for on-off control, automatic generator start/stop for sequential control, operation principles of Pressure switch, Temperature switch, Resistance bulb, Electric-Pneumatic convertor, Electro mechanical transducer, Value Positioner, Control valve, Relax.

40) Control Systems Control Fundamentals. Loops. Different types of control actions On-Off action, Simple proportional action, Integral action, Derivative action, Pneumatic control systems, Flapper and Nozzle, Description of electronic monitoring and control system fitted on Main and Auxiliary machinery, including Boilers, Purifiers, Steering Gears, Generators, Various automatic control methodologies and characteristics, What an optimal control means Feedback control and Feed forward control, ON-OFF Control, sequential control; PID Control and program control. Proportions Integrate Derivations (PID) Control characteristics and associated systems. Explain principles of PID Control. Explain how P, I and D actions can be electrically / pneumatically available showing simple electronic circuits and pneumatic diagrams, characteristics of P action as well as proportional band (PB) characteristics of I and D actions. How P, I and D actions contribute to control systems, components comprising PID control systems. Electrical controls of main engine, oily water separator and discharge monitoring, operation of cathodic protection.

Design features and system configurations of automatic control equipment and safety devices for main engine, generator and distribution system and steam boiler.

41) Monitoring systems:What is a monitoring system or a data logger, how monitoring system configured, briefly roles of following:-CPU unit, I/O Interface, Monitoring display, Log printer, Alarm printer. Function and performance tests of the following equipment and their configuration. Troubleshooting of monitoring systems.

42) Automatic control devices:Function / performances of automatic control systems incorporated in the following operation systems can be tested, Main Engine, Power generation and distribution, Boiler, Auxiliary machinery. Function and performance tests of the following equipment and their configuration.

43) Protective Devices: Describe how functions / performances of protective / safety devices tested, need of testing in ships statutory survey, major electric / electronic symbols used in circuit diagrams, function of circuit elements in the circuit diagram,

44) Computer Applications:

Basic knowledge of computer, Hardware and software, Operations of software packages applicable to ship board use such as E-Learning, LAN network, PowerPoint. Software version control.

45) Maintenance and Repair of Electrical and Electronic Equipment

a) Safety Precautions: necessary before commencing of work on electrical machineries, Do's and Don'ts when working on electrical equipment. Protective clothing, tools & equipment. Working in machinery spaces. First aid in electrical shocks, voltage range and level of current considered safe, electro static charging and potential hazards and remedies. Dangers associated with spaces in vicinity of bus bars. Purpose of interlocks fitted to circuit breakers.

b) Maintenance: Check and record the following of an alternator in running condition RPM, Frequency, Voltage, K.W, Amperes, Power factor, Condition on bearings and Airflow and cleanliness. Check and record following in stop condition - Airgap and interval, condition of cleanliness. Insulation of coils and

rotor between phase and body. - Condition of bearings. Emergency batteries requirement and maintenance, maintenance routine of circuit breakers. Routine checks and maintenance carried out on AC / DC Motors, Alternators, Starters, Switchboards, Transformers, Batteries. State safety and Isolation precautions necessary before commencing work. Importance and of checking Insulation of electrical equipment, minimum Insulation reading acceptable. Methods of bring up Insulation reading. Maintenance of cables. Explain how an earthing in a circuit can be detected and rectified. Explain Open circuit, Short circuit, how earth fault occurs and its effect on an insulated distribution system, appearance of lamps when an earth faults occurs. How power supplied to indicator lamps, procedure to locate earth faults, how to fit cable through gland into a terminal box, earthing the armouring as necessary, how to replace a fuse. Preferential tripping when overload occurs. Different types of over current protection relay reverse power protection. Under voltage protection of generators and motors. **Practical knowledge-** Troubleshooting of electrical and electronic control equipment. Function test of electrical, electronic control equipment and safety devices.

46) Tools used for electrical work: Pliers, Screw Drivers, Testers, Cutters, Insulation removers

a) Identify and use: Voltmeter – Ammeter- Different types of Megger - Multimeter- Frequency meter, Ohmmeter, Watt hour Meter, clamp meter.

b) Identify and use: Tong Tester- Tester, Oscilloscope, Hydrometer, Signal Generator, Pliers, Screw Driver, Cutters, Insulation Remover. Signal Generator. Interpretation of electrical and simple electronic diagrams. Function and performance tests of the following equipment and their configuration.

47) Maintenance and repair of shipboard machinery and equipment: Explain basic difference between following electrical diagrams: Block, System, Circuit, and wiring.

Practical knowledge - Detection of machinery malfunction, location of faults and action to prevent damage. Detection of faults of machinery by visual inspection, NDT methods (Non-destructive examination) and by other advanced systems such as vibration monitoring (condition monitoring). Inspection and adjustment of equipment. Planning maintenance and repair.

a) Repair and maintenance of Main and Auxiliary Engine: Procedure for dismantling and assembling of Main Engine unit, including all cylinder head mountings. Inspect condition, wear, clearances etc. of Piston, Piston Ring, Cylinder head, and Cylinder liner, air starting valve, fuel injectors, relief valve, and exhaust valve. Prepare decarbonizing report. Procedure for dismantling and assembling Main Engine bearings a) Main bearings b) Cross head bearings c) Bottom End bearing. Inspect above bearings, check clearances, drops, criteria for rejection of a white metal bearing. Crankshaft deflections, purpose, procedure tabulation and interpretation of results. Causes of crankshaft misalignment. Main engine maintenance routines, schedules. Checking adjusting, Main Engine fuel pump timings. Inspection of holding down bolts. Procedure of pretensioning and checking tie rods. Carrying out Crank Case Inspection and measurement of bearing clearances. Familiarization with special tools and measuring equipment used in overhauling the Engine.

Practical knowledge - Organizing & managing safe and effective maintenance and repair procedures.

b) Repair & Maintenance of Auxiliary Engine: Methods of safe isolation of machinery. Safety measures to be taken before dismantling. Generator maintenance routines / schedules. Check fuel pump timing. Starting Procedures. Check working of safety cut outs. Safe working procedures for various operations. Special tools and measuring instruments used for above work.

c) Repair & Maintenance of Main and Auxiliary Boiler including Economizer Blowing of gauge glasses. Procedure of setting of safety valves. Preparing, the Boiler for complete survey – including pressure testing. Overhauling of F.O. Burner.

48) Maintenance and Repair in Dry Dock: List of repairs carried out in Dry Dock. Preparing the ship for dry docking. Making Dry Docking defect list. Precautions during dry dock. Measuring Rudder drops; propeller drop; Rudder bearing clearances; and jumping clearances. Inspection of overboard valves; sacrificial anodes; and fittings in sea suctions. Procedure for removing propeller; Intermediate shaft. Safe Working Practices in dry dock. Oil fuels & lubricating system Maintenance. Filters, Purifiers, Setting Tanks.

Deck Machinery Maintenance Routine Maintenance carried out on windlass, Winches, Cranes.

Special Tools and Measuring Instruments used in overhauling diesel engine. Use of wear down gauges for stern tube bearing. Tools used for measuring rudder, propeller drop.

49) Boiler water and Engine Cooling Water Maintenance and tests. Explain importance of PH value in solutions & name the additives which can maintain PH value. Explain importance of having gas free condition in the water to feed a steam boiler or to circulate in engine cooling systems. Name the metallic salts found in: fresh water – sea water – Distilled water. Define: - Permanent hardness – Temporary hardness. Explain how metallic hydroxide is formed when iron is immersed in an acidic solution. Explain why boiler water should be alkaline & contain no dissolved oxygen. By-chemical analysis of known feed water samples, determine its alkalinity, hardness and chloride contents. Conduct Boiler Water Test. Conduct Engine cooling water test and state importance of keeping engine cooling water parameters within limits to prevent corrosion.

50) Strength of Materials: Production of pig iron from iron ore, principles of: open hearth, bersermer, and more modern processes used in production of steel from pig iron, normal range of carbon content in mild steel, tool steel, cast steel, cast iron. State the difference between Ferrous & Non-Ferrous metals and their application in marine engineering, effects of adding Nickel, Chromium, molybdenum to steels. List the main sources of vibrations on ship and state how the forces result which cause vibrations of ship. What type of materials is used for construction of ships structure and machinery and state whether vibrations from one elastic material or component can be transmitted to another. Are the stresses due to vibrations normally within limits of design and how can they become magnified and cause permanent damage.

51) Properties of Metals: Tensile strength – yield strength – creep and impact strength, different modes of fracture e.g. ductile & brittle fracture. Describe effects of it (on properties of materials), Describe elastic and plastic deformation. Describe elastic effect and work hardening.

52) Corrosion: What is corrosion & surface protection. Describe theory of corrosion and principle of corrosion control. Describe fundamentals of electrochemical theory.

53) Theory of Machines: Belts & Gears & Chain Learn Flat belts and effect of centrifugal tension. Learn initial tension & conditions for maximum power transmission, Roller & inverted tooth chains, fundamental law of gearing, tooth profiles & properties, interferences, spur, Level and worm gears, plain and epicyclic gear trains. **Cams:** different types of cams, cam velocity, drawings of cam profile from given displacement.

54) Materials used for Engine parts: Explain what materials are used in construction of major parts of following equipment: Diesel engine, crankshaft, cylinder liner, cylinder head, piston, exhaust valve, Stem Turbine, Casing, rotor, blade, nozzle, Gas Turbine, Casing, rotor, compressor, gas generator, Boilers : furnace, steam / water drum, super heater, Shafting : propeller shaft, stern tube, bearing, propeller, Pumps, Heat Exchangers, Compressors & Purifiers, Bearings. White metal bearings, thin walled, Trimetal shell bearings. How to interpret piping diagrams taking a major system as an example. Major symbols used in piping diagram. Major symbols used in hydraulic and pneumatic diagrams.

55) Parameters considered in the fabrication and repair:

(a) Low (b) medium (c) high carbon steels and compare their tensile strength, ductility and hardness, uses of low, medium and high carbon steels, properties of Cast iron and its use in engineering.

Lab Test: Tensile strength of M.S. sample – round/flat, %elongation, yield strength, UTS. Izod Impact test; notch cutting, type of fracture (ductile or brittle) Types of fracture, of material and its grain structure (CI, and MS, non-ferrous) Hardness test of materials. NDT – applications. Describe the use of sacrificial anodes. Explain methods of reducing galvanic action in the choice of metal and exposed surface area. Explain stress corrosion & the metals in which it commonly occurs. Pitting corrosion, Dezincification, Dealuminification, Fretting corrosion, Corrosion fatigue, factors which increase corrosion process.

56) Adhesive Bonding: Advantages and disadvantages of adhesive bonding, basic principles of joining by adhesive. How are the following bonded: friction lining to steel shoes or discs. smooth surfaces, purpose of fusing an activator when using epoxy resin and various types to meet different service conditions.

57) Safety Working Practices:

Practical knowledge - Safe working practices, overhauling machinery, mechanical safety in workshops, protective equipment, lifting gear.

Safety Procedures in Workshop: Use of Safety Helmets, Eye protection Gear, Protective footwear, Skin protection Gear. Care of hands- treatment of cuts and abrasions. Control of power supply for machines. Difference between start & stop Buttons. Emergency stop buttons. Precautions necessary where welding in closed spaces or near combustible material. Danger of fumes from welding & how to deal with them. Precautions and care necessary when handling storing gas cylinders like oxygen, acetylene. Safety fittings or acetylene gas cylinders. Use of Regulators. Safety features of gas pressure gauges. Care for blow pipe nozzles, Hoses, Purpose of hose check valve and flash back arrestors. Colour coding of gas cylinders and cylinder outlet threads. Care necessary when lighting a gas cutter. Adjustment of flame. Safety factors in grinding, welding, use of lathe & drill machines.

58) Hand and Power tools: Types of Hammer, Chisel, Vice, Scriber, Hacksaw, File, Scribing Block, Calliper, Divider, Trisquare, Steel Rule, Reamer, Vernier Calliper. Scrapers, Taps & Dies, Drills Bits, Screw Driver, Marking Table, Spring Calliper, Number & letter punch, Tri Square, Centre Punch, use of following cold chisels, how chisels are tempered and sharpened. Describe the care necessary for surface plates, vee blocks, scorers, dividers, odd leg calipers, use of powered tools. Maximum and minimum capacities of an electric powered hand drill care necessary for supply cable of powered hand tools. Use of Micrometer, Vernier Calliper, Marking table, Tri Square, Dial gauge. Explain the use of taper, second and plug taps and what governs the diameter of hole to be drilled before tapping.

59) Basic Fittings: Practice on grinding, chipping, marking, hacksawing, filing, Marking out lines according to simple blue prints-locating position holes, scribing lines on chalked surfaces with marking tools. Finding centre of round bar with the help of V block. Tapping holes as per diagram. V-Fitting, Dove Tail Fitting, H – Fitting,

60) Basic Machining Process: Lathe work-step, taper and thread cutting. Drilling & tapping. Reaming.

61) Welding: Bead Building Flat, Single Vee Butt Joint, Bead Building Horizontal, Single V-Butt Horizontal, Bead Building Vertical, Single 'V' Butt Joint in Vertical position, Bead Building Overhead, Single 'V' Butt Joint in Overhead Position. Butt Joint, Fillet Joint, Round Cutting / Beveling. Principles of Soldering and practice it. Metals which can be joined by silver soldering, Brazing, Bronze welding. List

the processes and state the approx. Melting points. Practice Brazing. Familiarize with electric arc welding machines & learn how current adjustment is made. How to earth the machine and why? How electrodes are classified & learn How to select a correct electrode. How to hold welding rods. Practice arc welding. Learn principle of gas welding and the features of Low Pressure system and High pressure system. Practice gas welding & Familiarization with gas cutting equipment. Describe flame produced with Oxygen and Acetylene and correct adjustment of flame for Welding, Cutting, and Heating. Describe various types of welds. Preparation of plate edges. Faults which take place in welding.

62) Repair Welding: Putting a doubler in a plate and a pipe. Repairing a holed pipe by filling metal. Cutting of flange from old pipe and welding it to new pipe. Making a jig to weld pipes. Method of joining pipes, fitting nipples use of flaring tool.

63) Sealants and Packings: Types and properties of Gland packings; jointings used. Various sealants used. Selecting correct joints. Marking and cutting joints. Cold welding of pipes, plates use of epoxy resins.

64) Balancing & Vibrations: balancing of rotating masses in one or several planes, Primary and Secondary balancing of single and multicylinder engines, free and forced vibrations, damping of vibrations, Torsional vibrations of shafting and of gear systems.

65) Ship Construction:

Principle structural members of a ship and the proper names for various parts. Principal types of Vessels and their general arrangement plan showing extreme dimensions, bulkheads cofferdams, pump rooms etc. Outline of midship section showing camber, rise of floor, tumble home, bilge radius gunwale etc., flare, sheer, rake, parallel middle body entrance, run etc. transverse, longitudinal and combined system of framing, construction of double bottom & frames in a Bulk carrier & Tanker etc. Section of bulk carrier. Functions of deck beam and shell plating & methods of securing the shell plating. Functions of bulkhead and pillars, stern frame & rudder, different types of rudder, advantages etc. Stern & bow construction. Different types of propeller and its geometry. How propeller attached to tail shaft.

66) Naval Architecture:

Working Knowledge and application of stability, trim and stress tables, diagrams and stress calculating equipments. Define principal terms used in Naval Architecture. Learn Ships forms and principal dimensions. Define Displacement, buoyancy and deadweight. Explain hydrostatic calculations & statical stability of ships. Form co-efficient. Principal dimension. Laws of Floatation. Use of hydrometer to find the density of fluid. (Effect of rain & tide on density of water.) Effect of shifting of weights and suspended weight on centre of gravity & Motion of a ship. What causes ship to list when centre of gravity is shifted off centerline. Lines plan. Fairing of lines. Table of offset. Integration Rules. Simpson's rule 5, 8 – 1 rule, Tchebycheff's Rule. Application of integration rules in determining areas, volumes, centroids, first moments and moment of inertia of water planes of ships. VCB, KB, KM, LCF, LCB, CB, CP, CVP, CM, CWP, MCT, TPC and displacement curves. Use of dead weight Scale. Define T.P.C. and calculate effect of vertical and horizontal movement of G due to cargo loading operations. Describe the inclining experiment and determination of G.M of floating body. Type of equilibrium. Initial stability-heeling and righting moment. Statical Stability Curve- range of stability initial GM, Maximum GZ, angle of vanishing stability, point of inflection and angle of loll. Cross curves of stability. Determination of GZ curves from cross curves. Effect of various factors on stability (range of stability is reduced in listed condition). Calculation of free surface effect longitudinal stability and trim. At woods and wall sided formula. Dynamic Stability. Explain stresses in ship structures. Longitudinal strength – weight curves, buoyancy curve, load curve, sheer force and bending moment diagrams of still water condition. Calculation of hull girder section modules and stresses induced on deck and keel check on mid-ship section module. Wave bending moment. Liquid pressure loading on tank structure.

Understanding of fundamentals of watertight integrity. Sub division. Penetration of pipes and structure i.w.o. watertight bulkhead. Permeability, margin line, sub division. Effect of flooding. Determination of draft, list, trim and stability after flooding of vessel of simple configuration. Floodable Length Calculations. Freeboard, Reserved buoyancy. Understanding of Damaged stability requirements for Type A vessels, Type m (B-60) and Type (B-100) vessels. Explain reason for damage stability requirements. Damage stability requirements for passenger vessels. Load line and its purpose. Explain fresh water allowance.

67) Understanding of fundamentals of actions to be taken in the event of partial loss of intact stability:

Understanding of fundamental principles of ship construction and the theories and factors affecting trim and stability and measures necessary to preserve trim and stability. Knowledge of the effect on trim and stability of a ship in the event of damage to, and consequent flooding of, a compartment and countermeasures to be taken

Actions to be taken in the event of partial loss of intact buoyancy. Closing Appliances used on board ships and rules governing them. Cross flooding & closing of valve and watertight doors. Effects of flooding on intact stability.

68) Resistance and propulsion and powering of ships: Explain how ship performance of measures in terms of speed, fuel consumption and displacement. Explain propeller action and calculations of propeller slip. Describe ship's resistances experienced at sea and powering of ships. Components of ship resistance. Froude's and Reynolds's number. Froude's law of similarity. Determination of frictional resistance and residuary resistance. Determination of effective horsepower. Model ship correlation calculation of effective power. Geometry of the screw propeller thrust deduction and wake fraction. Law of similitude of propellers, efficiencies such as open water efficiencies, relative relative efficiency, hull efficiency etc. Propeller slip. Selection of suitable types of Propellers. Special types of propellers. Relation between power, speed, displacement and fuel consumption, Specific fuel consumption, fuel consumption for the voyage. Area of rudder, steering torque, stock diameter. Power requirements for steering. Heeling of the ship while turning. Turning circles. Power required for towing. Bollard Pull. Determination of size of anchor, cables, ropes. Power for windlass, mooring winch.

69) Tonnage: Outline of ships survey rules & certificates to carry on board. Arrangement & layout of accommodation, cargo spaces, machinery spaces, etc. Bottom Structure: Single bottom construction and double bottom construction, keels, types of floors, girders, bottom frames, transverse and longitudinal framing. Side shell and decks: transverse and longitudinal framing side, transverse deck / Bilge keel / longitudinal, stringers, deck girders. Hold drainage system. Bulkheads corrugates, ordinary, transverse, longitudinal and stiffening angle pillars. How water tightness is achieved between hatch cover and coming. superstructures. Structural strains on ships. (i.e. panting, pounding, racking, torsion, sloshing load etc.) Material used in construction of ship and standard steel sections. Describe fitting of air pipe, sounding pipe to tanks on a ship. Shaft tunnel and stern tube.

70) Fire Fighting Onboard:

Classes of fire, Explain Chemistry of Fire.

Practical knowledge - Precautions against fire or explosion. Explosive mixtures. Danger of oil leakage's. Sources of ignition. Safety devices. Toxic and other dangerous properties of substances used.

71) Knowledge of fire fighting Systems: Knowledge of fire fighting appliances and firefighting system. IMO Rules on safety equipment. Use of breathing apparatus and its functions. Fire detecting equipment and fire alarm signals on board ship. Fire fighting organization on board ship and fire fighting methods. Flammable limits. Inert gas systems.

72) Hand Fire Fighting Equipment: Chemical Type, Mechanical Type, Water Type, Foam Type, CO₂ Type, DCP Type. Fixed firefighting equipment Fire main. CO₂ System and procedure of admitting CO₂ in Engine Room and entering E.R. after the fire is put off. Foam System. High expansion foam system. Sprinkler system. International shore connection. Securing of fire hose after use. Checks made on fire fighting equipment.

73) Action to be taken in the event of fire on a ship including fires involving oil systems. Fire in machinery spaces. Fire in cargo spaces

74) Life Saving:

Knowledge of alarms and signal on board ships. Knowledge of life saving appliances and equipment on board ships. Life boats and life rafts. Their stowing, maintenance, care and checks made on life boat engine. Lowering and hoisting and embarkation procedures for life boats launching of life rafts study of anchor & cable.

75) Medical First Aid On Board Ship:

Seafarers Health Information Programme: Food Safety, Physical fitness, Travel Safety, Healthy Diet, Spread of illness, Obesity, STD including HIV and AIDS.

76) Legislative Requirements:

Knowledge of following IMO Convention SOLAS, MARPOL, LOADLINE, STCW. Introduction to Maritime Law. Law of the sea – on the high seas. Protection and preservation of Marine Environment. ISM Code, its objective. Role of classification societies from construction stage till the life of the ship. Machinery survey schedules. Role of Administration (Government of India) in control of Ships. Responsibilities of Administration towards shipping / seafarers / safety of ships. MS Act 1958. Recruitment & Placement rules 2005. Articles of Agreement (Indian Ships).Articles of Agreement (Foreign Flag Ships).

77) Pollution of the marine environment:

Precautions to be taken to prevent pollution of the marine environment. Typical shipboard oil pollution emergency plan as per Regulation 26 of Annexure 1 MARPOL 73/78. Annexures of MARPOL 73/78.

78) Antipollution procedures and all associated equipment: Oily Bilge Separator, construction and operation of O.B.S. used on board ship, oil level detection and discharge monitoring system and permitted amount of oil discharge overboard in open sea. Actions to be taken in Port to prevent discharge of oily bilges overboard. Oil Record Book used for machinery spaces. Precautions taken while bunkering and discharge of oily waste. Construction and operation of an incinerator. Records to be maintained of burning oil in incinerator. Maintenance of the equipment. Incinerator: Maintenance of the equipment. Sewage Treatment plant, treatment of sewage done and limitations of discharge overboard. Arrangement provided to discharge sewage to shore facility. Precautions to be taken in opening & cleaning sewage plant. Proactive measures to protect marine environment. Observe regulations concerned in actual tasks onboard ships which give direct impact on marine environment.

79) Leadership and Team Working Skills

Introduction to Management:

Planning and co-ordination, Personnel assignment, Time and resource constraints, Prioritization. Objectives and aims of Maritime labour Convention 2006 (MLC), Outline of relevant provisions in MLC, STCW Convention and code concerning responsibilities of seafarers and shipping Industry including fitness for duties. Explain how National legislations are implemented w.r.t relevant regulations. Planning and coordination

Personnel assignment. Time and resource constraints. Priorization. Allocation, assignment, and prioritization of resources. Effective communication on board and ashore. Decisions reflect consideration of team experiences. Assertiveness and leadership, including motivation. Obtaining and maintaining situational awareness. Situation and risk assessment. Identify and consider generated options. Selecting course of action. Evaluation of outcome effectiveness.

80) Ship Security:

Working knowledge of maritime security terms and definitions, maritime security levels security reporting procedures, procedures and requirements for drills and exercises under relevant conventions, codes and IMO circulars, procedures for conducting inspections and surveys and monitoring of security activities specified in a ship security plan, security related contingency. Knowledge of security documentation, Knowledge enabling recognition of potential security threats, Knowledge enabling recognition of weapons, dangerous substances and devices and awareness of the damage they can cause; crowd management and control techniques, handling security related information and security related communications, methods for physical searches and non-intrusive inspection. Knowledge of techniques for monitoring restricted areas. Knowledge of controlling access to the ship and to restricted areas onboard; methods of effective monitoring of deck areas and areas surrounding the ship, methods for controlling the embarkation, disembarkation and access while onboard of persons and their effects, General knowledge of various types of security equipment and systems, including their limitations, need for testing, calibrating and maintaining security systems and equipments.

18 Months course in Marine Engineering for Graduates in Electrical / Electronic Engineering

COMPETENCY AND COURSE SUBJECTS		Hrs of training			Assessment
		Classroom	Lab	Workshop/ Afloat	
FUNCTION : Marine Engineering at the operational and management level					
Competency No.1 : Maintain a safe Engineering watch (Table A-III/ 1)					
1.1	Thorough knowledge of Principles to be observed in keeping an Engineering watch, including:	4		4	Written & Practical Examination
1.1.1	duties associated with taking over and accepting a watch				
1.1.2	routine duties undertaken during a watch				
1.1.3	maintenance of the machinery space logs and the significance of the readings taken				
1.1.4	duties associated with handing over a watch				
1.2	Safety and emergency procedures; change-over of remote/automatic to local control of all systems	4		4	
1.3	Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems	4		4	Written & Practical Examination
1.4	<i>Engine-room resource management</i>	7			Written Examination
1.4.1	Knowledge of engine-room resource management principles, including:				
1.4.1.1	allocation, assignment, and prioritization of resources				
1.4.1.2	effective communication				
1.4.1.3	assertiveness and leadership				
1.4.1.4	obtaining and maintaining situational awareness				
1.4.1.5	consideration of team experience				
Competency No. 2 : Use English in written and oral form (Table A-III/ 1)					
2.1	Adequate knowledge of the English language to enable the officer to use Engineering publications and to perform Engineering duties				
2.1.1	Oral Communication	12	18		Written & Oral Examination
2.1.2	Written Communication and Grammar	12			
2.1.3	Comprehension and speech	12			
2.1.4	Technical report writing	18			
Competency No. 3 : Use internal communication systems (Table A-III/ 1)					
3.1	Operation of all internal communication systems on board	3		2	Written & Practical Examination
Competency No. 4 : Operate main and auxiliary machinery and associated control systems (Table A-III/ 1)					

4.1	Basic construction and operation principles of machinery systems, including:				
4.1.1	marine diesel engine	25		40	Written & Practical Examination
4.1.2	marine steam turbine	15			Written Examination
4.1.3	marine gas turbine	15			
4.1.4	marine boiler	20		15	Written & Practical Examination
4.1.5	shafting installations, including propeller	15		5	
4.1.6	other auxiliaries, including various pumps, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, air-conditioning and ventilation systems	30		50	
4.1.7	steering gear	10		10	
4.1.8	automatic control systems	10		10	
4.1.9	fluid flow and characteristics of lubricating oil, fuel oil and cooling systems	10		5	
4.1.10	deck machinery	5		5	
4.2	Safety and emergency procedures for operation of propulsion plant machinery, including control systems	10		10	Written Examination
4.3	Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems:	20		50	
4.3.1	main engine and associated auxiliaries				
4.3.2	steam boiler and associated auxiliaries and steam systems				
4.3.3	auxiliary prime movers and associated systems				
4.3.4	other auxiliaries, including refrigeration, air conditioning and ventilation systems				
	Competency as per Table A-III/ 2: Manage the operation of propulsion plant machinery. Plan and schedule operations. Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery.				
4.4	Design features, and operative mechanism of the following machinery and associated auxiliaries: marine diesel engine, marine steam turbine, marine gas turbine, marine boiler	15			Written & Oral Examination
4.5	Theoretical knowledge: Thermodynamics and Heat Engines	85			
	<i>Heat and Mass Transfer</i>	34			
	<i>Refrigeration and Air Conditioning</i>	34			
	<i>Applied Mechanics</i>	85			
	<i>Fluid Mechanics</i>	86			
	<i>Propulsive characteristics of diesel engines, steam and gas turbines, including speed, output and fuel consumption</i>	5			

	Heat cycle, thermal efficiency and heat balance of marine diesel engine, marine steam turbine, marine gas turbine, marine steam boiler.	3				
	Physical and chemical properties of fuels and lubricants & Technology of materials	2				
4.6	Practical knowledge: Start up and shut down main propulsion and auxiliary machinery, including associated systems, Operating limits of propulsion plant & The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery	10				Written & Practical Examination
Competency No. 5 : Operate fuel, lubrication, ballast and other pumping systems and associated control systems (Table A-III/ 1).						
5.1	Operational characteristics of pumps and piping system including control systems:	1				Written Examination
5.2	Operation of pumping systems:					
5.2.1	routine pumping operations	2		5		Written & Practical Examination
5.2.2	operation of bilge, ballast and cargo pumping systems	5		24		
5.3	Oily-water separators (or-similar equipment) requirements and operation	3		5		
	Competency as per Table A-III/ 2: Manage fuel, lubrication and ballast operations.					
5.4	Operation and maintenance of machinery, including pumps and piping systems.	7				Written & Oral Examination
FUNCTION : Electrical, electronic & Control Engineering at the operational and management level						
Competency No. 6 : Operate electrical, electronic and control systems (Table A-III/ 1).						
6.1	Basic configuration and operation principles of the following electrical, electronic and control equipment:					
6.1.1	electrical equipment:	25		40		Written & Practical Examination
6.1.1.a	generator and distribution systems	10	10	15		
6.1.1.b	preparing, starting, paralleling and changing over generators	5		5		
6.1.1.c	electrical motors including starting methodologies	10		20		
6.1.1.d	high-voltage installations	5				Written Examination
6.1.1.e	sequential control circuits and associated system devices	10	10			Written & Practical Examination
6.1.2	electronic equipment:					

6.1.2.a	characteristics of basic electronic circuit elements	5		15	Written & Practical Examination
6.1.2.b	flowchart for automatic and control systems	5		5	Written Examination
6.1.2.c	functions, characteristics and features of control systems for machinery items, including main propulsion plant operation control and steam boiler automatic controls	5	5	5	Written & Practical Examination
6.1.3	control systems:				
6.1.3.a	various automatic control methodologies and characteristics	20	20	20	
6.1.3.b	Proportional–Integral–Derivative (PID) control characteristics and associated system devices for process control	3	5	2	
6.2	Computer Applications (PMS, E learning, LAN network etc).		5		Practical Examination
	Competency as per Table A-III/ 2: Manage operation of electrical and electronic control equipment. Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery.				
6.3	Theoretical knowledge: Marine electro technology, electronics, power electronics, automatic control engineering and safety devices. Design features and system configurations of automatic control equipment and safety devices for main engine, generator and distribution system, steam boiler.	15			Written & Oral Examination
6.3.1	Design features of high-voltage installations	5			
6.3.2	Features of hydraulic and pneumatic control equipment	5			
6.4	Practical knowledge: Functions and mechanism of automatic control for main engine & auxiliary machinery including generator distribution systems, steam boilers, oil purifier, refrigeration system, pumping and piping systems, steering gear system, cargo-handling equipment and deck machinery.	10			Written & Practical Examination
Competency No. 7 : Maintenance and repair of electrical and electronic equipment (Table A-III/ 1).					
7.1	Safety requirements for working on shipboard electrical systems, including the safe isolation of electrical equipment required before personnel are permitted to work on such equipment	2		10	Written & Practical Examination
7.2	Maintenance and repair of electrical system equipment, switchboards, electric motors, generator and DC electrical systems and equipment	5	5	40	
7.3	Construction and operation of electrical testing and measuring equipment	5		5	
7.4	Detection of electric malfunction, location of faults and measures to prevent damage	4	2	15	
7.5	Function and performance tests of the following				Written

	equipment and their configuration:				Examination
7.5.1	monitoring systems	3		2	
7.5.2	automatic control devices	5		5	
7.5.3	protective devices	5		5	
7.6	The interpretation of electrical and simple electronic diagrams	3		2	
	Competency as per Table A-III/ 2: Manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition.				
7.7	Practical knowledge: Troubleshooting of electrical and electronic control equipment & monitoring systems. Function test of electrical, electronic control equipment and safety devices.	5			Written & Practical Examination
7.7.1	Software version control.	2			
FUNCTION : Maintenance & repair at the operational and management level					
Competency No. 8 : Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board (Table A-III/ 1)					
8.1	Strength of Materials	86			Written & Practical Examination
8.1.1	Characteristics and limitations of materials used in construction and repair of ships and equipment	4	10		
8.2	Marine Engineering Materials	86			
8.2.1	Characteristics and limitations of processes used for fabrication and repair	5		5	
8.3	Properties and parameters considered in the fabrication and repair of systems and components	10		10	Practical Examination
8.4	Methods for carrying out safe emergency/temporary repairs	2		5	
8.5	Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools and measuring instruments	5			Written Examination
8.6	Use of hand tools, machine tools and measuring instruments	2		130	Written & Practical Examination
8.7	Use of various types of sealants and packings	2		4	
8.8	Theory of Machines	86			
Competency No. 9 : Maintenance and repair of shipboard machinery and equipment (Table A-III/ 1).					
9.1	Safety measures to be taken for repair and maintenance, including the safe isolation of shipboard machinery and equipment required before personnel are permitted to work on such machinery or equipment	5			Written & Practical Examination
9.2	Appropriate basic mechanical knowledge and skills	5			Written Examination
9.3	Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and			170	Written & Practical

	equipment	10			Examination
9.4	The use of appropriate specialized tools and measuring instruments	2	3	5	
9.5	Design characteristics and selection of materials in construction of equipment	10		5	Written Examination
9.6	Interpretation of machinery drawings and handbooks	121			
9.7	The interpretation of piping, hydraulic and pneumatic diagrams	5			
	-				
	Competency as per Table A-III/ 2: Manage safe and effective maintenance and repair procedures. Detect and identify the cause of machinery malfunctions and correct faults. Ensure safe working practices.				
9.8	Theoretical knowledge: Marine engineering practice Practical knowledge: Manage safe and effective maintenance and repair procedures, Planning maintenance & repairs including statutory and class verifications.	18		20	Written & Practical Examination
9.9	Practical knowledge: Detection of machinery malfunction, location of faults and action to prevent damage Inspection and adjustment of equipment. Non-destructive examination.			50	Written & Practical Examination
9.10	Practical knowledge: Safe working practices			5	
FUNCTION : Controlling the operation of the ship and care for persons on board at the operational and management level					
Competency No. 10: Ensure compliance with pollution prevention requirements (Table A-III/ 1)					
10.1	<i>Prevention of pollution of the marine environment</i>				Written Examination
10.1.1	Knowledge of the precautions to be taken to prevent pollution of the marine environment	5			
10.1.2	Anti-pollution procedures and all associated equipment	6		6	Written & Practical Examination
10.1.3	Importance of proactive measures to protect the marine environment (+ Marine Environmental awareness)	12			
Competency No. 11 : Maintain seaworthiness of the ship (Table A-III/ 1).					
11.1	<i>Ship stability</i>				

11.1.1	Working knowledge and application of stability, trim and stress tables, diagrams and stress-calculating equipment	35			Written Examination
11.1.2	Understanding of the fundamentals of watertight integrity	15			
11.1.3	Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy	5			
11.1.4	Resistance propulsion & Powering of Ships.	35			
11.2	<i>Ship construction</i>				
11.2.1	General knowledge of the principal structural members of a ship and the proper names for the various parts	30			Written Examination
	-				
	Competency as per Table A-III/ 2: Control trim, stability and stress.				
11.3	Understanding of fundamental principles of ship construction and the theories and factors affecting trim and stability and measures necessary to preserve trim and stability	10			Written Examination
11.4	Knowledge of the effect on trim and stability of a ship in the event of damage to, and consequent flooding of, a compartment and countermeasures to be taken	10			
Competency No. 12 : Prevent, control and fight fires on board (Table A-III/ 1)					
12.1	<i>Fire prevention and fire-fighting appliances</i>				
12.1.1	Ability to organize fire drills				Written Examination
12.1.2	Knowledge of classes and chemistry of fire	5			
12.1.3	Knowledge of fire-fighting systems	15		5	Written & Practical Examination
12.1.4	Action to be taken in the event of fire, including fires involving oil systems	5			Written Examination
Competency No. 13 : Operate life-saving appliances (Table A-III/ 1)					
13.1	<i>Life-saving</i>				
13.1.1	Ability to organize abandon ship drills and knowledge of the operation of survival craft and rescue boats, their launching appliances and arrangements, and their equipment, including radio life-saving appliances, satellite EPIRBs, SARTs, immersion suits and thermal protective aids, knowledge of alarms & signals on board. IMO approved model course.	5		5	Written & Practical Examination
Competency No. 14 : Apply medical first aid on board ship (Table A-III/ 1)					
14.1	<i>Medical aid</i>				
14.1.1	Practical application of medical guides and advice by radio, including the ability to take effective action based on such knowledge in the case of accidents or illnesses that are likely to occur on board ship. IMO approved model course. Seafarers health information programme.	6			Written Examination

Competency No. 15: Monitor compliance with legislative requirements (Table A-III/ 1)					
15.1	Basic working knowledge of the relevant IMO conventions concerning safety of life at sea, security and protection of the marine environment (Incl M.S.Act and rules thereunder)	10			Written & Oral Examination
15.2	ISM Code and Quality management system	4		1	
15.3	Classification societies and their role in shipping	4		1	
15.4	Role of National Government in control of ships	4			
15.5	Recruitment and Placement of Indian Seafarers.	3			
Competency No. 16 : Application of leadership and teamworking skills (Table A-III/ 1)					
16.1	Working knowledge of shipboard personnel management and training	5			Written Examination
16.2	A knowledge of related international maritime conventions and recommendations, and national legislation	5			
16.3	Ability to apply task and workload management, including:	5			
16.3.1	planning and coordination				
16.3.2	personnel assignment				
16.3.3	time and resource constraints				
16.3.4	prioritization				
16.4	Knowledge and ability to apply effective resource management:	5			
16.4.1	allocation, assignment, and prioritization of resources				
16.4.2	effective communication on board and ashore				
16.4.3	decisions reflect consideration of team experiences				
16.4.4	assertiveness and leadership, including motivation				
16.4.5	obtaining and maintaining situational awareness				
16.5	Knowledge and ability to apply decision-making techniques:	5			
16.5.1	situation and risk assessment				
16.5.2	identify and consider generated options				
16.5.3	selecting course of action				
16.5.4	evaluation of outcome effectiveness				
Competency No. 17 : Contribute to the safety of personnel and ship (Table A-III/ 1)					
17.1	Knowledge of personal survival techniques				CONDUCTED AS MODULAR COURSE TRAINING AS PER SEPARATE DGS APPROVED TRAINING COURSE
17.2	Knowledge of fire prevention and ability to fight and extinguish fires				
17.3	Knowledge of elementary first aid				
17.4	Knowledge of personal safety and social responsibilities				

Competency No. 18 : Maintain the conditions set forth in a ship security plan; Recognition of security risks and threats; Undertake regular security inspections of the ship; and proper usage of security equipment if any					
18.1	Working knowledge of maritime security terms and definitions, maritime security levels; security reporting procedures; procedures and requirements for drills and exercises under relevant conventions, codes and IMO circulars; procedures for conducting inspections and surveys and monitoring of security activities specified in a ship security plan; security related contingency plans.	8		3	Written & Skill Test Examination
18.2	Knowledge of security documentation; Knowledge enabling recognition of potential security threats; Knowledge enabling recognition of weapons, dangerous substances and devices and awareness of the damage they can cause; crowd management and				
	control techniques; handling security related information and security related communications; methods for physical searches and non-intrusive inspections.				
18.3	Knowledge of techniques for monitoring restricted areas: Knowledge of controlling access to the ship and to restricted areas onboard; methods for effective monitoring of deck areas and areas surrounding the ship; methods for controlling the embarkation, disembarkation and access while onboard of persons and their effects; General knowledge of various types of security equipment and systems, including their limitations; need for testing, calibrating and maintaining security systems and equipment.				
	TOTAL	1536	93	889	
	GRAND TOTAL	2518			

**12 months course in Marine Engineering for Graduates in Mechanical Engineering /
Mech. & Automation / Naval Architecture**

COMPETENCY AND COURSE SUBJECTS		Hrs of training			Assessment
		Classroom	Lab	Workshop/ Afloat	
FUNCTION : Marine Engineering at the operational and management level					
Competency No.1 : Maintain a safe Engineering watch (Table A-III/ 1)					
1.1	Thorough knowledge of Principles to be observed in keeping an Engineering watch, including:	4		4	Written & Practical Examination
1.1.1	duties associated with taking over and accepting a watch				
1.1.2	routine duties undertaken during a watch				
1.1.3	maintenance of the machinery space logs and the significance of the readings taken				
1.1.4	duties associated with handing over a watch				
1.2	Safety and emergency procedures; change-over of remote/automatic to local control of all systems	4		4	
1.3	Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems	4		4	Written & Practical Examination
1.4	<i>Engine-room resource management</i>	7			Written Examination
1.4.1	Knowledge of engine-room resource management principles, including:				
1.4.1.1	allocation, assignment, and prioritization of resources				
1.4.1.2	effective communication				
1.4.1.3	assertiveness and leadership				
1.4.1.4	obtaining and maintaining situational awareness				
1.4.1.5	consideration of team experience				
Competency No. 2 : Use English in written and oral form (Table A-III/ 1)					
2.1	Adequate knowledge of the English language to enable the officer to use Engineering publications and to perform Engineering duties				
2.1.1	Oral Communication	6			Written & Oral Examination
2.1.2	Written Communication and Grammar	4			
2.1.3	Comprehension and speech	4			
2.1.4	Technical report writing	6			

Competency No. 3 : Use internal communication systems (Table A-III/ 1)					
3.1	Operation of all internal communication systems on board	3		2	Written & Practical Examination
Competency No. 4 : Operate main and auxiliary machinery and associated control systems (Table A-III/ 1)					
4.1	Basic construction and operation principles of machinery systems, including:				
4.1.1	marine diesel engine	25		40	Written & Practical Examination
4.1.2	marine steam turbine	15			Written Examination
4.1.3	marine gas turbine	15			
4.1.4	marine boiler	20		15	Written & Practical Examination
4.1.5	shafting installations, including propeller	15		5	
4.1.6	other auxiliaries, including various pumps, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, air-conditioning and ventilation systems	30		50	
4.1.7	steering gear	10		10	
4.1.8	automatic control systems	10		10	
4.1.9	fluid flow and characteristics of lubricating oil, fuel oil and cooling systems	10		5	
4.1.10	deck machinery	5		5	
4.2	Safety and emergency procedures for operation of propulsion plant machinery, including control systems	10		10	Written Examination
4.3	Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems:	20		50	
4.3.1	main engine and associated auxiliaries				
4.3.2	steam boiler and associated auxiliaries and steam systems				
4.3.3	auxiliary prime movers and associated systems				
4.3.4	other auxiliaries, including refrigeration, air conditioning and ventilation systems				
	Competency as per Table A-III/ 2: Manage the operation of propulsion plant machinery.				

	Plan and schedule operations. Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery.				
4.4	Design features, and operative mechanism of the following machinery and associated auxiliaries: marine diesel engine, marine steam turbine, marine gas turbine, marine boiler	15			Written & Oral Examination
4.5	Theoretical knowledge: Thermodynamics and heat transmission, Mechanics and hydromechanics Propulsive characteristics of diesel engines, steam and gas turbines, including speed, output and fuel consumption Heat cycle, thermal efficiency and heat balance of marine diesel engine, marine steam turbine, marine gas turbine, marine steam boiler. Refrigerators and refrigeration cycle, Physical and chemical properties of fuels and lubricants & Technology of materials	10			
4.6	Practical knowledge: Start up and shut down main propulsion and auxiliary machinery, including associated systems, Operating limits of propulsion plant & The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery	10			
Competency No. 5 : Operate fuel, lubrication, ballast and other pumping systems and associated control systems (Table A-III/ 1).					
5.1	Operational characteristics of pumps and piping system including control systems:	1			Written Examination
5.2	Operation of pumping systems:				
5.2.1	routine pumping operations	2		5	Written & Practical Examination
5.2.2	operation of bilge, ballast and cargo pumping systems	5		24	
5.3	Oily-water separators (or-similar equipment) requirements and operation	3		5	
	Competency as per Table A-III/ 2: Manage fuel, lubrication and ballast operations.				
5.4	Operation and maintenance of machinery, including pumps and piping systems.	7			Written & Oral Examination

FUNCTION : Electrical, electronic & Control Engineering at the operational and management level					
Competency No. 6 : Operate electrical, electronic and control systems (Table A-III/ 1).					
6.1	Basic configuration and operation principles of the following electrical, electronic and control equipment:				
6.1.1	electrical equipment:	25		40	Written & Practical Examination
6.1.1.a	generator and distribution systems	10	10	15	
6.1.1.b	preparing, starting, paralleling and changing over generators	5		5	
6.1.1.c	electrical motors including starting methodologies	10		20	
6.1.1.d	high-voltage installations	5			Written Examination
6.1.1.e	sequential control circuits and associated system devices	10	10		Written & Practical Examination
6.1.2	electronic equipment:				
6.1.2.a	characteristics of basic electronic circuit elements	5		15	Written & Practical Examination
6.1.2.b	flowchart for automatic and control systems	5		5	Written Examination
6.1.2.c	functions, characteristics and features of control systems for machinery items, including main propulsion plant operation control and steam boiler automatic controls	5	5	5	Written & Practical Examination
6.1.3	control systems:				
6.1.3. a	various automatic control methodologies and characteristics	20	20	20	
6.1.3. b	Proportional–Integral–Derivative (PID) control characteristics and associated system devices for process control	3	5	2	
6.2	Computer Applications (PMS, E learning, LAN network etc).		5		Practical Examination
	Competency as per Table A-III/ 2: Manage operation of electrical and electronic control equipment. Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery.				

6.3	Theoretical knowledge: Marine electro technology, electronics, power electronics, automatic control engineering and safety devices. Design features and system configurations of automatic control equipment and safety devices for main engine, generator and distribution system, steam boiler.	15			Written & Oral Examination
6.3.1	Design features of high-voltage installations	5			
6.3.2	Features of hydraulic and pneumatic control equipment	5			
6.4	Practical knowledge: Functions and mechanism of automatic control for main engine & auxiliary machinery including generator distribution systems, steam boilers, oil purifier, refrigeration system, pumping and piping systems, steering gear system, cargo-handling equipment and deck machinery.	10			Written & Practical Examination
Competency No. 7 : Maintenance and repair of electrical and electronic equipment (Table A-III/ 1).					
7.1	Safety requirements for working on shipboard electrical systems, including the safe isolation of electrical equipment required before personnel are permitted to work on such equipment	2		10	Written & Practical Examination
7.2	Maintenance and repair of electrical system equipment, switchboards, electric motors, generator and DC electrical systems and equipment	5	5	40	
7.3	Construction and operation of electrical testing and measuring equipment	5		5	
7.4	Detection of electric malfunction, location of faults and measures to prevent damage	4	2	15	
7.5	Function and performance tests of the following equipment and their configuration:				Written Examination
7.5.1	monitoring systems	3		2	
7.5.2	automatic control devices	5		5	
7.5.3	protective devices	5		5	
7.6	The interpretation of electrical and simple electronic diagrams	3		2	
	Competency as per Table A-III/ 2: Manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition.				

7.7	Practical knowledge: Troubleshooting of electrical and electronic control equipment & monitoring systems. Function test of electrical, electronic control equipment and safety devices.	5			Written & Practical Examination
7.7.1	Software version control.	2			
FUNCTION : Maintenance & repair at the operational and management level					
Competency No. 8 : Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board (Table A-III/ 1)					
8.1	Characteristics and limitations of materials used in construction and repair of ships and equipment	4	10		Written & Practical Examination
8.2	Characteristics and limitations of processes used for fabrication and repair	5		5	
8.3	Properties and parameters considered in the fabrication and repair of systems and components	10		10	Practical Examination
8.4	Methods for carrying out safe emergency/temporary repairs	2		5	
8.5	Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools and measuring instruments	5			Written Examination
8.6	Use of hand tools, machine tools and measuring instruments	2		130	Written & Practical Examination
8.7	Use of various types of sealants and packings	2		4	
Competency No. 9 : Maintenance and repair of shipboard machinery and equipment (Table A-III/ 1).					
9.1	Safety measures to be taken for repair and maintenance, including the safe isolation of shipboard machinery and equipment required before personnel are permitted to work on such machinery or equipment	5			Written & Practical Examination
9.2	Appropriate basic mechanical knowledge and skills	5			Written Examination
9.3	Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment	10		170	Written & Practical Examination
9.4	The use of appropriate specialized tools and measuring instruments	2	3	5	
9.5	Design characteristics and selection of materials in construction of equipment	10		5	Written Examination
9.6	Interpretation of machinery drawings and handbooks	35			
9.7	The interpretation of piping, hydraulic and	5			

	pneumatic diagrams				
	-				
	Competency as per Table A-III/ 2: Manage safe and effective maintenance and repair procedures. Detect and identify the cause of machinery malfunctions and correct faults. Ensure safe working practices.				
9.8	Theoretical knowledge: Marine engineering practice Practical knowledge: Manage safe and effective maintenance and repair procedures, Planning maintenance & repairs including statutory and class verifications.	18		20	Written & Practical Examination
9.9	Practical knowledge: Detection of machinery malfunction, location of faults and action to prevent damage Inspection and adjustment of equipment. Non-destructive examination.			50	Written & Practical Examination
9.10	Practical knowledge: Safe working practices			5	
FUNCTION : Controlling the operation of the ship and care for persons on board at the operational and management level					
Competency No. 10: Ensure compliance with pollution prevention requirements (Table A-III/ 1)					
10.1	<i>Prevention of pollution of the marine environment</i>				Written Examination
10.1.1	Knowledge of the precautions to be taken to prevent pollution of the marine environment	5			
10.1.2	Anti-pollution procedures and all associated equipment	6		6	Written & Practical Examination
10.1.3	Importance of proactive measures to protect the marine environment (+ Marine Environmental awareness)	12			
Competency No. 11 : Maintain seaworthiness of the ship (Table A-III/ 1).					
11.1	<i>Ship stability</i>				
11.1.1	Working knowledge and application of stability, trim and stress tables, diagrams and stress-calculating equipment	35			Written Examination
11.1.2	Understanding of the fundamentals of watertight integrity	15			

11.1.3	Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy	5			
11.1.4	Resistance propulsion & Powering of Ships.	35			
11.2	<i>Ship construction</i>				
11.2.1	General knowledge of the principal structural members of a ship and the proper names for the various parts	30			Written Examination
	Competency as per Table A-III/ 2: Control trim, stability and stress.				
11.3	Understanding of fundamental principles of ship construction and the theories and factors affecting trim and stability and measures necessary to preserve trim and stability	10			Written Examination
11.4	Knowledge of the effect on trim and stability of a ship in the event of damage to, and consequent flooding of, a compartment and countermeasures to be taken	10			
Competency No. 12 : Prevent, control and fight fires on board (Table A-III/ 1)					
12.1	<i>Fire prevention and fire-fighting appliances</i>				
12.1.1	Ability to organize fire drills				Written Examination
12.1.2	Knowledge of classes and chemistry of fire	5			
12.1.3	Knowledge of fire-fighting systems	15		5	Written & Practical Examination
12.1.4	Action to be taken in the event of fire, including fires involving oil systems	5			Written Examination
Competency No. 13 : Operate life-saving appliances (Table A-III/ 1)					
13.1	<i>Life-saving</i>				
13.1.1	Ability to organize abandon ship drills and knowledge of the operation of survival craft and rescue boats, their launching appliances and arrangements, and their equipment, including radio life-saving appliances, satellite EPIRBs, SARTs, immersion suits and thermal protective aids, knowledge of alarms & signals on board. IMO approved model course.	5		5	Written & Practical Examination
Competency No. 14 : Apply medical first aid on board ship (Table A-III/ 1)					
14.1	<i>Medical aid</i>				

14.1.1	Practical application of medical guides and advice by radio, including the ability to take effective action based on such knowledge in the case of accidents or illnesses that are likely to occur on board ship. IMO approved model course. Seafarers health information programme.	6			Written Examination
Competency No. 15: Monitor compliance with legislative requirements (Table A-III/ 1)					
15.1	Basic working knowledge of the relevant IMO conventions concerning safety of life at sea, security and protection of the marine environment (Incl M.S.Act and rules thereunder)	10			Written & Oral Examination
15.2	ISM Code and Quality management system	4		1	
15.3	Classification societies and their role in shipping	4		1	
15.4	Role of National Government in control of ships	4			
15.5	Recruitment and Placement of Indian Seafarers.	3			
Competency No. 16 : Application of leadership and teamworking skills (Table A-III/ 1)					
16.1	Working knowledge of shipboard personnel management and training	5			Written Examination
16.2	A knowledge of related international maritime conventions and recommendations, and national legislation	5			
16.3	Ability to apply task and workload management, including:	5			
16.3.1	planning and coordination				
16.3.2	personnel assignment				
16.3.3	time and resource constraints				
16.3.4	prioritization				
16.4	Knowledge and ability to apply effective resource management:	5			
16.4.1	allocation, assignment, and prioritization of resources				
16.4.2	effective communication on board and ashore				

16.4.3	decisions reflect consideration of team				
	experiences				
16.4.4	assertiveness and leadership, including motivation				
16.4.5	obtaining and maintaining situational awareness				
16.5	Knowledge and ability to apply decision-making techniques:	5			
16.5.1	situation and risk assessment				
16.5.2	identify and consider generated options				
16.5.3	selecting course of action				
16.5.4	evaluation of outcome effectiveness				
Competency No. 17 : Contribute to the safety of personnel and ship (Table A-III/ 1)					
17.1	Knowledge of personal survival techniques				CONDUCTED AS MODULAR COURSE TRAINING AS PER SEPARATE DGS APPROVED TRAINING COURSE
17.2	Knowledge of fire prevention and ability to fight and extinguish fires				
17.3	Knowledge of elementary first aid				
17.4	Knowledge of personal safety and social responsibilities				
Competency No. 18 : Maintain the conditions set forth in a ship security plan; Recognition of security risks and threats; Undertake regular security inspections of the ship; and proper usage of security equipment if any					

18.1	Working knowledge of maritime security terms and definitions, maritime security levels; security reporting procedures; procedures and requirements for drills and exercises under relevant conventions, codes and IMO circulars; procedures for conducting inspections and surveys and monitoring of security activities specified in a ship security plan; security related contingency plans.				
18.2	Knowledge of security documentation; Knowledge enabling recognition of potential security threats; Knowledge enabling recognition of weapons, dangerous substances and devices and awareness of the damage they can cause; crowd management and control techniques; handling security related information and security related communications; methods for physical searches and non-intrusive inspections.	8		3	Written & Skill Test Examination
18.3	Knowledge of techniques for monitoring restricted areas: Knowledge of controlling				
	access to the ship and to restricted areas onboard; methods for effective monitoring of deck areas and areas surrounding the ship; methods for controlling the embarkation, disembarkation and access while onboard of persons and their effects; General knowledge of various types of security equipment and systems, including their limitations; need for testing, calibrating and maintaining security systems and equipment.				
	TOTAL	834	75	889	
	GRAND TOTAL	1798			

Syllabus for One Year Marine Engineering Course

(12 Months Shore Based Training)

1) On Board Operations:

Introduction to watch keeping, Number of watches per day, day watch/sea watch, number of watch keepers, stand by duties, Familiarity with the engine room and plant. Knowing emergency exits, location of fire fighting equipment in engine room,

Stand actual watch on the running diesel generator in the live bay of the workshop/ Ship-in-campus and/or in Engine Room during Afloat period - Noting and logging temperatures, pressures, tank levels and other parameters in the engine log book.

Check list for taking over watch at sea, port/anchorage, UMS check list etc. Standing orders, night orders.

A brief introduction to Contingency Manual and a few likely scenarios where an emergency or contingency may arise.

Getting main engine, steam plant ready for departure, checks on plant while engine maneuvering, arriving port, stopping main engine. Readings to take during maneuvering, preparing noon chits. Arrival/Departure check lists. To gain understanding that operation are planned and carried out in accordance with established rules and procedures to ensure safety of operations and to avoid pollution of the marine environment. Learning to identify deviations from norms, causes of machinery malfunction and taking to ensure overall safety of ship and plant.

2) Preparing Main Engine and associated auxiliaries for Arrival /departure. Starting up / Shutting off a steam Boiler and associated steam systems: Starting Auxiliary prime movers and associated systems, Starting and putting in operation refrigeration, air conditioning & ventilating systems.

Practical knowledge - Start up and shut down main propulsion and auxiliary machinery, including associated systems. Operating limits of propulsion plant.

The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery.

3) Engine Room Resource Management:

ERM principles based on Bridge Resource Management

Necessity of ERM - ERM in terms of maintaining the safe engineering watch

Resources considered in ERM - Resource management eg, personnel management, information management and management of installations/ equipment

Necessity to practice ERM - Allocation, assignment and prioritization of the resources, effective communication, assertiveness and leadership, obtaining and maintaining situational awareness, consideration of team experience.

4) Internal Communication:

Knowledge of various communication systems available on board, such as: Verbal, telephonic (power/sound power), signals, telegraph, hand signals;

5) Use of English Language:

To exhibit communication skill in English & proficiency in Marine Vocabulary

Writing letters with correct grammar & spellings, in English.

To demonstrate ability to comprehend clearly & use engineering publications and perform engineering functions to speak ensuring that the intended message is understood in English.

Address & type letters both of technical and non technical nature with correct grammar & spellings, in English.

6) Thermodynamics and Heat Engines:

Theoretical knowledge -Thermodynamics and heat transmission, Mechanics and hydromechanics.

Propulsive characteristics of diesel engines, steam and gas turbines, including speed, output and fuel consumption

Heat cycle, thermal efficiency and heat balance of marine diesel engine, marine steam turbine, marine gas turbine and marine steam boiler.

Propulsive characteristics of diesel engines, steam and gas turbines, including speed, output and fuel consumption.

7) Marine Diesel Engines:

Basic Principles, cycles, timings, engine types, configuration and features. Structure, components, gas exchange process - scavenging, supercharging, turbochargers, combustion process, fuel injection, camshaft. Power measurement, Indicator cards, fault finding. Control, safety, operation, difficulties, trouble shooting, governor, modern developments. Maintenance, Decarburization, bearing clearances, etc.

8) Auxiliary Machinery: Acquire knowledge of construction & operation of all auxiliary machinery including associated equipment. Study & understand the general layout of machinery in the engine room.

9) Air Compressors:

Air compressor and system principles - Operation, Principles, Types, Material of construction, Compression process, Inter and after coolers.

10) Purifier:

Purifier and fuel oil treatment – Operation, Principles, Types, Material of construction. Familiarize with filtration & purification methods in fuels & lubricants, their necessity, operation & care.

11) Boiler:

Marine Boiler - Steam boiler fuel atomization and combustion, Marine boiler fundamentals, Marine Boiler construction, Boiler mountings and steam distribution, Marine boiler operation.

Steam Cycle, Properties of steam, Feed water, Basic components, types of boilers - smoke & water tube, Feed water and circulation, tubes, stays, headers, super heaters, furnace, casing, supports, internal fittings, external fittings, mountings. Burners. Instrumentation, Automation, Controls. Safeties. Preparation, Flashing up, Steaming up, Pre and Post purging. Cooling down, blowing down, and blowing through gauge glass. Boiler water testing and treatment. Emergency Operation.

12) Marine Steam Turbines:

Marine Steam Turbine – Rankine cycle, Operation principle, Basic construction and materials of Steam Turbine, Impulse Turbine, Reaction turbine, Bleeder turbine (extraction turbine), Regenerative turbine, Reheat turbine.

Principle, Major components, number of nozzles, multi-stage turbines, types and stages, vacuum exhaust, compound turbines, high pressure with reaction stages, double flow low-pressure turbines, single cased propulsion turbines, turbines for fans and pumps.

Turbine Details: Casing, Bearing Housing, Bed Plate, Rotor, Blades, Diaphragm, Nozzles, packing gland, Journal, Thrust Bearings, preparation, Raising Vacuum, Maneuvering, Routine and Emergency operation.

13) Marine Gas Turbines:

Marine Gas Turbine – Operation principle & Basic construction.

Characteristics of gas turbine plants, gas turbines Vs other prime movers, principles, major components, temperature limits, waste heat recovery, maintenance, compressor, turbine types.

14) Pumps & Piping:

Principles, Types of pumps, Characteristics, Fundamentals, Centrifugal, Reciprocating, Rotary and Jet Pumps, Liquid-ring vacuum pumps, blowers, fans, compressors, pump operation, starting procedure for - centrifugal as well as positive displacement pumps.

Fluid flow and characteristics of major systems – Description of all fluid flow systems on board, Operation and material construction of devices/ equipment in the system. Operation and maintenance of machinery, including pumps and piping systems. Construction and characteristics of pumps and pumping systems.

Physical & chemical properties of fuels and lubricants.

Familiarize with the various pipe line layout of bilge, ballast, fuel, lubricating oil & cooling water systems.

Introduction, Piping and Tubing, Valves, different types of valves, maintenance of valves, vents, sounding pipes, fuel -oil transfer and service systems, steam, condensate and feed systems, waste heat recovery systems, sea water circulating and cooling systems, fresh water cooling systems, main lubricating systems, Bilge and ballast systems, Compressed air and Control systems, Fire main systems, Sanitary and drinking water hydrophore systems, Cargo Handling Systems.

15) Deck Machinery:

Deck Machinery - Operation, Principles, Types, Material of construction, Windlass/ mooring winch, Winch, Boat winch.

16) Shafting Installations & Propeller:

Equipment constructing shafting, Types of propeller and features, Material of construction and definitions, Cavitation. Shafting Arrangements, Shaft bearings, Stern Tube, Stern Tube Seal, Propeller Shaft, Propeller - Fixed and Controllable, Tightening/ Withdrawal of propeller, tail shaft, inspection, etc. Study shafting & propellers.

17) Fresh Water Generator:

Evaporators and distillers – Operation, Principles, Types, Material of construction. Flash evaporators, Multiple effect evaporation. Familiarize with purification methods in respect of fresh water, their necessity, operation & care.

18) Heat exchangers:

Operation, Principles, Types, Material of construction.

19) Refrigeration:

Marine refrigeration cycle, Principles of refrigeration, Refrigerating compressors and system components, Refrigerating system brines, Cold storage spaces and insulation, Air conditioning and ventilation system.

20) Main Engine & Auxiliary Machinery - Maintenance and Repair:

Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems.

Main Engine and Associated Auxiliaries, Boiler and Associated Auxiliaries, and Steam Systems,

Auxiliary Prime Movers and Associated Systems (Diesel engine, Steam Turbine),

Other Auxiliaries – Purifiers and Fuel oil treatment, Air compressors, Evaporators and distillers, Refrigerator.

Practical knowledge - Organizing & managing safe and effective maintenance and repair procedures. Planning maintenance & repairs

21) Maintenance and repair such as dismantling, adjustment and reassembling of machinery and equipment:

Fastening, Centrifugal Pumps, Reciprocating Pumps, Screw and Gear Pumps, Valves, Air Compressors, Heat Exchangers, Diesel Engine, Turbocharger, Boiler, Maintenance Propulsion Shafting Procedures, Refrigeration Maintenance, Oils Fuels and Lubricating System Maintenance, Deck Machinery Maintenance.

22) Marine Engineering Practice:

Methods for carrying out safe emergency/ temporary repairs.

Practical knowledge

Detection of machinery malfunction, location of faults and action to prevent damage.

Detection of faults of machinery by visual inspection, NDT methods (Non-destructive examination) and by other advanced systems such as vibration monitoring (condition monitoring). Inspection and adjustment of equipment

Modern approach to machinery reliability methods and their execution.

Principles and practice of reliability and trends in breakdown. Typical failures and fault diagnosis.

Reliability of machinery, its principle and practice.

23) Electrical & Electronic

a) Basic electrical engineering:

(i) Electrical Theory – Ohm's Law, Kirchhoff's Law, Electrical circuits, Impedance and inductance.

Review of basic electrical knowledge, Introduction-Ship's electrical system-Circuit calculations-Electrical safety-Electric shock-Insulation resistance-circuit testing-insulation testing-continuity Testing-Introduction-Ship's electrical system-Circuit calculations-Electrical safety-Electric shock-Insulation resistance-circuit testing-insulation testing-continuity Testing.

(ii) Fundamentals of Alternating Current – Alternating current, Electro-magnetic induction, Work energy and power.

(iii) Generators – A.C. & D.C. generators.

Introduction to marine power generation equipment, AC / DC machines, AVR, characteristics of electrical machines used on board, induction, synchronous motors, transformers, circuit breakers. Navigational, signalling equipment, cables.

(iv) Power Distribution Systems– Distribution, Insulation, Transformer, Types.Distribution & switchboard arrangement; switchgears and starters. Operation, maintenance & repair of above equipment; Insulated and earthed neutral systems-significance of earth faults-distribution circuit breakers-Shore supply connection-Circuit protection.

Method of voltage control, paralleling procedure and load sharing between generators. Manual Synchronizing-Auto Synchronizing-Prime Mover Characteristic-parallel operation-Excitation Control-Load sharing-Speed droop and power generation.

(v) Electrical Motors – A.C. & D.C. Motor.

Introduction-Motor construction-Enclosures and ratings, Electrical Motor Starting Methodologies - Induction Motor operation-Control Equipment-Direct On-line Starting-Reduced voltage starting-Speed control-Motor operation-Single phase motors-Maintenance. Design features and system configurations of operational control equipment for electrical motors

b) Basic electronics:

Electron Theory

c) Basic Electronic Circuit Elements:

Semi conductor, Thyristor, Integrated Circuit (IC) and Large scale Integrated Circuit (LSI).

Working and Characteristics of Diode, Triode, Thyristor-TRAIC-, Amplifier,Transistor, Rectifier-Half wave & Full Wave.

d) Electronic Control Equipment:

Control mechanism of PLC (Programmable Logic Controller), Integrated Automation Control and Monitoring System (IACMS), Computer programmable Controller, Relay Circuit unit, Digital Sequential Control devices.

Study of fuses-Relays-Overload relay-reverse power Relay-Air Circuit Breakers-MCCB-MCB-ELCB-Under Voltage Protection-Preference tripping-Over Current protection-Motor Protection-Single Phasing.

Voltage stabilization-Filter choke-Impedance-Rectification-Grid Bias Voltage-and their significance-Characteristic curves of PN Junction Diode-Forward and Reverse bias modes.

24) Electrical, Electronic Maintenance & Repair:

Principles of Maintenance, Generator, Switchboard, Electrical Motors, Starters.

Do's and don't while working on Electrical panel/Circuits-Safety precautions before entering into battery room-Safe working practices while working on any Electrical Circuits/machineries/panels.

D.C Electrical Systems and Equipment – Battery system, Remote automatic control equipment.

DC power supply control-Corrective and preventive actions in case of fire in the Main switchboard-Star-delta circuit for Main Seawater pump-Auto transformer starter-ACB.

Distribution System – Transformer, Distribution, Cables.

Open Circuit Fault-Short Circuit Fault-Earth Fault-Significance of Earth Fault-Fault finding in generator-Trouble shooting of AC motors.

Use of Engine Simulator for Electrical Fault Finding.

Construction and operation of electrical testing and measuring equipment – Construction, Operation & Principles of insulation tester, Continuity tester, Multi tester, Multimeter, Megger, Clampmeter, Wattmeter, Frequency meter, Synchronoscope, Continuity test, Insulation test.

25) High voltage Practice- Power supply network-Review of motor Operation-Controlled Rectification and Inversion-Converter types.

High-Voltage Installations- High voltage Protection-High Voltage safety-High voltage equipment testing. Lighting, Cables, Batteries.

26) Detection of electric malfunction and measures to prevent damage:

Essential requirements for Fault Protection, Fault Location.

Practical knowledge -Troubleshooting of electrical and electronic control equipment
Troubleshooting of monitoring systems

27) Function, performance test and configuration:

Monitoring Systems, Automatic Control Devices (Process control & system control), Protective Devices.

Design features and system configurations of automatic control equipment and safety devices for main engine, generator and distribution system and steam boiler.

Function test of electrical, electronic control equipment and safety devices.

28) Electrical and simple electronic diagrams:

Electric and Electronic symbols and Interpretations of Flow diagrams and Circuits.

29) Flowchart for Automatic and Control System – Depiction and understanding of flowcharts, Symbols utilization and processes involved.

Routine testing Flow chart, Manual and automatic starting flow chart, Automatic changeover of supply on main's failure.

30) Automation & Control Systems

a) Basic control engineering:

Fundamentals of Automatic Control, Various Automatic Control, ON-OFF Control, Sequential Control, Proportional-Integral-Derivative (PID) Control.

Process Control Theory-Open loop, close loop-Sensing elements and transducers-Monitors-Automatic control system- pneumatic controllers-electronic controllers-PLC-final control systems.

On/OFF and Continuous control system-Interdependence of PID control action-characteristics -Temperature vs time, temperature vs valve relationship-proportional band and gain-Direct acting signal-Reverse acting signal-On/off -P,P+I,P+D,P+I+D Characteristic.

b) Measurement of Process Value – Temperature (Mechanical, Electrical), Pressure, Level (Direct methods and Inferential methods), Flow, General measurement and process.

Process Control systems on ships, Boiler water level control, L.O. Temp control, Jacket cooling water, Feed water circulation, Auto combustion control of a boiler, etc

c) Transmission of Signals – Transmitters, Controlling elements (Pneumatic, Electrical, Receivers).

Steam Pressure Control of the Exhaust Gas Boiler control System - Dearator level control-Feed Water Circulation-Piston Cooling Water Temperature - Centralized cooling System-

d) Manipulator Elements– Principles, Operation, Application, Pneumatic, Electrical Servomotor, Hydraulic Servomotor.

e) Functions and mechanism of automatic control for main engine and auxiliary machinery including generator distribution systems, steam boilers, refrigeration system and pumping and piping systems.

31) Safe Working Practice:

Practical knowledge

Describe & demonstrate safe working practices in carrying out all relevant ship board tasks. Procedures for handling heavy machinery parts & overhaul of engines. Precautions to be taken while entering enclosed spaces. Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools and measuring instruments.

Safety measures to be taken for repair and maintenance including the safe isolation of shipboard machinery and equipment required before personnel are permitted to work on such machinery or equipment.

32) Ship Construction:

Ship construction Terminology, Hull construction, structure, description and construction of structural members, Fore and Aft peak, Double bottom, Load Line and draught marks ship dimensions and form, Bow and stern, Fittings, Rudders and propellers.

Understanding of fundamental principles of ship construction and the theories and factors affecting trim and stability and measures necessary to preserve trim and stability

33) Naval Architecture:

Definition of principal terms used in Naval Architecture. Draft, buoyancy, Geometry of ships, Hydrostatic calculations, Stability of ships, Trim, Stress Calculations .

Ship stability - Displacement, Buoyancy, Fresh water allowance, Statical stability, Initial stability, Angle of loll, Curves of statical stability, Movement of centre of gravity, List and Its Correction, Effect of slack tanks, Trim, Stress tables, Actions to be taken in the event of partial loss of Loss of intact buoyancy. Knowledge of the effect on trim and stability of a ship in the event of damage to, and consequent flooding of, a compartment and countermeasures to be taken

Buoyancy, Reserve buoyancy, Metacentre, Inclining experiment, water tight integrity. Stresses on ship, Resistance, Admiralty & Fuel Co-efficients.

34) Fire:

Introduction to Fire, what 'FIRE' stands for, the Fire Triangle etc. Portable FFA.

Practical demonstration of organising fire drills.

Precautions against fire or explosion. Explosive mixtures. Danger of oil leakage's. Sources of ignition. Safety devices.

Types and classes of fire. The Fire Triangle, methods of fire fighting such as starvation, smothering etc.

Various fixed fighting systems. Their operation and maintenance.

Ship board fire fighting - Organisation, Muster list, duties, Mock drills and practice. Fighting oil fires.

Basic seamanship; knowledge of life saving appliances & equipment on board ship.

Knowledge of alarms & signals on board ship.

35) Safety Equipments:

Alarm monitoring systems, Heat detectors, Fire detectors, Oil mist Detector, Dead Man Alarm, Monitoring of CO₂-Oxygen analyzer-Explosimeter-vibration monitoring.

36) Safety & Emergency Procedures:

Safety and emergency procedures for operation of propulsion plant machinery including control systems:

Main Engine Auto-slow Down and Shut Down,

Main Boiler Auto shut Down, Power Failure,

Emergency Procedures for Other Equipment/ Installations – Emergency steering,

Back out operations and restoration. Propulsion plant operation.

37) Workshop Management & Skills:

a) Design Characteristics and limitations/ selection of materials used in construction and repair of ships and equipment

Basic Metallurgy, Metals and Processes, Technology of materials.

Properties and Uses, Non-Metallic Materials.

Review properties of materials, their limitations, heat treatment of carbon steels. Testing of components used in manufacture. Need for lifting gear, various types, their operation & care, inspections & surveys. Lifting gear-chains, tackles, chain blocks, overhead engine room crane-their testing & surveys.

b) Properties and parameters considered in the fabrication and repair of systems and components:

Materials under Load, Vibration, Self-Secured Joints, Permanent Joints, Bonding Plastics, Adhesives and Bonding, Pipework.

(i) Basic work shop practice: Fabrication, fitting, welding - (gas, arc), cutting, brazing. Operation of lathe, drilling machine. Introduction to methods of emergency repairs such as use of jubilee clips, use of plugs, adhesives, putty, doubler plates, 'C' clamps etc.

Safety practices to be adopted, use of PPE, reading and understanding standing orders, good house keeping, proper handling of equipment

The use of appropriate specialized tools and measuring instruments - Review and learn use of various tools and instruments. Their use, such as the vernier calipers, inside/outside micrometer, inside/outside calipers, depth gauge etc.

(ii) Workshop Management – Discipline, safety management, preventive maintenance, cleanliness, familiarization with safety equipment and aspects relating to shipboard practices.

Advanced skills in fitting and fabrication. Use of jigs. Joint cutting, use of chisel. Overhauling various types of valves, valve grinding, pipe line repair,

Overhaul of fuel injectors, air start valves, tappet clearance adjustment, assembling, dismantling pumps. Assist senior engineers during afloat training in decarburization, inspection, surveys, and other machinery overhauls.

(iii) Basic introduction to Preventive Maintenance program. Familiarization with AMOS/Ship manager or any other integrated PMS program. Basic understanding of the spares/stores requisition process, inventory control. Software version control.

(iv) Learn about specialized tools such as trammel gauge, peak pressure gauge, indicator instrument, crank web deflection gauge, bridge gauge, piston crown template etc.

(v) Use of various types of sealants and packings - rubber, oil, steam, general purpose, 'O' rings, copper gaskets, washers. When, where and how to use .

(vi) Study of pipes, pipe fitting, bending & fabrication. Introduction to gas welding, basic principles of welding, various electrodes and consumables, gas cutting, maintenance and safety.

(vii) Interpretation of machinery drawings and handbooks marine engineering drawing and design.

Types of Drawing, Linework, Pictorial Projection, Development, Dimensioning, Geometrical Tolerancing, Limits and Fits, Engineering Drawing Practice.

Familiarise with notations used and interpret drawings of ships structure, equipment, electrical and mechanical systems.

The interpretation of piping, hydraulic and pneumatic diagrams - Carry out assignments in drawing machinery parts and pipe system layouts from actual machinery in workshop and blue prints supplied to ships.

Ability to make simple sketches relating to machinery components with supplementary notes and specifications.

38) Marine Pollution Awareness:

Importance of proactive measures.

Anti-pollution procedures and associated equipment fitted on board.

Oily water separator/ similar equipment Construction and operation – Prevention of pollution, Requirements, Principles, Their operation, maintenance, record keeping.

The precautions to be taken to prevent pollution of the marine environment – Prevention of pollution, MARPOL 73/78 technical annexes.

Regulation 26 - Annex 1 MARPOL 73/78, Anti-Pollution Equipment, Control of oil from machinery space, Oil record book (Part I – Machinery space operation), Precautions which should be taken to prevent accidental pollution by oil. Sewage.

IOPP Certificate and Surveys – Annex I – Oil, Annex II – Noxious liquid substances in bulk, Annex III – Harmful substances carried by sea in Packaged forms, Annex IV – Sewage, Annex V – Garbage, Annex VI – Air pollution.

Convention of prevention of Marine pollution by dumping of waste and other matter (London Dumping Convention (LDC)).

International Convention relating to Intervention on the High Seas in case of Oil Pollution Casualties, 1969.

International Convention on civil liability for Oil Pollution damage 1969.

Bunkering procedure, bunker plan, bunker check list, etc. SOPEP equipment. Fighting, containing oil spill.

The various emissions arising from ships, their effect on environment - sea and air. Green house emission, other emissions from ships such as SO_x and NO_x, Introduction to invasive species including ballast water, other impacts such as noise, anti-fouling paint, recycling of ships. Pollution prevention measures, Personal involvement such as behaviour, responsibility.

39) National Regulations:

Role of Govt in control of ships, DG Shipping, MMD, Flag State, Port State Control, Inspections of ships, Examinations.

Special needs of the shipping industry, various demands of the career - technical, practical, physical, emotional, psychological, desirable personal traits.

40) International Regulations:

Introduction to MARPOL, Annexes I to VI, why introduced, how the environment is affected.

Regulations governing discharge criteria, procedures for discharge, documentation, record keeping, inspection and penalty for violation.

Working knowledge of SOLAS, MARPOL, STCW etc.

Introduction to ISM, SMS documentation, manuals, ISO 9001, ISO 14001, DPA, forms, check lists

Introduction to ISPS, Security levels, Security Officer, documentation, security patrolling.

Various Classification Societies, IRS, LRS, ABS etc; CSM, ESP, Surveys, Certificates. Oil majors and Vetting Inspection.

Basic working knowledge of the relevant IMO conventions concerning safety of life at sea and protection of the marine environment

Introduction to Maritime Law, Law of sea-on high seas, Safety

International Convention on Load Lines, 1966

SOLAS, 1974 as amended

SOLAS—Sub division and stability

SOLAS—Fire protection, detection and extinction

SOLAS—LSA and arrangements (LSA Code)

SOLAS—Radio telegraphy and R/T

SOLAS—Radio communications (amended Chap. 1V)

SOLAS—Carriage of grain

SOLAS—Carriage of dangerous goods

STCW, 1995

ITU Radio regulations

STP ships Agreement, 1971

SPACE STP, 1973

PAL, 1974 and Tonnage 1969

41) Leadership & Team working/ Managerial Skills:

Introduction to human factors, communication, Inter-personal relationships.

Understanding Team work, importance of team spirit, nurturing a conducive work ethos leadership qualities, development of a positive attitude, organizational behaviour, functional responsibilities, role clarity, expectations,

Introduction to situation and risk assessment. Risk analysis, critical equipment, and critical maintenance.

Identifying activities that may be hazards to occupational health and safety and damage to property, carrying out risk assessment, documenting same in the SMS manuals.

Effective Resource Management and Decision Making. Use of probability, consequence/ severity matrix to evaluating impact on safety, loss/ damage to property, establishing acceptance criteria. Establishing control procedure to mitigate risk posed by hazard.

Task and Workload Management. Evaluation of outcome. Regular review of outcome, procedures, task identification to assess effectiveness of program.

42) Marine Industry:

Knowledge of Marine insurance, claims, legal matters in ship operation, etc.; conference systems; freight rates & fares fixation machinery and government control; Carriage of Goods by Sea Act.

ONE YEAR MARINE ENGINEERING COURSE
(8 Months Training ashore & 4 Months Training onboard)

COMPETENCY AND COURSE SUBJECTS		Hrs of training proposed			Assessment
		Class room	Lab	Worksh op / Afloat	
FUNCTION : Marine engineering at the operational and management level					
Competency No.1 : Maintain a safe engineering watch (Table A-III/ 1)					Written & Oral Examination
1.1	Thorough knowledge of Principles to be observed in keeping an engineering watch, including:	2			
1.1.1	duties associated with taking over and accepting a watch	1		1	
1.1.2	routine duties undertaken during a watch	1			
1.1.3	maintenance of the machinery space logs and the significance of the readings taken	1			
1.1.4	duties associated with handing over a watch	1			
1.2	Safety and emergency procedures; change-over of remote/automatic to local control of all systems		1	7	
1.3	Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems	4		4	
1.4	<i>Engine-room resource management</i>	1			
1.4.1	Knowledge of engine-room resource management principles, including:	1		1	
1.4.1.1	allocation, assignment, and prioritization of resources	1			
1.4.1.2	effective communication				
1.4.1.3	assertiveness and leadership	1			
1.4.1.4	obtaining and maintaining situational awareness	1			
1.4.1.5	consideration of team experience			1	
Competency No. 2 : Use English in written and oral form (Table A-III/ 1)					Written & Oral Examination
2.1	Adequate knowledge of the English language to enable the officer to use engineering publications and to perform engineering duties				

2.1.1	Oral Communication	6			
2.1.2	Written Communication and Grammar	4			
2.1.3	Comprehension and speech	4			
2.1.4	Technical report writing	6			
Competency No. 3 : Use internal communication systems (Table A-III/ 1)					Oral Examination & Demonstration
3.1	Operation of all internal communication systems on board	3		2	
Competency No. 4 : Operate main and auxiliary machinery and associated control systems (Table A-III/ 1)					Written & Oral Examination
4.1	Basic construction and operation principles of machinery systems, including:				
4.1.1	marine diesel engine	30	2	5	
4.1.2	marine steam turbine	10		3	
4.1.3	marine gas turbine	4			
4.1.4	marine boiler	10	2	5	
4.1.5	shafting installations, including propeller	8		1	
4.1.6	other auxiliaries, including various pumps, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, air-conditioning and ventilation systems	40	2	7	
4.1.7	steering gear	6	2	3	
4.1.8	automatic control systems	8	2	4	
4.1.9	fluid flow and characteristics of lubricating oil, fuel oil and cooling systems	5		8	
4.1.10	deck machinery	3		6	
4.2	Safety and emergency procedures for operation of propulsion plant machinery, including control systems	2		4	
4.3	Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems:				
4.3.1	main engine and associated auxiliaries	8	1	4	
4.3.2	steam boiler and associated auxiliaries and steam systems	8	1	3	
4.3.3	auxiliary prime movers and associated systems	5	1	2	
4.3.4	other auxiliaries, including refrigeration, airconditioning and ventilation systems	5	1	6	

	Competency as per Table A-III/ 2: Manage the operation of propulsion plant machinery. Plan and schedule operations. Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery.				
4.4	Design features, and operative mechanism of the following machinery and associated auxiliaries: marine diesel engine, marine steam turbine, marine gas turbine, marine boiler	10			Written & Oral Examination
4.5	Theoretical knowledge: Thermodynamics and heat transmission, Mechanics and hydromechanics Propulsive characteristics of diesel engines, steam and gas turbines, including speed, output and fuel consumption Heat cycle, thermal efficiency and heat balance of marine diesel engine, marine steam turbine, marine gas turbine, marine steam boiler. Refrigerators and refrigeration cycle, Physical and chemical properties of fuels and lubricants & Technology of materials	15			
4.6	Practical knowledge: Start up and shut down main propulsion and auxiliary machinery, including associated systems, Operating limits of propulsion plant & The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery	5		5	Written & Practical Examination
Competency No. 5 : Operate fuel, lubrication, ballast and other pumping systems and associated control systems (Table A-III/ 1)					Written & Oral Examination
5.1	Operational characteristics of pumps and piping systems, including control systems	15			
5.2	Operation of pumping systems:				
5.2.1	routine pumping operations	4		6	
5.2.2	operation of bilge, ballast and cargo pumping systems as per established rules and procedures	4		20	
5.3	Oily-water separators (or-similar equipment) requirements and operation	5		7	
	Competency as per Table A-III/ 2: Manage fuel, lubrication and ballast operations.				
5.4	Operation and maintenance of machinery, including pumps and piping systems.	5		5	Written & Oral Examination
FUNCTION : Electrical, electronic & Control Engineering at the operational and management level					

Competency No. 6 : Operate electrical, electronic and control systems (Table A-III/ 1)					Written & Oral Examination & Demonstration
6.1	Basic configuration and operation principles of the following electrical, electronic and control equipment:				
6.1.1	electrical equipment:				
6.1.1.a	generator and distribution systems	25	10	30	
6.1.1.b	preparing, starting, paralleling and changing over generators	5	5	35	
6.1.1.c	electrical motors including starting methodologies	10	5	15	
6.1.1.d	high-voltage installations	4	1		
6.1.1.e	sequential control circuits and associated system devices	3	2	15	
6.1.2	electronic equipment:				
6.1.2.a	characteristics of basic electronic circuit elements	12	5	3	
6.1.2.b	flowchart for automatic and control systems	5	3	2	
6.1.2.c	functions, characteristics and features of control systems for machinery items, including main propulsion plant operation control and steam boiler automatic controls	4	4	7	
6.1.3	control systems:				
6.1.3. a	various automatic control methodologies and characteristics	15		40	
6.1.3. b	Proportional–Integral–Derivative (PID) control characteristics and associated system devices for process control	5	5	8	
	Competency as per Table A-III/ 2: Manage operation of electrical and electronic control equipment. Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery.				
6.2	Theoretical knowledge: Marine electro technology, electronics, power electronics, automatic control engineering and safety devices. Design features and system configurations of automatic control equipment and safety devices for main engine, generator and distribution system, steam boiler.	5			Written & Oral Examination
6.2.1	Design features of high-voltage installations	1			
6.2.2	Features of hydraulic and pneumatic control equipment	1			
6.3	Practical knowledge: Functions and mechanism of automatic control for main engine & auxiliary machinery including generator distribution systems, steam boilers, oil purifier, refrigeration system, pumping and piping systems, steering gear system, cargo-handling equipment and deck machinery.	3		5	Written & Practical Examination
Competency No. 7 : Maintenance and repair of electrical and electronic equipment (Table A-III/ 1)					Written & Oral Examination

7.1	Safety requirements for working on shipboard electrical systems, including the safe isolation of electrical equipment required before personnel are permitted to work on such equipment	2		9	
7.2	Maintenance and repair of electrical system equipment, switchboards, electric motors, generator and DC electrical systems and equipment	10		40	
7.3	Detection of electric malfunction, location of faults and measures to prevent damage	4	1	15	
7.4	Construction and operation of electrical testing and measuring equipment	10			
7.5	Function and performance tests of the following equipment and their configuration:				
7.5.1	monitoring systems	2	1	2	
7.5.2	automatic control devices	2	2	6	
7.5.3	protective devices	2		6	
7.6	The interpretation of electrical and simple electronic diagrams	2	2	5	
	Competency as per Table A-III/ 2: Manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition.				
7.7	Practical knowledge: Troubleshooting of electrical and electronic control equipment & monitoring systems. Function test of electrical, electronic control equipment and safety devices.	2		2	Written & Practical Examination
7.8	Software version control.	1		1	
FUNCTION : Maintenance & repair at the operational and management level					
Competency No. 8 : Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board (Table A-III/ 1)					Written & Oral Examination & Demonstration
8.1	Characteristics and limitations of materials used in construction and repair of ships and equipment	15			
8.2	Characteristics and limitations of processes used for fabrication and repair	10			
8.3	Properties and parameters considered in the fabrication and repair of systems and components (Fabrication, welding, jointing & cutting)	2	2	20	
8.4	Methods for carrying out safe emergency/temporary repairs	1		10	
8.5	Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools and measuring instruments	2		7	
8.6	Use of hand tools, machine tools and measuring instruments	5		110	
8.7	Use of various types of sealants and packings	1	1	10	

Competency No. 9 : Maintenance and repair of shipboard machinery and equipment (Table A-III/ 1)					Written & Oral Examination
9.1	Safety measures to be taken for repair and maintenance, including the safe isolation of shipboard machinery and equipment required before personnel are permitted to work on such machinery or equipment	3	2	20	
9.2	Appropriate basic mechanical knowledge and skills	5		100	
9.3	Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment	5	4	200	
9.4	The use of appropriate specialized tools and measuring instruments	4	1	60	
9.5	Design characteristics and selection of materials in construction of equipment	4		30	
9.6	Interpretation of machinery drawings and handbooks	8	4	70	
9.7	The interpretation of piping, hydraulic and pneumatic diagrams	5	4	60	
	Competency as per Table A-III/ 2: Manage safe and effective maintenance and repair procedures. Detect and identify the cause of machinery malfunctions and correct faults. Ensure safe working practices.				
9.8	Theoretical knowledge: Marine engineering practice Practical knowledge: Manage safe and effective maintenance and repair procedures, Planning maintenance & repairs including statutory and class verifications.	3		35	Written & Practical Examination
9.9	Practical knowledge: Detection of machinery malfunction, location of faults and action to prevent damage Inspection and adjustment of equipment. Non-destructive examination.	3		35	Written & Practical Examination
9.10	Practical knowledge: Safe working practices	1		10	
FUNCTION : Controlling the operation of the ship and care for persons on board at the operational and management level					
Competency No. 10: Ensure compliance with pollution prevention requirements (Table A-III/ 1)					Written & Oral Examination
10.1	<i>Prevention of pollution of the marine environment</i>				
10.1.1	Knowledge of the precautions to be taken to prevent pollution of the marine environment	6			

10.1.2	Anti-pollution procedures and all associated equipment	2		6	
10.1.3	Importance of proactive measures to protect the marine environment (+ Marine Environmental awareness)	12			
Competency No. 11 : Maintain seaworthiness of the ship (Table A-III/ 1)					Written & Oral Examination
11.1	<i>Ship stability</i>				
11.1.1	Working knowledge and application of stability, trim and stress tables, diagrams and stress-calculating equipment	30	2		
11.1.2	Understanding of the fundamentals of watertight integrity	20			
11.1.3	Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy	10			
11.1.4		5			
	Resistance propulsion & Powering of Ships.				
11.2	<i>Ship construction</i>				
11.2.1	General knowledge of the principal structural members of a ship and the proper names for the various parts	40	3		
	Competency as per Table A-III/ 2: Control trim, stability and stress.				
11.3	Understanding of fundamental principles of ship construction and the theories and factors affecting trim and stability and measures necessary to preserve trim and stability	10			Written Examination
11.4	Knowledge of the effect on trim and stability of a ship in the event of damage to, and consequent flooding of, a compartment and countermeasures to be taken	5			
Competency No. 12 : Prevent, control and fight fires on board (Table A-III/ 1)					Written & Oral Examination
12.1	<i>Fire prevention and fire-fighting appliances</i>	3		2	
12.1.1	Ability to organize fire drills	3			
12.1.2	Knowledge of classes and chemistry of fire	3		2	
12.1.3	Knowledge of fire-fighting systems	2		4	
12.1.4	Action to be taken in the event of fire, including fires involving oil systems	4		2	
Competency No. 13 : Operate life-saving appliances (Table A-III/ 1)					Written & Oral Examination
13.1	<i>Life-saving</i>				

13.1.1	Ability to organize abandon ship drills and knowledge of the operation of survival craft and rescue boats, their launching appliances and arrangements, and their equipment, including radio life-saving appliances, satellite EPIRBs, SARTs, immersion suits and thermal protective aids	10		6	
Competency No. 14 : Apply medical first aid on board ship (Table A-III/ 1)					Written Examination
14.1	<i>Medical aid</i>				
14.1.1	Practical application of medical guides and advice by radio, including the ability to take effective action based on such knowledge in the case of accidents or illnesses that are likely to occur on board ship	10	6		
Competency No. 15: Monitor compliance with legislative requirements (Table A-III/ 1)					Written & Oral Examination
15.1	Basic working knowledge of the relevant IMO conventions concerning safety of life at sea, security and protection of the marine environment	15			
15.2	ISM Code and Quality management system	4		1	
15.3	Classification societies and their role in shipping	4		1	
15.4	Role of National Government in control of ships	4			
Competency No. 16 : Application of leadership and teamworking skills (Table A-III/ 1)					Written & Oral Examination
16.1	Working knowledge of shipboard personnel management and training	5			
16.2	A knowledge of related international maritime conventions and recommendations, and national legislation	5			
16.3	Ability to apply task and workload management, including:	5			
16.3.1	planning and coordination				
16.3.2	personnel assignment				
16.3.3	time and resource constraints				
16.3.4	prioritization				
16.4	Knowledge and ability to apply effective resource management:	5			
16.4.1	allocation, assignment, and prioritization of resources				

16.4.2	effective communication on board and ashore				
16.4.3	decisions reflect consideration of team experiences				
16.4.4	assertiveness and leadership, including motivation				
16.4.5	obtaining and maintaining situational awareness				
16.5	Knowledge and ability to apply decision-making techniques:	5			
16.5.1	situation and risk assessment				
16.5.2	identify and consider generated options				
16.5.3	selecting course of action				
16.5.4	evaluation of outcome effectiveness				
Competency No. 17 : Contribute to the safety of personnel and ship (Table A-III/ 1)					CONDUCTED AS MODULAR COURSE TRAINING AS PER SEPARATE DGS APPROVED TRAINING COURSE
17.1	Knowledge of personal survival techniques				
17.2	Knowledge of fire prevention and ability to fight and extinguish fires				
17.3	Knowledge of elementary first aid				
17.4	Knowledge of personal safety and social responsibilities				
Competency No. 18 : Maintain the conditions set forth in a ship security plan; Recognition of security risks and threats; Undertake regular security inspections of the ship; and proper usage of security equipment if any.					
18.1	Working knowledge of maritime security terms and definitions, maritime security levels; security reporting procedures; procedures and requirements for drills and exercises under relevant conventions, codes and IMO circulars; procedures for conducting inspections and surveys and monitoring of security activities specified in a ship security plan; security related contingency plans.	8		3	Written & Skill Test Examination
18.2	Knowledge of security documentation; Knowledge enabling recognition of potential security threats; Knowledge enabling recognition of weapons, dangerous substances and devices and awareness of the damage they can cause; crowd management and control techniques; handling security related information and security related communications; methods for physical searches and non-intrusive inspections.				

18.3	Knowledge of techniques for monitoring restricted areas: Knowledge of controlling access to the ship and to restricted areas onboard; methods for effective monitoring of deck areas and areas surrounding the ship; methods for controlling the embarkation, disembarkation and access while onboard of persons and their effects; General knowledge of various types of security equipment and systems, including their limitations; need for testing, calibrating and maintaining security systems and equipment.				
	Total Hours:	700	90	1170	
	Grand Total	1960			

Syllabus for One Year Marine Engineering Course

(8 Months Training ashore & 4 Months Training onboard)

1) On Board Operations:

Introduction to watch keeping, Number of watches per day, day watch/sea watch, number of watch keepers, stand by duties, Familiarity with the engine room and plant. Knowing emergency exits, location of fire fighting equipment in engine room,

Stand actual watch on the running diesel generator in the live bay of the workshop/ Ship-in-campus and/or in Engine Room during Afloat period - Noting and logging temperatures, pressures, tank levels and other parameters in the engine log book.

Check list for taking over watch at sea, port/anchorage, UMS check list etc. Standing orders, night orders.

A brief introduction to Contingency Manual and a few likely scenarios where an emergency or contingency may arise.

Getting main engine, steam plant ready for departure, checks on plant while engine maneuvering, arriving port, stopping main engine. Readings to take during maneuvering, preparing noon chits. Arrival/Departure check lists. To gain understanding that operation are planned and carried out in accordance with established rules and procedures to ensure safety of operations and to avoid pollution of the marine environment. Learning to identify deviations from norms, causes of machinery malfunction and taking to ensure overall safety of ship and plant.

2) Preparing Main Engine and associated auxiliaries for Arrival /departure. Starting up / Shutting off a steam Boiler and associated steam systems: Starting Auxiliary prime movers and associated systems, Starting and putting in operation refrigeration, air conditioning & ventilating systems.

Practical knowledge - Start up and shut down main propulsion and auxiliary machinery, including associated systems. Operating limits of propulsion plant.

The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery.

3) Engine Room Resource Management:

ERM principles based on Bridge Resource Management

Necessity of ERM - ERM in terms of maintaining the safe engineering watch

Resources considered in ERM - Resource management eg, personnel management, information management and management of installations/ equipment

Necessity to practice ERM - Allocation, assignment and prioritization of the resources, effective communication, assertiveness and leadership, obtaining and maintaining situational awareness, consideration of team experience.

4) Internal Communication:

Knowledge of various communication systems available on board, such as: Verbal, telephonic (power/sound power), signals, telegraph, hand signals;

5) Use of English Language:

To exhibit communication skill in English & proficiency in Marine Vocabulary

Writing letters with correct grammar & spellings, in English.

To demonstrate ability to comprehend clearly & use engineering publications and perform engineering functions to speak ensuring that the intended message is understood in English.

Address & type letters both of technical and non technical nature with correct grammar & spellings, in English.

6) Thermodynamics and Heat Engines:

Theoretical knowledge -Thermodynamics and heat transmission, Mechanics and hydromechanics.

Propulsive characteristics of diesel engines, steam and gas turbines, including speed, output and fuel consumption

Heat cycle, thermal efficiency and heat balance of marine diesel engine, marine steam turbine, marine gas turbine and marine steam boiler.

Propulsive characteristics of diesel engines, steam and gas turbines, including speed, output and fuel consumption.

7) Marine Diesel Engines:

Basic Principles, cycles, timings, engine types, configuration and features. Structure, components, gas exchange process - scavenging, supercharging, turbochargers, combustion process, fuel injection, camshaft. Power measurement, Indicator cards, fault finding. Control, safety, operation, difficulties, trouble shooting, governor, modern developments. Maintenance, Decarburization, bearing clearances, etc.

8) Auxiliary Machinery: Acquire knowledge of construction & operation of all auxiliary machinery including associated equipment. Study & understand the general layout of machinery in the engine room.

9) Air Compressors:

Air compressor and system principles - Operation, Principles, Types, Material of construction, Compression process, Inter and after coolers.

10) Purifier:

Purifier and fuel oil treatment – Operation, Principles, Types, Material of construction. Familiarize with filtration & purification methods in fuels & lubricants, their necessity, operation & care.

11) Boiler:

Marine Boiler - Steam boiler fuel atomization and combustion, Marine boiler fundamentals, Marine Boiler construction, Boiler mountings and steam distribution, Marine boiler operation.

Steam Cycle, Properties of steam, Feed water, Basic components, types of boilers - smoke & water tube, Feed water and circulation, tubes, stays, headers, super heaters, furnace, casing, supports, internal fittings, external fittings, mountings. Burners. Instrumentation, Automation, Controls. Safeties. Preparation, Flashing up, Steaming up, Pre and Post purging. Cooling down, blowing down, and blowing through gauge glass. Boiler water testing and treatment. Emergency Operation.

12) Marine Steam Turbines:

Marine Steam Turbine – Rankin cycle, Operation principle, Basic construction and materials of Steam Turbine, Impulse Turbine, Reaction turbine, Bleeder turbine (extraction turbine), Regenerative turbine, Reheat turbine.

Principle, Major components, number of nozzles, multi-stage turbines, types and stages, vacuum exhaust, compound turbines, high pressure with reaction stages, double flow low-pressure turbines, single cased propulsion turbines, turbines for fans and pumps.

Turbine Details: Casing, Bearing Housing, Bed Plate, Rotor, Blades, Diaphragm, Nozzles, packing gland, Journal, Thrust Bearings, preparation, Raising Vacuum, Maneuvering, Routine and Emergency operation.

13) Marine Gas Turbines:

Marine Gas Turbine – Operation principle & Basic construction.

Characteristics of gas turbine plants, gas turbines Vs other prime movers, principles, major components, temperature limits, waste heat recovery, maintenance, compressor, turbine types.

14) Pumps & Piping:

Principles, Types of pumps, Characteristics, Fundamentals, Centrifugal, Reciprocating, Rotary and Jet Pumps, Liquid-ring vacuum pumps, blowers, fans, compressors, pump operation, starting procedure for - centrifugal as well as positive displacement pumps.

Fluid flow and characteristics of major systems – Description of all fluid flow systems on board, Operation and material construction of devices/ equipment in the system. Operation and maintenance of machinery, including pumps and piping systems. Construction and characteristics of pumps and pumping systems.

Physical & chemical properties of fuels and lubricants.

Familiarize with the various pipe line layout of bilge, ballast, fuel, lubricating oil & cooling water systems.

Introduction, Piping and Tubing, Valves, different types of valves, maintenance of valves, vents, sounding pipes, fuel -oil transfer and service systems, steam, condensate and feed systems, waste heat recovery systems, sea water circulating and cooling systems, fresh water cooling systems, main lubricating systems, Bilge and ballast systems, Compressed air and Control systems, Fire main systems, Sanitary and drinking water hydrophone systems, Cargo Handling Systems.

15) Deck Machinery:

Deck Machinery - Operation, Principles, Types, Material of construction, Windlass/ mooring winch, Winch, Boat winch.

16) Shafting Installations & Propeller:

Equipment constructing shafting, Types of propeller and features, Material of construction and definitions, Cavitation. Shafting Arrangements, Shaft bearings, Stern Tube, Stern Tube Seal, Propeller Shaft, Propeller - Fixed and Controllable, Tightening/ Withdrawal of propeller, tail shaft, inspection, etc. Study shafting & propellers.

17) Fresh Water Generator:

Evaporators and distillers – Operation, Principles, Types, Material of construction. Flash evaporators, Multiple effect evaporation. Familiarize with purification methods in respect of fresh water, their necessity, operation & care.

18) Heat exchangers:

Operation, Principles, Types, Material of construction.

19) Refrigeration:

Marine refrigeration cycle, Principles of refrigeration, Refrigerating compressors and system components, Refrigerating system brines, Cold storage spaces and insulation, Air conditioning and ventilation system.

20) Main Engine & Auxiliary Machinery - Maintenance and Repair:

Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems.

Main Engine and Associated Auxiliaries, Boiler and Associated Auxiliaries, and Steam Systems,

Auxiliary Prime Movers and Associated Systems (Diesel engine, Steam Turbine),

Other Auxiliaries – Purifiers and Fuel oil treatment, Air compressors, Evaporators and distillers, Refrigerator.

Practical knowledge - Organizing & managing safe and effective maintenance and repair procedures. Planning maintenance & repairs

21) Maintenance and repair such as dismantling, adjustment and reassembling of machinery and equipment:

Fastening, Centrifugal Pumps, Reciprocating Pumps, Screw and Gear Pumps, Valves, Air Compressors, Heat Exchangers, Diesel Engine, Turbocharger, Boiler, Maintenance Propulsion Shafting Procedures, Refrigeration Maintenance, Oils Fuels and Lubricating System Maintenance, Deck Machinery Maintenance.

22) Marine Engineering Practice:

Methods for carrying out safe emergency/ temporary repairs.

Practical knowledge

Detection of machinery malfunction, location of faults and action to prevent damage.

Detection of faults of machinery by visual inspection, NDT methods (Non-destructive examination) and by other advanced systems such as vibration monitoring (condition monitoring). Inspection and adjustment of equipment

Modern approach to machinery reliability methods and their execution.

Principles and practice of reliability and trends in breakdown. Typical failures and fault diagnosis.

Reliability of machinery, its principle and practice.

23) Electrical & Electronic

a) Basic electrical engineering:

(i) Electrical Theory – Ohm's Law, Kirchhoff's Law, Electrical circuits, Impedance and inductance.

Review of basic electrical knowledge, Introduction-Ship's electrical system-Circuit calculations-Electrical safety-Electric shock-Insulation resistance-circuit testing-insulation testing-continuity Testing-Introduction-Ship's electrical system-Circuit calculations-Electrical safety-Electric shock-Insulation resistance-circuit testing-insulation testing-continuity Testing.

(ii) Fundamentals of Alternating Current – Alternating current, Electro-magnetic induction, Work energy and power.

(iii) Generators – A.C. & D.C. generators.

Introduction to marine power generation equipment, AC / DC machines, AVR, characteristics of electrical machines used on board, induction, synchronous motors, transformers, circuit breakers. Navigational, signalling equipment, cables.

(iv) Power Distribution Systems– Distribution, Insulation, Transformer, Types.Distribution & switchboard arrangement; switchgears and starters. Operation, maintenance & repair of above equipment; Insulated and earthed neutral systems-significance of earth faults-distribution circuit breakers-Shore supply connection-Circuit protection.

Method of voltage control, paralleling procedure and load sharing between generators. Manual Synchronizing-Auto Synchronizing-Prime Mover Characteristic-parallel operation-Excitation Control-Load sharing-Speed droop and power generation.

(v) Electrical Motors – A.C. & D.C. Motor.

Introduction-Motor construction-Enclosures and ratings, Electrical Motor Starting Methodologies - Induction Motor operation-Control Equipment-Direct On-line Starting-Reduced voltage starting-Speed control-Motor operation-Single phase motors-Maintenance. Design features and system configurations of operational control equipment for electrical motors

b) Basic electronics:

Electron Theory

c) Basic Electronic Circuit Elements:

Semi conductor, Thyristor, Integrated Circuit (IC) and Large scale Integrated Circuit (LSI).

Working and Characteristics of Diode, Triode, Thyristor-TRAIC-, Amplifier,Transistor, Rectifier-Half wave & Full Wave.

d) Electronic Control Equipment:

Control mechanism of PLC (Programmable Logic Controller), Integrated Automation Control and Monitoring System (IACMS), Computer programmable Controller, Relay Circuit unit, Digital Sequential Control devices.

Study of fuses-Relays-Overload relay-reverse power Relay-Air Circuit Breakers-MCCB-MCB-ELCB-Under Voltage Protection-Preference tripping-Over Current protection-Motor Protection-Single Phasing.

Voltage stabilization-Filter choke-Impedance-Rectification-Grid Bias Voltage-and their significance-Characteristic curves of PN Junction Diode-Forward and Reverse bias modes.

24) Electrical, Electronic Maintenance & Repair:

Principles of Maintenance, Generator, Switchboard, Electrical Motors, Starters.

Do's and don't while working on Electrical panel/Circuits-Safety precautions before entering into battery room-Safe working practices while working on any Electrical Circuits/machineries/panels.

D.C Electrical Systems and Equipment – Battery system, Remote automatic control equipment.

DC power supply control-Corrective and preventive actions in case of fire in the Main switchboard-Star-delta circuit for Main Seawater pump-Auto transformer starter-ACB.

Distribution System – Transformer, Distribution, Cables.

Open Circuit Fault-Short Circuit Fault-Earth Fault-Significance of Earth Fault-Fault finding in generator-Trouble shooting of AC motors.

Use of Engine Simulator for Electrical Fault Finding.

Construction and operation of electrical testing and measuring equipment – Construction, Operation & Principles of insulation tester, Continuity tester, Multi tester, Multimeter, Megger, Clampmeter, Wattmeter, Frequency meter, Synchronoscope, Continuity test, Insulation test.

25) High voltage Practice- Power supply network-Review of motor Operation-Controlled Rectification and Inversion-Converter types.

High-Voltage Installations- High voltage Protection-High Voltage safety-High voltage equipment testing. Lighting, Cables, Batteries.

26) Detection of electric malfunction and measures to prevent damage:

Essential requirements for Fault Protection, Fault Location.

Practical knowledge -Troubleshooting of electrical and electronic control equipment
Troubleshooting of monitoring systems

27) Function, performance test and configuration:

Monitoring Systems, Automatic Control Devices (Process control & system control), Protective Devices.

Design features and system configurations of automatic control equipment and safety devices for main engine, generator and distribution system and steam boiler.

Function test of electrical, electronic control equipment and safety devices.

28) Electrical and simple electronic diagrams:

Electric and Electronic symbols and Interpretations of Flow diagrams and Circuits.

29) Flowchart for Automatic and Control System – Depiction and understanding of flowcharts, Symbols utilization and processes involved.

Routine testing Flow chart, Manual and automatic starting flow chart, Automatic changeover of supply on main's failure.

30) Automation & Control Systems

a) Basic control engineering:

Fundamentals of Automatic Control, Various Automatic Control, ON-OFF Control, Sequential Control, Proportional-Integral-Derivative (PID) Control.

Process Control Theory-Open loop, close loop-Sensing elements and transducers-Monitors-Automatic control system- pneumatic controllers-electronic controllers-PLC-final control systems.

On/OFF and Continuous control system-Interdependence of PID control action-characteristics -Temperature vs time, temperature vs valve relationship-proportional band and gain-Direct acting signal-Reverse acting signal-On/off -P,P+I,P+D,P+I+D Characteristic.

b) Measurement of Process Value – Temperature (Mechanical, Electrical), Pressure, Level (Direct methods and Inferential methods), Flow, General measurement and process.

Process Control systems on ships, Boiler water level control, L.O. Temp control, Jacket cooling water, Feed water circulation, Auto combustion control of a boiler, etc

c) Transmission of Signals – Transmitters, Controlling elements (Pneumatic, Electrical, Receivers).

Steam Pressure Control of the Exhaust Gas Boiler control System - Dearator level control-Feed Water Circulation-Piston Cooling Water Temperature - Centralized cooling System-

d) Manipulator Elements– Principles, Operation, Application, Pneumatic, Electrical Servomotor, Hydraulic Servomotor.

e) Functions and mechanism of automatic control for main engine and auxiliary machinery including generator distribution systems, steam boilers, refrigeration system and pumping and piping systems.

31) Safe Working Practice:

Practical knowledge

Describe & demonstrate safe working practices in carrying out all relevant ship board tasks. Procedures for handling heavy machinery parts & overhaul of engines. Precautions to be taken while entering enclosed spaces. Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools and measuring instruments.

Safety measures to be taken for repair and maintenance including the safe isolation of shipboard machinery and equipment required before personnel are permitted to work on such machinery or equipment.

32) Ship Construction:

Ship construction Terminology, Hull construction, structure, description and construction of structural members, Fore and Aft peak, Double bottom, Load Line and draught marks ship dimensions and form, Bow and stern, Fittings, Rudders and propellers.

Understanding of fundamental principles of ship construction and the theories and factors affecting trim and stability and measures necessary to preserve trim and stability

33) Naval Architecture:

Definition of principal terms used in Naval Architecture. Draft, buoyancy, Geometry of ships, Hydrostatic calculations, Stability of ships, Trim, Stress Calculations .

Ship stability - Displacement, Buoyancy, Fresh water allowance, Statical stability, Initial stability, Angle of loll, Curves of statical stability, Movement of centre of gravity, List and Its Correction, Effect of slack tanks, Trim, Stress tables, Actions to be taken in the event of partial loss of Loss of intact buoyancy. Knowledge of the effect on trim and stability of a ship in the event of damage to, and consequent flooding of, a compartment and countermeasures to be taken

Buoyancy, Reserve buoyancy, Metacentre, Inclining experiment, water tight integrity. Stresses on ship, Resistance, Admiralty & Fuel Co-efficients.

34) Fire:

Introduction to Fire, what 'FIRE' stands for, the Fire Triangle etc. Portable FFA.

Practical demonstration of organising fire drills.

Precautions against fire or explosion. Explosive mixtures. Danger of oil leakage's. Sources of ignition. Safety devices.

Types and classes of fire. The Fire Triangle, methods of fire fighting such as starvation, smothering etc.

Various fixed fighting systems. Their operation and maintenance.

Ship board fire fighting - Organisation, Muster list, duties, Mock drills and practice. Fighting oil fires.

Basic seamanship; knowledge of life saving appliances & equipment on board ship.

Knowledge of alarms & signals on board ship.

35) Safety Equipments:

Alarm monitoring systems, Heat detectors, Fire detectors, Oil mist Detector, Dead Man Alarm, Monitoring of CO₂-Oxygen analyzer-Explosimeter-vibration monitoring.

36) Safety & Emergency Procedures:

Safety and emergency procedures for operation of propulsion plant machinery including control systems:

Main Engine Auto-slow Down and Shut Down,

Main Boiler Auto shut Down, Power Failure,

Emergency Procedures for Other Equipment/ Installations – Emergency steering,

Back out operations and restoration. Propulsion plant operation.

37) Workshop Management & Skills:

a) Design Characteristics and limitations/ selection of materials used in construction and repair of ships and equipment

Basic Metallurgy, Metals and Processes, Technology of materials.

Properties and Uses, Non-Metallic Materials.

Review properties of materials, their limitations, heat treatment of carbon steels. Testing of components used in manufacture. Need for lifting gear, various types, their operation & care, inspections & surveys. Lifting gear-chains, tackles, chain blocks, overhead engine room crane-their testing & surveys.

b) Properties and parameters considered in the fabrication and repair of systems and components:

Materials under Load, Vibration, Self-Secured Joints, Permanent Joints, Bonding Plastics, Adhesives and Bonding, Pipework.

(i) Basic work shop practice: Fabrication, fitting, welding - (gas, arc), cutting, brazing. Operation of lathe, drilling machine. Introduction to methods of emergency repairs such as use of jubilee clips, use of plugs, adhesives, putty, doubler plates, 'C' clamps etc.

Safety practices to be adopted, use of PPE, reading and understanding standing orders, good house keeping, proper handling of equipment

The use of appropriate specialized tools and measuring instruments - Review and learn use of various tools and instruments. Their use, such as the vernier calipers, inside/outside micrometer, inside/outside calipers, depth gauge etc.

(ii) Workshop Management – Discipline, safety management, preventive maintenance, cleanliness, familiarization with safety equipment and aspects relating to shipboard practices.

Advanced skills in fitting and fabrication. Use of jigs. Joint cutting, use of chisel. Overhauling various types of valves, valve grinding, pipe line repair,

Overhaul of fuel injectors, air start valves, tappet clearance adjustment, assembling, dismantling pumps. Assist senior engineers during afloat training in decarburization, inspection, surveys, and other machinery overhauls.

(iii) Basic introduction to Preventive Maintenance program. Familiarization with AMOS/Ship manager or any other integrated PMS program. Basic understanding of the spares/stores requisition process, inventory control. Software version control.

(iv) Learn about specialized tools such as trammel gauge, peak pressure gauge, indicator instrument, crank web deflection gauge, bridge gauge, piston crown template etc.

(v) Use of various types of sealants and packings - rubber, oil, steam, general purpose, 'O' rings, copper gaskets, washers. When, where and how to use .

(vi) Study of pipes, pipe fitting, bending & fabrication. Introduction to gas welding, basic principles of welding, various electrodes and consumables, gas cutting, maintenance and safety.

(vii) Interpretation of machinery drawings and handbooks marine engineering drawing and design.

Types of Drawing, Linework, Pictorial Projection, Development, Dimensioning, Geometrical Tolerancing, Limits and Fits, Engineering Drawing Practice.

Familiarise with notations used and interpret drawings of ships structure, equipment, electrical and mechanical systems.

The interpretation of piping, hydraulic and pneumatic diagrams - Carry out assignments in drawing machinery parts and pipe system layouts from actual machinery in workshop and blue prints supplied to ships.

Ability to make simple sketches relating to machinery components with supplementary notes and specifications.

38) Marine Pollution Awareness:

Importance of proactive measures.

Anti-pollution procedures and associated equipment fitted on board.

Oily water separator/ similar equipment Construction and operation – Prevention of pollution, Requirements, Principles, Their operation, maintenance, record keeping.

The precautions to be taken to prevent pollution of the marine environment – Prevention of pollution, MARPOL 73/78 technical annexes.

Regulation 26 - Annex 1 MARPOL 73/78, Anti-Pollution Equipment, Control of oil from machinery space, Oil record book (Part I – Machinery space operation), Precautions which should be taken to prevent accidental pollution by oil. Sewage.

IOPP Certificate and Surveys – Annex I – Oil, Annex II – Noxious liquid substances in bulk, Annex III – Harmful substances carried by sea in Packaged forms, Annex IV – Sewage, Annex V – Garbage, Annex VI – Air pollution.

Convention of prevention of Marine pollution by dumping of waste and other matter (London Dumping Convention (LDC)).

International Convention relating to Intervention on the High Seas in case of Oil Pollution Casualties, 1969.

International Convention on civil liability for Oil Pollution damage 1969.

Bunkering procedure, bunker plan, bunker check list, etc. SOPEP equipment. Fighting, containing oil spill.

The various emissions arising from ships, their effect on environment - sea and air. Green house emission, other emissions from ships such as SO_x and NO_x, Introduction to invasive species including ballast water, other impacts such as noise, anti-fouling paint, recycling of ships. Pollution prevention measures, Personal involvement such as behaviour, responsibility.

39) National Regulations:

Role of Govt in control of ships, DG Shipping, MMD, Flag State, Port State Control, Inspections of ships, Examinations.

Special needs of the shipping industry, various demands of the career - technical, practical, physical, emotional, psychological, desirable personal traits.

40) International Regulations:

Introduction to MARPOL, Annexes I to VI, why introduced, how the environment is affected.

Regulations governing discharge criteria, procedures for discharge, documentation, record keeping, inspection and penalty for violation.

Working knowledge of SOLAS, MARPOL, STCW etc.

Introduction to ISM, SMS documentation, manuals, ISO 9001, ISO 14001, DPA, forms, check lists

Introduction to ISPS, Security levels, Security Officer, documentation, security patrolling.

Various Classification Societies, IRS, LRS, ABS etc; CSM, ESP, Surveys, Certificates. Oil majors and Vetting Inspection.

Basic working knowledge of the relevant IMO conventions concerning safety of life at sea and protection of the marine environment

Introduction to Maritime Law, Law of sea-on high seas, Safety

International Convention on Load Lines, 1966

SOLAS, 1974 as amended

SOLAS—Sub division and stability

SOLAS—Fire protection, detection and extinction

SOLAS—LSA and arrangements (LSA Code)

SOLAS—Radio telegraphy and R/T

SOLAS—Radio communications (amended Chap. 1V)

SOLAS—Carriage of grain

SOLAS—Carriage of dangerous goods

STCW, 1995

ITU Radio regulations

STP ships Agreement, 1971

SPACE STP, 1973

PAL, 1974 and Tonnage 1969

41) Leadership & Team working/ Managerial Skills:

Introduction to human factors, communication, Inter-personal relationships.

Understanding Team work, importance of team spirit, nurturing a conducive work ethos leadership qualities, development of a positive attitude, organizational behaviour, functional responsibilities, role clarity, expectations,

Introduction to situation and risk assessment. Risk analysis, critical equipment, and critical maintenance.

Identifying activities that may be hazards to occupational health and safety and damage to property, carrying out risk assessment, documenting same in the SMS manuals.

Effective Resource Management and Decision Making. Use of probability, consequence/ severity matrix to evaluating impact on safety, loss/ damage to property, establishing acceptance criteria. Establishing control procedure to mitigate risk posed by hazard.

Task and Workload Management. Evaluation of outcome. Regular review of outcome, procedures, task identification to assess effectiveness of program.

42) Marine Industry:

Knowledge of Marine insurance, claims, legal matters in ship operation, etc.; conference systems; freight rates & fares fixation machinery and government control; Carriage of Goods by Sea Act.

30 Months ATS MARINE ENGINEERING COURSE

PHASE I - 12 months training at Institution

COMPETENCY AND COURSE SUBJECTS		Hrs of training			At Sea	Assessment
		Theory	Practical			
		Classroom	Lab	Workshop/ Afloat		
FUNCTION : Marine Engineering at the operational and management level						
Competency No.1 : Maintain a safe Engineering watch (Table A-III/ 1)						
1.1	Thorough knowledge of Principles to be observed in keeping an Engineering watch, including:	7				
1.1.1	duties associated with taking over and accepting a watch					
1.1.2	routine duties undertaken during a watch					W
1.1.3	maintenance of the machinery space logs and the significance of the readings taken					
1.1.4	duties associated with handing over a watch					
1.2	Safety and emergency procedures; change-over of remote/automatic to local control of all systems	8				
1.3	Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems	8				W
1.4	Engine-room resource management	7				
1.4.1	Knowledge of engine-room resource management principles, including:					
1.4.1.1	allocation, assignment, and prioritization of resources					
1.4.1.2	effective communication					W
1.4.1.3	assertiveness and leadership					
1.4.1.4	obtaining and maintaining situational awareness					
1.4.1.5	consideration of team experience					
	Sub Total	30				

Competency No. 2 : Use English in written and oral form (Table A-III/ 1)						
2.1	Adequate knowledge of the English language to enable the officer to use Engineering publications and to perform Engineering duties	30				
2.1.1	Oral Communication					W
2.1.2	Written Communication and Grammar					W
2.1.3	Comprehension and speech					W
2.1.4	Technical report writing					W
	Sub Total	30				
Competency No. 3 : Use internal communication systems (Table A-III/ 1)						
3.1	Operation of all internal communication systems on board	5				W
	Sub Total	5				
Competency No. 4 : Operate main and auxiliary machinery and associated control systems (Table A-III/ 1)						
4.1	Mathematics	55				W
4.2	Thermodynamics	30				W
4.3	Basic construction and operation principles of machinery systems, including:					
4.3.1	Marine Diesel Engine (Main & Aux)	100				W & P
4.3.2	Marine Steam Turbine	50				
4.3.3	Marine Gas Turbine	15				
4.3.4	Marine Boiler	40				W
4.3.5	Shafting Installations, including propeller	20				W
4.3.6	other auxiliaries, including various pumps and their operational characteristics including control systems, piping's, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, air-conditioning and ventilation systems	115				W
4.3.7	steering gear	20				W
4.3.8	automatic control systems	20				
4.3.9	fluid flow and characteristics of lubricating oil, fuel oil and cooling systems	15				
4.3.10	deck machinery	10				W
4.4	Safety and emergency procedures for operation of propulsion plant machinery, including control systems	30				
4.5	Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems:					
4.5.1	main engine and associated auxiliaries	8		8		

4.5.2	steam boiler and associated auxiliaries and steam systems	8		8		W
4.5.3	auxiliary prime movers and associated systems	8				
4.5.4	other auxiliaries, including refrigeration, airconditioning and ventilation systems	30				
	Sub Total	574		16		
Competency No. 5 : Operate fuel, lubrication, ballast and other pumping systems and associated control systems (Table A-III/ 1)				12		
5.1	Operational characteristics of pumps and piping systems, including control systems	10				
5.2	Operation of pumping systems:					W & P
5.2.1	Routine pumping operations	2				
5.2.2	Operation of bilge, ballast and cargo pumping systems	10				W
5.3	Oily-water separators (or-similar equipment) requirements and operation	8				
	Sub Total	30		12		
FUNCTION : Electrical, electronic & Control Engineering at the operational and management level						
Competency No. 6 : Operate electrical, electronic and control systems (Table A-III/ 1)						
6.1	Basic configuration and operation principles of the following electrical, electronic and control equipment:					
6.1.1	electrical equipment:	65				W
6.1.1.a	generator and distribution systems					W & P
6.1.1.b	preparing, starting, paralleling and changing over generators	45				
6.1.1.c	electrical motors including starting methodologies	30				
6.1.1.d	high-voltage installations	5				
6.1.1.e	sequential control circuits and associated system devices	20				
6.1.2	electronic equipment:					W
6.1.2.a	characteristics of basic electronic circuit elements	20				W
6.1.2.b	flowchart for automatic and control systems	10				

6.1.2.c	functions, characteristics and features of control systems for machinery items, including main propulsion plant operation					
	control and steam boiler automatic controls	15				
6.1.3	control systems:					
6.1.3.a	various automatic control methodologies and characteristics	60				
6.1.3.b	Proportional–Integral–Derivative (PID) control characteristics and associated system devices for process control	10				
6.2	Computer Applications (PMS, E learning, LAN network etc)	9				P
	Sub Total	289				
Competency No. 7: Maintenance and repair of electrical and electronic equipment (Table A-III/1)						
7.1	Safety requirements for working on shipboard electrical systems, including the safe isolation of electrical equipment required before personnel are permitted to work on such equipment	20	20			
7.2	Maintenance and repair of electrical system equipment, switchboards, electric motors, generator and DC electrical systems and equipment		20			W
7.3	Detection of electric malfunction, location of faults and measures to prevent damage		6			
7.4	Construction and operation of electrical testing and measuring equipment		14			
7.5	Function and performance tests of the following equipment and their configuration:	10	30			
7.5.1	monitoring systems					
7.5.2	automatic control devices					
7.5.3	protective devices					

7.6	The interpretation of electrical and simple electronic diagrams					
	Sub Total	30	90			
FUNCTION : Maintenance & repair at the operational and management level						
Competency No. 8 : Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board (Table A-III/ 1)						
8.1	Characteristics and limitations of materials used in construction and repair of ships and equipment	15				W
8.2	Characteristics and limitations of processes used for fabrication and repair	10				P
8.3	Properties and parameters considered in the fabrication and repair of systems and components	20				W
8.4	Methods for carrying out safe emergency/temporary repairs	5		10		W
8.5	Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools and measuring instruments	5		5		W
8.6	Use of hand tools, machine tools and measuring instruments	4				W & P
8.7	Use of various types of sealants and packings	5				W & P
8.8	Hand & Power Tools & Fabrication			40		
8.9	Machine Tools & Process	6		40		
8.10	Arc Welding, Gas Cutting, Brazing	8		80		
	Sub Total	78		175		
Competency No. 9 : Maintenance and repair of shipboard machinery and equipment (Table A-III/ 1)						
9.1	Safety measures to be taken for repair and maintenance, including the safe isolation of shipboard machinery and equipment required before personnel are permitted to work on such machinery or equipment	5				W & P
9.2	Appropriate basic mechanical knowledge and skills	5				W
9.3	Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment	5		150		W & P
9.4	The use of appropriate specialized tools and measuring instruments	5				
9.5	Design characteristics and selection of materials in construction of equipment	10	5			

9.6	Interpretation of machinery drawings and handbooks	10	15			W
9.7	The interpretation of piping, hydraulic and pneumatic diagrams	5				W
9.8	Engineering Drawing	5	100			
9.9	Material science & Industrial Chemistry	15	20			
9.10	Basic Engineering & Applied Mechanics	30	10			
	Sub Total	95	150	150		
FUNCTION : Controlling the operation of the ship and care for persons on board at the operational and management level						
Competency No. 10: Ensure compliance with pollution prevention requirements (Table A-III/ 1)						
10.1	<i>Prevention of pollution of the marine environment</i>					
10.1.1	Knowledge of the precautions to be taken to prevent pollution of the marine environment	12				W
10.1.2	Anti-pollution procedures and all associated equipment					W
10.1.3	Importance of proactive measures to protect the marine environment (+ Marine Environmental awareness)					W & O
	Sub Total	12	0			
Competency No. 11 : Maintain seaworthiness of the ship (Table A-III/ 1)						
11.1	<i>Ship stability</i>					
11.1.1	Working knowledge and application of stability, trim and stress tables, diagrams and stress-calculating equipment	70				
11.1.2	Understanding of the fundamentals of watertight integrity					
11.1.3	Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy					
11.1.4	Resistance propulsion & Powering of Ships.					
11.2	<i>Ship construction</i>					
11.2.1	General knowledge of the principal structural members of a ship and the proper names for the various parts	35				
	Sub Total	105				
Competency No. 12 : Prevent, control and fight fires on board (Table A-III/ 1)						
12.1	<i>Fire prevention and fire-fighting appliances</i>					
12.1.1	IMO approved Model Course	12		4		
12.1.2	Knowledge of classes and chemistry of					W

	fire					
12.1.3	Knowledge of fire-fighting systems					W
12.1.4	Action to be taken in the event of fire, including fires involving oil systems					W
	Sub Total	12		4		
Competency No. 13 : Operate life-saving appliances (Table A-III/ 1)						
13.1	<i>Life-saving</i>					
13.1.1	IMO approved Model Course					
13.1.2	Knowledge of alarms & signals on board	8		4		W
13.1.3	Knowledge of life saving appliances & equipments					W
	Sub Total	8		4		
Competency No. 14 : Apply medical first aid on board ship (Table A-III/ 1)						
14.1	<i>Medical aid</i>					
14.1.1	IMO approved Model Course					
14.1.2	Seafarers Health Information Programme	6		4		W
	Sub Total	6		4		
Competency No. 15: Monitor compliance with legislative requirements (Table A-III/ 1)						
15.1	Basic working knowledge of the relevant IMO conventions concerning safety of life at sea, security and protection of the marine environment					
15.2	ISM Code and Quality management system	24				
15.3	Classification societies and their role in shipping					
15.4	Role of National Government in control of ships					
15.5	Recruitment & Placement of Indian Seafarers					
	Sub Total	24		0		
Competency No. 16 : Application of leadership and teamworking skills (Table A-III/ 1)						
16.1	Working knowledge of shipboard personnel management and training	24				
16.2	A knowledge of related international maritime conventions and recommendations, and national					

	legislation					
16.3	Ability to apply task and workload management, including:					
16.3.1	planning and coordination					
16.3.2	personnel assignment					
16.3.3	time and resource constraints					
16.3.4	prioritization					
16.4	Knowledge and ability to apply effective resource management:					
16.4.1	allocation, assignment, and prioritization of resources					
16.4.2	effective communication on board and ashore					
16.4.3	decisions reflect consideration of team experiences					
16.4.4	assertiveness and leadership, including motivation					
16.4.5	obtaining and maintaining situational					
	awareness					
16.5	Knowledge and ability to apply decision-making techniques:					
16.5.1	situation and risk assessment					
16.5.2	identify and consider generated options					
16.5.3	selecting course of action					
16.5.4	evaluation of outcome effectiveness					
	Sub Total	24				
Competency No. 17 : Contribute to the safety of personnel and ship (Table A-III/ 1)						
17.1	Knowledge of personal survival techniques					
17.2	Knowledge of fire prevention and ability to fight and extinguish fires					
17.3	Knowledge of elementary first aid					
17.4	Knowledge of personal safety and social responsibilities					
Competency No. 18 : Maintain the conditions set forth in a ship security plan; Recognition of security risks and threats; Undertake regular security inspections of the ship; and proper usage of security equipment if any						

18.1	Working knowledge of maritime security terms and definitions, maritime security levels; security reporting procedures; procedures and requirements for drills and exercises under relevant conventions, codes and IMO circulars; procedures for conducting inspections and surveys and monitoring of security activities specified in a ship security plan; security related contingency plans.	8				
18.2	Knowledge of security documentation; Knowledge enabling recognition of potential security threats; Knowledge enabling recognition of weapons, dangerous substances and devices and awareness of the damage they can cause; crowd management and control techniques; handling security related information and security related communications; methods for physical searches and non-intrusive inspections.					
18.3	Knowledge of techniques for monitoring restricted areas: Knowledge of controlling access to the ship and to restricted areas onboard; methods for effective monitoring of deck areas and areas surrounding the ship; methods for controlling the embarkation, disembarkation and access while onboard of persons and their effects; General knowledge of various types of security equipment and systems, including their limitations; need for testing, calibrating and maintaining security systems and equipment.					
	Sub Total	8	240	365		
	TOTAL	1360				
	GRAND TOTAL	1965				

30 Months ATS MARINE ENGINEERING COURSE

PHASE II - 9 months training at Sea

COMPETENCY AND COURSE SUBJECTS		Hrs of training			At Sea	Assessment
		Theory	Practical			
		Classroom	Lab	Workshop/ Afloat		
FUNCTION : Marine Engineering at the operational and management level						
Competency No.1 : Maintain a safe Engineering watch (Table A-III/ 1)						
1.1	Thorough knowledge of Principles to be observed in keeping an Engineering watch, including:				140	
1.1.1	duties associated with taking over and accepting a watch					
1.1.2	routine duties undertaken during a watch					
1.1.3	maintenance of the machinery space logs and the significance of the readings taken					P
1.1.4	duties associated with handing over a watch					
1.2	Safety and emergency procedures; change-over of remote/automatic to local control of all systems					
1.3	Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems					
1.4	Engine-room resource management					
1.4.1	Knowledge of engine-room resource management principles, including:					
1.4.1.1	allocation, assignment, and prioritization of resources					
1.4.1.2	effective communication					
1.4.1.3	assertiveness and leadership					
1.4.1.4	obtaining and maintaining situational awareness					
1.4.1.5	consideration of team experience					
	Sub Total	0	0	0	140	
Competency No. 2 : Use English in written and oral form (Table A-III/ 1)						
2.1	Adequate knowledge of the English language to enable the officer to use Engineering publications and to perform Engineering duties				2	
2.1.1	Oral Communication					
2.1.2	Written Communication and Grammer					
2.1.3	Comprehension and speech					
2.1.4	Technical report writing					
	Sub Total	0	0	0	2	
Competency No. 3 : Use internal communication systems (Table A-III/ 1)						
3.1	Operation of all internal communication systems on board				0	P
	Sub Total	0	0	0	0	

Competency No. 4 : Operate main and auxiliary machinery and associated control systems (Table A-III/ 1)							
4.1	Mathematics				350		
4.2	Applied Mechanics						
4.3	Basic construction and operation principles of machinery systems, including:						
4.3.1	Marine Diesel Engine (Main & Aux)					P	
4.3.2	Marine Steam Turbine						
4.3.3	Marine Gas Turbine						
4.3.4	Marine Boiler						
4.3.5	Shafting Installations, including propeller						
4.3.6	other auxiliaries, including various pumps and their operational characteristics including control systems, pipings, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, air-conditioning and ventilation systems					P	
4.3.7	steering gear						
4.3.8	automatic control systems						
4.3.9	fluid flow and characteristics of lubricating oil, fuel oil and cooling systems						
4.3.10	deck machinery						
4.4	Safety and emergency procedures for operation of propulsion plant machinery, including control systems						
4.5	Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems:						
4.5.1	main engine and associated auxiliaries						O & P
4.5.2	steam boiler and associated auxiliaries and steam systems						
4.5.3	auxiliary prime movers and associated systems						
4.5.4	other auxiliaries, including refrigeration, airconditioning and ventilation systems						
	Sub Total	0	0	0	350		
Competency No. 5 : Operate fuel, lubrication, ballast and other pumping systems and associated control systems (Table A-III/ 1)							
5.1	Operational characteristics of pumps and piping systems, including control systems				280		
5.2	Operation of pumping systems:						
5.2.1	Routine pumping operations						
5.2.2	Operation of bilge, ballast and cargo pumping systems						
5.3	Oily-water separators (or-similar equipment) requirements and operation	30					
	Sub Total	30	0	0	280		

FUNCTION : Electrical, electronic & Control Engineering at the						
operational and management level						
Competency No. 6 : Operate electrical, electronic and control systems (Table A-III/ 1)						
6.1	Basic configuration and operation principles of the following electrical, electronic and control equipment:				180	
6.1.1	electrical equipment:					
6.1.1.a	generator and distribution systems					O & P
6.1.1.b	preparing, starting, paralleling and changing over generators					
6.1.1.c	electrical motors including starting methodologies					
6.1.1.d	high-voltage installations					
6.1.1.e	sequential control circuits and associated system devices					
6.1.2	electronic equipment:					
6.1.2.a	characteristics of basic electronic circuit elements					
6.1.2.b	flowchart for automatic and control systems					
6.1.2.c	functions, characteristics and features of control systems for machinery items, including main propulsion plant operation control and steam boiler automatic controls					
6.1.3	control systems:					
6.1.3. a	various automatic control methodologies and characteristics					
6.1.3. b	Proportional–Integral–Derivative (PID) control characteristics and associated system devices for process control					
6.2	Computer Applications (PMS, E learning, LAN network etc)					
	Sub Total	0	0	0	180	
Competency No. 7: Maintenance and repair of electrical and electronic equipment (Table A-III/ 1)						
7.1	Safety requirements for working on shipboard electrical systems, including the safe isolation of electrical equipment required before personnel are permitted to work on such equipment				300	
7.2	Maintenance and repair of electrical system equipment, switchboards, electric motors, generator and DC electrical systems and equipment					
7.3	Detection of electric malfunction, location of faults and measures to prevent damage					
7.4	Construction and operation of electrical testing and measuring equipment					O & P
7.5	Function and performance tests of the following equipment and their configuration:					

7.5.1	monitoring systems					
7.5.2	automatic control devices					
7.5.3	protective devices					
7.6	The interpretation of electrical and simple electronic diagrams					
	Sub Total	0	0	0	300	
FUNCTION : Maintenance & repair at the operational and management level						
Competency No. 8 : Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board (Table A-III/ 1)						
8.1	Characteristics and limitations of materials used in construction and repair of ships and equipment					
8.2	Characteristics and limitations of processes used for fabrication and repair					
8.3	Properties and parameters considered in the fabrication and repair of systems and components					
8.4	Methods for carrying out safe emergency/temporary repairs					
8.5	Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools and measuring instruments					
8.6	Use of hand tools, machine tools and measuring instruments					
8.7	Use of various types of sealants and packings					P
8.8	Theory of Machines					
	Sub Total	30	0	0	200	
Competency No. 9 : Maintenance and repair of shipboard machinery and equipment (Table A-III/ 1)						
9.1	Safety measures to be taken for repair and maintenance, including the safe isolation of shipboard machinery and equipment required before personnel are permitted to work on such machinery or equipment					
9.2	Appropriate basic mechanical knowledge and skills					
9.3	Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment					
9.4	The use of appropriate specialized tools and measuring instruments					P
9.5	Design characteristics and selection of materials in construction of equipment					
9.6	Interpretation of machinery drawings and handbooks					
9.7	The interpretation of piping, hydraulic and pneumatic diagrams					
	Sub Total	0	0	0	300	
FUNCTION : Controlling the operation of the ship and care for persons on board at the operational and management level						

Competency No. 10: Ensure compliance with pollution prevention requirements (Table A-III/ 1)						
10.1	<i>Prevention of pollution of the marine environment</i>					
10.1.1	Knowledge of the precautions to be taken to prevent pollution of the marine environment					
10.1.2	Anti-pollution procedures and all associated equipment				20	O
10.1.3	Importance of proactive measures to protect the marine environment (+ Marine Environmental awareness)					
	Sub Total	0	0	0	20	
Competency No. 11 : Maintain seaworthiness of the ship (Table A-III/ 1)						
11.1	<i>Ship stability</i>					
11.1.1	Working knowledge and application of stability, trim and stress tables, diagrams and stress-calculating equipment				50	
11.1.2	Understanding of the fundamentals of watertight integrity					
11.1.3	Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy					
11.1.4	Resistance propulsion & Powering of Ships.					
11.2	<i>Ship construction</i>					
11.2.1	General knowledge of the principal structural members of a ship and the proper names for the various parts					W & P
	Sub Total	0	0	0	50	
Competency No. 12 : Prevent, control and fight fires on board (Table A-III/ 1)						
12.1	<i>Fire prevention and fire-fighting appliances</i>				8	
12.1.1	IMO approved Model Course					
12.1.2	Knowledge of classes and chemistry of fire					
12.1.3	Knowledge of fire-fighting systems					W & O
12.1.4	Action to be taken in the event of fire, including fires involving oil systems					
	Sub Total	0	0	0	8	
Competency No. 13 : Operate life-saving appliances (Table A-III/ 1)						
13.1	<i>Life-saving</i>				15	
13.1.1	IMO approved Model Course					
13.1.2	Knowledge of alarms & signals on board					
13.1.3	Knowledge of life saving appliances & equipments					W & O
	Sub Total	0	0	0	15	
Competency No. 14 : Apply medical first aid on board ship (Table A-III/ 1)						
14.1	<i>Medical aid</i>				12	
14.1.1	IMO approved Model Course					
14.1.2	Seafarers Health Information Programme					
	Sub Total	0	0	0	12	

Competency No. 15: Monitor compliance with legislative requirements (Table A-III/ 1)						
15.1	Basic working knowledge of the relevant IMO conventions concerning safety of life at sea, security and protection of the marine environment					
15.2	ISM Code and Quality management system					
15.3	Classification societies and their role in shipping					
15.4	Role of National Government in control of ships					
15.5	Recruitment & Placement of Indian Seafarers					
	Sub Total	0	0	0	0	
Competency No. 16 : Application of leadership and teamworking skills (Table A-III/ 1)						
16.1	Working knowledge of shipboard personnel management and training				5	
16.2	A knowledge of related international maritime conventions and recommendations, and national legislation					
16.3	Ability to apply task and workload management, including:					
16.3.1	planning and coordination					
16.3.2	personnel assignment					
16.3.3	time and resource constraints					
16.3.4	prioritization					
16.4	Knowledge and ability to apply effective resource management:					
16.4.1	allocation, assignment, and prioritization of resources					
16.4.2	effective communication on board and ashore					
16.4.3	decisions reflect consideration of team experiences					
16.4.4	assertiveness and leadership, including motivation					
16.4.5	obtaining and maintaining situational awareness					
16.5	Knowledge and ability to apply decision-making techniques:					
16.5.1	situation and risk assessment					
16.5.2	identify and consider generated options					
16.5.3	selecting course of action					
16.5.4	evaluation of outcome effectiveness					
	Sub Total	0	0	0	5	
Competency No. 17 : Contribute to the safety of personnel and ship (Table A-III/ 1)						
17.1	Knowledge of personal survival techniques					
17.2	Knowledge of fire prevention and ability to fight and extinguish fires					
17.3	Knowledge of elementary first aid					
17.4	Knowledge of personal safety and social responsibilities					
	Sub Total	0	0	0	0	
Competency No. 18 : Maintain the conditions set forth in a ship security plan; Recognition of security risks and threats; Undertake regular security inspections of the ship; and proper usage of security equipment if any						

18.1	Working knowledge of maritime security terms and definitions, maritime security levels; security reporting procedures; procedures and requirements for drills and exercises under relevant conventions, codes and IMO circulars; procedures for conducting inspections and surveys and monitoring of security activities specified in a ship security plan; security related contingency plans.					
18.2	Knowledge of security documentation; Knowledge enabling recognition of potential security threats; Knowledge enabling recognition of weapons, dangerous substances and devices and awareness of the damage they can cause; crowd management and control techniques; handling security related information and security related communications; methods for physical searches and non-intrusive inspections.					
18.3	Knowledge of techniques for monitoring restricted areas: Knowledge of controlling access to the ship and to restricted areas onboard; methods for effective monitoring of deck areas and areas surrounding the ship; methods for controlling the embarkation, disembarkation and access while onboard of persons and their effects; General knowledge of various types of security equipment and systems, including their limitations; need for testing, calibrating and maintaining security systems and equipment.					
	Sub Total	0	0	0	0	
	TOTAL	60	0	0	1862	
	GRAND TOTAL	1922				

30 Months ATS MARINE ENGINEERING COURSE

PHASE III - 9 months training at Institution

COMPETENCY AND COURSE SUBJECTS		Hrs of training			At Sea	Assessment
		Theory	Practical			
		Classroom	Lab	Workshop/ Afloat		
FUNCTION : Marine Engineering at the operational and management level						
Competency No.1 : Maintain a safe Engineering watch (Table A-III/ 1)						
1.1	Thorough knowledge of Principles to be observed in keeping an Engineering watch, including:					
1.1.1	duties associated with taking over and accepting a watch					
1.1.2	routine duties undertaken during a watch					
1.1.3	maintenance of the machinery space logs and the significance of the readings taken					
1.1.4	duties associated with handing over a watch					
1.2	Safety and emergency procedures; change-over of remote/automatic to local control of all systems					
1.3	Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems					
1.4	Engine-room resource management					
1.4.1	Knowledge of engine-room resource management principles, including:					
1.4.1.1	allocation, assignment, and prioritization of resources					
1.4.1.2	effective communication					
1.4.1.3	assertiveness and leadership					
1.4.1.4	obtaining and maintaining situational awareness					
1.4.1.5	consideration of team experience					
	Sub Total	0	0	0	0	
Competency No. 2 : Use English in written and oral form (Table A-III/ 1)						
2.1	Adequate knowledge of the English language to enable the officer to use Engineering publications and to perform Engineering duties					
2.1.1	Oral Communication					

2.1.2	Written Communication and Grammar					
2.1.3	Comprehension and speech					
2.1.4	Technical report writing					
	Sub Total	0	0	0	0	
Competency No. 3 : Use internal communication systems (Table A-III/ 1)						
3.1	Operation of all internal communication systems on board					
	Sub Total	0	0	0	0	
Competency No. 4 : Operate main and auxiliary machinery and associated control systems (Table A-III/ 1)						
4.1	Mathematics					
4.2	Applied Mechanics					
4.3	Basic construction and operation principles of machinery systems, including:					
4.3.1	Marine Diesel Engine (Main & Aux)	35	15			
4.3.2	Marine Steam Turbine	30				
4.3.3	Marine Gas Turbine	10				W
4.3.4	Marine Boiler	35	10			
4.3.5	Shafting Installations, including propeller	50	10			
4.3.6	other auxiliaries, including various pumps and their operational characteristics including control systems, pipings, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, air-conditioning and ventilation systems					
4.3.7	steering gear					
4.3.8	automatic control systems					
4.3.9	fluid flow and characteristics of lubricating oil, fuel oil and cooling systems					
4.3.10	deck machinery					
4.4	Safety and emergency procedures for operation of propulsion plant machinery, including control systems					
4.5	Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems:					
4.5.1	main engine and associated auxiliaries					
4.5.2	steam boiler and associated auxiliaries and steam systems					
4.5.3	auxiliary prime movers and associated systems					
4.5.4	other auxiliaries, including refrigeration, airconditioning and ventilation systems					

	Competency as per Table A-III/ 2: Manage the operation of propulsion plant machinery. Plan and schedule operations. Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery.					
4.6	Design features, and operative mechanism of the following machinery and associated auxiliaries: marine diesel engine, marine steam turbine, marine gas turbine, marine boiler					W
4.7	Theoretical knowledge: Thermodynamics and heat transmission	60				
	Mechanics and hydromechanics	60				
	Propulsive characteristics of diesel engines, steam and gas turbines, including speed, output and fuel consumption	7				
	Heat cycle, thermal efficiency and heat balance of marine diesel engine, marine steam turbine, marine gas turbine, marine steam boiler. Refrigerators and refrigeration cycle, Physical and chemical properties of fuels and lubricants & Technology of materials	55		15		
4.8	Practical knowledge: Start up and shut down main propulsion and auxiliary machinery, including associated systems, Operating limits of propulsion plant & The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery	25				Written & Practical Examination
	Sub Total	367	35	15	0	
Competency No. 5 : Operate fuel, lubrication, ballast and other pumping systems and associated control systems (Table A-III/ 1)						
5.1	Operational characteristics of pumps and piping systems, including control systems					
5.2	Operation of pumping systems:					
5.2.1	Routine pumping operations					
5.2.2	Operation of bilge, ballast and cargo pumping systems					
5.3	Oily-water separators (or-similar equipment) requirements and operation					

	Competency as per Table A-III/ 2: Manage fuel, lubrication and ballast operations.					
5.4	Operation and maintenance of machinery, including pumps and piping systems.	12				
5.5	Piping system of fuel and ballast operations	12				
5.6	SOLAS regulations on fuel and ballast systems					
5.7	Routine and emergency preparedness of pollution prevention from fuel					
5.8	Ballast Water contamination					
	Sub Total	24	0	0	0	
FUNCTION : Electrical, electronic & Control Engineering at the operational and management level						
Competency No. 6 : Operate electrical, electronic and control systems (Table A-III/ 1)						
6.1	Basic configuration and operation principles of the following electrical, electronic and control equipment:					
6.1.1	electrical equipment:					
6.1.1.a	generator and distribution systems					
6.1.1.b	preparing, starting, paralleling and changing over generators					
6.1.1.c	electrical motors including starting methodologies					
6.1.1.d	high-voltage installations					
6.1.1.e	sequential control circuits and associated system devices					
6.1.2	electronic equipment:					
6.1.2.a	characteristics of basic electronic circuit elements					
6.1.2.b	flowchart for automatic and control systems					
6.1.2.c	functions, characteristics and features of control systems for machinery items, including main propulsion plant operation control and steam boiler automatic controls					
6.1.3	control systems:					
6.1.3. a	various automatic control methodologies and characteristics					W & P ,O
6.1.3. b	Proportional–Integral–Derivative (PID) control characteristics and associated system devices for process control					
6.2	Computer Applications (PMS, E learning, LAN network etc)					

	Competency as per Table A-III/ 2: Manage operation of electrical and electronic control equipment. Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery.					
6.3	Theoretical knowledge: Marine electro technology, electronics, power electronics, automatic control engineering and safety devices.	110				
6.4	Design features and system configurations of automatic control equipment and safety devices for main engine, generator and distribution system, steam boiler.	27				
6.5	Design features and system configurations of operational control equipment for electrical motors.	40				
6.6	Design features of high-voltage installations	20				
6.7	Features of hydraulic and pneumatic control equipment	10				
6.8	Practical knowledge: Functions and mechanism of automatic control for main engine & auxiliary machinery including generator distribution systems, steam boilers, oil purifier, refrigeration system, pumping and piping systems, steering gear system, cargo-handling equipment and deck machinery.	36				
	Sub Total	243	0	0	0	
Competency No. 7: Maintenance and repair of electrical and electronic equipment (Table A-III/ 1)						
7.1	Safety requirements for working on shipboard electrical systems, including the safe isolation of electrical equipment required before personnel are permitted to work on such equipment					
7.2	Maintenance and repair of electrical system equipment, switchboards, electric motors, generator and DC electrical systems and equipment					
7.3	Detection of electric malfunction, location of faults and measures to prevent damage					W & O
7.4	Construction and operation of electrical testing and measuring equipment					
7.5	Function and performance tests of the following equipment and their configuration:					
7.5.1	monitoring systems					

7.5.2	automatic control devices					
7.5.3	protective devices					
7.6	The interpretation of electrical and simple electronic diagrams					
	Competency as per Table A-III/ 2: Manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition.					
7.7	Practical knowledge: Troubleshooting of electrical and electronic control equipment & monitoring systems. Function test of electrical, electronic control equipment and safety devices.	48	51			
7.8	Software version control.	20	5			
	Sub Total	68	56	0	0	
FUNCTION : Maintenance & repair at the operational and management level						
Competency No. 8 : Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board (Table A-III/ 1)						
8.1	Characteristics and limitations of materials used in construction and repair of ships and equipment					
8.2	Characteristics and limitations of processes used for fabrication and repair					
8.3	Properties and parameters considered in the fabrication and repair of systems and components					
8.4	Methods for carrying out safe emergency/temporary repairs					
8.5	Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools and measuring instruments					
8.6	Use of hand tools, machine tools and measuring instruments					P
8.7	Use of various types of sealants and packings					
8.8	Theory of Machines					
	Sub Total	0	0	0	0	
Competency No. 9 : Maintenance and repair of shipboard machinery and equipment (Table A-III/ 1)						

9.1	Safety measures to be taken for repair and maintenance, including the safe isolation of shipboard machinery and equipment required before personnel are permitted to work on such machinery or equipment					
9.2	Appropriate basic mechanical knowledge and skills					
9.3	Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment					W & O
9.4	The use of appropriate specialized tools and measuring instruments					
9.5	Design characteristics and selection of materials in construction of equipment					
9.6	Interpretation of machinery drawings and handbooks					W
9.7	The interpretation of piping, hydraulic and pneumatic diagrams					
	Competency as per Table A-III/ 2: Manage safe and effective maintenance and repair procedures. Detect and identify the cause of machinery malfunctions and correct faults. Ensure safe working practices.					
9.8	<i>Theoretical knowledge:</i> Marine engineering practice	20		110		W & O
9.9	<i>Practical knowledge:</i> Manage safe and effective maintenance and repair procedures, Planning maintenance & repairs including statutory and class verifications.	35				
9.10	<i>Practical knowledge:</i> Detection of machinery malfunction, location of faults and action to prevent damage Inspection and adjustment of equipment. Non-destructive examination.	15	15			
9.11	<i>Practical knowledge:</i> Safe working practices	25		15		
9.12	Precautions against fire or explosion, Explosive mixtures. Danger of oil leakage's Sources of ignition					
9.13	Toxic and other dangerous properties of substances used in marine practice. Mainatenance of plant associated with the carriage of dangerous goods.					
	Sub Total	95	15	125	0	

FUNCTION : Controlling the operation of the ship and care for persons on board at the operational and management level						
Competency No. 10: Ensure compliance with pollution prevention requirements (Table A-III/ 1)						
10.1	<i>Prevention of pollution of the marine environment</i>					
	Knowledge of the precautions to be taken to prevent pollution of the marine environment	20				
10.1.2	Anti-pollution procedures and all associated equipment					W & O
10.1.3	Importance of proactive measures to protect the marine environment (+ Marine Environmental awareness)					
	Sub Total	20	0	0	0	
Competency No. 11 : Maintain seaworthiness of the ship (Table A-III/ 1)						
11.1	<i>Ship stability</i>					
11.1.1	Working knowledge and application of stability, trim and stress tables, diagrams and stress-calculating equipment					
11.1.2	Understanding of the fundamentals of watertight integrity					
11.1.3	Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy					W & O
11.1.4	Resistance propulsion & Powering of Ships.					
11.2	<i>Ship construction</i>					
11.2.1	General knowledge of the principal structural members of a ship and the proper names for the various parts					
	Sub Total	0	0	0	0	
Competency as per Table A-III/ 2: Control trim, stability and stress.						
11.3	Understanding of fundamental principles of ship construction and the theories and factors affecting trim and stability and measures necessary to preserve trim and stability	85				W
11.4	Knowledge of the effect on trim and stability of a ship in the event of damage to, and consequent flooding of, a compartment and countermeasures to be taken	10				W
11.5	Knowledge of IMO recommendations concerning ship stability	5				
	Sub Total	95	0	0	0	
Competency No. 12 : Prevent, control and fight fires on board (Table A-III/ 1)						
12.1	<i>Fire prevention and fire-fighting</i>					

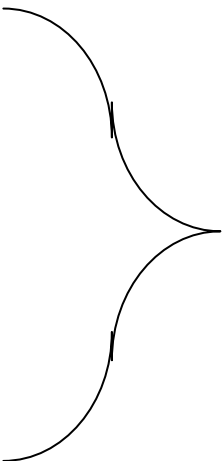
	<i>appliances</i>					
12.1.1	IMO approved Model Course					
12.1.2	Knowledge of classes and chemistry of fire					
12.1.3	Knowledge of fire-fighting systems					
12.1.4	Action to be taken in the event of fire, including fires involving oil systems					
	Sub Total	0	0	0	0	
Competency No. 13 : Operate life-saving appliances (Table A-III/ 1)						
13.1	<i>Life-saving</i>					
13.1.1	IMO approved Model Course					
13.1.2	Knowledge of alarms & signals on board					
13.1.3	Knowledge of life saving appliances & equipments	2				
	Sub Total	2	0	0	0	
Competency No. 14 : Apply medical first aid on board ship (Table A-III/ 1)						
14.1	<i>Medical aid</i>					
14.1.1	IMO approved Model Course					
14.1.2	Seafarers Health Information Programme					
	Sub Total	0	0	0	0	
Competency No. 15: Monitor compliance with legislative requirements (Table A-III/ 1)						
15.1	Basic working knowledge of the relevant IMO conventions concerning safety of life at sea, security and protection of the marine environment	18				W
15.2	Regard shall be paid especially to the following subjects :					
15.2.1	Certificates and other documents required to be carried on board ships by international conventions	5				
15.2.2	Requirements of International Convention on Load Line	5				
15.5	Requirements of International Convention on Safety of life at Sea, Prevention on pollution from ships	10				
	Sub Total	38	0	0	0	
Competency No. 16 : Application of leadership and teamworking skills (Table A-III/ 1)						
16.1	Working knowledge of shipboard personnel management and training					W
16.2	A knowledge of related international maritime conventions and recommendations, and national legislation	5				W
16.3	Ability to apply task and workload management, including:					
16.3.1	planning and coordination	6				
16.3.2	personnel assignment					W

16.3.3	time and resource constraints					
16.3.4	prioritization					
16.4	Knowledge and ability to apply effective resource management:	3				
16.4.1	allocation, assignment, and prioritization of resources					
16.4.2	effective communication on board and ashore					W
16.4.3	decisions reflect consideration of team experiences					
16.4.4	assertiveness and leadership, including motivation					
16.4.5	obtaining and maintaining situational awareness					
16.5	Knowledge and ability to apply decision-making techniques:	8				
16.5.1	situation and risk assessment					W
16.5.2	identify and consider generated options					
16.5.3	selecting course of action					
16.5.4	evaluation of outcome effectiveness					
	Sub Total	22	0	0	0	
Competency No. 17 : Contribute to the safety of personnel and ship (Table A-III/ 1)						
17.1	Knowledge of life saving appliances	2				
17.2	Fire and abandoned ship drill to	2				
17.3	maintenance of operational condition of life-saving, fire-fighting and other safety systems	5				
17.4	Actions to be taken to protect and safeguard all persons on board in emergencies	1				
17.5	Actions to Limit damage and save the ship following fire, explosion, collision or grounding	3				
17.6						
	Sub Total	13	0	0	0	
Competency No. 18 : Maintain the conditions set forth in a ship security plan; Recognition of security risks and threats; Undertake regular security inspections of the ship; and proper usage of security equipment if any						

18.1	Working knowledge of maritime security terms and definitions, maritime security levels; security reporting procedures; procedures and requirements for drills and exercises under relevant conventions, codes and IMO circulars; procedures for conducting inspections and surveys and monitoring of security activities specified in a ship security plan; security related contingency plans.					
18.2	Knowledge of security documentation; Knowledge enabling recognition of potential security threats; Knowledge enabling recognition of weapons, dangerous substances and devices and awareness of the damage they can cause; crowd management and control techniques; handling security related information and security related communications; methods for physical searches and non-intrusive inspections.					W
18.3	Knowledge of techniques for monitoring restricted areas: Knowledge of controlling access to the ship and to restricted areas onboard; methods for effective monitoring of deck areas and areas surrounding the ship; methods for controlling the embarkation, disembarkation and access while onboard of persons and their effects; General knowledge of various types of security equipment and systems, including their limitations; need for testing, calibrating and maintaining security systems and equipment.					
	Sub Total	0	0	0	0	
	TOTAL	987	106	140		
	GRAND TOTAL	1233				

**SUMMARY OF WRITTEN EXAMINATION TO BE CONDUCTED BY THE CHIEF EXAMINER OF ENGINEERS FOR
COMPETENCE FOR OFFICERS IN CHARGE OF AN ENGINEERING WATCH IN A
MANNED ENGINE - ROOM OR DESIGNATED DUTY
ENGINEER IN A PERIODICALLY UNMANNED ENGINE - ROOM (MEO CLASS IV)**

TABLE A - III/I

	SUBJECTS UNDER EACH FUNCTION	COMPETENCIES COVERED	DURATION OF EXAM	MAXIMUM MARKS	PASS MARKS
1	Marine Engineering at operational level				
	PART – A	1,2,3,4,5,6 &7			
	I. Heat Engines.		3 hours	100	50
	II. Applied Mechanics.		3 hours	100	50
	III. Mathematics.		3 hours	100	50
	IV. Marine Engineering Drawing.		3 hours	100	50
	PART – B				
	V. Marine Engineering Knowledge (General)		3 hours	100	50
	VI. Marine Engineering Knowledge (Motor or Steam).		3 hours	100	50
	Orals			100	60
2	Electrical, Electronic & Control engineering at the operational level				
	VII. Marine Electrotechnology.	} 3 & 8	3 hours	100	50
	Orals			100	60
3	Maintenance & Repair at the operational level				
	VIII. Marine Engineering Practice.	} 1 to 8 and 9	3 hours	100	50
	Orals			100	60
4	Controlling the operation of the ship & care for				

	persons				
	IX. Naval Architecture & Ship Construction.	} 10,11,12, 13,14 ,15, 16 & 17	3 hours	100	50
	X. Ship's safety & environmental protection.		3 hours	100	50
	Orals			100	60

THE COURSE IS NOT MANDATORY FOR ELIGIBILITY TO APPEAR FOR CLASS IV EXAMINATION

SUMMARY OF POSTSEA TRAINING PROGRAMMES, EXAMINATION & ASSESSMENT FOR MEO CLASS IV

Regulation III/I of STCW '2010 & Section A - III/I of STCW Code Department Engine
Level Operational

Capacity MEO Class IV

Duration 45 days(After the mandatory 6 months sea service)

FUNCTION: MARINE ENGINEERING AT THE OPERATIONAL LEVEL.

NO.	COMPETENCY	ON-BOARD TRAINING	TYPE OF ASSESSMENT	HOURS
				INSTITUTION
				CLASS
1	Maintain a safe engineering watch	YES	Written examination & or skills test.	60 Hours Note: 30 hrs is to be devoted for Marine Engineering Knowledge (General) paper + 30 hrs is to be devoted for Marine Engineering Knowledge (Motor and/or Steam) paper
2	Use English in written and oral form	----	Written examination & or skills test.	
3	Use internal communication systems	YES	Written examination & or skills test.	
4	Operate main and auxiliary machinery and associated control systems	YES	Written examination & or skills test.	
5	Operate fuel, lubrication, ballast and other pumping systems and associated control systems	YES	Written examination & or skills test.	

FUNCTION: ELECTRICAL, ELECTRONIC AND CONTROL ENGINEERING AT THE OPERATIONAL LEVEL.

NO.	COMPETENCY	ON-BOARD TRAINING	TYPE OF ASSESSMENT	HOURS
				INSTITUTION
				CLASS
6	Operate electrical, electronic and control systems	YES	Written examination & or skills test.	30 hrs
7	Maintenance and repair of electrical and electronic equipment	YES	Written examination & or skills test.	Note: The time is to be devoted for Marine Electro Technology paper.

FUNCTION: MAINTENANCE AND REPAIR AT THE OPERATION LEVEL

NO.	COMPETENCY	ON-BOARD TRAINING	TYPE OF ASSESSMENT	HOURS
				INSTITUTION
				CLASS
8	Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board	YES	Written examination & or skills test	30 hrs
9	Maintenance and repair of shipboard machinery and equipment	YES	Written examination & or skills test	Note: The time is to be devoted for Marine Engineering Practice paper.

FUNCTION: CONTROLLING THE OPERATION OF THE SHIP & CARE FOR PERSONS ON BOARD AT THE OPERATIONAL LEVEL.

COURSE IS NON MANDATORY FOR APPEARING IN CLASS IV EXAMINATION.

TABLE A - III/1

**STANDARD OF COMPETENCE FOR OFFICERS IN CHARGE OF AN ENGINEERING WATCH IN A MANNED
ENGINE - ROOM OR DESIGNATED DUTY ENGINEERS IN A PERIODICALLY UNMANNED ENGINE – ROOM
(MARINE ENGINEER OFFICER CLASS IV)**

SYLLABUS FOR CLASS IV MEO EXAMINATION

FUNCTION 1: - MARINE ENGINEERING AT THE OPERATIONAL LEVEL

Knowledge, Understanding & Proficiency / Course Covered	Methods of Demonstrating Competence	Criteria for Evaluating Competence

Competence No. 1: Maintain a safe engineering watch Thorough knowledge of principles to be observed in keeping an engineering watch, including: – duties associated with taking over and accepting a watch – routine duties undertaken during a watch including Ship Bilge/Ballast/oil - Pumping system. – maintenance of the machinery space log-book and the significance of the readings taken – duties associated with handing over a watch Safety and emergency procedures; change-over of remote/automatic to local control of all systems. Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems Engine Room Resource Management Knowledge of Engine room resource management principles including: - allocation, assignment and principles of resources - effective communication - assertiveness and leadership - obtaining and maintaining situational awareness - Consideration of team experience	Assessment of evidence obtained from one or more of the following: .1 approved in service experience. .2 approved training ship experience. .3 approved simulator experience where appropriate. .4 approved laboratory equipment training.	The conduct, handover and relief of the watch conforms with accepted principles and procedures. The frequency and extent of monitoring of engineering equipment and systems conforms to manufacturers recommendations and accepted principles and procedures, including Principles to be observed in keeping an engineering watch. A proper record is maintained of the movements and activities relating to the ship's engineering systems. Resources are allocated and assigned as needed in correct priority to perform necessary tasks. Communication is clearly and unambiguously given and received Questionable decisions and/or actions result in appropriate challenge and response Effective leadership behaviours are identified Team member(s) share accurate understanding of current and predicted engine room and associated systems state, and external environment.
Competence No. 2: Use English in written & oral form. Adequate knowledge of the English language to enable the officer to use engineering publications and to perform engineering duties.	Examination and assessment of evidence obtained from practical instructions.	English language publications relevant to engineering duties are correctly interpreted. Communications are clear and understood.
Competence No.3: Use internal communication systems Operation of all internal communication	Examination and assessment of evidence obtained from one or	Transmission and reception of messages are consistently

systems on board	more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate .4 approved laboratory equipment training	successful Communication records are complete, accurate and comply with statutory requirements
Competence No. 4: Operate main and auxiliary machinery and associated control systems Operate. shipboard plant machinery and associated control systems – periodically unattended machinery techniques and work practices – bridge control – interpretation of indicator cards, instruments print outs in connection with main engine, auxiliary engines and test data of auxiliary machinery – interpretation of functional tests on control systems. Basic construction structure and operation principles of major machinery systems including: .1 marine diesel engine .2 marine steam turbine .3 marine gas turbine .4 marine boiler .5 shafting installations including propeller .6 other auxiliaries including various pumps, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, air conditioning and ventilation systems .7 Steering gear .8 automatic control systems .9 Fluid flow and characteristics of lubricating oil, fuel oil and cooling systems .10 deck machinery Safety and emergency procedures for operation of propulsion plant machinery	Assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved laboratory equipment training Assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate .4 approved laboratory equipment training	Operation of equipment and systems is in accordance with operating manuals Construction and operating mechanisms can be understood and explained with drawings /instructions. Operations are planned and carried out in accordance with established rules & procedures to ensure safety of operations and avoid pollution of the marine environment. Deviations from the norm are promptly identified. The output of plant and engineering systems consistently meets requirements, including bridge orders relating to changes in

including control systems Operational characteristics of machinery and control systems Preparation, operation, fault detection and necessary measures to prevent damage for the following major machinery items and control systems: . 1 main engine and associated auxiliaries . 2 steam boiler and associated auxiliaries and steam systems . 3 auxiliary prime movers and associated systems . 4 other auxiliaries including refrigeration, air- conditioning and ventilation systems		speed and direction. The causes of machinery malfunctions are promptly identified and actions are designed to ensure the overall safety of the ship and the plant, having regard to the prevailing circumstances and conditions. Structures and operating mechanisms can be understood and explained with drawings /instructions.
Competence No. 5: Operate fuel, lubrication, ballast and other pumping systems and associated control systems Operational characteristics of machinery and control systems Operation of pumping systems – routine pumping operations – operation of bilge, ballast, fire and cargo pumping systems Oily water separators (or similar equipment) requirements and operation.	Examination and assessment of evidence obtained from one or more of the following: .1 approved in service experience. .2 approved training ship experience. .3 approved simulator training, where appropriate. .4 approved laboratory equipment training.	Operation of machinery and systems is in accordance with operating manuals Operations are planned and carried out in accordance with established rules & procedures to ensure safety of operations and avoid pollution of the marine environment. Deviations from the norm are promptly identified and appropriate action taken
<u>DETAILED SYLLABUS & PAPERS UNDER WHICH FUNCTION OF MARINE ENGINEERING AT THE OPERATIONAL LEVEL WILL BE COVERED</u> PART A <u>PAPER I : HEAT ENGINES</u> Properties of pure substances: Heat, Temperature and its measurement. Absolute temperature, pressure and its measurement Specific heat capacity. Specific entropy. Specific enthalpy of evaporation and fusion. Problems involving changes of phase and not more than three substances. Laws of Thermodynamics: Basic thermodynamic principles.		

Properties, energy, the First Law of Thermodynamic, flow and non-flow processes. Constant pressure process, Steady flow process. Second law of thermodynamics& T-S diagrams

Heat and work transfer:

Qualitative treatment of heat transfer by conduction convection and radiation. Laws of conduction and thermal conductance and applications to problems.

Cases Boyle's and Charles laws for perfect gases. Characteristics equation. Constant R and its use in simple problems. Isothermal, adiabatic and polytropic process.

Relationships between pressure, temperature and volume. Work done.

Changes in internal energy.

Specific heat C_p and C_v and the relationship between them.

Ideal Gas cycles:

Constant volume cycle. Dual cycle. Air standard efficiency.

I.C. Engines, Elementary Principles and cycles of operation, Actual indicator diagrams. Mean effective pressure. Work done, power developed, indicated and brake thermal efficiencies, mechanical efficiency, overall efficiency. Fuel consumption. Heat balance.

Applied Thermodynamics:

Air compressors, Elementary principles and cycles of operation .Calculation of work done. Indicator diagrams.

Properties of steam. Saturated steam, dry, wet. Dryness fraction. Super-heated steam. Internal energy. Enthalpy. Specific volume. Steam tables. Throttling.

Steam plant. Advantages of using steam expansively. Rankine cycles. Thermal, mechanical and overall efficiencies of prime movers. Steam cycle with economiser, air heater. Regenerative feed heating. Boiler efficiency, heat balance for engine and boiler trials. Change in dissolved solids in boilers and evaporators due to contaminated feed and effect of blowing down. Elementary principles of steam turbines including simple velocity diagrams

for impulse and reaction turbines. Force and work done on blades.
 Combustion. Solid and liquid fuels. Calorific value. Chemical equations for complete combustion. Theoretical minimum air required. Excess air.
 Refrigeration. Vapour-compression cycle. Refrigerating effect.
 Cooling load. Use of tables of properties of refrigerants.
 Coefficient of performance.
 Gas dynamics, Gas nozzles and steam nozzles. One dimension flow of gases through varying cross section, critical pressure ratio, convergent nozzle, convergent-divergent nozzle,
 Gas turbine Open cycle gas turbine. Effect on thermal efficiency due to change in pressure ratio, inclusion of inter-cooler, re-heaters and heat exchanger.

PAPER II : APPLIED MECHANICS

Statics:

Force as a vector. Triangle and polygon of forces. Resultant and equilibrium of a system of concurrent coplanar forces. Lami's Theorem, Concurrent Forces in a Plane, Parallel forces in a Plane, General Case of forces in a Plane. Couples, Method of Moments, Plain Trusses (Method of Joints, Method of Sections, Method of Members),

Friction, Coefficient of friction, Friction angle. Energy and power lost due to Friction in simple bearings, Friction in belt drive, Efficiency of Screw jack (Square and V-Thread).

Centroids of composite body, Area & Volume (Pappus Theorem)

Simple lifting machine. Graphics of load-effort and load-efficiency. Linear law. Velocity ratio, mechanical advantages and efficiency of the following machines: Wheel and Axle, Differential Wheel and Axle, Rope Pulley blocks, Differential Pulley blocks, Warwick screw, worm-driven chain blocks and single and double purchase crab winches.

Virtual Work

Moment of Inertia of Plane figures,

Moment of Inertia of Material Bodies. Strength of Material: Stress and strain. Direct stress and strain. Modulus of elasticity. Shear stress and strain. Modulus of rigidity. Factor of safety. Stress due to restricted expansion or contraction of single members. Hydrostatic stresses and the corresponding strains. Relationship between three elastic constants. Thermal stress; Axial stresses in composite materials. Strength of welded joints. Concept of Strain Energy; Strain Energy due to normal and Shear Stresses; Strain Energy due to impact loads; Resilience. Compound Stress and strain. Stresses on an oblique section, General two dimensional stress system, Principal planes and principal stresses, Strain on an oblique section, Determination of principal strains, Principal strain in three dimensions, Principal stresses determined from principal strains, Mohr's Diagram for stress and strain, Combined bending and twisting, Equivalent Bending Moment and Twisting Moment, Shear, bending and torsion, Theories of failure. Beams. Simply supported beams, Cantilevers, Shearing force and bending moment diagrams for cantilevers, simply supported beams with concentrated and uniformly distributed loads. Stress due to bending. Strain energy due to bending, Application of impact. Deflection of Built-in beams and Continuous beams by integration and Macaulay's Method. Moment area Methods of deflection co-efficient. Deflection due to shear, Deflection by graphical method. Clapeyrons three moment theorem. Applied problems. Thin Curved bar, Strain energy due to bending. Castigliano's theorem, and its application to curved bars, strain energy due to twisting. Applied problems. Fluid Mechanics: Properties of fluid-density, compressibility, vapour pressure, capillarity, Cavitation phenomena viscosity & measurement-		

rotating viscometer.

Euler's Formula, Bernoulli's Formula, Energy equations & applications, Flow rate measurement-Venturimeter, Orificemeter & Pitot tube.

Impact of jets-force exerted by jet on a flat, curved plates & pipe bend. Surge pressure and control.

Equilibrium of floating bodies. Variation of fluid pressure with depth. Total force due to liquid pressure on immersed plane surfaces horizontal or vertical. Centre of pressure on a rectangular vertical plane surface or triangular plane surface, both with one edge parallel to the surface of the liquid. Coefficient of velocity, contraction of area and discharge.

PAPER III : MATHEMATICS

Differential Calculus:

Differentiation of algebraic, circular, exponential and logarithmic functions, of products, quotients functions of a function and simple implicit functions.

Successive differentiation - intro. and notation, n th order derivatives of std. Functions, n th

order derivatives using (a) trig. Identities and std. fns.(b) partial fractions, Leibnitz' Theorem,

Maclaurin's Theorem and std. Expansions, Expansions using std. Expansions, Taylor's Theorem, Indeterminate forms and L'Hospital's rule, Curve tracing of cartesian and polar

curves. Functions of several variables, limits and continuity, Partial derivatives - def., geometrical interpretation and rules of partial differentiation, Higher order partial derivatives,

Homogeneous fns. and Euler's Theorem, Total derivatives and chain rules, Implicit fns. and

composite fns., Errors and approximations, Maxima and minima, Lagrange's multipliers.

Integral Calculus:

Integration of standard forms by

substitution and by parts. The definite integral as the limit of a sum. Application of integration to area under curve; volume of revolution; First moment of area and the position of a centroid of an area; Work done by variable forces; mean values, Root mean square values of $\sin nx$ and $\cos nx$. The rules of Guldinus. Theorems of parallel and perpendicular axes. Second moments of area and moments of inertia of a rectangular and circular laminae.

Multiple Integrals. Double and Triple Integrals. Region of integration and change of order of integration. Spherical Polar and Cylindrical Co-ordinates. Applications – Area, Volume, Mass of wire, lamina and solid. Centre of Gravity of wire, lamina and solid. Moment of Inertia using multiple integrals.

Ordinary Differential Equations:

Def., order and degree, formation of differential equation. Solution of first order, first degree equations in variable separable form, homogeneous equations. other substitutions, Equations.

Reducible to homogeneous and exact differential equations.

Equations reducible to exact, IF, Linear differential equation. Of first order first degree, reducible to linear, Applications to electrical circuits and orthogonal trajectories, n th order LDE - def. and complementary solution, Methods of obtaining PI, Method of variation of parameters, Method of undetermined coefficients, Cauchy's homogeneous LDE and Legendre's equation., System of Ordinary differential equations. Simultaneous equations. in symmetrical form, Applications to deflection of beams, struts and columns, Applications to electrical circuits and coupled circuits.

Calculus of Finite Differences:

Difference operators and relation between them, Algebra of finite difference operators, Newton's forward and backward interpolation formulae, Stirling's

interpolation formula
Lagrange's interpolation formula,
Numerical differentiation, Numerical
integration, Difference
equations. - def., formation and solution,
Linear difference equation. with constant
coefficients.

PAPER IV: ENGINEERING DRAWING

Types of Technical Drawings, Lettering,
Dimensioning, Limits and fits, Geometrical
tolerance Line work, Pictorial Projection,
Development of Surface, Isometric
Projection / Views ,Orthographic
Projection, Missing Views, Machine Parts,
Screw threads and fasteners, Locking and
retaining devices, Riveted type fastenings,
Welded connections, Bearings, Seals,
Lubrication arrangement, ball and roller
bearings, Machinery Components and
Assembly drawings, and Blue Print
Reading.

List of drawings:

{Air Inlet Valve, Automatic Valve, Ballast
Chest, Bilge Suction Strainer, Burner
Carrier, Connecting Rod And Bearings,
Control Valve, Crosshead And Guide Shoe,
Cylinder Relief Valve, Feed Check Valve,
Flow Regulator, Full Bore Safety Valve,
Gauge Glass (Plate Type), Gear Pump, High
Lift Safety Valve, Oil Strainer, Parallel Slide
Stop Valve, Pedestal Bearing, Piston (4
Stroke), Piston (Upper And Rod), Piston
Type Stop Valve, Reducing Valve, Starting
Air Valve, Starting Air Pilot Valve, Stern

Tube And Tail Shaft, Telemotor Receiver, Tunnel Bearing, Valve Actuator.}

The drawing paper will consist of a test of the ability to apply the principles of projection and candidates will be asked to draw a plan, elevation, side view or section or a combination of these views of a piece of marine machinery from information supplied. Only one question will be set and all required information for the completion of the drawing will be given in the question paper.

PART 'B'

PAPER V : MARINE ENGINEERING **KNOWLEDGE (GENERAL)**

Marine Engineering Materials:

Properties and uses, Processes. Basic Metallurgy, metals and processes, Iron Carbon Equilibrium Diagram, Heat treatment of carbon steels, Non Ferrous alloys, Non-metallic materials, Welding, Gas cutting, Materials under load, Vibrations. Mechanical testing of Materials, Failure modes viz plastic deformation, fracture, fatigue, creep

Industrial Chemistry:

Fundamentals, Acidity/Alkalinity, Corrosion, Water testing/treatment, Introduction to fuels and lubricants, toxic and other ill effects of cargoes on human and environment.

Fabrication, Welding, Joining and Cutting:

Permanent joints, Riveting, Soldering, Self secured joints, Safety and health when welding, Principles of electrical arc welding, Principles of gas welding, Welded joints and low carbon steels, Common faults in welded joints, Plate work-marking out, Thermal Cutting, Mechanical Cutting, Forming, Bending Plates, Inspection, Pipe work. Non-destructive testings
Manufacture of components. Gauges, deck machinery, gearing, clutches.

Corrosion Control on Board Ship:

Thermodynamics & Kinetics of corrosion, various forms of corrosion, corrosion prevention methods.

Introduction to ship and ship's Routines:

Sensing and monitoring devices associated with marine equipment; Propulsion transmission systems, including thrust and shaft bearings, stern tubes and propellers; Steering and stabilizing systems, including bow thrusters; Refrigeration machinery and air conditioning systems; Safe and efficient operation in the UMS mode; Procedures to be adopted for operating main machinery under emergency conditions.

Auxiliary steam boilers and Auxiliary steam plant:

Steam boiler mountings and feed water systems; Auxiliary steam boilers and associated equipment, Boiler water testing and conditioning. Operation of auxiliary steam plant, pipelines, condenser, drain cooler. Auxiliary boiler fuel and air blower system. Methods of checking water level in steam boilers and action necessary if water level is abnormal.

Safe Engineering Watch-keeping:

Procedures to be adopted in safe watchkeeping. Procedures for taking over and handing over watches. Routine work during watchkeeping such as soot blowing, cleaning of filters, pumping out of bilges through oily bilge separator, routine pumping operations of fuel oil, ballast water, fire pump and cargo pumping system, remote operation of pumping system and associated controls, purification and clarification of fuel oil, purification of lubricating oil. Construction and characteristics of Separators, Purifiers and Clarifiers.

Location of common faults in machinery and plant in engine and boiler rooms and action necessary to prevent damage.

Interpretation of functional tests on communication and control system. Maintenance of machinery space log book and the significance of readings taken.

Ship Bilge/Ballast/oil – Pumps and pumping system. Hydrophore system:

Various types of pumps, construction, operation and characteristics. Compressors construction, operation and characteristics. Compressed air system. Air bottles, construction, mountings and associated system.

Fresh water generators and vacuum evaporators:

Construction, characteristics and operation of fresh water generators and vacuum evaporators.

Safety & emergency procedures:

Change over of remote/automatic to local control of all main and auxiliary systems. Safe working practices. Safe practices in carrying out hot work and welding. Procedure to be taken while handling heavy machinery parts and overhauling of engines. Cleaning, man-entry and hot work in enclosed compartments. Emergency procedures such as actions to be taken in case of fire including fire drill, flooding of engine room compartment, rescue operation of injured persons, actions to be taken in case of stoppage of main engine, auxiliary engine and associated system.

English language: Ability to communicate in oral form & write technical reports: understand and use technical/engineering publications

Internal communication systems:

Operation of all internal communication systems on board and maintain Statutory communication Records.

Engine Room Resource Management:

Allocation, assignment and principles of resources; effective communication, assertiveness and leadership; situational awareness

PAPER VI : MARINE ENGINEERING
KNOWLEDGE (MOTOR OR STEAM)

Marine Plant Operation:

Construction, characteristics and operation of large bore and medium speed Diesel Engine parts.

Performance characteristics of diesel engines by taking indicator cards. Steering gear, Auxiliary Boilers.

Operation of Marine Machinery, Equipments and Diesel Engines:

Marine Diesel engines, Aux. steam boilers, construction and details of all parts and fittings, Fuel and combustion systems, Marine diesel engine, marine gas turbines (trunk and cross-head types) gearing systems and clutches; Starting and reversing systems; Cooling and lubricating systems; Fuel oil preparation systems; Auxiliary diesel engine and associated equipment; Control and alarm systems associated with automatic operation of a diesel plant; Assessment of engine power, the running adjustments to maintain performance; Safe and efficient operation and maintenance of marine diesel engines/Steam turbines. Crank case inspection, depth gauge and crank shaft deflection. UMS operations. Governors. Turbo chargers. Supercharging and Scavenging system.

For Steam candidates:

Steam boilers, mountings, feed water systems and lubricating oil system. Gland sealing system. Assessment of plant efficiencies. Steam turbines, Gearing and Lubricating systems, Steam distribution systems, and associated equipment, condensers, ejectors, heat exchangers and feed heaters, air heaters and economisers and draining system of turbine and plants including steam traps. Manoeuvring system including Astern running.

ORALS

[The oral is the final assessment of Paper I (Marine Engineering Knowledge - General) and Paper II (Marine Engineering Knowledge - Motor/ Steam) of Part B. The assessment is on the function, *Marine Engineering at the Operational level* based on competences, knowledge, understanding and proficiency under this function. The criteria for evaluating competence is to be as per Column III of above]

FUNCTION 2: ELECTRICAL, ELECTRONIC AND CONTROL ENGINEERING AT THE OPERATIONAL LEVEL.

Knowledge, Understanding Proficiency / Course Covered	Methods of Demonstrating Competence	Criteria for Evaluating Competence
Competence No. 6: Operate electrical, electronic and control systems Basic configuration and operation principles of the following electrical, electronic and control equipment: .1 electrical equipment a. power generation systems, generator and distribution systems b. preparing, starting, paralleling and changing over generators c. induction electrical motors including starting methodologies d. high-voltage installations e. sequential control circuits and associated system devices .2 electronic equipment functions, a. characteristics of basic electronic circuit elements and features of control systems for major machinery items including main propulsion plant operation control and steam boiler automatic combustion control b. flowchart for automatic and control systems c. functions characteristics and features of control systems for machinery items including main propulsion plant operation control and steam boiler automatic controls of basic electronic circuit elements .3 control systems a. various automatic control methodologies and characteristics b. Proportional–Integral–Derivative (PID) control characteristics and associated system devices for process control	Examination and assessment of evidence obtained from one or more of the following: .1 approved in service experience. .2 approved training ship experience. .3 approved simulator training where appropriate. .4 approved laboratory equipment training.	Operations are planned and carried out in accordance with operating manuals, established rules and procedures to ensure safety of operations Electrical, electronic and control systems Structures and operating mechanisms can be understood and explained with drawings /instructions
Competence No. 7: Maintenance and repair of electrical and electronic equipment Safety requirements for working on shipboard electrical systems including safe	Examination and assessment of evidence obtained from one or more of the following: .1 approved workshop	Safety measures for working are appropriate Selection and use of hand tools, measuring instruments and testing devices are

isolation of electrical equipment required before personnel are permitted to work on such equipment Maintenance and repair works of for electrical system equipment, main switch boards, electric motors, generator and DC electrical systems and equipment. Detection of electric malfunction, location of faults and measures to prevent damage Construction and operation of electrical test and measuring equipment Function and performance tests of the following equipment and their configuration .1 monitoring systems .2 automatic control devices .3 protective devices The interpretation of electrical and simple electronic diagrams <u>DETAILED SYLLABUS & PAPERS UNDER FUNCTION OF ELECTRICAL, ELECTRONICS AND CONTROL ENGINEERING AT THE OPERATIONAL LEVEL WILL BE COVERED.</u> <u>PAPER VII : MARINE ELECTROTECHNOLOGY</u> Basic Electricity & Storage Batteries: The electrical circuit D.C. wire distribution system. Types of insulation. Wheatstone network bridge, slide wire bridge; applications to steering gears, resistance pyrometers, strain gauges etc. Electrolytic action and secondary cells. Theory of electrolytic dissociation applied to common solutions. Uses of electrolysis. Secondary cells (acid or alkaline), construction and principles, maintenance, charging. Watt-hour and ampere-hour efficiencies. Applied Electricity: Typical B/H and μ/B circuit. Alternating current theory. Simple continuous periodic waves: frequency, amplitude instantaneous, maximum r.m.s.	skills training .2 approved practical experience and tests .3 approved in-service experience .4 approved training ship experience	appropriate and interpretation of results is accurate Dismantling, inspecting, repairing and reassembling equipment are in accordance with manuals and good practice Reassembling and performance testing is in accordance with manuals and good practice

and average values, form factor. Phasor representation of a.c. quantities. Phase difference.

Simple treatment of power factor. Power in single phase a.c. circuit.

Electrical machines and troubleshooting:

Distribution systems. Systems. Systems of a.c. and d.c. shipboard installation. Protective devices such as fuses, circuit breakers, earth lamps. Cable material and installation. Connection of shore supply d.c. machines. The principles, constructional details and protection of d.c. series, shunt and compound wound motors and generators. Self excitation, e.m.f and load voltage equations. Load characteristics. Methods of voltage control, paralleling procedures and load sharing for generators. Need for and types of starter, speed and torque equations, speed control of d.c. motors.

a.c. machines, Simple explanation of the principles, constructional details and protection of alternators, squirrel-cage induction motors and single-phase transformers. Parallel running and synchronising theory. Synchronous motors, motor starters, Soft Starter, motor speed control, HV switch gear, switch gear equipments, MSB, DBS, HV & LV distribution, Electric Propulsion System, Layout of ships electrical system, fault level calculations, fault protection, electrical maintenance, electrical survey requirements, ships lighting.

Electronics:

Junction diodes, junction transistors and their operating characteristics. Simple transistor circuits. Transistor as an Amplifier, Switch, Oscillator. Transistor biasing and its types e.g. Fixed bias and potential divider bias. IC 555 based Timers, Alarms / Siren / Buzzers Photoelectric effect. Photo Electric Devices e.g. LED, LCD, 7 Segment Display, Power semiconductor devices e.g. SCR, PMOSFET, IGBT and Rectifier, Inverter its applications onboard ship e.g. Ship Propulsion and ballast, cargo pump control using variable frequency drives. Digital Electronics, communication

systems: Modulation & Demodulation, AM/FM transmitter and receivers, Radar. Operational Amplifier and its application in measurement and control of process parameters onboard ship.

Instrumentation:

Instruments. Qualitative treatment of the principles and functions of a.c. and d.c. indicating instruments and relays. Uses of shunts and series resistances to increase the range. Rectifiers and transducers. Rectifier analysis Filters, Regulated Power Supply using Zener diode, Transistors and IC with its applications. Types of transducers suitable for measurement and control of Temperature, Pressure, Flow, Level, Speed, Torque, Force, Acceleration, Vibration, Humidity and Moisture with calibration of all.

Control Systems:

Simple theory of all control systems, location of common faults and action to prevent damage. PID control, Basics and Tuning. V-I, I-V, P-I & I-P control. Programmable Logic Control: basics, operation, safety, maintenance and fault finding.

Maintenance and repair of electrical and electronic equipment

Maintenance of generators, motors and circuit breakers

Safe isolation of all electrical plants and equipments required before personnel are permitted to work on such plant and equipment.

ORALS

The assessment is on the function, ***Electrical, Electronics and Control Engineering at the Operational level*** based on competences, knowledge, understanding and proficiency under this function. The criteria for evaluating competence is to be as per Column III of above]

FUNCTION 3: - MAINTENANCE AND REPAIR AT THE OPERATIONAL LEVEL

Knowledge, Understanding & Proficiency / Course Covered	Methods of Demonstrating Competence	Criteria for Evaluating Competence
Competence No. 8: Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board Characteristics and limitations of materials used in construction and repair of ships and equipment Characteristics and limitations of processes used for fabrication and repair Properties and parameters considered in the fabrication and repair of systems and components Application of safe working practices in the workshop environment Methods for carrying out safe of emergency/temporary repairs Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools and measuring instruments Use of hand tools, machine tools and measuring instruments Use of various types of sealants and packings	Assessment of evidence obtained from one or more of the following: .1 approved workshop skills training .2 approved practical experience and tests .3 approved in-service experience .4 approved training ship experience	Identification of important parameters for fabrication of typical ship related components is appropriate Selection of material is appropriate Fabrication is to designated tolerances Use of equipment, and hand tools, machine tools and measuring instruments is appropriate and safe
Competence No. 9: Maintenance and repair of shipboard plant machinery	Examination and assessment of evidence obtained from one or more of the following:	Safety procedures followed are appropriate

and equipment Safety measures to be taken for repair and maintenance works Safety measures to be taken for repair and maintenance including safe isolation of shipboard machinery and equipment required before personnel are permitted to work on such machinery or equipment. Appropriate basic mechanical knowledge and skills Maintenance and repair works such as dismantling, adjustment and reassembling of plant machinery including propeller The use of appropriate specialized tools and measuring instruments Design characteristics and selection of materials in construction of equipment Interpretation of machinery drawings and handbooks The interpretation of piping, hydraulic and pneumatic diagrams <i>DETAILED SYLLABUS & PAPERS UNDER FUNCTION OF <u>MAINTENANCE AND REPAIR AT THE OPERATIONAL LEVEL</u> WILL BE COVERED.</i> <i><u>PAPER VIII : MARINE ENGINEERING PRACTICE</u></i> Marine Engineering Maintenance	.1 approved workshop skills training .2 approved practical experience and tests .3 approved in-service experience .4 approved training ship experience	Selection of tools and spare gear is appropriate Dismantling, inspecting, repairing and reassembling equipment is in accordance with manuals and good practice Re-commissioning and performance testing is in accordance with manuals and good practice Selection of materials is appropriate

Fastening, Preparation for work on machinery, heat exchangers etc., General maintenance procedure of Centrifugal Pumps fitted with a means of air extraction, reciprocating pumps. Screw and Gear Pumps, pipes, valves, air compressors, heat exchanger. Maintenance and repair of diesel engine, auxiliary steam engine, petrol engine, turbocharger, diesel engine components, wear and tear, alignment of machinery components, correction of defects, breakdown repairs, steering gear. Maintenance and repair of oil fuel burners, propulsion shafting, refrigeration, deck machinery. Maintenance and repair of Auxiliary Boilers; Maintenance and repairs of deck machinery and hydraulic equipments; Hull inspection, maintenance and repairs of vessel in dry dock. Maintenance and repairs of main boilers, turbines and steam plants (for steam candidates). Safety and emergency procedures, safe isolation of all main and auxiliary machineries required before personnel are permitted to work on such plant and equipment. Safe trials and commissioning after repairs and trials. <u>ORALS</u> [The assessment is on the function, <i>Maintenance and Repair at the Operational level</i> based on competences, knowledge, understanding and		

proficiency under this function. The criteria for evaluating competence is to be as per Column III of above]		

FUNCTION 4: - CONTROLLING THE OPERATION OF THE SHIP & CARE FOR PERSONS ON BOARD AT THE OPERATIONAL LEVEL

Knowledge, Understanding & Proficiency / Course Covered	Methods of Demonstrating Competence	Criteria for Evaluating Competence
Competence No. 10: Ensure compliance with pollution prevention requirements Prevention of pollution of the marine environment – Knowledge of the precautions to be taken to prevent pollution of the marine environment – Anti-pollution procedures and all associated equipment – Importance of proactive measures to protect the marine environment	Examination and assessment of evidence obtained from one or more of the following: .1 approved in service experience. .2 approved training ship experience. .3 approved training	Procedures for monitoring shipboard operations and ensuring compliance with MARPOL requirements are fully observed. Actions to ensure that a positive environmental reputation is maintained
Competence No. 11: Maintain seaworthiness of the ship. Ship Stability – Working knowledge and application of stability, trim and stress tables, diagrams and stress-calculating equipment – Understanding of the fundamentals of watertight integrity – Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy. Ship Construction – General knowledge of the principal structural members of a ship and the proper names for the various parts	Examination and assessment of evidence obtained from one or more of the following: .1 approved in service experience. .2 approved training ship experience. .3 approved simulator training where appropriate. .4 approved laboratory equipment training.	The stability conditions comply with the IMO intact stability criteria under all conditions of loading. Actions to ensure and maintain the watertight integrity of the ship are in accordance with accepted practice.
Competence No. 12: Prevent, control and fight fires on board. <i>Fire prevention and fire-fighting appliances</i>	Assessment of evidence obtained from approved fire-fighting training and	The type and scale of the problem is promptly identified and initial actions conform with the emergency procedure and

– Precautions against fire or explosion. Explosive mixtures, danger of oil leakages, sources of ignition, safety devices. – Knowledge of fire prevention – Ability to organise fire drills – Knowledge of classes and chemistry of fire – Knowledge of fire-fighting systems – Knowledge of action to be taken in the event of fire, including fires involving oil systems	experience as set out in section A- VI/3, paragraphs 1 to 3	contingency plans for the ship. Evacuation, emergency shutdown and isolation procedures are appropriate to the nature of the emergency and are implemented promptly. The order of priority, and the levels and time-scales of making reports and informing personnel on board, are relevant to the nature of the emergency and reflect the urgency of the problem.
Competence No. 13: Operate life saving appliance. <i>Life –saving</i> – Ability to organise abandon ship drills and knowledge of the operation of survival craft and rescue boats, their launching appliances and arrangements, and their equipment, including radio life-saving appliances, satellite EPIRBs, SARTs, immersion suits and thermal protective aids. – Knowledge of survival at sea techniques.	Assessment of evidence obtained from approved training and experience as set out in section A- VI/2, paragraphs 1 to 4	Actions in responding to abandon ship and survival situations are appropriate to the prevailing circumstances and conditions and comply with accepted safety practices and standards.
Competence No. 14: Apply medical first aid on board ship. <i>Medical aid</i> – Practical application of medical guides and advice by radio, including the ability to take effective action based on such knowledge in the case of accidents or illnesses that are likely to occur on board ship.	Assessment of evidence obtained from approved training As set out in section A- VI/4, paragraphs 1 to 3	Identification of probable cause, nature and extent of injuries or conditions is prompt and treatment minimises immediate threat to life.
Competence No. 15: Monitor compliance with legislative requirements. Basic working knowledge of the relevant IMO convention concerning safety of life at sea and protection of the marine environment.	Assessment of evidence obtained from examination or approved training course.	Legislative requirements relating to safety of life at sea and protection of the marine environment are correctly identified.
Competence No. 16: Application of leadership and teamworking skills Working knowledge of shipboard personnel management and training	Assessment of evidence obtained from one or more of the following: .1 approved training	The crew are allocated duties and informed of expected standards of work and behaviour in a manner appropriate to the individuals concerned

A knowledge of related international maritime conventions and recommendations, and national legislation Ability to apply task and workload management including: .1 planning and coordination .2 personnel assignment .3 time and resource constraints .4 prioritization Knowledge and ability to apply effective resource management: .1 allocation, assignment, and prioritization of resources .2 effective communication on board and ashore .3 decisions reflect consideration of team experiences .4 assertiveness and leadership including motivation .5 obtaining and maintaining situational awareness Knowledge and ability to apply decision-making techniques: .1 Situation and risk assessment .2 Identify and consider generated options .3 Selecting course of action .4 Evaluation of outcome effectiveness	.2 approved in-service experience .3 practical demonstration	Training objectives and activities are based on assessment of current competence and capabilities and operational requirements. Operations are demonstrated to be in accordance with applicable rules Operations are planned and resources are allocated as needed in correct priority to perform necessary tasks Communication is clearly and unambiguously given and received Effective leadership behaviours are demonstrated Necessary team member(s) share accurate understanding of current and predicted vessel and operational status and external environment Decisions are most effective for the situation
Competence No. 17: Contribute to the safety of personnel and ship Knowledge of personal survival techniques Knowledge of fire prevention and ability to fight and extinguishing fires Knowledge of elementary first aid Knowledge of personal safety and social responsibilities	Assessment of evidence obtained from approved trainings and experiences as set out in section A-VI/1, paragraph 2	Appropriate safety and protective equipment is correctly used Procedures and safe working practices designed to safeguard personnel and the ship are observed at all times Procedures designed to safeguard the environment are observed at all times Initial and follow-up actions on becoming aware of an

		emergency conforms with established emergency response procedures
<u>DETAILED SYLLABUS & PAPERS UNDER FUNCTION OF CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD AT THE OPERATIONAL LEVEL WILL BE COVERED</u> <u>PAPER IX : SHIP CONSTRUCTION & STABILITY</u> Ship construction: Common terms used in the measurement of steel ships. E.g. length between perpendiculars, breadth overall, moulded depth, draught and freeboard. Definitions of shipbuilding terms in general use. Descriptions and sketches of structural members in ordinary types of steel ships. Load Lines, Deck line, Free board, Plimsol line, Watertight doors. Hatches, Rudders, Bow-thrusters. Propellers, Watertight bulkheads. Double bottoms. Anchors and cables. Descriptive treatment of the effect of free surface of liquids on stability. Arrangements for the carriage of dangerous goods in bulk. Ventilation arrangements (natural and mechanical) for pump rooms in tankers and for holds and oil fuel tanks. Fore and aft peak tanks, double bottom and deep tank filling and pumping arrangements. Compartmental drainage. Leveling arrangements for damaged side compartments. Ship dimensions and form: General arrangement of General cargo, tankers, bulk carriers, combination carriers, containers, ro-ro and passenger ships, definitions of camber, rise of floor, flare, sheer, rake etc., Ship stresses: Hogging, sagging, racking, panting, pounding, slamming etc, Hull structure: Proper names for the various parts, standard steel sections etc., Bow and stern: Stern frame, structural arrangement forward and aft to withstand panting and pounding etc., Fittings: Water tightness to the hatches, opening in oil tankers, chain lockers and attachment of cables, bilge piping system, ballast system, sounding and air pipes etc., Rudders and propellers: Construction of		

rudders and propeller, controllable pitch propeller, stern tube arrangement etc.,
Process of welding.

Naval Architecture:

General. Displacement, Wetted surface, block midsection, prismatic and water-plane area coefficient. Bonjean Curves, Body Plan, Tonne per centimeter immersion. Application of Simpson's 1st and 2nd Rules to areas, moments of areas, volumes and moments of volumes, 2nd Moment of area, Application of 3, -8, 1 rule,

Displacement, Laws of Floatation, TPC, Coefficient of Form, Calculation of area, volume & moments. Transverse Stability of ships, Working knowledge and application of stability, trim and stress tables, diagrams and stress calculating equipment, fundamentals of water tight integrity, actions to be taken in the event of partial loss of intact stability.

Draught and buoyancy. Alteration of mean draught due to change in density of water, Buoyancy and reserve buoyancy. Effect of bilging amid ship compartments.

Transverse stability Centre of gravity. Centre of buoyancy. Metacentre. Shift of centre of gravity due to addition or removal of mass, transverse movement of mass. Stability at small angles of heel, KB, BM and Hydrostatic Curves, Moments of statical stability. The inclining experiment.

Resistance and propulsion. Comparison of skin frictional resistance of hull with model at different speeds. $R = f.s.v^n$ and residual resistance. Admiralty and Fuel coefficients. Relation between speed of vessel and fuel consumption with constant displacement and assuming that resistance varies as (speed)ⁿ.

PAPER X: SHIP SAFETY & ENVIRONMENTAL PROTECTION.

Precaution to be taken to prevent pollution of the Marine environment:

While bunkering, loading/ discharging oil cargo, tank cleaning, pumping out bilges, and knowledge of construction and operation of Oil pollution prevention equipment in engine room and on tankers.

Legislation awareness and compliance : MARPOL 73/78 as amended, GOI rules wrt pollution prevention and other national legislations like OPA – 90 etc and other applicable international conventions on pollution. Knowledge of Codes of Safe Working Practices as published; knowledge of type of information issued by D.G. Shipping with regard to safety at sea; Safe Working Practices; Oil record book and SOPEP manual. Ballast Water Management. Precautions against fire and explosions, fire prevention, detection and extinction in all parts of a ship Personal survival techniques and life saving appliances on ship, Medical Care: Theory of fire; Fire control aboard ships; Ship fire fighting organisations; Training of seafarers in fire fighting; Procedures for fire fighting; Inspection and servicing of fire appliances and equipment; Fire fighting process hazards; First aid; Fire investigations and reporting; Case studies; Introduction and safety; Emergency situations; Principles of survival; Use of survival equipment; Survival craft and rescue boat; Methods of helicopter rescue; Launching arrangements; Lifeboat engine and accessories; Evacuation; Signalling equipment and pyrotechnics; First aid; Radio equipment; Launching and handling survival craft in rough weather; Understands practical applications of medical guides; Understands process of radio medical advice; Demonstrates knowledge of actions to be taken in case of accidents or illnesses that are likely to occur on board ships Legislation with regard ship safety:		

SOLAS, Load lines Connection, STCW. Security Aspects: ISPS codes and its requirements, ship security plan, levels of security. Legislations: Knowledge of National & International legislation, IMO & Conventions, Indian Merchant Shipping Act & Rules, Classification society, Charterers, Personal relationship on board ship. Statutory Survey and Certification, Port State Control, Flag State Inspection, ISM Code. Leadership and team working skills: Engine room resource management, effective corrections, allocation of resources. Planning and coordination, work load management, time and resource constraints ORALS. [The assessment is on the function, <i>Controlling operation of ship and care for persons on board at the Operational level</i> based on competences, knowledge, understanding and proficiency under this function. The criteria for evaluating competence is to be as per Column III of above]		

ENGINE ROOM SIMULATOR COURSE (OPERATIONAL LEVEL)

Course Syllabus

SR NO	SUBJECT AREA	TRAINING METHOD	TIME (Hrs)
1	FAMILIRIARIZATION (3 HOURS) 1.1 Plant Arrangement .1 lists the machinery and associated systems and equipment which form the simulated plant as: • tanks • valves • pipe systems • pumps • heat exchangers • oil treatment plant • line filters • electric generators • steam generators • main propulsion unit • local controls • distant controls .2 describes how the machinery and associated systems and equipment are arranged and linked together to form the plant and compiles a block diagram illustrating this .3 compares the block diagram with the mimic diagram 1.2 Instrumentation .1 describes and lists the instrumentation used in the simulated plant to measure and indicate: • pressure • temperature • fluid level • volume/mass (quantity) • flow rate • speed of rotation • torque power • voltage • current (amps) • CO2 content (of exhaust gases) • pressure/volume in the engine cylinder (indicator diagram) .2 describes the alarms that are used to indicate malfunctions and faults 1.3 Controls .1 states that the machinery units forming the plant can be controlled from: • a position adjacent to the units in the "engine room" (local control) • a console in the "control room" (central control).	LECTURE/ SIMULATOR	1.0 0.5 0.5

	.2 states that the operation of the main propulsion unit can be monitored from the instructor console and faults introduced as required by the training program .3 states that the "instructor console can also be used to issue commands for main engine power .4 demonstrates the use of controls from each location 1.4 Operational procedures .1 states that the safe practices must always be used when preparing machinery units and associated systems for start up and operation .2 discusses the safe practices to be used for: • opening and closing valves • starting and running pumps • operating water-circulation system • admitting steam into a steam system • lighting fire in an oil-fired boiler • filling oil tanks • operating centrifuges .3 states that as far as is practicable a "check-list" should be used for all machinery units and systems when: • preparing for use • starting up • operating normally .4 compiles a check-list for the preparation, start-up and operation of an auxiliary machinery unit .5 states the special requirements for connecting an electrical generator into the electrical system in terms of: • speed • voltage • frequency • synchronization .6 demonstrates, using the simulated plant and a check-list, the procedures for: • opening and closing valves in a system • the circulation of sea-water • lighting an oil fire in the steam boiler • operating a fuel oil centrifuge • pumping out bilges		1.0

2	Operation (6 hours)	SIMULATOR/ LECTURE	
	2.1 General Procedures .1 observes and applies safe practices in all exercises .2 uses check-list in all exercises, as far as is practicable .3 maintains a "log" of procedures and normal operating conditions for each exercise 2.2 Auxiliary units and systems 1 prepares, starts up and puts into the normal operating mode: - the seawater circulating system - the freshwater circulating system - the compressed-air system - the fuel service tanks - the fuel centrifuge 2.3 Diesel-driven generator .1 prepares, starts up and runs the diesel-driven electrical generator .2 establishes the main electrical system using the diesel generator 2.4 Steam boiler .1 prepares and raises steam to normal working pressure .2 puts the steam boiler "on-line" into the steam system 2.5 Steam driven turbo generator .1 prepares, starts up ,and runs the steam driven –generator .2 connects the turbo generator into the main electrical system, applying control on: - voltage - Frequency - Synchronization .3 demonstrates load sharing between diesel and turbo generators 2.6 Main propulsion diesel engine .1 applies preparation procedures, including: - checking the seawater circulation through heat exchanger - checking the freshwater circulation through engine heat exchanger - checking the lubricating-oil circulation through engine heat exchanger - confirming that the engine-turning gear is "out" - checking the fuel oil circulation through heaters to injection pump inlet exchanger - confirming that the bridge/engine telegraph is functioning correctly - confirming that compressed air is available for starting - confirming that the engine cylinder lubrication is functioning - turning the engine on startingair for one revolution with indicator cock open		1.0 1.0 1.0 1.0 1.0 2.0

	.2 applies starting procedures, including: • confirming all cylinder cocks closed • confirming fuel oil circulation • confirmation of bridge order for engine movement • application of starting air for 3-4 • moving fuel control to required speed position .3 establishes the normal running mode and observes operating conditions, including: • temperatures of lubricating oil and cooling water • temperature of exhaust gas from each cylinder • temperature of engine exhaust gas at inlet and exit from turbocharger • engine speed and power output • maintaining a check on fuel oil supply (service tank) • maintaining a check on fuel viscosity/temperature .4 applies changes of engine speed and power as directed and notes changes in operating conditions		
3	WATCHKEEPING (5 HOURS)	SIMULATOR/ LECTURE	
	3.1 Taking over and accepting an engineering watch .1 enters the machinery space 15 minutes before the change of watch .2 inspects all operating units, noting operational conditions and any deviation from the normal mode • checks steam boiler water level • inspects bilge and underfloor spaces • notes engine telegraph instruction and checks engine control position and related speed • checks quantities and levels in engine room service tanks • examines the engine room log • receives a report from the engineer officer in charge of the watch for the period of watch keeping now completed • enters in the engine room log any abnormal operational conditions noted during inspection • if satisfied, accepts responsibility for the machinery space operation over the next period of watch keeping 3.2 Watch keeping routines and duties .1 at regular intervals, inspects all operational machinery, noting operating conditions and correcting any deviations from the normal mode .2 operates the oil fuel centrifuges as necessary (complying with anti pollution regulations) to maintain service tank levels .3 checks the levels and quantities in all engine room service tanks, transfers or “tops up” as necessary .4 records in the engine room log all required information on the operating conditions of main and auxiliary machinery		2.0 1.0

	.5 checks the steam boiler periodically, and makes necessary adjustments for: • water level • steam pressure and temperature • CO2 content of exhaust gas if on oil firing or • exhaust gas inlet and outlet temperature if operating on waste heat .6 check the seawater temperature periodically and adjusts the heat exchanger, control valves, as necessary to maintain the engine cooling water and lubricating oil within the correct operational range .7 checks that the main engine cylinder lubrication is within the correct range .8 checks the electrical system voltage and load, and, if two or more generators are operating, that the load is properly balanced .9 checks the pressure in compressed-air storage tanks and "tops up" as necessary, with air compressor .10 Inspects bilge and underfloor spaces and clears them as necessary, using the bilge pump and complying with any anti-pollution regulations .11 states that when serving on an actual ship the watch keeping routines and duties would also include responsibilities related to: • steering gear • propeller shaft gland • domestic fresh water • seawater for sanitary use 3.3 Main engine operation .1 applies maneuvering procedures and uses the controls to obtain different power outputs .2 with the engine control at a specific power setting, uses the recorder to obtain a cylinder p/v diagram ("indicator card") .3 notes all important operational parameters for this power setting .4 uses all data obtained to calculate • power output to shaft • cylinder mean effective pressure • power produced in cylinders • engine's mechanical efficiency • specific fuel consumption in kg/kW/hour .5 uses the thermal data obtained to construct an energy balance table		2.0
4	TROUBLE SHOOTING (3 HOURS)	SIMULATOR/ LECTURE	
	4.1 Main propulsion unit operating at full power .1 prepares, starts and runs the main propulsion unit and associated systems .2 sets the main propulsion unit controls to maximum full ahead sea power (or as directed from "bridge control") 4.2 Trouble-shooting procedures		1.0 2.0

	.1 locates and applies remedial action for the following malfunctions or faults • fuel injection timing (early/late) • worn piston ring in one cylinder • scavenge space fire • overheated main bearing • fouled heat exchanger surfaces • lubricating-oil circulation pump failure • lubricating oil filters choked • bilge spaces flooding		
		TOTAL HOURS	18. 0

Note: IMO reference (R):

R1 International Convention on Standards of Training, Certification and Watch keeping for Seafarers 2010

FORM OF TESTIMONIAL FOR SEA-SERVICE (ENGINEERS)
(For Ministry of Surface Transport Examination purpose only)

I, certify that the following is a full and true statement of sea service performed by _____ under my supervision in M. V./S.S. _____ O. No. _____ Port of Registry _____

Period of Service		Rank of Officer and actual seniority on Watch	Type of Main Engines and Boilers, Single or Twin Screw KW	Nature of duties (For appropriate description see below)
From	To			

During the whole period stated above, this Engineer Officer was on articles of agreement.

No. of days actual spent at Sea: _____

 Sign. of Master or Engr. Supt.

 Sign. Of Chief Engineer Officer

 (Name of the Master or Engr. Supt.)

 (Name of Chief Engineer Officer)

Dated _____ at _____

DESCRIPTION OF DUTIES

- I. On fitter's work either by day or regular watch. IV. On regular watch on Main Engines and Boilers Simultaneously.

- a) Within Main Engine and Boiler spaces.
- b) Outside Main Engine and Boiler Spaces.
- c) On refrigerating or other machinery not essential to the propulsion of the vessel
- d) On Auxiliary Engines separated from main propelling units, but worked in conjunction therewith.

II. On regular watch on Main Engines as

- a) Senior in full charge.
- b) First Assistant.
- c) Second Assistant.

III. On Regular which on Main Boiler.

- a) In-charge of all stoke holds.
- b) In-charge of section or one stokehold only.
- c) As Boiler Room Assistant.

- a) Senior in full charge.
- b) First Assistant.
- c) Second Assistant.

In ships where watches are kept on other than tradition system of not less than eight out of each twenty four hours, a brief description of the duration and frequency of the watches should be given.

Mention of periods on day work or on fitters' work by watch should be made. This is particularly applicable to vessels that.

1. Have a centralised control room:
2. Are fully or partly automated.
3. Have arrangements such as the engine room is unmanned for some part of the twenty-four hours.

NOTE: It is recommended that this form should be used when the Engineer is reported on or when the Chief Engineer leaves the ship.

**SUMMARY OF WRITTEN EXAMINATION TO BE CONDUCTED BY THE CHIEF EXAMINER OF
ENGINEERS FOR COMPETENCE FOR SECOND ENGINEER OFFICER ON SHIPS POWERED BY MAIN
PROPULSION MACHINERY OF 3000 kW OR MORE**

REFERENCE TABLE A - III/ 2

	SUBJECTS UNDER EACH FUNCTION	COMPETENCIES COVERED	DURATION OF EXAM	MAXIMUM MARKS	PASS MARKS
	Marine Engineering at management level				
i	PART – A Paper - I. Mechanics & Hydromechanics.	 1, 2, 3 & 4	3 hours	100	50
ii	Paper - II. Thermodynamics & Heat transmission.		3 hours	100	50
iii	PART – B Paper - I. Marine Engineering Knowledge (General)		3 hours	100	50
iv	Paper - II. Marine Engineering Knowledge (Motor or Steam).		3 hours	100	50
	Orals			100	60
	Electrical, Electronic & Control Engineering at the management level				
v	Paper - III. Marine Electro Technology.	 5 & 6	3 hours	100	50
	Orals			100	60
	Maintenance & Repair at the management level				
vi	Paper – IV. Marine Engineering Practice.	 7, 8 & 9	3 hours	100	50
	Orals			100	60
	Controlling the operation of the ship & care for persons on board at management level.				
vii	Paper - V. Naval Architecture & Ship Construction.	 10, 11, 12, 13 & 14	3 hours	100	50
viii	Paper - VI. Ship’s Safety & environmental protection &		3 hours	100	50
	Personnel care.				
	Orals				100

SUMMARY OF POSTSEA TRAINING PROGRAMMES, EXAMINATION & ASSESSMENT FOR MEO CLASS II

Regulation III/2 of STCW 2010 & Section A - III/2 of STCW Code.

Department:
Engine

Level:
Management

Capacity: Second Engineer Officer

Duration:
4 Months

NO.	COMPETENCE	HOURS	TYPE OF ASSESSMENT
		INSTITUTION	
		CLASS	
Function 1: Marine Engineering at the Management Level.			
1.	Manage the operation of propulsion plant machinery	180 hrs Note: 90 hrs is to be devoted for Marine Engineering Knowledge (General) paper + 90 hrs is to be devoted for Marine Engineering Knowledge (Motor or Steam) paper	Written examination & or skills test.
2.	Plan and Schedule operations		
3.	Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery		
4.	Manage fuel, lubrication and ballast operations		
Function 2: Electrical, Electronic & Control Engineering at the Management Level.			
5.	Manage operation of electrical and electronic control equipment	100hrs Note: The time is to be devoted for Marine Electro Technology paper.	Written examination & or skills test.
6.	Manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition		

Function 3: Maintenance and repair at the management level.			
7	Manage safe and effective maintenance and repair procedures	60 hrs Note: The time is to be devoted for Marine Engineering Practice paper.	Written examination & or skills test.
8	Detect and identify the cause of machinery malfunctions and correct faults		
9	Ensure safe working practices		
Function 4: Controlling the operation of the ship and care for persons on board at the management level			
10	Control trim, stability and stress	140 hrs Note: 50 hrs is to be devoted for Naval Architecture paper + 90 hrs is to be devoted for Ship's Safety, Environmental Protection and Personnel care paper.	Written examination & or skills test.
11	Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea, security and protection of the marine environment		
12	Maintain safety and security of the vessel, crew and passengers and the operational condition of life-saving, fire-fighting and other safety systems		
13	Develop emergency and damage control plans and handle emergency situations		
14	Use leadership and managerial skills		
	TOTAL	480 Hours	

For each Function a variation of +/- 10 hrs is permitted, however the total hrs will remain 480 hrs.

NOTE: - 1. Candidate must have passed or exempted from MEO Class II Part A examination before appearing for MEO Class II Part B examination.

REF. TABLE A – III/2

SPECIFICATION OF MINIMUM STANDARD OF COMPETENCE FOR SECOND ENGINEER OFFICER ON SHIPS
POWERED BY MAIN PROPULSION MACHINERY OF 3000 kW OR MORE

FUNCTION 1: MARINE ENGINEERING AT THE MANAGEMENT LEVEL

Knowledge, Understanding & Proficiency / Course Covered	Methods of Demonstrating Competence	Criteria for Evaluating Competence
Competence No. 1: Manage the operation of propulsion plant machinery Design features, and operative mechanism of the following machinery and associated auxiliaries: 1. marine diesel engine 2. marine steam turbine 3. marine gas turbine 4. marine steam boiler	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate .4 approved laboratory equipment training	Explanation and understanding of design features and operating mechanisms are appropriate
Competence No. 2: Plan and Schedule operations Competence No. 3: Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery Theoretical knowledge Thermodynamics and heat transmission Mechanics and hydromechanics Propulsive characteristics of diesel engines,	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training,	The planning and preparation of operations is suited to the design parameters of the power installation and to the requirements of the voyage The methods of preparing for the start-up and of making available fuels, lubricants, cooling water and air are the most appropriate Checks of pressures, temperatures and revolutions during the start-up and warm-up period are in accordance with technical specifications and agreed work plans

steam and gas turbines, including speed, output and fuel consumption Heat cycle, thermal efficiency and heat balance of the following: 1. marine diesel engine 2. marine steam turbine 3. marine gas turbine 4. marine steam boiler Refrigerators and refrigeration cycle Physical and chemical properties of fuels and lubricants Technology of materials Naval architecture and ship construction, including damage control Practical knowledge Start up and shut down main propulsion and auxiliary machinery, including associated systems Operating limits of propulsion plant The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery Functions and mechanism of automatic control for main engine Functions and mechanism of automatic control for auxiliary machinery including but not limited to: 1. generator distribution systems 2. steam boilers 3. oil purifier 4. refrigeration system 5. pumping and piping systems 6. steering gear system 7. cargo-handling equipment and deck machinery	where appropriate .4 approved laboratory equipment training	Surveillance of main propulsion plant and auxiliary systems is sufficient to maintain safe operating conditions The methods of preparing the shutdown, and of supervising the cooling down of the engine are the most appropriate The methods of measuring the load capacity of the engines are in accordance with technical specifications Performance is checked against bridge orders Performance levels are in accordance with technical specifications
Competence No. 4:Manage fuel, lubrication and ballast operations Operation and maintenance of machinery, including pumps and piping systems. Construction and characteristics of pumps and pumping systems used for fuel and ballast operations.	Examination and assessment of evidence obtained from one or more of the following:	Fuel and ballast operations meet operational requirements and are carried out so as to prevent pollution of the marine environment

Piping system of fuel and ballast operations. SOLAS Regulations on fuel and ballast systems and its implementation on board and ashore. Routine and emergency preparedness of pollution prevention from fuel. Ballast water contamination.	.1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate	

FUNCTION 2: ELECTRICAL, ELECTRONIC & CONTROL ENGINEERING AT THE MANAGEMENT LEVEL.

Competence No. 5:Manage operation of electrical and electronic control equipment <i>Theoretical knowledge</i> Marine electro technology, electronics, power electronics, automatic control engineering and safety devices Design features and system configurations of automatic control equipment and safety devices for the following: 1. main engine 2. generator and distribution system 3. steam boiler Design features and system configurations of operational control equipment for electrical motors Design features of high-voltage installations Features of hydraulic and pneumatic control equipment	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate .4 approved laboratory equipment training	Operation of equipment and system is in accordance with operating manuals Performance levels are in accordance with technical specifications
Competence No. 6:Manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition <i>Practical knowledge</i> Troubleshooting of electrical and electronic control equipment Function test of electrical, electronic control equipment and safety devices Troubleshooting of monitoring systems Software version control	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate .4 approved laboratory equipment training	Maintenance activities are correctly planned in accordance with technical, legislative, safety and procedural specifications Inspection, testing and troubleshooting of equipment are appropriate

FUNCTION 3: MAINTENANCE AND REPAIRS AT THE MANAGEMENT LEVEL.

Competence No. 7: Manage safe and effective maintenance and repair procedures <i>Theoretical knowledge</i> Marine engineering practice <i>Practical knowledge</i> Organizing & managing safe and effective maintenance and repair procedures Planning maintenance, including statutory and class verifications Planning repairs	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved workshop training	Maintenance activities are correctly planned and carried out in accordance with technical, legislative, safety and procedural specifications Appropriate plans, specifications, materials and equipment are available for maintenance and repair Action taken leads to the restoration of plant by the most suitable method
Competence No. 8: Detect and identify the cause of machinery malfunctions and correct faults <i>Practical knowledge</i> Detection of machinery malfunction, location of faults and action to prevent damage Detection of faults of machinery by visual inspection, NDT methods (Non-destructive examination) and by other advanced systems such as vibration monitoring (condition monitoring). Inspection and adjustment of equipment Modern approach to machinery reliability methods and their execution. Principles of Tero technology. Principles and practice of reliability and trends in breakdown. Typical failures and fault diagnosis. Reliability of machinery, its principle and practice.	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate .4 approved laboratory equipment training	The methods of comparing actual operating conditions are in accordance with recommended practices and procedures Actions and decisions are in accordance with recommended operating specifications and limitations
Competence No. 9: Ensure safe working practices <i>Practical knowledge</i> Safe working practices, overhauling machinery, mechanical safety in workshops, protective equipment, lifting gear, entering tanks, work in confined and hazardous spaces. Precautions against fire or explosion. Explosive mixtures. Danger of oil leakage's.	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved laboratory equipment training	Working practices are in accordance with legislative requirements, codes of practice, permits to work and environmental concerns

Sources of ignition. Safety devices.		
Toxic and other dangerous properties of substances used in marine practice. Maintenance of plant associated with the carriage of dangerous goods.		

FUNCTION 4: CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD AT THE MANAGEMENT LEVEL

Competence No. 10:Control trim, stability and stress Understanding of fundamental principles of ship construction and the theories and factors affecting trim and stability and measures necessary to preserve trim and stability Knowledge of the effect on trim and stability of a ship in the event of damage to, and consequent flooding of, a compartment and countermeasures to be taken Knowledge of IMO recommendations concerning ship stability	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate	Stability and stress conditions are maintained within safety limits at all times Procedures for monitoring operations and maintenance comply with legislative requirements Procedures for monitoring operations and maintenance comply with legislative requirements Potential non-compliance is promptly and fully identified Requirements for renewal and extension of certificates ensure continued validity of survey items and equipment
Competence No. 11:Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea, security and protection of the marine environment Knowledge of relevant international maritime law embodied in international agreements and conventions. Regard shall be paid especially to the following subjects: 1. certificates and other documents required to be carried on board ships by international conventions, how they may be obtained and the period of their legal validity 2. responsibilities under the relevant requirements of the International Convention on Load Lines, 1966, as amended 3. responsibilities under the relevant requirements of the International Convention for the Safety of Life at Sea, 1974, as amended 4. responsibilities under the International Convention for the Prevention of Pollution from Ships, as amended 5. maritime declarations of health and the		

requirements of the International Health Regulations 6. responsibilities under international instruments affecting the safety of the ships, passengers, crew or cargo 7. methods and aids to prevent pollution of the environment by ships 8. knowledge of national legislation for implementing international agreements and conventions		
Competence No. 12: Maintain safety and security of the vessel, crew and passengers and the operational condition of life-saving, fire-fighting and other safety systems A thorough knowledge of life-saving appliance regulations (International Convention for the Safety of Life at Sea) Organization of fire and abandon ship drills Maintenance of operational condition of life-saving, fire-fighting and other safety systems Actions to be taken to protect and safeguard all persons on board in emergencies Actions to limit damage and save the ship following fire, explosion, collision or grounding.	Examination and assessment of evidence obtained from practical instruction and approved in-service training and experience	Procedures for monitoring fire-detection and safety systems ensure that all alarms are detected promptly and acted upon in accordance with established emergency procedures
Competence No. 13: Develop emergency and damage control plans and handle emergency situations Ship construction, including damage control. Methods and aids for fire prevention, detection and extinction. Functions and use of life-saving appliances		Emergency procedures are in accordance with the established plans for emergency situations
Competence No. 14: Use leadership and managerial skills Knowledge of shipboard personnel management and training A knowledge of international maritime conventions and recommendations, and related national legislation Ability to apply task and workload management, including: 1. planning and coordination 2. personnel assignment 3. time and resource constraints	Assessment of evidence obtained from one or more of the following: .1 approved training .2 approved in-service experience .3 approved simulator training	The crew are allocated duties and informed of expected standards of work and behaviour in a manner appropriate to the individuals concerned Training objectives and activities are based on assessment of current competence and capabilities and operational requirements Operations are demonstrated to be in accordance with

4. prioritization <i>Knowledge and ability to apply effective resource management:</i> 1. allocation, assignment, and prioritization of resources 2. effective communication on board and ashore 3. decisions reflect consideration of team experience 4. assertiveness and leadership, including motivation 5. obtaining and maintaining situation awareness <i>Knowledge and ability to apply decision-making techniques:</i> 1. situation and risk assessment 2. identify and generate options 3. select course of action 4. evaluation of outcome effectiveness Development, implementation, and oversight of standard operating procedures		applicable rules Operations are planned and resources are allocated as needed in correct priority to perform necessary tasks Communication is clearly and unambiguously given and received. Effective leadership behaviors are demonstrated Necessary team member(s) share accurate understanding of current and predicted vessel state and operational status and external environment Decisions are most effective for the situation Operations are demonstrated to be effective and in accordance with applicable rules

**DETAILED SYLLABUS & PAPERS UNDER WHICH FUNCTION OF MARINE ENGINEERING AT THE
MANAGEMENT LEVEL WILL BE COVERED**

PART A

PAPER I : MECHANICS AND HYDROMECHANICS

Mechanics and Hydromechanics -

Theoretical Knowledge - Statics, Dynamics, Friction, Balancing, Simple Harmonic Motion, Stress & Strain, Bending of Beams, Torsion, Struts, Combined Stress, Stresses in Thick Shells, Fluid Mechanics.

1. **Statics** - Bow's notation, Force analysis by method of sections, framed structures.
2. **Dynamics** - Equations of motion, Velocity and acceleration diagrams, Laws of conservation of energy and momentum, Collision of rigid and elastic bodies, Projectiles, Engine mechanisms, Flywheels, Hoists, Cams, Governors, Simple and epicyclic gear systems, Vehicle dynamics.
3. **Friction** - Sliding friction on horizontal and inclined planes, Cotter, Screw threads, Belt drives, Friction brakes, Plate and cone clutches.
4. **Balancing** - Primary and secondary forces, Primary and secondary couples, Complete balancing of reciprocating machinery.
5. **Simple Harmonic Motion** - Equation of simple harmonic motion, Amplitude, frequency and periodic time, Vibrating spring mass systems, Springs, Resonance, Transmissibility, Vibrations of flywheels and gearwheels.
6. **Stress & Strain** - Stress and strain relationships in thin cylindrical and spherical shells, Stress in thin, rotating rims, Thermal stress, Stress in compound bars, Elastic strain energy, Stresses due to gradually applied and shock loads.
7. **Bending of Beam** - Shear force and bending moment diagrams, Fundamental bending equation, Bending stresses, Deflection of beams. Macaulay's method.
8. **Torsion** - **Stress**, strain and strain energy due to torsion, Fundamental torsion equation, Reciprocating engine crank effort, Rudder stock turning moment from steering gear, Deflection of helical springs.
9. **Struts** - Euler's formula, Slenderness ratio.
10. **Combined Stress** - Stresses on an oblique plane, Material subjected to two perpendicular stresses, Axial and bending stress, Mohr's stress circle. Principal stresses and strains, Combined bending and twisting.
11. **Stresses In Thick Shells** - Lamé's equations, The Lamé Line, Shrinkage allowance.

- 12. Fluid Mechanics** - Volume and mass flow, Venturi meter, Bernoulli's equation, Jets. Orifice coefficients, Dynamic and kinematic viscosity, Reynolds' number, Flow losses in pipes and fittings, Darcy's formula, Centrifugal pumps.

PART A

PAPER II : THERMODYNAMICS AND HEAT TRANSMISSION

Thermodynamics and Heat Transmission -

Theoretical Knowledge - Thermodynamic Fundamentals, Perfect Gas, Second Law, Gas Cycles/Engine Analysis, Properties of Vapours, Steam Cycles, Steam Turbine Velocity Diagrams, Refrigeration, Combustion, Compressors, Heat Transfer, Air Conditioning.

1. **Thermodynamic Fundamentals** - System and working substance, SI Units. Property and State, Reversible and Irreversible processes, Reversible work of compression or expansion, First Law applied to non-flow and flow processes, Throttling, nozzles and mixing of streams.
2. **Perfect Gas** - Equation of state, Specific heat, internal energy, Adiabatic, polytropic, isobaric and isothermal compression/expansion, Enthalpy, Gas mixtures and Daltons Law of partial pressures.
3. **Second Law** - Classical statements, Heat engine, Thermal efficiency, Entropy, Isentropic process, Reversible heat engine, Temperature – entropy (T-s) diagram for a perfect gas, Isentropic efficiency.
4. **Gas Cycles/Engine Analysis** - Constant pressure and constant volume air standard cycles, Reciprocating internal combustion engine performance parameters, indicator diagrams, power, mean effective pressure, thermal efficiency, brake specific fuel consumption, mechanical efficiency, energy balance, Open and closed gas turbine systems, Power, isentropic efficiency and thermal efficiency for gas turbines.
5. **Properties of Vapours** - Saturation, dryness fraction and superheat, T-s, p-h, p-v, h-s diagrams, Fluid properties using steam tables, Throttling and separating calorimeters, Air in condensers.
6. **Steam Cycles** - Rankine cycle. Turbine isentropic efficiency, Feed heating, Thermal efficiency, Cycle on T-s diagram,
7. **Steam Turbine Velocity Diagrams** - Principles of reaction and impulse turbines including compounding, Velocity diagrams, Nozzle steam velocity (excluding proof of critical pressure ratios), Force and work done on blades.
8. **Refrigeration** - Vapour compression cycle, Refrigerant properties and hazards, Refrigerant tables, Cycle on p-h diagram, Coefficient of performance, Refrigerant mass flow, Compressor calculations, Secondary refrigerants.
9. **Combustion** - Combustion equations, Fuel composition, Air-fuel ratio, Excess air, Volumetric analysis of combustion products, Calorific value.
10. **Compressors** - Reciprocating compressors: Operating principles, volumetric efficiency, free air delivery, power, mechanical efficiency, isothermal efficiency, multi-stage and inter-

cooling, p-V diagram, Positive displacement rotary compressors: Operating principles, power, efficiency.

- 11. Heat Transfer** - Conduction, radiation and convection, Composite walls. Insulation, Film coefficient, Interface temperature, Stefan-Boltzmann Law, Parallel flow and cross flow heat exchangers, Logarithmic mean temperature difference.
- 12. Air Conditioning** - Comfort conditions, Psychrometric charts, Wet and dry bulb temperatures, Humidity, Dew point, Dehumidifying and humidifying processes, Air conditioning systems.
- 13. Heat Cycle**, Thermal Efficiency and Heat Balance of Marine diesel engine, Marine steam turbine, Marine gas turbine, Marine steam boiler.

PART B

PAPER I : MARINE ENGINEERING KNOWLEDGE (GENERAL)

The Engineering knowledge to be shown by candidates in that which is required for the use, operation and maintenance of the machinery, equipment and ship structure usually in the charge of an Engineer Officer at Management level.

Candidates may be required to illustrate their answers by means of freehand sketches.

The scope would include following:

- 1. Technology of materials** - Metallurgy of Steel and Cast Iron, Properties and application of material used in machinery on board ships, Destructive and non-destructive testing of material, Engineering processes used in construction and repair, Materials and welding.
- 2. Physical & chemical properties of fuel & lubricants** - Production of Oils from Crude Oil, Properties and characteristics of fuels and lubricants, Shore side and shipboard sampling and testing, Interpretation of test results, Contaminants including microbiological infection, Treatments of fuels and lubricants including storage, centrifuging, blending, pretreatment and handling.
- 3. Construction details**, and where applicable the manner of attachment to ship, principles involved and operation Surveillance & Performance assessment of :
 - I. water gauge, thermometer, salinometer, ammeter, water meter, pressure gauge and other meters and gauges commonly used by engineers on board ship.
 - II. All auxiliary machineries of engine room including associated systems, pumps, pumping and piping systems, oily water separators.
 - III. Thrust blocks, shafting, bearings, stern tubes, and propellers, shipside fittings.
 - IV. steering gear, stabilisers.
 - V. Refrigeration machinery, deck machinery.
 - VI. Auxiliary boilers and steam plant.
 - VII. Auxiliary compression ignition engines and associated plant.
 - VIII. turbo-electric, diesel electric, gas turbine drives.

- 4. Start Up and Shut down of Auxiliary Machinery**, including associated system: Air compressors and compressed air systems, Hydraulic power system, Types of auxiliary boilers, Auxiliary steam system, Safety valves, Boiler water levels, Use of 'Sea water in Boilers', Use of 'Fresh Water in Boilers', Boiler Water Testing, Boiler Water Treatment, Auxiliary Steam turbines, Boiler defects, Boiler and Steam turbine survey and repairs, Evaporators, Thermal fluid heating system
- Safe and efficient operation, Surveillance & Performance assessment of electrical machines and systems.
 - Requirements, including operations and maintenance of pumps and pumping systems including bilge, fire main, ballast, sewage & sludge systems.
 - Refrigeration, working principles of air conditioning, cargo and domestic refrigeration plants. Refrigerants used in the marine refrigeration plants, green house effects and future refrigerants. Air conditioning including psychometric process for heating, cooling and humidification.
 - Steering gear systems, single failure criteria of steering gear Surveillance & Performance assessment.
 - Operation and testing of pneumatic hydraulic and electric control systems.
 - Functions and Mechanism of Automatic Control for auxiliary machinery: Generator distribution system, Steam boiler, Oil purifier, Refrigeration system, Pumping and piping system, Steering gear system, Cargo-handling equipment and deck machinery.
 - Operation of cargo handling equipment and deck machinery.
 - Operation of fresh water systems, fresh water generating systems and its performance assessment.
 - Shipboard Personnel & Resource Management & emergency preparedness.

PART B

PAPER II : ENGINEERING KNOWLEDGE (MOTOR)

1. Design of Marine machinery:

Design features and operating mechanisms of marine diesel engines, marine gas turbines and marine steam boilers. Technical communications for design.

2. Operations of marine machinery:

- .5 Propulsive characteristics of diesel engines and gas turbines, including speed, output and fuel consumption. Operating limits of the propulsion plants.
- .6 Safe and efficient operation and surveillance of, main propulsion plant and its systems and services. The determination of shaft power and recognition of irregularity in the performance of the machinery and plant. Operation, monitoring and evaluation of engine performance and capacity.
- .7 Analysis and interpretation of information gained from monitoring equipment. Operation of gearing, clutches, air compressors.
- .8 Planning and scheduling of engine operations.
- .9 Functions and mechanism of automatic control of main engine.
- .10 Safety of engine equipment, systems and services.

- 3. Start up and Shut down main and auxiliary machinery, including associated system** – Engine components, engine lubrication, fuel injection, scavenging and supercharging, starting and reversing, cooling systems, diesel engine control and safety, diesel engine emergency operation, multi-engine propulsion arrangement.

3.1 Engine components

- (a) Interpret static and dynamic loads and stresses, identifying service limitations of diesel engine components.
- (b) Evaluate different fabrication methods of diesel engine components, including: Welding, forging, utilizing composite materials, plasma-spraying, laser hardening and use of ceramics and other special materials.
- (c) Identify two and four stroke operating cycle forces, couples, and moments, relating these to design principles of: Crankshafts, bedplates, foundations, cross heads.
- (d) Explain out of balance gas and inertia forces, couples, and moments, and relate these to flywheels, balance weights, and first/second order balancing, and hull vibration.
- (e) Explain factors contributing to torsional vibration, and identify methods of minimizing or eliminating harmful effects of critical speeds.
- (f) Evaluate the calibration of: Pistons, cylinder liners, piston rings, bearings, crankshafts, to identify wear patterns, limits, and means of correction
- (g) Specify alignment and adjustment criteria of: Crankshafts, chain drives, gear drives, integral thrust bearings, crossheads
- (h) Compile specified working clearances and limits of all bearings, sliding surfaces, and interference fits of a typical diesel engine, using engine builders' manuals.

3.2 Engine Lubrication

- (a) Identify diesel engine lubricant types, properties, and applications. Outline principles of diesel engine lubrication. Contamination and deterioration of diesel engine lubricants - Discuss the sources/ causes types, and effects of contamination.
- (b) Describe typical testing and treatment methods, and Interpret typical results of testing, giving appropriate actions which should be undertaken.
- (c) Describe, using diagrams, the distribution of lubricating oil to diesel engines, in particular the: Guides and crosshead bearings of slow speed diesel engines, Top end bearings of medium speed engines, Bottom end bearing, Main bearings, Camshaft drives, showing direction of flow, typical clearances, and stating normal operating parameters.

3.3 Fuel Injection

- (a) Explain why atomization and penetration of fuel and the turbulence of air are essential to optimum combustion in a diesel engine.
- (b) State typical injection pressures and viscosities for different grades of fuel.
- (c) Describe how and why fuel pumps, camshafts, and injectors are altered for varying fuel types.
- (d) Describe, with the aid of simple sketches, the difference between constant and variable injection timing of fuel, showing materials, principal parts, methods of operation and adjustments of common types of fuel pump.
- (e) Compare injection requirements for slow speed, medium speed, and high speed diesel engines, including pilot injection and pre-combustion chambers.

- (f) Identify common service faults, symptoms, and causes of combustion problems, specifying appropriate adjustments, including methods of fuel pump timing.
- (g) Summarize Occupational Health & Safety aspects of handling and testing fuel injection systems.
- (h) Explain, using relevant diagrams and stating normal operating parameters: Fuel valve cooling arrangement and Uni-fuel and dual-fuel systems (for high/medium viscosity fuel types)
- (i) Discuss the atmospheric pollution aspects of diesel engine combustion, and give methods which reduce this pollution (especially SO_x and NO_x reduction).

3.4 Scavenging and Supercharging

Evaluate the need for scavenging diesel engines, Compare methods of scavenging diesel engines, Specify methods of providing pressurized air for combustion in diesel engines, Assess pressure charging methods for diesel engines, Assess pressure charging methods for diesel engines, Examine the working principles of turbochargers, Assess lubrication and cooling requirements of turbochargers, Analyze typical faults and identify appropriate actions to be undertaken with defective or damaged turbochargers.

3.5 Starting and Reversing

- (a) Describe starting procedures of diesel engines for power generation, propulsion, and emergency use.
- (b) Explain starting and maneuvering requirements/sequences for direct coupled reversible and geared propulsion diesel engines, for fixed and controllable pitch propeller applications
- (c) Describe, with labeled diagrams to indicate major components, typical maneuvering and reversing systems for propulsion diesel engines
- (d) Compare different methods of reversing direct coupled propulsion diesel engines
- (e) Identify common faults and identify appropriate actions to be undertaken with typical diesel engine starting and maneuvering systems
- (f) Compare the different methods of utilizing diesel engines for ship propulsion, including - Direct coupled, reversible slow and medium speed engines and Clutched and geared reversible and unidirectional medium speed engines with a fixed pitch propeller, Clutched and geared reversible and unidirectional medium speed engines with a controllable pitch propeller, and Diesel electric drive.

3.6 Cooling systems

- (a) Analyze the problems that may arise in cooling water spaces of diesel engines.
- (b) Evaluate common methods of diesel engine cooling water treatment.
- (c) State the importance of maintaining diesel engine thermal efficiency and evaluate thermal loads on engine components.
- (d) Justify cooling media selection and state the advantages and disadvantages of various diesel cooling methods.
- (e) Evaluate the tests used in the control of diesel engine cooling water treatment.
- (f) Enumerate the normal operating limits for diesel engine cooling water treatment.
- (g) Interpret the implications of out of limit readings from water treatment tests and state the corrective procedures which should be undertaken.

- (h) Itemize the sources and types of contamination of diesel engine cooling water and explain the effects of these contaminations on the reserves of treatment chemicals.
- (i) Compare the procedures which may be used to counter contamination of diesel engine cooling water.
- (j) Explain, using relevant diagrams and stating normal operating parameters, typical methods of cooling:
- (k) Medium and slow speed diesel engine pistons, Exhaust valves, Cylinders, Turbochargers, Cylinder heads.

3.7 Diesel Engine Control and Safety

3.8 Diesel Engine Emergency operation

3.9 Multi-engine Propulsion Arrangement

ENGINEERING KNOWLEDGE (STEAM)
(For Candidates seeking certification for ships with main propulsion plant operated by steam boilers & steam turbines)

1. Design features and operative mechanism of a Marine Steam Turbines and associated auxiliaries

- (a) Describes with the aid of sketches/computer aided drawing, material selection and design features of steam turbines - Convergent and convergent/divergent nozzles and Nozzle boxes, Impulse and reaction turbines, Pressure and velocity compounding, Pressure/velocity diagrams, Optimum blade speeds, Hybrid blades, Materials of blades and other components, Turbine construction, Erosion shields, Bearings, thrust bearings, Turbine glands and gland steam systems, Astern turbines, Turbine casings, Diaphragms, Reheat turbines, Support and expansion of turbines.
- (b) Describes with the aid of sketches the operative mechanism of steam turbines - Alarms and trips, Warming through, Normal and emergency operation, Shut down procedures, Turbine performance, Sequential nozzle operation, Resonance, Critical speed, Vibration, Emergency control systems, Rotor straightening.
- (c) Describes with the aid of sketches/computer aided drawing, material selection and design features of steam turbine gear box - Single and double reduction, Double helical involute gear teeth, Single and double locked gear trains, Epicyclic gearing, Flexible couplings, Nodal drive, Method of manufacturing of spur gears.

2. Design features and operative mechanism of Marine Steam Boiler and associated auxiliaries

- (a) Describes with the aid of sketches/computer aided drawing, material selection and design features of marine steam boilers - Types of main steam boilers, Methods of construction, Boiler fittings and drum internals, Water circulation, Gas circulation, Operating parameters, Support and expansion, Super heaters and their temperature control, Soot blowers, Economizers, Air heaters, Steam to steam generation, Chemistry of combustion, Burners and burner registers, Local and remote water level indicators, Safety valves.
- (b) Describes with the aid of sketches/computer aided drawing, material selection and design features of marine steam boiler feed water

- (c) systems - Main feed systems, Condenser types, level control, construction, materials, support, expansion, operating parameters, loss of vacuum and leak testing, Air ejectors, Vacuum pumps, Extraction pumps, Gland condensers, Low pressure heaters, Drain coolers, High-pressure heaters, Turbo feed pumps, hydraulic balance, De-aerators.

3.Propulsive characteristics of Steam Turbine - Propeller curve, Propeller design point, Fouled hull, sea margin and heavy propeller, Continuous service rating, Limits for continuous operation, Limits for overload operation, Evaluate plant performance and analysis.

4.The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery

- (a) Performance data of individual turbines and cycle components during sea trial
- (b) Periodic acquisition of above mentioned data and comparison for location of deterioration,
- (c) Enthalpy drop test in superheated section of steam turbine
- (d) Quantification of stage efficiency losses – Leakage, Friction, Aerodynamic and Changes in flow passage areas.

5. Theoretical knowledge:

- (a) Ancillary feed water/ steam plant and combustion equipment.
- (b) Safe and efficient operation of steam plant. The determination of shaft power and the recognition of irregularity in the performance of machinery and plant. Analysis and interpretation of information gained from monitoring equipment.
- (c) Boiler and feed water testing and interpretation of results. Chemical treatment of feed water and boiler water. Effect of high chloride content, high phosphate reserve and high hydrazine reserve.
- (d) Methods of superheated temperature control, importance of steam purity and steam separation.
- (e) Boiler, steam pipe line, condenser and turbine support arrangement and expansion.
- (f) Procedure for warming up and cooling down of main turbines. Emergency lighting up procedure for main boilers.
- (g) Repair and maintenance procedure for refractory, insulation, water wall tubes (membrane type) water tubes, safety valve, retractable soot blowers, burners, steam traps and water level indicators.
- (h) Understanding of automatic combustion control system, burner management system, safety cut-outs and alarm system. Gas burning and monitoring system.
- (i) Types of auxiliary boilers, Auxiliary steam system, Safety valves, Boiler water level indicators, Use of Sea water in Boilers, Use of Fresh Water in Boilers, Boiler Water Testing, Boiler Water Treatment, Auxiliary Steam turbines, Boiler defects, Boiler survey and repairs, Evaporators, Thermal fluid heating system.

ORALS

[The oral is the final assessment of Paper 1 (Marine Engineering Knowledge - General) and Paper II (Marine Engineering Knowledge - Motor/ Steam) of Part B. The assessment is on the function, “Marine Engineering at the Management level” based on competences, knowledge, understanding and proficiency under this function. The criteria for evaluating competence is to be as per Column III of the above function]

ENGINE ROOM SIMULATOR COURSE (MANAGEMENT LEVEL)

Course Syllabus

SR NO	SUBJECT AREA	TRAINING METHOD	TIME (Hrs)
	Introduction to syllabus		30 Minutes
1	FAMILIRIARIZATION (6 HOURS) 1.3 Plant Arrangement .1 lists the machinery and associated systems and equipment which form the simulated plant as: - tanks - valves - pipe systems - pumps - heat exchangers - oil treatment plant - line filters - electric generators - steam generators - main propulsion unit - local controls - distant controls .2 describes how the machinery and associated systems and equipment are arranged and linked together to form the plant and compiles a block diagram illustrating this .3 compares the block diagram with the mimic diagram 1.4 Instrumentation .1 describes and lists the instrumentation used in the simulated plant to measure and indicate: - pressure - temperature - fluid level - volume/mass (quantity) - flow rate - speed of rotation - torque power - voltage - current (amps) - O2 content (of exhaust gases) - pressure/volume in the engine cylinder (indicator diagram) .2 describes the alarms that are used to indicate malfunctions and faults	LECTURE/ SIMULATOR	1.5 45 Minutes

	1.3 Controls .1 states that the machinery units forming the plant can be controlled from: • a position adjacent to the units in the “engine room” (local control) • a console in the “control room” (central control). .2 states that the operation of the main propulsion unit can be monitored from the instructor console and faults introduced as required by the training program .3 states that the “instructor console can also be used to issue commands for main engine power .4 demonstrates the use of controls from each location 1.5 Operational procedures .1 states that the safe practices must always be used when preparing machinery units and associated systems for start up and operation .2 discusses the safe practices to be used for: • opening and closing valves • starting and running pumps • operating water-circulation system • admitting steam into a steam system • lighting fire in an oil-fired boiler • filling oil tanks • operating centrifuges .3 states that as far as is practicable a “check-list” should be used for all machinery units and systems when: • preparing for use • starting up • operating normally .4 compiles a check-list for the preparation, start-up and operation of an auxiliary machinery unit .5 states the special requirements for connecting an electrical generator into the electrical system in terms of: • speed • voltage • frequency • synchronization		45 Minutes 3.0

	.6 demonstrates, using the simulated plant and a check-list, the procedures for: • opening and closing valves in a system • the circulation of sea-water • lighting an oil fire in the steam boiler • operating a fuel oil centrifuge • pumping out bilges		
2	Operation (9 hours)	SIMULATOR/ LECTURE	
	2.7 General Procedures .1 observes and applies safe practices in all exercises .2 uses check-list in all exercises, as far as is practicable .3 maintains a “log” of procedures and normal operating conditions for each exercise 2.8 Auxiliary units and systems <i>1 prepares, starts up and puts into the normal operating mode:</i> • the seawater circulating system • the freshwater circulating system • the compressed-air system • the fuel service tanks • the fuel centrifuge 2.9 Diesel-driven generator .1 prepares, starts up and runs the diesel-driven electrical generator .2 establishes the main electrical system using the diesel generator 2.10 Steam boiler .1 prepares and raises steam to normal working pressure .2 puts the steam boiler “on-line” into the steam system 2.11 Steam driven turbo generator 2.12 Steam Cargo Pump .1 prepares, starts up ,and runs the steam driven –generator .2 connects the turbo generator into the main electrical system, applying control on: • voltage • Frequency • Synchronization .3 demonstrates load sharing between diesel and turbo generators 2.12.1 Prepares, starts and runs the steam driven cargo pump. 2.12.2 Operates the pump to discharge cargo. 2.13 Main propulsion diesel engine .1 applies preparation procedures, including: • checking the seawater circulation through heat exchanger		1.5 1.5 1.5 1.5 1.5 3.0

	• checking the freshwater circulation through engine heat exchanger • checking the lubricating-oil circulation through engine heat exchanger • confirming that the engine-turning gear is "out" • checking the fuel oil circulation through heaters to injection pump inlet exchanger • confirming that the bridge/engine telegraph is functioning correctly • confirming that compressed air is available for starting • confirming that the engine cylinder lubrication is functioning • turning the engine on starting air for one revolution with indicator cock open .3 applies starting procedures, including: • confirming all cylinder cocks closed • confirming fuel oil circulation • confirmation of bridge order for engine movement • application of starting air for 3-4 • moving fuel control to required speed position .4 establishes the normal running mode and observes operating conditions, including: • temperatures of lubricating oil and cooling water • temperature of exhaust gas from each cylinder • temperature of engine exhaust gas at inlet and exit from turbocharger • engine speed and power output • maintaining a check on fuel oil supply (service tank) • maintaining a check on fuel viscosity/temperature .4 applies changes of engine speed and power as directed and notes changes in operating conditions		
3	WATCHKEEPING (8 HOURS)	SIMULATOR/ LECTURE	
	3.4 Taking over and accepting an engineering watch .3 enters the machinery space 15 minutes before the change of watch .4 inspects all operating units, noting operational conditions and any deviation from the normal mode • checks steam boiler water level • inspects bilge and underfloor spaces • notes engine telegraph instruction and checks engine control position and related speed • checks quantities and levels in engine room service		3.0

	- tanks - examines the engine room log - receives a report from the engineer officer in charge of the watch for the period of watch keeping now completed - enters in the engine room log any abnormal operational conditions noted during inspection - if satisfied, accepts responsibility for the machinery space operation over the next period of watch keeping 3.5 Watch keeping routines and duties .1 at regular intervals, inspects all operational machinery, noting operating conditions and correcting any deviations from the normal mode .2 operates the oil fuel centrifuges as necessary (complying with anti pollution regulations) to maintain service tank levels .12 checks the levels and quantities in all engine room service tanks, transfers or “tops up” as necessary .13 records in the engine room log all required information on the operating conditions of main and auxiliary machinery .14 checks the steam boiler periodically, and makes necessary adjustments for: - water level - steam pressure and temperature - CO2 content of exhaust gas if on oil firing or - exhaust gas inlet and outlet temperature if operating on waste heat .15 check the seawater temperature periodically and adjusts the heat exchanger, control valves, as necessary to maintain the engine cooling water and lubricating oil within the correct operational range .16 checks that the main engine cylinder lubrication is within the correct range .17 checks the electrical system voltage and load, and, if two or more generators are operating, that the load is properly balanced .18 checks the pressure in compressed-air storage tanks and “tops up” as necessary, with air compressor .19 Inspects bilge and underfloor spaces and clears them as necessary, using the bilge pump and complying with any anti-pollution regulations .20 states that when serving on an actual ship the watch keeping routines and duties would also include responsibilities related to: - steering gear - propeller shaft gland - domestic fresh water - seawater for sanitary use		2.0

ENGINEERING MANAGEMENT COURSE
MARINE ENGINEERING OFFICER CLASS - I CERTIFICATE

Duration : Two Months

Sr. No.	SUBJECTS	Theory	Case Study & Interaction Between Participants
		(In Hrs)	
	Regulatory Aspects		
1.0	Knowledge of National legislation, Indian Merchant Shipping Act, knowledge of International Treaties, Conventions, Protocols, Rules legislations & regulations including United Nations Convention on the Law of the Sea 1982 (UNCLOS)	9	3
1.1	Knowledge of International legislation; national legislation and method of adoption		
1.2	International Maritime Organisation (IMO) and IMO's Conventions Related to Safety, Related to Pollution, Related to Liability and Compensation and Related to other subjects		
2.0	ISO 9001-2008, ISM Code, – Ship board internal audit – Total Quality Management	9	3
3.0	Classification societies and their functions. Certificates and documents as per international convention.	3	3
3.1	Continuous survey of machinery and other methods of machinery surveys		
3.2	Continuous survey of hull and other methods of hull surveys		
3.3	Enhanced special survey programmes		
3.4	Ship inspections for first entry into Indian flag		
4.0	Ship Stability	8	8
4.1	Ship stability- during drydocking and damage stability during flooding and grounding. Counter measures to be taken		
4.2	IMO Regulations on ship stability; control of trim, stability & stress		
4.2.1	International Intact Stability Code		
4.3	Probabilistic method of damage stability assessment		
5.0	SOLAS Convention	3	0
5.1	SOLAS Convention; procedure to determine applicability of regulations to ships of different builds		
5.2	SOLAS updates and amendments		

6.0	Official log books and procedures relating to entries	3	0
6.1	Legislation requirements		
7.0	Monitor and control Compliance with legislative requirements and measures to ensure safety of life at sea and protection of the marine environment	20	0
7.1	Knowledge of relevant international maritime law embodied in international agreements and conventions		
7.2	Regard shall be paid especially to the following subjects:		
7.2.1	Certificates and other documents required to be carried onboard ships by international conventions, how they may be obtained and the period of their legal validity		
7.2.2	Responsibilities under the relevant requirements of the International Convention on Load Lines		
7.2.3	Responsibilities under the relevant requirements of the International Convention for the Safety of Life at Sea		
7.2.4	Responsibilities under the International Convention for the Prevention of Pollution from Ships		
7.2.5	Knowledge of national legislation for implementing international agreements and conventions		
7.2.6	Chief Engineer's role in Tanker Vetting and SIRE Inspections TMSA Procedures and Bulk Carrier Structural Inspections (RIGHTSHIP Programme) Marine environment awareness Model course.		
7.2.7	Ship inspections for Charter Party requirements		
8.0	Ship security system	3	0
8.1	ISPS code		
8.1.1	Piracy threat and anti piracy measures		
8.1.2	Current Industry best management practices (from ICS)		
9.0	World Health Organisation & International Labour Organisation	2	0
9.1	World Health Organisation (WHO)		
9.2	International Health Regulation 2005 and Ship Sanitation Control Exemption Certificate and Ship Sanitation Control Certificate		
9.3	Maritime declaration of health		
9.4	WHO's Guidelines for Drinking Water Quality		
9.5	International Labour Organisation (ILO)		
9.6	ILO's Maritime Labour Convention 2006 (MLC 2006)		
9.7	Maritime Labour Certificate and Declaration of Maritime Labour Compliance		

10.0	Ship surveys and inspections for port state control / flag state control Various MOUs and their salient features.	10	6
10.1	Explain that Port State Control (PSC) is the inspection of foreign ships in national ports to verify that the condition of the ship and its equipment comply with the requirements of international regulations and that the ship is manned and operated in compliance with these rules.		
10.2	Explain about initial survey, periodical survey, renewal survey, intermediate survey, annual survey, additional survey		
	Ship Operations & Commercial/ Legal Aspects		
11.0	P&I Clubs, - principles of protection & indemnity Insurance – types of P&I covers available – their modes of operation	18	3
11.1	Charter party, and role of Chief Engineer in compliance of charter		
11.2	Marine insurance, - general principles of insurance - Institute time clauses - types of marine insurance covers - Particular and General Average Act		
11.3	Salvage - International Convention on Salvage 1989 and Lloyd's Standard Form of Salvage (LOF 2000)		
11.4	Breakdown of machineries and equipments (Action/ handling/ rectification) - Bearings, chains, turbo charger, a.c/ fridge system etc.		
12.0	Emergency Preparedness	6	6
12.1	Emergency preparedness for oil spill, fire flooding, collision, grounding and accident involving personnel		
12.2	Study of emergency and damage control plans		
12.3	Case studies of accidents; root cause analysis		
12.4	Reporting procedures		
12.5	Risk assessment prior commencement of work		
	Human Resource Management Aspects		
13.0	Human relations and modern management principles	15	12
13.1	Organizational behaviour		
13.1.1	Understand how perceived behaviour of organization and individuals is influenced		
13.1.2	Explore the methods by which the behaviour of members of organization are constrained and influenced		
13.1.3	Discuss the nature of information and communication in relation to Organization and their environment		
13.1.4	Describe the types and nature of conflicts in organization		
13.1.5	Study the influence of human factors in systems		
13.1.6	Awareness & appreciation of cross / multi cultural aspects of man management on board ships		

13.2	Workload management		
13.2.1	Planning and coordination		
13.2.2	Personnel assignment / Delegation		
13.2.3	Time and resource Constraints		
13.2.4	Prioritization		
13.3	Effective resource management		
13.3.1	Allocation, assignment, and prioritization of resources		
13.3.2	Effective communication on board and ashore		
13.3.3	Decisions reflect consideration of team experience		
13.3.4	Assertiveness and leadership, including motivation		
13.3.5	Obtaining and maintaining situation awareness		
13.4	Decision-making techniques		
13.4.1	Situation and risk assessment / risk management		
13.4.2	Identify and generate options		
13.4.3	Select course of action		
13.4.4	Evaluation of outcome Effectiveness		
13.5	Prevention of human error		
13.5.1	Reasons		
13.5.2	Corrective actions		
13.5.3	Error pyramid		
13.6	Development, implementation, and oversight of standard operating procedures		
13.7	Crisis management on board ships.		
13.7.1	Human behaviour in crisis		
13.7.2	Leadership in crisis		
13.7.3	Importance of emergency drills		
14.0	Leadership and managerial skills	6	3
14.1	Personality development		
15.0	Training of trainers. Chief Engineer as trainer for engine room staff		
15.1	Discipline on board and counseling		
15.2	Communication process		
15.3	House keeping, safety and hygiene		
15.4	Need analysis and development		
15.5	Motivation		
15.6	Mentoring		
	Technical Management Aspects		
16.0	Inventory management, including	6	3

16.1	Spares, stores,		
16.2	Lead time.		
16.3	Inventory of Fuel oil		
16.4	Inventory of lub oil, Use of low BN cylinder oil for low sulphur fuel		
16.5	Management of quality of above		
17.0	Management Information Systems		
17.1	Computer system resources	3	3
17.2	Decision Support system and expert system		
18.0	Records		
18.1	Record making, keeping and its interpretation for complete engine room with regard to maintenance		
18.2	Record making, maintaining with regard to operation		
18.2.1	C/E s standing orders / night order book / updation of circulars	6	0
18.3	New ORB entries		
18.4	Other records as per MARPOL requirements		
19.0	Economising of fuel consumption.		
19.1	Effective power balancing; propulsive characteristics of Diesel Engines including speed, output and fuel consumption	11	0
19.2	Bunker management, Use of low sulphur fuel, Change over procedures current version of ISO 8217 fuel standards		
19.3	Factors affecting vessel's performance; load diagrams		
20.0	Budgeting		
20.1	Cost value analysis		
20.2	Fixed and consumable costs	6	0
20.3	Voyage expenses		
20.4	Drydock and repair cost analysis		
20.5	Down time realisation		
	Latest Technical Developments		
21.0	Practical electricity and electronics		
21.1	High voltage on ships	6	6
21.2	Electrical propulsion		
21.3	Sulfur Hexafluoride (SF6) and vacuum circuit breakers		
22.0	Engine developments	9	0

22.1	Camshaft less main engines and other diesel engine		
	developments		
22.2	New developments in tribology		
22.3	Propulsion system developments		
		172	68
		Total	240

(Followed by 3 Hour written paper of 200 marks on Engineering Management)

ORAL EXAMINATION

The orals will be based on the Theoretical aspect of the syllabus of Engineering Management Course.

Syllabus for MEO Class I Preparatory Course

1. Knowledge of National legislation, Indian Merchant Shipping Act, knowledge of International Treaties, Conventions, Protocols, Rules legislations & regulations including United Nations Convention on the Law of the Sea 1982 (UNCLOS)

1.1 Explain International legislation; national legislation and method of adoption of the above legislations

- (i) Explain about Indian Merchant Shipping Act and various rules under it
- (ii) Explain UN convention on carriage of goods at sea
- (iii) Explain about Hamburg and Hague-visby rules.
- (iv) Define the following conventions
 - (a) International Convention for the Safety of Life at Sea (SOLAS)
 - (b) International Convention on Load Lines (LL),
 - (c) Special Trade Passenger Ships Agreement (STP),
 - (d) Convention on the International Regulations for Preventing Collisions at Sea (COLREG),
 - (e) International Convention for Safe Containers (CSC),
 - (f) Convention on the International Maritime Satellite Organization (INMARSAT),
 - (g) International Convention on Standards of Training, Certification and Watch keeping for Seafarers (STCW),
 - (h) International Convention on Maritime Search and Rescue (SAR),
 - (i) International Convention for the Prevention of Pollution from Ships, (MARPOL)
 - (j) International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (INTERVENTION)
 - (k) International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC),
 - (l) International Convention on Tonnage Measurement of Ships (TONNAGE),
 - (m) Convention for the Suppression of Unlawful Acts Against the Safety of Maritime Navigation (SUA),
 - (n) Protocol for the Suppression of Unlawful Acts Against the Safety of Fixed Platforms Located on the Continental Shelf (SUAPROT),
 - (o) International Convention on Salvage (SALVAGE),
- (v) Define adopting a convention
- (vi) Explain various conventions on Liability and Compensation
- (vii) Explain Signature, ratification, acceptance, approval and accession
- (viii) Explain that the Amendments will be made to the regulations as and when required
- (ix) Explain that the enforcement of IMO conventions depends upon the Governments of Member Parties.
- (x) Relationship between Conventions and interpretation
- (xi) Defines Uniform law and conflict of law rules
- (xii) Discuss legislation on Sox and NOx emissions
- (xiii) Full awareness of the international treaties and protocols at port

- (xiv) Explain United Nations Convention on the Law of the Sea: Territorial sea and contiguous zone, straits used for international navigation, Archipelagic states, exclusive economic zone, continental shelf, high seas, protection and preservation of the marine environment, settlement of disputes

1.2 International Maritime Organization (IMO) and IMO's Conventions Related to Safety, Related to Pollution, Related to Liability and Compensation and Related to other subjects.

Explain that IMO is the United Nations specialized agency with responsibility for the safety and security of shipping and the prevention of marine pollution by ships.

(i) Maritime Safety:

- (a) Recommendations on the safe transport of dangerous cargoes and related activities in port areas*
- (b) Fire Protection, fire detection and fire extinction (Summary of SOLAS Chapter II-2)*
- (c) Implementation, Control and Coordination*
- (d) Casualties*
- (e) Reporting to IMO of marine safety investigations and marine casualties and incidents
- (f) Applicable IMO instruments on casualty matters
- (g) Port State Control
- (h) Integrated Technical Co-operation Programme (ITCP)
- (i) The Voluntary IMO Member State Audit Scheme
- (j) Surveys, Verifications and Certification
- (k) The IMO ship identification number scheme
- (l) Improvement of navigational safety.
- (m) Goal-based construction standards for new ships
- (n) Stability and Subdivision
- (o) Safety regulations for different types of ships
- (p) Other Safety Topics

(ii) Maritime security:

- (a) Chapter XI-2 of SOLAS on Special measures to enhance maritime security and the International Ship and Port Facility Security (ISPS) Code
- (b) Convention for the Suppression of Unlawful Acts Against the Safety of Maritime Navigation, **2005 Protocol to the SUA Convention**
- (c) The ILO/IMO Code of practice on security in ports
- (d) Acts of piracy and armed robbery against ships

(iii) Marine Environment:

- (a) Pollution Response & Pollution Incidents
- (b) Ballast Water Management
- (c) The International Convention on the Control of Harmful Anti-fouling Systems on Ships
- (d) The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009 (the Hong Kong Convention)
- (e) Special Programmes and Initiatives

(iv) Liability and Compensation for Ship-Source Marine Pollution:

2. ISO 9001-2008, ISM Code, – Ship board internal audit – Total Quality Management:

- (i) Interpret and understand the ISM Code with the inter-relationship to the ISO 9001:2008
- (ii) An Introduction to Quality and Safety Management Systems.
- (iii) An Introduction to the “Guidelines on the Application of the ISM Code” and its relationship to ISO 9001:2008, ISO14001, OH&S systems and ISPS.
- (iv) Types of Audit – 1st, 2nd and 3rd Party fully explained with practical case studies.
- (v) Auditing Techniques: Planning – Preparation – Performance – Reporting and Follow-up – Close Outs.
- (vi) Writing Audit Findings as Audit Reports including accidents, incidents and hazardous occurrences.
- (vii) Corrective and Preventive Action and being able to identify Major and Minor Non-Conformances and Observations.
- (viii) Requirements to become a Lead Auditor for Quality, Safety, Environmental and Security Management Systems.
- (ix) Quality Management System certification requirements.
- (x) ISM certification requirements (DOC and SMC).
- (xi) Interactive training, combining lectures and videos with practical application of the techniques and requirements in team role-play scenarios.
- (xii) Explain that Total quality management (TQM) is one of the management techniques widely applied by organizations that commit to achieving a world-class quality standard.
- (xiii) Explain that the technique facilitates the establishment of a management system that enables organizational growth through a framework for continuous improvement.
- (xiv) Explain that the system aims to help cultivate quality initiatives from every individual working within the organization.
- (xv) It also helps individuals to acquire the commitment, knowledge and skills to improve his or her own work within an enabling environment.

3. Classification societies and their functions. Certificates and documents as per international convention.

- (i) Explain flags of convenience
- (ii) Explain the need and duties of classification society & Discuss about classification
- (iii) Classification surveys
 - (a) Explain Continuous survey of machinery and other methods of machinery surveys
 - (b) Explain Continuous survey of hull and other methods of hull surveys
 - (c) Explain Enhanced special survey programmes
- (iv) Assignment, maintenance, suspension and withdrawal of class
- (v) Ship inspections for first entry into Indian flag - Explain Section 27(1) of the M.S. Act and Rule 5 of the M.S. (Registration of Indian Ships) Rules, 1960, either by the Mercantile Marine Department (MMD) or the Indian Register of Shipping (IRS). - discusses MSL Branch Circular 2 of 2008

4. Ship Stability:

- (i) Explain Ship stability- during dry docking
- (ii) Explain damage stability during flooding and grounding.

- (iii) Explain Counter measures to be taken to maintain stability during the above
- (iv) Define and Explain IMO Regulations on ship stability; control of trim, stability & stress
 - (a) Explain SOLAS chapter II-1, part B, regulations 5 to 25
 - (b) Explain MARPOL regulations 27, 28
- (v) Define and Explain International Intact Stability Code - Explain The International Code on Intact Stability 2008 (2008 IS CODE), presents mandatory and recommendatory stability criteria and other measures for ensuring the safe operation of ships, to minimize the risk to such ships, to the personnel on board and to the environment
- (vi) Explain probabilistic method of damage stability assessment
 - (a) describe a method for developing probability density functions
 - (b) describe struck ship damage in ship collisions.
- (vii) Explain that Struck and striking ship speed, collision angle, striking ship type and striking ship displacement are treated as independent random variables.

5. SOLAS Convention:

- (i) SOLAS Convention; procedure to determine applicability of regulations to ships of different build
 - (a) briefly Explain about the articles of International Convention for the safety of Life at Sea, 1974
 - (b) briefly Explain about the 1988 protocol
 - (c) briefly Explain about the various surveys and certificates
- (ii) Explain briefly sections of the convention
 - (a) Chapter I – General Provisions
 - (b) Chapter II-1 – Construction – Subdivision and stability, machinery and electrical installations
 - (c) Chapter II-2 – Fire protection, fire detection and fire extinction
 - (d) Chapter III – Life-saving appliances and arrangements
 - (e) Chapter IV – Radio communications
 - (f) Chapter V – Safety of navigation
 - (g) Chapter VI – Carriage of Cargoes
 - (h) Chapter VII – Carriage of dangerous goods
 - (i) Chapter VIII – Nuclear ships
 - (j) Chapter IX – Management for the Safe Operation of Ships
 - (k) Chapter X – Safety measures for high-speed craft
 - (l) Chapter XI-1 – Special measures to enhance maritime safety
 - (m) Chapter XI-2 – Special measures to enhance maritime security
 - (n) Chapter XII – Additional safety measures for bulk carriers
- (iii) SOLAS updates and amendments:
 - (a) Explain about the various amendments made from time to time,
 - (b) Discuss about the latest amendments and their applicability with validity dates etc.

6. Official log books and procedures relating to entries

- (i) Legislation requirements
 - (a) Explain that the log book is a book containing the official record of trips made by a ship

- (b) Explain that the log book is an official channel of communication between the master and the administration and it is a document which is acceptable in evidence in court proceedings.
- (c) Explain about the various legislation requirements regarding upkeep of logbook as well as entries to be made.

7. Monitor and control Compliance with legislative requirements and measures to ensure safety of life at sea and protection of the marine environment:

- (i) Details knowledge of relevant international maritime law embodied in international agreements and conventions
- (ii) Regard shall be paid especially to the following subject:
- (iii) Certificates and other documents required to be carried onboard ships by international conventions, how they may be obtained and the period of their legal validity
- (iv) Responsibilities under the relevant requirements of the International Convention on Load Lines
- (v) Responsibilities under the relevant requirements of the International Convention for the Safety of Life at Sea
- (vi) Responsibilities under the International Convention for the Prevention of Pollution from Ships
- (vii) Knowledge of national legislation for implementing international agreements and conventions
- (viii) Chief Engineer's role in Tanker Vetting and SIRE Inspections TMSA Procedures and Bulk Carrier Structural Inspections (RIGHTSHIP Programme) Marine environment awareness Model course.
- (ix) Ship inspections for Charter Party requirements

8. Ship security system

- (i) ISPS code - Explain part A and part B of ISPS code regarding mandatory requirements and guidance as per the provisions of Chapter XI - 2
- (ii) Piracy threat and anti piracy measures - discusses the piracy threat, existing and proposed counter piracy measures
- (iii) Current Industry best management practices (from ICS)
 - (a) Explain Best Management Practices guidance as per Marine Safety Committee circulars
 - (b) Discusses the best management practices suggested by INTERTANKO, ICS, BIMCO, OCIMF etc.

9. World Health Organization & International Labour Organization:

- (i) World Health Organization (WHO) - Explain that The United Nations public health arm. Monitors disease outbreaks, assesses the performance of health systems around the globe
- (ii) International Health Regulation 2005 and Ship Sanitation Control Exemption Certificate and Ship Sanitation Control Certificate
 - (a) Explain International Health Regulations (2005) ("IHR (2005)") have introduced new certification procedures for ships.
 - (b) Explain that the new certificates are entitled Ship Sanitation Control Exemption Certificate/Ship Sanitation Control Certificate ("Ship Sanitation Certificates" or "SSC").
 - (c) Explain that these SSC replace the previous Deratting/ Deratting Exemption Certificates ("DC/DEC") provided for under the IHR (1969).
 - (d) Explain the implementation of this new health document by States Parties to the IHR (2005).
- (iii) Maritime declaration of health
 - (a) Explain that the master has to complete and sign a Maritime Declaration of Health.
 - (b) States that the standard international form has to be used.
 - (c) Explain the requirement of Particulars that have to be reported (as per standard form):
 - 1. Ship Sanitation Exemption / Control Certificate expiry date;
 - 2. The number of passengers and crew
- (iv) WHO's Guidelines for Drinking Water Quality
- (v) International Labour Organization (ILO) - Explain that the International Labor Organization (ILO) is the UN agency with responsibility for the world of work.
- (vi) Maritime Labor Certificate and Declaration of Maritime Labor Compliance – briefly describes Regulation 5.1.3 - Maritime labor certificate and declaration of maritime labor compliance

10. Ship surveys and inspections for port state control / flag state control Various MOUs and their salient features.

10.1 Explain that Port State Control (PSC) is the inspection of foreign ships in national ports to verify that the condition of the ship and its equipment comply with the requirements of international regulations and that the ship is manned and operated in compliance with these rules.

- (i) Discusses Update on implementing Port State Control Directive applicable from time to time
- (ii) Define that FlagState refers to the authority under which a country exercises regulatory control over the commercial vessel which is registered under its flag.
- (iii) Define the duties of a FlagState
- (iv) Explain the role of the FlagState
- (v) FlagState responsibilities as defined by the International Chamber of Shipping (ICS) & The International Shipping Federation (ISF)
- (vi) Explain that Flag States should participate in the IMO Member State Audit Scheme
- (vii) Discusses various Commitments under MOU

- (viii) Explain the Relevant instruments used by MOU authorities
- (ix) Explain Inspection Procedures, Rectification and Detention
- (x) Discusses Provision of information by authorities
- (xi) Explain Operational violations
- (xii) States that any Authority may propose amendments to the Memorandum, and the enforcement of amendments

10.2 Explain about initial survey, periodical survey, renewal survey, intermediate survey, annual survey, additional survey

- (i) Explains Harmonized system of ship survey and certification
- (ii) Tacit acceptance in LL Convention
- (iii) Types of ship survey
- (iv) List of certificates required on board ship relating to harmonized system of survey and certification
- (v) Explain general survey requirements

Ship Operations & Commercial/ Legal Aspects

11. P&I Clubs, - principles of protection & indemnity Insurance – types of P&I covers available – their modes of operation

- (i) Explain the principle of indemnity and insurance - Growth of third party liabilities, Mutuality, Moral hazard, Willful misconduct.
- (ii) Explain the different covers available under P & I - cargo insurance, protection and indemnity insurance, death and personal injury on board etc., running down clause and fixed or floating objects, repatriation of sick or injured crew and hospital expenses, Loss of personal effects of the crew, loss of damage to cargo, liability for stowaways, liability for oil pollution and other types of pollution, legal liability for wreck removal.
- (iii) Explain the modes of operation
- (iv) Charter party, and role of Chief Engineer in compliance of charter party
 - (a) Explain time charter, voyage charter & bare boat charter
 - (b) The importance of correct labelling of bunker
 - (c) The importance of an efficient fuel oil treatment system
 - (d) Chief engineer's role in collecting samples and sending the sample fuel, lubricating oil for analysis on periodical basis
 - (e) Chief engineer's responsibilities in maintaining the machinery to enable smooth voyage to meet the charter party requirements
- (v) Marine insurance - discuss marine insurance act, Essentials of the valid marine insurance contract, Contract of indemnity, Insurable interest, Fair dealing, Sea worthiness, Non deviation, Legality of the venture, Condition of the cargo, General consideration, general principles of insurance, Institute time clauses, types of marine insurance covers, Particular and General Average Act.
- (vi) Salvage:
 - (a) Explain that Marine salvage is the process of rescuing a ship, its cargo, or other property from peril.

- (b) International Convention on Salvage 1989 and Lloyd's Standard Form of Salvage (LOF 2000)
- (c) Classification of salvage - Offshore salvage, Harbor salvage, Cargo and equipment salvage, Wreck removal, Afloat salvage, Clearance salvage.
- (d) Types of salvage - contract salvage, pure salvage, naval salvage.
- (e) discuss ship salvage and the law

12. Emergency Preparedness:

- (i) Emergency preparedness for - oil spill, fire, flooding, collision, grounding and accident involving personnel
- (ii) Study of emergency and damage control plans
 - (a) Damage control involves all aspects of damage that a ship may encounter.
 - (b) The vital damage control systems aboard ship include - Communications, Emergency power, Pumping system, Fire main, Drainage system.
- (iii) Details of the measures used and adopted
- (iv) Maintenance and drills to be conducted
- (v) Define damage control strategies - Line of action before the damage occurs, Reduce the effects of damage after it has occurred, Emergency repairs to damage caused by accident, Restoration of services to ship after damage has occurred
- (vi) Validate damage control tactics - Trained personnel, Available equipment & materials, desired results. Supervise the maintenance, sharing higher responsibilities, co-ordinate with authorities and owners.
- (vii) Case studies of accidents; root cause analysis & Reporting procedures
- (viii) Risk assessment prior commencement of work - Define risk assessment, Define risk management, Explain ALARP, Explain risk management and its importance, ISM Code – Explicit as amended, EU Regulations, IMO, Flag Requirements, Industry Best Practice – TMSA – Mandatory, Discuss Company Responsibility, Different methods for hazard identification and assessment of the risks, Discuss the benefits of risk management.
- (ix) Detection/ Breakdowns/ repairs/ restoration:
 - (a) Failure of cross-head bearing/ main bearing/ bottom end bearings of main engine
 - (b) Breakage of chain drives of main engine
 - (c) Breakdown on turbo chargers
 - (d) Breakdown of main air conditioning and fridge system
 - (e) Collapse/ failure of multiple boiler water tubes
 - (f) Major contamination of main L.O. sump – Action/ handling/ rectification.
 - (g) Severe flooding of engine room bilges – Action/ handling/ rectification.

Human Resource Management Aspects

13. Human relations and modern management principles.

- (i) Organizational behavior
- (ii) Understand how perceived behaviour of organization and individuals is influenced

- (iii) Explore the methods by which the behaviour of members of organization are constrained and influenced
- (iv) Discuss the nature of information and communication in relation to Organization and their environment
- (v) Describe the types and nature of conflicts in organization
- (vi) Study the influence of human factors in systems
- (vii) Awareness & appreciation of cross / multi cultural aspects of man management on board ships
- (viii) Workload management, Planning and coordination, Personnel assignment / Delegation
- (ix) Time and resource Constraints, Prioritization, Effective resource management
- (x) Allocation, assignment, and prioritization of resources
- (xi) Effective communication on board and ashore
- (xii) Decisions reflect consideration of team experience
- (xiii) Assertiveness and leadership, including motivation
- (xiv) Obtaining and maintaining situation awareness
- (xv) Decision-making techniques, Situation and risk assessment / risk management
- (xvi) Identify and generate options, Select course of action
- (xvii) Evaluation of outcome Effectiveness, Prevention of human error, Reasons
- (xviii) Corrective actions, Error pyramid
- (xix) Development, implementation, and oversight of standard operating procedures
- (xx) Crisis management on board ships, Human behaviour in crisis, Leadership in crisis
- (xxi) Importance of emergency drills

14. Leadership and managerial skills

- (i) Explain that Leadership is a combination of character traits and learned skills
- (ii) States the importance of effective interpersonal communication
- (iii) Explain about team building and motivational skills, good managerial skills - develop the practice of sound record keeping, encourage team work - present case study, erase 'us' from 'them' feeling, facilitate rather than dictate, daily and weekly plan for both administrative and creative tasks
 - (a) Explain work delegation and its importance
 - (b) Explain and demonstrate how to handle stress
 - (c) Explain how to set target or goals
- (iv) Personality development
 - (a) Explain about choosing competent subordinates
 - (b) Explain the need for demonstrating high moral standards
 - (c) Explain the need for non abusing the power
 - (d) role plays and importance of being a role model
 - (e) present case studies, power point slides available

15. Training of trainers. Chief Engineer as trainer for engine room staff:

- (i) Skills needed for the chief engineer to be a trainer – Comprehension, Conceptualization, Creativity and Conduct
- (ii) personal qualities of chief engineer as trainer - Personal skills, Confidence, Voice modulation, Adjusting to environment, Ability to listen, Theatrical skills, Flexible, Cools headed, Desire to learn, Ability to relate, Sense of humor

- (iii) Explain the training process
 - (a) Determine (Requires Comprehension skill)
 - (b) Design and Development (Requires Conceptualization and Creativity skill)
 - (c) Deployment (Requires Conduct skill)
 - (d) Determine (Requires Comprehension skill)
- (iv) Details the Discipline required on board and the need for counseling
- (v) Explain House keeping, need for safety and hygiene.
- (vi) Explain the Need analysis and development
- (vii) Explain that by being a role model others can be motivated
- (viii) Details the importance of Mentoring
- (ix) Encouraging group participation and Explain the advantage of group discussion and its outcome

Technical Management Aspects

16. Inventory management, including:

- (i) Spares, stores - Explain quantity of inventory called the safety stock, Explain when to re-order spares or stores, Explain the formula $ROP = SSQ + (QUD \times ALT)$
- (ii) Explain what is a Lead time.
- (iii) Explain about calculating the bunker requirements and maintaining the level Inventory of Fuel oil
- (iv) Explain Inventory of lub oil, Use of low BN cylinder oil for low sulphur fuel
- (v) Explain and details Management of quality of above
- (vi) Discusses certain relevant case studies either from previous cases or from MAIB

17. Management Information Systems:

- (i) Computer system resources
- (ii) Decision Support system and expert system:
 - (a) Explain Decision Support System aid in problem solving by allowing for manipulation of data & models whereas Expert System allow experts to 'teach' computers about their field so that the system may support more of the decision making process for less expert decision makers.
 - (b) Explain the benefits of decision support system and expert system
- (iii) Types of decision support systems
 - (a) Computer based information system - it includes knowledge based systems, communication driven DSS, data-driven DSS, document-driven DSS, and model-driven DSS.

18. Records

- (i) Record making, keeping and its interpretation for complete engine room with regard to maintenance & operation
- (ii) C/E s standing orders / night order book / updation of circulars, New ORB entries & Other records as per MARPOL requirements

19. Economizing of fuel consumption

- (i) Explain Effective power balancing; Propulsive characteristics of Diesel Engines including speed, output and fuel consumption
- (ii) Explain Bunker management, Explain the Use of low sulphur fuel, Change over procedures
- (iii) Explain the current version of ISO 8217 fuel standards
- (iv) Explain Factors affecting vessel's performance, Discusses about load diagrams

20. Budgeting

- (i) Explain that Cost value analysis (CVA) is an effective way to reduce the costs
- (ii) Fixed and consumable costs
- (iii) Explain Voyage expenses are all expenses unique to a particular voyage, including any bunker fuel expenses, port fees, cargo loading and unloading expenses, canal tolls, agency fees and commissions.
- (iv) Explain about Dry-dock and repair cost analysis
- (v) Explain Down time realization

Latest Technical Developments

21. Practical electricity and electronics

- (i) High voltage on ships
 - (a) Define the high voltage & HV Systems on vessels & advantages of high voltage applications
 - (b) Explain about the safety requirements while working on the high voltage systems
 - (c) Explain Effects of short circuit and protection against short circuit
 - (d) Busbar arrangements and insulation requirements
 - (e) Benefits of HV systems, Explain typical marine HV systems with diagrams
 - (f) Protection system for DG & TG, motor protection, describe HV cargo switch board
 - (g) Procedure for meggering high voltage systems, Major Risk Factors in HV systems
 - (h) Discuss inter electrode capacitances and HV inductances
- (ii) Electrical propulsion
 - (a) Concept of Electrical Propulsion
 - (b) Explain about the Azipod propulsion systems
 - (c) Discusses the advantages and disadvantages of electrical propulsion system
 - (d) Use of synchronous motor for electrical propulsion
 - (e) Explain with the sketches, the construction of Azipod section.
 - (f) Discusses the maintenance requirement for such arrangement
 - (g) Discusses about the speed control by varying the frequency (Pulse Width Modulation)
- (iii) Sulfur Hexafluoride (SF6) and vacuum circuit breakers
 - (a) Discusses the various circuit breakers normally used
 - (b) Use of SF6 and vacuum circuit's breakers and their advantages are discussed in regard to high voltage application.
 - (c) Arc sustaining and quenching methods are explained

22. Engine developments

- (i) Camshaft less main engines and other diesel engine developments
 - (a) explain the electronic governor
 - (b) explain the common rail system for fuel injection
 - (c) control system for the camshaft less engines
- (ii) New developments in tribology
 - (a) explain lubrication of bearings and latest developments
 - (b) alpha cylindrical lubricator system Explained
 - (c) discusses about Fuel Dilution in Lubricating Oils and their avoidance, methods available etc.
 - (d) discusses about friction-speed characteristics in regard to lubrication
 - (e) explain hydrodynamic lubrication of lip seal etc.
- (iii) Propulsion system developments - discussion and explanation about the developments like contra rotating propellers, wake equalizing ducts, cavity system of propulsion, water jet propulsion, electrical propulsion, PTO/ PTI system in the conventional diesel electric propulsion etc.

**STRUCTURE AND SPECIFICATION OF
Engine Room Simulator Course for Chief Engineer Officer**

- 1) NAME OF COURSE: **Diesel Engine Combustion Gas Monitor Simulator Course.**
- 2) SCOPE: The course is essentially a practical one, consisting of a series of exercises built around the operation of a ship's diesel engine.
 - A) Familiarisation: Initially trainees familiarise themselves with instrumentation and controls of the simulator and also screening of displays.
 - B) Starting and Running: As the course progresses the trainees work through and get used to the procedures for changing the set up, initial condition control settings etc.
 - C) Faults / Malfunctions and their troubleshooting during the operation of the machinery. Briefing before each exercise and a debriefing after the exercise which includes group discussion and analysis of the actions of the students.
- 3) OBJECTIVE: Computer Based Combustion Gas Monitor Simulator training to educate senior level engineers in functioning of Combustion of Diesel Engines. Following variables, parameters, control settings etc are evaluated for better understanding.
 - a) Consumption of fuel
 - b) Effect of Advanced / Retarded timing on specific fuel oil consumption, peak pressures, exhaust temperatures and evolution of NO_x and SO_x.
 - c) Economical mode / environmental friendly mode for diesel engine operations.
 - d) Effects of different quality fuel on various parameters including ones mentioned above.
 - e) Effect of abnormal conditions including abnormal values of temperature pressure quality of fuel, scavenge air, cooling medium etc.

The individual on completion of the course will be able to make a safe and more effective contribution to the operation and control of the Diesel Engine installed on board a ship.
- 4) The course is in accordance with the requirements in addition to those laid down in STCW 95 Regulation 1/12 and Code B-1/12.42

DURATION OF COURSE IN HOURS: The total course duration is "Eight Hours"

CLASS ROOM HOURS – 1 hrs

PRACTICAL HOURS – NIL

HOURS ON SIMULATOR – 7 hrs.

Appendix-III/3B

ENGINEERING MANAGEMENT COURSE Chief Engineer Officer Class III Under Regulation III/3

Duration : Two Months

Sr. No.	SUBJECTS	Theory	Case Study & Interaction Between Participants
		(In Hrs)	
	Regulatory Aspects		
1.0	Knowledge of National legislation, Indian Merchant Shipping Act, knowledge of International Treaties, Conventions, Protocols, Rules legislations & regulations including United Nations Convention on the Law of the Sea 1982 (UNCLOS)	15	3
1.1	Knowledge of International legislation; national legislation and method of adoption		
1.2	International Maritime Organisation (IMO) and IMO's Conventions Related to Safety, Related to Pollution, Related to Liability and Compensation and Related to other subjects		
2.0	ISO 9001-2008, ISM Code, – Ship board internal audit – Total Quality Management	9	3
3.0	Classification societies and their functions. Certificates and documents as per international convention.	9	3
3.1	Continuous survey of machinery and other methods of machinery surveys		
3.2	Continuous survey of hull and other methods of hull surveys		
3.3	Enhanced special survey programmes		
3.4	Ship inspections for first entry into Indian flag		
4.0	Ship Stability	9	6
4.1	Ship stability- during drydocking and damage stability during flooding and grounding. Counter measures to be taken		
4.2	IMO Regulations on ship stability; control of trim, stability & stress		
4.2.1	International Intact Stability Code		
4.3	Probabilistic method of damage stability assessment		
5.0	SOLAS Convention	3	0

5.1	SOLAS Convention; procedure to determine		
	applicability of regulations to ships of different builds		
5.2	SOLAS updates and amendments		
6.0	Official log books and procedures relating to entries	3	0
6.1	Legislation requirements		
7.0	Monitor and control Compliance with legislative requirements and measures to ensure safety of life at sea and protection of the marine environment	21	0
7.1	Knowledge of relevant international maritime law embodied in international agreements and conventions		
7.2	Regard shall be paid especially to the following subjects:		
7.2.1	Certificates and other documents required to be carried onboard ships by international conventions, how they may be obtained and the period of their legal validity		
7.2.2	Responsibilities under the relevant requirements of the International Convention on Load Lines		
7.2.3	Responsibilities under the relevant requirements of the International Convention for the Safety of Life at Sea		
7.2.4	Responsibilities under the International Convention for the Prevention of Pollution from Ships		
7.2.5	Knowledge of national legislation for implementing international agreements and conventions		
7.2.6	Ship inspections for Charter Party requirements		
8.0	Ship security system	3	0
8.1	ISPS code		
8.1.1	Piracy threat and anti piracy measures		
8.1.2	Current Industry best management practices (from ICS)		
9.0	World Health Organisation & International Labour Organisation	3	0
9.1	World Health Organisation (WHO)		
9.2	International Labour Organisation (ILO)		
9.3	ILO's Maritime Labour Convention 2006 (MLC 2006)		
9.4	Maritime Labour Certificate and Declaration of Maritime Labour Compliance		

10.0	Ship surveys and inspections for port state control / flag state control Various MOUs and their salient features.		
10.1	Explain that Port State Control (PSC) is the inspection of foreign ships in national ports to verify that the condition of the ship and its equipment comply with the requirements of international regulations and that the ship is manned and operated in compliance with these rules.	9	3
10.2	Explain about initial survey, periodical survey, renewal survey, intermediate survey, annual survey, additional survey		
	Ship Operations & Commercial/ Legal Aspects		
11.0	P&I Clubs, - principles of protection & indemnity Insurance – types of P&I covers available – their modes of operation	12	3
11.1	Charter party, and role of Chief Engineer in compliance of charter		
11.2	Marine insurance, - general principles of insurance - Institute time clauses - types of marine insurance covers - Particular and General Average Act		
11.3	Salvage - International Convention on Salvage 1989 and Lloyd's Standard Form of Salvage (LOF 2000)		
11.4	Breakdown of machineries and equipments (Action/ handling/ rectification) - Bearings, chains, turbo charger, a.c/ fridge system etc.		
12.0	Emergency Preparedness	12	6
12.1	Emergency preparedness for oil spill, fire flooding, collision, grounding and accident involving personnel		
12.2	Study of emergency and damage control plans		
12.3	Case studies of accidents; root cause analysis		
12.4	Reporting procedures		
12.5	Risk assessment prior commencement of work		
	Human Resource Management Aspects		
13.0	Human relations and modern management principles	15	12
13.1	Organizational behaviour		
13.1.1	Study the influence of human factors in systems		
13.2	Workload management		
13.2.1	Planning and coordination		
13.2.2	Personnel assignment / Delegation		
13.2.3	Prioritization		

13.3	Effective resource management		
13.3.1	Allocation, assignment, and prioritization of resources		
13.3.2	Effective communication on board and ashore		
13.3.3	Obtaining and maintaining situation awareness		
13.4	Decision-making techniques		
13.4.1	Situation and risk assessment / risk management		
13.4.2	Select course of action		
13.5	Crisis management on board ships.		
13.5.1	Human behaviour in crisis		
13.5.2	Leadership in crisis		
13.5.3	Importance of emergency drills		
14.0	Leadership and managerial skills	6	3
14.1	Personality development		
15.0	Training of trainers. Chief Engineer as trainer for engine room staff		
15.1	Discipline on board and counseling		
15.2	Communication process	9	3
15.3	House keeping, safety and hygiene		
15.4	Need analysis and development		
15.5	Motivation		
15.6	Mentoring		
	Technical Management Aspects		
16.0	Inventory management, including		
16.1	Spares, stores,		
16.2	Lead time.		
16.3	Inventory of Fuel oil	6	3
16.4	Inventory of lub oil, Use of low BN cylinder oil for low sulphur fuel		
16.5	Management of quality of above		
17.0	Management Information Systems		
17.1	Computer system resources	3	3
17.2	Decision Support system and expert system		
18.0	Records		
18.1	Record making, keeping and its interpretation for complete engine room with regard to maintenance	6	0
18.2	Record making, maintaining with regard to operation		

18.2.1	C/E s standing orders / night order book / updation of		
	circulars		
18.3	New ORB entries		
18.4	Other records as per MARPOL requirements		
19.0	Economising of fuel consumption.		
19.1	Effective power balancing; propulsive characteristics of Diesel Engines including speed, output and fuel consumption	9	0
19.2	Bunker management, Use of low sulphur fuel, Change over procedures current version of ISO 8217 fuel standards		
19.3	Factors affecting vessel's performance; load diagrams		
20.0	Budgeting		
20.1	Cost value analysis	6	0
20.2	Fixed and consumable costs		
20.3	Voyage expenses		
20.4	Drydock and repair cost analysis		
20.5	Down time realisation		
	Latest Technical Developments		
21.0	Practical electricity and electronics		
21.1	High voltage on ships	6	6
21.2	Electrical propulsion		
21.3	Sulfur Hexafluoride (SF6) and vacuum circuit breakers		
22.0	Engine developments		
22.1	Camshaft less main engines and other diesel engine developments	9	0
22.2	New developments in tribology		
22.3	Propulsion system developments		
		183	57
		Total	240

(Followed by 3 Hour written paper on Engineering Management)

ORAL EXAMINATION

The orals will be based on the Theoretical aspect of the syllabus of Engineering Management Course.

EXTRA FIRST CLASS ENGINEER'S COURSE

1. Course Curriculum:

The Examination and Assessment for the **Extra First Class CoC** will cover 12 subjects divided equally in Part A and Part B. The subjects are as given below:

Part A

- A. 1. Law of the Sea & Maritime Law
- A. 2. Risk Management & Marine Insurance
- A. 3. Shipping, Economics & Finance
- A. 4. Marine Materials & Corrosion of Marine Structures
- A. 5. Advanced Electrical, Electronic and Control Engineering Knowledge
- 6. Environment Protection & Energy Management in the Maritime industry.

Part B

- 1. Maritime Regulations
- B. 2. Management Techniques & Applications
- B. 3. Naval Architecture
- B. 4. Vibration Engineering
- B. 5. Advanced Marine Engineering Knowledge
- B. 6. Human Element

The detailed syllabi is attached as Appendix-I to this circular.

Candidate can select any five subjects out of the six from each Part and therefore shall satisfactorily complete the course and assessment of a total of ten subjects to consider for the award of the Extra First Class CoC.

IX. Conduct of Course

- X. The conduct and coordination of course will be undertaken by an institute designated for the purpose by the Directorate General of Shipping, and will spread over two semesters, Semester-I (January-June) covering Part A and Semester-II (July-December) covering Part B.
- XI. The candidates are required to apply directly to the designated institute in order to enroll for the course and the conduct of course will be in correspondence mode with the provision for contact classes by the institute on demand from the candidates and if the institute so decides.

XII. Assessment:

- XIII. The assessment of the subject will be based on combination mode of **assignment and examination**. The weightage for the two may be different for different subject, as decided by the institute conducting the course. However, at no time the weightage for examination shall be less than 60%.

XIV. Institute conducting the course should ensure that the assignments are so designed that the analytic ability of the candidate is explored and evaluated, and the assignments in each subject should help in assessing the knowledge, comprehension, application and analytical capabilities of the candidates for different modules. The institute is required to prepare the guidelines for the written assignment and it should be a dynamic

document to be updated from time to time with the consent of the Chief Examiner of Engineers.

3. The Examination for all subjects is expected to be conducted by the Directorate General of Shipping, twice in a year ie. in **June and December** every year. However, the candidates applying for the examination have to satisfactorily complete the course for the respective subjects, including the assignments, if any, as per the schedule prescribed by the institute, but in any case before 31st May and 30th November, respectively.
4. The assignments will have to be evaluated by the institute conducting the course. The records of the evaluated assignments are to be kept in electronic format for future verification.
- XV. The designated institute conducting the course shall issue a certificate of completion of course to the candidate, mentioning the subjects he has satisfactorily completed along with the marks scored for the assignment part, if any, and also forward the details to that effect to the Mercantile Marine Departments, conducting the examinations by 5th June and 5th December, respectively.
- XVI. The duly filled-up applications from the candidates for the Examination shall reach the respective Mercantile Marine Department by 15th June and 15th December for the examination in June and December, respectively.
- XVII. Pass marks for each subject would be 50%. Candidates who fail to pass a subject would need to reappear for the written examination. They however, would be exempted to submit assignments again if they have secured 50% or more marks in such assignments.
- XVIII. The course and examination need to be successfully completed within a maximum of five years from the date of first enrollment for the course, failing which, the candidate has to undergo the complete course and examination all over again.

5. Exemptions:

1. Candidates who have partly completed the Extra-First Class examination on the basis of existing syllabus have the option to migrate to the new syllabus, with due credits for the subjects he has successfully completed under the existing syllabus. However, in-case of candidates who are only left with dissertation under the existing extra first class syllabus will be required to complete the same by 31st December 2016, failing which he has to take examination of subjects of Part A and Part B under the new syllabus for which he was not examined under the old syllabus of Part A and Part B.
2. The candidates who have successfully completed M.Sc degree in Maritime Affairs covering all aspects of "Administration of Maritime Safety and Environmental Protection from the World Maritime University, Malmo, Sweden or PGDMOM from IIT, Kharagpur shall be exempted from the following subjects and can therefore take credit for the same:-

Part A

- A1. Law of the Sea & Maritime Law
- A3. Shipping, Economics & Finance
- A4. Marine Materials & Corrosion of Marine Structures
- A5. Advanced Electrical, Electronic and Control Engineering Knowledge

Part B

- B1. Maritime Regulations
- B2. Management Techniques & Applications
- B3. Naval Architecture
- B4. Vibration Engineering

- .11 Candidates falling under the category mentioned at sub-para 5.2 above, would therefore have to clear two subjects, one each from Part A and Part B, out of the remaining four

Appendix-I

DETAILED SYLLABI- EXTRA FIRST CLASS

subjects (ie.A2, A6, B5 and B6).

- .12 Candidates who have successfully completed Post Graduate course from World Maritime University, Malmo, Sweden in Maritime Affairs in streams other than those mentioned at sub-para 5.2 above are required to clear four subjects two each from Part A and Part B out of six subjects i.e.(A4,A5,A6 and B3,B4,B5)

PART A

A1. Law of the Sea & Maritime Law

Law of Contract - general principles, essential features of a contract, types of contracts, breaches and their remedies; Bailment and its features; INCOTERMS 2010, Special Contracts - Indemnity and Guarantee;

Law of Agency - general principles, types of agencies, legal relationship between the parties involved, breach of warranty of authority and termination of agency; Tort - negligence in shipping and defences against tortious liabilities; Freight & types of freights; Fundamental of ship chartering - Voyage Charter, Time Charter, Bareboat Charter.

UN Convention of the Law of the Sea & Maritime Zones of India Act, 1976; Arrest of Ships- International Convention on the arrest of ships.

Maritime Arbitration -- methods of dispute resolution; arbitration: The Arbitration and Conciliation Act, 1996 (Indian); Convention on Facilitation of International Maritime Traffic, 1965 (FAL Convention of IMO).

Bill of Lading and the Indian Bills of Lading Act, 1856, ; Law of Carriage: the Indian Carriage of Goods by Sea Act, 1925, as amended; Hague-Visby Rules and Hamburg Rules; Rotterdam Rules: MMTG Act 1993, as amended.

Collision law -- Related Convention and apportionment of blame; Salvage and Towage and Related contracts; Lloyds Open Form; International Convention on Salvage, 1989; Limitation of Liability of Carrier -- Related conventions and method of Calculations; Admiralty Jurisdiction -- Methods of enforcement of marine liens and arrest of vessels; Maritime and possessory liens -- claims accepted as maritime lien; order of priorities; subjects of maritime liens; arrest and jurisdiction; International Conventions related to Pollution Claims -- Civil Liability Protocol, 1992 and Fund Protocol, 1992 as amended; OPA 1990; The Customs Act, 1962; Marine Frauds -- Preventive measures and role of International Maritime Bureau.

A2. Risk Management & Marine Insurance

Risk management : concept, process and practice; Fundamental precepts of safety and risk, including risk assessment, safety and Formal Safety Assessment (FSA); Relationship between risk

assessment and maritime casualty investigation; Emergency preparedness measures and contingency planning as part of the overall risk management process; Origin and history of insurance; Principles of insurance and their applications to marine insurance - insurable interest, utmost good faith, indemnity, subrogation, contribution and proximate cause;

Types of losses; Partial Loss or Particular Average, Total Loss - Actual Total Loss (ATL) & Constructive Total Loss (CTL); General Average; salvage and sue & labour expenses Marine insurance markets in India and abroad -GIC and its subsidiaries; Lloyd's of London; Hull and machinery insurance - relevance of statutory and classification certificates, basis of underwriting/rating; Relevant Clauses of time policy; Liability and insurance of liabilities; concept of mutual insurance and Protection & Indemnity clubs; international pool of P & I clubs; liabilities related international conventions.

Insurance claims, surveys, documentation and procedure; standard, non-standard and ex- gratia claims; Legal aspects of insurer's recovery claims against shipowner; General Average - principles and practice; York Antwerp Rules 1994; general average adjustment; Protection and Indemnity Clubs -- risks covered and practice; Insurance implication of Piracy- Kidnap & Ransom (KR) Insurance.

A.3 Shipping, Economics & Finance

Fundamentals of economics, basic concerns and special features of transport and maritime transport; To apply economic principles to maritime transport; effect of supply and demand on shipping markets; Cost structure in shipping; direct & indirect operating expenses; Importance of IOE per day;

Basic knowledge in shipping and port management; Sale and purchase of ships - process; role of brokers; inspection and valuation; memorandum of agreement; standard forms including SALEFORM; necessary documentation; standard contracts for new building and demolition;

Commercial operations - liner trade and chartering; voyage and time charters; clauses of charter party that are related to technical operations; performance evaluation.

Shipping Economics- Investment appraisal in shipping; payback, NPV and IRR methods; Economics of scrapping and laying up of ships; Budget and cost control in shipping; Financing of ship acquisition; investment in shipping; sources of finance; payments for purchase and/or construction of ships from abroad;

Foreign exchange - impact of exchange rates on shipping; Relevant sections of legislation e.g., Foreign Exchange Management Act, 1999 (including all amendments and revisions) regarding *remittances* for - (a) Collection of freight, (b) Acquisition of ships (c) Other related matters; Role of banks in shipping and banking procedures regarding documentary credit/UCP 600;

Ports and Harbour-infrastructure and their role in marine transportation, inter-modal transportation; Uncertainties in economic variables and their effect on economic evaluation; information Technology Applications, Ship Production Process.

A.4 Marine Materials & Corrosion of Marine Structures

Classification society requirements and other national and international material standards-selection of materials for marine construction. Steel: Shipbuilding quality steels-mild steels, HY steels, HSLA steels, Iron-carbon diagram, cooling processes and their effects on mechanical properties, Stress-strain characteristics. Composite material in marine applications.

Requirements for welded construction of ships. Weld induced distortions, distortion mitigation techniques. Welding flaws reason for same. Concept of welder's qualification.

Material Failure tests and evaluations: Metal behavior under different environments, Experimental methods of testing rate of atmospheric oxidation and thermal oxidation by Marker test, Thermogravimetric test, salt spray test etc. Identification of surface, subsurface and deep seated discontinuities in metals by suitable NDT techniques. Introduction to fracture mechanics to evaluate the tolerance limit of surface flaws for useful usage

Corrosion Principles: Factor influencing corrosion-types of corrosion- electrochemical aspects-environmental effects-metallurgical effects- mechanism of corrosion-galvanic or two metal corrosion - crevice corrosion--corrosion atmospheric corrosion-pitting-inter granular corrosion-selective leaching -erosion corrosion-stress corrosion-hydrogen damage - fatigue corrosion - corrosion due to biofouling- microbial corrosion-corrosion rate expressions - corrosion rate measurements.

Corrosion Control and Prevention: Materials selection-alteration of environments - design for cathodic and anodic protection -- comparison of cathodic and anodic protection- protective coating - metallic coating and other inorganic coat inorganic coating- coating system selection-paint system-protection by means of paints-antifouling paints-corrosion protection system of hull structure-corrosion control by GRP- biofouling control- corrosion inhibitors-anodic inhibitor-marine coating - corrosion resistant materials for propellers, pumps, system, heat exchangers, hulls, wire ropes.

A.5 Advanced Electrical, Electronic and Control Engineering Knowledge

Cable & Insulation: Cables and layout, International Protection ratings, fittings in hazardous areas, classification of insulation.

Protective relaying: Primary and back up protection, principle of working and characteristics of Induction type relays, static and digital relays, protection of alternators, motors, transformer and busbar.

High Voltage system: Requirements of classification societies, mandatory ruleswith/without earthing, interference with control system, safe practice while watch keepingand maintenance, switching and isolation procedure, various circuit breakers, lay out of system, rating of switch gear.

Propulsion Systems: Comparisons between Electric, Steam and Diesel driven propulsion systems, DC Propulsion motors: Constant Voltage Propulsion system, Induction propulsion motors, High Temperature Super-conducting motors, Harmonics.

Microcontroller: Number formats and operations, Fixed point 8 bit numbers representations of signed integers and fraction, Floating Point Numbers. Generation of PWM signals, sinusoidal pulse width modulation, ADC and DAC interface, Assemblers and assembly language programming.

Review of Power Devices: Power MOSFET, IGBT, Thyristor (SCR), GTO, IGCT, gate trigger circuits, commutation circuits and class, natural & forced commutation, comparison of power devices.

Speed Control: AC-DC converters: 3-phase half wave converters, single-phase dual converters. DC-DC converters : Step-down chopper, step-up chopper, 2-quadrant & 4- quadrant chopper, DC-AC converters:1-phase half bridge and full bridge, 3-phase inverter 180° and 120° conduction, Synchroconverter, Servo converter, Soft start technique. AC- AC converters: Application of cycloconverter in electric propulsion onboard.

Instrumentation and Control: Review of control systems; process control loop, PID control, modern control systems; PLC, PAC, SCADA, Field Bus, Introduction to motion control systems. Review of sensors; Temperature, Pressure, Flow, Level, Humidity, Viscosity etc, Smart sensors, introduction to wireless sensor networks.

A.6 Environment Protection & Energy Management in the Maritime Industry

Pollution:- the science, mechanisms and technologies for pollution monitoring and control, and the institutions within the United Nations system; To consider integrated management principles and approaches such as ecosystem-based management and integrated coastal and ocean management, in place for the achievement of healthy, resilient and sustainable marine ecosystems;

Marine pollution problems related to shipping and port development such as ballast water, dredging and spills from ships, and other significant global drivers including population migration to coasts, increasing urbanization and industrialization, land based pollution and climate change, and their impact on habitats and biodiversity, economic development and human well-being; Trends and trajectories of these pressures and impacts and the international, national and local responses that are being employed to address them; UNFCCC & Kyoto Protocol and its impact in shipping; Concerns and challenges of developing countries, particularly from maritime sector.

The International Convention for the prevention of pollution from ships (MARPOL) Annex VI, inter-alia: Ship Energy Efficiency Management Plan (SEEMP); EnergyEfficiency Operational Indicator (EEOI); Energy Efficiency Design Index (EEDI); Compliance timeframes and issues; Market based measures (MBMs) for GHG reduction.

Design and construction of more efficient vessels; Maintenance, Measurement and Management strategies towards sustainable development; Innovations including usage of sustainable marine renewable energy resources to tap into the power of the wind, solar and tidal energy; Reduction of Carbon dioxide -Regulation vs Responsibility (CSR aspects of emission); Energy efficiency calculations for a complete power generation plant; Fuel management and energy efficiency technologies and operational practices.

Ballast Water Convention 2004; Antifouling Convention 2001; Recycling of Ships: Hong Kong Convention;

PART B

B.1 Maritime Regulations

IMO Conventions, IMO Codes, IMO Guidelines; Knowledge of National Legislation, Knowledge of International Legislation & Regulations; Merchant Shipping Act, Merchant Shipping Rules; relevant sections from IV Act 1917, Indian Port Act 1908, and Indian Port Trust Act 1948.

Role of Govt.in policy formulation & administration of maritime affairs; To provide an overview of the various international institutions involved in shipping and maritime affairs, including UN agencies and inter-governmental and non-governmental organisations and their interrelationship.

Structure & functions of various maritime bodies,(MMDs, Maritime boards etc) and their jurisdiction; Registration of ships; Statutory survey & Certification; Flag State implementation and Port State Control; different MOUs, benefits and usefulness of information; Marine Accidents: Reporting/Investigation.

Role of Recognized Organizations; role of Classification Societies and their structure; IACS & Common Structural Rules; IMO RO Code.

Flag of convenience/open registry countries, their effect on shipping, ITF, Second International ship Registers; IMO Member State Audit Scheme.

Latest Conventions and impacts: Bunker Convention; Nairobi Convention; HNS Convention etc.

B.2 Management Techniques & Applications

Principles of Management; Strategic Management; Quality Control and TOM; Materials and Maintenance Management. Project management: Definition of Project and Project Management; Stages of a Project: Project Management processes such as Initiation, Planning, Execution, and Closure; Feasibility studies and Project Report; Techniques for project planning and scheduling, PERT, CPM, network, models, time-cost trade off concepts, resource allocation and Project monitoring and control; Project Integration Management; Computer applications for better Project Management.

Optimization: Schematic View of Optimization process, Optimization Methods in management science, and applications of optimization; Optimization methodologies including linear programming, network optimization, integer programming, and decision trees. Applications to logistics, manufacturing, transportation, marketing, project management, and finance.

Failure analysis tools: Fault Tree Analysis, Failure Mode and Effects Analysis, Root Cause Analysis, and Ishikawa Diagram.

B.3 Naval Architecture

Development of ship types: Internal arrangement based on cargo type; Structural arrangements of various ship types-longitudinal and transverse framing systems, continuity and connectivity of structural members. Ship hull form and its definitions; Sectional areas and moments; hydrostatics calculations; Floatation and trim.

Stability: Stability at small angles; Free surface effects; Effects of lifting and movement of large masses on stability, Stability at large angles; Cross-curves of stability; Curves of statical stability; Dynamical stability; Effect of asymmetrical flooding on trim and heel; Floodable length; Stability in damaged conditions-lost buoyancy and added weight methods.

Structural strength: Static force on ship in still waters, static longitudinal strength calculations, characteristics of shearing force and bending moment curves, response of the structure, shear stress in ship's structure, calculation of deflection, dynamic longitudinal strength, long term probability distribution, resistance of ship's structure's to buckling, strength of transverse structure, structural failure.

Powering & propulsion: Resistance of ships to forward motion-components of resistance, Viscous and wave resistance; Air resistance; Resistance due to roughness and fouling; Hump and hollow speeds; Laminar and turbulent boundary layer, Froude number and Reynolds number; Model experiment, ITTC friction formulation and extrapolation procedure. Screw propeller geometry and definitions; Propeller theories momentum, blade element and lifting line; Propeller characteristics and open water efficiency, Hull propeller interaction, Wake, thrust deduction fraction, relative-rotative efficiency and quasi-propulsive coefficient; Propeller design using standard series data; Powering performance calculations; Ship trials and trial data analysis. Sea keeping: Sea-waves-theory of regular waves; Energy celerity dispersion and other characteristics of water waves; ship in regular waves; Encounter frequency; Ship motions- uncoupled heave, pitch and roll, Response amplitude operator, irregular and realistic sea- waves; statistical description and wave-energy spectrum; Sea-states and theoretical energy-spectra motion of ships in irregular waves. Slamming, deck-wetness, sea-sickness and other derived responses Ship maneuverability; Definitions of directional stability, steering ability and controllability, Hydrodynamic derivatives for motions in horizontal plane; Directional stability criteria; Turning-circle, zig-zag and other maneuvering trials; Rudder and its hydrodynamic characteristics; model experiments to stability maneuvering characteristics.

B.4 Vibration Engineering

Introduction to Mechanical vibration; Hull girder vibration; Calculation of natural frequencies of hull girder and hull resonance diagram; Propeller induced vibration, Vibration control and Mount design.

Review of Basic Dynamics, Kinematics of Rigid Bodies, Vibration of Single DOF damped systems, Vibration of Multi- DOF Marine Structures, Free and Forced Response, Vibration isolation of Marine Engines, Tuned Absorbers, Rudiments of Rotor Dynamics, Critical Review of Basic Dynamics, Kinematics of Rigid Bodies, Vibration of Single DOF damped systems, Vibration of Multi- DOF Marine Structures, Free and Forced Response, Barred range, Vibration isolation of Marine Engines, Tuned Absorbers, Rudiments of Rotor Dynamics.

Single degree of freedom systems, two degree of freedom systems: Spring coupled, mass coupled, vibration absorbers, and vibration isolation. Multi degree of freedom systems: Lagrange's equation, close couples and far coupled systems, Dunker ley's approximation method, Rayleigh method, matrix method, matrix iteration, orthogonality principle, orthogonality, expansion theorem and modal analysis, Flexural and torsional vibration, single/two/three/multi rotor systems, torsion ally equivalent shafts, effect of inertia of shafts; Stodola method, Holzer method, Galerkin method, Rayleigh- Ritz method, Myklested - Prohl method for far coupled systems, transfer matrix method.

Experimental methods in vibration analysis: Vibration instruments, vibration exciters, transducers and measurement devices, analyzers, vibration tests: free and forced vibration tests.

B.5 Advanced Marine Engineering Knowledge

Latest developments of Marine Diesel engines, auxiliaries like boilers, purifiers, pumps & pumping system, evaporators, purification systems, oily water separators, incinerators, sewage treatment plants, refrigeration & air conditioning systems, coolers, heat exchangers & their controls, compressed air systems, cooling systems, hydraulics, steering gear systems, propeller shafting systems, automation & control systems etc. Latest developments in Marine Gas Engines (Operated by LNG). Suitability of LNG as marine fuel for upcoming MARPOL regulations and economy.

Comparative analysis of the advantages and disadvantages of latest technology -Electronic Engines vs Traditional Engines. Alternative fuel /energy sources, Fuel Cell Technology- possibility in shipping.

Technology to improve SFOC, Engine De-rating, retrofitting for today's slow steaming. Application of emerging technology for powering merchant ships.

Appreciation of combustion processes; Insight into steam based power plants and cogeneration plants; Advancements in Shipboard Instrumentation & Control; Introduction to dual fuel system and boil off system of LNG carriers; Appreciation of Gas turbine and combined cycle; Advancements related to improvement in design and materials of marine equipment.

B.6 Human Element

Broad overview of the relevant IMO, ILO, MLC and other regimes relating to the Human Element, in the maritime industry such as maritime labour and welfare, and in particular the rights and expectations of seafarers in relation to occupational safety.

Familiarization with the work that has been undertaken by IMO and ILO with respect to human element issues and measures and recommendations introduced to minimize or mitigate the effects of human error aboard ships.

Human Factor and ISM Code: implementation of the ISM Code; shipboard and shore- based safety management, the approach by a classification society; Development of shipboard and shore-based safety management, the approach by a shipping company; Flag and Port State applications of the ISM Code

Knowledge and understanding of mandates assigned to maritime administrations with particular reference to crew supply, manning and certification of seafarers.

Organizational behavior: Perception, Values, Attitudes, Beliefs, Learning, Motivation, Leadership, Communication; occupational behavioral related safety practices; cross/ multi-cultural issues; women in shipping.

Understanding the structure of the STCW 2010 Convention and the STCW Code and the MLC 2006.

Training Record Book for NCV Engineer Cadets

This is available with Institute of Marine Engineers (India) at their head office: - Plot No. 94, Sector-19, Nerul, Navi Mumbai, Maharashtra 400706, Phone:022 2770 1664

Appendix- III/5A

SUMMARY OF WRITTEN EXAMINATION TO BE CONDUCTED BY / OR ON BEHALF OF THE CHIEF EXAMINER OF ENGINEERS FOR COMPETENCE FOR OFFICERS IN CHARGE OF AN ENGINEERING WATCH OF SHIPS OPERATING IN NEAR COASTAL VOYAGES, CLASS IV MEO (NCV)

REFERENCE TABLE A - III/IAppendix III/5A

	SUBJECTS UNDER EACH FUNCTION	COMPETENCIES COVERED	DURATION OF EXAM	MAXIMUM MARKS	PASS MARKS
	PART A				
1.	<i>Marine Engineering at operational level</i>				
i	Paper - I. Marine Engineering Knowledge (Basic)	1,2,3	3 hours	100	50
ii	Paper - II. Marine Engineering Knowledge (Operational).	4, 5	3 hours	100	50
2.	<i>Electrical, Electronic & Control engineering at the operational level</i>				
iii	Paper - III. Marine Electro technology.	6 & 7	3 hours	100	50
3.	<i>Maintenance & Repair at the operational level</i>				
iv	Paper – IV. Marine Engineering Practice.	8 & 9	3 hours	100	50
4.	<i>Controlling the operation of the ship & care for persons onboard at the operational level</i>				
v	Paper - V. Ship operations control and shipboard personnel care.	10,11,12, 13,14 ,15, 16 , 17 & 18	3 hours	100	50
	Note: - In addition following modular course to be completed. i) Advanced Fire Fighting. ii) Proficiency in Survival Craft and Rescue Boat. iii) Proficiency in Medical First Aid. iv) Personal Safety & Social Responsibility. v) Security Training for Seafarers		As per requirement of respective modular course.		

	with designated Security Duties.				
	PART B				
vi	Orals Function: 1, 2, 3 & 4.			100	60
				Each function	Each function on

**SUMMARY OF WRITTEN EXAMINATION TO BE CONDUCTED BY / OR ON
BEHALF OF THE CHIEF EXAMINER OF ENGINEERS FOR COMPETENCE FOR
OFFICERS IN CHARGE OF AN ENGINEERING WATCH OF SHIPS
OPERATING IN NEAR COASTAL VOYAGES, CLASS IV MEO (NCV)
REFERENCE TABLE A - III/ 1**

Revised competence list as per Table A-III/I of STCW as applied to NCV CLASS IV

<i>Marine Engineering at operational level</i>	
1	Maintain a safe engineering watch
2	Use English in written and oral form
3	Use internal communication systems
4	Operate main and auxiliary machinery and associated control systems
5	Operate fuel, lubrication, ballast and other pumping systems and associated control systems
<i>Electrical, Electronic & Control engineering at the operational level</i>	
6	Operate electrical, electronic and control systems
7	Maintenance and repair of electrical and electronic equipment
<i>Maintenance & Repair at the operational level</i>	
8	Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board
9	Maintenance and repair of shipboard machinery and equipment
<i>Controlling the operation of the ship & care for persons onboard at the operational level</i>	
10	Ensure compliance with pollution prevention requirements
11	Maintain seaworthiness of the ship
12	Prevent, control and fight fires on board
13	Operate life-saving appliances
14	Apply medical first aid on board ship
15	Monitor compliance with legislative requirements
16	Application of leadership and team working skills
17	Contribute to the safety of personnel and ship
18	Maintain the conditions set forth in a ship security plan; Recognition of security risks and threats; Undertake regular security inspections of the ship; and proper usage of security equipment if any.

SUMMARY OF POST SEA TRAINING PROGRAMMES, EXAMINATION & ASSESSMENT FOR MEO CLASS IV (NCV)

Regulation III / Iof STCW 2010 & Section A – III / Iof STCW Code (as applicable to NCV)

Department:
Engine

Level:
Operational

Capacity:
upto 3000 kw

Duration:
4 Months

NO.	COMPETENCY	HOURS	TYPE OF ASSESSMENT
		INSTITUTION	
		CLASS	
	Function 1: Marine Engineering at the Operational Level.		
1	Maintain a safe engineering watch	210 Hours Note: 90 hrs is to be devoted for Marine Engineering Knowledge (Basic) paper + 120 hrs is to be devoted for Marine Engineering Knowledge (Operational) paper	Written examination & or skills test.
2	Use English in written and oral form		
3	Use internal communication systems		
4	Operate main and auxiliary machinery and associated control systems		
5	Operate fuel, lubrication, ballast and other pumping systems and associated control systems		
	Function 2: Electrical, Electronic & Control Engineering at the Operational Level.		
6	Operate and maintain electrical, electronic and control systems.	80 hrs Note: The time is to be devoted for Marine Electro Technology paper.	Written examination & or skills test.

NO.	COMPETENCY	HOURS	TYPE OF ASSESSMENT
		INSTITUTION	
		CLASS	
	Function 3: Maintenance and repair at the operational level.		
8	Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board	100 hrs Note: The time is to be devoted for Marine Engineering Practice paper.	Written examination & or skills test
9	Maintenance and repair of shipboard machinery and equipment		
	Function 4: Controlling the operation of the ship and care for persons on board at the operational level		
10	Ensure compliance with pollution prevention requirements	90 hrs Note: The time is to be devoted for Ship operations control and shipboard personnel care. (Ship Construction & Stability, Safety, Security & Environmental Protection) paper.	Written examination & or skills test.
11	Maintain seaworthiness of the ship		
12	Prevent, control and fight fires on board		
13	Operate life-saving appliances		
14	Apply medical first aid on board ship		
15	Monitor compliance with legislative requirements		
16	Application of leadership and team working skills		
17	Contribute to the safety of personnel and ship		
18	Maintain the conditions set forth in a ship security plan, Recognition of security risks and threats, Undertake regular security inspections of the ship and proper usage of security equipment if any		
		480 hrs	

For each Function a variation of +/- 10 hrs is permitted, however the total hrs will remain 480 hrs.

**SPECIFICATION OF MINIMUM STANDARD OF COMPETENCE FOR OFFICERS IN CHARGE OF AN
ENGINEERING WATCH OF SHIPS OPERATING IN NEAR COASTAL VOYAGES MEO CLASS IV (NCV)**

REFERENCE TABLE A - III/ 1

FUNCTION 1:- MARINE ENGINEERING AT THE OPERATIONAL LEVEL

Knowledge, Understanding & Proficiency / Course Covered	Methods of Demonstrating Competence	Criteria for Evaluating Competence
Competence No. 1: Maintain a safe engineering watch Thorough knowledge of principles to be observed in keeping an engineering watch, including: 1. duties associated with taking over and accepting a watch 2. Routine duties undertaken during a watch including Ship Bilge/Ballast/oil - Pumping system. 3. maintenance of the machinery space log-book and the significance of the readings taken 4. duties associated with handing over a watch Safety and emergency procedures; change-over of remote/automatic to local control of all systems. Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems Engine Room Resource Management Knowledge of Engine room resource management principles including: 1. allocation, assignment and principles of resources 2. effective communication	Assessment of evidence obtained from one or more of the following: 1. approved in service experience. 2. approved training ship experience. 3. approved simulator experience where appropriate. 4. approved laboratory equipment training.	The conduct, handover and relief of the watch conform to accepted principles and procedures. The frequency and extent of monitoring of engineering equipment and systems conforms to manufacturer's recommendations and accepted principles and procedures, including Principles to be observed in keeping an engineering watch. A proper record is maintained of the movements and activities relating to the ship are engineering systems. Resources are allocated and assigned as needed in correct priority to perform

3. assertiveness and leadership 4. obtaining and maintaining situational awareness 5. Consideration of team experience		necessary tasks. Communication is clearly and unambiguously given and received Questionable decisions and/or actions result in appropriate challenge and response Effective leadership behaviors are identified Team member(s) share accurate understanding of current and predicted engine room and associated systems state, and external environment.
Competence No. 2: Use English in written & oral form. Adequate knowledge of the English language to enable the officer to use engineering publications and to perform engineering duties.	Examination and assessment of evidence obtained from practical instructions.	English language publications relevant to engineering duties are correctly interpreted. Communications are clear and understood.
Competence No.3: Use internal communication systems Operation of all internal communication systems on board 1. Operation and maintenance of ship's telephone system. 2. Operation and maintenance of ship's telegraph between engine room and wheel house.	Examination and assessment of evidence obtained from one or more of the following: 1. approved in-service experience 2. approved training ship experience 3. approved simulator training, where	Transmission and reception of messages are consistently successful Communication records are complete, accurate

3. Operation and maintenance of ship's two-way communication system. 4. Operation and maintenance including close circuit TV for indications at respective control station for the following: a) Watertight door indicator panels and their closures. b) General/fire alarms. c) Fire door indicator panels and their closures. d) Closing of ventilation system and its flaps. e) Fixed fire detection and alarm system. f) Automatic sprinkler, fire detection and alarm systems. g) Stability information. h) All indicators for machinery space including main engine, auxiliary engine, bilge and ballast in machinery control room as well as in wheel house. i) Closing of bow door and stern door, if fitted. j) Steering failures including automatic starting of auxiliary steering. k) Microphones to public address systems. 5. Record keeping of all communication systems.	appropriate 4. approved laboratory equipment training	and comply with statutory requirements
Competence No. 4: Operate main and auxiliary machinery and associated control systems. Basic construction structure and operation principles of major machinery systems including: 1. marine diesel engine 2. marine steam turbine 3. marine gas turbine 4. marine boiler 5. shafting installations including propeller 6. other auxiliaries including various pumps, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, air conditioning and ventilation systems 7. Steering gear 8. automatic control systems 9. Fluid flow and characteristics of lubricating oil, fuel oil and cooling systems 10. deck machinery	Assessment of evidence obtained from one or more of the following: 1. approved in-service experience 2. approved training ship experience 3. approved simulator training, where appropriate 4. approved laboratory equipment training	Construction and operating mechanisms can be understood and explained with drawings /instructions. Operations are planned and carried out in accordance with established rules & procedures to ensure safety of operations and avoid pollution of the marine environment.

		Deviations from the
		norm are promptly identified. The output of plant and engineering systems consistently meets requirements, including bridge orders relating to changes in speed and direction. The causes of machinery malfunctions are promptly identified and actions are designed to ensure the overall safety of

Safety and emergency procedures for operation of propulsion plant machinery including control systems Operational characteristics of machinery and control systems Preparation, operation, fault detection and necessary measures to prevent damage for the following major machinery items and control systems: 1. main engine and associated auxiliaries 2. steam boiler and associated auxiliaries and steam systems 3. auxiliary prime movers and associated systems 4. other auxiliaries including refrigeration, air-conditioning and ventilation systems		the ship and the plant, having regard to the prevailing circumstances and conditions.

Competence No. 5: Operate fuel, lubrication, ballast and other pumping systems and associated control systems Operational characteristics of machinery and control systems Operation of pumping systems – routine pumping operations – operation of bilge, ballast, fire and cargo pumping systems Oily water separators (or similar equipment) requirements and operation.	Assessment of evidence obtained from one or more of the following: 1. approved in-service experience 2. approved training ship experience 3. approved simulator training, where appropriate 4. approved laboratory equipment training	Operation of machinery and systems is in accordance with operating manuals Operations are planned and carried out in accordance with established rules & procedures to ensure safety of operations and avoid pollution of the marine environment. Deviations from the norm are promptly identified and appropriate action taken

DETAILED SYLLABUS & PAPERS UNDER WHICH FUNCTION OF MARINE ENGINEERING AT THE OPERATIONAL LEVEL (NCV) WILL BE COVERED

PART A

PAPER I: MARINE ENGINEERING KNOWLEDGE (BASIC)

1. Basic Mathematics - power & roots, ratio and proportion, percentage, average, fractions, elementary algebra, removal of brackets, factorization, LCM, equations, measurement of angles, Pythagoras theorem, properties of triangle, areas.

2. Basic Engineering Drawing - Freehand sketches of a machinery part or sectional elevation, plan, side view of machinery components given. Identification of materials and knowledge of clearances. Drawing of simple machine parts from isometric view to correct scale in Plan, Elevation and Side View

3. English - Intensive English Language Programme in Maritime/Marine engineering context, Adequate knowledge of English Language to enable to perform engineering duties. Introduction to glossary in Marine Engineering pertaining to engine room watch keeping. Reading of instruction manuals. Writing machinery log book.

4. Watchkeeping - Principles to be observed in keeping a safe engineering watch on board ship including safety and emergency procedures. Routine associated with taking over and accepting watch. Routine duties undertaken during a watch including pumping systems, Routine associated

with handing over the watch. Maintenance of m/c space log books and significance of readings taken

5. Basic principles of resource management in Engine room. - ERM - Allocation, assignment and prioritization of the resources, effective communication, assertiveness and leadership, obtaining and maintaining situational awareness, consideration of team experience.

6. Basic internal communication systems used on board - telephone system, telegraph system, two way communication systems.

PART A

PAPER II: MARINE ENGINEERING KNOWLEDGE (OPERATION)

1. Mechanics and Thermodynamics - Basic units, Derived units, vectors & vector diagrams, resultant and equilibrium, triangle of forces, Linear motion, speed, linear velocity, acceleration, mass, force of gravity, inertia, momentum, torque, force, work, power, energy, friction, coefficient of friction. Efficiency, pressure, temperature, Heat specific heat, Latent heat, Heat transfer, Gas laws, Boyle's law, Charles law.

2. Machineries of Engine Room Including Main Engine and Auxiliary machineries -

- (a) Working principles of various pumps, centrifugal, reciprocating, gear and screw pump
- (b) Working principles of various valves such as Globe valve, Gate valve, Relief valve, Quick closing valve, and Screw down non-return valve.
- (c) Familiarization of Main and Auxiliary Machinery (preparation for operation)
- (d) Air Compressor - Principles, Shipboard uses of compressed air, Necessity of inter-cooler, Different parts of compressors including safety devices, Safety requirement before and during running and stopping air compressors. Routine maintenance.
- (e) Auxiliary Engine - Working principles and constructional features of auxiliary prime movers used for alternators
- (f) Heat exchangers
- (g) Boiler - Lists the different uses of steam, Use of package boiler on board ship, Pressure range in auxiliary boiler, Boiler operation – raising steam, shutting down, and Preliminary requirement to maintain feed water. Different parts – boiler mountings. Methods of checking water level in steam boilers and necessary action taken if water level is abnormal.
- (h) Steering Gear - Electro hydraulic four ram/two ram steering gear arrangement
- (i) Separators – F.O./L.O. - Need of separators onboard ship, Regular maintenance, Importance of size and gravity disc for correct separation, Importance of maintaining temperature while running separators.
- (j) Refrigeration system. Refrigerants, types, working principle, equipments, maintenance and running. Air conditioning plant
- (k) Routine pumping operation of fuel oil, bunkering, storage / pumping, transferring etc. - Bilge and ballast system, Working principles of hydrophore system. Identification and rectification of common faults in pumps and pumping systems.

3. Main Engine - Construction of medium speed and slow speed large bore diesel engines. Bed plate, crank shaft, connecting rod, cross head, bearings, entablature, liner, piston, cylinder head. Construction of turbo chargers and exhaust gas boilers. Working principles of fuel system, lubricating oil system. Working principles of air starting system, fuel pump and fuel

injector. Knowledge of turbo charging, Knowledge of scavenging, Knowledge of super charging system, pulse and constant pressure, Knowledge of maneuvering system of the main engine, Knowledge of reduction gear arrangements, Fresh and sea water system, Fuel oil and Lube oil system.

FUNCTION 2: - ELECTRICAL, ELECTRONIC & CONTROL ENGINEERING AT THE OPERATIONAL LEVEL

Knowledge, Understanding & Proficiency / Course Covered	Methods of Demonstrating Competence	Criteria for Evaluating Competence
Competence No. 6: Operate electrical, electronic and control systems Basic configuration and operation principles of the following electrical, electronic and control equipment: 1. electrical equipment a. power generation systems, generator and distribution systems and basic electrical knowledge and skills. b. preparing, starting, paralleling and changing over generators c. induction electrical motors including starting methodologies d. high-voltage installations e. sequential control circuits and associated system devices f. Location of common faults and action to prevent damage. 2. electronic equipment functions, a. characteristics of basic electronic circuit elements and features of control systems for major machinery items including main propulsion plant operation control and steam boiler automatic combustion control b. flowchart for automatic and control systems c. functions characteristics and features of control systems for machinery items including main propulsion plant operation control and steam boiler automatic controls of basic electronic circuit elements 3. control systems a. various automatic control methodologies and characteristics b. Proportional–Integral–Derivative (PID) control characteristics and associated system devices for process control	Examination and assessment of evidence obtained from one or more of the following: 1. approved in-service experience 2. approved training ship experience 3. approved simulator training, where appropriate 4. approved laboratory equipment training	Operations are planned and carried out in accordance with operating manuals, established rules and procedures to ensure safety of operations Electrical, electronic and control systems can be understood and explained with drawings /instructions

Competence No. 7: Maintenance and repair of electrical and electronic equipment Safety requirements for working on shipboard electrical systems including safe isolation of electrical equipment required before personnel are permitted to work on such equipment Construction and operational characteristics of shipboard AC and DC electrical systems and equipment. Maintenance and repair works of for electrical system equipment, main switch boards, electric motors, generator and DC electrical systems and equipment. Detection of electric malfunction, location of faults and measures to prevent damage Construction and operation of electrical test and measuring equipment. Function and performance tests of the following equipment and their configuration 1. monitoring systems 2. automatic control devices 3. protective devices The interpretation of electrical and simple electronic diagrams.	Examination and assessment of evidence obtained from one or more of the following: 1. approved in-service experience 2. approved training ship experience 3. approved simulator training, where appropriate 4. approved laboratory equipment training	Safety measures for working are appropriate Selection and use of hand tools, measuring instruments and testing devices are appropriate and interpretation of results is accurate Dismantling, inspecting, repairing and reassembling equipment are in accordance with manuals and good practice Reassembling and performance testing is in accordance with manuals and good practice

DETAILED SYLLABUS & PAPER UNDER WHICH FUNCTION OF ELECTRICAL, ELECTRONIC & CONTROL ENGINEERING AT THE OPERATIONAL LEVEL (NCV) WILL BE COVERED

PART A

PAPER III: MARINE ELECTRO TECHNOLOGY

1. Voltage, Current, Resistance, Ohm's Law, Simple D.C. Circuit.
2. Capacitance, Inductance, Simple A. C. Circuits, Star and Delta connection.
3. Routine testing and maintenance of electrical machinery equipments and ship-board wiring, MSB fitting and batteries.
4. Starting of generator, load sharing and stopping operation.
5. Working knowledge of induction motor and motor starters.
6. Working knowledge of transformers.
7. Working knowledge of simple electronic equipment use on board the ship.
8. Working knowledge of basic control circuits.
9. Basic electronics, conductors, insulators, semi conductors, PN – junction & numerical.
10. Control engineering – basic concepts.

11. Transducers for measurements.
12. Simple automatic controllers for various functions.
13. Safety requirements for working on electrical systems
14. Detection of electrical malfunctions and basic troubleshooting including card replacement etc.
15. Basic maintenance of electrical system equipments including batteries etc
16. Interpretation of simple electrical diagrams.

FUNCTION 3: - MAINTENANCE & REPAIR AT THE OPERATIONAL LEVEL

Knowledge, Understanding & Proficiency / Course Covered	Methods of Demonstrating Competence	Criteria for Evaluating Competence
Competence No. 8: Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board Characteristics and limitations of materials used in construction and repair of ships and equipment Characteristics and limitations of processes used for fabrication and repair Properties and parameters considered in the fabrication and repair of systems and components Application of safe working practices in the workshop environment Methods for carrying out safe of emergency/temporary repairs Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools and measuring instruments Use of hand tools, machine tools and measuring instruments Use of various types of sealants and packing's.	Assessment of evidence obtained from one or more of the following: 1. approved workshop skills training 2. approved practical experience and tests 3. approved in-service experience 4. approved training ship experience	Identification of important parameters for fabrication of typical ship related components is appropriate Selection of material is appropriate Fabrication is to designated tolerances Use of equipment, and hand tools, machine tools and measuring instruments is appropriate and safe.
Competence No. 9: Maintenance and repair of shipboard plant machinery and equipment Safety measures to be taken for repair and maintenance works Safety measures to be taken for repair and maintenance including safe isolation of shipboard machinery and equipment required before personnel are permitted to work on such machinery or equipment. Appropriate basic mechanical knowledge and skills Maintenance and repair works such as dismantling, adjustment and reassembling of plant machinery including propeller The use of appropriate specialized tools and measuring instruments	Examination and assessment of evidence obtained from one or more of the following: 1. approved workshop skills training 2. approved practical experience and tests 3. approved in-service experience 4. approved training ship experience	Safety procedures followed are appropriate Selection of tools and spare gear is appropriate Dismantling, inspecting, repairing and reassembling equipment is in accordance with manuals and good practice Re-commissioning and performance testing is in accordance with

Design characteristics and selection of materials in construction of equipment		manuals and good practice Selection of materials is appropriate
Operational characteristics of equipment and systems.		
Interpretation of machinery drawings and handbooks		
The interpretation of piping, hydraulic and pneumatic diagrams		

DETAILED SYLLABUS & PAPER UNDER WHICH FUNCTION OF MAINTENANCE & REPAIR AT THE OPERATIONAL LEVEL (NCV) WILL BE COVERED

PART A

PAPER IV: MARINE ENGINEERING PRACTICE

1. Basic Hand Tools, Lathe, Drill and Shaping Machines, Electric, Gas Welding, Brazing, Electric Measuring Tools - Use of Hand and Power Tools, Basic workshop practice and basic fitting, Selection and correct use of tools in any given situation to carry out maintenance. Machine tools and processes - lathes and shaping machine - maintenance of machine tools, using and wearing correct protective clothing and equipment. Knowledge in fabrication / repairs / maintenance, wearing and using proper protective clothing and equipment. Safe working practices. Knowledge in electric arc welding, gas welding, brazing and soldering, Use of measuring instruments - Vernier, micrometer thread gauge. Use of Megger avometer / multimeter, tong tester, understanding significance of reading. Use of various types of sealants and packings.

2. Overhaul

Inspect condition and measure clearances of the following using right tools and instruments for medium speed engines. Fuel injector, Fuel pump, Air starting valve, Cylinder head relief valve, Piston and ring calibration, Inside gauging of liner, Bearing clearance (connecting rod/main), Crank pin diameter/ ovality, Cranks shaft deflection, Overhaul and maintenance of heat exchangers, air compressor etc., Installation, reassembling and testing of machinery on board ships. Medium Speed Engines – routine overhaul, Safe working practices.

3. Basic principle and overhauling of Four stroke and two stroke cycles engines sketches and overhauling of -

- (a) Cylinder head, Piston, Liner, Crankshaft, Connecting rod and bottom and bearing bolts, Fuel injector, Fuel pump, Air starting valve.
- (b) Lub oil , F.O., Cooling Water, Starting air – Engine Systems
- (c) 500/1000 hrs. routines overhauls of Main and Auxiliary Engines
- (d) Requirement of C.P.P. or changing speed for maneuvering by controlling fuel oil quantity.
- (e) Safe working practices
- (f) Crank case explosion, air line explosion, scavenge fire
- (g) Turbocharger – routine maintenance
- (h) Reduction gear arrangement for medium speed engine.

4. Maintenance of Marine Auxiliaries

- (a) Pumps including selection and fixing a mechanical seal or gland packing for the pump.

- (b) Compressor
- (c) Separators
- (d) Piping systems of the ship
- (e) Heat exchangers opening, inspecting and list the types of defects normally looked for -
Pressure testing of heat exchanger for leaks, F. O. Heater, F. W. Cooler, L. O. Cooler,
Expanding tubes of heat exchanger using tube rollers.

5. Safety at work - Safety measures for safe working environment awareness Starting air line explosion, crank case explosion, scavenge-space fire, dangers involved in entry in enclosed spaces, safety associated with welding, gas cutting and other similar practices, precautions while carrying hot work.

FUNCTION 4: - CONTROLLING THE OPERATIONS OF THE SHIP & CARE FOR PERSONS ON BOARD AT THE OPERATIONAL LEVEL

Knowledge, Understanding & Proficiency / Course Covered	Methods of Demonstrating Competence	Criteria for Evaluating Competence
Competence No. 10: Ensure compliance with pollution prevention requirements Prevention of pollution of the marine environment – Knowledge of the precautions to be taken to prevent pollution of the marine environment – Anti-pollution procedures and all associated equipment – Importance of proactive measures to protect the marine environment	Examination and assessment of evidence obtained from one or more of the following: 1. approved in service experience. 2. approved training ship experience. 3. approved training	Procedures for monitoring shipboard operations and ensuring compliance with MARPOL requirements are fully observed. Actions to ensure that a positive environmental reputation is maintained
Competence No. 11: Maintain seaworthiness of the ship. Ship Stability 1. Working knowledge and application of stability, trim and stress tables, diagrams and stress-calculating equipment 2. Understanding of the fundamentals of watertight integrity 3. Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy. Ship Construction 1. General knowledge of the principal	Examination and assessment of evidence obtained from one or more of the following: .5 approved in service experience. .6 approved training ship experience. .7 approved simulator training where appropriate. .8 approved laboratory equipment training.	The stability conditions comply with the IMO intact stability criteria under all conditions of loading. Actions to ensure and maintain the watertight integrity of the ship are in accordance with accepted practice.

structural members of a ship and the proper names for the various parts		
Competence No. 12: Prevent, control and fight fires on board. <i>Fire prevention and fire-fighting appliances</i> 1. Precautions against fire or explosion. Explosive mixtures, danger of oil leakages, sources of ignition, safety devices. 2. Knowledge of fire prevention 3. Ability to organize fire drills 4. Knowledge of classes and chemistry of fire 5. Knowledge of fire-fighting systems 6. Knowledge of action to be taken in the event of fire, including fires involving oil systems	Assessment of evidence obtained from approved fire-fighting training and experience as set out in section A- VI/3, paragraphs 1 to 3	The type and scale of the problem is promptly identified and initial actions conform to the emergency procedure and contingency plans for the ship. Evacuation, emergency shutdown and isolation procedures are appropriate to the nature of the emergency and are implemented promptly. The order of priority, and the levels and time-scales of making reports and informing personnel on board, are relevant to the nature of the emergency and reflect the urgency of the problem.
Competence No. 13: Operate life saving appliance. <i>Life –saving</i> 1. Ability to organise abandon ship drills and knowledge of the operation of survival craft and rescue boats, their launching appliances and arrangements, and their equipment, including radio life-saving appliances, satellite EPIRBs, SARTs, immersion suits and thermal protective aids. 2. Knowledge of survival at sea techniques.	Assessment of evidence obtained from approved training and experience as set out in section A- VI/2, paragraphs 1 to 4	Actions in responding to abandon ship and survival situations are appropriate to the prevailing circumstances and conditions and comply with accepted safety practices and standards.
Competence No. 14: Apply medical first aid on board ship.	Assessment of evidence obtained from approved training As set out in section	Identification of probable cause, nature and extent of injuries or conditions

Medical aid 1. Practical application of medical guides and advice by radio, including the ability to take effective action based on such knowledge in the case of accidents or illnesses that are likely to occur on board ship.	A- VI/4, paragraphs 1 to 3	is prompt and treatment minimizes immediate threat to life.
Competence No. 15: Monitor compliance with legislative requirements. Basic working knowledge of the relevant IMO convention G.O.I. various M.S. Rules concerning safety of life at sea and protection of the marine environment.	Assessment of evidence obtained from examination or approved training.	Legislative requirements relating to safety of life at sea and protection of the marine environment are correctly identified.
Competence No. 16: Application of leadership and team working skills Working knowledge of shipboard personnel management and training A knowledge of related international maritime conventions and recommendations, and national legislation Ability to apply task and workload management including: 1. planning and coordination 2. personnel assignment 3. time and resource constraints 4. prioritization Knowledge and ability to apply effective resource management: 1. allocation, assignment, and prioritization of resources 2. effective communication on board and ashore 3. decisions reflect consideration of team experiences	Assessment of evidence obtained from one or more of the following: 1. approved training. 2. approved in-service experience 3. practical demonstration	The crew are allocated duties and informed of expected standards of work and behavior in a manner appropriate to the individuals concerned Training objectives and activities are based on assessment of current competence and capabilities and operational requirements. Operations are demonstrated to be in accordance with applicable rules Operations are planned and resources are allocated as needed in correct priority to perform necessary tasks

4. assertiveness and leadership including motivation 5. obtaining and maintaining situational awareness Knowledge and ability to apply decision-making techniques: 1. Situation and risk assessment 2. Identify and consider generated options 3. Selecting course of action 4. Evaluation of outcome effectiveness		Communication is clearly and unambiguously given and received Effective leadership behaviors are demonstrated Necessary team member(s) share accurate understanding of current and predicted vessel and operational status and external environment Decisions are most effective for the situation
Competence No. 17: Contribute to the safety of personnel and ship Knowledge of personal survival techniques Knowledge of fire prevention and ability to fight and extinguishing fires Knowledge of elementary first aid Knowledge of personal safety and social responsibilities	Assessment of evidence obtained from approved trainings and experiences as set out in section A-VI/1, paragraph 2	Appropriate safety and protective equipment is correctly used Procedures and safe working practices designed to safeguard personnel and the ship are observed at all times Procedures designed to safeguard the environment are observed at all times Initial and follow-up actions on becoming aware of an emergency

		conforms with established emergency response procedures
Competency No. 18 : Maintain the conditions set forth in a ship security plan; Recognition of security risks and threats; Undertake regular security inspections of the ship; and proper usage of security equipment if any Working knowledge of maritime security terms and definitions, maritime security levels; security reporting procedures; Procedures and requirements for drills and exercises under relevant conventions, codes and IMO circulars; Procedures for conducting inspections and surveys and monitoring of security activities specified in a ship security plan; security related contingency plans. Knowledge of security documentation; Knowledge enabling recognition of potential security threats; Knowledge enabling recognition of weapons, dangerous substances and devices and awareness of the damage they can cause; crowd management and control techniques; handling security related information and security related communications; methods for physical searches and non-intrusive inspections. Knowledge of techniques for monitoring restricted areas: Knowledge of controlling access to the ship and to restricted areas onboard; methods for effective monitoring of deck areas and areas surrounding the ship; methods for controlling the embarkation, disembarkation and access while onboard of persons and their effects; General knowledge of various types of security equipment and systems, including their limitations; need for testing, calibrating	Assessment of evidence obtained from approved training or examination	Procedures and actions are in accordance with the principles established by the ISPS Code and the SOLAS, 1974, as amended Legislative requirements relating to security are correctly identified Procedures achieve a state of readiness to respond to changes in maritime security levels Communications within the ship security officer's area of responsibility are clear and understood

and maintaining security systems and equipment.		

DETAILED SYLLABUS & PAPER UNDER WHICH FUNCTION OF CONTROLLING THE OPERATIONS OF THE SHIP & CARE FOR PERSONS ON BOARD AT THE OPERATIONAL LEVEL (NCV) WILL BE COVERED

PART A

PAPER V:SHIP OPERATIONS CONTROL AND SHIPBOARD PERSONNEL CARE

1. Environmental Protection – preventive and proactive measures

- (a) Pollution Prevention - Basic knowledge of
- (b) Prevention of pollution of the marine environment, anti pollution procedures and precautions
- (c) Effects of operational or accidental pollution on Marine environment
- (d) Familiarity with all annexes of MARPOL
- (e) Anti-pollution equipment & anti- pollution drills.
- (f) Familiarity with SOPEP manual and Oil Record Book
- (g) Working principles Oily Bilge Separator
- (h) Working principles of incinerator
- (i) Working principles of sewage treatment plant

2. Naval Architecture and Stability

- (a) Density, relative density, pressure exerted by a liquid load on an immersed plane, c.o. pressure. The meaning of the terms Block co-efficient, Displacement, Dead weight, Laws of floating bodies, Use of displacement and TPC Immersion scales to determine weight of cargo or ballast from draught or freeboard
- (b) Effect of density of water on draught or freeboard, Fresh water Allowance. The meaning of the terms Buoyancy and Reserve Buoyancy
- (c) General understanding of centre of gravity. Centre of buoyancy Metacentric height. Righting lever, Righting Moment, Stable, unstable and neutral equilibrium.
- (d) Stiff and Tender Ships. The dangers of slack tanks. Use of stability & Hydrostatic data as supplied to ships.
- (e) “The effect of adding and removing weights on ship’s centre of gravity, centre of buoyancy”.

3. Ship Construction

- (a) The name of the principal parts of a ship, general ideas on ship-construction and of plans available on board ships. General Definitions of main dimensions.
- (b) Definitions of Sheer, Camber, flair, rake, tumblehome and rise of floor. Sections used, welding and materials. Longitudinal and Transverse framing. Beam knees, water tight - Bulkhead, Hatchways and Closing appliances, Rudders and steering gear, Shell and Deck Plating.
- (c) Bilges, Bilge keels. Double Bottom and Peak Tanks, Floors, Types of Floors.
- (d) Side and wing tanks. Air pipes. Ventilators.

- (e) Panting, hogging, sagging, pounding, permissible stress limits
- (f) Causes and simple method of preventing corrosion in ship structure including use of modern mechanized tools in preparing steel surface for anticorrosive treatment.

4. Ship Safety and personnel care

- (a) Knowledge of fire fighting appliances used
- (b) Knowledge of life saving appliances used and personal survival techniques
- (c) Knowledge of Medical First Aid at sea
- (d) Knowledge of personal safety and social responsibility

5. Marine Legislation - Basic working knowledge of IMO Conventions: - SOLAS, MARPOL, LOADLINE, STCW and other legislations / instruments applicable to maritime field. G.O.I. M.S. Rules concerning maritime and Statutory Certificates to be kept on board issued under various conventions and G.O.I. Rules.

Leadership and Teamwork – basic principles and why essential on board

6. Security training

- (a) Knowledge of maritime security terms and definitions, including elements for various maritime security threats.
- (b) Knowledge of maritime security levels and their impact on security measures and procedures aboard ship and in the port facilities
- (c) Knowledge of security reporting procedures, security related contingency plan and procedures to respond to security threats or breaches of security including provisions for maintaining critical operations of the ship.
- (d) Recognizing security threats and risks, undertaking regular security inspections and maintaining security equipment and systems.

PART B

PAPER VI: ORALS

[The oral is the final assessment of Paper I to Paper V. of Part A. The assessment is on the functions, "Marine Engineering at Operational level", "Maintenance and Repair at the Operational level", "Electrical, Electronics and Control Engineering at the Operational level", "Controlling operation of ship and care for persons on board at the Operational level", (NCV) based on competences, knowledge, understanding and proficiency under these functions. The criteria for evaluating competence is to be as per Column III of above.]

**SUMMARY OF WRITTEN EXAMINATION TO BE CONDUCTED BY / OR ON BEHALF OF
THE CHIEF EXAMINER OF ENGINEERS FOR COMPETENCE FOR SECOND ENGINEER OFFICER
ON SHIPS POWERED BY MAIN PROPULSION MACHINERY OF BETWEEN 750 kW AND 3000
kW**

REFERENCE SECTION A – III/3 and TABLE A - III/ 2

Appendix; III/6

Duration - Total 4 months course for Part -B

	SUBJECTS UNDER EACH FUNCTION	COMPETENCIES COVERED	DURATION OF EXAM	MAXIMUM MARKS	PASS MARKS
1.	<i>Marine Engineering at management level</i>				
	PART – A	1, 2, 3 & 4			
i	Paper - I. Mechanics & Hydromechanics		3 hours	100	50
ii	Paper- II. Thermodynamics & Heat Transmission		3 hours	100	50
iii	PART – B				
iv	Paper – I. Marine Engineering Knowledge (General)		3 hours	100	50
2.	Paper - II. Marine Engineering Knowledge (Motor or Steam).		3 hours	100	50
v					
	<i>Electrical, Electronic & Control engineering at the management level</i>				
	Paper - III. Marine Electrotechnology.	5 & 6	3 hours	100	50
3.	<i>Maintenance & Repair at the management level</i>				
vi	Paper – IV. Marine Engineering Practice.	7, 8 & 9	3 hours	100	50
4.	<i>Controlling the operation of the ship & care for persons onboard at the management level</i>				
vii	Paper – V. Naval Architecture & Ship Construction.	10, 11, 12, 13 & 14	3 hours	100	50
viii	Paper – VI. Ship's safety & environmental		3 hours	100	50

	protection.				
	Orals			100	60
	Function: 1, 2, 3 & 4.			Each function	Each function

SUMMARY OF POST SEA TRAINING PROGRAMMES, EXAMINATION & ASSESSMENT FOR MEO			
CLASS III SEO LIMITED TO 3000 kW			
Regulation III/3 of STCW 2010 & Section A - III/3 of STCW Code.			
Department: Engine	Level: Management	Capacity: Second Engineer Officer (Limited to 3000 kW)	Duration: 4Months

NO.	COMPETENCE	HOURS	TYPE OF ASSESSMENT
		INSTITUTION	
		CLASS	
Function 1: Marine Engineering at the Management Level.			
1.	Manage the operation of propulsion plant machinery	180 hrs Note: 90 hrs is to be devoted for Marine Engineering Knowledge (General) paper + 90 hrs is to be devoted for Marine Engineering Knowledge (Motor or Steam) paper	Written examination & or skills test.
2.	Plan and Schedule operations		
3.	Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery		
4.	Manage fuel, lubrication and ballast operations		

NO.	COMPETENCE	HOURS	TYPE OF ASSESSMENT
		INSTITUTION	
		CLASS	
Function 2: Electrical, Electronic & Control Engineering at the Management Level.			
5.	Manage operation of electrical and electronic control equipment	100hrs Note: The time is to be devoted for Marine Electro Technology paper.	Written examination & or skills test.
6.	Manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition		
Function 3: Maintenance and repair at the management level.			
7.	Manage safe and effective maintenance and repair procedures	60 hrs Note: The time is to be devoted for Marine Engineering Practice paper.	Written examination & or skills test.
8.	Detect and identify the cause of machinery malfunctions and correct faults		
9.	Ensure safe working practices		
Function 4: Controlling the operation of the ship and care for persons on board at the management level			
10.	Control trim, stability and stress	140 hrs Note:50 hrs is to be devoted for Naval Architecture paper + 90hrs is to be devoted for	Written examination & or skills test.
11.	Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea, security and protection of the marine environment		

NO.	COMPETENCE	HOURS	TYPE OF ASSESSMENT
		INSTITUTION	
		CLASS	
12.	Maintain safety and security of the vessel, crew and passengers and the operational condition of life-saving, fire-fighting and other safety systems	Ship's Safety, Environmental Protection and Personnel care paper.	
13.	Develop emergency and damage control plans and handle emergency situations		
14.	Use leadership and managerial skills		
	TOTAL	480 Hours	

For each Function a variation of +/- 10 hrs is permitted, however the total hrs will remain 480 hrs.

SPECIFICATION OF MINIMUM STANDARD OF COMPETENCE FOR SECOND ENGINEER OFFICER ON SHIPS POWERED BY MAIN PROPULSION MACHINERY OF BETWEEN 750 kW and 3000 kW

SYLLABUS FOR MARINE ENGINEER OFFICER CLASS III SEO LIMITED TO 3000 kW

REFERENCE SECTION A – III/3 and TABLE A - III/ 2

FUNCTION 1:—MARINE ENGINEERING AT THE MANAGEMENT LEVEL

Knowledge, Understanding & Proficiency / Course Covered	Methods of Demonstrating Competence	Criteria for Evaluating Competence
Competence No. 1: Manage the operation of propulsion plant machinery Design features, and operative mechanism of the following machinery and associated auxiliaries: 1. marine diesel engine 2. marine steam turbine 3. marine gas turbine 4. marine steam boiler	Examination and assessment of evidence obtained from one or more of the following: 1. approved in-service experience 2. approved training ship experience 3. approved simulator training, where appropriate 4. approved laboratory equipment training	Explanation and understanding of design features and operating mechanisms are appropriate
Competence No. 2: Plan and Schedule operations Competence No. 3: Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery <i>Theoretical knowledge</i> Thermodynamics and heat transmission Mechanics and hydromechanics Propulsive characteristics of diesel engines, steam and gas turbines, including speed, output and fuel consumption Heat cycle, thermal efficiency and heat balance of the following: 1. marine diesel engine 2. marine steam turbine 3. marine gas turbine	Examination and assessment of evidence obtained from one or more of the following: 1. approved in-service experience 2. approved training ship experience 3. approved simulator training, where appropriate 4. approved laboratory equipment training	The planning and preparation of operations is suited to the design parameters of the power installation and to the requirements of the voyage The methods of preparing for the start-up and of making available fuels, lubricants, cooling water and air are the most appropriate Checks of pressures, temperatures and revolutions during the start-up and warm-up period are in accordance with technical specifications and agreed work plans Surveillance of main propulsion plant and auxiliary systems is sufficient to maintain safe operating conditions

4. marine steam boiler Refrigerators and refrigeration cycle Physical and chemical properties of fuels and lubricants Technology of materials Naval architecture and ship construction, including damage control Practical knowledge Start up and shut down main propulsion and auxiliary machinery, including associated systems Operating limits of propulsion plant The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery Functions and mechanism of automatic control for main engine Functions and mechanism of automatic control for auxiliary machinery including but not limited to: 1. generator distribution systems 2. steam boilers 3. oil purifier 4. refrigeration system 5. pumping and piping systems 6. steering gear system 7. cargo-handling equipment and deck machinery		The methods of preparing the shutdown, and of supervising the cooling down of the engine are the most appropriate The methods of measuring the load capacity of the engines are in accordance with technical specifications Performance is checked against bridge orders Performance levels are in accordance with technical specifications Arrangements for ensuring the safe and efficient operation and condition of the machinery installation are suitable for all modes of operation.
Competence No. 4:Manage fuel, lubrication and ballast operations Operation and maintenance of machinery, including pumps and piping systems. Construction and characteristics of pumps and pumping systems used for fuel and ballast operations. Piping system of fuel and ballast operations.	Examination and assessment of evidence obtained from one or more of the following: 1. approved in-service experience 2. approved training ship experience 3. approved simulator training, where appropriate	Fuel and ballast operations meet operational requirements and are carried out so as to prevent pollution of the marine environment

SOLAS Regulations on fuel and ballast systems and its implementation on board and ashore.		
Routine and emergency preparedness of pollution prevention from fuel.		
Ballast water contamination.		

**DETAILED SYLLABUS & PAPERS UNDER WHICH FUNCTION OF MARINE ENGINEERING AT THE
MANAGEMENT LEVEL FOR
MEO CLASS III SEO LIMITED TO 3000 kW WILL BE COVERED.**

PART A

PAPER I : MECHANICS AND HYDRO MECHANICS

Mechanics and Hydromechanics –

Theoretical Knowledge - Statics, Dynamics, Friction, Balancing, Simple Harmonic Motion, Stress & Strain, Bending of Beams, Torsion, Struts, Combined Stress, Stresses in Thick Shells, Fluid Mechanics.

2. **Statics** - Bow's notation, Force analysis by method of sections, framed structures.
2. **Dynamics** - Equations of motion, Velocity and acceleration diagrams, Laws of conservation of energy and momentum, Collision of rigid and elastic bodies, Projectiles, Engine mechanisms, Flywheels, Hoists, Cams, Governors, Simple and epicyclic gear systems, Vehicle dynamics.
3. **Friction** - Sliding friction on horizontal and inclined planes, Cotters, Screw threads, Belt drives, Friction brakes, Plate and cone clutches.
4. **Balancing** - Primary and secondary forces, Primary and secondary couples, Complete balancing of reciprocating machinery.
5. **Simple Harmonic Motion** - Equation of simple harmonic motion, Amplitude, frequency and periodic time, Vibrating spring mass systems, Springs, Resonance, Transmissibility, Vibrations of flywheels and gearwheels.
6. **Stress & Strain** - Stress and strain relationships in thin cylindrical and spherical shells, Stress in thin, rotating rims, Thermal stress, Stress in compound bars, Elastic strain energy, Stresses due to gradually applied and shock loads.
7. **Bending of Beam** - Shear force and bending moment diagrams, Fundamental bending equation, Bending stresses, Deflection of beams. Macaulay's method.
8. **Torsion - Stress**, strain and strain energy due to torsion, Fundamental torsion equation, Reciprocating engine crank effort, Rudder stock turning moment from steering gear, Deflection of helical springs.
9. **Struts** - Euler's formula, Slenderness ratio.
10. **Combined Stress** - Stresses on an oblique plane, Material subjected to two perpendicular stresses,

Axial and bending stress, Mohr's stress circle. Principal stresses and strains, Combined bending and twisting.

11. Stresses In Thick Shells - Lamé's equations, The Lamé Line, Shrinkage allowance.

12. Fluid Mechanics - Volume and mass flow, Venturi meter, Bernoulli's equation, Jets. Orifice coefficients, Dynamic and kinematic viscosity, Reynolds' number, Flow losses in pipes and fittings, Darcy's formula, Centrifugal pumps.

PART A

PAPER II : THERMODYNAMICS AND HEAT TRANSMISSION

Thermodynamics and Heat Transmission -

Theoretical Knowledge - Thermodynamic Fundamentals, Perfect Gas, Second Law, Gas Cycles/Engine Analysis, Properties of Vapours, Steam Cycles, Steam Turbine Velocity Diagrams, Refrigeration, Combustion, Compressors, Heat Transfer, Air Conditioning.

- 1. Thermodynamic Fundamentals** - System and working substance, SI Units. Property and State, Reversible and Irreversible processes, Reversible work of compression or expansion, First Law applied to non-flow and flow processes, Throttling, nozzles and mixing of streams.
- 2. Perfect Gas** - Equation of state, Specific heat, internal energy, Adiabatic, polytropic, isobaric and isothermal compression/expansion, Enthalpy, Gas mixtures and Dalton's Law of partial pressures.
- 3. Second Law** - Classical statements, Heat engine, Thermal efficiency, Entropy, Isentropic process, Reversible heat engine, Temperature – entropy (T-s) diagram for a perfect gas, Isentropic efficiency.
- 4. Gas Cycles/Engine Analysis** - Constant pressure and constant volume air standard cycles, Reciprocating internal combustion engine performance parameters, indicator diagrams, power, mean effective pressure, thermal efficiency, brake specific fuel consumption, mechanical efficiency, energy balance, Open and closed gas turbine systems, Power, isentropic efficiency and thermal efficiency for gas turbines.
- 5. Properties of Vapours** - Saturation, dryness fraction and superheat, T-s, p-h, p-v, h-s diagrams, Fluid properties using steam tables, Throttling and separating calorimeters, Air in condensers.
- 6. Steam Cycles** - Rankine cycle. Turbine isentropic efficiency, Feed heating, Thermal efficiency, Cycle on T-s diagram,
- 7. Steam Turbine Velocity Diagrams** - Principles of reaction and impulse turbines including compounding, Velocity diagrams, Nozzle steam velocity (excluding proof of critical pressure ratios), Force and work done on blades.
- 8. Refrigeration** - Vapour compression cycle, Refrigerant properties and hazards, Refrigerant tables, Cycle on p-h diagram, Coefficient of performance, Refrigerant mass flow, Compressor calculations, Secondary refrigerants.
- 9. Combustion** - Combustion equations, Fuel composition, Air-fuel ratio, Excess air, Volumetric analysis of combustion products, Calorific value.

- 11. Compressors** - Reciprocating compressors: Operating principles, volumetric efficiency, free air delivery, power, mechanical efficiency, isothermal efficiency, multi-stage and inter-cooling, p-V diagram, Positive displacement rotary compressors: Operating principles, power, efficiency.
- 11. Heat Transfer** - Conduction, radiation and convection, Composite walls. Insulation, Film coefficient, Interface temperature, Stefan-Boltzmann Law, Parallel flow and cross flow heat exchangers, Logarithmic mean temperature difference.
- 12. Air Conditioning** - Comfort conditions, Psychrometric charts, Wet and dry bulb temperatures, Humidity, Dew point, Dehumidifying and humidifying processes, Air conditioning systems.
- 13. Heat Cycle**, Thermal Efficiency and Heat Balance of Marine diesel engine, Marine steam turbine, Marine gas turbine, Marine steam boiler.

PART B

PAPER I: MARINE ENGINEERING KNOWLEDGE (GENERAL)

The Engineering knowledge to be shown by candidates in that which is required for the use, operation and maintenance of the machinery, equipment and ship structure usually in the charge of an Engineer Officer at Management level. Candidates may be required to illustrate their answers by means of freehand sketches. The scope would include following:

- 1. Technology of materials** - Metallurgy of Steel and Cast Iron, Properties and application of material used in machinery on board ships, Destructive and non-destructive testing of material, Materials and welding.
- 2. Physical & chemical properties of fuel & lubricants** - Properties and characteristics of fuels and lubricants, Shore side and shipboard sampling and testing, Interpretation of test results, Contaminants including microbiological infection, Treatments of fuels and lubricants including storage, centrifuging, blending, pretreatment and handling.
- 3. Construction details**, and where applicable the manner of attachment to ship, principles involved and operation Surveillance & Performance assessment of :
- XIX. water gauge, thermometer, clinometer, ammeter, water meter, pressure gauge and other meters and gauges commonly used by engineers on board ship.
 - XX. All auxiliary machineries of engine room including associated systems, pumps, pumping and piping systems, oily water separators.
 - XXI. Thrust blocks, shafting, bearings, stern tubes, and propellers, shipside fittings.
 - XXII. steering gear, stabilisers.
 - XXIII. Refrigeration machinery, deck machinery.
 - XXIV. Auxiliary boilers and steam plant.
 - XXV. Auxiliary compression ignition engines and associated plant.
 - XXVI. diesel electric drives.
- 4. Start Up and Shut down of Auxiliary Machinery**, including associated system: Air compressors and compressed air systems, Hydraulic power system, Types of auxiliary boilers, Auxiliary steam system, Safety valves, Boiler water levels, Boiler Water Testing, Boiler Water Treatment, Boiler defects, Boiler and repairs, Evaporators.
- j) Safe and efficient operation, Surveillance & Performance assessment of electrical machines and systems.

- k) Requirements, including operations and maintenance of pumps and pumping systems including bilge, fire main, ballast, sewage & sludge systems.
- l) Refrigeration, working principles of air conditioning, cargo and domestic refrigeration plants. Refrigerants used in the marine refrigeration plants, green house effects and future refrigerants. Air conditioning including psychometric process for heating, cooling and humidification.
- m) Steering gear systems, single failure criteria of steering gear Surveillance & Performance assessment.
- n) Operation and testing of pneumatic hydraulic and electric control systems.
- o) Functions and Mechanism of Automatic Control for auxiliary machinery: Generator distribution system, Steam boiler, Oil purifier, Refrigeration system, Pumping and piping system, Steering gear system, Cargo-handling equipment and deck machinery.
- p) Operation of cargo handling equipment and deck machinery.
- q) Operation of fresh water systems, fresh water generating systems and its performance assessment.

Shipboard Personnel & Resource Management & emergency preparedness.

PART B

PAPER II: MARINE ENGINEERING KNOWLEDGE (MOTOR)

1. Design of Marine machinery:

Design features and operating mechanisms of marine diesel engines and marine steam boilers.

2. Operations of marine machinery:

- .13 Propulsive characteristics of diesel engines and gas turbines, including speed, output and fuel consumption. Operating limits of the propulsion plants.**
- .14 Safe and efficient operation and surveillance of, main propulsion plant and its systems and services. The determination of shaft power and recognition of irregularity in the performance of the machinery and plant. Operation, monitoring and evaluation of engine performance and capacity.**
- .15 Analysis and interpretation of information gained from monitoring equipment. Operation of gearing, clutches, air compressors.**
- .16 Planning and scheduling of engine operations.**
- .17 Functions and mechanism of automatic control of main engine.**
- .18 Safety of engine equipment, systems and services.**

4. Start up and Shut down main and auxiliary machinery, including associated system – Engine components, engine lubrication, fuel injection, scavenging and supercharging, starting and reversing, cooling systems, diesel engine control and safety, diesel engine emergency operation, multi-engine propulsion arrangement.

3.1 Engine components

- (i) Interpret static and dynamic loads and stresses, identifying service limitations of diesel engine components.
- (j) Evaluate different fabrication methods of diesel engine components, including: Welding, forging,

utilizing composite materials,

- (k) Identify two and four stroke operating cycle forces, couples, and moments, relating these to design principles of: Crankshafts, bedplates, foundations, cross heads.
- (l) Explain out of balance gas and inertia forces, couples, and moments, and relate these to flywheels, balance weights, and first/second order balancing, and hull vibration.
- (m) Explain factors contributing to torsional vibration, and identify methods of minimizing or eliminating harmful effects of critical speeds.
- (n) Evaluate the calibration of: Pistons, cylinder liners, piston rings, bearings, crankshafts, to identify wear patterns, limits, and means of correction
- (o) Specify alignment and adjustment criteria of: Crankshafts, chain drives, gear drives, integral thrust bearings, crossheads
- (p) Compile specified working clearances and limits of all bearings, sliding surfaces, and interference fits of a typical diesel engine, using engine builders' manuals.
- (q)

3.2 Engine Lubrication

- (d) Identify diesel engine lubricant types, properties, and applications. Outline principles of diesel engine lubrication. Contamination and deterioration of diesel engine lubricants - Discuss the sources/ causes types, and effects of contamination.
- (e) Describe typical testing and treatment methods, and Interpret typical results of testing, giving appropriate actions which should be undertaken.
- (f) Describe, using diagrams, the distribution of lubricating oil to diesel engines, in particular the: Guides and crosshead bearings of slow speed diesel engines, Top end bearings of medium speed engines, Bottom end bearing, Main bearings, Camshaft drives, showing direction of flow, typical clearances, and stating normal operating parameters.

3.3 Fuel Injection

- (j) Explain why atomization and penetration of fuel and the turbulence of air are essential to optimum combustion in a diesel engine.
- (k) State typical injection pressures and viscosities for different grades of fuel.
- (l) Describe how and why fuel pumps, camshafts, and injectors are altered for varying fuel types.
- (m) Describe, with the aid of simple sketches, the difference between constant and variable injection timing of fuel, showing materials, principal parts, methods of operation and adjustments of common types of fuel pump.
- (n) Compare injection requirements for slow speed, medium speed, and high speed diesel engines, including pilot injection and pre-combustion chambers.
- (o) Identify common service faults, symptoms, and causes of combustion problems, specifying appropriate adjustments, including methods of fuel pump timing.
- (p) Summarize Occupational Health & Safety aspects of handling and testing fuel injection systems.
- (q) Explain, using relevant diagrams and stating normal operating parameters: Fuel valve cooling arrangement and Uni-fuel and dual-fuel systems (for high/medium viscosity fuel types)
- (r) Discuss the atmospheric pollution aspects of diesel engine combustion, and give methods which reduce this pollution (especially SO_x and NO_x reduction).

3.4 Scavenging and Supercharging

Evaluate the need for scavenging diesel engines, Compare methods of scavenging diesel engines, Specify methods of providing pressurized air for combustion in diesel engines, Assess pressure charging methods for diesel engines, Assess pressure charging methods for diesel engines, Examine

the working principles of turbochargers, Assess lubrication and cooling requirements of turbochargers, Analyze typical faults and identify appropriate actions to be undertaken with defective or damaged turbochargers.

3.5 Starting and Reversing

- (g) Describe starting procedures of diesel engines for power generation, propulsion, and emergency use.
- (h) Explain starting and maneuvering requirements/sequences for direct coupled reversible and geared propulsion diesel engines, for fixed and controllable pitch propeller applications
- (i) Describe, with labeled diagrams to indicate major components, typical maneuvering and reversing systems for propulsion diesel engines
- (j) Compare different methods of reversing direct coupled propulsion diesel engines
- (k) Identify common faults and identify appropriate actions to be undertaken with typical diesel engine starting and maneuvering systems
- (l) Compare the different methods of utilizing diesel engines for ship propulsion, including - Direct coupled, reversible slow and medium speed engines and Clutched and geared reversible and unidirectional medium speed engines with a fixed pitch propeller, Clutched and geared reversible and unidirectional medium speed engines with a controllable pitch propeller, and Diesel electric drive.

3.6 Cooling systems

- (l) Analyze the problems that may arise in cooling water spaces of diesel engines.
- (m) Evaluate common methods of diesel engine cooling water treatment.
- (n) State the importance of maintaining diesel engine thermal efficiency and evaluate thermal loads on engine components.
- (o) Justify cooling media selection and state the advantages and disadvantages of various diesel cooling methods.
- (p) Evaluate the tests used in the control of diesel engine cooling water treatment.
- (q) Enumerate the normal operating limits for diesel engine cooling water treatment.
- (r) Interpret the implications of out of limit readings from water treatment tests and state the corrective procedures which should be undertaken.
- (s) Itemize the sources and types of contamination of diesel engine cooling water and explain the effects of these contaminations on the reserves of treatment chemicals.
- (t) Compare the procedures which may be used to counter contamination of diesel engine cooling water.
- (u) Explain, using relevant diagrams and stating normal operating parameters, typical methods of cooling:
- (v) Medium and slow speed diesel engine pistons, Exhaust valves, Cylinders, Turbochargers, Cylinder heads.

3.7 Diesel Engine Control and Safety

3.8 Diesel Engine Emergency operation

FUNCTION 2: ELECTRICAL, ELECTRONIC & CONTROL ENGINEERING AT THE MANAGEMENT LEVEL.

Knowledge, Understanding & Proficiency / Course Covered	Methods of Demonstrating Competence	Criteria for Evaluating Competence
Competence No. 5:Manage operation of electrical and electronic control equipment <i>Theoretical knowledge</i> Marine electro technology, electronics, power electronics, automatic control engineering and safety devices. Fundamentals of automation, instrumentation and control systems Design features and system configurations of automatic control equipment and safety devices for the following: 1. main engine 2. generator and distribution system 3. steam boiler Design features and system configurations of operational control equipment for electrical motors Design features of high-voltage installations Features of hydraulic and pneumatic control equipment	Examination and assessment of evidence obtained from one or more of the following: 1. approved in-service experience 2. approved training ship experience 3. approved simulator training, where appropriate 4. approved laboratory equipment training	Operation of equipment and system is in accordance with operating manuals Performance levels are in accordance with technical specifications
Competence No. 6:Manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition <i>Practical knowledge</i> Troubleshooting of electrical and electronic control equipment Function test of electrical, electronic control equipment and safety devices Troubleshooting of monitoring systems Software version control		Maintenance activities are correctly planned in accordance with technical, legislative, safety and procedural specifications The effect of malfunctions on associated plants and systems is accurately identified, ships technical drawings are correctly interpreted, measuring and calibrating instruments are correctly used and actions taken are justified.

		Inspection, testing and troubleshooting of equipment are appropriate
DETAILED SYLLABUS & PAPERS UNDER WHICH FUNCTION OF ELECTRICAL, ELECTRONICS AND CONTROL ENGINEERING AT THE MANAGEMENT LEVEL FOR MEO CLASS III SEO LIMITED TO 3000 kW WILL BE COVERED <u>PART B</u> <u>PAPER III: MARINE ELECTRO TECHNOLOGY</u> In addition to the basic Electro Technology knowledge acquired at the operational level as regards to Electromagnetism, Electromagnetic induction, simple magnetic circuits, simple magnetic theory, alternating current theory, A.C. circuits and distribution systems involving A. C. & D. C. Shipboard installations & associated protective devices; the following additional syllabus to be adhered for the function "Electrical, Electronic and Control Engineering at the Management Level". 1. Automatic Control Engineering and safety devices. (a) Introduction - Open and closed control loops, Process control. Essential components in process control loops. (b) Sensors and transmitters - Resistance temperature devices. Thermocouples. Flow and pressure measurement. Level measurement. Ambient temperature compensation. Viscosity measurement. Torque measurement. Force balance transmitters. Oil/water interface and oil in water monitoring. The pneumatic flapper/nozzle system. Pneumatic 20 – 100 kPa, analogue 4 to 20 mA signals, Pneumatic pilot relays, Control air supply. Operational amplifiers. Electrical supply. (c) Controllers and Basic Control Theory - Disturbances and time delays and means to reduce them. Two step, proportional, integral, and derivative control actions. (d) Final Control Elements - Diaphragm operated control valves. Flow/lift characteristics of control valves. Control valve actuators and positioners. "Fail - safe", "fail - set" strategies. Wax element valves. Electrically operated valves. (e) Control Loop Analysis - Temperature control systems. Level control systems. Pressure control systems. Split range and cascade control. Single, two and three element control. (f) Governors - Need for governors. Governor terms, concepts and operation. Hydraulic governors. Digital governors, Power sharing. Governing systems. 2. Design features and system configuration of automatic control equipment and safety devices: 2.1 General Requirements (a) Electrical equipment designed for land use is often not suitable for use in ships. (b) As far as possible, all materials should be non-flammable explains where flame retardant materials may be used. (c) Meaning of the term flame retardant (d) Angles of heel and trim at which machinery should be capable of operating. (e) Effect of temperature changes on - Electromagnetic devices, Generator voltage. (f) Common maximum temperatures of air and sea water used for design purposes. (g) Axis of a rotating machine should not be placed athwart ships unless so designed. (h) Need to periodically check the security of all electrical connections.		

- (i) Requirements regarding the provision of electrical power and lighting for normal operation and for an emergency.

2.2 Main Engine

- (a) Monitoring & Control Systems - Boiler water level control. Advanced boiler combustion control. Diesel engine cooling control, Main engine control for FP and CP propellers. Alarm and monitoring systems. Programmable logic control and SCADA (supervisory control and data acquisition); Data logging and data transfer.
- (b) General requirements of automatic control equipment and safety devices - Monitoring system, Safety system, System independence, Local control, Failure mode and effect analysis, Power supply.
- (c) Remote control – Diesel propulsion, Control - electronic, electro-pneumatic, electro-hydraulic or pneumatic, Malfunctions – alarm, engine slow down, engine stop.
- (d) UMS Systems - Concept of Unattended Machinery Spaces (UMS). Requirements of UMS. Bridge control. Testing regime for UMS.

2.3 Generator and distribution system - Instrumentation and Safety in Generator and Distribution system, Auxiliary Diesel Generator Alarm and Shut Down, Automatic Starting of Propulsion Auxiliaries.

2.4 Steam boiler

- (a) Following failures will have alarms and display – feedwater high salinity, high water level, boiler pressure high and low, super heater outlet temperature high, fuel pump low outlet pressure, heavy fuel temperature high and low (or high and low viscosity), uptake high temperature, control system power failure, atomization steam / air pressure low
- (b) Following failures will have alarms, display and automatic shutdown of boiler – low water level, supply air pressure failure, ignition or flame failure.

3. Design features and system configuration of operational control equipment for electrical motors:

3.1 Three Phase A.C. Motors - Construction, principle of operation of 3-phase induction motors, Design features of star and delta motors, Starting, speed controlling and braking methods of 3-phase induction motors, Load-torque characteristics and protection.

3.2 Three Phase Synchronous Motors - Construction. Principle of operation. Load characteristics, Power factor improvement with synchronous motors.

3.3 Effect of varying frequency and voltage of A.C. Motors – Speed, Temperature, Torque, Power output and Starting time, current.

3.4 Motor control and protection - D. C. motors, A. C. motors.

3.5 Insulated Gate Bipolar Transistor (IGBT) motor speed control - Gate driving characteristics with high current, High frequency, high current switch, Advantages of IGBT in varying motor speed control.

3.6 Motor speed control by Thyristors - Application of thyristors in motor speed control.

3.7 Three Phase Generators - Construction. Salient and cylindrical rotor types, Shaft generators, Excitation methods, Automatic voltage regulation, Synchronization, Parallel operation,

Generator trouble shooting.

3.8 Three Phase Transformers - Construction Polarity, Configurations in Star and Delta combinations, Open delta configuration.

3.9 Distribution - Main switchboard construction and configuration. Short circuit protection - fuses, main circuit breakers, the generator air circuit breaker, Protection co-ordination, Distribution configuration, Electrical equipment for tankers and hazardous areas and safety systems.

3.10 Emergency Power - Automatic starting arrangements for the emergency generator, Emergency power requirements, Essential and non essential circuits, Batteries.

4. Electronics, Power Electronics

(a) Semiconductor Devices - Uni-junction transistor, The Bipolar transistor, operation and characteristics, bias circuits, AC and DC current gain, data sheets. Field Effect Transistors, Thyristors & operations.

(b) Integrated Circuits - Ideal operational amplifier, characteristics, types, mounting methods and markings, advantages of ICs. Practical operational amplifier, circuit configurations,

(c) Electronic Fault Diagnosis - Interpretation and use of electronic systems and subsystem circuit diagrams, operation and maintenance manuals.

Analysis of measurement and test result on components and circuits. Methods of fault detection.

5. High voltage systems:

Design features, operational and safety requirements for marine HV system. Mandatory rules for HV system in safe and flammable areas and with/ without earthing. Carrying out switching and isolation procedure.

6. Management of Troubleshooting & Restoration of electrical & electronic equipment to operating conditions.

6.1 Control System & Troubleshooting:

(a) Troubleshooting of electrical and electronic control equipment - Electrical safety, Test equipment, Interpretation of circuit symbols, Logical six step trouble shooting procedure, Generation, Prime mover electrical control, Main air circuit breaker, Protection of generators, Electrical distribution systems, Motors, Electrical survey requirements, Calibrate and adjust transmitters and controllers, Control system fault finding.

(b) Function test of electrical. Electronic control equipment and safety devices.

(c) Troubleshooting of monitoring systems - Test and calibration of sensors and transducers of monitoring system.

6.2 Maintenance & repair of the following:

Electrical and electronic systems operating in flammable areas, Carrying out safe maintenance and repair procedures, Detection of machinery malfunction, location of faults and action to prevent damage.

FUNCTION 3:– MAINTENANCE AND REPAIR AT THE MANAGEMENT LEVEL

Knowledge, Understanding & Proficiency / Course Covered	Methods of Demonstrating Competence	Criteria for Evaluating Competence
Competence No. 7: Manage safe and effective maintenance and repair procedures <i>Theoretical knowledge</i> Marine engineering practice <i>Practical knowledge</i> Organizing & managing safe and effective maintenance and repair procedures Planning maintenance, including statutory and class verifications Planning repairs	Examination and assessment of evidence obtained from one or more of the following: 1. approved in-service experience 2. approved training ship experience 3. approved workshop training	Maintenance activities are correctly planned and carried out in accordance with technical, legislative, safety and procedural specifications Appropriate plans, specifications, materials and equipment are available for maintenance and repair Action taken leads to the restoration of plant by the most suitable method
Competence No. 8: Detect and identify the cause of machinery malfunctions and correct faults <i>Practical knowledge</i> Detection of machinery malfunction, location of faults and action to prevent damage Detection of faults of machinery by visual inspection, NDT methods (Non-destructive examination) and by other advanced systems such as vibration monitoring (condition monitoring). Inspection and adjustment of equipment Modern approach to machinery reliability methods and their execution. Principles of Tero technology. Principles and practice of reliability and trends in breakdown. Typical failures and fault diagnosis. Reliability of machinery, its principle and practice.	Examination and assessment of evidence obtained from one or more of the following: 1. approved in-service experience 2. approved training ship experience 3. approved simulator training, where appropriate 4. approved laboratory equipment training	The methods of comparing actual operating conditions are in accordance with recommended practices and procedures Actions and decisions are in accordance with recommended operating specifications and limitations
Competence No. 9: Ensure safe working practices <i>Practical knowledge</i> Safe working practices, overhauling machinery, mechanical safety in workshops, protective equipment, lifting gear, entering	Examination and assessment of evidence obtained from one or more of the following: 1. approved in-service experience	Working practices are in accordance with legislative requirements, codes of practice, permits to work and environmental concerns

tanks, work in confined and hazardous spaces. Precautions against fire or explosion. Explosive mixtures. Danger of oil leakage's. Sources of ignition. Safety devices. Toxic and other dangerous properties of substances used in marine practice. Maintenance of plant associated with the carriage of dangerous goods.	2. approved training ship experience 3. approved laboratory equipment training	

DETAILED SYLLABUS & PAPERS UNDER WHICH FUNCTION OF MAINTENANCE AND REPAIR AT THE MANAGEMENT LEVEL FOR MEO CLASS III SEO LIMITED TO 3000 kW WILL BE COVERED

PART B

PAPER IV: MARINE ENGINEERING PRACTICE.

1. Theory of maintenance:

Theoretical knowledge of Marine engineering practice and maintenance of machinery.

Methods of dealing with wear and tear of machinery, both electrical and mechanical. Alignment of machinery components. Correction of defects.

Detection of machinery malfunction, location of faults and action to prevent damage - Unplanned maintenance.

Temporary or permanent repairs in the event of breakdown:

- (a) Failure of cross-head bearing/ main bearing/ bottom end bearings of main engine
- (b) Breakage of chain drives of main engine
- (c) Breakdown on turbo chargers
- (d) Breakdown of main air conditioning and fridge system
- (e) Collapse/ failure of multiple boiler water tubes

2. Practice of maintenance:

Management and conduct of ship maintenance by planned maintenance and preventive maintenance as per ISM Code. Theory of condition monitoring and its application onboard ships. Principles of tribology and its practices.

Planning and execution of dry docking and other major repairs. Manageable breakdowns and emergency repairs.

Planning and execution of safe maintenance activity and repair procedures taking into account technical, legislative, safety procedural specification, appropriate plan, specification of materials and equipment available for maintenance and repairs.

Risk assessment and evaluation before commencement of maintenance activity.

Destructive and non destructive testing.

Major contamination of main L.O. sump – Action/ handling/ rectification.

Severe flooding of engine room bilges – Action/ handling/ rectification.

Trials and restoration of the plant after repairs. Safe working practices.

Inspection and Adjustment of Equipment relevant to Marine Engineering.

3. Marine Engineering practice – Theoretical & Practical Knowledge

Classification society and class certificates, statutory certification of ships, Surveys for maintenance and renewal of class and statutory certificates.

FUNCTION 4: – CONTROLLING THE OPERATION OF THE SHIP & CARE FOR PERSONS ON BOARD **AT THE MANAGEMENT LEVEL**

Knowledge, Understanding & Proficiency / Course Covered	Methods of Demonstrating Competence	Criteria for Evaluating Competence
Competence No. 10:Control trim, stability and stress Understanding of fundamental principles of ship construction and the theories and factors affecting trim and stability and measures necessary to preserve trim and stability Knowledge of the effect on trim and stability of a ship in the event of damage to, and consequent flooding of, a compartment and countermeasures to be taken Knowledge of IMO recommendations concerning ship stability	Examination and assessment of evidence obtained from one or more of the following: 1. approved in-service experience 2. approved training ship experience 3. approved simulator training, where appropriate	Stability and stress conditions are maintained within safety limits at all times Procedures for monitoring operations and maintenance comply with legislative requirements Potential non-compliance is promptly and fully identified Requirements for renewal and extension of certificates ensure continued validity of survey items and equipment
Competence No. 11:Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea, security and protection of the marine environment Knowledge of relevant international maritime law embodied in international agreements and conventions Regard shall be paid especially to the following subjects: 1. certificates and other documents required to be carried on board ships by international conventions, how they may be obtained and the period of their legal validity		

2. responsibilities under the relevant requirements of the International Convention on Load Lines, 1966, as amended 3. responsibilities under the relevant requirements of the International Convention for the Safety of Life at Sea, 1974, as amended 4. responsibilities under the International Convention for the Prevention of Pollution from Ships, as amended 5. maritime declarations of health and the requirements of the International Health Regulations 6. responsibilities under international instruments affecting the safety of the ships, passengers, crew or cargo 7. methods and aids to prevent pollution of the environment by ships 8. knowledge of national legislation for implementing international agreements and conventions		
Competence No. 12: Maintain safety and security of the vessel, crew and passengers and the operational condition of life-saving, fire-fighting and other safety systems A thorough knowledge of life-saving appliance regulations (International Convention for the Safety of Life at Sea) All types of survival crafts, rescue boats, life rafts, pyrotechnics, life jackets, life buoys, thermal and immersion suits, launching device of survival craft. Organization of fire and abandon ship drills Maintenance of operational condition of life-saving, fire-fighting and other safety systems Actions to be taken to protect and safeguard all persons on board in emergencies Actions to limit damage and save the ship following fire, explosion, collision or grounding	Examination and assessment of evidence obtained from practical instruction and approved in-service training and experience	Procedures for monitoring fire-detection and safety systems ensure that all alarms are detected promptly and acted upon in accordance with established emergency procedures
Competence No. 13: Develop emergency and damage control plans and handle emergency situations		Emergency procedures are in accordance with the established plans for emergency situations

Ship construction, including damage control Methods and aids for fire prevention, detection and extinction Functions and use of life-saving appliances		
Competence No. 14: Use leadership and managerial skills Knowledge of shipboard personnel management and training A knowledge of international maritime conventions and recommendations, and related national legislation <i>Ability to apply task and workload management, including:</i> 1. planning and coordination 2. personnel assignment 3. time and resource constraints 4. prioritization <i>Knowledge and ability to apply effective resource management:</i> 1. allocation, assignment, and prioritization of resources 2. effective communication on board and ashore 3. decisions reflect consideration of team experience 4. assertiveness and leadership, including motivation 5. obtaining and maintaining situation awareness <i>Knowledge and ability to apply decision-making techniques:</i> 1. situation and risk assessment 2. identify and generate options 3. select course of action 4. evaluation of outcome effectiveness Development, implementation, and oversight of standard operating procedures	Assessment of evidence obtained from one or more of the following: 1. approved training 2. approved in-service experience 3. approved simulator training	The crew are allocated duties and informed of expected standards of work and behaviour in a manner appropriate to the individuals concerned Training objectives and activities are based on assessment of current competence and capabilities and operational requirements Operations are demonstrated to be in accordance with applicable rules Operations are planned and resources are allocated as needed in correct priority to perform necessary tasks Communication is clearly and unambiguously given and received. Effective leadership behaviours are demonstrated Necessary team member(s) share accurate understanding of current and predicted vessel state and operational status and external environment Decisions are most effective for the situation Operations are demonstrated to be effective and in accordance with applicable rules

DETAILED SYLLABUS & PAPERS UNDER WHICH FUNCTION OF CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD AT THE MANAGEMENT LEVEL FOR MEO CLASS III SEO LIMITED TO 3000 kW WILL BE COVERED

PART B

PAPER V: NAVAL ARCHITECTURE

General. Wetted surface formulae. Simpson's rules applied to second moments of areas, volumes, centroids and centres of pressure. Hydrostatic curves.

1. Structural strength: Total Pressure on Vertical Bulkhead of various shapes, Center of Pressure, Diagrams of Shear force and bending moment, Longitudinal Bending Moment in Still Water and wave induced.

2. Transverse stability:

Effect of free liquid surface and sub-division of tanks. Dangers due to water accumulation during fire-fighting Practical requirements to ensure stability at sea. Management of water and fuel tanks. Filling and emptying tanks at sea. Movement of centre of gravity. Angle of Loll and Stability beyond Angle of Loll, Correcting an angle of loll. Stability during Dry docking and Grounding, Damaged Stability,

3. Longitudinal stability:

Longitudinal BML and GML, Centre of flotation and its calculation. Moment to change trim by one centimeter.

Trim: Changes due to adding or removing fuel, ballast or cargo. Changes due to alteration in density of sea water. Changes due to bilging of compartments,

Using the Lost Buoyancy and Added Mass methods. Dynamical Stability, SOLAS, ILLC Convention requirement,

Forces on rudder and stress in rudder stock. Heel when turning, including effect of centrifugal force and of force on rudder.

4. Resistance and propulsion. Resistance and Fuel Consumption, Propeller and Power, Rudders & Damage Control. Various Types of resistance, Geometry of Propeller, The law of corresponding speeds. Froude's law of comparison. Simple problems on the prediction of full scale resistance from model experiments. Elementary treatment of propeller and simple problems on pitch, pitch ratio, apparent slip, wake velocity, Thrust and Power. Bulbous Bow, Sea trials and interpretation of data recorded. Effects of fouling.

Drag and Lift of Propeller, Problems on propellers involving the use of wake factor, Effective Power, Delivered Power, Propulsive & Quasi Propulsive coefficient, Propeller efficiency, Bollard Pull,

Computation of thrust and Power, Cavitation No, Cavitation Tunnel test of Model propeller, Co relation between Model and Full Propeller, Vibration in ships. Ducted Propeller.

Factors affecting trim and stability and measures necessary to preserve trim and stability. Effect on trim and stability of a ship in the event of damage to, and consequent flooding of, a compartment and countermeasures to be taken. IMO recommendations concerning ship stability

5. Ship construction:

Fundamental principles of ship construction and the theories and factors affecting trim and stability and measures necessary to preserve trim and stability Ship Types and Terms, Stresses in Ship Structures, Ship Dynamics, Hydrostatics, Displacement, TPC, Coefficients of Form, Areas and Volumes of ship shapes, 1st and 2nd Moments, Center of Gravity, Transverse Stability, Trim, Stability during dry docking and stability during grounding, Forces on ship under various conditions, including the effect of panting and pounding. Construction of all parts of steel ships. Use of high tensile steel and aluminum.

Structural fire protection arrangements. Dry docking. Design features of ships for general and specialized trades.

Life saving equipment Operation and handling gear for lifeboats and life rafts. Ship measurement and classification. Meaning of 'classed' and 'unclassed' ships. Common terms used in measurement of modern steel ships. Common terms used in tonnage measurement e.g. gross tonnage, net tonnage.

PART B

PAPER VI: SHIP'S SAFETY, ENVIRONMENTAL PROTECTION AND PERSONNEL CARE.

1 . Legislative requirements and measures to ensure safety of life at sea and protection of the marine environment

- (a) Knowledge of relevant International Maritime Law embodied in international agreements and conventions - United Nations Convention on the Law of Sea (UNCLOS), International Maritime Organization (IMO), World Health Organization (WHO), Introduction to International Labour Organization (ILO), Treaties, conventions, protocols, rules and regulations, List of IMO Conventions & Authorities & Regulations.
- (b) Certificates and other documents to be carried on board ships by international conventions (as per SOLAS Annex 1) and how they may be obtained and period of their legal validity.
- (c) Responsibilities under the relevant requirements of the international convention on load lines.
- (d) Responsibilities under the relevant requirements of the International Convention for the Safety of Life at Sea - Brief description of International Convention for the Safety of Life at Sea, Obligation - to carry out surveys and maintain validity of certificates, to maintain records and rights of master.

- (e) Responsibilities under the relevant requirements of the International Convention for the Prevention of Pollution from Ships - Annex I, Annex II, Annex III, Annex IV, Annex V, Annex VI.
- (f) Maritime declarations of Health and the requirements of the International Health Regulations – WHO's International Health Regulations 2005 (IHR), WHO's Guidelines for drinking water quality, International Medical Guide for ships (IMGS) and IMO's Medical First Aid Guide (MFAG)
- (g) Responsibilities under International Instruments Affecting the Safety of the Ships, Passengers, Crew or Cargo:
 - (i) ILO's Maritime Labour Convention 2006 (MLC 2006)
 - (ii) Convention on the International Regulation for Preventing Collisions at Sea (COLREG) 1972
 - (iii) Charter parties
 - (iv) Marine Insurance, General Average and P & I Club
- (h) Methods and aids to prevent pollution of the environment by ships
 - (i) List of Conventions, Sources of Marine Pollution, Effects of Marine oil spills and Noise
 - (ii) International Convention for the Control and Management of Ship's Ballast Water and Sediments
 - (iii) International Convention for the Control of Harmful Anti-Fouling Systems on Ships (AFS) 2001
 - (iv) Regulations for prevention of oil pollution as per Annex I of MARPOL 73/78
 - (v) Regulations for control of pollution from noxious liquid substances carried in bulk as per Annex II of MARPOL 73/78
 - (vi) Regulations for the Prevention of Pollution by harmful substances carried by sea in packaged form as per Annex III of MARPOL 73/78
 - (vii) Requirements covering the carriage of dangerous goods by sea as per Chapter VII of the SOLAS Convention
 - (viii) Regulations for the Prevention of Pollution by Sewage from Ships as per Annex IV of MARPOL 73/78
 - (ix) Regulations for the Prevention of Pollution by Garbage from Ships as per Annex V of MARPOL 73/78
 - (x) Regulations for the Prevention of Air Pollution as per Annex VI of MARPOL 73/78
- (i) National Legislation for implementing International agreements and Conventions.

2. Safety and security of the vessel, crew and passengers

- (a) Life Saving Appliances Regulations (SOLAS) - Life-Saving appliances and arrangements (Chapter III of SOLAS) and Life-Saving Appliance Code.
- (b) Organization of fire and abandon ship drill.
- (c) Maintenance, functions and use of Life Saving Appliances, Fire-Fighting and other safety systems.
- (d) Actions to protect and safeguard all persons on board in emergencies; rescue of persons from a vessel in distress or from a wreck; and Man-overboard procedures.
- (e) Action and means to limit damage and save the ship following fire, explosion, collision or grounding – Contingency plans for response to emergencies and Procedures for abandoning ship.

3. Develop Emergency and Damage Control Plans and Handle Emergency Situation

- (a) Methods and Aids for Fire Prevention, detection and extinction - Fire -fighting equipment.

4. Use Leadership and Managerial Skills

- (a) Knowledge of shipboard Personnel Management and Training - Engineer and Manager, Human Resource Management, Training and Development, Maintenance Management.
- (b) Knowledge of International Maritime Conventions and recommendations and related National Legislations - The ISM Code, STCW Convention, ILO's MLC 2006.
- (c) Ability to apply task and workload management – Communication, Team building, Planning and co-ordination, Personal assignments, Time and resource constraints, Prioritization.
- (d) Knowledge and ability to apply effective resource management - Allocation, assignment and prioritization of resources, Effective communication on board and ashore, Decisions reflect consideration of team experience.
- (e) Knowledge and ability to apply decision-making techniques - Management processes and functions, Negotiating skills, Situation and risk assessment, Identify and generate options, Select course of action, Evaluation of outcome effectiveness.
- (f) Development, implementation, and oversight of standard operating procedures - Project planning and controlling.

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ORALS

[The oral is the final assessment of Paper I to Paper VI of Part B. The assessment is on the functions, "Marine Engineering at Management level", "Electrical, Electronics and Control Engineering at the Management level", "Maintenance and Repair at the Management level", "Controlling operation of ship and care for persons on board at the Management level", based on competences, knowledge, understanding and proficiency under these functions. The criteria for evaluating competence is to be as per Column III of above.]

**SUMMARY OF WRITTEN EXAMINATION TO BE CONDUCTED BY / OR ON BEHALF OF THE
CHIEF EXAMINER OF ENGINEERS FOR COMPETENCE FOR SECOND ENGINEER OFFICER (SEO)
OF SHIPS OPERATING ON NEAR COASTAL VOYAGES (NCV) – UPTO 8000 Kw.
(MEO Class II NCV)**

REFERENCE TABLE A - III/ 2 AS AMENDED FOR NEAR COASTAL VOYAGES (NCV)

	SUBJECTS UNDER EACH FUNCTION	COMPETENCIES COVERED	DURATION OF EXAM	MAXIMUM MARKS	PASS MARKS
1.	Marine Engineering at management level				
i	PART – A Paper - I. Mechanics & Hydromechanics Paper - II. Thermodynamics & Heat Transmission PART – B		3 hours	100	50
ii			3 hours	100	50
iii					
iv					
2.	Paper – I. Marine Engineering Knowledge (General)	1, 2, 3 & 4	3 hours	100	50
v	Paper - II. Marine Engineering Knowledge (Motor or Steam).		3 hours	100	50
Electrical, Electronic & Control engineering at the management level					
	Paper - III. Marine Electrotechnology.	5 & 6	3 hours	100	50
3.	Maintenance & Repair at the management level				
vi	Paper – IV. Marine Engineering Practice.	7, 8 & 9	3 hours	100	50
4.	Controlling the operation of the ship & care for persons onboard at the management level				
vii	Paper – V. Naval Architecture & Ship Construction.	10, 11, 12, 13 & 14	3 hours	100	50
viii	Paper - VI Ship’s safety & environmental protection.		3 hours	100	50
	Orals			100	60
	Function: 1, 2, 3 & 4.			Each function	Each function

SUMMARY OF POST SEA TRAINING PROGRAMMES, EXAMINATION & ASSESSMENT FOR MARINE ENGINEER OFFICER CLASS II SEO (NCV) – UPTO

8000 Kw

**Regulation III/2 of STCW 2010 & Section A - III/2 of STCW Code
(as applicable to NCV).**

Department:	Level:	Capacity:	
Engine	Management	Second Engineer Officer (NCV)Upto 8000 kW	Duration: 4 Months

NO.	COMPETENCE	HOURS	TYPE OF ASSESSMENT
		INSTITUTION	
		CLASS	
Function 1: Marine Engineering at the Management Level.			
1.	Manage the operation of propulsion plant machinery	 180 hrs Note: 90 hrs is to be devoted for Marine Engineering Knowledge (General) paper + 90 hrs is to be devoted for Marine Engineering Knowledge (Motor or Steam) paper	Written examination & or skills test.
2.	Plan and Schedule operations		
3.	Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery		
4.	Manage fuel, lubrication and ballast operations		

NO.	COMPETENCE	HOURS	TYPE OF ASSESSMENT
		INSTITUTION	
		CLASS	
Function 2: Electrical, Electronic & Control Engineering at the Management Level.			
5.	Manage operation of electrical and electronic control equipment	100hrs Note: The time is to be devoted for Marine Electro Technology paper.	Written examination & or skills test.
6.	Manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition		
Function 3: Maintenance and repair at the management level.			
7.	Manage safe and effective maintenance and repair procedures	60 hrs Note: The time is to be devoted for Marine Engineering Practice paper.	Written examination & or skills test.
8.	Detect and identify the cause of machinery malfunctions and correct faults		
9.	Ensure safe working practices		
Function 4: Controlling the operation of the ship and care for persons on board at the Management Level.			
10.	Control trim, stability and stress	140 hrs	

NO.	COMPETENCE	HOURS	TYPE OF ASSESSMENT
		INSTITUTION	
		CLASS	
11.	Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea, security and protection of the marine environment	Note:50 hrs is to be devoted for Naval Architecture paper + 90hrs is to be devoted for Ship's Safety, Environmental Protection and Personnel care paper.	Written examination & or skills test.
12.	Maintain safety and security of the vessel, crew and passengers and the operational condition of life-saving, fire-fighting and other safety systems		
13.	Develop emergency and damage control plans and handle emergency situations		
14.	Use leadership and managerial skills		
	TOTAL	480 Hours	

For each Function a variation of +/- 10 hrs is permitted, however the total hrs will remain 480 hrs.

SPECIFICATION OF MINIMUM STANDARD OF COMPETENCE FOR SECOND ENGINEER OFFICER (SEO) OF SHIPS OPERATING ON NEAR COASTAL VOYAGES (NCV) – UPTO 8000 Kw
SYLLABUS FOR MARINE ENGINEER OFFICER CLASS II SECOND ENGINEER OFFICER (SEO) OF SHIPS OPERATING ON NEAR COASTAL VOYAGES (NCV) – UPTO 8000 Kw
REFERENCE TABLE A - III/ 2 AS AMENDED FOR NEAR COASTAL VOYAGES (NCV)

FUNCTION 1:—MARINE ENGINEERING AT THE MANAGEMENT LEVEL

Knowledge, Understanding & Proficiency / Course Covered	Methods of Demonstrating Competence	Criteria for Evaluating Competence
Competence No. 1: Manage the operation of propulsion plant machinery Design features, and operative mechanism of the following machinery and associated auxiliaries: 1. marine diesel engine 2. marine steam turbine 3. marine gas turbine 4. marine steam boiler	Examination and assessment of evidence obtained from one or more of the following: 1. approved in-service experience 2. approved training ship experience 3. approved simulator training, where appropriate 4. approved laboratory equipment training	Explanation and understanding of design features and operating mechanisms are appropriate
Competence No. 2: Plan and Schedule operations Competence No. 3: Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery <i>Theoretical knowledge</i> Thermodynamics and heat transmission Mechanics and hydromechanics Propulsive characteristics of diesel engines, steam and gas turbines, including speed, output and fuel consumption Heat cycle, thermal efficiency and heat balance of the following: 1. marine diesel engine 2. marine steam turbine 3. marine gas turbine	Examination and assessment of evidence obtained from one or more of the following: 1. approved in-service experience 2. approved training ship experience 3. approved simulator training, where appropriate 4. approved laboratory equipment training	The planning and preparation of operations is suited to the design parameters of the power installation and to the requirements of the voyage The methods of preparing for the start-up and of making available fuels, lubricants, cooling water and air are the most appropriate Checks of pressures, temperatures and revolutions during the start-up and warm-up period are in accordance with technical specifications and agreed work plans Surveillance of main propulsion plant and auxiliary systems is sufficient to maintain safe operating conditions

4. marine steam boiler Refrigerators and refrigeration cycle Physical and chemical properties of fuels and lubricants Technology of materials Naval architecture and ship construction, including damage control Practical knowledge Start up and shut down main propulsion and auxiliary machinery, including associated systems Operating limits of propulsion plant The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery Functions and mechanism of automatic control for main engine Functions and mechanism of automatic control for auxiliary machinery including but not limited to: 1. generator distribution systems 2. steam boilers 3. oil purifier 4. refrigeration system 5. pumping and piping systems 6. steering gear system 7. cargo-handling equipment and deck machinery		The methods of preparing the shutdown, and of supervising the cooling down of the engine are the most appropriate The methods of measuring the load capacity of the engines are in accordance with technical specifications Performance is checked against bridge orders Performance levels are in accordance with technical specifications Arrangements for ensuring the safe and efficient operation and condition of the machinery installation are suitable for all modes of operation.
Competence No. 4:Manage fuel, lubrication and ballast operations	Examination and assessment of evidence obtained from one or more of the following:	Fuel and ballast operations meet operational requirements and are carried

Operation and maintenance of machinery, including pumps and piping systems. Construction and characteristics of pumps and pumping systems used for fuel and ballast operations. Piping system of fuel and ballast operations. SOLAS Regulations on fuel and ballast systems and its implementation on board and ashore. Routine and emergency preparedness of pollution prevention from fuel. Ballast water contamination.	1. approved in-service experience 2. approved training ship experience 3. approved simulator training, where appropriate	out so as to prevent pollution of the marine environment

DETAILED SYLLABUS & PAPERS UNDER WHICH FUNCTION OF MARINE ENGINEERING AT THE MANAGEMENT LEVEL FOR SECOND ENGINEER OFFICER (SEO) OF SHIPS OPERATING ON NEAR COASTAL VOYAGES (NCV) – UPTO 8000 Kw WILL BE COVERED.

PART A

PAPER I : MECHANICS AND HYDROMECHANICS

Mechanics and Hydromechanics -

Theoretical Knowledge - Statics, Dynamics, Friction, Balancing, Simple Harmonic Motion, Stress & Strain, Bending of Beams, Torsion, Struts, Combined Stress, Stresses in Thick Shells, Fluid Mechanics.

- 3. Statics** - Bow's notation, Force analysis by method of sections, framed structures.
- 2. Dynamics** - Equations of motion, Velocity and acceleration diagrams, Laws of conservation of energy and momentum, Collision of rigid and elastic bodies, Projectiles, Engine mechanisms, Flywheels, Hoists, Cams, Governors, Simple and epicyclic gear systems, Vehicle dynamics.
- 3. Friction** - Sliding friction on horizontal and inclined planes, Cotter's, Screw threads, Belt drives, Friction brakes, Plate and cone clutches.
- 4. Balancing** - Primary and secondary forces, Primary and secondary couples, Complete balancing of reciprocating machinery.
- 5. Simple Harmonic Motion** - Equation of simple harmonic motion, Amplitude, frequency and periodic time, Vibrating spring mass systems, Springs, Resonance, Transmissibility, Vibrations of flywheels and gearwheels.
- 6. Stress & Strain** - Stress and strain relationships in thin cylindrical and spherical shells, Stress in thin, rotating rims, Thermal stress, Stress in compound bars, Elastic strain energy, Stresses due

to gradually applied and shock loads.

7. **Bending of Beam** - Shear force and bending moment diagrams, Fundamental bending equation, Bending stresses, Deflection of beams. Macaulay's method.
8. **Torsion - Stress**, strain and strain energy due to torsion, Fundamental torsion equation, Reciprocating engine crank effort, Rudder stock turning moment from steering gear, Deflection of helical springs.
9. **Struts** - Euler's formula, Slenderness ratio.
10. **Combined Stress** - Stresses on an oblique plane, Material subjected to two perpendicular stresses, Axial and bending stress, Mohr's stress circle. Principal stresses and strains, Combined bending and twisting.
11. **Stresses In Thick Shells** - Lamé's equations, The Lamé Line, Shrinkage allowance.
12. **Fluid Mechanics** - Volume and mass flow, Venturi meter, Bernoulli's equation, Jets. Orifice coefficients, Dynamic and kinematic viscosity, Reynolds' number, Flow losses in pipes and fittings, Darcy's formula, Centrifugal pumps.

PART A

PAPER II : THERMODYNAMICS AND HEAT TRANSMISSION

Thermodynamics and Heat Transmission -

Theoretical Knowledge - Thermodynamic Fundamentals, Perfect Gas, Second Law, Gas Cycles/Engine Analysis, Properties of Vapours, Steam Cycles, Steam Turbine Velocity Diagrams, Refrigeration, Combustion, Compressors, Heat Transfer, Air Conditioning.

1. **Thermodynamic Fundamentals** - System and working substance, SI Units. Property and State, Reversible and Irreversible processes, Reversible work of compression or expansion, First Law applied to non-flow and flow processes, Throttling, nozzles and mixing of streams.
2. **Perfect Gas** - Equation of state, Specific heat, internal energy, Adiabatic, polytropic, isobaric and isothermal compression/expansion, Enthalpy, Gas mixtures and Dalton's Law of partial pressures.
3. **Second Law** - Classical statements, Heat engine, Thermal efficiency, Entropy, Isentropic process, Reversible heat engine, Temperature – entropy (T-s) diagram for a perfect gas, Isentropic efficiency.
4. **Gas Cycles/Engine Analysis** - Constant pressure and constant volume air standard cycles, Reciprocating internal combustion engine performance parameters, indicator diagrams, power, mean effective pressure, thermal efficiency, brake specific fuel consumption, mechanical efficiency, energy balance, Open and closed gas turbine systems, Power, isentropic efficiency and thermal efficiency for gas turbines.
5. **Properties of Vapors** - Saturation, dryness fraction and superheat, T-s, p-h, p-v, h-s diagrams, Fluid properties using steam tables, Throttling and separating calorimeters, Air in condensers.
6. **Steam Cycles** - Rankine cycle. Turbine isentropic efficiency, Feed heating, Thermal efficiency, Cycle on T-s diagram,

- 7. Steam Turbine Velocity Diagrams** - Principles of reaction and impulse turbines including compounding, Velocity diagrams, Nozzle steam velocity (excluding proof of critical pressure ratios), Force and work done on blades.
- 8. Refrigeration** - Vapor compression cycle, Refrigerant properties and hazards, Refrigerant tables, Cycle on p-h diagram, Coefficient of performance, Refrigerant mass flow, Compressor calculations, Secondary refrigerants.
- 9. Combustion** - Combustion equations, Fuel composition, Air-fuel ratio, Excess air, Volumetric analysis of combustion products, Calorific value.
- 12. Compressors** - Reciprocating compressors: Operating principles, volumetric efficiency, free air delivery, power, mechanical efficiency, isothermal efficiency, multi-stage and inter-cooling, p-V diagram, Positive displacement rotary compressors: Operating principles, power, efficiency.
- 11. Heat Transfer** - Conduction, radiation and convection, Composite walls. Insulation, Film coefficient, Interface temperature, Stefan-Boltzmann Law, Parallel flow and cross flow heat exchangers, Logarithmic mean temperature difference.
- 12. Air Conditioning** - Comfort conditions, Psychometric charts, Wet and dry bulb temperatures, Humidity, Dew point, Dehumidifying and humidifying processes, Air conditioning systems.
- 13. Heat Cycle**, Thermal Efficiency and Heat Balance of Marine diesel engine, Marine steam turbine, Marine gas turbine, Marine steam boiler.

PART B

PAPER I: MARINE ENGINEERING KNOWLEDGE (GENERAL)

The Engineering knowledge to be shown by candidates in that which is required for the use, operation and maintenance of the machinery, equipment and ship structure usually in the charge of an Engineer Officer at Management level. Candidates may be required to illustrate their answers by means of freehand sketches. The scope would include following:

- 1. Technology of materials** - Metallurgy of Steel and Cast Iron, Properties and application of material used in machinery on board ships, Destructive and non-destructive testing of material, Materials and welding.
- 2. Physical & chemical properties of fuel & lubricants** - Properties and characteristics of fuels and lubricants, Shore side and shipboard sampling and testing, Interpretation of test results, Contaminants including microbiological infection, Treatments of fuels and lubricants including storage, centrifuging, blending, pre-treatment and handling.
- 3. Construction details**, and where applicable the manner of attachment to ship, principles involved and operation Surveillance & Performance assessment of :
 - XXVII. Water gauge, thermometer, salinometer, ammeter, water meter, pressure gauge and other meters and gauges commonly used by engineers on board ship.
 - XXVIII. All auxiliary machineries of engine room including associated systems, pumps, pumping and piping systems, oily water separators.
 - XXIX. Thrust blocks, shafting, bearings, stern tubes, and propellers, shipside fittings.
 - XXX. Steering gear, stabilisers.
 - XXXI. Refrigeration machinery, deck machinery.
 - XXXII. Auxiliary boilers and steam plant.

- XXXIII. Auxiliary compression ignition engines and associated plant.
XXXIV. Diesel electric drives.

4. Start Up and Shut down of Auxiliary Machinery, including associated system: Air compressors and compressed air systems, Hydraulic power system, Types of auxiliary boilers, Auxiliary steam system, Safety valves, Boiler water levels, Boiler Water Testing, Boiler Water Treatment, Boiler defects, Boiler and repairs, Evaporators.

- r) Safe and efficient operation, Surveillance & Performance assessment of electrical machines and systems.
- s) Requirements, including operations and maintenance of pumps and pumping systems including bilge, fire main, ballast, sewage & sludge systems.
- t) Refrigeration, working principles of air conditioning, cargo and domestic refrigeration plants. Refrigerants used in the marine refrigeration plants, green house effects and future refrigerants. Air conditioning including psychometric process for heating, cooling and humidification.
- u) Steering gear systems, single failure criteria of steering gear Surveillance & Performance assessment.
- v) Operation and testing of pneumatic hydraulic and electric control systems.
- w) Functions and Mechanism of Automatic Control for auxiliary machinery: Generator distribution system, Steam boiler, Oil purifier, Refrigeration system, Pumping and piping system, Steering gear system, Cargo-handling equipment and deck machinery.
- x) Operation of cargo handling equipment and deck machinery.
- y) Operation of fresh water systems, fresh water generating systems and its performance assessment.

Shipboard Personnel & Resource Management & emergency preparedness.

PART B

PAPER II: MARINE ENGINEERING KNOWLEDGE (MOTOR)

1. Design of Marine machinery:

Design features and operating mechanisms of marine diesel engines and marine steam boilers.

2. Operations of marine machinery:

- .19 Propulsive characteristics of diesel engines and gas turbines, including speed, output and fuel consumption. Operating limits of the propulsion plants.**
- .20 Safe and efficient operation and surveillance of, main propulsion plant and its systems and services. The determination of shaft power and recognition of irregularity in the performance of the machinery and plant. Operation, monitoring and evaluation of engine performance and capacity.**
- .21 Analysis and interpretation of information gained from monitoring equipment. Operation of gearing, clutches, air compressors.**
- .22 Planning and scheduling of engine operations.**
- .23 Functions and mechanism of automatic control of main engine.**
- .24 Safety of engine equipment, systems and services.**

5. Start up and Shut down main and auxiliary machinery, including associated system – Engine components, engine lubrication, fuel injection, scavenging and supercharging, starting and

reversing, cooling systems, diesel engine control and safety, diesel engine emergency operation, multi-engine propulsion arrangement.

3.1 Engine components

- (r) Interpret static and dynamic loads and stresses, identifying service limitations of diesel engine components.
- (s) Evaluate different fabrication methods of diesel engine components, including: Welding, forging, utilizing composite materials,
- (t) Identify two and four stroke operating cycle forces, couples, and moments, relating these to design principles of: Crankshafts, bedplates, foundations, cross heads.
- (u) Explain out of balance gas and inertia forces, couples, and moments, and relate these to flywheels, balance weights, and first/second order balancing, and hull vibration.
- (v) Explain factors contributing to torsional vibration, and identify methods of minimizing or eliminating harmful effects of critical speeds.
- (w) Evaluate the calibration of: Pistons, cylinder liners, piston rings, bearings, crankshafts, to identify wear patterns, limits, and means of correction
- (x) Specify alignment and adjustment criteria of: Crankshafts, chain drives, gear drives, integral thrust bearings, crossheads
- (y) Compile specified working clearances and limits of all bearings, sliding surfaces, and interference fits of a typical diesel engine, using engine builders' manuals.

3.2 Engine Lubrication

- (g) Identify diesel engine lubricant types, properties, and applications. Outline principles of diesel engine lubrication. Contamination and deterioration of diesel engine lubricants - Discuss the sources/ causes types, and effects of contamination.
- (h) Describe typical testing and treatment methods, and Interpret typical results of testing, giving appropriate actions which should be undertaken.
- (i) Describe, using diagrams, the distribution of lubricating oil to diesel engines, in particular the: Guides and crosshead bearings of slow speed diesel engines, Top end bearings of medium speed engines, Bottom end bearing, Main bearings, Camshaft drives, showing direction of flow, typical clearances, and stating normal operating parameters.

3.3 Fuel Injection

- (s) Explain why atomization and penetration of fuel and the turbulence of air are essential to optimum combustion in a diesel engine.
- (t) State typical injection pressures and viscosities for different grades of fuel.
- (u) Describe how and why fuel pumps, camshafts, and injectors are altered for varying fuel types.
- (v) Describe, with the aid of simple sketches, the difference between constant and variable injection timing of fuel, showing materials, principal parts, and methods of operation and adjustments of common types of fuel pump.
- (w) Compare injection requirements for slow speed, medium speed, and high speed diesel engines, including pilot injection and pre-combustion chambers.
- (x) Identify common service faults, symptoms, and causes of combustion problems, specifying appropriate adjustments, including methods of fuel pump timing.
- (y) Summarize Occupational Health & Safety aspects of handling and testing fuel injection systems.
- (z) Explain, using relevant diagrams and stating normal operating parameters: Fuel valve

cooling arrangement and Uni-fuel and dual-fuel systems (for high/medium viscosity fuel types)

- (aa) Discuss the atmospheric pollution aspects of diesel engine combustion, and give methods which reduce this pollution (especially SO_x and NO_x reduction).

3.4 Scavenging and Supercharging

Evaluate the need for scavenging diesel engines, Compare methods of scavenging diesel engines, Specify methods of providing pressurized air for combustion in diesel engines, Assess pressure charging methods for diesel engines, Assess pressure charging methods for diesel engines, Examine the working principles of turbochargers, Assess lubrication and cooling requirements of turbochargers, Analyze typical faults and identify appropriate actions to be undertaken with defective or damaged turbochargers.

3.5 Starting and Reversing

- (m) Describe starting procedures of diesel engines for power generation, propulsion, and emergency use.
- (n) Explain starting and maneuvering requirements/sequences for direct coupled reversible and geared propulsion diesel engines, for fixed and controllable pitch propeller applications
- (o) Describe, with labeled diagrams to indicate major components, typical maneuvering and reversing systems for propulsion diesel engines
- (p) Compare different methods of reversing direct coupled propulsion diesel engines
- (q) Identify common faults and identify appropriate actions to be undertaken with typical diesel engine starting and maneuvering systems
- (r) Compare the different methods of utilizing diesel engines for ship propulsion, including - Direct coupled, reversible slow and medium speed engines and Clutched and geared reversible and unidirectional medium speed engines with a fixed pitch propeller, Clutched and geared reversible and unidirectional medium speed engines with a controllable pitch propeller, and Diesel electric drive.

3.6 Cooling systems

- (w) Analyze the problems that may arise in cooling water spaces of diesel engines.
- (x) Evaluate common methods of diesel engine cooling water treatment.
- (y) State the importance of maintaining diesel engine thermal efficiency and evaluate thermal loads on engine components.
- (z) Justify cooling media selection and state the advantages and disadvantages of various diesel cooling methods.
- (aa) Evaluate the tests used in the control of diesel engine cooling water treatment.
- (bb) Enumerate the normal operating limits for diesel engine cooling water treatment.
- (cc) Interpret the implications of out of limit readings from water treatment tests and state the corrective procedures which should be undertaken.
- (dd) Itemize the sources and types of contamination of diesel engine cooling water and explain the effects of these contaminations on the reserves of treatment chemicals.
- (ee) Compare the procedures which may be used to counter contamination of diesel engine cooling water.
- (ff) Explain, using relevant diagrams and stating normal operating parameters, typical methods of cooling:
- (gg) Medium and slow speed diesel engine pistons, Exhaust valves, Cylinders, Turbochargers, Cylinder heads.

3.7 Diesel Engine Control and Safety
3.8 Diesel Engine Emergency operation

FUNCTION 2: ELECTRICAL, ELECTRONIC & CONTROL ENGINEERING AT THE MANAGEMENT LEVEL.

Knowledge, Understanding & Proficiency / Course Covered	Methods of Demonstrating Competence	Criteria for Evaluating Competence
Competence No. 5:Manage operation of electrical and electronic control equipment <i>Theoretical knowledge</i> Marine electro technology, electronics, power electronics, automatic control engineering and safety devices. Fundamentals of automation, instrumentation and control systems Design features and system configurations of automatic control equipment and safety devices for the following: 1. main engine 2. generator and distribution system 3. steam boiler Design features and system configurations of operational control equipment for electrical motors Design features of high-voltage installations Features of hydraulic and pneumatic control equipment	Examination and assessment of evidence obtained from one or more of the following: 1. approved in-service experience 2. approved training ship experience 3. approved simulator training, where appropriate 4. approved laboratory equipment training	Operation of equipment and system is in accordance with operating manuals Performance levels are in accordance with technical specifications
Competence No. 6:Manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition <i>Practical knowledge</i> Troubleshooting of electrical and electronic control equipment		Maintenance activities are correctly planned in accordance with technical, legislative, safety and procedural specifications The effect of malfunctions on associated plants and systems is accurately identified, ships

Function test of electrical, electronic control equipment and safety devices		technical drawings are correctly interpreted, measuring and calibrating instruments are correctly used and actions taken are justified.
Troubleshooting of monitoring systems		
Software version control		Inspection, testing and troubleshooting of equipment are appropriate

DETAILED SYLLABUS & PAPERS UNDER WHICH FUNCTION OF ELECTRICAL, ELECTRONICS AND CONTROL ENGINEERING AT THE MANAGEMENT LEVEL FOR SECOND ENGINEER OFFICER (SEO) OF SHIPS OPERATING ON NEAR COASTAL VOYAGES (NCV) – UPTO 8000 Kw WILL BE COVERED

PART B

PAPER III: MARINE ELECTRO TECHNOLOGY

In addition to the basic Electro Technology knowledge acquired at the operational level (NCV) as regards to Electromagnetism, Electromagnetic induction, simple magnetic circuits, simple magnetic theory, alternating current theory, A.C. circuits and distribution systems involving A. C. & D. C. Shipboard installations & associated protective devices; the following additional syllabus to be adhered for the function "Electrical, Electronic and Control Engineering at the Management Level".

1. Automatic Control Engineering and safety devices.

- (a) Introduction - Open and closed control loops, Process control. Essential components in process control loops.
- (b) Sensors and transmitters - Resistance temperature devices. Thermocouples. Flow and pressure measurement. Level measurement. Ambient temperature compensation. Viscosity measurement. Torque measurement. Force balance transmitters. Oil/water interface and oil in water monitoring. The pneumatic flapper/nozzle system. Pneumatic 20 – 100 kPa, analogue 4 to 20 mA signals, Pneumatic pilot relays, Control air supply. Operational amplifiers. Electrical supply.
- (c) Controllers and Basic Control Theory - Disturbances and time delays and means to reduce them. Two step, proportional, integral, and derivative control actions.
- (d) Final Control Elements - Diaphragm operated control valves. Flow/lift characteristics of control valves. Control valve actuators and positioners. "Fail - safe", "fail - set" strategies. Wax element valves. Electrically operated valves.
- (e) Control Loop Analysis - Temperature control systems. Level control systems. Pressure control systems. Split range and cascade control. Single, two and three element control.
- (f) Governors - Need for governors. Governor terms, concepts and operation. Hydraulic governors. Digital governors, Power sharing. Governing systems.

2. Design features and system configuration of automatic control equipment and safety devices:

2.1 General Requirements

- (j) Electrical equipment designed for land use is often not suitable for use in ships.
- (k) As far as possible, all materials should be non-flammable explains where flame retardant materials may be used.
- (l) Meaning of the term flame retardant

- (m) Angles of heel and trim at which machinery should be capable of operating.
- (n) Effect of temperature changes on - Electromagnetic devices, Generator voltage.
- (o) Common maximum temperatures of air and sea water used for design purposes.
- (p) Axis of a rotating machine should not be placed athwart ships unless so designed.
- (q) Need to periodically check the security of all electrical connections.
- (r) Requirements regarding the provision of electrical power and lighting for normal operation and for an emergency.

2.2 Main Engine

- (e) Monitoring & Control Systems - Boiler water level control. Advanced boiler combustion control. Diesel engine cooling control, Main engine control for FP and CP propellers. Alarm and monitoring systems. Programmable logic control and SCADA (supervisory control and data acquisition); Data logging and data transfer.
- (f) General requirements of automatic control equipment and safety devices - Monitoring system, Safety system, System independence, Local control, Failure mode and effect analysis, Power supply.
- (g) Remote control – Diesel propulsion, Control - electronic, electro-pneumatic, electro-hydraulic or pneumatic, Malfunctions – alarm, engine slow down, engine stop.
- (h) UMS Systems - Concept of Unattended Machinery Spaces (UMS). Requirements of UMS. Bridge control. Testing regime for UMS.

2.3 Generator and distribution system - Instrumentation and Safety in Generator and Distribution system, Auxiliary Diesel Generator Alarm and Shut Down, Automatic Starting of Propulsion Auxiliaries.

2.4 Steam boiler

- (c) Following failures will have alarms and display – feed water high salinity, high water level, boiler pressure high and low, super heater outlet temperature high, fuel pump low outlet pressure, heavy fuel temperature high and low (or high and low viscosity), uptake high temperature, control system power failure, atomization steam / air pressure low
- (d) Following failures will have alarms, display and automatic shutdown of boiler – low water level, supply air pressure failure, ignition or flame failure.

3. Design features and system configuration of operational control equipment for electrical motors:

3.1 Three Phase A.C. Motors - Construction, principle of operation of 3-phase induction motors, Design features of star and delta motors, Starting, speed controlling and braking methods of 3-phase induction motors, Load-torque characteristics and protection.

3.2 Three Phase Synchronous Motors - Construction. Principle of operation. Load characteristics, Power factor improvement with synchronous motors.

3.3 Effect of varying frequency and voltage of A.C. Motors – Speed, Temperature, Torque, Power output and Starting time, current.

3.4 Motor control and protection - D. C. motors, A. C. motors.

3.5 Insulated Gate Bipolar Transistor (IGBT) motor speed control - Gate driving characteristics with high current, High frequency, high current switch, Advantages of IGBT in varying motor speed control.

3.6 Motor speed control by Thyristors - Application of thyristors in motor speed control.

3.7 Three Phase Generators - Construction. Salient and cylindrical rotor types, Shaft generators, Excitation methods, Automatic voltage regulation, Synchronization, Parallel operation, Generator trouble shooting.

3.8 Three Phase Transformers - Construction Polarity, Configurations in Star and Delta combinations, Open delta configuration.

3.9 Distribution - Main switchboard construction and configuration. Short circuit protection - fuses, main circuit breakers, the generator air circuit breaker, Protection co-ordination, Distribution configuration, Electrical equipment for tankers and hazardous areas and safety systems.

3.10 Emergency Power - Automatic starting arrangements for the emergency generator, Emergency power requirements, Essential and non essential circuits, Batteries.

4. Electronics, Power Electronics

(a) Semiconductor Devices - Uni-junction transistor, The Bipolar transistor, operation and characteristics, bias circuits, AC and DC current gain, data sheets. Field Effect Transistors, Thyristors & operations.

(b) Integrated Circuits - Ideal operational amplifier, characteristics, types, mounting methods and markings, advantages of ICs. Practical operational amplifier, circuit configurations,

(c) Electronic Fault Diagnosis - Interpretation and use of electronic systems and subsystem circuit diagrams, operation and maintenance manuals.

Analysis of measurement and test result on components and circuits. Methods of fault detection.

5. High voltage systems:

Design features, operational and safety requirements for marine HV system. Mandatory rules for HV system in safe and flammable areas and with/ without earthing. Carrying out switching and isolation procedure.

6. Management of Troubleshooting & Restoration of electrical & electronic equipment to operating conditions.

6.1 Control System & Troubleshooting:

(d) Troubleshooting of electrical and electronic control equipment - Electrical safety, Test equipment, Interpretation of circuit symbols, Logical six step trouble shooting procedure, Generation, Prime mover electrical control, Main air circuit breaker, Protection of generators, Electrical distribution systems, Motors, Electrical survey requirements, Calibrate and adjust transmitters and controllers, Control system fault finding.

(e) Function test of electrical. Electronic control equipment and safety devices.

(f) Troubleshooting of monitoring systems - Test and calibration of sensors and transducers of monitoring system.

6.2 Maintenance & repair of the following:

Electrical and electronic systems operating in flammable areas, Carrying out safe maintenance and repair procedures, Detection of machinery malfunction, location of faults and action to prevent damage.

FUNCTION 3:– MAINTENANCE AND REPAIR AT THE MANAGEMENT LEVEL

Knowledge, Understanding & Proficiency / Course Covered	Methods of Demonstrating Competence	Criteria for Evaluating Competence
Competence No. 7: Manage safe and effective maintenance and repair procedures <i>Theoretical knowledge</i> Marine engineering practice <i>Practical knowledge</i> Organizing & managing safe and effective maintenance and repair procedures Planning maintenance, including statutory and class verifications Planning repairs	Examination and assessment of evidence obtained from one or more of the following: 1. approved in-service experience 2. approved training ship experience 3. approved workshop training	Maintenance activities are correctly planned and carried out in accordance with technical, legislative, safety and procedural specifications Appropriate plans, specifications, materials and equipment are available for maintenance and repair Action taken leads to the restoration of plant by the most suitable method
Competence No. 8: Detect and identify the cause of machinery malfunctions and correct faults <i>Practical knowledge</i> Detection of machinery malfunction, location of faults and action to prevent damage Detection of faults of machinery by visual inspection, NDT methods (Non-destructive examination) and by other advanced systems such as vibration monitoring (condition monitoring). Inspection and adjustment of equipment Modern approach to machinery reliability methods and their execution. Principles of Tero technology. Principles and practice of reliability and trends in breakdown. Typical failures and fault diagnosis. Reliability of machinery, its principle and practice.	Examination and assessment of evidence obtained from one or more of the following: 1. approved in-service experience 2. approved training ship experience 3. approved simulator training, where appropriate 4. approved laboratory equipment training	The methods of comparing actual operating conditions are in accordance with recommended practices and procedures Actions and decisions are in accordance with recommended operating specifications and limitations
Competence No. 9: Ensure safe working practices <i>Practical knowledge</i> Safe working practices, overhauling machinery, mechanical safety in workshops, protective equipment, lifting gear, entering tanks, work in	Examination and assessment of evidence obtained from one or more of the following: 1. approved in-service experience	Working practices are in accordance with legislative requirements, codes of practice, permits to work and environmental concerns

confined and hazardous spaces. Precautions against fire or explosion. Explosive mixtures. Danger of oil leakage's. Sources of ignition. Safety devices. Toxic and other dangerous properties of substances used in marine practice. Maintenance of plant associated with the carriage of dangerous goods.	2. approved training ship experience 3. approved laboratory equipment training	

DETAILED SYLLABUS & PAPERS UNDER WHICH FUNCTION OF MAINTENANCE AND REPAIR AT THE MANAGEMENT LEVEL FOR SECOND ENGINEER OFFICER (SEO) OF SHIPS OPERATING ON NEAR COASTAL VOYAGES (NCV) – UPTO 8000 Kw WILL BE COVERED

PART B

PAPER IV: MARINE ENGINEERING PRACTICE

1. Theory of maintenance:

Theoretical knowledge of Marine engineering practice and maintenance of machinery.

Methods of dealing with wear and tear of machinery, both electrical and mechanical. Alignment of machinery components. Correction of defects.

Detection of machinery malfunction, location of faults and action to prevent damage - Unplanned maintenance.

Temporary or permanent repairs in the event of breakdown:

- (f) Failure of cross-head bearing/ main bearing/ bottom end bearings of main engine
- (g) Breakage of chain drives of main engine
- (h) Breakdown on turbo chargers
- (i) Breakdown of main air conditioning and fridge system
- (j) Collapse/ failure of multiple boiler water tubes

2. Practice of maintenance:

Management and conduct of ship maintenance by planned maintenance and preventive maintenance as per ISM Code. Theory of condition monitoring and its application onboard ships. Principles of tribology and its practices.

Planning and execution of dry docking and other major repairs. Manageable breakdowns and emergency repairs.

Planning and execution of safe maintenance activity and repair procedures taking into account technical, legislative, safety procedural specification, appropriate plan, specification of materials and equipment available for maintenance and repairs.

Risk assessment and evaluation before commencement of maintenance activity.

Destructive and non destructive testing.

Major contamination of main L.O. sump – Action/ handling/ rectification.

Severe flooding of engine room bilges – Action/ handling/ rectification.

Trials and restoration of the plant after repairs. Safe working practices.

Inspection and Adjustment of Equipment relevant to Marine Engineering.

3. Marine Engineering practice – Theoretical & Practical Knowledge

Classification society and class certificates, statutory certification of ships, Surveys for maintenance and renewal of class and statutory certificates.

FUNCTION 4: – CONTROLLING THE OPERATION OF THE SHIP & CARE FOR PERSONS ON BOARD AT THE MANAGEMENT LEVEL

Knowledge, Understanding & Proficiency / Course Covered	Methods of Demonstrating Competence	Criteria for Evaluating Competence
Competence No. 10:Control trim, stability and stress Understanding of fundamental principles of ship construction and the theories and factors affecting trim and stability and measures necessary to preserve trim and stability Knowledge of the effect on trim and stability of a ship in the event of damage to, and consequent flooding of, a compartment and countermeasures to be taken Knowledge of IMO recommendations concerning ship stability	Examination and assessment of evidence obtained from one or more of the following: 1. approved in-service experience 2. approved training ship experience 3. approved simulator training, where appropriate	Stability and stress conditions are maintained within safety limits at all times Procedures for monitoring operations and maintenance comply with legislative requirements Potential non-compliance is promptly and fully identified Requirements for renewal and extension of certificates ensure continued validity of survey items and equipment
Competence No. 11:Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea, security and protection of the marine environment Knowledge of relevant international maritime law embodied in international agreements and conventions Regard shall be paid especially to the following subjects: 1. certificates and other documents required to be carried on board ships by international conventions, how they may be obtained and the period of their legal validity 2. responsibilities under the relevant requirements of the International Convention on Load Lines, 1966, as amended 3. responsibilities under the relevant		

requirements of the International Convention for the Safety of Life at Sea, 1974, as amended 4. responsibilities under the International Convention for the Prevention of Pollution from Ships, as amended 5. maritime declarations of health and the requirements of the International Health Regulations 6. responsibilities under international instruments affecting the safety of the ships, passengers, crew or cargo 7. methods and aids to prevent pollution of the environment by ships 8. knowledge of national legislation for implementing international agreements and conventions		
Competence No. 12: Maintain safety and security of the vessel, crew and passengers and the operational condition of life-saving, fire-fighting and other safety systems A thorough knowledge of life-saving appliance regulations (International Convention for the Safety of Life at Sea) All types of survival crafts, rescue boats, life rafts, pyrotechnics, life jackets, life buoys, thermal and immersion suits, launching device of survival craft. Organization of fire and abandon ship drills Maintenance of operational condition of life-saving, fire-fighting and other safety systems Actions to be taken to protect and safeguard all persons on board in emergencies Actions to limit damage and save the ship following fire, explosion, collision or grounding	Examination and assessment of evidence obtained from practical instruction and approved in-service training and experience	Procedures for monitoring fire-detection and safety systems ensure that all alarms are detected promptly and acted upon in accordance with established emergency procedures

Competence No. 13: Develop emergency and damage control plans and handle emergency situations Ship construction, including damage control Methods and aids for fire prevention, detection and extinction Functions and use of life-saving appliances		Emergency procedures are in accordance with the established plans for emergency situations
Competence No. 14: Use leadership and managerial skills Knowledge of shipboard personnel management and training A knowledge of international maritime conventions and recommendations, and related national legislation <i>Ability to apply task and workload management, including:</i> 1. planning and coordination 2. personnel assignment 3. time and resource constraints 4. prioritization <i>Knowledge and ability to apply effective resource management:</i> 1. allocation, assignment, and prioritization of resources 2. effective communication on board and ashore 3. decisions reflect consideration of team experience 4. assertiveness and leadership, including motivation 5. obtaining and maintaining situation awareness <i>Knowledge and ability to apply decision-making techniques:</i> 1. situation and risk assessment 2. identify and generate options 3. select course of action 4. evaluation of outcome effectiveness	Assessment of evidence obtained from one or more of the following: 1. approved training 2. approved in-service experience 3. approved simulator training	The crew are allocated duties and informed of expected standards of work and behaviour in a manner appropriate to the individuals concerned Training objectives and activities are based on assessment of current competence and capabilities and operational requirements Operations are demonstrated to be in accordance with applicable rules Operations are planned and resources are allocated as needed in correct priority to perform necessary tasks Communication is clearly and unambiguously given and received. Effective leadership behaviours are demonstrated Necessary team member(s) share accurate understanding of current and predicted vessel state and operational status and external environment Decisions are most effective for the situation Operations are demonstrated to be effective and in

Development, implementation, and oversight of standard operating procedures		accordance with applicable rules

DETAILED SYLLABUS & PAPERS UNDER WHICH FUNCTION OF CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD AT THE MANAGEMENT LEVEL FOR SECOND ENGINEER OFFICER (SEO) OF SHIPS OPERATING ON NEAR COASTAL VOYAGES (NCV) – UPTO 8000 kW WILL BE COVERED

PART B

PAPER V: NAVAL ARCHITECTURE

General. Wetted surface formulae. Simpson's rules applied to second moments of areas, volumes, centroids and centres of pressure. Hydrostatic curves.

1. Structural strength: Total Pressure on Vertical Bulkhead of various shapes, Center of Pressure, Diagrams of Shear force and bending moment, Longitudinal Bending Moment in Still Water and wave induced.

2. Transverse stability:

Effect of free liquid surface and sub-division of tanks. Dangers due to water accumulation during fire-fighting Practical requirements to ensure stability at sea. Management of water and fuel tanks. Filling and emptying tanks at sea. Movement of centre of gravity. Angle of Loll and Stability beyond Angle of Loll, Correcting an angle of loll. Stability during Dry docking and Grounding, Damaged Stability,

3. Longitudinal stability:

Longitudinal BML and GML, Centre of flotation and its calculation. Moment to change trim by one centimetre.

Trim: Changes due to adding or removing fuel, ballast or cargo. Changes due to alteration in density of sea water. Changes due to bilging of compartments, Using the Lost Buoyancy and Added Mass methods. Dynamical Stability, SOLAS, ILLC Convention requirement,

Forces on rudder and stress in rudder stock. Heel when turning, including effect of centrifugal force and of force on rudder.

4. Resistance and propulsion: Resistance and Fuel Consumption, Propeller and Power, Rudders & Damage Control. Various Types of resistance, Geometry of Propeller, The law of corresponding speeds. Froude's law of comparison. Simple problems on the prediction of full scale resistance from model experiments. Elementary treatment of propeller and simple problems on pitch, pitch ratio, apparent slip, wake velocity, Thrust and Power. Bulbous Bow, Sea trials and interpretation of data recorded. Effects of fouling.

Drag and Lift of Propeller, Problems on propellers involving the use of wake factor, Effective Power, Delivered Power, Propulsive & Quasi Propulsive coefficient, Propeller efficiency, Bollard Pull, Computation of thrust and Power, Cavitation No, Cavitation Tunnel test of Model propeller, Co relation between Model and Full Propeller, Vibration in ships. Ducted Propeller,

Factors affecting trim and stability and measures necessary to preserve trim and stability. Effect on trim and stability of a ship in the event of damage to, and consequent flooding of, a compartment and countermeasures to be taken. IMO recommendations concerning ship stability

5. Ship construction:

Fundamental principles of ship construction and the theories and factors affecting trim and stability and measures necessary to preserve trim and stability Ship Types and Terms, Stresses in Ship Structures, Ship Dynamics, Hydrostatics, Displacement, TPC, Coefficients of Form, Areas and Volumes of ship shapes, 1st and 2nd Moments, Center of Gravity, Transverse Stability, Trim, Stability during dry docking and stability during grounding, Forces on ship under various conditions, including the effect of panting and pounding. Construction of all parts of steel ships. Use of high tensile steel and aluminum.

Structural fire protection arrangements. Dry docking. Design features of ships for general and specialized trades.

Life saving equipment Operation and handling gear for lifeboats and life rafts. Ship measurement and classification. Meaning of 'classed' and 'unclassed' ships. Common terms used in measurement of modern steel ships. Common terms used in tonnage measurement e.g. gross tonnage, net tonnage.

PART B

PAPER VI: SHIP'S SAFETY, ENVIRONMENTAL PROTECTION AND PERSONNEL CARE.

1 . Legislative requirements and measures to ensure safety of life at sea and protection of the marine environment

- (a) Knowledge of relevant International Maritime Law embodied in international agreements and conventions - United Nations Convention on the Law of Sea (UNCLOS), International Maritime Organization (IMO), World Health Organization (WHO), International Labour Organization (ILO), Treaties, conventions, protocols, rules and regulations, List of IMO Conventions & Authorities & Regulations.
- (b) Certificates and other documents to be carried on board ships by international conventions (as per SOLAS Annex 1) and how they may be obtained and period of their legal validity.
- (c) Responsibilities under the relevant requirements of the international convention on load lines.
- (d) Responsibilities under the relevant requirements of the International Convention for the Safety of Life at Sea - Brief description of International Convention for the Safety of Life at Sea, Obligation - to carry out surveys and maintain validity of certificates, to maintain records and rights of master.
- (e) Responsibilities under the relevant requirements of the International Convention for the Prevention of Pollution from Ships - Annex I, Annex II, Annex III, Annex IV, Annex V, Annex VI.
- (f) Maritime declarations of Health and the requirements of the International Health Regulations - WHO's International Health Regulations 2005 (IHR), WHO's Guidelines for drinking water quality, International Medical Guide for ships (IMGS) and IMO's Medical First Aid Guide (MFAG)

(g) Responsibilities under International Instruments Affecting the Safety of the Ships, Passengers, Crew or Cargo:

- (v) ILO's Maritime Labour Convention 2006 (MLC 2006)
- (vi) Convention on the International Regulation for Preventing Collisions at Sea (COLREG) 1972
- (vii) Charter parties
- (viii) Marine Insurance, General Average and P & I Club

(h) Methods and aids to prevent pollution of the environment by ships

- (xi) List of Conventions, Sources of Marine Pollution, Effects of Marine oil spills and Noise
- (xii) International Convention for the Control and Management of Ship's Ballast Water and Sediments
- (xiii) International Convention for the Control of Harmful Anti-Fouling Systems on Ships (AFS) 2001
- (xiv) Regulations for prevention of oil pollution as per Annex I of MARPOL 73/78
- (xv) Regulations for control of pollution from noxious liquid substances carried in bulk as per Annex II of MARPOL 73/78
- (xvi) Regulations for the Prevention of Pollution by harmful substances carried by sea in packaged form as per Annex III of MARPOL 73/78
- (xvii) Requirements covering the carriage of dangerous goods by sea as per Chapter VII of the SOLAS Convention
- (xviii) Regulations for the Prevention of Pollution by Sewage from Ships as per Annex IV of MARPOL 73/78
- (xix) Regulations for the Prevention of Pollution by Garbage from Ships as per Annex V of MARPOL 73/78
- (xx) Regulations for the Prevention of Air Pollution as per Annex VI of MARPOL 73/78

(i) National Legislation for implementing International agreements and Conventions.

2. Safety and security of the vessel, crew and passengers

- (a) Life Saving Appliances Regulations (SOLAS) - Life-Saving appliances and arrangements (Chapter III of SOLAS) and Life-Saving Appliance Code.
- (b) Organization of fire and abandon ship drill.
- (c) Maintenance, functions and use of Life Saving Appliances, Fire-Fighting and other safety systems.
- (d) Actions to protect and safeguard all persons on board in emergencies; rescue of persons from a vessel in distress or from a wreck; and Man-overboard procedures.
- (e) Action and means to limit damage and save the ship following fire, explosion, collision or grounding – Contingency plans for response to emergencies and Procedures for abandoning ship.

3. Develop Emergency and Damage Control Plans and Handle Emergency Situation

- (a) Methods and Aids for Fire Prevention, detection and extinction - Fire -fighting equipment.

4. Use Leadership and Managerial Skills

- (a) Knowledge of shipboard Personnel Management and Training - Engineer and Manager, Human Resource Management, Training and Development, Maintenance Management.
- (b) Knowledge of International Maritime Conventions and recommendations and related National Legislations - The ISM Code, STCW Convention, ILO's MLC 2006.
- (c) Ability to apply task and workload management – Communication, Team building, Planning and co-ordination, Personal assignments, Time and resource constraints, Prioritization.
- (d) Knowledge and ability to apply effective resource management - Allocation, assignment and prioritization of resources, Effective communication on board and ashore, Decisions reflect consideration of team experience.
- (e) Knowledge and ability to apply decision-making techniques - Management processes and functions, Negotiating skills, Situation and risk assessment, Identify and generate options, Select course of action, Evaluation of outcome effectiveness.
- (f) Development, implementation, and oversight of standard operating procedures - Project planning and controlling.

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ORALS

[The oral is the final assessment of Paper I to Paper VI of Part B. The assessment is on the functions, "Marine Engineering at Management level", "Electrical, Electronics and Control Engineering at the Management level", "Maintenance and Repair at the Management level", "Controlling operation of ship and care for persons on board at the Management level", (NCV) based on competences, knowledge, understanding and proficiency under these functions. The criteria for evaluating competence is to be as per Column III of above.]

ENGINEERING MANAGEMENT SYLLABUS
CHIEF ENGINEER OFFICER (NCV) CLASS - III (750kW ~ 3000 kW)
AND
CHIEF ENGINEER OFFICER (NCV) CLASS I (3000 ~ 8000 kW - except tankers)

Duration : Two Months

Sr. No.	SUBJECTS	Theory	Case Study & Interaction Between Participants
		(In Hrs)	
1	Knowledge of Indian Merchant Shipping Act, International Treaties & Conventions relevant to Shipping Rules. Indian Coast Guard, it's structure and operations	15	3
2	ISO 9001:2008, ISM Code, Shipboard Internal Audits / Verification Audits and Certification.	9	3
3	Ship's Hull and Machinery Surveys and Maintenance of up-to-date statutory and other related certificates. Classification Societies and their functions: CSM, CHS & Special Survey Programme.	9	3
4	Ship's Safety, Security and Pollution Prevention. Knowledge of related Conventions Codes and GOI Rules.	9	0
5	Budgeting: Understanding fixed and consumable cost, Voyage Expenses, Repair Cost Analysis, Dry-docking Cost Analysis, Economizing of Fuel/Lub Oil Consumption.	9	3
6	Emergency Preparedness: Emergency Preparedness for oil pollution, Fire, Collision, Grounding and Accidents involving personnel. Root Cause Analysis and Reporting Procedures.	15	6
7	Ship's Stability: Ship's Stability incl at drydocking time -Damage Stability - flooding / grounding.	9	6
8	Inventory Management including spares/stores/lead time, Inventory of lub-oil, fuel oil. Availability, quality and management of same.	6	0
9	Log books and Records: Record making, keeping and its interpretation for complete engine room with regard to maintenance/operation/personnel.	9	3
10	Practical Electricity Electronics and Control	6	3

	System with stress on high voltage on ships and electrical propulsion.		
11	Training of trainers. Chief Engineer as trainer for engine room staff with stress on discipline, motivation, mentoring and communication.	9	3
12	Marine Insurance- general principles and types of insurance covers and P & I Clubs / charter party.	9	3
13	Organizational behaviour, Effective resource management, Development of standard operating procedures, Workload management and application of decision-making techniques. Crises management – need of leadership in crises. Importance of drills.	15	12
14	Machinery performance testing and interpretation of results and application of corrective actions, knowledge of planned maintenance system and repair management.	9	3
15	Latest development in main propulsion and auxiliary machinery.	9	0
16	Monitor and control Compliance with legislative requirements and measures to ensure safety of life at sea and protection of the marine environment	21	0
17	Ship Security System.	6	0
18	Flag State / Port State Control & compliance for NCV vessels.	9	6
		183	57
		Total	240

Note: Though the syllabus for both of the above categories is common; however the level of examination will be different.

(A comprehensive oral exam after completion of the "Engineering Management Course" & written exam syllabus of which is given above.)

**STRUCTURE AND SPECIFICATION OF
Engine Room Simulator Course for Chief Engineer Officer (NCV)**

- 1) NAME OF COURSE: **Diesel Engine Combustion Gas Monitor Simulator Course.**
- 2) SCOPE: The course is essentially a practical one, consisting of a series of exercises built around the operation of a ship's diesel engine.
 - D) Familiarisation: Initially trainees familiarise themselves with instrumentation and controls of the simulator and also screening of displays.
 - E) Starting and Running: As the course progresses the trainees work through and get used to the procedures for changing the set up, initial condition control settings etc.
 - F) Faults / Malfunctions and their troubleshooting during the operation of the machinery. Briefing before each exercise and a debriefing after the exercise which includes group discussion and analysis of the actions of the students.
- 3) OBJECTIVE: Computer Based Combustion Gas Monitor Simulator training to educate senior level engineers in functioning of Combustion of Diesel Engines. Following variables, parameters, control settings etc are evaluated for better understanding.
 - a) Consumption of fuel
 - b) Effect of Advanced / Retarded timing on specific fuel oil consumption, peak pressures, exhaust temperatures and evolution of NO_x and SO_x.
 - c) Economical mode / environmental friendly mode for diesel engine operations.
 - d) Effects of different quality fuel on various parameters including ones mentioned above.
 - e) Effect of abnormal conditions including abnormal values of temperature pressure quality of fuel, scavenge air, cooling medium etc.The individual on completion of the course will be able to make a safe and more effective contribution to the operation and control of the Diesel Engine installed on board a ship.
- 4) The course is in accordance with the requirements in addition to those laid down in STCW 95 Regulation 1/12 and Code B-1/12.42

DURATION OF COURSE IN HOURS: The total course duration is "Eight Hours"

CLASS ROOM HOURS – 1 hrs PRACTICAL HOURS – NIL

HOURS ON SIMULATOR – 7 hrs.

Rating Training Record Book

Note: This will be available through Directorate General of Shipping and regional Mercantile Marine Department Offices.

Training Circular 8 of 2016

THESE GUIDELINES ARE FOR THE

CONDUCT OF

***PRE-SEA TRAINING COURSE FOR GENERAL PURPOSE (GP) RATINGS IN
COMPLIANCE WITH STCW CONVENTION AS AMENDED IN 2010***

ISSUED BY

THE DIRECTORATE GENERAL OF SHIPPING

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PRE-SEA TRAINING COURSE FOR GENERAL PURPOSE (GP) RATINGS

1. PREAMBLE

Safety and efficiency of ship operation are dependent on the professional competence and dedication to duty of the seafarers on board. Hence maritime education and training, and within that, pre-sea training is of vital importance. With this in mind, this course is compulsorily residential with workshop training, boat work, team games, swimming, physical training, parade and a host of other extra-curricular activities. Students successfully completing this course should have the required standard of knowledge, communication skills in English, competence and cheerful obedience to orders of superiors, team spirit, leadership and other seaman-like qualities. These guidelines shall be followed in letter and in spirit.

2. BASIC DETAILS OF THE COURSE

2.1 Aims

To provide pre-sea training that would balance theoretical knowledge, practical skills, safety consciousness and efficiency for those who wish to take up seafaring as a profession to serve as ratings on merchant ships.

2.2. Objectives

By conducting compulsorily residential, regimented and disciplined courses to impart training that would, after the prescribed sea experience, enable a rating to comply with Regulation II/4 and III/4 of STCW convention as amended in 2010, achieve the standards of competence as specified in Table A-II/4 ('Rating forming part of a Navigation watch') and A-III/4 ('Rating forming part of an Engine room watch') of STCW convention as amended in 2010 and hence become eligible to serve on merchant ships as a Watch Keeping Rating. The curriculum intends to make the rating competent all round with hands on skills in both the deck and engine departments and not merely comply with minimum requirements.

The curriculum also includes the knowledge, understanding and proficiency as specified in Table A-II/5 ('Able Seafarer - Deck') and A-III/5 ('Able Seafarer - Engine') of STCW convention as amended in 2010 and after the prescribed sea experience as watchkeeping rating, would enable the rating to comply with regulation II/5 and III/5 of the STCW convention as amended in 2010 and obtain certificate of proficiency as "Able Seafarer - Deck" or "Able Seafarer - Engine" as applicable.

2.3. Scope

These guidelines are for institutes that already conduct, or seek approval of the Directorate General of Shipping (DGS) to conduct, Pre-Sea Training Courses for General Purpose (GP) Ratings.

2.4. Application

Compliance with these guidelines, read in conjunction with DGS Order no: 2 of 2007, and DGS Order no. 5 of 2013, shall be mandatory for all institutes. These guidelines are course-specific, superseding Training Circular 9 of 2010 and other guidelines issued earlier specifically for this course.

QUALIFICATION & ELIGIBILITY OF CANDIDATES

3.1. Entry standards (to be verified by the Institute)

3.1.1. Academic standards:

1. Xth Standard pass from government recognized board with subjects English, Mathematics & Science with 40 % aggregate. English 40% in Xth / XIIth
OR
2. XIIth Standard (any stream) pass from government recognized board with 40 % aggregate. English 40% at Xth or XIIth but with subjects English, Mathematics & Science at Xth.
OR
3. Pass in 2 year ITI course approved by DVET; with minimum 40% aggregate marks in final year of ITI & minimum 40% in English in Xth / XIIth.

3.1.2 Age limit: Minimum age 17½ years and maximum age 25 years on the date of commencement of course.

3.1.3 Physical standards: As per M.S (Medical Examination for seafarers) Rules 2000 as amended from time to time.

3.2. Required attendance and conduct

All trainees must join the course within the first ten days of commencement of the course. Considering that the course is residential, attendance shall normally be 100%. However, 90% and above is acceptable. In exceptional cases, the head of the institute may accept attendance of 75% and above if he is satisfied that the reason for shortfall is genuine and that the trainee's performance in the course has been good. Such reasons shall be recorded and be available for inspection.

Should any candidate fail to satisfy the above criteria, the institute must intimate the name to the Directorate General of Shipping (Training Branch) and to the Examination Authority before the commencement of the All India Exit Examination.

3.3. Course intake limitations

The sanctioned number of ratings shall not exceed 40 per class and in multiples with a maximum of 40 per class, thereafter. For fresh approvals, commencement can be made with one batch of maximum 40 trainees and thereafter additional batch(es) approval may be sought on satisfying relevant conditions laid down by DG Shipping. The course intake, expansion of capacity and fresh approvals shall be governed by orders issued by the DGS from time to time.

4. INFRASTRUCTURE REQUIREMENTS

4.1. Infrastructural requirements to be in line with DGS Order 7 of 2016.

4.2. List of Course Specific minimum equipment required for this course is given in **Annexure 9**.

4.3. The following facilities of suitable area commensurate with the number of trainees at a time, with equipment as listed in **Annexure 9**:

- Navigation
- Seamanship
- Marine Engineering
- Carpentry
- Plumbing
- Machining
- Electrical
- Hot Work

5. COURSE DETAILS

5.1.Duration of the course: The duration of the course shall be twenty-five weeks.

5.2.Dates of commencement of the course: Courses shall commence on the first working day after 1st February and 1st August every year.

5.3.Course Syllabus:

The syllabus for this twenty-five-week course includes five basic modular courses as follows:

- i. Proficiency in Survival Techniques
- ii. Elementary First Aid
- iii. Fire Prevention and Fire Fighting
- iv. Personal Safety and Social Responsibility
- v. Security Training for Seafarers with Designated Security Duties

5.4. Course Structure, Specific Learning Objectives, and Practical Tasks:

5.4.1 Course Outline: As per **Annexure 1**.

5.4.2 Outline of each part of the course **Annexure 2**

5.4.3 Tasks and expected contact hours for each component:

Part 1 - General Aspects **Annexure 2 A**

Part 2 - General Ship Knowledge (GSK) **Annexure 2 B**

Part 3 - Marine Engineering Knowledge & Practice (MEK) **Annexure 2 C**

Part 4 - Prevention of Pollution of the Marine Environment **Annexure 2C**

Part 5 - STCW Mandatory Courses **Annexure 2 D**

Part 6 - Assessment detailed in **Annexure 4**

Part 7 - Upkeep of the Campus **Annexure 2 D**

5.4.4. Specific Learning Objectives for Part 1 General Aspects Appendix 1A

5.4.5. Specific Learning Objectives for Part 2 GSK **Appendix 1B**

5.4.6. Specific Learning Objectives for Part 3 MEK **Appendix 1C**

5.4.7. Specific Learning Objectives for Part 4 MAR **Appendix 1C**

5.4.8. List of Practical Tasks for Part 2 – GSK **Appendix1D**

5.4.9. List of Practical Tasks for Part 3 – MEK **Appendix 1E**

6. FACULTY REQUIREMENTS

6.1. Qualifications and experience of Principal and faculty members:

Institutes shall comply with para 3.8 of DGS Order 5 of 2013.

The Principal, and the Vice Principal if designated, and faculty shall hold minimum qualifications of a Certificate of Competency, issued or recognised by the Government of India, as Chief Mate (FG) of a foreign going ship or Master Near Coastal Voyages (NCV) (for Nautical subjects) and MEO Class II (FG) or Chief Engineer NCV (MEO III) (for Engineering subjects).

6.2. Qualifications and experience of faculty members (academic subjects):

Academic faculty, if employed, should possess at least a Master's degree in the subject taught by them.

6.3. Minimum Qualifications and experience of instructors:

- 6.3.1 Held a rank as Bosun (Serang) or Able Seafarer on a merchant ship.
- 6.3.2 PT instructor should have PTI qualification.
- 6.3.3 For Seamanship, Ex-Navy instructors must be Petty Officers from the Seamanship branch..
- 6.3.4 For Machine Workshop, Fitters who have five years sea experience on merchant ships or ex-Navy / CG instructors with qualification as Mechanician/ Engine room artificiers. Instructors for skills such as Carpentry, Plumbing, possess appropriate trade certificates from ITI or persons who have five years sea experience on merchant ships as Petty Officer (maintenance) or equivalent acceptable to DGS.
- 6.3.5 Instructors for Electrical Workshop may be persons who have experience on merchant ships of one year as Electrical Officer or five years as Electrician/wireman or ex-Navy / CG Petty officers from the electrical branch.

6.4. Training of Trainers Course:

All faculty members and instructors must have undergone an appropriate approved training course – Training of Trainers & Assessors Course for faculty members and Training of Instructors (TOI) for instructors.

6.5. Faculty Strength:

- 6.5.1. The number of trainees in a lecture class shall not exceed 40.
- 6.5.2. For practicals and other work where greater inter-action is necessary, the class should be sub-divided into groups of not more than 10 trainees per instructor.
- 6.5.3. At least 50% of the faculty and instructors in each category must be on full-time employment of the institute.

6.6. The minimum faculty and instructor strength:

- 6.6.1 For 41 to 80 Ratings per course: Inclusive of the course in charge, not less than two (2) holding COC as Chief Mate of Foreign Going ship or Master-Near Coastal Voyages (NCV)

and one (1) holding COC as MEO II or Chief Engineer NCV (MEO III) and eight (8) instructors qualified to cover Seamanship, Carpentry, Plumbing, Machining, Electrical Work, hot work, Marine Engineering Work, Drill and Physical Training.

- 6.6.2 For 81 to 120 Ratings per course: Inclusive of the course in charge, not less than three (3) holding COC as Chief Mate of Foreign Going ship or Master-Near Coastal Voyages (NCV) and two (2) holding COC as MEO II or Chief Engineer NCV (MEO III) and ten (10) instructors qualified to cover Seamanship, Carpentry, Plumbing, Machining, Electrical Work, Hot work, Marine Engineering Work, Drill and Physical Training.

7. DUTY OFFICER AND DUTY INSTRUCTOR

There must be at least one Nautical Officer or Engineer Officer or Warden (senior instructor) and one instructor on duty on the campus at all times during the course period.

8. CONTACT HOURS PER WEEK

The curriculum shall be planned for a 42 hour six-day week.

Routine for the day: (Mon-Sat) – for guidance only

0600	Fall-in
0600-0830	Wash/PT-Yoga/ Clean Ship/ Parade/ Breakfast
0830-1245	Classes/Workshop/Lab (with 15 min break)
1245-1330	Lunch Break
1330-1630	Classes/Workshop/Lab (with 15 min break)
1630-1700	Break
1700-1830	Sports/ Swimming/ Parade/ Library/ Project work
1830-1930	Wash
1930-2000	Dinner
2000-2100	Indoor Games/Recreation/ Library
2100-2200	Self-Study
2200	Lights out

9. HOLIDAYS

- 9.1 Sundays shall be holidays.
 9.2 Independence Day and Republic Day shall be compulsory holidays.
 9.3 All government holidays, applicable to the state in which the institute is situated, shall normally be observed.

10. UNIFORMS

- 10.1. **For ratings:** The list of uniforms, accessories and text books that each Rating must possess while under training in the institute is given in **Annexure 3**
 10.2. **For faculty:** While in the campus of the institute, all teaching staff and faculty must wear uniforms as set out in **Annexure 8**.
 10.3. **For other staff:** The institute may prescribe suitable uniform to be worn by non-teaching staff.

11. QUALITY STANDARDS AND COMPREHENSIVE INSPECTION PROGRAMME

Quality Standards to be followed as per DGS Order no: 7 of 2016. Institutes shall undergo inspection as per the Comprehensive Inspection Programme (CIP) for Pre-Sea Institutes as per DGS Order 4 of 2016 within 6 months of starting the first course and it should achieve a grading of A2 atleast, by approved R.O. If any institute is graded less than A2, it will be allowed 1 years time to upgrade to A2, failing which it shall be closed down and derecognized.

12. ASSESSMENT

The structure is given in **Annexure 4.** (Including Rules of Examinations)

Internal Assessment:

A formal midterm test is to be conducted by the institute (written, orals, and practicals) and records of these tests to be maintained.

External Assessment:

In line with DGS guidelines an exit examination shall be conducted by the Examination Authority (ref: Training Circular 10 of 2005) or any other body so appointed by the DGS.

13. INSPECTION & DISCIPLINARY ACTION IF ANY FOR DEFICIENCIES

Inspection as per DGS Order 7 of 2016 Disciplinary action as per DGS order no: 7 of 2016.

14. COST OF INSPECTIONS

All costs of scheduled inspections shall be borne by the concerned institute.

15. FEES TO GOVT

As per DGS order no: 7 of 2016 & Training Circular 09 of 2013.

16. PLACEMENT OF TRAINEES FOR SHIPBOARD TRAINING

16.1 The institute shall admit only those candidates for whom they have secured sponsorship from shipping companies for six months onboard training. Institutes shall submit the sponsorship letter to DGS, before admitting the students for each batch.

16.2 Undertaking will be obtained from the MTI about placement to be done through Indian shipping companies or DGS approved RPSL agencies. The MMD shall verify the capability of the said Indian shipping companies or RPSL companies to place the students for onboard ship training and shall give a clear finding in this respect in their recommendation to this Directorate after the inspection.

16.3 Institutes are to ensure placement for onboard training with Indian Shipping Companies or DGS approved RPSL, of a minimum of 85% of all its trainees who

have passed out from the GP Ratings course within a period of 12 months from the date of passing out / examination result.

- 16.2 The placement records will be checked during every CIP inspection by the ROs, as per the norms specified therein, and any non-compliance will result in the intake of the institute to be reduced for the next academic year or approval will be withdrawn.

17. COMMUNICATION TO DGS & INDOS

The institute shall upload all data related to the course on E-Samundra within 10 working days of the commencement of the course And must forward a soft copy and hard copy of list of candidates enrolled for the course to: The Directorate General of Shipping, INDOS Cell and the Examination Authority in the format given below:

Information of Institute	
Name of the Institute	
INDOS No. of Institute	
Approved Capacity	
Course Title	
Batch No.	
Date of Commencement and ending of the course	

S. No.	Registered Name of the Candidate	DOB DD MMM YYYY e.g. (26 MAR 1994)	Place X under each as applicable		
			X Std	XII Std	ITI

- B. Together with list of the candidates, institute must submit a complete list of faculty/instructors – Full Time and Part Time in tabulated format as given below.

Course In-Charge and Faculty specifically for the ratings course

Starting with Course In-Charge:

S. No.	Qualification	Full Name	Age	Starting with FT – Full Time PT – Part Time
1.				
2.				
3.				
4.				

Instructors specifically for the rating course

Starting with – FT – Full Time – PT – Part Time;

S. No.	Qualification	Full Name	Specialization	FT or PT
1.				
2.				
3.				
4.				

- C. Within one month from the date of commencement of the course, every institute must apply for INDOS No. for each of the trainee.
- D. By the end of the third month from the date of commencement of the course, every institute may apply for CDC for each of the trainee.
- E. By end of 10 weeks from the date of commencement of the course, each institute must send details of each candidate together with the INDOS No to the Examination Authority or any other specified authority.

Annexure 1

COURSE OUTLINE

Total Duration of the Course – 25 weeks (on the basis of 42 contact hours per week)

Parts/Title	Theory Hrs	Practical's Hrs	Total contact	Weeks
Part 1 General Aspects Induction, personality & communication skills development, general knowledge about shipping and ships, and introduction to computers	91	64	155	
Part 2 General Ship Knowledge (Seamanship and Navigation) at Support Level	123	154	277	
Part 3 Marine Engineering Knowledge and Practice at Support Level	99	257	356	
Part 4 Prevention of Pollution of the Marine Environment	8	4	12	
Sub Total of Part 1 + Part 2 + Part 3 + Part 4	321	479	800	20.5
Part 5 Mandatory STCW Courses and Ship Visit				
H. Proficiency in Survival Techniques (TC 31 of 2004)	10	5	15	1
I. Elementary First Aid (TC 30 of 2004)	10	5	15	
J. Fire Prevention and Fire Fighting	13	5	18	1
K. Personal Safety and Social Responsibility (STCW 2010 TC13 of 2012)	18	0	18	
L. Security Training for Seafarers with Designated Security Duties (STCW 2010 TC 27 Of 2012)	13	1	14	0.5
M. Port/Dock/Harbour/Ship Visit	01	7	08	
Total of Part 5	65	23	88	2.5
Part 6 Revision/Assessment (Internal and External)	40	43	83	2
Total of Part 1 to Part 6	426	545	971	25
Part 7 Upkeep of the campus (three hours per week for 13 weeks) (Supervised by Instructors)			39	
Part 8 Holidays/passing out/etc.			42	
GRAND TOTAL (Part 1 to Part 7)			1052	25

Annexure 2

Outline of each part of the course

Annexure 2 A

Parts/Title	T Hrs	P Hrs	Total Hrs	Wks
Part 1 – General Aspects: Induction to the course, personality and communication skills development, general knowledge about shipping and ships, and introduction to computers.	91	64	155	

(Please see Appendix 1A Specific Learning Objectives)

S. No.	Topics & sub topics	Theory	Practical
1.11	English speaking, reading, writing (using topics 1.5 and 1.6 and charts and reading material)	35	30
1.12	Computers (Familiarization)	10	20
1.13	Discipline, etiquettes and Gender Sensitization	5	10
1.14	Health and Hygiene	8	4
1.15	General Aspects of Shipping 1.5.1 Importance of Shipping in the National and International Trade 1.5.2 International Routes 1.5.3 Types of Ships and Cargoes 1.5.4 Shipboard Organization	15	0
1.16	Nautical Terms – Parts of the Ship (Using ship models and video) 1.6.1 Hull 1.6.2 Ships Decks 1.6.3 Fore Castle 1.6.4 Poop Deck 1.6.5 Accommodation: (Teaching Aid: Video) 1.6.6 Bridge:(Teaching Aid: Video) 1.6.7 Monkey Island 1.6.8 Cargo Spaces (Cargo Holds, Tanks) 1.6.9 Cargo Handling Gear (Derricks, Cranes, Grabs, Pumps) 1.6.10 Machinery Space (Engine Room/Pump room)	18	0

Annexure 2 B

Parts/Title	T Hrs	P Hrs	Total Hrs	Wks
Part 2 General Ship knowledge (Seamanship and Bridge duties at Support Level)	123	154	277	

General Ship Knowledge
(Seamanship and Bridge duties at Support Level)
(Please see Appendix 1B Specific Learning Objectives)

S. No.	Topics & sub topics (indicative hours Theory + Practical)	Theory	Practical
2.1	Basic Navigation, Operate emergency equipment & apply emergency procedures 2.1.1 Navigation Terms 2.1.2 Rules of the Road (elementary) & Buoyage 2.1.3 Navigational aids on the Bridge of a Modern Cargo ship 2.1.4 International Code of Signal & Flags 2.1.5 Operate emergency equipment on bridge & apply emergency procedures 2.1.6 Look Out Duties: 2.1.7 Reporting to OOW on sighting 2.1.8 Reporting to OOW on hearing 2.1.9 Relieving the Look-Out Man: 2.1.10 Information required to maintain a safe watch 2.1.11 Other Bridge Duties: 2.1.12 Steer the Ship & Comply with Helm Orders in the English language: 2.1.13 Berthing, Anchoring and other Mooring Operations	41	40
2.2	Cargo Handling and Stowage 2.2.4 Cargo Handling equipment (Derricks, Cranes, Grabs, Gantry, Spreaders, Pumps) 2.2.5 Cargo Spaces, Opening & Closing of Hatches 2.2.6 Securing Cargoes 2.2.7 Container Cargo 2.2.8 Bulk Cargo (Other Than Grain) 2.2.9 Bulk Grain Cargo 2.2.10 Preparation of Holds and Segregation of Cargoes 2.2.11 Ventilation and Control 2.2.12 Identification of dangerous goods and precautions for their carriage	38	42
2.3	Controlling the operation of ship and care of persons onboard 2.3.7 Personal Protection Equipment 2.3.8 Safe working practices (General) 2.3.9 Risk Assessment (Basic) 2.3.10 Permit to Work System	32	48

	2.3.11 Work-Permits 2.3.12 Emergencies 2.3.13 Safe Access to the Ship 2.3.14 Safe Working Practices during Berthing / Unberthing, and Anchoring 2.3.15 Safety Precautions, when working aloft 2.3.16 Safety Precautions, when working over side 2.3.17 Safety Precautions during working in enclosed spaces 2.3.18 Safety Precautions, during manual lifting of weights 2.3.19 Demonstrates working knowledge of electrical safety 2.3.20 Safety precautions when climbing fixed vertical ladders and portable ladders. 2.3.21 Safety precautions when rigging scaffolding and using it 2.3.22 Safety precautions when handling chemicals and strong detergents 2.3.23 Communicate with other persons on board on elementary safety matters (1.5 hours) understand safety Information symbols, signs and alarm signals 2.3.24 Shipping Organisation (National) & documents for seafarers 2.3.25 International Organizations and Conventions 2.3.26 Seamanship, Ropes & Rope Work 2.3.27 Blocks and Tackles 2.3.28 Rigging of 'Pilot ladder', 'Bosun's Chair', 'Stage', Gangway & climb a mast 2.3.29 Duties of a Gangway Watch in Port (introduction to ISPS Code)		
2.4	Ship Maintenance and Repair 2.4.1 Surface Preparation and Painting 2.4.2 Lubrication	12	24
	Total	123	154

Annexure 2 C

Parts/Title	T Hrs	P Hrs	Total Hrs	Wks
Part 3 Marine Engineering knowledge and Practice (at Support Level)	99	257	356	

Marine Engineering Knowledge and Practice (Please see Appendix 1C for Specific Learning Objectives)

Marine Engineering Knowledge & Practice (at support Level)		Suggested (Hrs)	
S. No.	Topic & Sub topics	Theory	Practical
3.19	Familiarization with duties and Engine Room environment 3.1.1 Duties of a Trainee Rating in the Engine Room 3.1.2 Engine Room Space 3.1.3 Engine Room Machinery 3.1.4 Auxiliary Machinery 3.1.5 Symbols used in the engine room 3.1.6 Engine Room watch keeping procedures	7	0
3.20	Instruments (Thermometers, pressure gauges, level gauges)	2	0
3.21	Safe working procedures, Tools & instruments 3.3.1 Hand Tools, Measuring instruments 3.3.2 Lifting devices and equipment, Basic fitting, Fasteners 3.3.3 Safety precautions while working in the engine room 3.3.4 Safety precautions during bad weather 3.3.5 Safety precautions during hot work 3.3.6 Safety precautions while working on electrical equipments 3.3.7 Safety precautions before entering enclosed spaces 3.3.8 Safety precautions during dry dock 3.3.9 Cleaning of engine room bilges, disposal of engine room waste 3.3.10 Bilge pumping system 3.3.11 Ballasting & de-ballasting system, bunkering procedures 3.3.12 Maintenance work & preservation	12	86
3.22	Auxiliary Equipment & maintenance work 3.4.1 Valves 3.4.2 Pumps and Pumping Systems including ballasting & Deballasting 3.4.3 Joints and gland packing 3.4.4 Filters 3.4.5 Centrifugal separators 3.4.6 Other Auxiliaries 3.4.7 Boiler and Steam System & watch keeping duties 3.4.8 Propeller & shafting 3.4.9 Preservation of equipment in good condition	26	25

3.23	Identify components of diesel engines listed below: 3.5.1 Generator Engines 3.5.2 Main Engine	8	12
3.24	Compressed air for auxiliary purposes	2	0
3.25	Machines: Grinder, Drill, Lathe	3	60
3.26	Basic welding and cutting: Arc welding, gas welding, gas cutting	3	60
3.27	Lubricants and lubrication	2	4
3.28	Level measuring devices and techniques	1	0
3.29	Lagging and insulation	1	0
3.30	Safe use of electrical equipment 3.12.1 Hand tools for Electrical Maintenance 3.12.2 Electrical Components & Equipment 3.12.3 Electrical Safety	4	6
3.31	Chemicals on board	1	4
3.32	Steering Gear 3.14.1 Function of steering gear, check to be made while taking a round in the steering gear compartment 3.14.2 Bow thruster location & importance	3	0
3.33	Storage tanks 3.15.1 Types of storage tanks in the engine room 3.15.2 Purpose & operation of quick closing valves	2	0
3.34	Emergencies in the engine room 3.16.1 Various emergencies in the engine room 3.16.2 Types of audio-visual alarms 3.16.3 Action to be taken on hearing/seeing alarms 3.16.4 Emergency escape routes	4	0
3.35	Fire extinguishing equipment in the engine room 3.17.1 Portable firefighting appliances in the engine room 3.17.2 Fixed firefighting equipment i.e CO ₂ , Foam, Water Sprinkler, Hyper Mist, Emergency Fire Pump	4	0
3.36	Basic Marine Engineering at Support Level 3.18.1 Engineering Materials & Special Tools used for maintenance of Engine Room main & auxiliary machineries 3.18.2 Watch keeping duties on main & auxiliary machineries including boilers 3.18.3 Working of Diesel engine, air compressor, evaporator, oily bilge separator, AC & fridge plant 3.18.4 Remote operations & internal communications system	14	0
	Total	99	257

Part 4. Prevention of Pollution of the Marine Environment
(Please see Appendix 1C for Specific Learning Objectives)

4.0	Prevention of pollution to the Marine Environment ➤ Sources of pollution at Sea from ship ➤ Damage to the environment ➤ Importance of prevention of pollution of the sea ➤ Ways and means of preventing pollution ➤ Pollution prevention equipment on board	8	4
	Total	8	4

Annexure 2 D

Title	T Hrs	P Hrs	Total Hrs	Wks
Part 5				
Mandatory STCW Courses and Ship Visit				
• Proficiency in Survival Techniques	10	5	15	1
• Elementary First Aid	10	5	15	
• Fire Prevention and Fire Fighting	13	5	18	1
• Personal Safety and Social Responsibility	18	0	18	
• Security Training for Seafarers with Designated Security Duties	13	1	14	0.5
• Port/Dock/Harbour/Ship Visit	1	7	8	
Total	65	23	88	2.5
Part 6 Assessment (Internal and External)/ revision Details in Annexure 4	40	43	83	2
Part 7 Upkeep of the campus (three hours per week for 13 weeks) (Supervised by Instructors)			39	
Part 8 Holidays/passing out/etc.			42	

Annexure 3

List of approved accessories and recommended books and accessories for Pre Sea Courses for GP Ratings

S. No	Accessories	Quantity
1.	Boiler Suits	4
2.	White Uniform Shirt, Half Sleeves	2
3.	White Uniform Shorts	2 pairs
4.	Black Leather Belt with Buckle	1
5.	Blue Stockings	2 pairs
6.	Soft, Blue Peak Cap with emblem of institute	1
7.	White "T" shirts with the emblem of institute	2
8.	Sports Shirt – coloured	2
9.	Sports shorts – (coloured)	2
10.	Black socks	2
11.	Pugree (Blue Cotton) for Sikhs only	1
12.	Coloured swimming trunks	1
13.	Black Shoes (without toe caps with laces)	1 pair
14.	Black Safety Shoes (ISI standard)	1 pair
15.	Leather Safety Gloves	1 pair
16.	Safety Goggles	1
17.	Ear Defenders	1
18.	Helmet	1
19.	Geometrical Instrument Box with Pencils, Erasers and Coloured Pencils	1
20.	Exercise Books as specified by the institute	-
21.	Black Shoe Polish	1
22.	Track suit	1 pair
23.	White Handkerchief	4
24.	Winter sweater (blue)	1

Text Books (to be issued to each candidate)

01. Basic Seamanship Marine Engineering and Human Relations for Seafarers Vol. 1 & Vol. 2 by Board of Examinations for Seafarers Trust.

Reference Books

06. Seamanship Primer by Capt. J. Dinger
07. Safe Working Practices (MCA - UK) publication
08. Seamanship Techniques 1 Shipboard Practice, D.J. House
09. Admiralty Manual of Seamanship (HMSO)
05. Bridge Watchkeeping, a practical guide, Nautical Institute
06. Mooring and Anchoring Ships, Volume 1 and 2, Nautical Institute
07. Ship Knowledge, Dokmar Publications
08. The Colregs Guide, Dokmar Publications
09. 21st Century Seamanship, Witherby Seamanship
10. A Guide to the Collision Avoidance Rules, by Cockcroft and Lameijer
11. The Boatswain's Manual, Brown, Son and Ferguson, Ltd.
12. Marine Navigation and Safety of Sea Transportation, Nautical Institute
13. Shipboard Drills, Witherby Seamanship
14. Ashley Book of Knots, Doubleday

15. Illustrated Dictionary of Cargo Handling, Taylor & Francis Ltd.
16. The Theory and Practice of Seamanship, Routledge
17. Peril at Sea and Salvage, International Chamber of Shipping, OCIMF
18. Accident Prevention on Board Ship at Sea and in Port, International Labour Office
19. Onboard Safety, Witherby Seamanship
20. Basic Marine Engineering – Author – Jai Kishen Dhar – Publisher – G. Maritime Publications
21. The Best Seamanship – A Guide to Engine Skills – Publisher – International Mariners Management Association of Japan (IMMAJ).
22. Seafarers' Health Information Programme – a set of booklets - International Seafarers Welfare and Assistance Network (ISWAN).
23. Unitor Welding Handbook – Wilhelmsen Ships Service.
24. A Guide to Safety and Health at Work for Gas Welding and Flame Cutting - Occupational Safety and Health Branch Labour Department
25. A Textbook of Workshop Practice by R.S. Khurmi, and J.K. Gupta

Annexure 4

STRUCTURE OF ASSESSMENT

Internal Assessment:

Each institute is expected to have an internal assessment scheme to monitor the progress of each trainee and effectiveness of teaching inputs.

Ideally, formal assessment at the end of each month should suffice; however, institutes can introduce 'continuous assessment' system that monitors the progress of each candidate at appropriate intervals. Institutes need to create and document their scheme and maintain records of assessment.

Internal assessment should also include elements such as discipline, attendance, attitudes, extra curricular activities, seamanship, teamwork and similar traits.

Institutes should specify disciplinary norms, and disqualify any trainee who fails to reach minimum standards. Such a trainee should be barred from taking All India Exit Examination. Such an action must be communicated to the authorised examination body, and DGS, immediately.

Practical Training Record Book

Each trainee will be issued a DG approved 'Practical Training Record Book' developed and periodically revised by the authorised examination body. When a trainee can perform the listed tasks to a satisfactory level, Record Book to be signed by instructor in-charge, and counter signed by the Course in-charge. Practical record books including ship visit reports must be sent to the authorised examination body after completion of the exit practical exam.

External Assessment:

All India Exit Examination to be conducted by the Examination Authority as per the guidelines issued and revised from time to time. The assessment scheme shall be as follows:

S.No.	Subject	Marks	Pass Marks	Mode	Duration
1.	General Aspects & General Ship Knowledge including navigational watch- keeping and safety.	50	30	Online & Written	1 hour 45 mins
2.	Marine Engineering, Knowledge of Machinery equipment and watch keeping procedure and safety	50	30		
3.	Seamanship, watch keeping, helms skills, and safety, personal survival techniques, and protection of environment	50	30	Practical	Approx. 2 hours
4.	Work shop practice, fitting, basic welding, use of machines, safety, and firefighting techniques and first aid.	50	30		
5.	General Aspects & General Ship Knowledge	50	30	Oral	Average

	including navigational watch- keeping and safety				duration 20 minutes
6.	Marine Engineering, Knowledge of Machinery equipment and watch keeping procedure and safety	50	30		

The external examination will be conducted during the months of July and January. Additional examination, for only repeater candidates, will be conducted in the month of March and September.

Annexure 5

RULE FOR ISSUE OF PASSING OUT CERTIFICATE BY THE INSTITUTE (Format in annexure 7)

The training institute shall award a Passing out Certificate (in the format shown in Annexure 7) to only those candidates who have passed the All India Exit Examination conducted by the examination authority.

Annexure 6

Rules for the conduct of All India Exit Examination Rules for Ratings Exit Examination

8. Definitions:

- D. Fresh Candidate (FC)** – A person appearing for the first time at the end of the training period.
- E. Repeater Candidate (RC)** – A person who has failed or absent in any one of the previous examination.

9. Eligibility criteria:

Candidate attending a training programme at a DGS approved training institute.

Applying through the training institute, and satisfying other criteria of admissions, discipline, attendance, and internal assessment at the institute.

Possession of an INDoS No. The institute must furnish INDoS No. to the Examination Authority within ten weeks from the commencement of the Course.

Attendance Record provided by the institute is in compliance with Para 3.2 of the Guidelines.

10. List of Candidates to be forwarded by the institute:

The institute will be required to forward complete details of the candidates who are to appear for examination alongwith application forms one month prior to the examination. This will be treated as final record of enrolled candidates at any time in the future.

If any of the enrolled trainees is not appearing for the immediate examination, for any reason, the training institute must inform Examination Authority at the time of sending application forms of candidates of that batch.

11. Eligibility of Repeater Candidates (Resit):

Any candidate who has failed in any of the previous examination or missed an examination should follow instructions given in DGS Training circular No. 13 of 2013.

Repeater candidates if they desire, may choose to forward the application form to the Examination Authority themselves or through the Training institute within the dates specified on the website of the Examination Authority.

5Disciplinary action against candidates

Guidelines for disciplinary action in cases of unlawful act of any candidate during 'All India Exit Examination for Ratings' conducted by the examination authority.

Definition: Examples of 'Unlawful act'.

- (F) Possession of prohibited material
- (G) Exchanging anything with other candidates
- (H) Attempt to copy from a candidate from an adjacent seat
- (I) Causing disturbance in the examination hall,
- (J) or any similar means.

J) If the candidate is caught at the venue of the examination:

The invigilator would collect the evidence, as far as possible, and report the matter to the Examination Coordinator immediately.

The invigilator shall write a report of the incidence and submit it to the Examination Coordinator. The candidate should be asked to sign the statement.

In case of no physical evidence, and a candidate refuses to sign, the Examination Coordinator shall make a remark on the report and forward the report, with or without the evidence, to the Chief Coordinator of the authorised examination body.

JJ) In case the copying is noticed at the time of marking of answer scripts.

The examiner or the moderator finding any evidence of copying shall report the matter to the Chief Coordinator as soon as possible.

JJJ) Further action:

If the evidence of cheating is confirmed, the Examination Authority shall declare the candidate(s) as failed. Any candidate who attempts to copy or is helping others to copy will be treated equally.

12. Appeal for review of Answer Script:

Any candidate will be allowed to appeal a review of the answer script by a panel of **two** moderators to be appointed by the authorised examination body.

Application for appeal should be made through the training institute within 15 days from the date of results. To be addressed to the authorised examination body.

Result of the review will be declared within 15 days of the closing date of appeal. This result will be submitted to the Directorate General of Shipping (Training Branch), and institute will be informed accordingly.

Examination Enquiry Report (Sample)
(Incense of unlawful act during the Exit Examination)

Date, place & time of Event:

Persons involved:

Name & Roll No:

Name & Roll No:

Name of the institute:

Allegation: Details of 'unlawful act'.

Evidence:

Statement from the candidates: (Add or delete as applicable)

The evidence presented is true/.....

I agree to have adopted unfair means during the examination as stated above.

I disagree to have adopted unfair means during the examination as stated above. (Agree or disagree to be written by the individual candidate in signature column.)

Names	Signature
Head of Institution	
Remarks (if any)	
Representatives of Examination Authority 1. 2.	

Date:

Place:

Annexure 7
FORMAT OF PASSING OUT CERTIFICATE

Institute
Logo

NAME OF THE ACADEMY
ADDRESS

Phone:(+91xx)_____ Fax:(+91xx)_____ E-mail:_____

PRE SEA TRAINING COURSE
FOR GENERAL PURPOSE (GP) RATINGS

This is to certify that _____ Roll No. _____
D.O.B. (DD,MMM,YYYY)*INDos No. _____ has successfully completed a Pre Sea
Training Course for Rating forming part of the Navigational and Engineering Watch from
_____ to _____. This course is an integral part of the overall planned
and structured training programme for the prospective Rating of a Sea going Ship of 500
gross tonnage or more and is designed to assist him in achieving the minimum
standards of competence as specified in Regulation II/4, II/5 and III/4, III/5 of STCW
convention as amended in 2010. This training programme was conducted in English
language and is approved by the Directorate General of Shipping, Ministry of Shipping,
Government of India.

Rating's Signature

Date of Issue CAPTAIN SUPERINTENDENT/PRINCIPAL

Colour
Photograph
40 mm X 30 mm

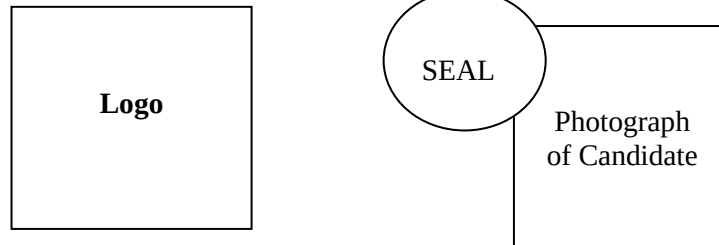
Rubber Stamp
of Institute

Embossed
seal of
Institute

*Indian National Database of Seafarers

All enquiries concerning the certificate should be addressed to the issuing authority above.

Sample of a Certificate to be issued on passing the All India Exit Examination



(Examination Authority)

**Under the authority of the Directorate General of Shipping, Ministry of Shipping,
Government of India**

Awards this

Certificate

Certificate No.: Candidates Code/year/Roll No.

This is to certify that SSSS KKKK YYYY

Roll No. XXXX **INDOS No.** YYYY **Date of Birth** DD-MMM-YY

has undergone an approved six months Pre-sea training Course for

General Purpose Rating

at: (Name of Training institute)

From MM-YY to MM-YY , **and has successfully passed the All India Exit Examination**

held in (Month – Year) and has been awarded grade - on the basis shown below:

A	B	C
Above 80% marks	70-79.99 % marks	60-69.99 % marks

Position in the merit list of first 25% -

Signature of the Candidate

Dated: DD-MMM-YY

Sd/
Head of Examination Authority
(Name)

(Name of Examination Authority)

Address

Sample of Endorsement at the back of GP Rating Certificate

Sample of Endorsement at the back of GP Rating Certificate

The All India Exit Examination is conducted in accordance with Training Circular 13 of 2013 in compliance with regulations II/4, II/5, III/4 and III/5 of STCW'2010

The curriculum for pre-sea training programme includes following components:

Part 1	Induction, personality and communication skills development, general knowledge about shipping and ships, and introduction to computers
Part 2	General Ship Knowledge (Navigation, Cargo Handling and Stowage, Maintenance, Repair and Seamanship, Controlling the operation on board, Care of Persons on board – at support Level)
Part 3	Marine Engineering Knowledge and Practice, Electrical, Electronic and Control engineering (at support Level)
Part 4	Prevention of Pollution of the Marine Environment
Part 5	Mandatory STCW Courses and Ship Visit
	H. Proficiency in Survival Techniques *
	I. Elementary First Aid *
	J. Fire Prevention and Fire Fighting *
	K. Personal Safety and Social Responsibility *
	L. Security Training for Seafarers with Designated Security Duties *
	M. Ship Visit / Harbour Visit (Two) *

*Mandatory courses for General Purpose Rating pre-sea training.

Under the All India Exit Examination, conducted by the Board of Examination for Seafarer Trust each candidate is evaluated through an online, written, practical and oral test for Parts 2 and 3. To pass the examination, a candidate must obtain a minimum of 60% marks in each component. Results are evaluated by the Directorate General of Shipping prior to issue of this certificate to successful candidates.

Annexure 8

Uniforms for faculty members

2. Epaulettes

- 1.1. Instructor: One Stripe.
- 1.2. Senior Instructor: Two stripes.
- 1.3. Nautical Officer: A diamond and four stripes.
- 1.4. Engineer Officer: A diamond and four stripes with purple in between.
- 1.5. Senior Nautical Officer, if post exists in institute: A diamond and a broad stripe.
- 1.6. Senior Engineer Officer, if post exists in institute: A diamond and a broad stripe with purple in between.
- 1.7. Course in charge (If Master Mariner) – Title: Captain Superintendent: A diamond, one stripe and a broad stripe.
- 1.8. Course in charge (If MEO Class I) – Title: Engineer Superintendent: A diamond, one stripe and a broad stripe with purple in between.

Note 1: Each stripe to be approximately 10 mm broad. The broad stripe to be approximately 45 mm broad.

Note 2: The diamond shape on the epaulette is only for an officer who possesses a Certificate of Competency granted or recognised by the Government of India.

4. Caps

- 2.1. All faculty members: White peak Cap.
- 2.2. Senior Nautical Officer and Senior Engineer Officer: White peak cap with one row of golden laurels.
- 2.3. Captain Superintendent: White peak cap with two rows of golden laurels.

5. Uniform

- 3.4. White half-sleeve shirt with epaulettes, white trousers, white belt, white socks and black shoes.
- 3.5. In cold weather, black trousers, black belt and black socks may be substituted for white.
- 3.6. White full-sleeve shirt may be worn after sunset in mosquito prone areas.

Annexure 9
List of Equipment (GP Rating)

Infrastructure, Equipment and teaching aids for Seamanship-Navigation-Engineering

The following facilities of suitable area commensurate with the number of trainees at a time:

- **Navigation**
- **Seamanship**
- **Marine Engineering**
- **Carpentry**
- **Plumbing**
- **Machining**
- **Electrical**
- **Hot work**

Open air demonstration, and practice area keeping in mind convenience of assessment
(Specifications for work benches, size of vices, ventilation, safe movement, and lighting)

1.	General Equipment to include:	For 40	For 80	For 120
1.1	World Maps (one in each Class Room and one in the library)	1	1	1
1.2	Minimum 3 models of Ships	1	2	3
1.3	Wall-mounted Photographs of Ships and Ports	10	10	10
1.4	Mate's Log Book	2	4	4
1.5	Official Log Book	2	4	4
1.6	Articles of Agreement	2	4	4
1.7	Muster List (one in each class room and one in the corridor)	2	4	4
1.8	Various plans of ships (GA/Fire control/LSA/Capacity/ loadline)	1 each	1 each	2 each
1.9	Gangway register	1	2	2
1.10	Rest Hours Record	1	2	3
2.	Video Cassettes/CD's/DVDs to include:			
2.1	Personal Safety on Deck	1	1	1
2.2	Personal Safety in Galley	1	1	1
2.3	Personal Safety in Accommodation	1	1	1
2.4	Personal Safety in Engine room	1	1	1
2.5	Shipboard Maintenance and Painting Systems	1	1	1
2.6	Anchors and Cables	1	1	1
2.7	Safe Mooring Practice	1	1	1
2.8	Good Bunkering Practices	1	1	1
2.9	Tank Cleaning	1	1	1
2.10	Entry into enclosed spaces	1	1	1
2.11	Use of Breathing Apparatus	1	1	1
2.12	Operation and maintenance of hatch covers	1	1	1
2.13	Pollution Prevention	1	1	1
2.14	Shipboard Oil Spill Contingency Planning	1	1	1

2.15	Waste and Garbage Management	1	1	1
2.16	Bridge Watch Keeping Procedures and Routine	1	1	1
2.17	Understanding English on Board - Normal Operations	1	1	1
2.18	Understanding English on Board – Emergencies	1	1	1
2.19	Good housekeeping on deck	1	1	1
2.20	Good housekeeping in engine room	1	1	1
2.21	Good housekeeping in accommodation	1	1	1
2.22	Permit to work systems and safe working practices	1	1	1
2.23	Working Aloft and Working Overside	1	1	1
2.24	Use of Personal Protective Equipment	1	1	1
2.25	Safe Welding and Gas Cutting Practice	1	1	1
2.26	Hold Cleaning Procedure	1	1	1
2.27	Correct use of Hand Tools	1	1	1
2.28	Using Power Tools	1	1	1
2.29	Safe rigging of gangways, pilot ladders	1	1	1
2.30	Working with Lifting Gear	1	1	1
2.31	Safe Slings	1	1	1
2.32	Hazards at Sea	1	1	1
3.	Navigation Equipment to include:			
3.1	Wet Card Magnetic Compass in a binnacle	1	1	1
3.2	Gyro Compass with repeaters	1	1	1
3.3	Model of Steering Wheel with Helm Indicator	1	1	2
3.4	Beaufort Scale Wind and state of Sea Chart	2	4	4
3.5	Binoculars.	2	4	4
3.6	Azimuth Circle	1	2	2
3.7	Aneroid Barometer	1	1	1
3.8	Mason's Hygrometer in a Stevenson's Screen	1	1	1
3.9	Whirling Psychrometer	1	2	2
3.10	VHF model	1	1	1
3.11	MOB Marker (dummy)	1	1	2
3.12	Navigation Lights Sentinel	1	1	1
3.13	Walkie-Talkie	2 sets	2 sets	2 sets
3.14	Steering Simulator (PC based)	1	1	1
3.15	International Code of Signals Flags (B, G, H, P, & Q)	2 sets	2 sets	2 sets
3.16	Day signals	1 set	1 set	1 set
3.17	Aldis Lamp with battery	1 set	1 set	1 set
3.18	Flag locker	1 set	1 set	1 set
4.	Seamanship Equipment to include:			
4.1	A ship-type mast as per DGS order no: 2 of 2007.	1	1	1
4.2	Manila Ropes [various sizes]			
4.3	Synthetic Ropes [various sizes]			
4.4	Steel wire Ropes [various sizes]			
4.5	Seizing twine and seizing wire			
4.6	Heaving Lines	4	8	8

4.7	Rope and chain stoppers	4	8	8
4.8	Anchor (Stockless) with D-shackle	1	1	1
4.9	Anchor Shackle	2	4	4
4.10	Lugless joining shackle for anchor chain	2	4	4
4.11	Mooring Shackle	2	4	4
4.12	Mooring Hawser (30 fathoms)	2	4	4
4.13	Mooring Wire (30 fathoms)	2	4	4
4.14	Bollards & Bits	2	4	4
4.15	Mooring winch with a warping drum	1	1	1
4.16	Rat guards	2	4	4
4.17	Single, double and triple sheave blocks	2 each	4 each	6 each
4.18	Cargo Block, gin block 5 ton	1	2	3
4.19	Snatch Block	1	2	3
4.20	Bottle screws and turn buckles	4	8	12
4.21	Bulldog Grips	12	24	36
4.22	Differential Pulley (chain block)	1	2	2
4.23	Container fittings including lashings	1 lot	1 lot	2 lots
4.24	Chipping hammers, scrapers and wire brushes	20 sets	40 sets	40 sets
4.25	Paint Brushes, roller brushes [various sizes and types] (1", 2", 3", 4")	12	24	36
4.26	Paint trays	12	12	12
4.27	Spray painting machine (with set of nozzles), and self-contained compressor, hose and attachment. (face mask, gloves, goggles)	1 set	2 set	2 set
4.28	Paints for practice (primer, enamel, polymer)			
4.29	Impeller (for mixing of paint)	1	1	1
4.30	Chipping machine, chipping gun with accessories with compressed air supply system	2 set	2 set	3 set
4.31	Life-jackets and life-buoys of approved type (in working condition)	12+2	12+2	24+2
4.32	Set of dummy distress signals	2	2	2
4.33	Pilot ladder rigged up for practice	1	2	2
4.34	Rope / coolie ladder rigged up for practice	1	2	2
4.35	Bosun's Chair (with self-lowering arrangement)	2	4	4
4.36	Overside Stage (with paint brush & ladder)	2	4	4
4.37	Safety Harness	4	8	12
4.38	Fall arrestor (FPD)	2	3	3
4.39	Marline Spikes	4	8	8
4.40	Wooden Spikes (fid and mallet)	4	8	8
4.41	Slings, - Snotter, net sling, endless rope sling, drum clamps, pallet	2	2	2
4.42	Sounding Rod with line	2	3	4
4.43	UTI tape	1	1	1
4.44	One ullage tape	1	1	1
4.45	Sounding tapes (Steel)	2	2	3
4.46	Fabricated manhole and its cover	2	2	2
4.47	Enclosed space (for enclosed space entry through manhole)	1	1	1

4.48	Scupper plugs	2	2	2
4.49	Coloured Garbage bins for different items as on board	1 set	2 sets	2 sets
4.50	SOPEP Locker equipment	1 set	1 set	1 set
4.51	5m telescopic ladder	1	1	2
4.52	Water finding paste	2	4	4
4.53	Hatch cover section with coaming, hatch cover and cleats	1	1	1
4.54	Mandel / Tonsberg shackle	1	1	1
4.55	Pedestal roller	1	1	1
4.56	Working life vest	1	2	2
4.57	Cargo Hold Booby hatch	1	1	1
4.58	De mucking winch	1	1	1
4.59	Gangway / accommodation ladder and Gangway net	1	1	1
4.60	Types of vents (various types)	1	1	1
4.61	Types of fenders (one each)	1	1	1
4.62	Pilot ladder Repair steps	2	4	4
4.63	Winnets for pilot ladder (chocks)	10	20	20
4.64	Paint remover	20 ltr	20 ltr	20 ltr
4.65	Stage horns and cleats	1	1	1
4.66	Turn buckle with senhouse slip	1	1	1
4.67	Jubilee clips	24	36	36
4.68	Hydraulic cutter	1	2	2
4.69	Pneumatic Needle Guns	2	2	3
4.70	Pneumatic Scrappers	2	3	3
4.71	Watertight door, with frame	1	1	1
4.72	Swing derrick / boom	1	1	1
4.73	Saws – Straight, hack and fret	4	4	4
4.74	Various Wood chisels	6	8	8
4.75	Various wood files	2	4	4
4.76	Breast braces and other clamps	4	4	4
4.77	Hand Drilling machine with hand drill bits	2	2	2
4.78	Masonry Punches	1 set	1 set	1 set
4.79	Portable electric drill and its bits including masonry bits	2	2	2
4.80	Wood screws and nails different sizes			
4.81	Jack plane	2	3	3

Engineering Workshop Equipment

List of equipment given below is with assumption that only half the number (20) from each batch of 40 will be in the engineering workshop at one time, remaining 20 will be involved in other activities.

1.	Fitting Shop	For 40	For 80	For 120
1.1	Work Bench 1200-2400-900 mm without vice	2	4	6
1.2	Work Bench 1200-2400-900 mm with four vices of two different sizes (100 mm to 150 mm wide parallel jaw)	2	4	6
2.	Hand Tools			
2.1	Hammers (ball pein) 150 gms, 200 gms gms	4 each	6 each	8 each
2.2	Hammer 500 gms	1	1	1
2.3	Claw Hammer 200 gms	3	6	8
2.4	Sledge Hammer 1 kg, 3 kg & 5 kg	1 each	1 each	1 each
2.5	Files flat – bastard, medium and fine cut (30 mm) (with wooden handles)	6 each	12 each	18 each
2.6	Files flat – medium and fine cut (25 mm) (with wooden handles)	6 each	12 each	18 each
2.7	Files half round; triangular, square	2 each	3 each	3 each
2.8	Needle files	1 set	2 sets	3 sets
2.9	Flat Chisels 200 mm length & 150 mm length	6 each	9 each	12 each
2.10	Chisel – caulking, diamond	2 each	2 each	2 each
2.11	Spanners double open ended - 6 to 36 mm	4 sets	6 sets	8 sets
2.12	Ring Spanners - 6 to 36 mm	4 sets	6 sets	8 sets
2.13	Adjustable spanners - 200 mm & 300 mm	2 each	2 each	2 each
2.14	Box Spanners 12 points and 6 points with ratchet spanner	1 set each	1 set each	1 set each
2.15	Allen Keys 1 mm to 10 mm, 1/16 to 3/8 inches	2 sets	2 sets	2 sets
2.16	Screw drivers (various sizes) (minus and Phillips)	12	18	24
2.17	Hack Saw Frame (standard)	4	6	8
2.18	Hack Saw frame small	2	3	4
2.19	Reamers 10 mm & 12 mm	1 set	1 set	1 set
2.20	Round Hole Punch	2 sets	2 sets	2 sets
2.21	Center Punch	6	6	6
2.22	Letter Punch	2 sets	2 sets	2 sets
2.23	Thread Extractor	3	3	3
2.24	Measuring Tape	2	2	2
2.25	Crow Bar	3	4	4
2.26	Male / Female Couplings (various types) for water line and pneumatic line	1 set	1 set	1 set
2.27	Hook spanner wrench	1	1	1
2.28	Flat nose plier	1	1	1
2.29	Water pump plier	1	1	1
2.30	Tongs	1	1	1
2.31	Hand snip	1	1	1

2.32	Plastic hammer	1	1	1
2.33	Wooden mallet	1	1	1
2.34	Cloth scissor	1	1	1
2.35	Gasket and washer cutter	1	1	1
2.36	Gland packing hook	1	1	1
2.37	Steel scriber	1	1	1
2.38	Gear and wheel puller - 2 legs and 3 legs	1 each	1 each	1 each
2.39	Tube cutter	1	1	1
2.40	C - clamps	1	1	1
3.	Instruments			
3.1	Steel Scales - 300 mm & 1000 mm	10	10	10
3.2	Try Squares - 150 mm & 300 mm	6	8	12
3.3	Straight edge - 300 mm	2	2	3
3.4	Vernier calipers - 0 -150 mm, 0-300 mm	2 each	3 each	4 each
3.5	Micrometer (Outside) 0-25 mm, 25-50 mm, 50 -300 mm	3	4	4
3.6	Micrometer (inside) 50 – 300 mm	1	1	1
3.7	Simple calipers (inside and outside type)	4 each	8 each	10 each
3.8	Dividers	6	9	9
3.9	Die Nuts - M6 to M22	1 set	1 set	1 set
3.10	Hand Taps - M6 to M22	2 sets	2 sets	2 sets
3.11	Thread pitch gauge	2	2	2
3.12	Feeler Gauge small	2	2	2
3.13	Feeler Gauge large	2	2	2
3.14	Circlip plier - internal and external	1 each	1 each	1 each
4.	Machines			
4.1	Pedestal grinder or a bench grinder independently Mounted	2	2	2
4.2	Vertical Drill Machine	2	2	2
4.3	Electric Portable Drill	2	2	2
4.4	Drill bits up to 10 mm	3 set	3 sets	3 sets
4.5	Lathe complete with basic accessories (in working condition)	2	3	3
4.6	Lathe tools for turning, cutting, boring and parting	4 each	6 each	8 each
5.	Plumbing Tools to include:			
5.1	Grip pliers	3	4	5
5.2	Pipe Vice	2	3	4
5.3	Pipe Wrench, (large and small)	2 each	3 each	4 each
5.4	Water taps with washers,	2	4	6
5.5	Taps and dies ½ - 2 inch, for cutting threads on pipes, etc.	1 set	1 set	1 set
5.6	Unions, bends, couplings	24 pcs	36 pcs	48 pcs
5.7	Pipes for practice various lengths	20 m	30 m	40 m
5.8	Valve packing material			
5.9	Teflon thread tape			

6.	Lubrication			
6.1	Oiling can with a hand pump	2	2	2
6.2	Spouted oil cans three sizes	1 set	1 set	1 set
6.3	Hand Grease gun with different types of adaptors	2	2	2
6.4	Pneumatic grease gun	1	1	2
7.	Electrical Tools to include:			
7.1	Insulated hand tools normally used by electricians	1 each	2 each	3 each
7.2	Multimeter and megger	1 each	1 each	1 each
7.3	Fuse cartridges, and circuit breakers samples	3 each	3 each	3 each
7.4	Various types of electrical connections - samples			
7.5	Soldering irons, solder, flux.	2	2	2
7.6	Tester	2	2	2
7.7	Portable grinder (straight)	1	2	2
7.8	Portable grinder (angled)	1	2	2
8.	Hot work equipment to include: (Working condition)			
8.1	Oxy-acetylene gas cutting/welding apparatus and its accessories (including personal protective gear) (approved type)	2 sets	4	6
8.2	Electric arc welding machine and its accessories (including personal protective gear)	4 sets	6	8
8.3	Adequate mild steel material for practice of cutting and welding. (3mm, 6mm plates, angle iron,)			
8.4	Electrodes in stock for use by candidates			
9.	Pumps and Valves			
9.1	Centrifugal Pump (vertical & horizontal), (mounted with electrical motor)	1 each	1 each	1 each
9.2	Centrifugal pump multi stage	1	1	1
9.3	Reciprocating Pump	1	1	1
9.4	Gear Pump	1	1	1
9.5	Vane Pump Optional	Optional		
9.6	Screw Pump	1	1	1
9.7	Hand pump (rotary)	2	2	2
9.8	Globe Valve a) Return b) Non Return	2 each	2 each	2 each
9.9	Gate/Sluice Valve	2	2	2
9.10	Butterfly Valve	2	2	2
9.11	Quick Closing Valve	2	2	2
9.12	Storm Valve	1	1	1
9.13	Safety Valve	1	1	1
9.14	Reducing Valve	1	1	1
9.15	Ball Valve	1	1	1
9.16	Float valve	1	1	1
9.17	Tapered Cock (small and medium size)	2 each	2 each	2 each

9.18	Cylindrical cock	2	2	2
10.	Filters			
10.1	Fuel Oil Filter (M/E) (complete) Duplex type	1	2	3
10.2	Fuel oil filter (felt type) (complete)	1	2	3
10.3	Lube Oil Filter (M/E) (duplex) (complete)	1	2	3
10.4	Lube oil filter for auxiliary engine (complete)	1	2	3
10.5	Air Filter of Turbo charger	1	2	3
11.	Gauges			
11.1	Level gauge for tanks	1	1	1
11.2	Pressure gauge	3	3	3
11.3	Thermometer of various sizes and range	6	6	6
11.4	Pyrometers	3	3	3
11.5	Sounding tape	2	2	2
11.6	Sounding rod	2	2	2
11.7	Boiler Gauge Glass (mounted model)	1	1	1
11.8	Boiler Gauge Glass (for practice of dismantling)	1	1	1
12.	Diesel Engine Components			
12.1	Fuel Injector (M/E)	1	1	1
12.2	Fuel Pump (M/E)	1	1	1
12.3	Cylinder Relief Valve (M/E)	1	1	1
12.4	Air Starting Valve (M/E)	1	1	1
12.5	Air Distributor (M/E)	1	1	1
12.6	Indicator Cock (M/E)	1	1	1
12.7	Cylinder Lubricator (M/E)	1	1	1
12.8	Cylinder Lubricator Quill (M/E)	1	1	1
12.9	Piston Rod Stuffing Box (M/E)	1	1	1
12.10	C/Case Relief Valve (M/E)	1	1	1
12.11	Scavenge Valve (M/E)	1	1	1
12.12	Cylinder Liner (Aux/E)	1	1	1
12.13	Cylinder Head (Aux/E)	1	1	1
12.14	Piston with Rings (Aux/E)	1	1	1
12.15	Connecting Rod (Aux/E)	1	1	1
12.16	Bottom End Bearing with (Aux/E) Bolts and Nuts	1	1	1
12.17	F.W/Lub. Oil Cooler	1	1	1
12.18	Aux. Air Receiver	1	1	1
13.	Compressor, Centrifugal Separator, etc.			
13.1	Main Air Compressor (marine type)	1	1	1
13.2	Lub. Oil/D.O/H.O. Separator	1	1	1
13.3	Boiler safety valve (complete)	1	1	1
13.4	Bilge Strum Box (complete)	1	1	1
13.5	Hydraulic Jacks, 1000 kg	1	1	1
13.6	High Pressure Washing machine for general cleaning, paint	1	1	1

	removal, descaling and hydro blasting			
14.	Posters for tools, instruments, engines, pumps, valves, protective gear, safety signs	One each	One each	One each
15.	Models			
15.1	Boiler	1	1	1
16.2	Diesel Engine	1	1	1

Annexure 10

Additional in-house safety equipment required where the modular courses are outsourced:

- 1) Demonstration Table
- 2) One inflated life-raft on display.
- 3) Complete set of Life Raft Equipment
- 4) Complete set of Life Boat Equipment
- 5) Two Immersion Suits
- 6) 10 lifejackets
- 7) Thermal Protective Aids
- 8) Retro reflective Tapes
- 9) 1 Hydrostatic Release Unit (HRU)
- 10) Lifebuoys
- 11) Man Overboard Markers
- 12) Self-igniting Lights
- 13) EPIRB (Model)
- 14) SART (Model)
- 15) Neil Robertson Stretcher
- 16) First Aid Kit
- 17) Various splints & bandages
- 18) Resuscitation Kit
- 19) One Emergency Escape Breathing Apparatus (EEBD)
- 20) Ten earmuffs
- 21) Four dust masks
- 22) One Explosimeter / Multi-gas detector
- 23) One Oxygen analyser
- 24) One Hydrocarbon detector.
- 25) One UTI tape.
- 26) One ullage tape.
- 27) Two dummies for search and rescue procedures
- 28) Four fire hoses – 64 mm
- 29) Four nozzles (2 jet, 2 dual purpose)
- 30) Two mechanical foam guns
- 31) Four pressurized water extinguishers
- 32) Four foam extinguishers
- 33) One 4.50 kg. D.C.P. extinguisher
- 34) One 10 kg D.C.P. extinguishers
- 35) Two 6.8 kg CO2 extinguishers
- 36) Sufficient refills for all types of extinguishers
- 37) A working model of fire & general alarm Two sets of self-contained breathing apparatus, complete with spare cylinders, spare parts and maintenance tools
- 38) Two sets of protective clothing for firemen
- 39) Four life lines
- 40) Fire Axe – (2)
- 41) Fire torch – (2)
- 42) Dragger pump and tubes – (1) with set of 10 tubes
- 43) Fire wallet – (1)
- 44) Hose Coupling (different types) – 1 set

Appendices - Training Circular of 2014

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Appendix 1A
General Purpose Ratings
Total Duration of the Course – 25 weeks (on the basis of 42 contact hours per week)

Parts/Title	Theory Hrs	Practical's Hrs	Total contact	Weeks
Part 1 General Aspects Induction, personality & communication skills development, general knowledge about shipping and ships, and introduction to computers	91	64	155	
Part 2 General Ship Knowledge (Seamanship and Navigation) at Support Level	123	154	277	
Part 3 Marine Engineering Knowledge and Practice at Support Level	99	257	356	
Part 4 Prevention of Pollution of the Marine Environment	8	4	12	
Sub Total of Part 1 + Part 2 + Part 3 + Part 4	321	479	800	20.5
Part 5 Mandatory STCW Courses and Ship Visit				
A. Proficiency in Survival Techniques (TC 31 of 2004)	10	5	15	1
B. Elementary First Aid (TC 30 of 2004)	10	5	15	
C. Fire Prevention and Fire Fighting	13	5	18	1
D. Personal Safety and Social Responsibility (STCW 2010 TC13 of 2012)	18	0	18	
E. Security Training for Seafarers with Designated Security Duties (STCW 2010 TC 27 Of 2012)	13	1	14	0.5
F. Port/Dock/Harbour/Ship Visit	01	7	08	
Total of Part 5	65	23	88	2.5
Part 6 Revision/Assessment (Internal and External)	40	43	83	2
Total of Part 1 to Part 6	426	545	971	25
Part 7 Upkeep of the campus (three hours per week for 13 weeks) (Supervised by Instructors)			39	
Part 8 Holidays/passing out/etc.			42	
GRAND TOTAL (Part 1 to Part 7)			1052	25

Port/Dock/harbour/Ship Visit: Instructors should explain in elementary detail, the basic functions of the following spaces & equipment, and also in elementary detail, the operations listed below:

- Windlass / Mooring Winch
- Berthing & Unberthing Operations – Handling of ropes on stations.
- Mooring Ropes / Wires
- Cargo Work. – Very basic ideas only.
- Operations of Cranes & Derricks.
- Gangway, Pilot Ladders.

- Crew Accommodation, Cabins, Galleys , Pantry
- Flag Hoisting, Courtesy Flags.
- Engine Room Main engines, propeller shaft, propeller, generators, control rooms, bilges, pumps, etc.

Trainees will write an essay on the visit, and show it to the external examiner on demand.

Appendix 1A

Title	T Hrs	P Hrs	Total Hrs	Wks
Part 1 – General Aspects: Induction to the course, personality and communication skills development, gender sensitization, general knowledge about shipping and ships, and introduction to computers.	91	64	155	

(Specific Learning Objectives)

S. No.	Topics & sub topics	T	P
1.11	English speaking, reading, writing (using topics 1.5 and 1.6, charts and reading material)	35	30
1.12	Computers (Familiarisation)	10	20
1.13	Discipline, etiquettes and Gender Sensitization	5	10
1.14	Health and Hygiene	8	4
1.15	General Aspects of Shipping Importance of Shipping in the National and International Trade International Routes Types of Ships and Cargoes Shipboard Organization	15	0
1.16	Nautical Terms – Parts of the Ship (Using ship models) Hull Ships Decks Fore Castle Poop Deck Accommodation Bridge Monkey Island Cargo Spaces (Cargo Holds, Tanks) Cargo Handling Gear (Derricks, Cranes, Grabs, Pumps) Machinery Space (Engine Room/Pump room)	18	0
		91	64

Specific Learning Objectives – General Aspects of Shipping

1.1	English speaking, reading, writing (using topics 1.5 and 1.6 and charts and reading material)	35	30

The trainee will be able to:

1.1.1 Oral communication:

Comprehend and answer questions related to his duties, types of ships, action in emergencies, terms related to parts of the ship, machinery in the engine room, and as expected in a visit of a Port State Control officer in a ship inspection.

1.1.2 Ability to read:

Read given handouts and instructions related to his duties on board ship.

1.1.3 Ability to write:

Copy and write legibly the given text from the text book or handouts for the course. Answers questions given in the written examination. (Spelling of simple terms, and basic grammar is expected.)

1.1.4 Ability to draw

Sketch simple components of equipment used on board, such as: anchor, bollard, spindle, piston, etc.

1.1.5 Additional Sessions:

The Institute should conduct special classes / use special means / interactive sessions / Videos / Power-point presentations / Multi-media sessions particularly for those students who are weak in written or spoken English. **This shall be outside the normal Class Hours.**

1.2	Computers (Familiarisation)	10	20

The trainee will be able to: (minimum expected learning).

Identify basic components of a PC: CPU, Monitor, keyboard, mouse, and state their purpose.

Identify keys on the keyboard and their functions: space bar, shift, return, ctrl, arrows, caps lock, Start and log on a computer

Demonstrate use of a keyboard and mouse for given tasks, using a self-learning module, starting and stopping a power point programme and a video.

Take a simple assessment on a computer (multiple choice questions).

Using Microsoft Word, Excel, and Power Point or their equivalents.

Learn to send e-mails, Use Internet, Fill up on-line forms (e.g. Seafarers Profile on DGS Website)

1.3	Discipline, etiquette and Gender Sensitization	5	10

The trainee will be able to:

3. Demonstrate aspects of discipline and etiquettes in performance of duties, routines, given tasks.

4. Change behavior & instill empathy into his views about his own & the other gender.

1.4	Health and Hygiene	8	4

The trainee will be able to:

- 1.4.5 State importance of maintaining personal health and hygiene.
- 1.4.6 States ways and means of maintaining good health.
- 1.4.7 State personal habits and conditions that lead to illness of an individual on board.
- 1.4.8 Maintenance of Cleanliness and hygiene on Board ships in the accommodation, Cabins, alleyways, toilets, Galleys, Pantries, Mess-rooms and provision stores.

1.5	General Aspects of Shipping	15	0
	1.5.5 Importance of Shipping in the National and International Trade		
	1.5.6 International Routes		
	1.5.7 Types of Ships and Cargoes		
	1.5.8 Shipboard Organization		

1.5.1 Importance of Shipping in the National and International Trade

The trainee will be able to:

- 1 State the role of shipping in the national and international trade.

1.5.2 International Routes

The trainee will be able to:

- 1 Using a World Map (without labels) or Globe, name and identify location of continents, and oceans.
- 2 State international sea routes for ships.

1.5.3 Types of Ships and Cargoes:

Trainee will be able to:

- Differentiate between Types of Merchant Vessels as mentioned below:
- State the use of each Type
- State the Type of Cargo carried by each Type of Vessel.

Basically 2 types of Ships exist namely Passenger & Cargo. Cargo Ships are further subdivided into Dry Cargoes and Wet Cargoes as per Table below:

Types of Ships				
Cargo Ships				Passenger Ships
Dry Cargo		Liquid Cargo		Cruise Liner
		Type of Ship / Type of Cargo		
General Cargo	General Cargo (eg :) Boxes, Machinery, etc	Oil Tankers	Oil	Ferries
Container Vessel	Containers	Chemical Tankers	Chemicals	
Bulk Carriers	Bulk Cargoes, (Ore, Grain, Coal, Cement, etc)	Gas Tankers	Liquefied Gases	

Roll On –Roll Off Vessel	Trucks, trailers, Cars and other vehicles			
Other ships: Tug Boats, Offshore supply vessels				

1.5.4 Shipboard Organization

Trainee will be able to state that:

- There are two Distinct Departments on the Ship
- These Departments are **Nautical Department** and **Engineering Department**
- Nautical Department is responsible for Cargo Operations, Navigation of the vessel and General Maintenance of the Ship and Administration
- Engineering Department is responsible for Upkeep and Maintenance of all Machinery onboard Ship and the propulsion system
- Each Department consists of Officers and ratings
- Nautical Department consists of Master, Chief Officer, 2/0, 3/0, Cadet or Apprentices and Able Seafarers (Deck), Watch-keeping deck ratings or GP ratings
- Engineering Department consists of Chief Engineer, 2/E, 3/E, 4/E, Electro-Technical Officer, Electrical Officer, Electro-Technical Rating, Electricians or Fitter and Able Seafarers (Engine), Watch-keeping engine ratings or GP ratings
- Master is overall in charge of the ship
- Catering Department includes Catering Officer, Chief Cook & General Steward (G.S.) who are responsible for cooking food for Officers and Crew and general cleanliness in accommodation.

1.6	Nautical Terms – Parts of the Ship (Using ship models and video) 1.6.1. Hull 1.6.2. Ships Decks 1.6.3. Fore Castle 1.6.4. Poop Deck 1.6.5. Accommodation 1.6.6. Bridge 1.6.7. Monkey Island 1.6.8. Cargo Spaces (Cargo Holds/Tanks) 1.6.9. Cargo Handling Gear (Derricks, Cranes, Grabs, Pumps etc.) 1.6.10. Machinery Space (Engine Room, Pump room etc.)	18	0

1.6 Nautical Terms – Parts of the Ship:

Trainee will be able to Name / Identify a part of the Ship given in the following sketches and state its purpose:-

1.6.1 Hull:

Shipside, Name of the Ship, Port of Registry, Stern, Propeller, Rudder, Draft marks, Load-line Marks, Bulbous Bow marks, Bow Thruster marks, Stem, Forecastle, Anchor, Hawse Pipe, Poop Deck,

1.6.2 Ships Deck:

Forward, Aft, Amidships, Portside, Starboard Side, Forecastle, Poop Deck, Derricks, Cargo Winches, Cranes, Cargo Holds, Hatches, Bulwarks, Railings, Sounding Pipes, Air Pipes, Filling Pipes, Bollards, Main Mast, Fore Mast, After Mast, Hold Ventilators, Gangway, Pilot Ladder, Scuppers, Tank domes, manhole & Covers, Cargo & Ballast lines.

1.6.3 Fore Castle:

Windlass, Brake Handle, Warping Drum, Spurling Pipe, Hawse Pipe, Bow Stopper, Devil's Claw, Chain Stopper, Rope Stopper, Heaving Line, Mooring Hawsers, Mooring Wires, Headline, Back-Spring, Breast Rope, Fair Leads, Panama Lead, forepeak stores, Rat guards, Jack staff, Ship's Bell, Anchor Ball, Anchor, Anchor Shackle, Joining Shackle, Chain-locker, Walkie-talkie.

1.6.4 Poop Deck:

Mooring Winch, Stern Line, After Back Spring, Breast Rope, Chain Stopper, Rope Stopper, Mooring hawser, Mooring Wires, After Peak, Steering Flat, and Accommodation, Walkie-talkie.

1.6.5 Accommodation

Bridge Front Bulkhead, Port holes, Alleyways, Officer's cabins, Passenger's cabins, crew cabins, Dining Rooms, Smoke rooms, Washrooms, Toilets, Pantry, Galley, Laundry, Storeroom, Cold storage, water-tight doors, Boat deck, Lifeboats, Life raft, Railing, Ship's funnel.

1.6.6 Bridge

Steering Wheel, Gyro Compass, Magnetic Compass, Radar, V.H.F, Engine Room Telegraph, Rudder Angle Indicator, Anemometer, Whirling-Psychrometer, R.P.M Indicator, Ship Whistle/Siren, Light Sentinel, Man Overboard Marker, Chart Room, Side Lights, Clear-View Screen, General Alarm, P.A. System (Public Address), Radio room – Equipment, EPIRB.

1.6.7 Monkey Island

Magnetic Compass, RADAR Scanner, Flag Mast, Halyards, Funnel, Ship's Whistle / Siren or Whistle.

1.6.8 Cargo Spaces:

Cargo Holds, Hatch Coamings, Hatch Openings, Hatch Covers, Hatch Boards, Hatch Beams, Tween Decks, Hold Bilges, Tank Top, Double-bottom Tanks, Manhole Covers, Cargo Tanks.

1.6.9 Cargo Handling Gear:

Derrick, Cargo Winch, Cranes, Grabs, Gentries, Spreaders, Slings, Cargo Pumps

1.6.10 Machinery Spaces (Engine Room, Pump Room)

Location of Engine Room: Existence of Entrance doors, Emergency escape routes. Location of steering gear. Location of pump room on tankers.

Appendix 1B

Specific Learning Objectives

General Ship Knowledge (Seamanship and Bridge duties at Support Level)

Title	T Hrs	P Hrs	Total Hrs	Wks
Part 2 General Ship Knowledge (Navigation, Cargo Handling and Stowage, Controlling the Operation of Ship and Seamanship, Repair and Maintenance duties at Support Level)	123	154	277	

S. No.	Topics & Sub topics	T	P
2.1	Basic Navigation, Operate emergency equipment and apply emergency procedures 2.1.1 Navigational Terms 2.1.2 Rules of the Road (elementary) & Buoyage 2.1.3 Navigational Aids available on the Bridge of a Modern Cargo ship 2.1.4 International Code of Signal & Flags 2.1.5 Operate emergency equipment on bridge and apply emergency procedures 2.1.6 Look Out Duties: 2.1.7 The Sighting to Report will be: 2.1.8 The Hearing to Report will be: 2.1.9 Relieving the Look-Out Man: 2.1.10 Information required to maintain a safe watch 2.1.11 Other Bridge Duties: 2.1.12 Steer the Ship & Comply with Helm Orders in the English language: 2.1.13 Berthing, Anchoring and other Mooring Operations	41	40
2.2	Cargo Handling and Stowage 2.2.1 Cargo Handling equipment (Derricks, Cranes, Grabs, Gantry, Spreaders, Pumps) 2.2.2 Cargo Spaces, Opening & Closing of Hatches 2.2.3 Securing Cargoes 2.2.4 Container Cargo 2.2.5 Bulk Cargo (Other Than Grain) 2.2.6 Bulk Grain Cargo 2.2.7 Preparation of Holds and Segregation of Cargoes 2.2.8 Ventilation and Control 2.2.9 Identification of dangerous goods and precautions for their carriage	38	42
2.3	Controlling the operation of ship and care of persons onboard 2.3.1 Personal Protection Equipment 2.3.2 Safe working practices (General) 2.3.3 Risk Assessment (Basic) 2.3.4 Permit to Work System	32	48

	2.3.5 Work-Permits 2.3.6 Emergencies 2.3.7 Safe Access to the Ship 2.3.8 Safe Working Practices during Berthing / Unberthing, and Anchoring 2.3.9 Safety Precautions, when working aloft 2.3.10 Safety Precautions, when working over side 2.3.11 Safety Precautions during working in enclosed spaces 2.3.12 Safety Precautions, during manual lifting of weights 2.3.13 Demonstrates working knowledge of electrical safety 2.3.14 Safety precautions when climbing fixed vertical ladders and portable ladders. 2.3.15 Safety precautions when rigging scaffolding and using it 2.3.16 Safety precautions when handling chemicals and strong detergents 2.3.17 Communicate with other persons on board on elementary safety matters (1.5 hours) understand safety Information symbols, signs and alarm signals 2.3.18 Shipping Organisation (National) & documents for seafarers 2.3.19 International Organizations and Conventions 2.3.20 Seamanship, Ropes & Rope Work (5+18) 2.3.21 Blocks and Tackles (2+10) 2.3.22 Rigging of 'Pilot ladder', 'Bosun's Chair', 'Stage', Gangway & climb a mast 2.3.23 Duties of a Gangway Watch in Port (introduction to ISPS Code)		
2.4	Ship Maintenance and Repair 2.4.1 Surface Preparation and Painting 2.4.2 Lubrication	12	24
	Total	123	154

2.1	Basic Navigation, Operate emergency equipment and apply emergency procedures 2.1.14 Navigational Terms 2.1.15 Rules of the Road (elementary) & Buoyage 2.1.16 Navigational Aids available on the Bridge of a Modern Cargo ship 2.1.17 International Code of Signal & Flags 2.1.18 Operate emergency equipment on bridge and apply emergency procedures 2.1.19 Look Out Duties: 2.1.20 The Sighting to Report will be: 2.1.21 The Hearing to Report will be: 2.1.22 Relieving the Look-Out Man: 2.1.23 Information required to maintain a safe watch 2.1.24 Other Bridge Duties: 2.1.25 Steer the Ship & Comply with Helm Orders in the English language: 2.1.26 Berthing, Anchoring and other Mooring Operations	41	40

2.1. Basic Navigation:

Trainee will be able to State that:

2.1.1. Navigational Terms

- Position of a Vessel is found by intersection of Latitude & Longitude on a chart.
- Latitude is measured from 0° to 90° North or South
- Latitude 0° is called Equator
- Latitude 90° North is called North Pole
- Latitude 90° South is called South Pole
- Latitude lines run East –West and are parallel to each other
- Latitude is expressed in degree and minutes North or South
- Each degree consists of 60 minutes
- Each minute of Latitude on Equator is one Nautical Mile
- Longitude is measured 0° to 180° E and 0° to 180° W
- Longitude is expressed in degrees East or West
- Longitude lines run North and South, and are parallel to each other

2.1.2. Rules of the Road (elementary) & Buoyage

Trainee will be able to recognize navigational lights & shapes, identify buoys

2.1.3. Navigational Aids available on the Bridge of a Modern Cargo ship

Trainee will be able to recognize Navigational Aids on the Bridge and explain its usage. Recognise the purpose of the individual equipment on the bridge and interpret the values displayed.

2.1.4. International Code of Signal & Flags

Trainee will be able to:

- Hoist any combination of Flags on the Halyards
- Identify and state the meaning / usage of the Single letter Flags
- Stitch flag on a lanyard and attach flag clip

Trainee will be able to explain that:

- Courtesy flag is the Flag of the Foreign Country, in which the ship is presently situated
- Courtesy Flag is hoisted outboard on the starboard yard arm of the main mast
- House Flag is the flag of the Shipping Company and is hoisted on the Main Mast
- The Ensign Flag is the flag of the Country where Ship is registered
- In port the Ensign Flag is hoisted on Ensign Staff, which is right aft
- Flag clips are used to join two or more flags, to hoist on a halyard
- Emergency duties and alarm signals, use of pyrotechnics and distress signals, EPIRBs and SARTs, avoidance of false distress alerts and action to be taken in event of accidental activation

2.1.5. Operate emergency equipment on bridge and apply emergency procedures

- Knowledge of emergency duties and alarm signals
- Knowledge of pyrotechnic distress signals; satellite EPIRBs and SARTs
- Avoidance of false distress alerts and action to be taken in event of accidental activation
- The integrity of emergency and distress alerting systems is maintained at all times

2.1.6. Look Out Duties:

A Lookout man on duty will:

- Stand in the Bridge Wings in an assigned place
- Be appropriately dressed for the weather, by warm clothes, gloves, rain coat etc.
- Keep an all-round look out by sight & hearing
- Report any sighting and hearing of any sound signals to the Officer on duty
- Sound signals, lights and other objects are promptly detected and their approximate bearing, in degrees or points, is reported to the officer of the watch

2.1.7. The Sighting to Report will be:

By Day: All Ships, Boats, Floating Objects, Land and the relative direction in which sighted.

By Night: All Lights with their colour, and the relative direction in which sighted.

2.1.8. The Hearing to Report will be:

By Day or Night: All Sounds and the external relative direction from which emanating.

Example:

- Points on Port Bow
- Points on Stbd Bow

Examples of Reports to be made by the Lookout Man would be as Follows:

- A White flashing light, two points forward / abaft the Starboard Beam, Sir.
- A Boat, 2 points on the Port Bow, Sir.
- A Ship Right Ahead, Sir.
- A Buoy, 3 points on the Starboard Bow, Sir.
- Loom of a White flashing light, Right Ahead Sir.
- Red lights on the Port Bow, Sir
- Several White lights Right Ahead, Sir
- Sound signal 4 points on Port Bow.

2.1.9. Relieving the Look-Out Man:

Trainee will state that before relieving the previous lookout Man he would do the following:

- Be appropriately dressed to suit the weather (Rain Coat, Caps, Woolens and Gloves etc.)
- Arrive on the bridge 15 minutes before time
- Get acclimatized to the weather and the darkness
- Check the courses being steered and report to Duty Officer
- Compare the Gyro Compass & Magnetic Compass
- See what Ships / Lights / Buoys are in sight.
- Receive any special instruction if any, from previous lookout man
- Inform Duty officer that you have taken charge.

2.1.10. Information required to maintain a safe watch

- Assist with analyzing of movement of different vessels
 - Identifies and understands the sound, light and flag signals pertaining to ships' operations and maneuvers
 - determines the time with respect to the time units used on board and convert local time in the respective time zones
 - recognizes the purposes of the individual instruments on the bridge (GPS and radar) and is able to assess the values displayed and to integrate them in the tasks of his watch duty
 - reads course, depth, and speed data from the nautical instruments (gyro and magnetic compass, echo sounder, and speed logs)
- Take and correct course data (4 hours)
 - describes the direction of the ship's head on a gyro-compass (gyro course)
 - describes the direction of the ship's head on a magnetic compass (compass course)
 - compares readings of magnetic and gyro compasses
 - Knows the compass error and can apply corrections to courses and bearings.
- Recognize the special characteristics of the landmarks
 - identifies landmarks and navigational aids and understand their purposes
 - identifies the characteristics of lights by observation
- Assist with collection and documentation of weather data
 - can observe the sea waves and swell and estimate the sea state as per Beaufort scale

- can take readings of thermometer, barometer, psychrometer and hygrometer
- can observe and estimate the cloud cover

2.1.11. Other Bridge Duties:

Trainee will be able to explain the Arc of visibility and Colors of:

- Masthead Lights
- Side Light Port
- Side Light Starboard
- Stern Light
- Anchor Lights

Trainee will be able to identify various Navigational Shapes:

- Ball
- Cylinder
- Diamond
- Cone

Trainee will be able to understand orders and to communicate with the officer of the watch on matters relevant to watchkeeping duties

- Communications are clear and concise and advice/clarification is sought from the officer on watch where watch information or instructions are not clearly understood.

2.1.12. Steer the Ship & Comply with Helm Orders in the English language:

Trainee will be able to State that:

- All Ships carry Gyro Compasses & Magnetic Compasses
- The Gyro Compass runs on Electricity
- Magnetic Compasses do not need electricity, but are directed by the Earth's magnetism.
- Gyro repeaters are fixed at steering platform, bridge wings, etc.
- Change over from Hand Steering to Auto Pilot and vice versa
- Applying Gyro Error

Trainee will be able to:

- Name the Cardinal Points
- Name the Inter Cardinal Points
- Name the Three letter Points
- Name the By Points
- Box the Compass from One Point to Another.
- Convert Degree to Points & Vice Versa

Trainee will be able to:

- Understand the Helm Orders given to him
- Repeat the Orders given to him
- Communications are clear and concise at all times and orders are acknowledged in a seamanlike manner.
- Implement/Carry out the orders given to him

- A steady course is steered within acceptable limits, having regard to the area of navigation and prevailing sea state. Alterations of course are smooth and controlled.
- Confirm that the Orders have been carried out / implemented
- List the Helm Orders as follows:

Starboard	Port
Starboard Easy	Port Easy
Starboard 5	Port 5
Starboard More	Port More
Starboard 10	Port 10
Starboard 20	Port 20
Hard Starboard	Hard Port
Ease the Helm	Ease the Helm
Mid Ship	Mid Ship
Steady	Steady
Steady as she goes	Steady as she goes
Nothing to Starboard	Nothing to Port

Trainee will be able to explain in detail the procedure for 'Relieving a Helmsman'

2.1.13. Berthing, Anchoring and other Mooring Operations

2.1.13.1. Berthing / Unberthing of ships

The trainee will be able to state:

- Working knowledge of the mooring system and related procedures, including the function of mooring and tug lines and how each line functions as part of an overall systems.
- Name the mooring ropes used in the forecastle as Headline, breast rope, back spring.
- Name the mooring ropes used aft as Stern-line, breast rope, back spring.
- The capacities, safe working loads and breaking strengths of mooring equipment, including mooring wires, synthetic and fibre lines, winches, anchore windlasses, capstans, bitts, chocks and bollards
- Knows the mooring arrangement on a ship and the sequence of using the mooring lines.
- List the equipment necessary for berthing operation forward and aft as, Heaving Lines, rope stopper, chain stopper, mooring ropes and wires, windlass, mooring winch, walky-talky etc.
- State that tugs are sometimes used to assist the ship in berthing / unberthing.
- The procedures and order of events for making fast and letting go mooring and tug lines and wires, including towing lines.
- Understands that a mooring rope under tension can snapback and recoil if parted.
- Be aware of snapback zones and precautions to be taken.
- Working knowledge of the procedures and order of events associated with mooring to a buoy or buoys.
- Methods of mooring to a buoy
- Picking up a mooring hawserr using messenger rope and hazards associated with them.
- Arrangements of chafe-claws, chafe gear and marker buoys.

2.1.13.2. Anchor-work

Trainee will be able to State that:

- Each vessel has two anchors in the Forecastle, one on each side.(Port & Starboard)
- The anchors pass through Hawse Pipe and are housed against the shipside
- Bow Stopper is fixed in the forecastle, close to the hawse pipe, to secure the anchor, against running out
- Anchor chain (also called cable) is connected to the anchor by joining shackle
- Anchor-chain passes over the gypsy of the windlass and goes into the chain-locker through spurling pipe
- Each length of cable is 15 fathoms or 90 feet. Identifies making on anchor cable
- The procedures and order of events for the use of anchors in various operations
- Terms used in anchoring and the reporting of the status of anchor and chain when dropped.

2.2. Cargo Handling and Stowage

2.2	Cargo Handling and Stowage 2.2.10 Cargo Handling equipment (Derricks, Cranes, Grabs, Gantry, Spreaders, Pumps) 2.2.11 Cargo Spaces, Opening & Closing of Hatches 2.2.12 Securing Cargoes 2.2.13 Container Cargo 2.2.14 Bulk Cargo (Other Than Grain) 2.2.15 Bulk Grain Cargo 2.2.16 Preparation of Holds and Segregation of Cargoes 2.2.17 Ventilation and Control 2.2.18 Identification of dangerous goods and precautions for their carriage	38	42

2.2.1 Cargo Handling equipment (Derricks, Cranes, Grabs, Gantry, Spreaders, Pumps)

Trainee will be able to state that:

- Cargo can be loaded/ discharged from the ships by use of ship's Derricks
- Derricks can be used to load / discharge by a single derrick (Swinging Derrick)
- Cargo runner wires of both derricks can be joint together (Union Purchase)
- Pedestal cranes and twinning of cranes
- Gantry cranes & spreaders are used on container ships
- Safe working Load is marked on the cranes and derricks
- SWL should never be exceeded
- There should be a signal-man to guide the winch / crane operator
- Use and understand Land signals, during operation of derricks and cranes
- Winch / crane operator, should be thoroughly proficient in handling controls
- Cargo gear must be examined and overhauled frequently
- Care and maintenance of cargo gear on board
- Correct use of slings, snotters, canvas slings, trays, pallets, nets, chain slings, cant hooks, bale hooks and vehicle slings
- Knows that all ropes and wires come with a certificate of their properties

- Precautions to be taken when fork-lift trucks or similar devices are used in the 'tween-decks or holds
- Limitations of the lifting gear and knowledge of limit switches
- All cargo gear and equipment to be visually inspected before and during cargo operations
- Provision of adequate lighting for working spaces, portable lights, cargo clutters in hold and precaution with dangerous cargoes
- Understands that cranes should not be used for dragging
- Identifies SWL of shackles, chains and slings correctly

2.2.2 Cargo Spaces, Opening & Closing of Hatches

Trainee will be able to state that:

- Cargo is carried in the holds of the ship
- Each hold has a coaming about one meter high, to prevent water going in the hold
- Each Hold has an opening in the center called 'Hatch'
- Cargo is loaded / unloaded through this 'hatch'
- 'Hatch Cover' is a steel platform that makes the hatch a weather tight compartment
- understands how to determine when a cargo runner needs replacing
- states that mechanically or hydraulically operated hatches should be opened or closed by the ship's crew under the supervision of a responsible person
- states that hatch covers are secured by locking devices (cleats) to prevent them moving accidentally
- states that hatch openings shall be securely fenced
- states that no person should stand on top of the coaming or pass or work under a suspended load
- methods of testing weather tightness of hatch covers
- reasons for lack of proper sealing of hatch covers

2.2.3 Securing Cargoes

Trainee will be able to

- knows that detailed information is contained in Code of Safe Practice for Cargo Stowage and Securing (CSS Code) and all cargo stowage and securing should be in accordance of CSS Code and Cargo Securing Manual (CSM)
- understands the need for solid stow and reducing broken stowage
- knows what is stowage factor of various cargoes and how does it affect the quantity of cargo to be carried in a hold.
- methods of blocking, lashing, shoring, chocking and tombing cargo under supervision of duty officer
- methods of securing cargo faces resulting from part discharge before making a sea passage under supervision of duty officer
- methods of securing heavy loads and heavy lifts under supervision of duty officer
- methods of stowing and securing vehicles and trailers under supervision of duty officer
- methods of lashing paper rolls, steel coils, steel billets, crates, plates inside the hold
- methods of lashing timber cargo on deck
- rigging of guard lines or rails at the sides of a deck stow and at openings in the stow

2.2.4 Container Cargo (2 hours)

Trainee will be able to

- describes the arrangement of a container ship and explains how the position of a particular container is designated
- understands the sequence of operations during discharging and loading at a terminal
- knows the types and sizes of container in use
- recognizes markings and labelling on containers
- knows the lifting gear used to load and unload containers
- knows the lashing gear used to lash containers

2.2.5 Bulk Cargo (Other Than Grain) (3 hours)

Trainee will be able to

- describes the preparation of cargo holds prior to loading bulk cargoes
- prepares the cargo hold under the supervision of the duty officer
- understands that some bulk cargoes may deplete the oxygen content of holds or produce toxic gases and describes the precautions to take before entry of holds
- understands the hazards and the precautions to take during loading and discharging coal

2.2.6 Bulk Grain Cargo (2 hours)

Trainee will be able to

- understands the technical terms that are used in the International Grain Code
- describes the cleaning and preparation of holds and decks for the carriage of grain
- understands that a thorough check for insect or rodent infestation should be made
- understands the dangers associated with fumigation of cargo holds
- understands securing arrangements for grain cargo as contained in the International Code for the Safe Carriage of Grain in Bulk (International Grain Code)

2.2.7 Preparation of Holds and Segregation of Cargoes

Trainee will be able to

- explains the importance of cleaning holds before loading
- describes how to clean holds after discharge of a general cargo
- understands that the use of a deodorizing wash may be necessary to remove strong odours from a previous cargo
- cleaning of bilges and strum box and made clean and dry and covered in the burlap
- understands the reasons for using dunnage and knows types and sizes of material used for dunnage
- explains how bilge suctions should be checked for efficient working scuppers and sounding pipes
- understands the need for the separation and segregation of different cargoes

2.2.8 Ventilation and Control

Trainee will be able to

- understands the factors involved in the control of sweat by ventilation
- understands the systems of natural and forced ventilation to minimise the formation of sweat

- understands that ventilation is also required for the removal of heat, gases and odours

2.2.9 Identification of dangerous goods and precautions for their carriage

Trainee will be able to

- understands the classification of dangerous goods in the International Maritime Dangerous Goods (IMDG) Code
- identifies the marking, labelling and placarding of dangerous goods as required by the IMDG Code
- understands the reason and need for segregation of dangerous goods
- observes the fire precautions which shall be taken when handling dangerous goods
- describes procedures to follow in event of spillage of dangerous goods

2.3. Controlling the operation of ship and care of persons onboard

2.3	Controlling the operation of ship and care of persons onboard	32	48
	2.3.24 Personal Protection Equipment		
	2.3.25 Safe working practices (General)		
	2.3.26 Risk Assessment (Basic)		
	2.3.27 Permit to Work System		
	2.3.28 Work-Permits		
	2.3.29 Emergencies		
	2.3.30 Safe Access to the Ship		
	2.3.31 Safe Working Practices during Berthing / Unberthing, and Anchoring		
	2.3.32 Safety Precautions, when working aloft		
	2.3.33 Safety Precautions, when working over side		
	2.3.34 Safety Precautions during working in enclosed spaces		
	2.3.35 Safety Precautions, during manual lifting of weights		
	2.3.36 Demonstrates working knowledge of electrical safety		
	2.3.37 Safety precautions when climbing fixed vertical ladders and portable ladders.		
	2.3.38 Safety precautions when rigging scaffolding and using it		
	2.3.39 Safety precautions when handling chemicals and strong detergents		
	2.3.40 Communicate with other persons on board on elementary safety matters (1.5 hours) understand safety Information symbols, signs and alarm signals		
	2.3.41 Shipping Organisation (National) & documents for seafarers		
	2.3.42 International Organizations and Conventions		
	2.3.43 Seamanship, Ropes & Rope Work (5+18)		
	2.3.44 Blocks and Tackles (2+10)		
	2.3.45 Rigging of 'Pilot ladder', 'Bosun's Chair', 'Stage', Gangway & climb a mast		
	2.3.46 Duties of a Gangway Watch in Port (introduction to ISPS Code)		

2.3.1 Personal Protection Equipment

Trainee will be able to list the different items of equipment as:

Equipment	Protection of
Safety Shoes	Feet
Safety Helmet	Head
Safety Goggles	Eyes
Hand Gloves	Hands
Ear Muffs	Ears
Boiler Suit	Body
Safety Harness	Working Aloft/overside
Face Mask	Nose, Mouth & Face
Nose Mask and Respirator	Nose and Lungs
Fall Arrestor	Working at heights
Apron	Body from chemicals

Trainee will be able to:

- Give examples, when and where to use each of the above equipment.
- Maintain the above equipment in clean, good, working condition ready for immediate use.
- State that safety of the ship and its crew would be his first priority.
- list the precautions necessary before lifting any heavy loads manually, Safe working procedures, Tools and instruments

2.3.2 Safe working practices (general)

Trainee will be able to:

- State importance of safety at Work
- Define accident as an 'unplanned, undesirable and uncontrollable event leading to injuries, loss of life, damage to property and environment'.
- States that accidents are avoidable by being aware and due diligence.
- State type of hazards that affect a seaman's body – mechanical, chemical, electrical, thermal, radioactive, biological, gaseous.
- State importance of using senses in recognising hazardous situation.
- State incidents that lead to injury such as Impacts, Slips, Falls, Entanglement, Burns (heat, chemical, radiation), Electric shocks, Cuts, Foreign particles in eyes, or lungs, or ingestion (through mouth), Inhalation of toxic vapour, or lack of breathable air, Sprains and other physical injuries
- Create a list of safe working practices

2.3.3 Risk Assessment (Basic)

Trainee will be able to

- Describe the concept of 'risk assessment' and basic approach
- State the five steps of risk assessment
- Identify hazards and place controls to minimize these hazards.

2.3.4 Permit to Work System

Trainee will be able to:

State purpose of 'work Permit', types of work permits.

Name various types of 'Permit to Work' as

- Hot Work Permit
- Tank Entry Permit
- Enclosed Space Entry Permit
- Working Aloft / Overside Permit
- Electrical Isolation Permit

2.3.5 Work-Permits

Trainee will be able to state that 'Work Permits' are required prior doing any of the following jobs on the ship:

- 'Man entry' into tanks.
- 'Hot work', anywhere on the ship.
- 'Enclosed space entry'
- 'Working aloft'
- 'Working Over the side'
- 'Lock out – Tag out' of electrical equipment

2.3.6 Emergencies

Trainee will be able to:

- Define an emergency
- Enumerate different types of emergencies he may encounter on a ship.
- State the emergency signal to be made to inform the ship's crew about the emergency.
- State the action to be taken by a crew member on hearing an emergency signal.
- Explain, what is 'Muster list' and what it used for?
- State that immediately after joining the ship, he will get himself familiarized with the Ship, and understand the location of LSA & FFA equipment onboard the ship, muster stations and duty.
- State that he will always follow the 'Safe Working Practices' onboard.

2.3.7 Safe Access to the Ship

Trainee will be able to state that:

- Access to the ship will be either from a shore gangway or from the ship's gangway (also called Accommodation ladder.)
- The gangway will be well secured on the ship,
- A safety net will be fixed below the gangway to protect someone falling accidentally
- Gangway will be lowered / hoisted during the rising / falling tide.
- A lifebuoy and a Heaving-line will be kept ready near the gangway for emergency use.
- Gangway will have railing and taut ropes on the sides.
- There will be a platform at the bottom end of the ship's gangway.

2.3.8 Safe Working Practices during Berthing / Unberthing, and Anchoring

Trainee will be able to state that:

- All crew should be properly dressed up in suitable clothes, depending upon the weather.

- All crew should be wearing Safety helmet, safety shoes, hand gloves, safety goggles(when anchoring)
- Crew should not stand in the bights of mooring ropes or wires.
- Crew should be careful not to stand too close to fairleads, to avoid the back-lash of parting mooring ropes.
- Keep clear of likely snap back zones

2.3.9 Safety Precautions, when working aloft

For working aloft, the Trainee will be able to list the following safety precautions:

- Take permission from Master, for working aloft.
- Be properly clad in Boiler suit, safety Helmet, Safety Harness, Safety shoes, Hand gloves
- Have necessary equipment for working aloft (e.g. Chipping hammers, scrapers, Paints, brushes etc) in a bucket with a heaving line.
- Have a Person standing by on deck for any assistance or emergency
- Before starting work aloft, fix the safety harness in position. Connect the fall arrestor device.

2.3.10 Safety Precautions, when working over side

Trainee will be able to list the following safety precautions:

- Take permission from the Master, for working over the side.
- Be properly clad in Boiler suit, safety Helmet, Life-Jacket, Safety shoes, Hand gloves etc.
- Have a 'stage' rigged up on the shipside, where work has to be carried out.
- Have a rope ladder fixed up securely close to the stage.
- Have necessary equipment for working over the side (e.g. Chipping hammers, Scrapers, Paints, Brushes etc) in a bucket with a heaving line.
- Have a Person standing by on deck for any assistance or emergency

2.3.11 Safety Precautions during working in enclosed spaces

Trainee will be able to:

- Explains the term enclosed space and what constitutes enclosed space
- Identifies typical enclosed spaces and potentially dangerous spaces on board
- Knows that on each ship a certain safety procedure with regard to entry into enclosed spaces has to be followed strictly and that responsibilities are defined clearly. No entry can be made to an enclosed space unless an enclosed space entry permit is issued by senior management on board
- Has working knowledge of safe working practices with regard to the entry into an enclosed space
- Has working knowledge the procedure of donning and use of breathing apparatus

2.3.12 Safety Precautions, during manual lifting of weights

The Trainee shall:

- Estimate the weight of the package / bag / bale/ drum / bottle / pipe
- Know that alone he can lift not more than 25 kg of weight
- Know that wrong lifting position can cause serious injury to back
- Learn the correct technique of lifting different types of packages

- Keep one hand free to hold onto railing when climbing steps with weight in hand
- Use additional help for oversize and overweight packages.

2.3.13 Demonstrates working knowledge of electrical safety

- Understands the harmful effects of direct and alternating current on human's heart and body functions
- Explains and applies the Five Safety Rules
- Has working knowledge of the function principles of electric power operated tools and equipment
- Has working knowledge of safe working practices in using electric power operated tools and equipment. Always use electrical equipment after it has been certified
- Performs function checks prior use of the equipment
- Knows that electrical equipment cannot be used in flammable atmosphere or on deck of a tanker unless they are certified intrinsically safe
- Knows the importance that any failure, damage or malfunction of electric power operated tools, electric lighting and electric equipment has to be reported to Officer in Charge immediately

2.3.14 Safety precautions when climbing fixed vertical ladders and portable ladders.

The trainee shall:

- Both hands shall be free to grip the rungs.
- Three point contact to be always maintained when climbing
- No tools / material to be carried on person or in pockets, instead tool bag should be used to hoist up the tools / material
- Portable ladders should be pitched between 65° - 75° from the horizontal on a firm base and secured from slipping at the bottom.
- The two halves of telescopic ladders should be locked as a composite unit prior pitching it to the correct angle.

2.3.15 Safety precautions when rigging scaffolding and using it

The trainee shall:

- Assemble scaffolding as per makers given procedure
- Safety precautions to be followed when assembling the scaffolding to prevent any falls, and back injury
- Know the SWL of the structure and ensure it is not exceeded
- Safety rails must be fitted at every deck to prevent risk of persons / objects following off.
- Take care to ensure stability and rigidity of the structure to prevent inadvertent movement.
- Scaffolding to be secured and lashed.

2.3.16 Safety precautions when handling chemicals and strong detergents

Trainee Shall:

- Be aware that chemicals and strong detergents like acid, caustic soda, bleaching powder and rust removers are corrosive and can burn and penetrate the skin if it comes in contact with the body.

- Substances hazardous to health are usually packed in drums which carry the health hazard label.
- Safety Data Sheets (SDs) should be referred to know their properties prior use.
- Wear suitable protective clothing (face mask, gloves, apron, boots) prior handling chemical drums.
- Always pour chemical in a container of water for dilution and not vice versa.
- Ensure space is well ventilated, to disperse toxic fumes emanating from the chemical.

2.3.17 Communicate with other persons on board on elementary safety matters (1.5 hours) understand safety Information symbols, signs and alarm signals

- understands the information and instructions of superiors and colleagues
- understands Safety Information Symbols, Signs and Alarm Signals and is able to respond appropriately
- reads and understands safety posters and abides by the instructions

2.3.18 Shipping Organisation (National) & documents for seafarers

Trainee will be able to state the major role of the following:

- Directorate General of Shipping (DGS)
- Mercantile Marine Department (MMD)
- Shipping Master
- Seamen's Provident Fund Organisation
- Seamen's Welfare Fund Society

Trainee will be aware of the existence, and able to explain the purpose of a Ship's

- Official Log Book
- Deck Log Book
- Engine Room Log Book

Trainee will be able to explain the contents of 'Articles of Agreement' of a ship and what it is used for?

Trainee will be able to:

- Explain what is meant by C.D.C and what it is used for?
- Explain the contents of C.D.C.
- Explain that offences against discipline are recorded in ship's official log-book and suitable penalties are awarded.
- Explain the importance of Contract of Employment, Collective Bargaining Agreement.
- Explain the need and contents of Seafarers Identity Document (SID).
- Explain function of Recruitment and Placement Agencies (RPS).
- Understand and be aware of Recruitment and Placement Rules and contents.
- Explain the purpose of articles of Agreement and its contents relating to Indian flag and Foreign Flag ships.
- Explain the importance of INDoS No.
- Understand and be aware of rights of a seaman.

2.3.19 International Organizations and Conventions

Trainee will be able to expand the following abbreviations and explain the purpose of these organizations and Conventions:

IMO	International Maritime Organization
STCW (STW)	(International) Standard of Training, Certification, and Watch Keeping
SOLAS	Safety of Life at Sea
ISM	International Safety Management Code
MARPOL	International Convention for the Prevention of Pollution from Ships
PSC	Port State Control
ISPS code	International Ship and Port Security Code
ILO	International Labour Organization
MLC	Maritime Labour Convention
PHO	Port Health Officer
	Customs and Immigration

Trainee will be able to state the role of the following:

- f. Port State Control (PSC)
- g. Flag State Inspections (FSI)
- h. Port Health
- i. Customs
- j. Immigration

2.3.20 Seamanship, Ropes & Rope Work

Trainee will be able to:

- List the kind of ropes used onboard the ship.
- Explain the construction and lay of the ropes.
- Explain the care and maintenance of the vegetable/ synthetic/ wire ropes.
- List the precautions necessary, when opening a new coil of rope or wire rope.
- Demonstrate his ability to make various knots, bends and hitches used onboard the ship and explain their uses.
- Demonstrate his ability to coil a rope.
- Demonstrate his ability to make various kinds of 'Whipping' on the ends of ropes and explain its uses.
- Identify ropes by their diameter, lay, strands, etc.
- Demonstrate his ability to do a short-splice, long-splice and eye-splice of ropes.
- Use of marlin spike, fid and mallet.
- Demonstrate ability to do an eye-splice on wire rope.
- Demonstrate ability to do an eye-splice on a polypropylene mooring hawser
- Building clips are used to make an eye or join two wire ropes in case splicing cannot be performed
- Use of building grips must not be used on lifting wires, mooring wires, plastic coated wire ropes
- Also building clips must not be used on wires subject to strong vibrations

- Building grips must be correctly fitted. The 'U' of the grip must be placed on the dead end of the rope. At least three grips must be applied, distance between the grips being approx. to rope diameters.

2.3.21 Blocks and Tackles

Trainee will be able to:

- Explain the purpose of using the blocks and tackles on the ships.
- State that Blocks, may be Single sheave Block, Double-sheave blocks or triple-sheave Blocks.
- Differentiate the Standing part, Hauling part, Running parts, Standing block, Moving – blocks of a tackle.
- Differentiate between various blocks and tackles.
- Explain the SWL of each block and where is it marked.
- Demonstrate overhauling of the blocks.
- State that sheaves of the block are measured by its diameter.

2.3.22 Rigging of 'Pilot ladder', 'Bosun's Chair', 'Stage', Gangway & climb a mast

Trainee will be able to rig the following with all its accessories & safety measures:

- A 'Stage' on Shipside for painting
- Self-Lowering / Hoisting 'Bosun's chair'
- Rigging of bosun's chair with gantline, double sheet bend and seizing.
- Rigging a Rope ladder
- Procedure of rigging/stowing gangways and accommodation ladders with regard to safety
- Securely rigging safety nets to prevent persons falling between ship and quay or onto the quay
- Rigging and attending rat guards
- Procedure of rigging and stowing pilot ladders, including pilot hoist
- During rigging proper PPE to be worn
- Prior usage proper inspection to be carried out.

2.3.23 Duties of a Gangway Watch in Port (introduction to ISPS Code)

The trainee will be able to:

- State duties of a person on the Gang Way Watch.
- State the importance verification of identity of any person coming on board.
- State procedures for reporting any abnormal movement of persons on board trespassers.

2.4. Ship Maintenance and Repair

2.4	Ship Maintenance and Repair	12	24
	2.4.3 Surface Preparation and Painting		
	2.4.4 Lubrication		

2.4.1 Surface Preparation and Painting

Trainee will be able to explain that:

- Steel plates must be protected against exposure to air & moisture, to prevent corrosion.
- This is done by painting the steel plates or structures.
- Prior to painting, the surface of the plates must be thoroughly chipped of rust, or old paint, wire brushed, then washed, cleaned and dried.
- Tools used for chipping are, chipping hammers, scrapers, wire brushes, sanding discs chipping Machines, needle, guns etc.
- Use of high pressure hydro blasting machines and grit blasting machines
- After cleaning, first coat of paint should be anti-corrosive paint or Primer paint. This is always by a brush.
- Second coat, followed by third coat, should also be the same, but after the first coat has dried.
- A stripe coat is applied at the corners and edges using a brush.
- Final coat of the paint should be the 'Finishing paint'.
- Where finishing paint is White, one additional coat of undercoat is applied.
- Types of paint coatings and areas where they are applied.
- Shelf life, pot life, over coating intervals, dry and film thickness.
- Boot topping paint is applied to shipside plates near the ship's waterline.
- Anti-fouling paint is applied to the underwater shipside plates in the dry-dock.
- Anti-fouling paint does not allow the marine growth to take place on the shipside.
- Tools used for painting on the ship, are paint brushes, roller Brushes, and spray machines.
- Understands the importance of preparing the paint before application
- It is essential that the paint is well mixed prior painting. For two pack epoxy paints, the packs to be mixed in correct preparation using a mechanical impeller
- Has working knowledge of brush application
- Has working knowledge of roller application
- Has working knowledge of spray application
- Has basic working knowledge of method of applying paint
- Knows that certain parts on deck may not be painted
- Paint brushes must be cleaned after every use, dried and then stored for future use.
- Paints give off combustible gases, therefore the paint locker must be well ventilated before entry.
- Precautions and procedure of using spray painting machine.
- Each ship provided with a paint coating plan by the paints manufacturer. This details which paint is to be applied where. This is accompanied with product data sheet for each paint type.
- Knows the care and maintenance practice of surface preparation and painting equipment.

2.4.2 Lubrication

Select and use correct fluids, lubricants or grease (1 hour)

- Knows the ships lubrication plan
- Understand that for different machinery and equipment different types of fluids, lubricants or grease are applied
- Knows the different types of grease nipples available
- Knows that all moving parts need to be lubricated otherwise the surfaces due to friction will wear out
- Knows the procedure of greasing windlass, winches, blocks, chocks, drums, wheels, cleats, dogs, nuts etc.
- Knows the procedure of greasing wires.
- Knowledge of selecting and using different types of grease gun or lubricating equipment
- Knows the care and maintenance practice of lubricating equipment

Appendix 1C
Part 3 – SLOs - Marine Engineering Knowledge and Practice
(With reference to Annexure 2C)

Title	T Hrs	P Hrs	Total Hrs	Wks
Part 3 Marine Engineering Knowledge and Practice (at Support Level)	99	257	356	

Marine Engineering Knowledge and Practice

Marine Engineering Knowledge & Practice (at support Level)		Suggested (Hrs)	
S. No.	Topic & sub topics	Theory	Practical
3.1	Familiarisation with duties and Engine Room environment 3.1.1 Duties of a Trainee Rating in the Engine Room 3.1.2 Engine Room Space 3.1.3 Engine Room Machinery 3.1.4 Auxiliary Machinery 3.1.5 Symbols used in the engine room 3.1.6 Engine room watch keeping procedures	7	0
3.2	Instruments (Thermometers, pressure gauges, level gauges)	2	0
3.3	Safe working procedures, Tools & instruments, Bilge and Ballast Pumping and Bunkering procedures 3.3.1 Hand tool, measuring instruments 3.3.2 Lifting devices and equipment, basic fittings and fasteners 3.3.3 Safety Precautions while working in the engine room 3.3.4 Safety Precautions during bad weather 3.3.5 Safety Precautions during hot work 3.3.6 Safety Precautions while working on electrical equipment 3.3.7 Safety Precautions before entering enclosed spaces 3.3.8 Safety Precautions during dry dock 3.3.9 Cleaning of engine room bilges disposal of engine room waste 3.3.10 Bilge pumping system 3.3.11 Ballasting and de-ballasting system bunkering procedures 3.3.12 Maintenance work & preservation	12	86
3.4	Auxiliary Equipment & maintenance work 3.4.1 Auxiliary equipment - general description 3.4.2 Valves 3.4.3 Pumps and Pumping Systems including ballasting and de-ballasting 3.4.4 Joints and gland packing 3.4.5 Filters 3.4.6 Centrifugal separators 3.4.7 Other Auxiliaries 3.4.8 Boiler and Steam System and watch keeping duties	26	25

	3.4.9 Propeller & Shafting 3.4.10 Preservation of equipment in good condition		
3.5	Identify components of diesel engines listed below: 3.5.1 Generator Engines 3.5.2 Main Engine	8	12
3.6	Compressed air for auxiliary purposes	2	0
3.7	Machines: Grinder, Drill, Lathe	3	60
3.8	Basic welding and cutting: Electric Arc welding, gas welding, gas cutting	3	60
3.9	Lubricants and lubrication	2	4
3.10	Level measuring devices and techniques	1	0
3.11	Lagging and insulation	1	0
3.12	Safe use of electrical equipment 3.12.1 Hand tools and electrical instruments for electrical maintenance 3.12.2 Electrical Components & Equipment 3.12.3 Electrical Safety	4	06
3.13	Chemicals on board	1	4
3.14	Steering Gear 3.14.1 Function of steering gear, Checks to be made while taking a round in the steering gear compartment 3.14.2 Bow thruster - Location and importance	3	0
3.15	Storage tanks 3.15.1 Types of Storage Tanks in the Engine Room 3.15.2 Purpose and Operation of Quick Closing Valves	2	0
3.16	Emergencies in the engine room 3.16.1 Various emergencies in the engine room 3.16.2 Types of audio-visual alarms 3.16.3 Action to be taken on hearing / seeing the alarms 3.16.4 Emergency escape routes	4	0
3.17	Fire extinguishing equipment in the engine room 3.17.1 Portable Fire Fighting Appliances in the Engine Room 3.17.2 Fixed Fire Fighting Equipment, i.e. CO ₂ , Foam, Water Sprinkler, Hyper Mist, Emergency Fire Pump	4	0
3.18	Basic Marine Engineering at Support Level 3.18.1 Engineering materials & Special Tools used for maintenance of Engine Room main and auxiliary Machineries 3.18.2 Watch-keeping duties on main and auxiliary Machineries, including Boilers 3.18.3 Working of Diesel engine, air compressor, evaporator, oily bilge separator, AC & fridge plant 3.18.4 Remote operations & internal communications system	14	0
	Total	99	257

Trainee will be able to: (To be used as a prefix to each of the statement of Specific Learning Objective)

3.1	Familiarization with duties and Engine Room environment	7	0
3.1.1	Duties of a Trainee Rating in the Engine Room		
3.1.2	Engine Room Space		
3.1.3	Engine Room Machinery		
3.1.4	Auxiliary Machinery		
3.1.5	Symbols used in the engine room		
3.1.6	Engine room watch keeping procedures		

3.1.1	Duties of a Trainee Rating: (1)
	1. States duties of a rating in the Engine room for assisting in maintenance and watch keeping 2. State the person to report to while working in the Engine room.
3.1.2	Engine Room Space (1)
	1. Describe engine room spaces – platforms (levels) – boiler – main engine cylinder head platform – generator platform – bottom platform, funnel trunking, tank top, pipe tunnel, emergency escapes, steering flat, workshop, ventilation, and engine control room.
3.1.3	Engine Room Machinery (1)
	1. State major items of machinery and their purpose (Main Engine, Shafting, Auxiliary Engines, Auxiliaries, Boilers,).
3.2.4	Auxiliary Machinery (1)
	1. State function of each of auxiliary machinery (pumps, valves, fresh water generator, oil separators - purifiers, hydrophores, air compressors and their importance.
3.2.5	Symbols used in the engine room (1)
	1. Identify different signs and symbols commonly found in the engine room (danger, no smoking, emergency escape, electrical safety, no entry).
3.2.6	Engine room watch keeping procedures (2)
	1. To understand orders & Communicate with Officer in-charge of Engineering Watch 2. State procedures for taking over a watch, duties undertaken during watch and maintenance procedures for handover of a watch.

3.3	Instruments (2)	2	0
	1. Identify and name instruments in the engine room: pressure gauges, thermometers, pyrometers, level gauges and units of measurements 2. Read different type of instruments in the engine room: pressure gauges, thermometers, pyrometers, level gauges.		

3.3	Safe working procedures, Tools & instruments 3.3.1 Hand Tools & Measuring instruments (1) 3.3.2 Lifting devices and equipment, Basic fitting, Fasteners (1) 3.3.3 Safety precautions while working in engine room(1) 3.3.4 Safety precautions during bad weather(1) 3.3.5 Safety precautions during hot work(1) 3.3.6 Safety precautions while working on electrical equipments(1) 3.3.7 Safety precautions before entering enclosed space(1) 3.3.8 Safety precautions during dry dock(1) 3.3.9 Cleaning of engine room bilges, disposal of engine room waste(1) 3.3.10 Bilge pumping system(1) 3.3.11 Ballasting & Deballasting system, Bunkering procedures(1) 3.3.12 Maintenance work & Preservation (1)	12	86

3.3.1	Hand Tools & Measuring Instruments 1. Identify and name each of hand tools listed below: (on a given diagram, and actual tool). Hammers, chisels, files, hack saw, screw drives, spanners, pliers, adjustable spanners, box spanners, wrench, crow bars, shears, type punches, center punch, hole punch, and marking tools. 2. Use each of the tools listed below properly and safely – Hammers, chisels, files, hack saw, screw drives, spanners, pliers, adjustable spanners, box spanners, wrench, crow bars, shears, type punches, center punch, hole punch, and marking tools. 3. Identify and name each of the measuring instruments (steel scales, inside and outside calipers, thread gauge, feeler gauge, vernier caliper, inside and outside micrometer) 4. Use the following measuring instruments properly on given tasks. (steel scales, inside and outside calipers, vernier caliper, inside and outside micrometer)	1	

3.3.2	Lifting devices and equipment, Basic Fitting, Fasteners: 1. Identify lifting devices and associated components (Slings, pulleys, eye bolts, shackles, pulleys, chain blocks, and engine room crane if available). 2. State checks to be made before using each of the (Slings, pulleys, eye bolts, shackles, pulleys, chain blocks, and engine room crane if available). 3. State hazards involved in moving and lifting heavy objects using slings, pulleys, eye bolts, shackles, pulleys, chain blocks, (engine room crane if available). 4. Move and shift equipment manually 5. Move and shift machinery item using lifting devices such as slings, pulleys, eye bolts, shackles, pulleys, chain blocks, (engine room crane if available).	1	

Basic fitting: 1. Demonstrate procedure for dismantling and assembling pipes and valves using hand tools. 2. State procedures for assembling the same. 3. State safety precautions to be taken before dismantling, while working and at the time of assembly. Fasteners 1. Identify and name each types of fasteners list (bolts, studs, nuts, common screw, common lock nuts and devices, and common types of washers) 2. Demonstrate proper methods of using fasteners and features. 3. Demonstrate ways and means of releasing rusted nuts, opening rounded nuts, removing broken studs, releasing nuts seized on a stud, securing studs back on a body of valves and similar locations. 4. State the tools that can be used to repair damaged internal or external threads.		
3.3.3 Safety Precautions while working in the engine room 1. State safety precautions while working in the engine room	1	
3.3.4 Safety precautions during bad weather 1. State Safety precautions during bad weather	1	
3.3.5 Safety precautions during hot work 1. State Safety precautions during hot work	1	
3.3.6 Safety precautions while working on electrical equipment 1. State Safety precautions while working on electrical equipment	1	
3.3.7 Safety precautions before entering enclosed space 1. State Safety precautions before entering enclosed space	1	
3.3.8 Safety precautions during dry dock 1. State Safety precautions in the dry dock 2. State Safety precautions during floating on completion of work in dry dock	1	
3.3.9 Cleaning of engine room bilges, disposal of engine room waste 1. Understand the importance of keeping the engine room floor plates clean and free of oil. 2. Know the importance of segregation of garbage and the colour coding used for garbage segregation. 3. Know the procedure to burn garbage in an incinerator. 4. Know the materials that are prohibited in an incinerator.	1	

5. Know the dangers associated with sewage treatment plant cleaning 6. Understand the importance of segregation of oil and water in the machinery space. 7. Know the precautions in operation of an oily water separator			
3.3.10 Bilge pumping system 1. Describe bilge pumping system 2. Know that the bilge and sludge system are segregated from each other. 3. Know the areas where bilges cannot be pumped out through the OWS.		1	
3.3.11 Ballasting & Deballasting system & Bunkering procedures 1. Describe Ballasting & Deballasting system & Bunkering procedures		1	
3.3.12 Maintenance work & Preservation 1. Assist in maintenance tasks on auxiliary diesel engines, heat exchangers, pumps 2. Clean diesel engine components such as pistons, piston rings, bearings, 3. Clean components using diesel oil, chemicals. Protection and preservation: (also in GSK) 1. Use chipping hammers, wire brushes, and power tools in removing rust. 2. Prepare surface for painting – cleaning and degreasing. 3. Paint surfaces using paint brushes, roller 4. Identify components and function of air spray machine 5. Explain advantages of using air spray machines 6. State risks involved in using air spray machines.		1	
3.4	Auxiliary Equipment & maintenance work 3.4.1 Auxiliary Equipment-general description 3.4.2 Valves 3.4.3 Pumps and Pumping Systems including ballasting/deballasting 3.4.4 Joints and gland packing 3.4.5 Filters 3.4.6 Centrifugal separators 3.4.7 Other Auxiliaries 3.4.8 Boiler and Steam System including watch keeping 3.4.9 Propeller & shafting 3.4.10 Preservation of equipment in good condition	26	25
3.4.1 Auxiliary Equipment-general description 1. Identify and state function of strainers, filters, heat exchangers – coolers and heaters.		2	

2. Name major parts of strainers, filters, heat exchangers – coolers and heaters		
3.4.2 Valves 1. Identify common types of valves and cocks used on board (globe, sluice or gate, butterfly, spring loaded, non-return globe, float valve, taper cock, and ball cocks. 2. Identify major components of each type of valve and cock. 3. State procedures for opening and closing of valves for operation (globe valves, gate valve, butterfly valve, using a wheel spanner) 4. State function of drain valves and drain cocks for air bottles, oil fuel tanks, expansion tanks and level gauges.	4	
3.4.3 Pumps and Pumping Systems including ballasting/deballasting 1. Identify common types of pumps in the Engine Room (centrifugal, reciprocating, gear, screw pump) 2. State the pumps that come under the category of 'positive displacement pump' and their peculiarity. 3. State precautions necessary before starting any pump 4. List major pumping systems in the engine room (Bilge, ballast, deck wash and fire supply, domestic fresh water, domestic sea water, expansion tanks, hot wells, compressed air system) 5. State the purpose of each of the pumping system (Bilge, ballast, deck wash and fire supply, domestic fresh water, domestic sea water, expansion tanks, hot wells, compressed air system) 6. State observations to be made on operating pump and air compressor	4	
3.4.4 Joints and gland packing 1. Identify types of joints used for pipe line and equipment having water, oil, air, steam, exhaust gases, and hot water. 2. Identify type of packing material used for packing glands of valves or pumps for sea water, steam, and oil. 3. Cut rubber or of stiff material suited for round or square flanges. 4. Demonstrate procedures for cutting packing and for packing a gland. 5. State precautions to be taken before commencing repair work on a pipeline or components in situ. 6. Identify soft metal joints and 'O' rings and state care to be taken on these during maintenance 7. Carry out temporary repair to a leaky pipe using clamps or jubilee clip.	1	
3.4.5 Filters 1. Identifying name oil filters, and air filters used on board. 2. Identifies parts of a bucket type filter and a duplex type filter	2	

3. States hazards involved in cleaning filters on a running machinery. 4. Know the PPE to be worn while cleaning filters. 5. Understand the importance of blowing cleaning air thru the filter opposite to the direction of medium flow. 6. Lists precautions to be taken before opening a filter for cleaning, on a stand by machine. 7. States checks to be made on a filter during cleaning and re-assembly. 8. State precautions to be taken while working on a hot filter.			
3.4.6 Centrifugal separators 1. Identify and state purpose of a centrifugal separator 2. Assist in opening up purifiers and cleaning disc stack.		1	
3.4.7 Other Auxiliaries 1. State functions of other auxiliaries and services such as sewage system, incinerators, refrigeration and air conditioning,		3	
3.4.8 Boiler and Steam System & watch keeping duties 1. State uses of steam on board. 2. State major mountings on the water and steam side (Main steam stop valve, gauge glasses, safety valves, feed valve, blow down valve, air vent, pressure gauge connection) 3. State basic operation of boiler (fuel supply, air supply, feed water supply, water level regulators, fuel control and cut outs) 4. State observations to be made on an operating boiler 5. State risks involved in operating an oil fired boiler 6. State the meaning of 'flash back', 'over pressure', 'low water level', 'high water level' 7. State procedures for keeping watch 8. State importance of water level in a boiler		7	
3.4.9 Propeller & Shafting 1. State the use of propeller & shafting		1	
3.4.10 Protection and preservation of equipment in good condition (also in GSK) 1. Use chipping hammers, wire brushes, and power tools in removing rust. 2. Prepare surface for painting, cleaning and degreasing. 3. Paint surfaces using paint brushes, roller 4. Identify components and function of air spray machine 5. Explains advantages of using air spray machines 6. States risks involved in using air spray machines.		1	
3.5	Identify components of diesel engines listed below:	8	12

	3.5.1 Generator Engines		
	3.5.2 Main Engine		

Identify components of diesel engines listed below:		8	12
3.5.1 Generator Engines 1. Identify and state function of major components of an auxiliary (generator) diesel engine 2. State important systems needed for operation of an auxiliary diesel engine (Lubrication, fuel, cooling water, starting, scavenge air and exhaust, safety system, governor) 3. List safety devices on an auxiliary diesel engine 4. Describe preparation needed for starting an auxiliary diesel engine 5. State instruments fitted on an auxiliary diesel engine for monitoring its operating parameters. 6. State checks to be made on an operating auxiliary engine.			
3.5.2 Main Engine: 1. Identify major components of Main Engine (Turning gear, Cylinder head, exhaust valves, indicator valve, fuel injectors, fuel pump, piston, piston rod, connecting rod, cross head and guide, main bearing, cam shaft, crank shaft, crank case, crankcase relief valve.) 2. State important systems necessary for operation of a Main Engine (Lubrication, fuel, cooling water, starting, air charging and exhaust, safety system)			
3.6 Compressed air for auxiliary purposes 1. State different uses of compressed air for auxiliary purposes. (cleaning components and portable machines) 2. State risks involved in working with compressed air for auxiliary purposes. 3. Demonstrates use of compressed in cleaning filters and other components 4. State the arrangement provided for draining the water from the air bottle		2	0
3.7 Machines 1. Identify and name major parts of a pedestal drill machine, and pedestal or a bench grinder: 2. Drill holes using a fixed and portable drill machine 3. Use fixed grinding machine for grinding plates, chisels, and scraper hand tools. 4. Use hand grinder for grinding plates or parts. 5. Use buffing or brush attachments for hand grinder. 6. Lathe machine: Identify parts and common tools, 7. Explain common tasks that can be performed on a lathe 8. Explain risks involved while working with power tools : Drill, Grinder and Lathe		3	60

9. Carry out basic turning and facing operation on lathe.		

3.8 Basic welding and cutting: Arc welding, gas welding, gas cutting	3	60
1. State the hazards involved in using and working with welding equipment – Arc Welding and Gas cutting/welding 2. Identify components of arc welding machine used on board, personal protective equipment, tools and accessories used for welding. 3. Arc welding: Perform welding of butt joints and lap joints using arc welding machine. Demonstrate basic procedures and techniques 4. Take precautions while performing tasks 5. Brazing ferrous and non-ferrous metal plates using gas welding equipment 6. Use a gas cutting torch for cutting a plate or rusted part.		

3.9 Lubricants and lubrication	2	4
1. State type of oils and greases used on board in ER and on Deck. (cylinder oil, crankcase oil, gear oil, hydraulic oil, general purpose grease, open grease, wire rope grease) 2. States different methods of lubrication used on machinery and components 3. Identify grease nipples, greasing and oiling equipment 4. Demonstrates use of grease guns 5. Use oil can for filling in oil in crankcase of a machine 6. State precautions to be taken while working on or near an operating machinery. 7. State risks involved if oil or grease falls on hot surfaces		

3.10 Level measuring devices and techniques	1	0
1. Identify and name different level measuring devices and equipment listed below: 2. Dip sticks, sounding rods, sounding tapes, gauge glass and sight glass. 3. Demonstrate use of dip sticks, sounding rods, sounding tapes, in sounding a level of liquid in a tank. 4. Read level gauges to check oil and water levels in tanks 5. State the type of fitting on a sounding pipe for a double bottom tank. 6. State the hazard of leaving the gauge in a working condition if cocks, spring loaded valves have been gagged while testing a gauge.		

3.11 Lagging and insulation	1	0
1. State purpose of lagging and insulation material on pipes and components in the engine room. 2. State importance of maintaining lagging and insulating material, and		

	prevention of contact with oil. 3. State the common material used for lagging 4. State precaution to be taken while handling a torn lagging.		
3.12	Safe use of electrical equipment 3.12.1 Hand tools and electrical instruments for electrical maintenance 3.12.2 Electrical Components & Equipment in ER 3.12.3 Electrical Safety	4	6
3.12.1	Hand tools and electrical instruments for electrical maintenance 1. Identify basic tools and their safety aspects 2. State precautions to be taken prior commencing work or repair of electrical equipment 3. State isolation & emergency procedures 4. State different voltages on board	2	2
3.12.2	Electrical Components and Equipment in ER 1. Electrical Equipment in ER (generators, motors, switch boards, lighting, switches, starters, starter panels 2. Identify electrical components - plugs, sockets, bulbs and tubes, cluster lights, and portable lamps 3. Carry out basic electrical maintenance: changing plugs, replacing bulbs and tubes, rigging up cluster lights and portable lamps 4. States importance of taking care of wires against chaffing	1	3
3.12.3	Electrical Safety 1. Understand and follow safety instructions of electrical equipment and machinery. 2. Recognizes and report electrical hazards and unsafe equipment. 3. Understand safe voltages for hand-held equipment. 4. Understand risks associated with high-voltage equipment and onboard work.	1	1
3.13	Chemicals on board 1. State chemicals used for different purposes on board: Air cooler and other coolers cleaners; Boiler water treatment, fuel oil treatment 2. State precautions to be taken while using and handling chemicals on board	1	4
3.14	Steering Gear 1. State function of a steering gear & its importance for trouble free operation & checks to be made while taking a round in the steering flat. 2. State functions of bow thruster, its location and importance	3	0

3.15 Storage tanks 1. State types of storage tanks – wing tanks, double bottom tanks, tanks within the engine room such as lube oil storage, expansion tank, lub oil sump) 2. State liquids stored in tanks: Fuel, lubricating oil, and fresh water. 3. State the purpose & operation of a ‘quick closing valve’. 4. Identify a quick closing valve.	2	0
3.16 Emergencies in the engine room 1. State emergencies that can occur in the engine room (fire, flooding, black out, oil spill, injuries, electric shocks, burns,) 2. State the difference between, machinery failure alarm, general alarm, CO₂ flooding alarm). 3. State action to be taken on hearing each type of alarm 4. State that all alarms in the ER are of Audio Visual Type 5. State the importance of emergency escape routes	4	0
3.17 Fire extinguishing equipment in the engine room 1. List fire extinguishing equipment found in the engine room (Portable extinguishers, non-portable extinguishers, fire hydrants, hoses and nozzles) 2. State methods of detecting fire in the engine room (smoke type, heat type, flame type) 3. State methods of raising alarm on finding a fire in the ER. 4. State the function of fixed firefighting installation: CO₂, foam, water sprinkler, hyper mist 5. State the purpose and location of Emergency fire pump that supplies water in emergency.	4	0
3.18 Basic Marine Engineering at Support Level 1. Describe engineering materials & Special Tools used for maintenance of Engine Room main and auxiliary Machineries. 2. State Watch-keeping procedures on main and auxiliary Machineries, including Boilers. 3. Describe working of Diesel engine, air compressor, evaporator, oily bilge separator, AC & fridge plant. 4. Describe Remote operations & internal communications system.	14	0

Appendix 1C

Prevention of pollution to the Marine Environment

4.0	Prevention of pollution to the Marine Environment Sources of pollution at Sea from ship Damage to the environment Importance of prevention of pollution of the sea Ways and means of preventing pollution Pollution prevention equipment on board	8	4

1. State the consequences of Pollution at Sea
2. List the causes of pollution at Sea being discharge from the ships:
 - a. Oil
 - b. Chemical
 - c. Hazardous goods
 - d. Sewage
 - e. Garbage including plastics
 - f. Air pollutants
 - g. Ballast water pollution
3. State different sources of pollutants in the engine room (oily rags, general garbage, plastics, soot and dust, oils, paints, chemicals)
4. List the precautions necessary in ships to avoid sea pollution
5. States methods of managing each of the pollutants and its disposal
6. List the steps to take for disposal of ship's garbage and plastics from the ship
7. List the precautions necessary to avoid Air pollution
8. States possibilities of fines and possibilities of arrest of an individual found to be polluting the environment deliberately
9. Explain about the 'SOPEP' Locker, and its utility
10. Understand there are strict rules for the prevention of pollution covering disposal of waste material at sea. Follow correct procedures for disposal of paint residues, solvents, sweepings and other chemicals in use
11. Safety precautions during bunkering
 - Draining any water on deck
 - Plugging of deck scuppers for bunkering purposes
 - Closing drain plugs of save all and drip trays
 - Bunker hose fitted to manifold using proper gasket and reducers and all bolts tightened
 - Opposite side bunker manifold blanked with all bolts tight
 - Drip sample bag fitted at the manifold
 - knowledge of use of emergency stop during bunkering
 - Blanks bunker hose tightly before hooking onto sling for lowered to barge in completion
12. Exchange of ballast water
 - knowledge of alien aquatic species migrating to other waters trough ballast water
 - be aware that certain alien species when introduced into another environment cause large scale destruction of local aquatic species
 - knowledge of ballast water management methods
 - knowledge of ballast water treatment
 - knowledge of sediment management

- knowledge of ballast water sample test points

Appendix 1D

General Ship Knowledge (Seamanship and Bridge duties at Support Level)

Recommended Practical Skills (GP Rating Pre-Sea Training)

(Practical Record Book)

(With reference to Annexure 2 B)

Hours against each heading are suggestive hours for each candidate to be on the job. Total hours of work in the workshop should be about 150-165 hours. Some of tasks may be grouped as a project, and for the sake of logistics. All practical tasks need to be completed within first 20 weeks of course to allow for revision, and schedule for practical examination.

Ref.	Imp.	Task and Sub-tasks Importance (Imp.) E-Essential D-Desirable	Signature of the Instructor on assessment of proficiency of the trainee, and date
7. Repair and maintenance (24 hrs.)			
7.	E	Chip the surface as per prescribed safety guideline	
8.	E	Clean the surface as per safety guidelines	
9.	E	Prepare the surface for painting	
10.	E	Demonstrate usage of a Chipping Machine, Needle gun, sanding machine and Wire brush Machine	
11.	E	Identify common types of brushes and demonstrate their use	
12.	D	Paint the surface by using various methods – brush, roller, spray	
13.	E	Watertight doors - Carried out water-tightness test - Change rubber packing - Tighten dogs	
14.	D	Hatch cover - Identify the parts - Tighten the cleats - Check weather-tightness	
15.	E	Carpentry - Identify and define the use of basic carpentry tools - Prepare a cement box - Make wedges - Cut 4x4 chocks - Tighten, fix loose legs by drilling and tightening screws	
16.	E	Enter an enclosed space complying with safety procedures. Use gas monitor and O2 analyser to check atmosphere in the space is safe enough to enter.	

8. Work with Bosun's chair, ladders, stages and gangway (42 hrs.)			
6.	E	Demonstrate donning of a Safety Harness.	
7.	E	Rig Bosun's chair and lower himself using self-lowering hitch observing safety guidelines	
8.	E	Rig the stage for working and painting over-side / aloft, complying to safety guidelines	
9.	E	Rig the Pilot ladder, Embark and disembark using the same observing safety guidelines	
10.	E	Rig a Coolie / rope ladder for working overside, embark and disembark the ladder complying with safety guidelines	
11.	E	Rig and use fall arrestor device	
12.	E	Rig and climb 5m telescopic ladder complying with safety guidelines	
13.	D	Swing out and rig gangway / accommodation ladder	
9. Rope work (18 hrs.)			
9.	E	Make a Bend, Hitch and a Knot for temporarily joining two ropes /temporary joining a rope to a structure. Demonstrate tying of all essential knots and hitches	
10.	E	Make a temporary eye using a bulldog grip on a wire rope.	
11.	E	Identify manila, polypropylene and other synthetic ropes and the precautions to be taken in using each.	
12.	E	Uncoil and Lay out a rope from a new coil	
13.	E	Secure the ends of a Rope using a Twine – Whipping	
14.	E	Seize the rope complying with the prescribed procedures.	
15.	E	Fetch equipment of various types.	
16.	E	Splice a permanent Eye on the end of a Fibre Rope;	
17.	E	Join two fibre ropes by a short splice & a long splice	
18.	D	Spice an eye on a polypropylene mooring rope	
19.	E	Spice an eye on a 12mm wire rope	
10. Mooring and Anchors (8 hrs.)			
6.	E	Make / prepare and throw the heaving line conforming to safety guidelines	
7.	E	Put a double stopper on berthing hawser and wire as per safety guidelines	
8.	E	Secure mooring ropes on bollards & bits.	
9.	E	Demonstrate correct practice of heaving in or paying out a hawser on a warping drum.	
10.	E	Demonstrate usage & fitting of Rat Guards.	
11.	E	Identify parts of an anchor and chain and their marking	
12.	E	Break open a kenter joining shackle and again join back	
11. Cargo Handling and stowage (20 hrs.)			

12.	E	Identify different types of slings and their uses.	
13.	E	Rig the single sheave tackle complying with Safety guidelines	
14.	E	Identify and use bulldog grips, demonstrate joining of 2 wires with bulldog grips, bottle screws, and wire lashings for securing cargo,	
15.	D	Fix container lashings such as twistlocks, bridge fitting, bars, turnbuckles, etc.	
16.	E	Identify parts of a swinging derrick / boom.	
17.	E	Demonstrate lifting / moving weights of different size and shapes using a lifting gear.	
18.	E	Identify various tackles and purchases and their use in cargo work.	
19.	E	Identify the lifting gear and know its S.W.L.	
20.	E	Demonstrate seizing of a shackle.	
21.	E	Demonstrate lifting of bales, drums, cartons, pipes, gas bottles using the correct sling and slinging procedure • Snotter • Endless sling • Net sling • Drum clamps • Log clamps • Pallet	
22.	E	Fetch the correct size of block for a specific SWL.	
23.	E	Oil & grease the wire rope as per safety guideline.	
24.	E	Use hand grease gun and pneumatic grease gun to grease watertight door dogs, winch clutch, etc.	
25.	D	Identify various cargo gears used on board and related safe working practices.	
26.	E	Lashing carried out on: • 200 litre drums • 20 litre drums • O2, Acetylene Gas bottles • Crates • Plates	
12. Navigational Watch (12 hrs)			
9.	E	Keep lookout duties, recognize and report the lights of lighthouse, buoys and ships navigation lights (identify types of navigation lights)	Orals
10.	E	Identify signals used for indicating distress and describe procedures to use them	
11.	E	Identify the basic parts of a magnetic compass	

12.	E	Recognize the cardinal and inter-cardinal points of a compass	
13.	E	Compare Magnetic and gyro compass and apply error.	
14.	E	Take bearing of terrestrial objects using an azimuth mirror	
15.	E	Understand Helm orders and steer the ship	
16.	E	Take readings of dry and wet bulb thermometer, psychrometer, hydrometer	
17.	E	Bend flags on the halyards for single letter signal (Five flags).	
18.	E	Identify type of ship by their navigation lights and what they are doing	
13. Miscellaneous (30 hrs)			
10.	E	Climb the Mast with appropriate safety measures	
11.	E	Use sounding tape, sounding rod and ullage tape and take readings	
12.	E	Demonstrate usage of Stag horns and Cleats.	
13.	E	Identify the MOB marker.	
14.	E	Identify SART & EPIRB.	
15.	E	Identify Jubilee Clips and demonstrate their usage.	
16.	E	Manual handling of weights • Moving and stowing 200 ltr drums • Lifting 20ltr paint drums and stowing on the rack • Lifting 25 kg bags • Moving O2 cylinders • Lifting 15 kg carton	
17. Port / Dock / Harbour / Ship Visit (8 hrs)			
2.	E	Write a brief report for one of the visits (List equipment and parts seen with date of visit, ships name, type of ship, port, etc.	
18. MARPOL and Prevention of Pollution (1 hr)			
1.	E	Identify different coloured Garbage Bins and indicate correct procedures for disposal of garbage.	
2.	E	Demonstrate usage of Scupper plugs.	
3.	E	SOPEP Oil Pollution Kit - identify the different equipment	
Additional assignments:			
4.			
5.			
6.			
7.			

Appendix 1E
Recommended Practical Skills (GP Rating Pre-Sea Training)
(Practical Record Book)

Marine Engineering at Support Level

Hours against each heading are suggestive hours for each candidate to be on the job. Total hours of work in the workshop should be 240-260 hours. Some of tasks may be grouped as a project, and for the sake of logistics. All practical tasks need to be completed within first 20 weeks of course to allow for revision, and schedule for practical examination.

Ref	Imp	Task and Sub-tasks Importance (Imp.) E-Essential D-Desirable	Signature of the Instructor on assessment of proficiency of the trainee, and date
1.	E	Identify personal protection gear and demonstrate their use. (2 hrs.)	
1. Hand tools and measuring instruments (24 hrs.)			
1.	E	Identify different spanners by type and size. Use appropriate spanner as per the requirement	
2.	E	Identify different types of hammers. Use appropriate hammers in required jobs	
3.	E	Identify nuts and bolts and their usage. Identify stud and demonstrate how to fit and remove a stud	
4.	E	Use a joint cutter to cut joint for a pipe flange.	
5.	E	Make a rubber gasket to fit on a manhole	
6.	E	Identify measuring instruments and their use, Callipers, Scale, Tri-square, Divider, Vernier callipers, Inside and outside Micrometers, Feeler gauge.	
2. Bench vice (4 hrs.)			
1.	E	Identify a bench vice and uses of it.	
2.	E	Demonstrate proper and safe procedures for holding different types of job in a bench vice. (Use soft jaws for holding a delicate job to prevent damage, handling odd and heavy items, personal protection)	
3. Using Chisels (6 hrs.)			
1.	E	Identify different types of chisels and their uses	
2.	E	Use a flat chisel for chipping a mild steel block or cutting a sheet taking specific safety precautions.	

3.	E	Demonstrate technique of removing a rusted nut	
4. Using hacksaw (6 hrs.)			
1.	E	Identify different types of hacksaw frames	
2.	E	Fit a hacksaw blade correctly in a frame	
3.	E	Carry out cutting work for a given job (a plate, or a rod or a pipe)	
5. Filing (8 hrs.)			
1.	E	Identify different types of files and their uses	
2.	E	Use flat file on a plate or a mild steel block to meet the given dimension	
6. Marking (2 hrs.)			
1.	E	Identify various types of marking tools.	
2.	E	To carry out marking a plate or a block as per given details on a diagram.	
7. Grinding (4 hrs.)			
1.	E	Identify major components of a pedestal grinding machine	
2.	E	Identify major components of a hand grinder and how to change wheels using the appropriate tools. Know how to select the grinding wheel based on the speed of the grinding machine.	
3.	E	Carry out grinding operation on a given job taking specific safety precautions related to grinding.	
8. Drilling (4 hrs.)			
1.	E	Identify different components of a vertical drill machine.	
2.	E	Fit and remove a drill bit in drilling machine.	
3.	E	Secure the job to be drilled to a vice. It must never be held by hand.	
4.	E	Carry out drilling operation on a given job taking specific safety precaution related to drilling	
9. Tapping (for making internal threads) (2 hrs.)			
1.	E	Identify a tap by type and size (Metric, BSW, BSP etc)	
2.	E	Demonstrate use of a tap in sequence by making internal threads on a metal piece	
10. Valves and pipe work (14 hrs.)			
1.	E	Identify different types of valves with respect to their common use on board (globe, globe non return, gate/slucice, butterfly,	

		ball, spring loaded, fire hydrant and float valve)	
2.	E	Demonstrate proper techniques for opening and closing each type of valve mentioned above, and how to read the indicators where fitted.	
3.	E	Identify major components of globe valve, gate valve and butterfly valve.	
4.	E	Demonstrate proper techniques for dismantling and assembling a globe valve	
5.	E	Demonstrate techniques of removing a flanged pipe from a pipeline	
6.	E	Identify various packing material and make joints/gaskets for a pipe or valve flange.	
7.	D	Demonstrate procedures for lapping a valve and seat of a globe valve.	
8.	D	Remove a packing from a valve gland and replace with new one	
11. Auxiliary Machinery- pumps (7 hrs.)			
1.	E	Identify Types of Pumps (centrifugal, reciprocating, gear and screw type)	
2.	E	Remove and place a pump from its foundation	
3.	D	Identify the parts of a centrifugal pump	
4.	D	Carry out checks before starting a centrifugal pump	
12. Auxiliary Machinery-air compressor (4 hrs.)			
1.	E	Identify parts of a reciprocating air compressor	
2.	E	Carry out relevant checks before starting and while it is running	
3.	E	Demonstrate procedures for cleaning heat exchanger tubes using appropriate tube cleaning brush	
4.	E	Uses compressed air hose for cleaning components such as filters, heat exchangers, etc.	
13. Lifting tools, equipment and techniques (14 hrs.)			
1.	E	Identify equipment used for lifting heavy machinery items. (eye bolts, slings, shackles, ratchet block, and chain block)	
2.	E	Demonstrate safe practices of using eye bolts, slings, shackles, ratchet block, and chain block for lifting and moving heavy machinery item. Understand Safe Working Load (SWL) of equipment used in lifting of loads.	
3.	E	Uses simple hydraulic jacks	
4.	D	Identify tools and jigs commonly used for lifting cylinder heads and pistons	

14. Diesel Engines (12 hrs.)			
1.	E	Identity the major components of a diesel engine. (Structure and running gear)	
2.	E	Indicate the parts of the engine that require external cleaning, while engine is working	
3.	E	Identify instruments such as Pressure gauges and thermometers	
4.	E	Demonstrate ability to read pressures, ~~and~~ temperatures and lub oil level in sump, turbocharger and governor.	
5.	E	Demonstrate techniques of cleaning of the engine parts such as pistons, ring grooves, and cylinder head during overhaul	
15. Lubrication (4 hrs.)			
1.	E	Identity various methods of lubrication (grease guns and nipples, grease cups, oil cups, splash and forced)	
2.	E	Ascertain level of lubricating oil using sight glass, dip stick, sounding tape, overflow pipe, sight plug in different machines	
3.	E	Carry out lubrication /Oiling /Greasing of machinery such as diesel engines, purifiers, compressors, electric motors & pumps	
16. Plumbing tools and practices (6 hrs.)			
1.	E	Identity different tools and jigs for plumbing work	
2.	E	Identity different components of pipes (elbows, unions, nipples, taps, cocks, glands, packing and joints)	
3.	E	Demonstrate use of different plumbing tools such as wrenches, hand saw, and thread cutting. Make external threads on a pipe	
4.	E	Demonstrate practices for joining plumbing components such as unions, bends, and nipples using sealing tapes and compounds	
5.	E	Dismantle and assemble a cock	
6.	E	Change tap, replace the washer of a tap	
7.	E	Demonstrate use of a Jubilee clip or Band It clamping tool for repairing a pipe	
8.	E	Use of sani-snake to clear blocked scuppers	
17. Gas cutting and welding kits and welding methods /procedures (20 hrs.)			
1.	E	Identify components of gas cut and welding equipment.	
2.	E	Demonstrate safety precautions while using a gas cutting torch	
3.	E	Carry out surface preparation prior gas welding/gas cutting jobs	

4.	E	Demonstrate the safety precautions required while handling Oxygen / Acetylene Bottles	
5.	D	Demonstrate process of brazing and gas cutting	
18. Electric Arc welding kit and welding methods /procedures (10 hrs.)			
1.	E	Identify components of arc welding equipment used on board.	
2.	E	Identify tools and apparel used for arc welding	
3.	E	Demonstrate the safety precautions to be observe prior commencement of arc welding	
19. Arc welding practice (30 hrs.)			
1.	E	Prepare two plates for joining by arc welding in simplest way (single butt)	
2.	E	Carry out arc welding to join two plates (butt weld)	
20. Hand tools and safe working practices electrical shop (4 hrs.)			
1.	E	Identify hand tools used for electric maintenance	
2.	E	Adopt safe working practice while working with electrical appliances	
3.	E	Identify the basic safety devices such as fuses and trips in electrical systems	
21. Electric cable and wires (2 hrs.)			
1.	D	Identify different types of cables - single core, two core, three core, four core and multi-core and current ratings of cables.	
22. Cleaning agents and boiler chemicals (4 hrs.)			
1.	E	Demonstrate proper techniques for handling chemicals.	
23. Lathe Machine (60 hrs.)			
1.	E	Identify major parts of a lathe machine and its operating levers and switches.	
2.	E	Demonstrate specific safety precautions while working on a lathe machine.	
3.	E	Center a circular section MS rod in the lathe	
4.	E	Identify use of common cutting tools and measuring instruments used in machining.	
5.	E	Use appropriate cutting tools and face a job and take a straight cut.	
24. MARPOL and Prevention of Pollution (2 hrs.)			
1.	D	Connect bunker hose to manifold using a reducer. Close drain plug of drip tray.	

	Additional Tasks, if any	
1.		
2.		
3.		
4.		

Electro Technical Officer (ETO) course
Annexure -I (WITHOUT HIGH VOLTAGE SEGMENT)
Annexure – II (HIGH VOLTAGE SEGMENT)

ANNEXURE - I

Mandatory Intake requirements for the 4 month Pre sea ETO course:-

- i. Passes 10 + 2 with Physics, Chemistry, Mathematics or equivalent vocational education course and English as a separate subject, with minimum 50% marks in English language at 10th or 12th or Diploma or Degree level.
- ii. Passed three years Diploma with 60% marks or four years Degree including lateral entry with 50% marks in Electrical Engineering, electronics Engineering, Electrical & Electronics Engineering, Electronics & Telecommunication/ Communication Engineering or Electronics and Instrumentation or equivalent.
- iii. Candidates who have not scored 50 % marks in English at 10th or 12th standard but have scored 60% in diploma and 50% in Degree course, will be eligible if the medium of learning in Diploma/ Degree course is in English language subject to fulfil all other eligibility norms and medical fitness.
- iv. The diploma / degree courses must have been recognized by any State or Central Government or the AICTE.

Guide to the documents (applicable for both Annex I and Annex II)

Primarily, the documents addresses following:

- i) The competencies specified for ETO is in accordance with the STCW document No. STCW/CONF.2/34, Section A-III/6 (Mandatory minimum requirements for certification of electro-technical officers)
- ii) Following competencies excluded in this document are to be covered in the 4 basic STCW courses i.e., PSC(RB), AFF, MFA, PSSR, which are to be attended additionally
 - a) “Operate Life-saving appliances”
 - b) “Apply medical first aid on board”
 - c) “Contribute to the safety of personnel & ship”
- iii) The duration of the Electro Technical Officer course to be of **minimum of 17 Weeks** (5.5 working days per week) of 7 hours
 - 0900 – 1300 (4 hours)
 - 1300 – 1400 Lunch Break
 - 14:00 to 17:00 hrs (3 hours)

The distribution of available 17 W x 5.5 D x 7H = 654.5 Hours is to be allocated as below:

489 Hours to be dedicated for knowledge transfer. Methods to include Theory, Practical's, and Demonstration by Videos

40 Hours to be dedicated for Review & Evaluation

09 Hrs for Library / Parade/ Swimming

14 Hrs for Project / Presentation

In addition to above following hours required for basic STCW courses and field trip

88 Hrs. for STCW basic courses

14 Hrs. for field trip

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
1.1	Monitor the operation of electrical, electronic and control systems	Ship board Machinery Familiarization: 1.1.1 Prime movers including main propulsion plant.	1. Lecture & Workshop Practical exercises on auxiliaries.	5	5	
		1.1.2 Engine-room auxiliary machineries - Boiler, incinerators, purifiers, oily-water separators, various types of pumps	2. Hands on skill in the electronic lab.	5	5	
		1.1.3 steering gear systems	Videos on ships Construction / equipments (videotel)	2	2	
		1.1.4 Cargo handling systems		4		
		1.1.5 Deck machineries		3	1	
		1.1.6 Galley equipment		3	3	
		1.1.7 Ship's Construction		8		
			Total	46 Hrs		

Explanation:

1.1.1 Prime Movers including propulsion plant

The objective being shipboard familiarization, this module must introduce the candidates to the key components & aids that are responsible in supervision & control of the Main propulsion plant (subsequent modules must provide an insight into the complex interdependency *between sub-systems*)

- Construction and operation of diesel engines, steam and gas turbines, steam boilers and ship electric propulsion motors
- Ship main propulsion plant configuration and efficiency

- Configuration and operation of engine room and ship piping systems
- Operation of ship propellers and propulsions'

1.1.2 Engine Room Auxiliary Machinery

The module must include 'engine starting arrangements', safety & interlocks, the fuel systems used, change over fuel systems & shutdowns & monitoring systems. Though involves a "host of machinery" but special emphasis on *centrifugal purifiers, compressors & boilers* must be the mainstay of this section.

Boilers should be addressed in this section as a functional unit & the controls aspect of it dealt in later sections. Thus, the sequential functioning of relay based systems & interlocks is to be well addressed in this section.

1.1.3 Steering Gear Systems

Construction and operation of steering gears, rudder propellers, azipods and cycloid propulsions.

Position control systems & the integration with the 'Auto-Pilot' for a complete understanding of the purpose & utility of the device with concerns (e.g. Starter panel overload not wired to trips but to alarms in the Engine Room). This section however must deal only with the starter panels, the unique nature of their design (no overload trip function) & the intent of usage.

1.1.4 Cargo Handling Systems

Based on vessel types a broad functional overview of the equipment that is used to handle cargo systems with due regard to the time frame allotted.

For e.g. on oil tankers – Inert Gas systems & Ullaging equipment in CCR, Ventilation arrangements Or LPG carriers – Re-liquefaction plant & Ullaging systems, Ventilation arrangements etc.

Hydrocarbon carriers imposing safety requirements on ships (e.g. Vapour concentration diagram for oil & other tankers)

1.1.5 Deck Machineries

These include mostly fixed equipment that are on deck & not connected with the nature of cargo the vessel is carrying, Thus Winches, Accommodation ladders, Forward house machinery, form a part of this segment 'Winches must include the interdependency of hydraulic power on the ships power systems & explain the criticality of mooring operations. Gantry cranes & hose handling winches are to be addressed in this section.

1.1.6 Galley & Hotel Equipment

Construction and operation of ship HVAC systems, Refrigeration systems, water supply and dosing systems

This section must especially highlight the distribution of three phase low voltage power through the ships LDB's & other arrangements. This must include Isolation

transformers for Galley, earth faults & methods of isolation & identification of the same. The very important aspect of earth faults on the low voltage systems is of critical concern & the need to isolate power supplied to control equipment from LDB systems to be adequately addressed.

1.1.7 Ship Construction

This is a section that is well documented & references must include the relevant sections as regards installations, electrical sensors, outfitting & Vapour concentration ideologies.¹ This section must also cover the ship constructional details as regards hull, outfitting & include one session on stability & the concept of a loadicator with reference to tanks, loading & plimsoll line or other method that details the relevant use of loadicators & stability calculation system. The use of 'on-line' Cargo loadicators is a direct abstraction of the same.

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
1.2	Monitor the operation of electrical, electronic and control systems (continued)	1.2.1 Basic knowledge of heat transmission, mechanics and hydromechanics	1. Lecture by electrical faculty.	20	12	
		1.2.2 Electrical power distribution board and electrical equipment - MSB, shore supply, ESB and normal & emergency lights	3. Practicals in Electronic lab.	4	2	
		1.2.3 Instrumentation, alarm and monitoring systems – Basic shipboard systems (Engine and deck)	Videos on the equipments & safety procedures from Video Tel.	4		
		1.2.4 Electrical drives		2		
		1.2.5 Technology of electrical materials		2		
		1.2.6 Electro-hydraulic and electro-pneumatic control systems		6	4	
		1.2.7 Appreciation of hazards of high voltage		2		

¹Pump rooms, duct keels, hold spaces, aft trunks & areas that especially concern electrical installations to be discussed in relevant detail

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
				Total = 58 Hrs		

Explanation:

1.2.1 Basic knowledge of heat transmission, mechanics and hydromechanics

Study of Mechanics and Thermodynamics – should cover at least following.

Basics of heat transmission: processes of heat transmission

Basics of mechanics: scalar and vector quantities, graphical representation of force, resultants, moment of force, equilibrium

Explains basic information concerning hydromechanics: hydrostatics, hydromechanics and fluid flow

1.2.2 Electrical power distribution board and electrical equipment

Effect of ship's environment on electrical power distribution;

General layout of electrical power systems on ships; Requirements for cables used on board ships.

MSB – Electrical layout, associated safeties, constructional features (may discuss SOLAS requirements). ESB – Link with MSB (safety interlock), purpose, load distribution from ESB. Discuss about normal and emergency lights distribution, difference with respect to distribution followed at shore.

1.2.3 Instrumentation, alarm and monitoring systems

Construction of distributed monitoring systems for engine room and for deck

Methods of communication with smart transducers using HART protocol, explain principle of communication with programmable transducers using Foundation Fieldbus or Profibus PA protocol.

Explain purpose, structure and functions of fire detection systems (different kind of sensors for fire, smoke, temperature)

Monitoring methods of explosive conditions in engine crankcase (oil mist detection systems for bearings' temperature measurement)

Describes the principle of operation of photoelectric oil detection systems

1.2.4 Electrical Drives

Starter panels including DOL, star-delta, auto-transformer & soft starter. This must be related to "Motor Control Centres" Here the focus must be on Group starter panels, their protection techniques for motors & broadly discuss the general formats available.

- Direct-On-Line Starter
- Star-Delta Starter
- Auto-Transformer Starter
- Starter with Drives (Soft Starter)

1.2.5 Technology of Electrical Materials

This section deals with knowledge about electrical materials; i.e. conductors, insulation materials, Insulation Class, Hot spot temperatures & how this knowledge is applied to approvals for electrical specifications. (IP rating, Ex rating, drip proof construction).

Here the section on cables (electrical cables) must be adequately addressed with candidates being advised on the different types of cables & how to read format. (TPYC, PPC etc).

Creepage, Insulation breakdown & some SF6 components for high voltage systems must be outlined. This section is to also cover in depth knowledge on 'hot-spot' temperatures, insulation class & continuous rating of machinery.

1.2.6 Electro Hydraulic & Pneumatic Control systems

Fluid systems, Nomenclature, function of primary components, pump displacement (Hi – Lo system for crane) must be covered in this section of the hydraulics session.

The extent should be indicated in the lesson plan with greater emphasis on practical's.

The sessions must include the following

- Directional control valves
- Proportional control valve (mechanical & electronic)
- Working circuits for pneumatics & hydraulics
- Power concerns & application differences

Note: It may not be possible to discuss in detail the working of a crane with regard to the circuits (hydraulic) but the key movements & their prime circuits must definitely be covered such as, slewing, luffing & hoisting motions. Counterbalance valves, unloading valves & pressure regulating valves are key components that must be discussed & working demonstrated.

Electro- Hydraulic & electro pneumatic control systems

The principle *of directional control valves* is a section that is directly related to this topic. It is recommended that this section be done as a workshop session for best effect. Trainers for this are available in the market & could be easily built for the specific purpose. Power packs, control valves should be suitably addressed. (e.g. types of pumps – pressure control valves, sequence & counterbalance valves, unloading valves) [course length does not permit the study & application of these valves]

Hydraulics – Single & double acting actuators for valves or other motion. Cylinders & the concerns when lifting loads. This section is best addressed on trainers. Reading of hydraulic diagrams & description of the working of a Hi-Lo system for cranes is most essential

Note: In the Cargo machinery section – Cargo valves, valve positioners are important topics that may be brought in after this section has been dealt with here.

Note: Diagrams must be used here to explain the control console connections & interconnections Micro-switches & IS relays in circuit for cargo valve hydraulics is a good example. This will help the candidates to build circuits using 4/3 or 4/2 valves with rotary or linear actuators.

Pneumatics – Circuits for pneumatic controls, FRL units, small circuits addressing speed / velocity circuits, building a platform to study manoeuvring system for the main engine. Lateral learning for control systems (this area not addressed anywhere in the course).

1.2.7 Appreciation of hazards of High Voltage

Explain the possibility of the electrical shock by the electrostatic charge

Physiological effects of electricity on human body

Explains the difference of electric shock caused by low and high voltage

Explain meaning of warning signs

Understands the possibility of essential lengthening and migration of electric arc at the voltages above 1kV

Explains basic parameters of electric arc: the temperature, the energy; high resistance arc interruptions and low resistance arc interruption;

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
2	Monitor the operation of automatic control systems of propulsion and auxiliary machinery	Main engine / Auxiliary machinery controls 2.1 Explain controls systems used for propulsion machine and auxiliary machines.	1. Lecture by electrical faculty. 2. Practicals in Electronic lab 3. Hands on skill in the workshop on main engines. 4. Videos on the equipments & safety procedures from Video Tel.	10	6	
		2.2 Operational requirements in electrical domain		4	4	
				Total = 24 Hrs		

Explanation:

2.1 Description of electrical controls on the Main Engine

The purpose of this section is to highlight the electrical / electronic control of the main engine. For this the following must be sequenced in a manner listed below

Knowledge of the support plant of the Main Engine

Engine Control system

- a) Pneumatic Manoeuvring system in conceptual I/O level
- b) Electronic / Mechanical Governor for speed control (alternatively CPP control)²
- c) Troubleshooting in the electrical domain of engines
 - i) Assuming 7 hours are spent on the practical's, this module must make a mention of 'Process Control'. Other topics will of course be covered but temperature & pressure control systems must be addressed in this section. It is recommended that PID controllers be demonstrated in a Lab space for function. Alternatively, the PID control system can be covered through simulators.
 - ii) The complex nature of electrical systems on the main engine necessitates that 'Governor' system be addressed here. With the trend to shift to 'Electronic Governors' the need for addressing the controls section is more relevant.
 - iii) Engine Shutdown / slowdown systems & testing of these sections is a crucial area for practice & demonstration
- d) Note : 3.2 section extends this point further

2.2 Troubleshooting in the electrical domain of engines

Extension of section above with the inclusion of manoeuvring systems logic with pneumatic valves & bridge control must be covered in this section.

This section must cover the shutdown & slowdown functions & troubleshooting related thereto.

2.3 ODME / OWS

Knowledge of calibration & operation of the OWS, alarm set points & testing routines with oil dump probe etc must be covered here. Formats of change over valves , their operation & working must be discussed. It is recommended to have a practical demonstration of the OWS.(through lab sessions, field trips or ship in campus)

ODME – general principles, inputs to the ODME computer such as ppm, flow, speed & manual entry of cargo volume to be discussed. Changeover system for overboard & slop recirculation valve to be covered. The computation of the values may be covered as a part of Competency 13, "Ensure compliance with pollution prevention requirements'

2.4 MGPS

Marine Growth prevention system – Installation & operational detail must be covered in this section with working principles.

2.5 ICCP

Impressed cathodic protection systems. Concerns & safety. Eletrostatic & bonding concerns when making alongside. Installation & operational detail must be covered in this section with working principles.

²Process control systems & governor as applied to Generators should be addressed before this section is covered
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Competency No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
3	Operate Generators and Distribution Systems	Generator Controls	1. Lecture by electrical faculty.	2	4	
		3.1 Starting a generator				
		3.2 Paralleling, load sharing and changing over generators	2. Practicals in Electronic / Electrical lab/ Engine control Room 3. Hands on skill in the workshop on Generators.	2	4	
		3.3. Generator protection systems	4. Hands on Skill on Switch Board Simulator in Electronic lab	3	2	
		3.4 Switch board protection systems	4 Videos on Video-Tel	3	2	
				Total = 22 Hrs		

Explanation:

3.1 Starting a Generator

The operational concerns of starting & running a generator having been discussed the focus must be on the 'Engine Management system' of the Alternator engine; starting valve, timing for starting valve, forced shut off periods & all other shutdowns.

Alternator system must include the following in this section

- Space heaters
- Temperature monitoring
- Passive components of the Alternator (Reactor, compensation element etc)

3.2 Paralleling, load sharing & changing over generators

- Alternator circuit schematic with excitation systems (at least two types to be discussed)
- AVR function & concerns (adjustments are very critical & the significance to be properly conveyed)

- Reactive Loading & the role of AVR & Governors
- Phase sequencing & paralleling generators with dark lamp method
- Hands on skill section on ACB's most relevant & it is recommended that the institute should have an ACB & be able to demonstrate & train the candidature in its basic operation & maintenance aspects
- The practical's must include meggering (insulation resistance) routines of alternators, space heaters, alignment & synchronizing & paralleling circuits on the Main Switchboard

3.3 Generator protection systems

Explains principles of operation of generators with specific reference to:

Generator winding and main exciter winding protection, bearings lubrication, air filters cleaning procedures;

3.4 Switch board protection systems

Principles of operation of equipment installed in main switchboard, emergency switchboard and distribution panels with specific reference to:

Circuit breakers, tripping devices, contactors, relays, thermal relays, fuses, busbars, terminal strips, measuring instruments, PLC controllers and monitoring panels, heating and ventilation circuits

Reverse Power

In this module the candidates must be conveyed the relevance of 'Reverse power' & the protection techniques must be covered. The faculty is to adequately convey the concept of absorbing power & what the 'motoring' effect is.

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
4	Operate Computers & Computer Networks on Ships	Networks & Computers	Lectures by specialised faculty			
		4.1 Main features of data processing		2	2	
		4.2 Construction and use of computer networks on ships - communication	Practical's in appropriate laboratory / workshop	6	6	
		4.3 Bridge-based, engine-room based and commercial computer use		6	6	
		4.4 PMS		4	4	
		4.5 Engine Monitoring Systems		2	2	
				Total = 40 Hrs		

Explanation:

4.1 Main feature of data processing & Computer Usage

Basic knowledge of data types and data description in digital systems;

Knowledge of Computer programs; the program applications may be for the purposes of word processing, presentation or calculation in spreadsheet format.

For e.g. Microsoft Office or Open office packages

Restoring systems, reformatting & installation of software must be addressed in this section.

4.2 Construction and use of computer networks on ships

This section aims to familiarise the candidate with the concept of networks & distribution of a LAN or similar system. The course content must include the following sections.

- i) Ether net systems
- ii) Switches & hubs
- iii) Server (what is a server & what role it plays)
- iv) Background backup software

4.3 Bridge based, Engine room based and commercial computer use

Bridge based computer systems: Integrated Navigation Systems, Voyage Data Recorder, Dynamic Positioning System, fuel consumption optimizing system, load and hull - stress calculation systems. Communications PC for Sat B interface, portal & company policy on startup.

E mail or GMDSS knowledge. Candidates must be given an example installation & explained the various methods by which the ship's internal & external communication is facilitated. The SAT – M, Mini-M & other derivatives of the GMDSS interpretation must be discussed.

4.4 Planned maintenance systems

Standard PMS packages such as AMOS or Consults or RAST etc are to be covered in this module. The candidate must understand the significance & be able to contribute to the overall PMS in relation to the profile.

4.5 Engine monitoring systems

Knowledge or awareness about external interfaces for the purposed of data collection & monitoring by third party vendors such as Engine manufacturers or predictive maintenance systems or condition based monitoring systems are to be highlighted in this section.

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
5	Maintenance & repair of electrical & electronic equipment	Electrical Practices & Safe Working 5.1 Electrical Safety practices on board ships	Lectures Workshop	2	4	

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
		5.2 Maintenance and repair of electrical systems & equipment and switchboards, AC and DC motors, systems and equipment	Practical (industrial visit /Ship in campus / ship visit)	4	8	
		5.3 Detection of electric malfunction, location of fault and measures to prevent damage		2	2	
		5.4 Construction & operation of electrical test & measuring equipment		2	2	
		5.5 Function, configuration and performance test of monitoring systems, automatic control devices, protective devices		2	2	
		5.6 Interpretation of electrical and electronic diagrams		2	4	
				36 Hrs		

Explanation:

5.1 Electrical Safety practices on board ships

Explain safety hazards which can be present when working on shipboard electrical equipment: electric shock, arc blast, transient overvoltage, movable (rotating) parts, environmental factors like high temperature, humidity, water, fuel, steam leaks, rain, wind, ship rolling or pitching
Selection of proper Personal Protective Equipment (PPE) to be used when working on various shipboard electrical equipment: coveralls, safety or insulation shoes, safety glasses or full face shield, insulation gloves, insulation mates, hearing protection equipment, safety harness, hard hat, rubber apron, dust mask

Discuss Lockout - Tagout procedures, risk assessment and work permit systems. Explain use of fixed and portable earthing devices and how to apply them safely.

Explain safety precautions when performing various maintenance or repair tasks on ship elevators, like releasing people trapped in elevator, checking of safety circuit and other safety functions, working with landing door open

5.2 Maintenance and repair of electrical systems & equipment and switchboards, AC and DC motors, systems and equipment

Describe the principle of major and periodic overhaul, periodic and daily maintenance, survey after damage with the use of technical documentation. Explain the principle of organization of maintenance, repairs and describes how to document maintenance, repairs and trials. Describe how to manage maintenance intervals, repairs and spare parts in the computer system (e.g. AMOS)

Principles of maintenance and repair of equipment installed in main switchboard, emergency switchboard and distribution panels with specific reference to:

- circuit breakers
- tripping devices
- contactors
- relays
- thermal relays
- fuses
- busbars
- terminal strips
- measuring instruments
- PLC controllers and monitoring panels
- heating and ventilation circuits

Explains principles of maintenance and repair of generators with specific reference to:

- generator winding condition
- main exciter winding condition
- bearings inspection
- air filters and cleaning procedures
- automatic voltage regulator inspection
- exciter, rotating rectifier and residual voltage check
- main terminal connections

Maintenance and repair of the AC and DC electric motors and systems:

- Various motors
- Batteries of different types
- Frequency converters, rectifiers and backup-UPS
- Electronic tank content measuring systems
- Electronic diagnostic systems for testing diesel engine

5.3 Detection of electric malfunction, location of fault and measures to prevent damage

Explain the methods for detection of electrical failures, instruments and methods of use. Explain importance of protection systems. Practical demonstration of locating faults as far as possible.

5.4 Construction and operation of electrical test and measuring instruments

Explain construction and operation principle of analogue and digital instruments for basic electrical quantities measurements, as voltage, current, frequency, power, time and phase displacement

Basic rules for using and connection of instruments to the electrical circuit for measurement of voltage, current, frequency and power

Interpretation of the results from oscilloscope

Theory and practical used of insulation test equipment both fixed and portable.

5.5 Function, configuration and performance test of monitoring systems, automatic control devices, protective devices

Explain how and why to connect simulators or calibrators in place of sensors to the terminals of PLC or other type of monitoring system.

Effect of capacity and resistivity of long cables on measurement accuracy

Explain the function of extension wires in the temperature measurement line with thermocouple

Use of pressure calibrators, use of 4-20 mA calibrators

Explain the maintenance of fire detection systems

5.6 Interpretation of electrical and electronic diagrams

Explain the basic differences between the following electrical diagrams:

- block
- system
- circuit
- wiring (connection)
- view (layout)

Discuss common symbols used in electrical drawings, explain how to read drawings, explain how to find fault using electrical wiring diagrams

On a given electrical circuit diagram ,carries out logical procedure to detect the location of an earth fault, using insulation testing instruments

Describes how to take measurement before and after the running of the device in order to determine its condition

Com pete ncy No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
6	Use English in Written & Oral Form	Communication Skills 6.1 Adequate knowledge of the English language to enable the officer to use engineering publication & perform officers duties	1. Lectures 2. Continuous interaction between faculty & students to enhance communic ation skills. 3. Marlins English speaking course	30		
				30 Hrs		

Com pete ncy No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	

Com pete ncy No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
7	Use Internal communication systems	Communication Skills 7.1 Operation of all internal communication systems on board including automatic phones, sound powered phone etc	Theoretical description of types of internal communication systems	6		
				6 Hrs		

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
8	Maintain and repair automation and control systems of main propulsion and auxiliary machinery	8.1 Temperature sensors	1. Lecture by electrical faculty. 2. Practicals in Electronic lab.	1	3	
		8.2 Pressure sensors	3. Hands on skill in the workshop on main engines controls/ auxiliary machineries controls.	1	3	
		8.3 Level sensors		1	3	
		8.4 Flow sensors	4. Training on industrial automation/instrumentation at reputed automation institutes like Honey-well.	1	3	
		8.5 Maintenance and repair of actuators, adjustment of controllers	5. Videos on Instrumentation & automation.	3	5	

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
		8.6 Appropriate electrical and mechanical knowledge and skills of safety and emergency procedures, safe isolation		8	8	
		8.7 Introduction to PLC/ SCADA/ & correlate it to their applications for engine controls & auxiliary machinery control		5	5	
		8.8 Fault diagnosis & rectification procedure of PLC/ SCADA based systems		5	5	
				60 Hrs		

Note: Although this section is in detail & needs greater depth of understanding than can be afforded by the period that this course is run for the following are to be explained. While this section broadly covers the key aspects, as mentioned earlier, the control systems aspects involve far greater involvement & relevance in general ship keeping. The use of pneumatic / electronic PID controllers & the control loops could be discussed.

- Inert Gas control system includes split ranging,
- the use of control valves & calibration of i/p converters & valve positioners.
- Boilers have FD fan vane actuators or level control valves
- the concept of single element control & feed forward to be addressed at least cursorily.³

Explanation:

8.1 to 8.4 Sensors – Temperature, pressure, flow and level.

- Temperature sensors – PT 100, thermocouples & upstream instrumentation
- Pressure transmitters, pressure switches etc
- Flow devices - Dp transmitters with orifices

³**Note:** Various sources are available for contribution with more details on these sections & even give a general design for the PLC trainers but this is more extensive. Introduce protocols for data exchange & how these are effected on ships with a central processing unit.

8.5 Controllers, adjustment of controllers, maintenance and repair of actuators,

Explain control action, PID controllers, multiple loop control systems, types of actuators, maintenance and repairs of actuators.

8.6 Appropriate electrical & mechanical knowledge & skills, safety & emergency procedures. Safe Isolation of equipment & systems

- a) This applies to general knowledge about combustion engines, steam plants etc & the methods & practices to isolate equipment
- b) Emergency operations of equipment & understanding the limitations

8.7 PLC / SCADA – Introduction & Applications

- a) General introduction to ‘Programmable Logic Controllers’
- b) Functions & Applications on ship board applications

8.8 Fault Diagnosis (PLC , Embedded systems)

- a) Troubleshooting PLC based system by querying the I/O interface & understanding analog manipulation in PLC's/ embedded systems

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
9	Maintain & repair Bridge Navigation Equipment & ships communication systems	Bridge Electronics Equipment	Lectures Workshop	7	5	
		9.1 Introduction to GMDSS				
		9.2 RADAR – Maintenance & brief theory	Practical (industrial visit / Ship in campus / ship visit)	5	5	
		9.3 UMS operation – BNWAS, Dead Man's Alarm & Watch keeper alarms systems		8	12	
				42 Hrs		

Explanation:

Appraised him with navigation terminology and introduce to bridge navigation and communication equipment such as

GPS, GMDSS, RADAR, ECDIS, Gyro compass, speed log, echo sounder, auto pilot, Voyage Data Recorders, Navigation Lights, Search Lights, Ship Horns and Sound Signal Systems, Wind Trackers.

RADAR:

Explain radar principle of operation, main components of radars and their location on board, describes their function.

Explain how to find and use radar diagnostic functions and troubleshooting documentation
radar performance monitor, how to change magnetron assembly and tune the radar after repairs.
Periodic maintenance for radar system

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
10	Maintain and Repair electrical, electronic and control systems of deck machinery and cargo handling equipment	Defect Diagnosis of auxiliary machineries 10.1 Maintenance and repair of electrical, electronic and control systems of deck machinery	1. Lecture by electrical faculty. 2. Practicals in Electronic lab	4 Hrs	3 Hrs	
		10.2 Maintenance and repair of electrical, electronic and control systems of cargo handling equipment	Hands on skill in the workshop on auxiliary machineries controls.	4 Hrs	3 Hrs	
		10.3 Electrical and electronic systems operating in flammable areas	Ship visit for system familiarization.	2 Hrs	2 Hrs	
		10.4 Safety and emergency procedures		3 Hrs	3 Hrs	
				24 Hrs		

Note: A general section on electronics, calibration & scaling is more in keeping with the competency & must be included here. Demonstrations of pressure monitoring by way of building a loop of pressure transmitter, power supply & display unit or similar being included will greatly enhance the understanding of deck & cargo supervision systems.

Explanation:

10.1 Windlass & Mooring Winches

Explain principle of operation and names main components of electrical, electronic and control systems of deck machinery, with specific reference to:

- mooring winches with manual and automatic control
- windlasses with manual and automatic control
- accommodation ladder winches
- lifesaving boat winches
- hatch covers winches

Explain principles of routine inspection, maintenance and repair of deck machinery equipment, with specific reference to:

- power supply
- cabling and grounding

- switchboards, terminal strips, connectors
- control panels
- PLC outputs and inputs
- electrical motors and brakes
- power electronic converters
- limit switches
- safety devices
- electric control of hydraulic pumps, motors, valves and brakes
- ventilation, heating

Cargo valve Automation with indication in CCR. Emergency override operation for these valves must be covered in this section

10.2 Cargo handling equipment

Deck Cranes, Reefer containers, Cargo systems and equipment on Tanker, Gas carriers. Calibration & setting of alarm set points

Alarm consoles in CCR (similar to ECR), Alarm inhibit functions, Analog & digital handling of peripheral devices, Adjusting set points or understanding the limitation of the designed Alarm systems which does not permit set point adjustment

10.3 Electrical and electronic systems operating in flammable areas.

Explain parameters of flammable substances as:

- LEL, UEL
 - temperature class
 - split on groups and subgroups
 - split hazardous area on zones or divisions
 - explain explosion-proof type of protection of electrical equipment for gas-explosive area
- Intrinsic barrier safety & Explosion protection techniques

10.4 Safety and emergency procedures

Safety precautions while working in confined spaces, hot work, working at height, working in hazardous area.

Fixed Gas detection systems

This section must include, Gas sampling systems, calibration & knowledge of HC content monitoring for fixed gas detection systems. Concerns for venting arrangements for the same to be highlighted & candidates made aware of the risks & HSE concerns.

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
11	Maintenance & repair of control & safety systems of Hotel Equipment.	Hotel Electrical Systems 11.1 Accommodation power system	Lectures Workshop Practical (industrial visit /Ship in campus / ship visit)	2	4	
		11.2 Galley equipment		4	4	

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
		11.3 Ships refrigeration system		4	6	
		11.4 Air conditioning		4	6	
		11.5 Laundry equipment		3	3	
		11.6 Electrical Fault Finding		2	6	
				48 hrs		

Explanation:

11.1 Accommodation power system

Power distribution & Earth fault location & tracing are to be addressed in this section.

440 power requirements in the accommodation for domestic use appliances to be detailed to the candidates giving specific details on safety & wiring practices.

11.2 Galley equipment

Heating plates, Ovens & galley air extraction systems are to be covered in this module.

11.3 Ships refrigeration system

Refrigeration system basics, Control panel for refrigeration systems & defrosting⁴ Refrigeration & AC Plants including the HVAC topics must be covered. For this the candidates should be able to draw (at bare minimum) the process instrumentation diagram for the installation in its basic form & identify the thermostatic control for the rooms. Further, “capacity regulation” may be included. The MP22 (oil pressure shutdown) is crucial for ETO’s & must be included in the syllabus. The starter or control panels functions to be demonstrated by means of a trainer if possible. **“Charging”** the system with refrigeration gas & **“pumping down”** the system may be considered in the practical’s.

11.4 Air conditioning

Basics of Air conditioning, Filter changing, safety & concerns, Air Re-circulation issues & concerns as regards port entry for tankers must be covered in this section of the course. For this the candidates should be able to draw (at bare minimum) the process instrumentation diagram for the installation in its basic form & identify the thermostatic control for the rooms. Further, “capacity regulation” may be included.

11.5 Laundry equipment

Washing machines, heaters & driers, Concerns when dealing with equipment in moisture prone areas are topics of discussion in this section of the course.

11.6 Electrical Fault finding

⁴This section should be kept rudimentary in keeping with the time frame allotted for the course

Standard fault finding & troubleshooting procedures on marine auxiliary machinery, safety equipments, refrigeration galley equipment must be followed. Special attention must be paid to find out earth leakages (24 V/ 220V/ 440V systems).

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
12	Application of leadership and Team working Skills	12.1 Introduction to management	Lecture Workshop Practical Industrial visit/ship in compass / Ship visit	2		
		12.2 Related conventions and national conventions		2		
		12.3 Tasks and workload Management		10		
		12.4 Effective resource Management and decision making		10		
				Total = 24 hrs		

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
13	Ensure Compliance with pollution prevention requirements	13.1 The precautions to be taken to prevent pollution of the marine environment - MARPOL 73/78 Annexes I to VI - Conventions and legislation adopted by various countries	Lectures Workshop Practical (industrial visit / Ship in campus / ship visit)	10		

Com pete ncy No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
		13.2 Antipollution procedures and associated equipment – Control of discharge of oil - Oil Record Book (Part I and Part II) - Shipboard oil pollution emergency plan (SOPEP), -Shipboard marine pollution emergency plant (SMPEP) and Vessels Response plan (VRP) -Operating procedures of anti pollution equipment, sewage plant, incinerator, comminutor, ballast water treatment -Volatile organic compound (VOC) management plan, Garbage Management system, Anti-fouling systems, Ballast water management and their discharge criteria		11		
		13.3 Importance of proactive measures		2		
				23 Hrs		

This section covers the vital information that the ETO must have as regards the IOPP, MARPOL requirements. While MARPOL requirements are discussed with the candidates the IOPP section must include the details as related to OWS, ODME etc. (Calculation of discharge quantity etc in the ODME, OWS 15 ppm testing etc & ‘magic pipe’ crime & punishment to be conveyed to the candidates)

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
14	Prevent, Control & fight Fire on board	Fire Detection Systems 1.4.1 Fire Detection & alarm System	Lectures Workshop Practical (industrial visit / Ship in campus / ship visit)	2	2	
		14.2 Type of Fire sensors		1		
		14.3 Hazardous zones & areas		1		
				6 Hrs		

Explanation:

14.1 Fire Detection & alarm System

This section must include the following

- Fire Detection & control strategy
- Fire Detector, loop faults, termination devices for loops, earth faults of loops'
- External interface for alarm bells & alarm system, door closers stc.
- Fault isolation & loop isolation – concerns & awareness
- Procedures

14.2 Type of Fire sensors

The candidates must be familiarized with the following type of sensors & detection instruments.

- Ionization type
- Rate of Rise type
- Heat type sensor
 - Testing methods, routines & logs

14.3 Hazardous zones & areas

Vapour concentration diagrams for ship indicating the presence of hydrocarbons (possible). Thus the introduction of designated 'Hazardous' zones as in the ship's bibliography must be outlined to the candidates

- Arrangements for lighting based on Vapour concentration diagrams
- Explosion protection techniques
- Ex(d), Ex(ia), Ex(p), Ex(n) etc
- Intrinsic Barrier installations
- Flame proof motors on Deck & their operational & maintenance concerns

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
15	Operate life-saving appliances	Completion of PSCRB under Section A-VI/2		As applicable		

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
16	Apply medical first aid on board ship	Completion of PSCRB under Section A-VI/4		As applicable		

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours		Reference
				Th	Pr	
17	Contribute to the safety of personnel and ship	Completion of PSCRB under Section A-VI/1		As applicable		

ANNEX III**GUIDELINES & ADDITIONAL INFORMATION FOR ETO COURSE**

DESCRIPTION OF THE EQUIPMENT	SPECIFICATION OF THE EQUIPMENT	MACHINE TO MA RATIO.
Ammeter analog.	Upto 500 V AC	1:1
Voltmeter analog.		1:1
Multimeter analog.		1:1
Multimeter digital.		1:1
Megohm meter	500 Volt	1:8
Megohm meter 5000v	5000 Volt or highere capacity	1:12
Frequency meter.	60 Hz	1:4
Main contactor auxiliary Contactor	Telemecanique / Mistubhishi or equivalent	1:1
Overload relay.	Omron / Mitsubishi or equivalent marine approved	1:1
Timer relays.	type	1:1
MCCB, marine approved		1:12
ACB of at least 300 KVA		1:12
Practical working bench with the following options: Start button Stop button Contact points Indicating lamps.		1:1
Main contactors		1:1 As per the exercise
Storage battery	12 Volt or above (alkaline/ lead acid)	
Transformers	Step up, step down & isolation transformer	1:12
Ex. proof/ Intrinsically safe equipments	Exi, Exd, Exia/ b Marine approved type	1:12
Lighting equipment with assembly station		1:3
Various types of Lights (Ex equipment, junction light fittings, halogens & Mercury vapour installation)		1:3

DESCRIPTION OF THE EQUIPMENT	SPECIFICATION OF THE EQUIPMENT	MACHINE TO MA RATIO.
Auxiliary contactors		1:1 As per the exercise
1.5 sq mm Single core cable		
Combination pliers		1:1
Wire stripper		1:1
Wire crimper		1:1
Marine Cable crimper		1:12
Assorted cables of marine approved type, multi core & network cable	Multi core marine approved, armoured, PVC insulated. Network cable CAT5 Type	
Assorted Electrical screw drivers.		1:1
Brushless alternator 300 KVA or more		1:12
Feeler gauge		1:12
Rotary rectifier unit.		1:12
Live main switch board with at least two generators controls and synchronizing panel. 440 Volt or above		1:12
Live Emergency switch board 440 Volt with tie breaker function		1:12
Squirrel cage induction motor.	10 Kw or more	1:8
Lifting chain block and gears		1:8
Electronic soft starter 3 KW, 3 phase connected into a starting circuit.	Telemecanique or equivalent, marine approved.	1:12
Variable frequency drive three phase connected into a starting circuit.	Telemecanique or equivalent, marine approved	
Bow thruster panel or equivalent	Relay type / electronic type	1:12
Fuel oil booster pump for control starter panel No.1 and No.2 or any equivalent thereof		1:12
Air condition control starter panel.		1:12
Air compressor control starter panel.		1:12

DESCRIPTION OF THE EQUIPMENT	SPECIFICATION OF THE EQUIPMENT	MACHINE TO MA RATIO.
Electronic starter controller for starting 3 phase induction motor. Of minimum capacity of 3KW 440 volt three phase motor.	Telemecanique or equivalent, marine approved	1:12
Variable frequency drive for starting Electrical motors	Minimum capacity of 7.5 KW 440 volt or 7 KW three phase squirrel cage induction motor or more capacity.	
High voltage switch board panel with 6.6 KV vacuum circuit breaker / sf6 marine approved type.	KV vacuum circuit breaker / Gas filled breaker.	1:12
Intrinsically safe zener barrier circuit modules.		1:12
Assorted electronic components.		1:1
PNP, NPN Transistor, power transistor, unijunction transistor.		1:1
Assorted PCBs of marine equipments used onboard from Radar, Alarm monitoring system.		
Soldering iron		1:1
Bred Board		1:1
FET		1:1
CRO		1:3
Function Generator		1:3
SCR Electronic components for building up Electronic circuit with the given PCB		1:1
OP-AMP PCB Electronic components to build OP-AMP Circuit with the given PCB		1:1
Marine Radar with trans-receiver and scanner	Marine approved	
Telephone instruments & EPABX		1:12
Programmable Logic Controller	Telemecanique or equivalent marine type	
PLC Controlled panel	Working panel of Boiler / Air condition plant / any	

DESCRIPTION OF THE EQUIPMENT	SPECIFICATION OF THE EQUIPMENT	MACHINE TO MA RATIO.
	other automated system extensively used onboard.	
P I D Controller used in a marine system	NAKAKITA / ROSMOND or equivalent, marine approved.	
Practical: Generator control panel circuit exercise	Circuit drawing	
Practical: Generator control panel circuit reading exercise (trouble shooting)	Circuit drawing	
Boiler panel circuit Trouble shooting.	Circuit drawing and boiler panel, relay controlled or PLC Controlled or appropriate marine boiler panel	
Thermocouple and PT.100 Calibration	Thermo couples calibration kit upto 300 Deg C	1:4
Pressure Transmitter Calibration	Kit for testing Pressure transmitter vacuum and positive pressure.	1:12
Practical session on the oil mist detector	Oil mist detector of approved marine type	1:12

SPECIFICATION OF MINIMUM STANDARDS OF COMPETENCE FOR ELECTRO-TECHNICAL OFFICERS

FUNCTION: ELECTRICAL, ELECTRONIC AND CONTROL ENGINEERING AT OPERATIONAL LEVEL

Column 1	Column 2	Column 3	Column 4	Column 5		Column 6
Competency No.	Competence	Details	Methodology	No. of Hrs		Reference
				Theory	Practical	
1.1	Monitor the operation of electrical, electronic and control systems	Ship board Machinery Familiarization: 1.1.2 Prime movers including main propulsion plant.	4. Lecture & Workshop Practical exercises on auxiliaries.	5 Hrs.	5 Hrs	Elstan A. Fernandez – Marine electrical Technology – 3 rd Edition Practical Marine Electrical Knowledge Dennis T. Hall
		1.1.3 Engine-room auxiliary machineries - Boiler, incinerators, purifiers, oily-water separators, various types of pumps.	5. Hands on skill in the electronic lab.	5 Hrs.	5 Hrs	
		1.1.3 Steering gear systems	6. Videos on ships Construction / equipments (videotel)	2 Hrs.	2 Hrs	List of Videos from videos from Videotel
		1.1.4 Cargo handling systems		4 Hrs		
		1.1.5 Deck machineries		3 Hrs	1 Hrs	

Column 1	Column 2	Column 3	Column 4	Column 5		Column 6
Competency No.	Competence	Details	Methodology	No. of Hrs		Reference
				Theory	Practical	
		1.1.6 Galley equipment		3 Hrs.	3 Hrs	
		1.1.7 Ship's construction		8 Hrs.		
				Total = 46 Hrs		
1.2	Monitor the operation of electrical, electronic and control systems (continued)	1.2.1 Basic knowledge of heat transmission, mechanics and hydromechanics	2. Lecture by electrical faculty.	20 Hrs	12 Hrs	Reference book?
		1.2.2 Electrical power distribution board and electrical equipment - MSB, shore supply, ESB and normal & emergency lights	3. Practical's in Electronic lab.	4 Hrs	2 Hrs	Elstan A. Fernandez – Marine electrical Technology – 3 rd Edition Practical Marine Electrical Knowledge Dennis T. Hall List of Videos from videos from Videotel Reference boosk as per IMO Model course
		1.2.3 Instrumentation, alarm and monitoring systems - Basic shipboard systems (Engine and deck)	4. Videos on the equipments & safety procedures from Video Tel.	4 Hrs		
		1.2.4 Electrical drives – Add ship specific		2 Hrs		
		1.2.5 Technology of electrical materials		2 Hrs		
		1.2.6 Electro-hydraulic and electro-pneumatic control systems		6 Hrs	4 Hrs	
		1.2.7 Appreciation of hazards of high voltage		2 Hrs		
				Total = 58 Hrs		

Column 1	Column 2	Column 3	Column 4	Column 5		Column 6
Competency No.	Competence	Details	Methodology	No. of Hrs		Reference
				Theory	Practical	
2	Monitor the operation of automatic control systems of propulsion and auxiliary machinery	Main engine / Auxiliary machinery controls 2.2 Explain controls systems used for propulsion machine and auxiliary machines.	5. Lecture by electrical faculty. 6. Practicals in Electronic lab 7. Hands on skill in the workshop on main engines. 8. Videos on the equipments & safety procedures from Video Tel.	10 Hrs	6 Hrs	Elstan A. Fernandez – Marine electrical Technology – 3 rd Edition Practical Marine Electrical Knowledge Dennis T. Hall List of Videos from videos from Videotel Reference book as per IMO Model course
		2.3 Operational requirements in electrical domain		4Hrs	4Hrs	List of Videos from videos from Videotel
				Total = 24 Hrs		
3	Operate Generators and Distribution Systems	Generator Controls 4.1 Starting a generator 4.2 Paralleling, load sharing and changing over generators	5. Lecture by electrical faculty. 6. Practicals in Electronic / Electrical lab/ Engine control Room 7. Hands on skill in the workshop on	2 Hrs	4 Hrs	Elstan A. Fernandez – Marine electrical Technology – 3 rd Edition Practical Marine Electrical Knowledge Dennis T. Hall List of Videos from videos from Videotel

Column 1	Column 2	Column 3	Column 4	Column 5		Column 6
Competency No.	Competence	Details	Methodology	No. of Hrs		Reference
				Theory	Practical	
			Generators.			
		4.3 Generator protection systems	8. Hands on Skill on Switch Board Simulator in Electronic lab	3 Hrs	2 Hrs	
		4.4 Switch board protection systems	9. Videos on Video-Tel	3 Hrs	2 Hrs	
				Total = 22 Hrs		
4	Operate computers and computer networks on ships	Understanding of: 8.1 Main features of data processing	1. Lecture by specialized faculty	2 Hrs	2 Hrs	Elstan A. Fernandez – Marine electrical Technology – 3 rd Edition Practical Marine Electrical Knowledge Dennis T. Hall List of Videos from videos from Videotel Reference books as per IMO Model course
		8.2 Construction and use of computer networks on ships - communication	2. Practical's in appropriate laboratory / workshop	6 Hrs	6 Hrs	
		8.3 Bridge-based, engine-room based		6 Hrs	6 Hrs	

Column 1	Column 2	Column 3	Column 4	Column 5		Column 6
Competency No.	Competence	Details	Methodology	No. of Hrs		Reference
				Theory	Practical	
		and commercial computer use				
		8.4 PMS		4 Hrs	4 Hrs	
		8.5 Engine Monitoring Systems		2 Hrs	2 Hrs	
				Total = 40 Hrs		

5	Maintenance & repair of electrical & electronic equipment	Electrical Practices & Safe Working	1. Lecture.	2 Hrs	4 Hrs	Elstan A. Fernandez – Marine electrical Technology – 3rd Edition <u>Practical Marine Electrical Knowledge</u> Dennis T. Hall List of Videos from videos from Video Tel
		9.1 Electrical safety practices on board ship				
		9.2 Maintenance and repair of electrical systems & equipment and switchboards, AC and DC motors, systems and equipment	2. Practicals in Electronic lab.	4 Hrs	8 Hrs	
		9.3 Detection of electric malfunction, location of fault and measures to prevent damage	3. Videos on the equipments & safety procedures from Video-Tel.	2 Hrs	2 Hrs	
		9.4 Construction and operation of		2 Hrs	2 Hrs	

		electrical test and measuring equipment				
		9.5 Function, configuration and performance tests of monitoring systems, automatic control devices, protective devices		2 Hrs	2 Hr	
		9.6 Interpretation of electrical and electronic diagrams		2 Hrs	4 Hrs	
				Total = 36 Hrs		
6.	Use English in written and oral form	Communication Skills 6.1 Adequate knowledge of the English language to enable the officer to use engineering publications and to perform the officers duties	1. Lecture English faculty.	30 Hrs		Excellent videos on communication skills downloaded from internet / Reference books and publications as per IMO Model course
			2. Continuous interaction between faculty & students to enhance			

			3. communication skills.			
			4. Marlins English speaking course& Videos from Video-tel VOD unit.			
				Total = 30 Hrs		

7	Use Internal Communication Systems	7.1 Operation of all internal communication systems on board Includes automatic phone, sound powered phone and talkback system	10. Lecture by electrical faculty.	2 Hrs	4 Hrs	Elstan A. Fernandez – Marine electrical Technology – 3 rd Edition Practical Marine Electrical Knowledge Dennis T. Hall List of Videos from videos from Videotel Reference books as per IMO Model course
				Total = 6 Hrs		

8	Maintain and repair automation and control	8.9 Temperature sensors	6. Lecture by electrical faculty.	1 Hrs	3 Hrs	

	systems of main propulsion and auxiliary machinery		7. Practicals in Electronic lab.			
		8.10 Pressure sensors	8. Hands on skill in the workshop on main engines controls/ auxiliary machineries controls.	1 Hrs	3 Hrs	
		8.11 Level sensors		1 Hrs	3 Hrs	
		8.12 Flow sensors	9. Training on industrial automation/instrumentation at reputed automation institutes like Honey-well.	1 Hrs	3 Hrs	
		8.13 Maintenance and repair of actuators, Adjustment of controllers	10. Videos on Instrumentation & automation on Video	3 hrs	5 Hrs	
		8.14 Appropriate electrical and mechanical knowledge and skills Safety and emergency procedures Safe isolation of equipment and		8 Hrs	8 Hrs	

		associated systems required before personnel are permitted to work on automation & control systems of main propulsion & auxiliary machineries.				
		8.15 Introduction to PLC/SCADA/ & correlate it to their applications for Engine Controls & auxiliary machineries controls.		5 Hrs	5 Hrs	
		8.16 Fault diagnosis & rectification procedure of PLC/SCADA/based systems		5 Hrs	5 Hrs	
				Total = 60 Hrs		

9	Maintain and repair bridge navigation equipment and ship communication systems	Handling the electronics of bridge equipments (GMDSS) 9.1 Introduction to GMDSS.	1. Lecture by faculty.	7 Hrs	5 Hrs	Practical Marine Electrical Knowledge by Dennis T Hall & Marine Electrical Technology by E. A Fernandez
		9.2 Radar – Theory, maintenance & safety	2. Practicals in Electronic lab/ Navigational lab.	5 Hrs	5 Hrs	
		9.3 UMS Operation – Dead man alarms, Bridge operation, Engine room machinery requirements for UMS, changing over command E/R to bridge watch keeping alarms	3. Practical training on the bridge simulator.	8 Hrs	12 Hrs	
				Total = 42 Hrs		

10	Maintain and Repair electrical, electronic and control systems of deck machinery and cargo handling equipment	Defect Diagnosis of auxiliary machineries 10.5 Maintenance and repair of electrical, electronic and control systems of deck machinery	3. Lecture by electrical faculty. 4. Practicals in Electronic lab	4 Hrs	3 Hrs	Practical Marine Electrical Knowledge by Dennis T Hall & Marine Electrical Technology by E. A Fernandez
		10.6 Maintenance and repair of electrical, electronic and control systems of cargo handling equipment	5. Hands on skill in the workshop on auxiliary machineries controls.	4 Hrs	3 Hrs	
		10.7 Electrical and electronic systems operating in flammable areas	6. Ship visit for system familiarization.	2 Hrs	2 Hrs	
		10.8 Safety and emergency procedures		3 Hrs	3 Hrs	
				24 Hrs		
11	Maintain and repair control and safety systems of hotel equipment	Maintenance of Hotel Electrical Equipment Onboard the vessel 11.1 Accommodation power system	1. Lecture by electrical faculty.	2 Hrs	4 Hrs	Practical Marine Electrical Knowledge by Dennis T Hall & Marine Electrical Technology by E. A Fernandez

		11.2 Galley equipments	2. Practical's in Electrical lab.	4 Hrs	4 Hrs	
		11.3 Ship's basic refrigeration system	3. Hands on skill in the workshop on AC & Ref plants.	4 Hrs	6 Hrs	
		11.4 Ship's Air-conditioning system	4. Practical's on galley equipment in the galley	4 Hrs	6 Hrs	
		11.5 Laundry Equipment	5. Ship visit for system familiarization.	3 Hrs	3 Hrs	
		11.6 Electrical Fault Finding	6. Practical's in workshop	2 Hrs	6 Hrs	
				Total = 48 Hrs		
12	Application of leadership and Team working Skills	12.5 Introduction to management	Lecture Workshop Practical Industrial visit/ship in compass / Ship visit	2 Hrs		
		12.6 Related conventions and national conventions		2 Hrs		
		12.7 Tasks and workload Management		10 Hrs		
		12.8 Effective resource Management and decision making		10 Hrs		

				Total = 24 Hrs	
13	Ensure compliance with pollution prevention requirements	13.1 The precautions to be taken to prevent pollution of the marine environment – MARPOL 73/78	Lecture by Engineering / Nautical faculty.	2 Hrs	Marpol 73/78 with amendments
		13.2 Antipollution procedures and associated equipment – Regulation 26, Annex 1 MARPOL - Anti Pollution equipment		10 Hrs	
		13.3 Importance of proactive measures		2 Hrs	
				Total = 14 Hrs	
14	Prevent, control and fight fire on board	14.1 Fire detection and alarm system	Lecture by Engineering / Nautical faculty.	6 Hrs	Fire Safety at Sea by Dr. James Cowley
				Total = 6 Hrs	
15	Operate life-saving appliances	Completion of PSCRB under Section A-VI/2			

16	Apply medical first aid on board ship	Completion of PSCRB under Section A-VI/4			
17	Contribute to the safety of personnel and ship	Completion of PSCRB under Section A-VI/1			

Flow Diagram

Degree/ Diploma in Electrical Engineering as per the
Para 3 of the guidelines



Approved ETO course of 17 weeks (without high
voltage segment as per **Annex I**) of the guidelines



Not less than 8 months Training with TAR Book on
the ship

Examination by DGS



CoC as ETO (without high voltage segment)



One year sailing experience (on any ship)



ETO course (with high voltage segment as per
Annex II)



CoC as ETO (endorsed for high voltage segment)

Total
of 12
mon
ths

HIGH VOLTAGE SAFETY AND SWITCH GEAR COURSE FOR MANAGEMENT LEVEL , AND ELECTRO TECHNICAL OFFICERS WITH 12 MONTHS SAILING EXPERIENCE

**MANDATORY GUIDELINES FOR TRAINING INSTITUTES
FOR OBTAINING APPROVAL FROM DIRECTORATE GENERAL OF SHIPPING**

TO CONDUCT

**HIGH VOLTAGE SAFETY AND SWITCH GEAR
(MANAGEMENT LEVEL)
COURSE ID: 169**

To avoid unnecessary repetition, reference has been made herein to DGS Order no: 5 of 2016 (Guidelines for the conduct of Post-Sea Training courses) wherever appropriate

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Annexure 1– Course Learning Objectives Annexure 2– Course Outline Annexure 3 – Course Timetable Annexure 4 – Course Certificate Format

BASIC DETAILS OF THE COURSE

1.1. AIMS:

The aim of the course is to provide Marine Engineering and Shipboard Electrical personnel, the necessary education and training in the operation and management of electrical power plants above 1000 volts, to meet the Knowledge, Understanding and Proficiency (KUP) requirements set out in the specific part of the STCW Section A-III/2, Table A-III/2 and Section A-III/3 at the management level and Section A-III/6, Table A-III/6 at the operational level, as given in the STCW convention and code as amended in 2010.

1.2. Objective

This training is applicable to Marine Engineer Officers with relevant Certificate of competency and Electro Technical Officers for the management level course; junior Marine Engineers for Operational level course; working on ships powered by main propulsion machinery above 750 kW and having onboard, electrical installations of above 1000 volts.

The objective of the training is the safe operation and management of high voltage systems onboard and their associated switch gear. The trainee shall be able to understand the HV/LV power systems including statutory regulations, hazards associated with high voltage systems, be able to safely operate and maintain such systems. The trainee shall also be able to perform HV switching operations on a wide range of marine and offshore power equipment, as well as carry out isolation, fault diagnosis and troubleshooting.

2. QUALIFICATION & ELIGIBILITY OF STUDENTS

2.1. Entry standards

The following officers are eligible to attend the Management Level course:

2.1.1 Marine Engineering officers holding as a minimum:

- a MEO Class IV (FG / NCV) certificate of competency and has completed a minimum of 12 months sea going service as a certificated Engineer Officer of watch OR
- a MEO Class II (FG / NCV) certificate of competency OR
- a Dredge Grade II certificate of competency

2.1.2 Electro-technical officers holding as a minimum,

- a Certificate of Competency as "Electro-Technical Officer" issued by the Govt. of India; OR
- a certificate of course completion, having successfully completed an approved ETO Pre-sea training course and has completed approved seagoing service to be eligible for appearing for ETO Certificate of competency examination; OR
- a record of sea going service of not less than 12 months in the capacity of ETO / Electrical Officer / trainee E/O.

2.2. Required attendance:

100% attendance is required for successful completion of the course.

However, in exceptional circumstances, a trainee is allowed absence of up to one day subject to his attending the lectures missed out during the subsequent course at the same institute, within a maximum period of three months. The institute shall keep proper records of such cases.

2.3. Course intake limitations

Maximum 12 trainees per batch.

3. INFRASTRUCTURE REQUIREMENT

3.1. Teaching facilities and equipment

Training center's seeking approval will need to demonstrate availability of suitable facilities for practical, general and theoretical instruction, appropriately equipped with teaching and learning aids and designed to enable each learner to fully engage in the learning process. All facilities must be maintained and where appropriate, inspected and tested in accordance with applicable regulations, current standards and manufacturers recommendations.

A. Classroom

Class room shall be of minimum area as specified in DGS order 5 of 2016, Post Sea Training course guidelines and equipped with a white / black board, overhead / LCD projector / Video player/ PC/Laptop.

B. High Voltage Lab

A laboratory containing the High Voltage equipment for practicals and demonstrations.

The equipment may be installed in the classroom for High voltage course provided that the area is sufficient for both lecture delivery and practical demonstrations.

The teaching aids required are mentioned under paragraph 14.

C. Visit to a High Voltage Facility

The institute shall have a tie-up with a High Voltage electrical facility which is using voltages over 1000V, so that the trainees can be shown live demonstration of energizing the high voltage switchboard and the arcing phenomenon.

This tie-up and visit is not required if the institute can provide high voltage (greater than 1000V) at the bus-bar on the switchboard fitted at the institute.

4. COURSE DETAILS

4.1. Course Duration: 5 days (40 hours) including practical and assessment

4.2. Course Outline: As per Annexure 2

5. HOLIDAYS

5.1. Sundays shall be holidays.

5.2. Independence Day (15th August) and Republic Day (26th January) shall be compulsory holidays.

5.3. Students shall normally enjoy the holidays observed by the Government of the state in which the institute is located.

6. FACULTY REQUIREMENT

6.1. Qualifications and experience of Training Faculty:

6.1.1 Course In-charge shall

- hold Certificate of competency MEO Class I (FG) issued or recognized by the Government of India, AND
- have not less than 5 years of sea going service onboard merchant vessels above 3000 kW, AND
- has undergone an approved High Voltage Safety and Switch Gear management level course and / or High Voltage trainer's course.

6.1.2 The faculty shall

- Hold a Certificate of competency MEO Class I (FG) issued or recognized by the Government of India, AND
- Have not less than 4 years of sea going service onboard merchant vessels above 3000 kW, AND
- has undergone High Voltage Safety and Switch Gear course and / or High Voltage trainer's course

OR

- Qualified as Electrical Officer and having not less than 6 years of sea going service as Electrical officer on Merchant ships; AND has undergone High Voltage Safety and Switch Gear management level course and / or High Voltage trainer's course

OR

- B. Tech/B.E. or equivalent degree in Electrical Engineering with not less than 1 year High Voltage industrial experience.

OR

- Indian Navy Officers / Chief Petty Officers from electrical branch with not less than 6 years experience on Naval ships; AND has undergone High Voltage Safety and Switch Gear management level course and / or High Voltage trainer's course

6.2. Training of Trainers & Assessors Course:

As per DGS Order no: 5 of 2016.

6.3. Visiting faculty:

Qualifications and experience of visiting faculty members should be the same as that of full time faculty as specified above.

6.4. Age limit for regular faculty members:

As per DGS Order no: 5 of 2016.

7. FACULTY TEAM

7.1. Not less than two faculty, of which one is the course-in-charge

7.2. Minimum of 50% of the entire portion must be covered by full time faculty.

8. COURSE DURATION

A total of 40 hours of lectures practical training and assessment for Management Level.

9. ASSESSMENT

To be deemed pass in the course, the student shall meet the following requirement.

1. Minimum classroom / practical session attendance required is 100%. However relaxation of attendance may be granted in exceptional circumstances as per prevailing DGS guidelines.
2. Assessment shall be conducted by way of a written test.
Objective Type theory paper: Pass Percentage 50%. Practical exercises / demonstration may also be one of the assessment methods.

Assessment must be organized so that learners can, through demonstration and examination, show that they meet the competence requirement as specified in STCW Tables A-III/2 and A-III/6 criteria for evaluating competence in column 4 of the tables.

The assessment system, methods and practice must be valid, reliable and authentic.

10. QUALITY STANDARDS

As per DGS Order no: 5 of 2016.

11. INSPECTIONS

As per DGS Order no: 5 of 2016.

12. COST OF INSPECTIONS

As per DGS Order no: 5 of 2016.

13. FEES TO GOVT.

As per DGS Order no: 5 of 2016.

14. TEACHING AIDS

A. Teaching Aids

- A1 OHP or LCD Projector
- A2 Computers
- A3 Video player/Compact disc
- A4 High voltage Personal Protective Equipment - 1 each
 - High voltage boots
 - HV arc flash protection suit with Hood with face shield.
 - UV filter goggles.
 - Rubber Gloves Class 2

All the PPEs must be of approved type and of industry standards.

- A5 High Voltage Lab Equipment
 - High voltage insulation resistance tester (at least 5kV rating)

- High voltage detector
- High voltage switchboard panel units rated at 6.6 KV or above, having bus bar, vacuum circuit breaker or SF6 circuit breaker with associated 'protection relay' systems. The panels are to be fitted with the necessary instrumentations, PT, CT systems and the interface for operation of the switchgear including indication lamps and meters. The panel must also have circuit main earthing arrangement. Participants should have experience in withdrawing the breaker from the panel, which is included in the practical session. They should be able to demonstrate safe earthing, "key safe" procedure and safety lock out devices.
- Vacuum electromagnetic contactor for high voltage systems
- Portable earthing cable and grounding assembly, at least two sets
- Insulated hand tool kit
- Insulation testing facilities on an Electrical motor
- High voltage to Low voltage steps down transformer and facility to carry out PI test.
- Variable frequency drives used in marine installations.
- High Voltage Electrical cables

B. IMO References

1. SOLAS 1974, International Convention for the Safety of Life at Sea, 1974 (SOLAS 1974), latest Consolidated Edition, (IMO-II0E)
2. International Convention on Standards of Training, Certification and Watch-keeping for Seafarers, STCW as amended in 2010, including subsequent amendments.(IMO-938E)
3. IMO Model Course 7.08, Ed. 2014 – Electro-Technical Officer
4. IMO Model Course 7.02, Ed. 2014 – Chief Engineer Officer and Second Engineer Officer

C. Reference Books

1. Practical Marine Electrical Knowledge, by Dennis T.Hall, Witherby Seamanship International
2. Ship's Electrical Power Distribution Diagram for high voltage system
3. Competency in Marine Electrical Engineering – 2015, by J. Majumder and Elstan A. Fernandez
4. High Voltage Engineering by M. S. Naidu and V. Kamraju
5. High Voltage Engineering Fundamentals by Kuffel
6. Introduction to High Voltage Engineering by Subir Ray

D. Other Textbooks (non-mandatory) :-

1. A textbook on Electrical Technology volume 2 – 1999 B. L Theraja, S. Chand & Co. Ltd.
2. A textbook on Electrical Technology volume 3 – 1999 B. L Theraja, S. Chand & Co. Ltd.
3. REED's Volume 7: Advanced electro-technology for engineers, 2nd Edition 2008 KRAAL, E.G.R. London, Adlard Coles Nautical
4. REED's Volume 6: Basic electro-technology for engineers; 1985, Thomas Reed Publications E. G. R. Kraal, Publisher: ISBN: 0900335963
5. Ship Automation for Marine Engineers and ETOs – by Alexandr Yakimchuk, Witherby Seamanship International.

E. Recommended Videos:-

1. Practical Marine Electrical Knowledge – Part – 7 (Electrical survey equipment) - Videotel
2. Practical Marine Electrical Knowledge – Part – 8 (Electrical Propulsion and High Voltage Practices)- Videotel

ANNEX 1

IMO Model Course 7.02, Ed. 2014

Chief Engineer Officer and Second Engineer Officer

Function 2: Electrical, electronic and control engineering at the management level

Competence 2.1: MANAGE OPERATION OF ELECTRICAL AND ELECTRONIC

CONTROL EQUIPMENT *THEORETICAL KNOWLEDGE*

2.1.4 DESIGN FEATURES OF HIGH-VOLTAGE INSTALLATIONS

Required Performance:

.1 Design features of high-voltage installations (20 hours)

- Generation and distribution of high voltage on ships
- Electric propulsion system
- Synchro-convertors and cyclo-convertors
- Functional, operational and safety requirements for a marine high voltage system
- Assigning qualified personnel to carry out maintenance and repair of High voltage switchgear of various types
- High voltage system advantages
- Advantages of an insulated system
- High voltage circuit breakers
- High voltage cable
- High voltage fuses
- Remedial action necessary during faults in a high-voltage system
- Switching strategy for isolating components of a high- voltage system
- Selection of suitable apparatus for isolation and testing of high-voltage equipment
- Switching and isolation procedure on a marine high-voltage system, complete with safety documentation
- Performance of insulation resistance and polarization index on high voltage equipment

2.1.4.1 Design features of high-voltage installations (20 hours)

Instructors should consult T14,T58 and V20 for :

- (i) Generation and distribution of high voltage on ships (ii) Electric propulsion system
(iii) Synchro-convertors and cyclo-convertors(iv) Functional, operational and safety

requirements for a marine high voltage system (v) Assigning qualified personnel to carry out maintenance and repair of high-voltage switchgear of various types (vi) High voltage system advantages (vii) Advantages of an insulated system (vii) High voltage circuit breakers (viii) High voltage cable (ix) High voltage fuses (x) Remedial action necessary during faults in a high-voltage system (xi) Switching strategy for isolating components of a high voltage system (xii) Selection of suitable apparatus for isolation and testing of high voltage equipment (xiii) Switching and isolation procedure on a marine high-voltage system, complete with safety documentation (xiv) Performance of insulation resistance and polarization index on high-voltage equipment.

STCW Section B-III/2

Guidance regarding training of engineering personnel having management responsibilities for the operation and safety of electrical power plant above 1,000 volts

- 1 Training of engineering personnel having management responsibilities for the operation and safety of electrical power plant more than 1,000 V should at least include:
 - .1 The functional, operational and safety requirements for a marine high-voltage system;
 - .2 Assignment of suitably qualified personnel to carry out maintenance and repair of high-voltage switchgear of various types;
 - .3 Taking remedial action necessary during faults in a high-voltage system;
 - .4 Producing a switching strategy for isolating components of a high-voltage system;
 - .5 Selecting suitable apparatus for isolation and testing of high-voltage equipment;
 - .6 Carrying out a switching and isolation procedure on a marine high-voltage system, complete with safety documentation; and
 - .7 Performing tests of insulation resistance and polarization index on high-voltage equipment.

IMO Model Course 7.08, Ed. 2014

Electro-Technical Officer

Function 1: Electrical, Electronic and Control Engineering at the Operational level

Competence 1.1 Monitor the Operation of Electrical, Electronic and Control Systems

1.1.11 APPRECIATIONS OF THE HAZARDS AND PRECAUTIONS REQUIRED FOR THE OPERATION OF POWER SYSTEMS ABOVE 1,000 VOLTS

Required performance

11.1 Hazards and Precautions Required for the Operation of Power Systems Above 1,000 Volts (5 hours)

- explains relation between shock voltage and shock current
- explains the possibility of distance electrical shock
- explains the possibility of the electrical shock by the electrostatic charge
- explains the influence of shock current on human body
- explains the difference of electric shock caused by low and high voltage
- understands meaning of warning signs
- understands the possibility of essential lengthening and migration of electric arc at the voltages above 1kV
- explains basic parameters of electric arc: the temperature, the energy etc.

Competence 1.4: OPERATE AND MAINTAIN POWER SYSTEMS IN EXCESS OF 1,000 VOLTS

1.4.1 HIGH VOLTAGE TECHNOLOGY

Required performance:

1.1 High Voltage Technology (15 hours)

- explains nature and forming of electric stresses in general, electric stresses in laminar structures and HV insulation structure
- explains the break-down strength of gases, discharge development in gases, critical voltage and stress, partial discharges, static and impulse air break-down strength, low and high pressure-gases insulation system break-down strength
- explains the break-down strength of solid dielectrics, discharge mechanism in solids
- describes the break-down strength of operation insulation systems, high voltage insulation systems on ships
- describes the general overvoltage characteristics, short-circuit and weak reactive current switching overvoltage
- explains the ageing of electrical insulation
- describes the circumstances causing development of high voltage power systems on ships

- explains construction and operation of HV equipment:
 - circuit breakers, vacuum type and pressurised gas type (SF6) for arc quenching, fuses, over current protection etc.
 - electrical machines: motors, generators, transformers
 - switchboards
 - instrumentation
- describes overvoltage protection, protectors and arresters, insulation systems coordination, voltage disturbances and threats elimination

1.4.2 SAFETY PRECAUTIONS AND TECHNOLOGY

Required performance:

2.1 Safety Precautions and Technology (5 hours)

- explains and describes general HV protection measures: housings, partitions, distances, insulation mats, insulation materials, access restrictions, markings and warnings, HV equipment access monitoring and locks
- explains and describes how to use fixed and portable HV measurement and control apparatus for testing insulation resistance of HV machines, cables and another equipment,
- explains how to check and use HV testers

1.4.3 ELECTRICAL PROPULSION OF THE SHIPS, ELECTRICAL MOTORS AND CONTROL SYSTEMS

Required performance:

3.1 Electrical Propulsion of the Ships, Electrical Motors and Control Systems (15 hours)

- describes advantages of ship electrical propulsion
- presents configurations of electrical propulsion:
 - Electric Propulsion Systems with classic shaft lines
 - Podded Propulsion Systems
- draws up general block diagram of electrical propulsion system with all main components
- states High Voltage Supply and Power range of electric propulsion systems used on ships
- describes main features of electric motors used in Main Propulsion systems:
 - types of electric motor
 - mechanical construction
 - excitation
 - motor cooling
- describes propulsion supply equipment:
 - transformers (air cooled and liquid cooled) with protection
 - slip rings with arc monitoring circuit
- names types of frequency drives used in main propulsion systems, draws up their block diagrams and explains main features:
 - Frequency Converter (with current source inverter and voltage source inverter)
 - Cyclo converter
- names methods of electric motor control used in Propulsion Drives, draws up their block diagrams and explains main features:
 - vector control
 - direct torque control
- describes remote control system of podded propulsion:
 - rpm control
 - steering angle control

- combined rpm and steering angle control during ship manoeuvring
- describes the harmonic distortion related to power electronic systems and use of harmonic filters

1.4.4 SAFE OPERATION AND MAINTENANCE OF HIGH-VOLTAGE SYSTEMS

Required performance:

4.1 Safe Operation and Maintenance of High-Voltage Systems (12 hours)

- knows how to use HV personal protection equipment (PPE): insulated gloves, goggles, insulating bars, insulating footwear, mates, earthing cables, HV testers
- knows terms of certification of personal protection equipment
- explains HV safety procedures:
 - permission and co-ordination of HV works
 - information, warnings and protection against unauthorized influence on safety
 - assistance during HV work
 - checking for voltage presence before any work starts

STCW Section A-III-6

Operate and maintain power systems in excess of 1000V

Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence
Operate and maintain power systems in excess of 1,000 volts	<i>Theoretical knowledge</i> High-voltage technology Safety precautions and procedures Electrical propulsion of the ships' electrical motors and control systems <i>Practical knowledge</i> Safe operation and maintenance of high-voltage systems, including knowledge of the special technical type of high-voltage systems and the danger resulting from operational voltage of more than 1,000 volts	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate .4 approved laboratory equipment training	Operations are planned and carried out in accordance with operating manuals, established rules and procedures to ensure safety of operations

ANNEX 2

COURSE OUTLINE

Knowledge, understanding and proficiency	Total hours for lectures	Total hours for practical's
1. Introduction, Safety briefing and objectives of the course.	0.25 hrs	
2. High Voltage Technology and application on board ships, concepts and terminology.	0.75 hrs	
3. Electrical hazards associated with High voltage systems and their precautions. eg. electrical shock, are flash and arc blast.	1.50 hrs	
4. Arrangement of high voltage installations, switch rooms, switchboards, transformers and earthing systems.	1.50 hrs	
5. Safety regulations regarding work on high voltage installations.	1.00 hrs	
6. Work Permits and procedures for preventing accidents while carrying out maintenance and repairs	1.00 hrs	
7. Operation and safety features of High Voltage switchgear and the use of HV PPE. (Practical: demonstration of PPE)	1.00 hrs	1.00 hr
8. Regulations governing High Voltage installations in marine / offshore.	1.50 hrs	
9. Electrical Stresses and Break down strength and ageing of High Voltage electrical insulation structure	1.00 hrs	
10. Types of High Voltage distribution systems, their construction, insulated and non-insulated system components, cables, fuses and protective devices	1.50 hrs	
11. Issue and control of safety documentation (Procedures, Control & policy) (Practical: Practice on actual ship's plan - Prepare switching plan, Limitation of access, Permit to work, Sanction for test & logbook)	0.75 hrs	1.00 hr
12. Safety lockout procedures, key safes / Multi Hasp locking devices and isolation procedure (Practical: Risk Assessment and Isolation and earthing diagram)	0.75 hrs	1.00 hr
13. Treatment of system neutral point (based on type of installation)	0.5 hrs	
14. Electrical propulsion systems – Direct Shaft / Podded type	2.00 hrs	

Knowledge, understanding and proficiency	Total hours for lectures	Total hours for practical's
15. Construction and Operation of High Voltage Systems - High Voltage motors, Cyclo-converters, Frequency control and controlling of motors / propulsion drives, Transformers & other equipment (Frequency control & Bus Management Strategy and switching sequence). (Practical: Demonstration of variable frequency drive operation and show its components)	2.00 hrs	2.00 hr
16. Power Management System, instrumentation and High Voltage measuring and testing equipment. (Fixed and Portable)	2.50 hrs	
17. Polarization Index and IR Test Procedure for High Voltage equipment. (Practical: IR test on HV cable, PI and DA test demonstration).	1.50 hrs	2.50 hrs
18. Maintenance and fault Identification in High Voltage system and procedure switching and isolation procedure using appropriate tools and PPE. Draw out VCB, key safe procedure. (Practical: Demonstrate operation of VCB, Isolation, draw out, vacuum checking, gap gauging. Demonstrate vacuum contractor).	2.50 hrs	2.50 hrs
19. Emergency Procedures and Case Studies	1.00 hr	
20. Demonstration of High Voltage systems and procedure for carrying out work using appropriate tools and PPE. (Practical: At High voltage facility: Effect of shapes of electrode on voltage breakdown, surface current and creepage distance, measurement of voltage and current by CT and PT. Or Demonstrate disconnection of VCB from live bus bar, safety precautions and application of CME)	1.00 hr	3.50 hrs
Practical Assessment test & Evaluation	0.50 hrs	0.50 hr
Subtotals	26.00 hrs	14.00 hrs
Total for the course	40.00 hrs	

ANNEX 3

COURSE TIME-TABLE

	1st Period (2.0 Hours) (0900 - 1100hrs)	2nd Period (2.0 Hours) (1115- 1315hrs)		3rd Period (2.0 Hours) (1345- 1545hrs)	4th Period (2.0 Hours) (1600- 1800hrs)
Day 1	• Introduction, Safety briefing and objectives of the course • High Voltage Technology and application on board ships, concepts and definitions • Electrical Hazards associated with high voltage systems and earthing system. e.g. electrical shock, arc flash and arc blast and their precautions	• Electrical Hazards associated with high voltage systems and earthing system. e.g. electrical shock, arc flash and arc blast and their precautions (contd...) • Arrangement of high voltage installation, switch room, switch boards, transformers and earthing system.	LUNCH BREAK	• Safety Regulations regarding work on high voltage installations. • Work Permits and procedures for preventing accidents while carrying out maintenance and repair	• Operational and safety features associated with high voltage switchgear • Practical demonstration of PPE Types of PPE requirement for High voltage system and Donning of PPE
Day 2	• Regulations governing High Voltage installations in marine / offshore. • Electrical Stresses and Break down strength and ageing of High Voltage electrical insulation structure	• Electrical Stresses and Break down strength and ageing of High Voltage electrical insulation structure (contd) • Types of High Voltage distribution systems, their construction, insulated and non-insulated system components, cables, fuses and protective devices		• Issue and control of safety documentation (Procedures, Control & policy) • Practical: Practice on actual ship's drawing - Prepare switching plan, Limitation of Access, Permit to work, Sanction for test and logbook. • Safety lockout procedures, key safes / Multi Hasp locking devices and isolation procedure	• Safety lockout procedures, key safes / Multi Hasp locking devices and isolation procedure (contd) • Practical: Risk assessment and isolation and earthing diagram. • Treatment of system neutral point (based on type of installation)
Day 3	• Electrical propulsion systems – Direct Shaft / Podded type	• Construction and Operation of High Voltage Systems - High Voltage motors, Cyclo-converters, Frequency control and controlling of motors / propulsion drives, Transformers & other equipment (Frequency control & Bus Management Strategy) and switching sequence.		• Practical: Demonstration of variable frequency drive operation and show its components	• Power Management System, instrumentation and High Voltage measuring and testing equipments. (Fixed and Portable)
Day 4	• Power Management System, instrumentation and High Voltage measuring and testing equipments. (Fixed and Portable) (contd..) • Polarization Index and IR Test Procedure for High Voltage equipments.	• Practical: IR test on HV cable, PI and DA test demonstration.		• Practical: IR test on HV cable, PI and DA test demonstration. (contd) • Maintenance and fault Identification in High Voltage system and procedure using appropriate tools and PPE. Draw out procedure of VCB and Key safe procedure.	• Maintenance and fault Identification in High Voltage system and procedure using appropriate tools and PPE. Draw out procedure of VCB and Key safe procedure. . (contd...) • Practical: Demonstrate operation of VCB, Isolation, draw out, vacuum checking, gap gauging. Demonstrate vacuum contactor.

	1st Period (2.0 Hours) (0900 - 1100hrs)	2nd Period (2.0 Hours) (1115- 1315hrs)		3rd Period (2.0 Hours) (1345- 1545hrs)	4th Period (2.0 Hours) (1600- 1800hrs)
Day 5	• Practical: Demonstrate operation of VCB, Isolation, draw out, vacuum checking, gap gauging. Demonstrate vacuum contactor. (contd) • Emergency Procedures and Case Studies	• Emergency Procedures and Case Studies (contd) • Demonstration of High Voltage systems and procedure for carrying out work using appropriate tools and PPE	LUNCH BREAK	• Practical: • At High voltage facility – Effect of shape of electrode on voltage breakdown, surface current and creep-age distance, measurement of voltage and current by CT and PT. OR Demonstrate disconnection of VCB from live bus bar, safety precautions and application of CME	• Practical: (contd...) • At High voltage facility – Effect of shape of electrode on voltage breakdown, surface current and creep-age distance, measurement of voltage and current by CT and PT. OR Demonstrate disconnection of VCB from live bus bar, safety precautions and application of CME • Practical Assessment test & Evaluation.

ANNEX 4

Institute's
LOGO

NAME and ADDRESS of the D. G. Approved Training Institute

INDOS No:

Tel:

Fax:

E-mail:

THIS IS TO CERTIFY THAT *[full name of candidate]*

Date of Birth (dd/mm/yyyy)

Holder of C.D.C. No.

Certificate of Competency (if any), Grade : No.

Indian National Database of Seafarers (INDoS No.)

has successfully completed a training course in

HIGH VOLTAGE SAFETY AND SWITCH GEAR (MANAGEMENT LEVEL)

held from to

This course is approved by the Directorate General of Shipping and meets the requirement laid down in Regulation III/2 paragraph 2, Section A- III/2 and relevant sections of Table A- III/6 of the STCW Convention and Code 1978, as amended in 2010.

The candidate has also met the additional criteria in the STCW convention, applicable to the issues of the certificate

The certificate is issued under the authority of the Directorate General of Shipping, Ministry of Shipping, Government of India.

Signature of Candidate

Name and Signature of Course In-charge

Date of Issue: _____

Date of Expiry: UNLIMITED

Name and Signature of Dean / Principal

Official
seal

Colour

Photograph

(35 mm x 35 mm)

(Details of topics covered are mentioned overleaf)

ANNEX I
IMO Model Course 7.04, Ed. 2014
Officer in charge of an Engineering Watch
Function 2: Electrical, Electronic and Central Engineering at the Operational Level

Competence 2.1: Operate Electrical, Electronic and Control Systems.

Section 1.7: High Voltage Installation (5 hours)

- States that more than 1,000 V is usually called high voltage
- States how and why high-voltage installations are used on board ships
- States what voltage are mostly used as high voltage on board ships
- Describe equipment/ installations in high- voltage systems such as high-voltage generator, distributor board, motors, etc.
- States the special characteristic and features of high-voltage installations in comparison with less than 1,000 V
- States that high voltage systems are normally earthed via a resistor
- Explain how the presence of earth faults is indicated in a high- voltage system with an earthed neutral
- States safety precautions to be strictly observed to prevent accidents when working on high-voltage electrical equipment
- States that any operation of high-voltage installations must be carried out remotely at places where a certain distance is being kept from the installations.

Learning Outcomes

- Definition of high- voltage and typical voltages found on board ship.
- The learner knows the arrangement and protection of high voltage installations on board a vessel
- Need for High Voltage safety rules and procedures
- Requirements of modern vessels which are equipped with high voltage generator and distribution system.
- Statutory regulations & requirements for high voltage system on marine and offshore applications
- Difference between insulated & earthed neutral distribution system and function of the protection devices and their sequence of operation in a high voltage distribution system.
- Electrical Hazards associated with thigh voltage systems. E.g. electrical shock, arc flash and arc blast.
- Arrangement of high voltage switches room equipment and associated equipment
- Practices and PPE requirements.
- Competent person and authorized personnel to carry out maintenance and repair and permits.
- Operational and safety features associated with high voltage electrical hazards, including importance of a Circuit Main Earth.

ANNEX 2

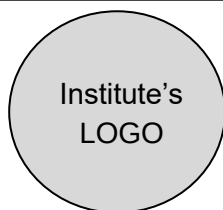
COURSE OUTLINE

Knowledge, understanding and proficiency	Total	Total hours Hours for Lectures	practical's
1. Introduction, Safety briefing and objectives of the course.		0.25 hrs	
2. High Voltage Technology and application on board ships, concepts and terminology.		0.75 hrs	
3. Electrical hazards associated with High voltage systems and their precautions. eg. electrical shock, arc flash and arc blast.		1.50 hrs	
4. Arrangement of high voltage installations, switch rooms, switchboards, transformers and earthing systems and remote operation.		1.50 hrs	
5. Safety Regulations, Permit and procedures for preventing accidents while carrying out maintenance and repair.		1.00 hrs	
6. Operation and safety features of High Voltage electrical hazards		0.75 hrs	
7. Demonstration of High Voltage Safeties and functionalities of High Voltage Switch Gear			0.50hrs
8. Types of PPE requirement for HIGH voltage system and Donning of PPE		0.50 hrs	
9. Practical Donning and Use of High Voltage PPE (Practical: demonstration of PPE)			0.75 hrs
Assessment and Discussions		0.50 hrs	
Subtotals		6.75	1.25
TOTAL HOURS		8.0	

ANNEX 3
COURSE TIME-TABLE

	1st Period (2.0 Hours) (0900 - 1100hrs)	2nd Period (2.0 Hours) (1115- 1315hrs)		3rd Period (1.45 Hours) (1345- 1545hrs)	4th Period (2.15 Hours) (1600- 1800hrs)
Day 1	1. Introduction, Safety briefing and objectives of the course 2. High Voltage Technology and application on board ships, concepts and definitions 3. Electrical Hazards associated with high voltage systems and earthing system. e.g. electrical shock, arc flash and arc blast and their precautions	4. Electrical Hazards associated with high voltage systems and earthing system. e.g. electrical shock, arc flash and arc blast and their precautions (contd...) 5. Arrangement of high voltage installation, switch room, switch boards, transformers and earthing system. and remote operation	LUNCH BREAK (1315-1345 hrs)	6. Safety Regulation, Permits and procedure for preventing accidents while carrying out maintenance and repair 7. Operational and safety features associated with high voltage electrical hazards	8. Demonstration of high voltage safeties and functionalities of High Voltage Switch Gear 9. Types pf PPE requirement for High Voltage system and Donning of PPE 10. Practical Donning and Use of High Voltage PPE Assessment and Discussions

ANNEX 4



NAME and ADDRESS of the D. G. Approved Training Institute

INDOS No:

Tel:

Fax:

E-mail:

Certificate No: _____

THIS IS TO CERTIFY THAT *[full name of candidate]*

Date of Birth (dd/mm/yyyy)

Holder of C.D.C. No.

Certificate of Competency (if any), Grade : No.

Indian National Database of Seafarers (INDoS No.)

has successfully completed a training course in

HIGH VOLTAGE SAFETY SWITCH GEAR COURSE (OPERATIONAL LEVEL)

held from to

This course is approved by the Directorate General of Shipping and meets the requirement laid down in Regulation III/1, Section A- III/1, Table A- III/1 and Regulation A-III/7, Section A-III/7, Table A-III/7 of the STCW Convention and Code 1978, as amended in 2010.

The candidate has also met the additional criteria in the STCW convention, applicable to the issues of the certificate

The certificate is issued under the authority of the Directorate General of Shipping, Ministry of Shipping, Government of India.

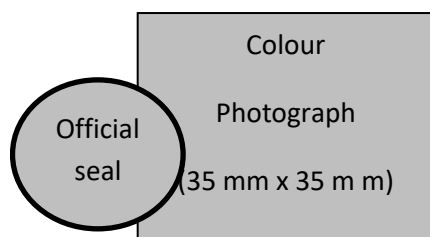
Signature of Candidate

Name and Signature of Course In-charge

Date of Issue: _____

Date of Expiry: UNLIMITED

Name and Signature of Dean / Principal



(Details of topics covered are mentioned overleaf)

The candidate has received training on the following systems and equipment:

- High Voltage Technology and its application on board ships
- Electrical hazards associated with High Voltage systems and their precaution
- Arrangement of high voltage installation and earthing system
- Operation and safety features and functionalities of High Voltage Switch Gear
- Permit Systems, safety procedure and use Personnel Protective device when working with High Voltage systems.

**BRIDGING COURSE FOR EXISTING ELECTRICAL OFFICERS TO ELECTRO TECHNO
OFFICER AS PER STCW CONVENTION AS AMENDED IN 2010**

COMPETENCY AND COURSE SUBJECTS	Methods for demonstrating competence	Criteria for evaluating competence	Hrs of training	
			Theor y	Practi cal
FUNCTION 1 : Electrical, electronic and control Engineering at the operational level				
Competency No.1 : Monitor the operation of electrical, electronic and control systems Basic understanding of the operation of mechanical engineering systems, including: 1) prime movers, including main propulsion plant 2) engine-room auxiliary machinery 3) steering systems 4) cargo handling systems 5) deck machinery 6) hotel systems Basic knowledge of heat transmission, mechanics and hydromechanics <i>Knowledge of:</i> Electro-technology and electrical	Examination and assessment of evidence obtained from one or more of the following: 1) approved in- service experience 2) approved training ship experience 3) approved simulator training, where appropriate 4) approved laboratory equipment training	Operation of equipment and system is in accordance with operating manuals Performance levels are in accordance with technical specifications	4	4

machines theory Fundamentals of electronics and power electronics Electrical power distribution boards and electrical equipment Fundamentals of automation, automatic control systems and technology Instrumentation, alarm and monitoring systems Electrical drives Technology of electrical materials Electro-hydraulic and electro-pneumatic control systems Appreciation of the hazards and precautions required for the operation of power systems above 1,000 volts				
Competency No.2 : Monitor the operation of automatic control systems of propulsion and auxiliary machinery Preparation of	Examination and assessment of evidence obtained from one or more of the following: 1) approved in-service experience 2) approved training ship	Surveillance of main propulsion plant and auxiliary systems is sufficient to maintain safe operation condition	6	6

control systems of propulsion and auxiliary machinery for operation	experience 3) approved simulator training, where appropriate 4) approved laboratory equipment training			
Competency No.3 : Operate generators and distribution systems Coupling, load sharing and changing over generators Coupling and breaking connection between switchboards and distribution panels	Examination and assessment of evidence obtained from one or more of the following: 1) approved in-service experience 2) approved training ship experience 3) approved simulator training, where appropriate 4) approved laboratory equipment training	Operations are planned and carried out in accordance with operating manuals, established rules and procedures to ensure safety of operations Electrical distribution systems can be understood and explained with drawings/instructions	4	6
Competency No. 4 : Operate and maintain power systems in excess of 1,000 volts <i>Theoretical knowledge</i> High-voltage technology Safety precautions and procedures Electrical propulsion of the	Examination and assessment of evidence obtained from one or more of the following: 1) approved in-service experience 2) approved training ship experience 3) approved simulator training, where appropriate 4) approved	Operations are planned and carried out in accordance with operating manuals, established rules and procedures to ensure safety of operations	10	10

ships, electrical motors and control systems <i>Practical knowledge</i> Safe operation and maintenance of high-voltage systems, including knowledge of the special technical type of high voltage systems and the danger resulting from operational voltage of more than 1,000 volts	laboratory equipment training			
Competency No. 5 : Operate computers and computer networks on ships Understanding of: 1) main features of data processing 2) construction and use of computer networks on ships 3) bridge-based, engine-room-based and commercial computer use	Examination and assessment of evidence obtained from one or more of the following: 1) approved in-service experience 2) approved training ship experience 3) approved simulator training, where appropriate 4) approved laboratory equipment training	Computer networks and computers are correctly checked and handled	2	2
Competency No. 6 : Use English in written and oral form	Examination and assessment of evidence obtained from practical	English language publications relevant to the officer's duties are correctly	1	0

Adequate knowledge of the English language to enable the officer to use engineering publications and to perform the officer's duties	instructions	interpreted Communications are clear and understood		
Competency No. 7 : Use internal communication systems Operation of all internal communication systems on board	Examination and assessment of evidence obtained from one or more of the following: 1) approved in-service experience 2) approved training ship experience 3) approved simulator training, where appropriate 4) approved laboratory equipment training	Transmission and reception of messages are consistently successful. Communication records are complete, accurate and comply with statutory requirements	1	1
FUNCTION 2 : Maintenance and repair at the operational level				
Competency No. 8 : Maintenance and repair of electrical and electronic equipment Safety requirements for working on shipboard electrical systems, including the safe isolation of electrical	Examination and assessment of evidence obtained from one or more of the following: 1) approved in-service experience 2) approved training ship experience 3) approved	Safety measures for working are appropriate Selection and use of hand tools, measuring instruments, and testing equipment are appropriate and interpretation of results is accurate Dismantling,	8	8

equipment required before personnel are permitted to work on such equipment Maintenance and repair of electrical system equipment, switchboards, electric motors, generators and DC electrical systems and equipment Detection of electric malfunction, location of faults and measures to prevent damage Construction and operation of electrical testing and measuring equipment Function and performance tests of the following equipment and their configuration: 1) monitoring systems 2) automatic control devices 3) protective devices The interpretation of electrical and electronic diagrams	simulator training, where appropriate 4) approved laboratory equipment training	inspecting, repairing and reassembling equipment are in accordance with manuals and good practice Reassembling and performance testing is in accordance with manuals and good practice		
Competency No. 9 : Maintenance and repair of	Examination and assessment of evidence obtained	The effect of malfunctions on associated plant	6	6

automation and control systems of main propulsion and auxiliary machinery Appropriate electrical and mechanical knowledge and skills. <i>Safety and emergency Procedures</i> Safe isolation of equipment and associated systems required before personnel are permitted to work on such plant or equipment Practical knowledge for the testing, maintenance, fault finding and repair. (Auxiliary Machines including PLC controlled Boiler) Test, detect faults and maintain and restore electrical and electronic control equipment to operating condition	from one or more of the following: 1) approved in-service experience 2) approved training ship experience 3) approved simulator training, where appropriate 4) approved laboratory equipment training	and systems is accurately identified, ship's technical drawings are correctly interpreted, measuring and calibrating instruments are correctly used and actions taken are justified Isolation, dismantling and reassembly of plant and equipment are in accordance with manufacturer's safety guidelines and shipboard instructions and legislative and safety specifications. Action taken leads to the restoration of automation and control systems by the method most suitable and appropriate to the prevailing circumstances and conditions		

Competency No. 10 : Maintenance and repair of bridge navigation equipment and ship communication systems Knowledge of the principles and maintenance procedures of navigation equipment, internal and external communication systems <i>Theoretical knowledge:</i> Electrical and electronic systems operating in flammable areas <i>Practical knowledge:</i> Carrying out safe maintenance and repair procedures Detection of machinery malfunction, location of faults and action to prevent damage		The effect of malfunctions on associated plant and systems is accurately identified, ship's technical drawings are correctly interpreted, measuring and calibrating instruments are correctly used and actions taken are justified Isolation, dismantling and re-assembly of plant and equipment are in accordance with manufacturer's safety guidelines and shipboard instructions, legislative and safety specifications. Action taken leads to the restoration of bridge navigation equipment and ship communication systems by the method most suitable and appropriate to the prevailing circumstances and conditions	6	6

Competency No. 11 : Maintenance and repair of electrical, electronic and control systems of deck machinery and cargo-handling equipment Appropriate electrical and mechanical knowledge and skills <i>Safety and emergency procedures</i> Safe isolation of equipment and associated systems required before personnel are permitted to work on such plant or equipment Practical knowledge for the testing, maintenance, fault finding and repair Test, detect faults and maintain and restore electrical and electronic control equipment to operating condition	Examination and assessment of evidence obtained from one or more of the following: 1) approved in-service experience 2) approved training ship experience 3) approved simulator training, where appropriate 4) approved laboratory equipment training	The effect of malfunctions on associated plant and systems is accurately identified, ship's technical drawings are correctly interpreted, measuring and calibrating instruments are correctly used and actions taken are justified Isolation, dismantling and re-assembly of plant and equipment are in accordance with manufacturer's safety guidelines and shipboard instructions, legislative and safety specifications. Action taken leads to the restoration of deck machinery and cargo-handling equipment by the method most suitable and appropriate to the prevailing circumstances and conditions	4	4

Competency No. 12 : Maintenance and repair of control and safety systems of hotel equipment <i>Theoretical knowledge:</i> Electrical and electronic systems operating in flammable areas <i>Practical knowledge:</i> Carrying out safe maintenance and repair procedures Detection of machinery malfunction, location of faults and action to prevent damage		The effect of malfunctions on associated plant and systems is accurately identified, ship's technical drawings are correctly interpreted, measuring and calibrating instruments are correctly used and actions taken are justified Isolation, dismantling and re-assembly of plant and equipment are in accordance with manufacturer's safety guidelines and shipboard instructions, legislative and safety specifications. Action taken leads to the restoration of control and safety systems of hotel equipment by the method most suitable and appropriate to the prevailing circumstances and conditions	2	2

FUNCTION 3: Controlling the operation of the ship and care for persons on board at operational level				
Competency No. 13 : Ensure compliance with pollution prevention requirements <i>Prevention of pollution of the marine environment</i> Knowledge of the precautions to be taken to prevent pollution of the marine environment Anti-pollution procedures and all associated equipment Importance of proactive measures to protect the marine environment	Examination and assessment of evidence obtained from one or more of the following: 1) approved in-service experience 2) approved training ship experience 3) approved training	Procedures for monitoring shipboard operations and ensuring compliance with pollution-prevention requirements are fully observed. Actions to ensure that a positive environmental reputation is maintained.	2	
Competency No. 14 : Prevent, control and fight fire on board <i>Fire prevention and fire-fighting appliances</i> Ability to organize fire drills Knowledge of	Assessment of evidence obtained from approved fire-fighting training and experience as set out in section A-VI/3, paragraphs 1 to 3 of STCW Code	The type and scale of the problem is promptly identified and initial actions conform with the emergency procedure and contingency plans for the ship Evacuation, emergency shutdown and	1	

classes and chemistry of fire Knowledge of fire-fighting systems Action to be taken in the event of fire, including fires involving oil systems		isolation procedures are appropriate to the nature of the emergency and are implemented promptly. The order of priority, and the levels and time-scales of making reports and informing personnel on board, are relevant to the nature of the emergency and reflect the urgency of the problem		
Competency No. 15 : Operate life-saving appliances <i>Life-saving</i> Ability to organize abandon ship drills and knowledge of the operation of survival craft and rescue boats, their launching appliances and arrangements, and their equipment, including radio life-saving appliances, satellite EPIRBs, SARTs, immersion	Assessment of evidence obtained from approved training and experience as set out in section A-VI/2, paragraphs 1 to 4 of STCW Code	Actions in responding to abandon ship and survival situations are appropriate to the prevailing circumstances and conditions and comply with accepted safety practices and standards	1	

suits and thermal protective aids				
Competency No. 16 : Apply medical first aid on board ship <i>Medical aid</i> Practical application of medical guides and advice by radio, including the ability to take effective action based on such knowledge in the case of accidents or illnesses that are likely to occur on board ship	Assessment of evidence obtained from approved training as set out in section A-VI/4, paragraphs 1 to 3 of STCW Code	Identification of probable cause, nature and extent of injuries or conditions is prompt and treatment minimizes immediate threat to life	1	
Competency No. 17 : Application of leadership and team working skills Working knowledge of shipboard personnel management and training Ability to apply task and workload management, including: 1) planning and co-ordination 2) personnel assignment 3) time and	Assessment of evidence obtained from one or more of the following: 1) approved training 2) approved in-service experience 3) practical demonstration	The crew are allocated duties and informed of expected standards of work and behaviour in a manner appropriate to the individuals concerned Training objectives and activities are based on assessment of current competence and capabilities and operational requirements.	3	2

resource constraints 4) prioritization Knowledge and ability to apply effective resource management: 1) allocation, assignment, and prioritization of resources 2) effective communication on board and ashore 3) decisions reflect consideration of team experiences 4) assertiveness and leadership, including motivation 5) obtaining and maintaining situational awareness Knowledge and ability to apply decision-making techniques: 1) Situation and risk assessment 2) Identify and consider generated options 3) Selecting course of action 4) Evaluation of outcome effectiveness		Operations are planned and resources are allocated as needed in correct priority to perform necessary tasks. Communication is clearly and unambiguously given and received. Effective leadership behaviours are demonstrated Necessary team member(s) share accurate understanding of current and predicted vessel state and operational status and external environment. Decisions are most effective for the situation		

Competency No. 18 : Contribute to the safety of personnel and ship Knowledge of personal survival techniques Knowledge of fire prevention and ability to fight and extinguish fires Knowledge of elementary first aid Knowledge of personal safety and social responsibilities. Security and related Regulations	Assessment of evidence obtained from approved training and experience as set out in section A-VI/1, paragraph 2 of STCW Code	Appropriate safety and protective equipment is correctly used Procedures and safe working practices designed to safeguard personnel and the ship are observed at all times Procedures designed to safeguard the environment are observed at all times Initial and follow-up actions on becoming aware of an emergency conform with established emergency response procedures.	1	
Total hours :			63	57
Evaluation hours :			1	2
Total no. of days @ 8 hours / day			16 days (3 weeks)	

HIGH VOLTAGE SAFETY AND SWITCH GEAR COURSE FOR MANAGEMENT LEVEL, AND ELECTRO TECHNICAL OFFICERS WITH 12 MONTHS SAILING EXPERIENCE

MANDATORY GUIDELINES FOR TRAINING INSTITUTES FOR OBTAINING APPROVAL FROM DIRECTORATE GENERAL OF SHIPPING

TO CONDUCT

HIGH VOLTAGE SAFETY AND SWITCH GEAR (MANAGEMENT LEVEL)

COURSE ID: 169

To avoid unnecessary repetition, reference has been made herein to DGS Order no: 5 of 2016 (Guidelines for the conduct of Post-Sea Training courses) wherever appropriate

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BASIC DETAILS OF THE COURSE

1.1. AIMS:

The aim of the course is to provide Marine Engineering and Shipboard Electrical personnel, the necessary education and training in the operation and management of electrical power plants above 1000 volts, to meet the Knowledge, Understanding and Proficiency (KUP) requirements set out in the specific part of the STCW Section A-III/2, Table A-III/2 and Section A-III/3 at the management level and Section A-III/6, Table A-III/6 at the operational level, as given in the STCW convention and code as amended in 2010.

1.2. Objective

This training is applicable to Marine Engineer Officers with relevant Certificate of competency and Electro Technical Officers for the management level course; junior Marine Engineers for Operational level course; working on ships powered by main propulsion machinery above 750 kW and having onboard, electrical installations of above 1000 volts.

The objective of the training is the safe operation and management of high voltage systems onboard and their associated switch gear. The trainee shall be able to understand the HV/LV power systems including statutory regulations, hazards associated with high voltage systems, be able to safely operate and maintain such systems. The trainee shall also be able to perform HV switching operations on a wide range of marine and offshore power equipment, as well as carry out isolation, fault diagnosis and troubleshooting.

2. QUALIFICATION & ELIGIBILITY OF STUDENTS

2.1. Entry standards

The following officers are eligible to attend the Management Level course:

2.1.1 Marine Engineering officers holding as a minimum:

- a MEO Class IV (FG / NCV) certificate of competency and has completed a minimum of 12 months sea going service as a certificated Engineer Officer of watch OR
- a MEO Class II (FG / NCV) certificate of competency OR
- a Dredge Grade II certificate of competency

2.1.2 Electro-technical officers holding as a minimum,

- a Certificate of Competency as "Electro-Technical Officer" issued by the Govt. of India; OR
- a certificate of course completion, having successfully completed an approved ETO Pre-sea training course and has completed approved seagoing service to be eligible for appearing for ETO Certificate of competency examination; OR
- a record of sea going service of not less than 12 months in the capacity of ETO / Electrical Officer / trainee E/O.

2.2. Required attendance:

100% attendance is required for successful completion of the course.

However, in exceptional circumstances, a trainee is allowed absence of up to one day subject to his attending the lectures missed out during the subsequent course at the same institute, within a maximum period of three months. The institute shall keep proper records of such cases.

2.3. Course intake limitations

Maximum 12 trainees per batch.

3. INFRASTRUCTURE REQUIREMENT

3.1. Teaching facilities and equipment

Training center's seeking approval will need to demonstrate availability of suitable facilities for practical, general and theoretical instruction, appropriately equipped with teaching and learning aids and designed to enable each learner to fully engage in the learning process. All facilities must be maintained and where appropriate, inspected and tested in accordance with applicable regulations, current standards and manufacturers recommendations.

D. Classroom

Class room shall be of minimum area as specified in DGS order 5 of 2016, Post Sea Training course guidelines and equipped with a white / black board, overhead / LCD projector / Video player/ PC/Laptop.

E. High Voltage Lab

A laboratory containing the High Voltage equipment for practicals and demonstrations.

The equipment may be installed in the classroom for High voltage course provided that the area is sufficient for both lecture delivery and practical demonstrations.

The teaching aids required are mentioned under paragraph 14.

F. Visit to a High Voltage Facility

The institute shall have a tie-up with a High Voltage electrical facility which is using voltages over 1000V, so that the trainees can be shown live demonstration of energizing the high voltage switchboard and the arcing phenomenon.

This tie-up and visit is not required if the institute can provide high voltage (greater than 1000V) at the bus-bar on the switchboard fitted at the institute.

4. COURSE DETAILS

4.1. Course Duration: 5 days (40 hours) including practical and assessment

4.2. Course Outline: As per Annexure 2

5. HOLIDAYS

5.1. Sundays shall be holidays.

5.2. Independence Day (15th August) and Republic Day (26th January) shall be compulsory holidays.

5.3. Students shall normally enjoy the holidays observed by the Government of the state in which the institute is located.

6. FACULTY REQUIREMENT

6.1. Qualifications and experience of Training Faculty:

6.1.1 Course In-charge shall

- hold Certificate of competency MEO Class I (FG) issued or recognized by the Government of India, AND
- have not less than 5 years of sea going service onboard merchant vessels above 3000 kW, AND
- has undergone an approved High Voltage Safety and Switch Gear management level course and / or High Voltage trainer's course.

6.1.3 The faculty shall

- Hold a Certificate of competency MEO Class I (FG) issued or recognized by the Government of India, AND
- Have not less than 4 years of sea going service onboard merchant vessels above 3000 kW, AND
- has undergone High Voltage Safety and Switch Gear course and / or High Voltage trainer's course

OR

- Qualified as Electrical Officer and having not less than 6 years of sea going service as Electrical officer on Merchant ships; AND has undergone High Voltage Safety and Switch Gear management level course and / or High Voltage trainer's course

OR

- B. Tech/B.E. or equivalent degree in Electrical Engineering with not less than 1 year High Voltage industrial experience.

OR

- Indian Navy Officers / Chief Petty Officers from electrical branch with not less than 6 years experience on Naval ships; AND has undergone High Voltage Safety and Switch Gear management level course and / or High Voltage trainer's course

6.2. Training of Trainers & Assessors Course:

As per DGS Order no: 5 of 2016.

6.3. Visiting faculty:

Qualifications and experience of visiting faculty members should be the same as that of full time faculty as specified above.

6.4. Age limit for regular faculty members:

As per DGS Order no: 5 of 2016.

7. FACULTY TEAM

7.1. Not less than two faculty, of which one is the course-in-charge

7.2. Minimum of 50% of the entire portion must be covered by full time faculty.

8. COURSE DURATION

A total of 40 hours of lectures practical training and assessment for Management Level.

9. ASSESSMENT

To be deemed pass in the course, the student shall meet the following requirement.

3. Minimum classroom / practical session attendance required is 100%. However relaxation of attendance may be granted in exceptional circumstances as per prevailing DGS guidelines.
4. Assessment shall be conducted by way of a written test.
Objective Type theory paper: Pass Percentage 50%. Practical exercises / demonstration may also be one of the assessment methods.

Assessment must be organized so that learners can, through demonstration and examination, show that they meet the competence requirement as specified in STCW Tables A-III/2 and A-III/6 criteria for evaluating competence in column 4 of the tables.

The assessment system, methods and practice must be valid, reliable and authentic.

10. QUALITY STANDARDS

As per DGS Order no: 5 of 2016.

11. INSPECTIONS

As per DGS Order no: 5 of 2016.

12. COST OF INSPECTIONS

As per DGS Order no: 5 of 2016.

13. FEES TO GOVT.

As per DGS Order no: 5 of 2016.

14. TEACHING AIDS

F. Teaching Aids

A5 OHP or LCD Projector

A6 Computers

A7 Video player/Compact disc

A8 High voltage Personal Protective Equipment - 1 each

- High voltage boots
- HV arc flash protection suit with Hood with face shield.
- UV filter goggles.
- Rubber Gloves Class 2

All the PPEs must be of approved type and of industry standards.

A5 High Voltage Lab Equipment

- High voltage insulation resistance tester (at least 5kV rating)

- High voltage detector
- High voltage switchboard panel units rated at 6.6 KV or above, having bus bar, vacuum circuit breaker or SF6 circuit breaker with associated 'protection relay' systems. The panels are to be fitted with the necessary instrumentations, PT, CT systems and the interface for operation of the switchgear including indication lamps and meters. The panel must also have circuit main earthing arrangement. Participants should have experience in withdrawing the breaker from the panel, which is included in the practical session. They should be able to demonstrate safe earthing, "key safe" procedure and safety lock out devices.
- Vacuum electromagnetic contactor for high voltage systems
- Portable earthing cable and grounding assembly, at least two sets
- Insulated hand tool kit
- Insulation testing facilities on an Electrical motor
- High voltage to Low voltage steps down transformer and facility to carry out PI test.
- Variable frequency drives used in marine installations.
- High Voltage Electrical cables

G. IMO References

5. SOLAS 1974, International Convention for the Safety of Life at Sea, 1974 (SOLAS 1974), latest Consolidated Edition, (IMO-II0E)
6. International Convention on Standards of Training, Certification and Watch-keeping for Seafarers, STCW as amended in 2010, including subsequent amendments.(IMO-938E)
7. IMO Model Course 7.08, Ed. 2014 – Electro-Technical Officer
8. IMO Model Course 7.02, Ed. 2014 – Chief Engineer Officer and Second Engineer Officer

H. Reference Books

7. Practical Marine Electrical Knowledge, by Dennis T.Hall, Witherby Seamanship International
8. Ship's Electrical Power Distribution Diagram for high voltage system
9. Competency in Marine Electrical Engineering – 2015, by J. Majumder and Elstan A. Fernandez
10. High Voltage Engineering by M. S. Naidu and V. Kamraju
11. High Voltage Engineering Fundamentals by Kuffel
12. Introduction to High Voltage Engineering by Subir Ray

I. Other Textbooks (non-mandatory) :-

6. A textbook on Electrical Technology volume 2 – 1999 B. L Theraja, S. Chand & Co. Ltd.
7. A textbook on Electrical Technology volume 3 – 1999 B. L Theraja, S. Chand & Co. Ltd.
8. REED's Volume 7: Advanced electro-technology for engineers, 2nd Edition 2008 KRAAL, E.G.R. London, Adlard Coles Nautical
9. REED's Volume 6: Basic electro-technology for engineers; 1985, Thomas Reed Publications E. G. R. Kraal, Publisher: ISBN: 0900335963
10. Ship Automation for Marine Engineers and ETOs – by Alexandr Yakimchuk, Witherby Seamanship International.

J. Recommended Videos:-

3. Practical Marine Electrical Knowledge – Part – 7 (Electrical survey equipment) - Videotel
4. Practical Marine Electrical Knowledge – Part – 8 (Electrical Propulsion and High Voltage Practices)- Videotel

ANNEX 1

IMO Model Course 7.02, Ed. 2014

Chief Engineer Officer and Second Engineer Officer

Function 2: Electrical, electronic and control engineering at the management level

Competence 2.1: MANAGE OPERATION OF ELECTRICAL AND ELECTRONIC

CONTROL EQUIPMENT *THEORETICAL KNOWLEDGE*

2.1.4 DESIGN FEATURES OF HIGH-VOLTAGE INSTALLATIONS

Required Performance:

.1 Design features of high-voltage installations (20 hours)

- Generation and distribution of high voltage on ships
- Electric propulsion system
- Synchro-convertors and cyclo-convertors
- Functional, operational and safety requirements for a marine high voltage system
- Assigning qualified personnel to carry out maintenance and repair of High voltage switchgear of various types
- High voltage system advantages
- Advantages of an insulated system
- High voltage circuit breakers
- High voltage cable
- High voltage fuses
- Remedial action necessary during faults in a high-voltage system
- Switching strategy for isolating components of a high- voltage system
- Selection of suitable apparatus for isolation and testing of high-voltage equipment
- Switching and isolation procedure on a marine high-voltage system, complete with safety documentation
- Performance of insulation resistance and polarization index on highvoltage equipment

2.1.4.1 Design features of high-voltage installations (20 hours)

Instructors should consult T14,T58 and V20 for :

(i) Generation and distribution of high voltage on ships (ii) Electric propulsion system (iii) Synchro-convertors and cyclo-convertors(iv) Functional, operational and safety requirements for a marine high voltage system (v) Assigning qualified personnel to carry out maintenance and repair of high-voltage switchgear of various types (vi)

High voltage system advantages (vii) Advantages of an insulated system (vii) High voltage circuit breakers (viii) High voltage cable (ix) High voltage fuses (x) Remedial action necessary during faults in a high-voltage system (xi) Switching strategy for isolating components of a high voltage system (xii) Selection of suitable apparatus for isolation and testing of high voltage equipment (xiii) Switching and isolation procedure on a marine high-voltage system, complete with safety documentation (xiv) Performance of insulation resistance and polarization index on high-voltage equipment.

STCW Section B-III/2

Guidance regarding training of engineering personnel having management responsibilities for the operation and safety of electrical power plant above 1,000 volts

- 1 Training of engineering personnel having management responsibilities for the operation and safety of electrical power plant more than 1,000 V should at least include:
 - .1 The functional, operational and safety requirements for a marine high-voltage system;
 - .2 Assignment of suitably qualified personnel to carry out maintenance and repair of high-voltage switchgear of various types;
 - .3 Taking remedial action necessary during faults in a high-voltage system;
 - .4 Producing a switching strategy for isolating components of a high-voltage system;
 - .5 Selecting suitable apparatus for isolation and testing of high-voltage equipment;
 - .6 Carrying out a switching and isolation procedure on a marine high-voltage system, complete with safety documentation; and
 - .7 Performing tests of insulation resistance and polarization index on high-voltage equipment.

IMO Model Course 7.08, Ed. 2014

Electro-Technical Officer

Function 1: Electrical, Electronic and Control Engineering at the Operational level

Competence 1.1 Monitor the Operation of Electrical, Electronic and Control Systems

1.1.11 APPRECIATIONS OF THE HAZARDS AND PRECAUTIONS REQUIRED FOR THE OPERATION OF POWER SYSTEMS ABOVE 1,000 VOLTS

Required performance

11.1 Hazards and Precautions Required for the Operation of Power Systems Above 1,000 Volts (5 hours)

- explains relation between shock voltage and shock current
- explains the possibility of distance electrical shock
- explains the possibility of the electrical shock by the electrostatic charge
- explains the influence of shock current on human body
- explains the difference of electric shock caused by low and high voltage
- understands meaning of warning signs
- understands the possibility of essential lengthening and migration of electric arc at the voltages above 1kV
- explains basic parameters of electric arc: the temperature, the energy etc.

Competence 1.4: OPERATE AND MAINTAIN POWER SYSTEMS IN EXCESS OF 1,000 VOLTS

1.4.1 HIGH VOLTAGE TECHNOLOGY

Required performance:

1.2 High Voltage Technology (15 hours)

- explains nature and forming of electric stresses in general, electric stresses in laminar structures and HV insulation structure
- explains the break-down strength of gases, discharge development in gases, critical voltage and stress, partial discharges, static and impulse air break-down strength, low and high pressure-gases insulation system break-down strength
- explains the break-down strength of solid dielectrics, discharge mechanism in solids
- describes the break-down strength of operation insulation systems, high voltage insulation systems on ships
- describes the general overvoltage characteristics, short-circuit and weak reactive current switching overvoltage
- explains the ageing of electrical insulation
- describes the circumstances causing development of high voltage power systems on ships
- explains construction and operation of HV equipment:

- circuit breakers, vacuum type and pressurised gas type (SF6) for arc quenching, fuses, over current protection etc.
- electrical machines: motors, generators, transformers
- switchboards
- instrumentation
- describes overvoltage protection, protectors and arresters, insulation systems coordination, voltage disturbances and threats elimination

1.4.2 SAFETY PRECAUTIONS AND TECHNOLOGY

Required performance:

2.1 Safety Precautions and Technology (5 hours)

- explains and describes general HV protection measures: housings, partitions, distances, insulation mats, insulation materials, access restrictions, markings and warnings, HV equipment access monitoring and locks
- explains and describes how to use fixed and portable HV measurement and control apparatus for testing insulation resistance of HV machines, cables and another equipment,
- explains how to check and use HV testers

1.4.3 ELECTRICAL PROPULSION OF THE SHIPS, ELECTRICAL MOTORS AND CONTROL SYSTEMS

Required performance:

3.1 Electrical Propulsion of the Ships, Electrical Motors and Control Systems (15 hours)

- describes advantages of ship electrical propulsion
- presents configurations of electrical propulsion:
 - Electric Propulsion Systems with classic shaft lines
 - Podded Propulsion Systems
- draws up general block diagram of electrical propulsion system with all main components
- states High Voltage Supply and Power range of electric propulsion systems used on ships
- describes main features of electric motors used in Main Propulsion systems:
 - types of electric motor
 - mechanical construction
 - excitation
 - motor cooling
- describes propulsion supply equipment:
 - transformers (air cooled and liquid cooled) with protection
 - slip rings with arc monitoring circuit
- names types of frequency drives used in main propulsion systems, draws up their block diagrams and explains main features:
 - Frequency Converter (with current source inverter and voltage source inverter)
 - Cyclo converter
- names methods of electric motor control used in Propulsion Drives, draws up their block diagrams and explains main features:
 - vector control
 - direct torque control
- describes remote control system of podded propulsion:
 - rpm control
 - steering angle control
 - combined rpm and steering angle control during ship manoeuvring

- describes the harmonic distortion related to power electronic systems and use of harmonic filters

1.4.4 SAFE OPERATION AND MAINTENANCE OF HIGH-VOLTAGE SYSTEMS

Required performance:

4.1 Safe Operation and Maintenance of High-Voltage Systems (12 hours)

- knows how to use HV personal protection equipment (PPE): insulated gloves, goggles, insulating bars, insulating footwear, mats, earthing cables, HV testers
- knows terms of certification of personal protection equipment
- explains HV safety procedures:
 - permission and co-ordination of HV works
 - information, warnings and protection against unauthorized influence on safety
 - assistance during HV work
 - checking for voltage presence before any work starts

STCW Section A-III-6

Operate and maintain power systems in excess of 1000V

Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence
Operate and maintain power systems in excess of 1,000 volts	<i>Theoretical knowledge</i> High-voltage technology Safety precautions and procedures Electrical propulsion of the ships' electrical motors and control systems <i>Practical knowledge</i> Safe operation and maintenance of high-voltage systems, including knowledge of the special technical type of high-voltage systems and the danger resulting from operational voltage of more than 1,000 volts	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience .3 approved simulator training, where appropriate .4 approved laboratory equipment training	Operations are planned and carried out in accordance with operating manuals, established rules and procedures to ensure safety of operations

ANNEX 2

COURSE OUTLINE

Knowledge, understanding and proficiency	Total hours for lectures	Total hours for practical's
21. Introduction, Safety briefing and objectives of the course.	0.25 hrs	
22. High Voltage Technology and application on board ships, concepts and terminology.	0.75 hrs	
23. Electrical hazards associated with High voltage systems and their precautions. eg. electrical shock, arc flash and arc blast.	1.50 hrs	
24. Arrangement of high voltage installations, switch rooms, switchboards, transformers and earthing systems.	1.50 hrs	
25. Safety regulations regarding work on high voltage installations.	1.00 hrs	
26. Work Permits and procedures for preventing accidents while carrying out maintenance and repairs	1.00 hrs	
27. Operation and safety features of High Voltage switchgear and the use of HV PPE. (Practical: demonstration of PPE)	1.00 hrs	1.00 hr
28. Regulations governing High Voltage installations in marine / offshore.	1.50 hrs	
29. Electrical Stresses and Break down strength and ageing of High Voltage electrical insulation structure	1.00 hrs	
30. Types of High Voltage distribution systems, their construction, insulated and non-insulated system components, cables, fuses and protective devices	1.50 hrs	
31. Issue and control of safety documentation (Procedures, Control & policy) (Practical: Practice on actual ship's plan - Prepare switching plan, Limitation of access, Permit to work, Sanction for test & logbook)	0.75 hrs	1.00 hr
32. Safety lockout procedures, key safes / Multi Hasp locking devices and isolation procedure (Practical: Risk Assessment and Isolation and earthing diagram)	0.75 hrs	1.00 hr
33. Treatment of system neutral point (based on type of installation)	0.5 hrs	
34. Electrical propulsion systems – Direct Shaft / Podded type	2.00 hrs	
35. Construction and Operation of High Voltage Systems - High Voltage motors, Cyclo-converters, Frequency control and controlling of motors / propulsion drives, Transformers & other equipment (Frequency control & Bus Management Strategy and switching sequence).	2.00 hrs	2.00 hr

Knowledge, understanding and proficiency	Total hours for lectures	Total hours for practical's
(Practical: Demonstration of variable frequency drive operation and show its components)		
36. Power Management System, instrumentation and High Voltage measuring and testing equipment. (Fixed and Portable)	2.50 hrs	
37. Polarization Index and IR Test Procedure for High Voltage equipment. (Practical: IR test on HV cable, PI and DA test demonstration).	1.50 hrs	2.50 hrs
38. Maintenance and fault Identification in High Voltage system and procedure switching and isolation procedure using appropriate tools and PPE. Draw out VCB, key safe procedure. (Practical: Demonstrate operation of VCB, Isolation, draw out, vacuum checking, gap gauging. Demonstrate vacuum contractor).	2.50 hrs	2.50 hrs
39. Emergency Procedures and Case Studies	1.00 hr	
40. Demonstration of High Voltage systems and procedure for carrying out work using appropriate tools and PPE. (Practical: At High voltage facility: Effect of shapes of electrode on voltage breakdown, surface current and creepage distance, measurement of voltage and current by CT and PT. Or Demonstrate disconnection of VCB from live bus bar, safety precautions and application of CME)	1.00 hr	3.50 hrs
Practical Assessment test & Evaluation	0.50 hrs	0.50 hr
Subtotals	26.00 hrs	14.00 hrs
Total for the course	40.00 hrs	

ANNEX 3

COURSE TIME-TABLE

	1st Period (2.0 Hours) (0900 - 1100hrs)	2nd Period (2.0 Hours) (1115- 1315hrs)		3rd Period (2.0 Hours) (1345- 1545hrs)	4th Period (2.0 Hours) (1600- 1800hrs)
Day 1	• Introduction, Safety briefing and objectives of the course • High Voltage Technology and application on board ships, concepts and definitions • Electrical Hazards associated with high voltage systems and earthing system. e.g. electrical shock, arc flash and arc blast and their precautions	• Electrical Hazards associated with high voltage systems and earthing system. e.g. electrical shock, arc flash and arc blast and their precautions (contd...) • Arrangement of high voltage installation, switch room, switch boards, transformers and earthing system.	LUNCH BREAK	• Safety Regulations regarding work on high voltage installations. • Work Permits and procedures for preventing accidents while carrying out maintenance and repair	• Operational and safety features associated with high voltage switchgear • Practical demonstration of PPE Types of PPE requirement for High voltage system and Donning of PPE
Day 2	• Regulations governing High Voltage installations in marine / offshore. • Electrical Stresses and Break down strength and ageing of High Voltage electrical insulation structure	• Electrical Stresses and Break down strength and ageing of High Voltage electrical insulation structure (contd) • Types of High Voltage distribution systems, their construction, insulated and non-insulated system components, cables, fuses and protective devices		• Issue and control of safety documentation (Procedures, Control & policy) • Practical: Practice on actual ship's drawing - Prepare switching plan, Limitation of Access, Permit to work, Sanction for test and logbook. • Safety lockout procedures, key safes / Multi Hasp locking devices and isolation procedure	• Safety lockout procedures, key safes / Multi Hasp locking devices and isolation procedure (contd) • Practical: Risk assessment and isolation and earthing diagram. • Treatment of system neutral point (based on type of installation)
Day 3	• Electrical propulsion systems – Direct Shaft / Podded type	• Construction and Operation of High Voltage Systems - High Voltage motors, Cyclo-converters, Frequency control and controlling of motors / propulsion drives, Transformers & other equipment (Frequency control & Bus Management Strategy) and switching sequence.		• Practical: Demonstration of variable frequency drive operation and show its components	• Power Management System, instrumentation and High Voltage measuring and testing equipments. (Fixed and Portable)
Day 4	• Power Management System, instrumentation and High Voltage measuring and testing equipments. (Fixed and Portable) (contd..) • Polarization Index and IR Test Procedure for High Voltage equipments.	• Practical: IR test on HV cable, PI and DA test demonstration.		• Practical: IR test on HV cable, PI and DA test demonstration. (contd) • Maintenance and fault Identification in High Voltage system and procedure using appropriate tools and PPE. Draw out procedure of VCB and Key safe procedure.	• Maintenance and fault Identification in High Voltage system and procedure using appropriate tools and PPE. Draw out procedure of VCB and Key safe procedure. . (contd...) • Practical: Demonstrate operation of VCB, Isolation, draw out, vacuum checking, gap gauging. Demonstrate vacuum contactor.

	1st Period (2.0 Hours) (0900 - 1100hrs)	2nd Period (2.0 Hours) (1115- 1315hrs)		3rd Period (2.0 Hours) (1345- 1545hrs)	4th Period (2.0 Hours) (1600- 1800hrs)
					•
Day 5	• Practical: Demonstrate operation of VCB, Isolation, draw out, vacuum checking, gap gauging. Demonstrate vacuum contactor. (contd) • Emergency Procedures and Case Studies	• Emergency Procedures and Case Studies (contd) • Demonstration of High Voltage systems and procedure for carrying out work using appropriate tools and PPE	LUNCH BREAK	• Practical: • At High voltage facility – Effect of shape of electrode on voltage breakdown, surface current and creep-age distance, measurement of voltage and current by CT and PT. OR Demonstrate disconnection of VCB from live bus bar, safety precautions and application of CME	• Practical: (contd...) • At High voltage facility – Effect of shape of electrode on voltage breakdown, surface current and creep-age distance, measurement of voltage and current by CT and PT. OR Demonstrate disconnection of VCB from live bus bar, safety precautions and application of CME • Practical Assessment test & Evaluation.

ANNEX 4

Institute's
LOGO

NAME and ADDRESS of the D. G. Approved Training Institute

INDOS No:

Tel:

Fax:

E-mail:

THIS IS TO CERTIFY THAT *[full name of candidate]*

Date of Birth (dd/mm/yyyy)

Holder of C.D.C. No.

Certificate of Competency (if any), Grade : No.

Indian National Database of Seafarers (INDoS No.)

has successfully completed a training course in

HIGH VOLTAGE SAFETY AND SWITCH GEAR (MANAGEMENT LEVEL)

held from to

This course is approved by the Directorate General of Shipping and meets the requirement laid down in Regulation III/2 paragraph 2, Section A- III/2 and relevant sections of Table A- III/6 of the STCW Convention and Code 1978, as amended in 2010.

The candidate has also met the additional criteria in the STCW convention, applicable to the issues of the certificate

The certificate is issued under the authority of the Directorate General of Shipping, Ministry of Shipping, Government of India.

Signature of Candidate

Name and Signature of Course In-charge

Date of Issue: _____

Date of Expiry: UNLIMITED

Name and Signature of Dean / Principal

Official
seal

Colour

Photograph

(35 mm x 35 mm)

(Details of topics covered are mentioned overleaf)

ANNEX I
IMO Model Course 7.04, Ed. 2014
Officer in charge of an Engineering Watch
Function 2: Electrical, Electronic and Central Engineering at the Operational Level

Competence 2.1: Operate Electrical, Electronic and Control Systems.
Section 1.7: High Voltage Installation (5 hours)

- States that more than 1,000 V is usually called high voltage
- States how and why high-voltage installations are used on board ships
- States what voltage are mostly used as high voltage on board ships
- Describe equipment/ installations in high- voltage systems such as high-voltage generator, distributor board, motors, etc.
- States the special characteristic and features of high-voltage installations in comparison with less than 1,000 V
- States that high voltage systems are normally earthed via a resistor
- Explain how the presence of earth faults is indicated in a high- voltage system with an earthed neutral
- States safety precautions to be strictly observed to prevent accidents when working on high-voltage electrical equipment
- States that any operation of high-voltage installations must be carried out remotely at places where a certain distance is being kept from the installations.

Learning Outcomes

- Definition of high- voltage and typical voltages found on board ship.
- The learner knows the arrangement and protection of high voltage installations on board a vessel
- Need for High Voltage safety rules and procedures
- Requirements of modern vessels which are equipped with high voltage generator and distribution system.
- Statutory regulations & requirements for high voltage system on marine and offshore applications
- Difference between insulated & earthed neutral distribution system and function of the protection devices and their sequence of operation in a high voltage distribution system.
- Electrical Hazards associated with thigh voltage systems. E.g. electrical shock, arc flash and arc blast.
- Arrangement of high voltage switches room equipment and associated equipment
- Practices and PPE requirements.
- Competent person and authorized personnel to carry out maintenance and repair and permits.
- Operational and safety features associated with high voltage electrical hazards, including importance of a Circuit Main Earth.

ANNEX 2

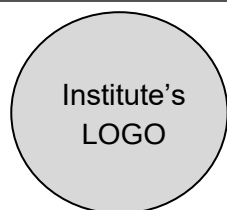
COURSE OUTLINE

Knowledge, understanding and proficiency	Total Hours for Lectures	Total hours practical's
1. Introduction, Safety briefing and objectives of the course.	0.25 hrs	
2. High Voltage Technology and application on board ships, concepts and terminology.	0.75 hrs	
3. Electrical hazards associated with High voltage systems and their precautions. eg. electrical shock, are flash and arc blast.	1.50 hrs	
4. Arrangement of high voltage installations, switch rooms, switchboards, transformers and earthing systems and remote operation.	1.50 hrs	
5. Safety Regulations, Permit and procedures for preventing accidents while carrying out maintenance and repair.	1.00 hrs	
6. Operation and safety features of High Voltage electrical hazards	0.75 hrs	
7. Demonstration of High Voltage Safeties and functionalities of High Voltage Switch Gear		0.50hrs
8. Types of PPE requirement for HIGH voltage system and Donning of PPE	0.50 hrs	
9. Practical Donning and Use of High Voltage PPE (Practical: demonstration of PPE)		0.75 hrs
Assessment and Discussions	0.50 hrs	
Subtotals	6.75	1.25
TOTAL HOURS	8.0	

ANNEX 3
COURSE TIME-TABLE

	1st Period (2.0 Hours) (0900 - 1100hrs)	2nd Period (2.0 Hours) (1115- 1315hrs)		3rd Period (1.45 Hours) (1345- 1545hrs)	4th Period (2.15 Hours) (1600- 1800hrs)
Day 1	11. Introduction, Safety briefing and objectives of the course 12. High Voltage Technology and application on board ships, concepts and definitions 13. Electrical Hazards associated with high voltage systems and earthing system. e.g. electrical shock, arc flash and arc blast and their precautions	14. Electrical Hazards associated with high voltage systems and earthing system. e.g. electrical shock, arc flash and arc blast and their precautions (contd...) 15. Arrangement of high voltage installation, switch room, switch boards, transformers and earthing system. and remote operation	LUNCH BREAK (1315-1345 hrs)	16. Safety Regulation, Permits and procedure for preventing accidents while carrying out maintenance and repair 17. Operational and safety features associated with high voltage electrical hazards	18. Demonstration of high voltage safeties and functionalities of High Voltage Switch Gear 19. Types of PPE requirement for High Voltage system and Donning of PPE 20. Practical Donning and Use of High Voltage PPE Assessment and Discussions

ANNEX 4



NAME and ADDRESS of the D. G. Approved Training Institute

INDOS No:

Tel:

Fax:

E-mail:

Certificate No: _____

THIS IS TO CERTIFY THAT *[full name of candidate]*

Date of Birth (dd/mm/yyyy)

Holder of C.D.C. No.

Certificate of Competency (if any), Grade : No.

Indian National Database of Seafarers (INDoS No.)

has successfully completed a training course in

HIGH VOLTAGE SAFETY SWITCH GEAR COURSE (OPERATIONAL LEVEL)

held from to

This course is approved by the Directorate General of Shipping and meets the requirement laid down in Regulation III/1, Section A- III/1, Table A- III/1 and Regulation A-III/7, Section A-III/7, Table A-III/7 of the STCW Convention and Code 1978, as amended in 2010.

The candidate has also met the additional criteria in the STCW convention, applicable to the issues of the certificate

The certificate is issued under the authority of the Directorate General of Shipping, Ministry of Shipping, Government of India.

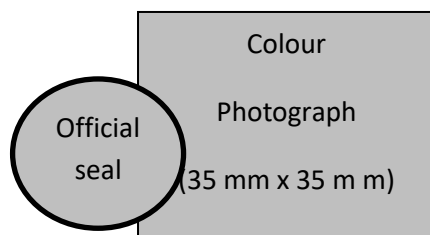
Signature of Candidate

Name and Signature of Course In-charge

Date of Issue: _____

Date of Expiry: UNLIMITED

Name and Signature of Dean / Principal



(Details of topics covered are mentioned overleaf)

The candidate has received training on the following systems and equipment:

- High Voltage Technology and its application on board ships
- Electrical hazards associated with High Voltage systems and their precaution
- Arrangement of high voltage installation and earthing system
- Operation and safety features and functionalities of High Voltage Switch Gear
- Permit Systems, safety procedure and use Personnel Protective device when working with High Voltage systems.

MARINE BOILER AND STEAM ENGINEERING COURSE- OPERATIONAL LEVEL COURSE guidelines

Course Title : MARINE BOILERS & STEAM ENGINEERING.

Level : Operational

Theory : 20 hours

Practical: 21 hours

Faculty In-charge

- a) Name, Address & Telephone No. of :
Head of Institute and course In-charge
- b) List of Instructors and Name & :
Telephone No. of Warden
- c) Guidelines for Instructors :

1. All the instructors to adhere the timing as mentioned in time table.
2. All the instructors should prepare the lesson plans, course materials and presentation as mentioned in these guidelines.
3. All the instructors should evaluate the trainee at the end of the course.

(d) Course objectives: At the end of the course, the cadets will be able to

- Describe the classification societies requirement for boiler construction ‘
- Differentiate between application & operating principal of smoke tube and water tube boiler List types of smoke tube and water tube boiler describe Features and operating principals
- Describe function of boiler mountings
- Describe operating principal and features of steam plant associated equipment and systems.
- Describe the operations and operating procedure of Marine auxiliary Boilers
- Describe Boiler maintenance requirement and list out the procedure

(e) Scope of the Course: The scope includes the following: Design considerations, classification society requirements of steam equipment in general, specific Marine Auxiliary boilers equipment used on merchant vessels. Types of boilers and boiler mountings. Study in details Auxiliary boilers (Sunrod element, water tube, AO9 mission OL, Composite Boiler) Starting, stopping, operation of auxiliary Boilers and turbines. Boiler water testing and treatment.

(f) Reference Books (a) Text books Marine boilers 3ed, by GTH Flanagan (b) Marine Steam Boilers by JH Milton (c) Boilers Operation Guide by A L Kohan (d) Reed's Series Vol 8 and 9 (e) Marine Engineering by Harrington (f) Running and Maintenance of Marine Machinery by Dr J Cowley.

(g) Course Plan:

Sr. No	Topic	Book	Faculty's Name	No. of lectures	Practical's
1	General principles of steam generator. General considerations of design			2	3
2	Smoke tube boilers			2	-
3	Water tube boilers			2	3
4	Waste heat boilers			2	-
5	Boiler Mountings			4	4
6	Combustion system and safeties			2	3
7	Boiler water treatment			3	3
8	Operation care & Maintenance			2	2
9	Boiler System			-	3
10	Assessment and Review			1	-
	Total			20	21

Each session will be followed up by a question answer exercise on the day's topic.

(h) Procedure for Evaluation, Criteria for Passing and Instructions for Resists: Written & oral examination by Institutions. 70 % is the pass marks. Failed student will be given additional classes and re-exam will be conducted.

(i) Re- Examination: Written & Orals

MARINE BOILER AND STEAM ENGINEERING COURSE- OPERATIONAL LEVEL(SYLLABUS)

MARINE BOILER AND STREAM ENGINEERING COURSE- OPERATIONAL LEVEL

SYLLABUS

Main Topic	General Learning Objectives (Duration) (Training Aids)	Specific Learning Objectives	Remarks
			Competency
1 .General considerations Governing the design of Boilers 5.0/41	A. Student learns about development of Steam Machinery & design considerations (2+3 Hr)	1.1 1.1 Understand the types of Modern day steam plants & machinery 1.2 1.2 State marine applications of Boilers & Turbines(30) 1.3 1.3 State stresses in boiler shell (15) 1.4 1.4 Understand the working conditions of boiler pressure and effect of temperature on yield strength (15) 1.5 1.5 Describe the classification- society requirements for calculation of minimum thickness selection of materials, working temperature, design pressure. (30) 1.6 1.6 Understand the requirement of auxiliary boiler onboard.(30) 1.7 1.7 Familiarization of boiler System-PRACTICALS(180)	Table A-III/1 Marine Engineering at the operational Level Operate main And Auxiliary Machinery and Associated control systems- Marine Boiler
2.Smoke tube boilers 7.0/41	A. student learns about Smoke tube boilers & auxiliary boilers, components and systems(2 Hrs)	2.1 Describe general arrangement, flow of hot gases 2.2 Describe vertical smoke tube boiler 2.3 Describe Aalborg Mission OM Boilers 2.4 State the requirements of steam to steam generator 2.5 Describe composite boiler Aalborg OC type.	-Do-
3.Water tube Boilers 12.0/48	A. Student learns about features, general arrangement of water tube boilers its advantages (2+3 Hrs)	3.6 Audi visual Presentation on types of Boilers-PRACTICALS Self Learning tool	-Do-
4.Waste heat boilers	A.Student learns about Waste heat recovery boiler, Economizers (02 Hrs)	4.1 Describe the design considerations for waste heat recovery 4.2 Describe types of waste heat recovery boilers 4.3 Explain operation methods of boiler and economizer under way	

		4.4 Explain precautions for using exhaust gas economizer 4.5 Explain why the temperature of boiler exhaust gases should be maintained above a minimum value 4.6 Explain with the help of line diagram the arrangement on board for an oil fired boiler working in conjunction with exhaust gas recovery boiler / economizer	
5.Boiler Mountings	A. Student learns about Boiler Mountings and their functions (04+04 Hrs)	5.1. State the various mountings fitted on boilers and their basic function -identify the following boiler fitting and position on boiler shell (supply shell diagram for fitting to be marked/ drawn and identified): -main stream outlet (or stop) valve -safety valves and easing gear -water level gauge -feed inlet valve -blow-down valve -scumming valve -soot blower -connection for pressure gauge -air release valve -sampling valve Explain the importance of boiler mounting valves 5.2 Describe Classification society rules for Safety valves selection, set pressure, accumulation test 5.3 Describe constructional features of high lift and full bore safety vv-State the function of safety valve and how to adjust the setting point to blow Safety valves (7.02 1.3.1.14) 2Hrs Analyze operational problems that can occur with safety valves Examine how a safety valve is inspected and overhauled, giving common defects and areas Of importance when inspecting. Formulate a procedure for setting safety valves and examine the precautions necessary when testing safety valves on boilers and waste heat units 5.4 Describe constructional features of water level indicators. -Describe the method used to ensure that all pipes,	

		cocks, valves and other fittings used for indicating water level are clear and in good working order -Describe the correct procedure for checking the water level in steaming boiler. 5.5 Describe class requirement of Feed regulator, circulating valve, blow down valve, air vents, low water level sensor and alarm/trip, 5.6 identify the following internal boiler fitting and internal position within boiler shell: - feed water distribution unit - summing pan - blow down dip pipe 5.7 Explain the purpose of a reducing valves and fittings listed in the above objective, compare the difference where applicable between water tube and fire tube boiler 5.8 Explain the purpose of a reducing valve 5.9 Describe the operation of a reducing valve, using a single line sketch 5.10 Explain how steam pipes are supported 5.11 Explain how expansion and contraction are allowed for in steam pipes 5.12 Describe the purpose of drains and steam traps 5.13 Describe the operation of steam traps	
6 Combustion System and safeties 27/41	Student learns about firing the boiler (2+3hrs)	6.1 Describe the fuel system and associated components. State the range of percentages of CO₂ which indicate: - good combustion - poor combustion - bad combustion Reference to be made of the relevance of stoichiometric combustion for tanked operation. Describe furnace condition which indicate good combustion. Explain the importance of atmosphere	

		when it is required to mix a liquid fuel with air prior to combustion. Explain why the viscosity of a fuel is important in its atomization Describe how the viscosity of a liquid fuel can be controlled by varying its temperature State the theoretical air/fuel ratio for a typical boiler fuel State the actual air/fuel ratio allowing for normal excess air in the furnace of steam boiler Describe with a single line diagram, a combustion air register, identify -Swirl vanes -The quarl -the flame stabilizer - Air flow control valve -The burner 6.2 Describe types of burners (Y jet, spinning cup, steam assisted atomizers) Sketch a section through the nozzle assembly of a pressure-jet burner. State that the above objective atomization is produced by the fuel, at high pressure passing through a small orifice in the burner nozzle. Describe with the aid of sketches how pressure jet, steam jet and rotary cup burner atomize fuel and promote adequate fuel/air mix ratio. Describe the attention required by burner atomizer tip. 6.3 explain ignition system inclosing the function of burner control state what is meant by ABC and ACC Describe the principles of construction, operation and control of a package boiler – PRACTICALS	
8 Operation & maintenance of boilers37/41	A. Student learns about operation of	8.1 Describe the procedure for preparing auxiliary boilers for flashing up	

	boilers(02+02 hrs)	-State how to build up the steam pressure and to put boiler into service. -Explain precautions and necessary measures to be taken when getting up steam 784 Describe the procedure for warming through a steam line and explain the causes in simple terms of water hammer and how water hammer can be avoided Explain what malfunction / trouble is likely to happen to boiler in operation 8.5 Describe the procedure of plugging of tubes and renewal. 8.6 Explain the need for and the use of soot blowers -understand requirement soot blowing. - Describe types of soot blowers and their function - Describe types of soot blowers and their function - State what is meant by soot blow including the function of soot blowers	
9. Boiler systems 40/41	Students learns to simulate boiler operation 3 hrs	Simulator	
10. 41/41	Assessment & review 1hrs		

MARINE BOILER AND STEAM ENGINEERING COURSE- OPERATIONAL LEVEL- CERTIFICATE FORMAT

Emblem
name ...

Certificate No:

THIS IS TO CERTIFY THAT MR.

Date of Birth:/...../.....

Holder of C.D.C. No. and Passport No.

Certificate of Competency, Grade No.

Indian National Date base (INDos No.)

has successfully completed a training course

MARINE BOILERS AND STEAM ENGINEERING COURSE-OPERATIONAL LEVEL

held from to and has been found qualified.

The course is approved by the Directorate General of Shipping and meets the requirement laid down in:
Table A-III/I (Operational level) of STCW Convention as amended in 2010.

The Candidate has also met the additional criteria specified in the STCW Convention, applicable to the
issue of the certificate.

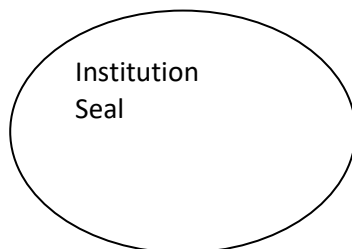
This certificate is issued under the authority of the Directorate General of Shipping, Ministry of Shipping,
Govt. of India.

Signature of Candidate
(Name & Signature)

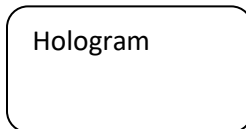
Course Officer
(Name & Signature)

Date of issue:

Date of Expiry: UNLIMITED



Hologram



Principal

MARINE BOILER AND STEAM ENGINEERING COURSE- MANAGEMENT LEVEL COURSE GUIDELINES

Course handout

Course Title : MARINE BOILERS & STEAM ENGINEERING.

Level : Management.

Theory: 38 hours

Practicals : 24 hours

Faculty In- charge:

a) **Name, Address & Telephone No. of** :
Head of Institute and course In-charge

b) **List of Instructors and Name &** :
Telephone No. of Warden

c) **Guidelines for Instructors** :

1. All the instructors to adhere the timing as mentioned in time table.
2. All the instructors should prepare the lesson plans, course materials and presentation as mentioned in these guidelines.
3. All the instructors should evaluate the trainee at the end of the course.

(d) Course objectives: At the end of the course, the cadets will be able to

- Describe the classification societies requirement for boiler construction ‘
- Differentiate between application & operating principal of smoke tube and water tube boiler List types of smoke tube and water tube boiler describe Features and operating principals
- Describe function of boiler mountings
- Describe operating principal and features of steam plant associated equipment and systems.
- Describe the operations and operating procedure of Marine auxiliary Boilers
- Describe Boiler maintenance requirement and list out the procedure

(e) Scope of the Course: The scope includes the following: Design considerations, classification society requirements of steam equipment in general, specific Marine Auxiliary boilers equipment used on merchant vessels. Types of boilers and boiler mountings. Study in details Auxiliary boilers Starting, stopping, operation of auxiliary Boilers and turbines. Boiler water testing and treatment.

(f) Reference Books (a) Text books Marine boilers 3ed, by GTH Flanagan (b) Marine Steam Boilers by JH Milton (c) Boilers Operation Guide by A L Kohan (d) Reed's Series Vol 8 and 9 (e) Marine Engineering by Harrington (f) Running and Maintenance of Marine Machinery by Dr J Cowley.

(g) Course plan:

Sr. No	Topic	Book	Faculty's Name	No. of lectures	Practical's
1	General principles of steam generator. General considerations of design			6	3
2	Smoke tube boilers			2	-
3	Water tube boilers			4	3
4	Waste heat boilers			2	-
5	Boiler Mountings			4	4
6	Boiler auto control system, burner management system, SCC			6	3
7	Boiler water treatment			5	3

8	Operation care & Maintenance			4	2
9	Boiler System			-	5
10	Auxiliary Steam Turbine – Operation			3	1
11	Assessment and Review			3	1
	Total			38	24

Each session will be followed up by a question answer exercise on the day's topic.

(h) Procedure for Evaluation, Criteria for Passing and Instructions for Resists: Written & oral examination by Institutions. 70 % is the pass marks. Failed student will be given additional classes and re-exam will be conducted.

(i) Re- Examination: Written & Orals

MARINE BOILER AND STEAM ENGINEERING COURSE- MANAGEMENT LEVEL (SYLLABUS)

MARINE BOILER AND STREAM ENGINEERING COURSE- OPERATIONAL LEVEL SYLLABUS

Sr. No	Topic	Book	Faculty's Name	No. of lectures	Practicals
1	General principles of steam generator. General considerations of design			6	3
2	Smoke tube boilers			2	-
3	Water tube boilers			4	3
4	Waste heat boilers			2	-
5	Boiler Mountings			4	4
6	Boiler auto control system, burner management system, SCC			6	3
7	Boiler water treatment			5	3
8	Operation care & Maintenance			4	2
9	Boiler System			-	5
10	Auxiliary Steam Turbine – Operation			3	1
11	Assessment and Review			3	1
	Total			38	24

Main Topic	General Learning Objectives (Duration) (Training Aids)	Specific Learning Objectives	Remarks
			Competency
1 .General considerations Governing the design of Boilers 9/62	A. Student learns about development of Steam Machinery & design considerations (6+3 Hr)	1.8 1.1 Understand the types of Modern day steam plants & machinery 1.9 1.2 State marine applications of Boilers & Turbines(30) 1.3 State stresses in boiler shell (15) 1.4 Understand the working conditions of boiler pressure and effect of temperature on yield strength (15) 1.5 Describe the classification-society requirements for calculation of minimum thickness selection of materials, working temperature, design pressure. (30) 1.6 Understand the requirement of auxiliary boiler onboard (30) 1.7 Familiarization of boiler System-PRACTICALS(180) 1.8 Name the various heating loads on ship and required temperatures to maintain them. 1.9 Average working pressure of Saturated steam boiler 2.0 Steam line layout and steam traps. 2.1 Human injury and safety to be adopted.	Table A-III/2 Marine Engineering at the Management Level Operate main And Auxiliary Machinery and Associated control systems- Marine Boiler
2.Smoke tube boilers	A. student learns about Smoke tube boilers & auxiliary boilers, components and systems(2 Hrs)	2.1 Describe general arrangement, flow of hot gases 2.2 Describe vertical smoke tube boiler 2.3 Describe Aalborg Mission OM Boilers 2.4 State the requirements of steam to steam generator 2.5 Describe composite boiler Aalborg OC type.	-Do-
3.Water tube Boilers 18/62	A. Student learns about features, general arrangement of water tube boilers its advantages (4+3 Hrs)	Boiler and associated auxiliaries and steam systems 7.04 1.4.3.2 (16 Hrs) 3.1 Describe the basic arrangement of a D type water tube boiler and the salient features of D type boilers Explain Natural circulation within boiler 3.2 Describe the functions of major components, types of tubes and functions (steam drum,	-Do-

		water drum, header, Steam drum internal) 3.3 Describe the types of tubes and functions (Screen, water wall, generating, super heater, down comer, riser) 3.4 Describe salient features of Aalborg water tube boilers- 3.5 Explain the outline of steam supply system including its component/ installation 3.6 Audio visual Presentation on types of Boilers- PRACTICALS-Self	
4.Waste heat boilers	A. Student learns about Waste heat recovery boiler, Economizers (02 hrs)	4.1 Describe the design considerations for waste heat recovery 4.2 Describe types of waste heat recovery boilers 4.3 Explain operation methods of boiler and economizer under way 4.4 Explain precautions for using exhaust gas economizer 4.5 Explain why the temperature of boiler exhaust gases should be maintained above a minimum value 4.6 Explain with the help of line diagram the arrangement on board for an oil fired boiler working in conjunction with exhaust gas recovery boiler / economizer	
5.Boiler Mountings 28/62	A. Student learns about Boiler Mountings and their functions (04+04 Hrs)	5.1. State the various mountings fitted on boilers and their basic function -identify the following boiler fitting and position on boiler shell (supply shell diagram for fitting to be married/ drawn and identified): -main stream outlet (or stop) valve -safety valves and easing gear -water level gauge -feed inlet valve -blow-down valve -scrumming valve -soot blower -connection for pressure gauge -air release valve -sampling valve Explain the importance of boiler mounting valves 5.2Describe Classification society rules for Safety valves selection, set pressure, accumulation test 5.3Describe constructional features of high lift and full bore	

		safety vv -State the function of safety valve and how to adjust the setting point to blow Safety valves (7.02 1.3.1.14) 2Hrs Analyze operational problems that can occur with safety valves Examine how a safety valve is inspected and overhauled, giving common defects and areas Of importance when inspecting. Formulate a procedure for setting safety valves and examine the precautions necessary when testing safety valves on boilers and waste heat units. 5.4 Describe constructional features of water level indicators. -Describe the method used to ensure that all pipes, cocks, valves and other fittings used for indicating water level are clear and in good working order - Describe the correct procedure for checking the water level in steaming boiler. 5.5 Describe class requirement of Feed regulator, circulating valve, blow down valve, air vents, low water level sensor and alarm/trip, 5.6 identify the following internal boiler fitting and internal position within boiler shell: - feed water distribution unit - summing pan - blow down dip pipe 5.7 Explain the purpose of a reducing valves and fittings listed in the above objective, compare the difference where applicable between water tube and fire tube boiler 5.8 Explain the purpose of a reducing valve 5.9 Describe the operation of a reducing valve, using a single line sketch 5.10 Explain how steam pipes are supported 5.11 Explain how expansion and contraction are allowed for in steam pipes	

		5.12 Describe the purpose of drains and steam traps 5.13 Describe the operation of steam traps	
6 Boiler Auto control system 37/62	Student learns about firing the boiler (6+3hrs)	6.1 Describe the fuel system and associated components. State the range of percentages of CO₂ which indicate: - good combustion - poor combustion - bad combustion Describe furnace condition which indicates good combustion. Explain the importance of atmosphere when it is required to mix a liquid fuel with air prior to combustion. Explain why the viscosity of a fuel is important in its atomization Describe how the viscosity of a liquid fuel can be controlled by varying its temperature State the theoretical air/fuel ratio for a typical boiler fuel State the actual air/fuel ratio allowing for normal excess air in the furnace of steam boiler Describe with a single line diagram, a combustion air register, identify -Swirl vanes -The quarl -the flame stabilizer - Air flow control valve -The burner 6.2 Describe types of burners (Y jet, spinning cup, steam assisted atomizers) Sketch a section through the nozzle assembly of a pressure-jet burner. State that the above objective atomization is produced by the fuel, at high pressure passing	

		through a small orifice in the burner nozzle. Describe with the aid of sketches how pressure jet, steam jet and rotary cup burner atomize fuel and promote adequate fuel/air mix ratio. Describe the attention required by burner atomizer tip. 6.3 explain ignition system inclosing the function of burner control state what is meant by ABC and ACC 6.4 Boiler automation with respect to SCC, BMS and water level Describe the principles of construction, operation and control of a package boiler – PRACTICALS	
7. Boiler water treatment 45/62	A. Student learns about scale formation, corrosion and requirements of water treatment (05+03 hrs)	7.1 Describe the constitute of sea water and type of salts 7.2 explain the need for removal of hardness salts 7.3 Understand types of corrosion and effect of quality of boiler water on boiler (dependence on pH, alkalinity and Oxygen content) 7.4 Describe the terms Blow down, dosing, sampling, carryover, priming, Caustic Embrittlement. 7.5 Explain the importance of boiler water treatment. Explain the treatment of boiler water including examination of properties of boiler water including surface and bottom blow of boiler life. 7.6 Explain the effect of quality of boiler water on boiler life 7.7 State procedure for determination of (a) Chloride content (b) Alkalinity	

		(c) Phosphate Understand requirement of blow down, dosing, sampling and meaning of priming carryover Describe the danger of oil entering with the feed water. Describe the means used to minimize the possibility of oil contaminating the boiler feed water.	
8. Operation & maintenance of boilers 51/62	A. Student learns about operation of boilers	8.1 Describe the procedure of (a) Pressure testing (b) Laying up and explain how to keep boiler in cold condition while it is out of service (c) Inspection 8.2 Describe the procedure for preparing auxiliary boilers for flashing up 8.3 Describe the procedure of raising steam from cold and safety precautions State procedure for igniting the burner manually automatically - Explain what is meant by 'blow-back' - Explain how blow back can be avoided - State hoe to build up the steam pressure and to put boiler in to service - Explain precautions and necessary measures to be taken when getting up steam - Explain the benchmark for building up steam pressure 8.4 Describe the procedure for warming through a steam line and explain the causes in simple terms of water hammer and how water hammer can be avoided - Describe the correct procedure for operating steaming boiler in parallel on load - State precaution for opening high temperature steam valves - Explain what malfunction/	

		trouble is likely to happen to boiler in operation 8.5 Describe the procedure of plugging of tube and renewal.	
9. Boiler systems 40/41	Students learn to simulate boiler operation 3 hrs	Simulator	
10. Auxiliary Steam Turbine	Student Understand the basic turbine and its starting (3 hrs = 1 hrs)	10.1 Understands steam turbine 10.2 Understands the features of a steam turbine plant 10.3 Understand the sequence of events in starting a turbine from cold	
60/62	Assessment & review 1hrs		

MARINE BOILER AND STEAM ENGINEERING COURSE- MANAGEMENT LEVEL – CERTIFICATE FORMAT

Emblem-

Certificate No:

THIS IS TO CERTIFY THAT MR.

Date of Birth:/...../.....

Holder of C.D.C. No. and Passport No.

Certificate of Competency, Grade No.

Indian National Data base (INDos No.)

has successfully completed a training course

MARINE BOILERS AND STEAM ENGINEERING COURSE-MANAGEMENT LEVEL

held from to and has been found qualified.

The course is approved by the Directorate General of Shipping and meets the requirement laid down in: Table A-III/I (Operational level) of STCW Convention as amended in 2010.

The Candidate has also met the additional criteria specified in the STCW Convention, applicable to the issue of the certificate.

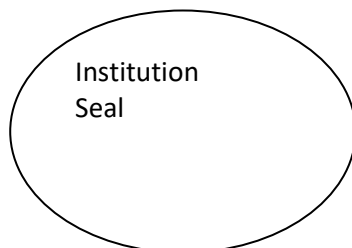
This certificate is issued under the authority of the Directorate General of Shipping, Ministry of Shipping, Govt. of India.

Signature of Candidate
(Name & Signature)

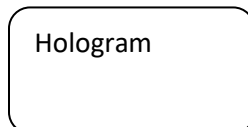
Course Officer
(Name & Signature)

Date of issue:

Date of Expiry: UNLIMITED



Hologram



Principal

Chapter IV – Radio Communication and Radio Operators – Pg.857- 874

IV/1	IV/1	GMDSS Operator's Course (GOC)	858-870
	IV/1A	Provisional certificate of GMDSS	871
	IV/1B	Format of GMDSS General Operator's Certificate of Proficiency	872-874

OPERATOR'S COURSE (GOC)

Reference Table A-IV/1
Specification of minimum standard of competence for GMDSS radio operators
(General Operator certificate)
Function – Radio communication at Operation level

knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
Competence No. 1: Transmit and receive information using GMDSS subsystems and equipment and fulfilling the functional requirements of GMDSS In addition to the requirements of the Radio Regulations, a knowledge of: .1 search and rescue radiocommunications, including procedures in the International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual .2 the means to prevent the transmission of false distress alerts and the procedures to mitigate the effects of such alerts .3 ship reporting systems .4 radio medical services .5 use of the International Code of Signals and the IMO Standard Marine Communication Phrases .6 the English language, both written and spoken, for the communication of information relevant to safety of life at sea <i>Note:</i> This requirement may be reduced in the case of the Restricted Radio Operator's Certificate 1 Knowledge of the basic features of the maritime mobile service and maritime mobile satellite service. 1.1 The general principles and basic features of the maritime mobile service and the maritime mobile satellite service. Types of the communication in the Maritime Mobile and Maritime Mobile Satellite Service • Distress, Urgency & Safety communication • SAR Communications • On-scene communications • Public correspondence • Port operation service • Ship movement service • Internship communication • Onboard communication Types of stations in the Maritime Mobile and Maritime Mobile Satellite Service	Examination and assessment of evidence obtained from practical demonstration of operational procedures, using: .1 approved equipment .2 GMDSS communication simulator, where appropriate. .3 radiocommunication on laboratory equipment	Transmission and reception of communications comply with international regulations and procedures and are carried out efficiently and effectively English language messages relevant to the safety of the ship, security and persons on board and protection of the marine environment are correctly handled.

knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
• Ship Stations and Ship Earth Stations • Coast Radio stations and Coast Earth Stations • Vessel Traffic Service Stations. • Aircraft stations • Rescue co-ordination centers (RCC) • Maritime Rescue co-ordination centers (MRCC) Elementary knowledge of frequencies and frequency bands • The concept of frequency and relationship between frequency and wavelength The unit of frequency (Hz, Khz, Mhz, Ghz). • The subdivision of the most significant part of the radio spectrum: MF, HF, VHF, UHF, SHF. Characteristics of frequencies. • Different propagation mechanisms: propagation in free space, ground wave, ionosphere propagation. • Propagation of MF frequencies • Propagation of different HF frequency bands • Propagation of VHF and UHF frequencies Knowledge of the role of the various modes of communication. • DSC • Radio telephony • NBDP • Facsimile • Data Elementary knowledge of different types of modulation and classes of emission • Classes of emission • Carrier frequency and assigned frequency • Bandwidth of different emissions • Official designations of emissions (E.g. F1B, HSB, CW, AM, etc) • Unofficial designations of emissions (E.g. Tlx, SSB, CW, AM, etc.) Frequencies allocated to the Maritime Mobile Service The usage of MF, HF, VHF, UHF and SHF frequencies in the Maritime Mobile and Maritime Mobile Satellite Service • The concept of radio channel. Simplex, semi-duplex and duplex. Paired and unpaired frequencies. • Frequencies plans and channeling systems		

knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
MF telephony (Relevant appendix of the Radio Regulations) VHF telephony (Relevant appendix of the Radio Regulations) HF NBDP (Relevant appendix of the Radio Regulations) MF telephony and NBDP for Region 1 (Geneva 85 plan) GMDSS distress and safety frequencies DSC- MF, HF, VHF frequencies MSI frequencies Distress and safety frequencies of the pre-GMDSS system Calling frequencies 1.3 General Principles and Basic Features of the Maritime Mobile and Maritime Mobile Satellite Service Basic Knowledge of Satellite Communication • Inmarsat space segment • Modes of communications • Telex services • Telephone services • Data and facsimile communications • Store and Forward communications • Inmarsat – C communications • Fleet-77 Communications • Inmarsat – Enhanced Group Call (EGC) system 2 Detailed practical knowledge and ability to use the basic equipment of a ship station • Use in practice the basic equipment of a ship station • Digital Selective Calling (DSC) • General principles of Narrow Band Directing Printing (NBDP). Ability to use maritime NBDP equipment in practice. • Usage of Inmarsat systems. Inmarsat equipment or simulator in practice. • Fault locating 2.1 Knowledge of and ability to use in practice the basic equipment of a ship station Watch keeping receivers • The controls and usage of 2182 kHz watch receiver • The controls and usage of VHF DSC watch receiver and MF/HF watch receiver VHF radio installation • Channels • Controls		

knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
• Usage • DSC MF/HF radio installation • Frequencies • Typical controls and usage... - Connecting the Power - Selecting Rx Frequency - Selecting Tx Frequency - Selecting ITU channel number - Tuning the transmitter - Selecting the class of emission - Using volume control and squelch - Using clarifier or RX fine tuning - Controlling RF gain - Using automatic gain control - Using the 2182 kHz instant selector - Testing the alarm generator - Using the alarm generator Antennae • Isolators • VHF whip antennae • MF/HF whip antennae • MF/HF wire antennae • Construction of an MF emergency antenna • Sources of Energy: • Main source • Emergency source • Reserve source • Batteries • Different kinds of batteries and their characteristics • Charging • Maintenance of batteries Survival craft radio equipment • Portable two-way radiotelephone apparatus • SART • EPIRB • AIS • LRIT • SSAS 2.2 Digital Selective Calling (DSC) Call format specifier • Distress call • All ships call		

knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
• Call to individual stations • Geographic area calls • Group calls • automatic/semi-automatic service Call address selection with the MMSI number system • The nationality identification • Group calling numbers • Coast station numbers • MMSI number with three trailing zeros Call categorization • Distress • Urgency • Safety • Ship business • Routine Call telecommand and traffic information • Distress alerts • Other calls • Working frequency information 2.3 Knowledge of the general principles of NBDP. Ability to use maritime NBDP equipment in practice NBDP systems • Automatic systems • Semi-Automatic systems • Manual systems • ARQ mode • FEC mode ISS/IRS arrangement • Master and slave • Radio telex number • Answerback • Numbering of the SSFC selective calling system 2.4 Knowledge of the usage of Inmarsat systems. Ability to use Inmarsat equipment or simulator in practice. Inmarsat –C ship Earth Station • Components of an Inmarsat-C terminal • Entering/updating position • Usage of an Inmarsat-C Ship Earth Station • Sending and receiving text messages 2.5 Fault Locating • Proficiency in elementary fault localization by		

knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
means of built-in measuring instruments or software in accordance with the equipment manuals. Elementary fault repair such as replacement of fuses, indicator lamps and the like. 3.0 Operational procedures and detailed practical operation of the GMDSS and subsystems • Global Maritime Distress and Safety System (GMDSS) • INMARSAT • NAVTEX • Emergency Position Indicating Radio Beacons (EPIRBs) • Search and Rescue Radar Transponder (SART) • Distress, Urgency and Safety Communication procedures in the GMDSS • The provision of radio services in emergencies • Search and Rescue Operation (SAR)		
Competence No. 2: Provide radio services in emergencies The provision of radio services in emergencies such as: • .1 abandon ship • .2 fire on board ship • .3 partial or full breakdown of radio installations Preventive measures for the safety of ship and personnel in connection with hazards related to radio equipment, including electrical and non-ionizing radiation hazards 3.1 Global Maritime Distress and Safety System (GMDSS) • Sea Areas and the GMDSS Master Plan • Watchkeeping on distress frequencies • Functional requirements of ship stations • Carriage requirements of ship stations • Sources of energy of ship stations • Means of ensuring availability of ship station equipment • Licenses, Safety Radio Certificates, Inspection and Surveys 3.2 INMARSAT Usage in the GMDSS Fleet-77 Ship Earth Station Distress Communications	Examination and assessment of evidence obtained from practical demonstration of operational procedures, using: • .1 approved equipment • .2 GMDSS communication simulator, where appropriate. • .3 radiocommunication laboratory equipment	Response is carried out efficiently and effectively

knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
• Use of the distress facility • Satellite acquisition • Telex and Voice distress communications • Procedures for distress communications • Rescue Co-ordination Centres associated with the Coast Earth Stations <u>Medical Services</u> Inmarsat-C Ship Earth Station Distress and Safety Services • Sending a distress alert • Sending a distress priority message • The Inmarsat-C safety services • 2-digit code safety services Inmarsat EGC • The purpose of the EGC system • All Ships messages and Inmarsat system messages • Classes of Inmarsat-C SES and their EGC reception 3.3 NAVTEX • The Navtex System • The purpose of Navtex • Navtex frequencies • Reception Range • Message format (transmitter ID, message type, message Number) Navtex Receiver • Selection of transmitters • Selection of message type • Messages which cannot be rejected • Use of subsidiary controls and changing paper 3.4 Emergency Position Indicating Radio Beacons (EPIRBs) Satellite EPIRBs • Basic characteristics of operation on 406 MHz • Basic characteristics of operation on 1.6 GHz • 121.5 MHz including homing functions • Information contents of a distress alert • Manual Usage • Float-free function		

knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
• Documentation • Routine Maintenance - Testing - Checking battery expiry date - Cleaning of the float-free release mechanism VHF DSC EPIRB • The main technical characteristics • Information contents of a distress alert • Manual operation • Float-free function • Routine maintenance - Testing - Checking battery expiry date - Cleaning of the float-free release mechanism 3.5 Search and Rescue Transponder and Search and Rescue Transmitter Search and Rescue Radar Transponder (SART) • The main technical characteristics • Operation • Range of a SART transmitter • Routine maintenance of a SART - Checking battery expiry date Search and Rescue AIS Transmitter (AIS SART) • The main technical characteristics • Operation • Range of a SART transmitter • Routine maintenance of a SART - Checking battery expiry date 3.6 Distress, Urgency and safety communication procedures in the GMDSS Distress communications. • DSC distress alert - The definition of a distress alert - Transmission of a distress alert - Transmission of a shore to ship distress alert relay - Transmission of a distress alert by a station not itself in distress • Receipt and acknowledgement of DSC distress alert - Acknowledgement procedure by radiotelephony - Acknowledgement Procedure by NBDP		

knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
Receipt and acknowledgement by a coast station Receipt and acknowledgement by a ship station • Handling of distress alerts Preparations for handling of distress traffic Distress traffic terminology • Testing DSC distress and safety calls • On-scene communications • SAR operations Urgency and safety communications • The meaning of urgency and safety communications • Procedures for DSC urgency and safety calls • Urgency communications • Medical transports • Safety communications Communication by radiotelephony with stations of the old distress and safety system • Radiotelephone alarm signal • Distress signal • Distress call • Distress message • Acknowledgement of a distress message • Distress traffic terminology • Transmission of distress message by a station not itself in distress • Medical advice by radio Reception of maritime safety information (MSI) • Reception by NAVTEX • Reception by INMARSAT EGC • Reception by HF NBDP • The Navigation warning signal of the old distress and safety system • The navigation warnings transmitted by radiotelephony Protection of distress frequencies • Guard Bands • Tests on distress frequencies		

knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
• Transmission during distress traffic • Avoiding harmful interference • Prevention of unauthorized transmission <u>Provision of radio services in emergencies such as:</u> 1. Abandon ship 2. Fire on board ship 3. Partial or full breakdown of radio installations • Knowledge of the GMDSS operating guidance for masters of ships in distress situations. • Awareness of the marine radio communication facilities available for distress purposes. • Complete familiarization with the operation of the marine radio communication equipment for use in situations indicated above (both on board and lifeboat equipment). <u>Search and rescue operation (SAR)</u> • The role of RCCs • International Aeronautical and Maritime Search and Rescue Manual Volume – 3 (IAMSAR) Co-ordination of search and rescue operations (Terms, definitions abbreviations, co-ordination by land-based authorities, and on–scene co-ordination, designation of OSC and CSS and their responsibilities) Action by assisting ships (Transmission of distress messages, components of a distress message, direction-finding and homing and cancellations of distress messages) Action by assisting ships (Reception of distress call and messages, immediate action following reception of distress call and message, D/F bearings, acknowledgement of receipt of the distress message and transmission of message of proceeding for rescue		

knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
Marine radiocommunication frequencies available for distress purposes (both GMDSS and pre-GMDSS) Ship/shore frequencies by- DSC on VHF, MF, HF INMARSAT, R/T, EPIRBs Ship/Ship, Ship/SAR vessel/aircraft frequencies • Maritime rescue organizations • Ship reporting systems (AMVER, AUSREP, JASREP, INSPIRES.....etc.) 3.7 The means to prevent the transmission of false distress alerts and the procedures to mitigate the effects of such alerts • Emphasis on the need to avoid false distress alerts • Stressing the importance of knowledge and familiarity of all radio equipment on the ship through routine drills • Stressing the importance of routine testing under the direct supervision of the person responsible for the radiocommunication functions • Silencing of distress alerts sent inadvertently on VHF, MF, HF, INMARSAT and EPIRBs • Care during testing, Transportation and scrapping of EPIRBs 4 Miscellaneous skills and operational procedures for general communications • Ability to use English language both written and spoken for the satisfactory exchange of communications relevant to the safety of life at sea • Obligatory procedures and practices • Practical and theoretical knowledge of general communication procedures 4.1 Ability to use English language both written and spoken for the satisfactory exchange of communications relevant to the life at sea. • Use of the International Code of Signals. • IMO Standard Marine Communication Phrases. • Recognized Standard abbreviations and commonly used services codes. • Use of International phonetic alphabets. 4.2 Obligatory procedures practices		

knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
• Effective use of obligatory documents and publications. • Radio record keeping. • Knowledge of the regulations and agreements governing the maritime mobile service and the maritime mobile- satellite service 4.3 Practical and theoretical knowledge of general communication procedures • Selection of appropriate communication methods in different situations • Traffic lists • Radio telephone call - Method of calling a coast station by radiotelephony - Ordering for a manually switched link call - Ending facilities of calls - Method of calling a coast station by DSC - Selecting an automatic radiotelephone call • Traffic charges - International charging system - Inmarsat communications charging system - AAIC code - The meaning of land line charge (LL), Coast charge (CC) and ship charge (SS) Currencies used in international charging - Practical traffic routines - World geography, especially the principal shipping routes and related communication routes Preventive measures for the safety of ship and connection with hazards related to radio equipment, including electrical and no ionizing radiation hazards. • Safety precautions to be taken while handling radio equipment (maintenance and minor repairs) • Safe rigging of antennae • Precautions against chemical burns and electrical shock Publications Ability to use ITU manual/publications and ALRS Publications Inmarsat Space Segment Modes of Communication:		

knowledge, Understanding & Proficiency / Course covered	Methods of demonstrating competence	Criteria for evaluating competence
Telex, Telephone, Data, Fax, Store and Forward Distress and /safety/communication: Inmarsat C Enhance Group Call.		

PROVISIONAL CERTIFICATE OF GMDSS



GOVERNMENT OF INDIA

MINISTRY OF COMMUNICATIONS

(WIRELESS PLANNING & COORDINATION WING)

Sanchar Bhavan, 20-Ashok Road, New Delhi – 110001

Phone: (91 11) 3032181 Fax: (91 11) 3716111

PROVISIONAL CERTIFICATE

No: GMDSS (GOC) /MUMBAI/KOLKATA/CHENNAI/DELHI/_____

Date: _____

This is to certify that Shri_____

Son of Shri_____ CDC/PP/COP No. _____

has passed the **GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GOC)**
EXAMINATION conducted by this Ministry on _____

Validity: Three months from the date of issue.

()

Examination - In – Charge

For Assistance Wireless Adviser
to the Government of India.

Centre: MUMBAI/KOLKATA/CHENNAI/DELHI

FORMAT OF GMDSS GENERAL OPERATOR'S CERTIFICATE OF PROFICIENCY



**GOVERNMENT OF INDIA
MINISTRY OF COMMUNICATIONS
CERTIFICATE OF PROFICIENCY
AND
License to operate**

**GMDSS
General Operator's Certificate
ISSUED UNDER THE INDIAN TELEGRAPH ACT, 1985
AND RULES MADE THEREUNDER**

Particulars of Holder

Provisional Certificate No.: _____
License No.: _____
Issued on.: _____
Valid upto: _____
Name: _____
Father's Name: _____
Date of Birth: _____
Place of Birth: _____
Nationality: _____
Height: _____
Color of eyes: _____
Color of Hair: _____
Complexion: _____
Marks of Identification: _____
Signature of holder: _____

PHOTOGRAPH

(Signature)
Assistance Wireless Advise to the Government of India



GOVERNMENT OF INDIA
Ministry of Communications

General Operator's Certificate (GMDSS)

No.:

This is to Certify that under the provisions of section 3 of the Indian Wireless Telephony (Commercial Radio Operator's certificate of Proficiency and Licence to operate Global Maritime Distress and Safety System), Rules 1997 and the Radio Regulations, Geneva annexed to the International Telecommunications Convention, Shri _____

Son/Daughter of Shri _____

Given proof, by examination that he/she possesses the technical and professional knowledge and the qualifications is hereby granted GMDSS general Operator's Certificate.

It is also certified that the holder has made a declaration that he will preserve the secrecy of correspondence.

(Signature)

Assistance Wireless Adviser to the Government of India

Place: _____

Date: _____

No.: _____

LICENCE TO OPERATE

The holder of this certificate is hereby authorized to perform the duties appropriate to the holder of General Operator's Certificate on board a ship in which GMDSS equipment have been established under a licence issued by Central Government subject to his satisfying other conditions laid down by the Central Government in this behalf from time to time.

The licence shall be in force during the period commencing on _____ and termination on _____ unless renewed further.

If the holder of this certificate or licence is proved in the opinion of the Central Government willfully or negligently to have failed to comply with the provisions of: -

- (i) the International Telecommunication Convention (or)
- (ii) the Indian Wireless Telegraphy (Commercial Radio Operator's Certificate of Proficiency and Licence to operate Global Maritime Distress and safety system), Rules 1997 (or)
- (iii) any regulations lawfully applicable to him in respect of Wireless Telegraphy or of Wireless apparatus (or)
- (iv) the lawful orders of the Master or person lawfully in -charge of the station, in which he is employed.

the Central Government may endorse, suspend or cancel the licence.

If this certificate or Licence is lost, mutilated or destroyed, the holder should immediately notify the same to the Central Government which may issue duplicate copies of the certificate or licence on payment of prescribed fees,

(Signature)
Assistance Wireless Advisor to the Government of India

Place: _____

Date: _____

Note: NO ENTRIES OR ENDORCEMENTS MAY BE MADE ON THIS CERTIFICATE AND LICENCE EXCEPT IN THE MANNER BY THE PERSONS AUTHORISED FOR THAT PURPOSE BY THE CENTRAL GOVERNMENT.

Chapter V
Special Training Requirements for Personnel on Certain Types of Ships
Pg. 875-935

V/1	V/1A	Basic Training for Oil and Chemical Tanker Cargo Operations Course	876-881
	V/1B	Advanced Training for Oil Tanker Cargo Operations Course	882-883
	V/1D	Format of the Combined Certificate of Proficiency for Basic Training for Oil and Chemical Tanker Cargo Operations	884
	V/1F	Format of the Certificate of Proficiency for Advanced Training for Oil Tanker Cargo Operations	885
V/2	V/2B	Format of the Certificate of Proficiency for Advanced Training for Chemical Tanker Cargo Operations	886
V/3	V/3	Basic Training for Liquefied Gas Tanker Cargo Operations Course	887-892
	V/3A	Advanced Training for Liquefied Gas Tanker Cargo Operations Course	893-895
	V/3C	Format of the Certificate of Proficiency for Advanced Training for Liquefied Gas Tanker Cargo Operations	896
V/4	V/4A	2.5 - day Passenger Ship Familiarization Course	897-905
	V/4B	Format of the Certificate for Passenger Ship Familiarization Course	906
	V/4C	5 - day Passenger Ship Safety Course	907-922
	V/4D	Format of the Certificate for Passenger Ship Safety Course	923-935

OIL AND CHEMICAL TANKER FAMILIARISATION BASIC DETAILS OF THE COURSE

COURSE OUTLINE

Knowledge, understanding and proficiency		Total hours for lectures	Total hours for practical's
1	Basic knowledge of tankers		
1.1	Types of oil and chemical tankers	0.25	
1.2	Basic knowledge of ship arrangements of an Oil tanker (*)	0.25	
1.3	Basic knowledge of ship arrangements of a Chemical Tanker (*) (##)	0.25	
1.4	Pumps and Eductors	1.0	
1.5	Cargo heating System	0.25	
1.6	Inert Gas System	0.5	
1.7	Cargo measurement systems	0.25	
2	Physical and chemical properties of oil and chemicals		
2.1	Basic physics	2.0	
2.2	Basic chemistry, chemical elements and groups	1.5	
2.3	Physical properties of oil and chemicals carried in bulk	1.5	
3	Knowledge and understanding of tanker safety culture and safety management	2.0	
4.1	Hazards		
4.1.1	Health hazards	0.5	
4.1.2	Environmental hazards	0.5	
4.1.3	Reactivity hazards	0.25	
4.1.4	Corrosion hazards	0.25	
4.1.5	Explosion and Flammability hazards	0.5	
4.1.6	Sources of ignition, Including electrostatic Hazards	0.5	
4.1.7	Toxicity hazards	0.25	
4.1.8	Vapour leaks and clouds	0.25	
4.2	Basic knowledge of hazard controls		
4.2.1	Inerting, water padding, drying agents and monitoring techniques	0.50	
4.2.2	Anti-static measures	0.5	
4.2.3	Ventilation	0.25	
4.2.4	Cargo segregation	0.25	
4.2.5	Cargo inhibition	0.25	
4.2.6	Importance of cargo Compatibility	0.5	
4.2.7	Atmospheric control	0.5	
4.2.8	Gas Testing	0.25	
4.2.9	Understanding of Information on a Material Safety Data Sheet (MSDS)	0.5	0.5
5	SAFETY		
5.1	Function and proper use of gas-measuring		1.0

Knowledge, understanding and proficiency		Total hours for lectures	Total hours for practical's
	instruments (**)		
5.2	Proper use of safety equipment and protective devices including:		
5.2.1	breathing apparatus and tank evacuating equipment(**)	0.5	0.5
5.2.2	protective clothing and equipment(**)	0.5	
5.2.3	resuscitators(**)	0.5	
5.2.4	rescue and escape equipment(**)	0.5	
5.3	Basic knowledge of safe working practices and procedures in accordance with legislation and industry guidelines relevant to oil and chemical tankers		
5.3.1	Precautions to be taken when entering enclosed spaces	1.0	
5.3.2	Precautions to be taken before and during "repair and maintenance" work in a gas dangerous area	0.5	
5.3.3	Safety measures for hot and cold work	1.5	
5.3.4	Electrical safety precautions	0.5	
5.4	Basic knowledge of first aid with reference to a Material Safety Data Sheet (MSDS)	2.0	
6	Fire Safety and Fire fighting operations		
6.1	Oil and Chemical Tanker fire response organization and action to be taken (**)	1.5	
6.2	Fire hazards associated with cargo handling and transportation of hazardous and noxious liquids in bulk	1.5	
6.3	Fire-fighting agents used to extinguish oil fires (**)	0.25	
6.4	Fire-fighting agents used to extinguish chemical fires and its compatibility with chemical cargoes (**)(##)	0.25	
6.5	Fixed fire-fighting foam operations (#)	0.5	2.0
6.6	Portable fire-fighting foam operations(#)	0.25	1.0
6.7	Fixed dry chemical powder operations (#)	0.5	2.0
6.8	Spill containment in relation to fire-fighting operations	0.25	
7	Cargo operations		
7.1	For Oil and Chemical Tankers	0.25	
7.2	For oil tankers (*)		
7.2.1	Cargo information	0.5	
7.2.2	Inerting	1.0	
7.2.3	Loading	0.5	
7.2.4	Unloading	0.5	
7.2.5	Tank cleaning	1.0	
7.2.6	Purging and gas freeing	0.5	
7.3	For Chemical Tankers (*) (##)		
7.3.1	Cargo information	0.5	
7.3.2	Loading	1.0	
7.3.3	Unloading	0.5	
7.3.4	Tank cleaning and gas-freeing	1.0	

Knowledge, understanding and proficiency		Total hours for lectures	Total hours for practical's
8	Emergencies For Oil and Chemical Tankers		
8.1	Basic knowledge of emergency procedures, including emergency shutdown	0.5	
8.2	Organizational structure	0.25	
8.3	Alarms	0.25	
8.4	Emergency procedures (*)	0.5	
9	Pollution Prevention for Oil and Chemical Tankers		
9.1	Basic knowledge of the effects of oil and chemical pollution on human and marine life	0.5	
9.2	Basic knowledge of shipboard procedures to prevent pollution	0.25	
9.3	SOPEP and SMPEP Measures to be taken in the event of spillage, including the need to:	0.5	
	.1 report relevant information to the responsible persons		
	.2 assist in implementing shipboard spill-containment procedures		
10	Case Studies on oil and NLS ship emergencies		
10.1	Fire and Explosion during unloading operations on an oil tanker	0.25	
10.2	Collapsing of seamen during squeegeeing operations (##)	0.25	
11	Discussions & Assessment	0.75	
	Subtotals	40.75	2.0
Total for the course			42.75

Notes:-

It is suggested that relevant topics which are marked with an Asterisk (*) may be taught on a simulator, if available.

The relevant topics which are marked with a double Asterisk (**) shall be demonstrated practically and may be supplemented with videos and CBT's.

Practical fire-fighting topics (6.5, 6.6, 6.7) covering 5 hrs, which are marked with a Hash (#) to be conducted separately in any facility which can conduct practical exercises and instruction under approved and truly realistic training conditions (e.g., fire-fighting mock up). The practical fire-fighting demonstrations is not part of this course and must be covered as an additional module in a Fire-fighting complex. However, the theory section to be covered within the time table frame of this course.

Topics which are specific to Chemical tankers are marked with (##) and should be taught by the faculty having chemical tanker experience at Management level.

COURSE TIME-TABLE

	1st Period (2.0 Hours) (0900 - 1100hrs)	2nd Period (2.0 Hours) (1115- 1315hrs)		3rd Period (1.5 Hours) (1345- 1515hrs)	4th Period (1.5 Hours) (1530- 1700hrs)
Day 1	1.1 Types of oil and chemical tankers 1.2 Basic knowledge of ship arrangements of an oil tanker(*) 1.3 Basic knowledge of ship arrangements of a Chemical tanker(*) 1.4 Pumps and Eductors(*) 1.5 Cargo heating System(*) 1.6 Inert Gas System(*) 1.7 Cargo measurement systems(*)	2.1 Basic physics	Lunch Break (1315– 1345hrs)	2.2 Basic chemistry, chemical elements and groups	2.3 Physical properties of oil and chemicals carried in bulk
Day 2	3 Knowledge and understanding of tanker safety culture and safety management	4.1.1 Health hazards 4.1.2 Environmental hazards 4.1.3 Reactivity hazards 4.1.4 Corrosion hazards 4.1.5 Explosion and flammability hazards		4.1.6 Sources of ignition, including electrostatic hazards 4.1.7 Toxicity hazards 4.1.8 Vapour leaks and clouds 4.2.1 Inerting, water padding drying agents and monitoring techniques	4.2.2 Anti- static measures 4.2.3 Ventilation system on oil and chemical tankers 4.2.4 Cargo Segregation 4.2.6 Importance of cargo compatibility (**)
Day 3	4.2.5 Cargo Inhibition 4.2.7 Atmospheric control 4.2.8 Gas testing Understanding of Information on a Material Safety Data Sheet (MSDS)	5.1 Function and proper use of gas measuring instruments (**) 5.2.1 Use of breathing apparatus and tank evacuating equipment (**)		5.2.2 Use of protective clothing and equipment (**) 5.2.3 Proper use of resuscitators (**) 5.2.4 Use of rescue and escape equipment (**)	5.3 Safe working practices relevant to oil and chemical tankers 5.3.1 Enclosed space entry 5.3.2 Precautions to be taken before and during repair and maintenance work in a gas dangerous area
Day 4	5.3.3 Safety measures for hot and cold work 5.3.4 Electrical safety precautions	5.4 Basic Knowledge of first aid with reference to a Material Safety Data Sheet	Lunch Break (1315– 1345hrs)	6.1 Oil and chemical tanker fire response organization (**)	6.2 Fire hazards associated with cargo handling and transportation of hazardous and noxious liquids in bulk

	1st Period (2.0 Hours) (0900 - 1100hrs)	2nd Period (2.0 Hours) (1115- 1315hrs)		3rd Period (1.5 Hours) (1345- 1515hrs)	4th Period (1.5 Hours) (1530- 1700hrs)
Day 5	6.3 Fire-fighting agents used to extinguish oil fires (**) 6.4 Fire-fighting agents used to extinguish chemical fires and its compatibility with chemical cargoes (**)(##) 6.5 Fixed fire-fighting foam operations 6.6 Portable fire-fighting foam operations 6.7 Fixed dry chemical system operations 6.8 Spill containment in relation to fire-fighting operations	7.1 Cargo operations for oil and chemical tankers 7.2 For oil tankers(*) 7.2.1 Cargo Information 7.2.2 Inerting 7.2.6 Purging and Gas Freeing		7.2.3 Loading (*) 7.2.3.2 Ship shore safety check List	7.2.4 Unloading (*)
Day 6	7.3 For Chemical Tankers (*) (##) 7.3.1 Cargo information 7.3.2 Loading 7.3.3 Unloading (Chemical tankers)	7.2 For Oil Tankers (*) 7.2.5 Tank cleaning for Chemical Tankers (##) 7.3.4 Tank cleaning and Gas freeing		8.1 Basic knowledge of emergency procedures, including emergency shutdown 8.2 Organizational structure 8.3 Alarms Emergency procedures (*)	9.1 Basic knowledge of the effects of oil and chemical pollution on human and marine 9.2 Basic knowledge of shipboard procedures to prevent pollution 9.3 SOPEP and SMPEP 10.1 Fire and Explosion during unloading operations on an oil tanker 10.2 Asphyxiation of seamen during squeegeeing operations (##) 11 Discussions and Assessment

Tea Breaks: 1100-1115 / 1515-1530



NAME and ADDRESS of the D.G. Approved Training Institute
INDOS No: **Tel:** **Fax:** **Email:**

Certificate No: _____

THIS IS TO CERTIFY THAT [full name of candidate]

Date of Birth(dd/mm/yyyy)

Hold of C.D.C. No.

Certificate of Competency, (if any) Grade : No.

Indian National Database of Seafarers (INDoS No.)

Has successfully completed a training course in

**BASIC TRAINING FOR
OIL AND CHEMICAL TANKER CARGO OPERATIONS**

Held from to

The Course is approved by the Directorate General of Shipping and meets the training requirements laid down in Regulation V/1-1 paragraph 2, Section A-V/1-1 paragraph 1 and Table A-V 1-1-1 of the STCW Convention and Code as amended in 2010, related to Oil and Chemical Tanker cargo Operations.

The Candidate has also met the additional criteria specified in the STCW Convention, applicable to the Shipping, Government of India.

This certificate is issued under the authority of the Directorate General of Shipping Ministry of Shipping, Government of India.

Signature of Candidate

Name and Signature of Course In-charge

Date of Issue : _____

Date of Expiry: UNLIMITED

Colour Photograph
(35 mm x 35 mm)

Official
Seal

Name and Signature of Dean/ Principal

Note : This is not a certificate of Proficiency In Basic Training in Oil and Chemical Tanker Cargo Operations. This Certificate along with with DGS approved "Practical Fire-fighting Course" certificate and other requisite documents must be submitted to the Administration or its centre(s) to obtain the Certificate of Proficiency.

Specialised Training Programme on:

- **Oil Tanker Operations**

SPECIALISED TRAINING PROGRAMME ON:

OIL TANKER OPERATIONS

SYLLABUS

Regulations and codes of practice

- 1 Familiarisation with the appropriate provisions of relevant international conventions; relevant international and national codes; the IMO Manual on Oil Pollution; relevant tanker safety guides and relevant port regulations as commonly applied.

2

Design and equipment of oil tankers

- 3 Familiarisation with piping, pumping, tank and deck arrangements; types of cargo pumps and their application to various types of cargoes; tank cleaning, gas-freeing and inerting systems; cargo tank venting and accommodation ventilation; gauging systems and alarms; cargo heating systems; and the safety aspects of electrical systems.

Cargo characteristics

- 4 Knowledge of the chemical and physical properties of different oil cargoes.

Ship operations

- 5 Cargo calculations; loading and discharging plans; loading and discharging procedures, including ship-to-ship transfers, checklists; use of monitoring equipment; importance of proper supervision of personnel; gas-freeing operations and tank cleaning operations; where appropriate, crude oil washing procedures and the operations and maintenance of inert gas systems; control of entry into pump-rooms and enclosed spaces; use of gas-detecting and safety equipment; load-on-top and proper ballasting and deballasting procedures; air and water pollution prevention.

Repair and maintenance

- 6 Precautions to be taken before and during repair and maintenance work, including that affecting pumping, piping, electrical and control systems; safety factors necessary in the performance of hot work; control of hot work and proper hot work procedures.

Emergency-operations

- 7 The importance of developing ship emergency plans; cargo operations emergency shut down; action in the event of failure of services essential to cargo; fire fighting on oil tankers; action following collision, stranding or spillage; medical first-aid procedures and the use of resuscitation equipment; use of breathing apparatus for safe entry into and rescue from enclosed spaces.

Additional topics

- 8 **Boiler combustion control**
- 9 **Bilge water separator and sewage plant**
- 10 **Helicopter/Tanker operations**
- 11 **Double hull tankers**
- 12 **Oil pollution liabilities and compensation**
- 13 **Transportation losses and commercial aspects of tanker operations**

**SPECIALISED TRAINING PROGRAMME ON:
OIL TANKER OPERATIONS**

COURSE PLAN

SR. NO.	SUBJECT AREA	TIME IN HOURS
1.	Introduction :	
	Oil Tankers, International & National regulations concerning oil tankers	2.0
2.	Basic Properties of Petroleum and its Hazards :	
	Basic physics; Properties of petroleum; Hazards associated with the handling and carriage of petroleum; Toxicity	6.0
3.	Safety:	
	General Precautions; Entry into enclosed spaces; Precautions against electrostatic hazards; Gas indicators; Fire-fighting principles; Protective equipment	9.0
4.	Pollution Prevention :	
	Ship & Equipment; Operational Pollution; Oil Record Book; Action in case of Oil spills; Air Pollution	5.0
5.	Oil Tanker Design and Equipment :	
	Construction; Pumping, piping and discharge arrangements; Cargo heating systems; Venting arrangements; Level gauges; Environmental protection equipment	6.0
6.	Oil Tanker Operations :	
	General precautions; Loading and discharging operations; Ballasting and deballasting; Tank cleaning; Slop-tank operation; Purging and gas-freeing; Ship/shore liaison	11.0
7.	Pump Theory & Characteristics:	
	Types of pumps; Pump theory; Centrifugal pumps	2.0
8.	Pressure Surge	1.0
9.	Emergency Procedures:	
	Emergency plan; Emergency alarms; Emergency organization; Action on discovering an emergency; SOPEP	3.0
10.	Boiler Combustion Control	1.0
11.	Inert Gas Systems:	
	Introduction; Inert gas system and its components; Operations; Maintenance and testing; Emergency procedures; Inert Gas Generators; IG for product carriers	7.0
12.	Crude Oil Washing:	
	Introduction; Crude oil washing system and its components; Stripping systems; Operations	5.0
13.	Bilge Water Separator & O.D.M	2.0
14.	Helicopter Operations	1.0
15.	Ship to Ship Transfer	1.0
16.	Tanker Mooring	1.0
17.	Double Hull Tankers	1.0
18.	Oil Pollution Liabilities and Compensation	2.0
19.	Transportation Losses and Commercial Aspects of Tanker Operations	2.0
20.	Assessment/Discussion	3.0
	TOTAL TIME :	71.0 Hours



NAME and ADDRESS of the D.G. Approved Training Institute

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Held from to

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The Candidate has also met the additional criteria specified in the STCW Convention, applicable to the Shipping, Government of India.

This certificate is issued under the authority of the Directorate General of Shipping Ministry of Shipping, Government of India

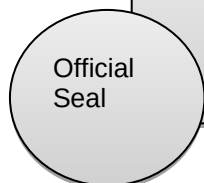
Signature of Candidate

Name and Signature of Course In-charge

Date of Issue : _____

Date of Expiry: UNLIMITED

Colour Photograph
(35 mm x 35 mm)



Name and Signature of Dean/ Principal

Note : This is not a certificate of Proficiency In Basic Training in Oil and Chemical Tanker Cargo Operations. This Certificate alongwith with DGS approved "Practical Fire-fighting Course" certificate and other requisite documents must be submitted to the Administration or its centre(s) to obtain the Certificate of Proficiency.



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Hold of C.D.C. No.

Certificate of Competency, (if any) Grade : No.

Indian National Database of Seafarers (INDoS No.)

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**BASIC TRAINING FOR
OIL AND CHEMICAL TANKER CARGO OPERATIONS**

Held from to

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The Candidate has also met the additional criteria specified in the STCW Convention, applicable to the Shipping, Government of India.

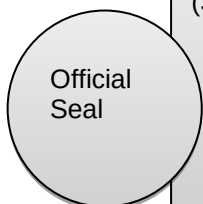
This certificate is issued under the authority of the Directorate General of Shipping Ministry of Shipping, Government of India

Signature of Candidate

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Date of Issue : _____

Date of Expiry: UNLIMITED



Colour Photograph
(35 mm x 35 mm)

Name and Signature of Dean/ Principal

Note : This is not a certificate of Proficiency In Basic Training in Oil and Chemical Tanker Cargo Operations. This Certificate alongwith with DGS approved "Practical Fire-fighting Course" certificate and other requisite documents must be submitted to the Administration or its centre(s) to obtain the Certificate of Proficiency.



NAME and ADDRESS of the D.G. Approved Training Institute
INDOS No: **Tel:** **Fax:** **Email:**

Certificate No: _____

THIS IS TO CERTIFY THAT *[full name of candidate]*

Date of Birth(dd/mm/yyyy)

Hold of C.D.C. No.

Certificate of Competency, (if any) Grade : No.

Indian National Database of Seafarers (INDoS No.)

Has successfully completed a training course in

**ADVANCED TRAINING FOR
CHEMICAL TANKER CARGO OPERATIONS**

Held from to

The Course is approved by the Directorate General of Shipping and meets the training requirements laid down in Regulation V/1-1 paragraph 6, Section A-V/1-1 paragraph 3 and Table A-V 1-1-3 of the STCW Convention and Code as amended in 2010.

The Candidate has also met the additional criteria specified in the STCW Convention, applicable to the Shipping, Government of India.

This certificate is issued under the authority of the Directorate General of Shipping Ministry of Shipping, Government of India.

Signature of Candidate

Name and Signature of Course In-charge

Date of Issue : _____

Date of Expiry :UNLIMITED

Colour Photograph
(35 mm x 35 mm)

Official
Seal

Name and Signature of Dean/ Principal

Note : This is not a certificate of Proficiency In Advanced Training in Chemical Tanker Cargo Operations. This Certificate alongwith other requisite documents must be submitted to the Administration to obtain the Certificate of Proficiency.

FAMILIARISATION TRAINING FOR LIQUEFIED GAS TANKER CARGO OPERATIONS

BASIC DETAILS OF THE COURSE

Annex 1

COURSE OUTLINE

Knowledge, understanding and proficiency		Total hours for lectures	Total hours for exercises
Competence 1 : Contribute to the safe operation of a liquefied gas tanker			
1.0	Basic knowledge of liquefied gas tankers		
1.1	Types of liquefied gas tankers	1.5	
1.2	General arrangement and construction (*)	1.5	
2.0	Basic knowledge of cargo operations		
2.1	Piping systems and valves (*)	1.5	
2.2	Cargo handling equipment (*)	1.5	
2.3	Loading, unloading and care in transit (*)	3.0	
2.4	Emergency shutdown(ESD) system (*)	0.5	
2.5	Tank cleaning, purging, gas freeing and inerting (*)	1.0	
3.0	Basic knowledge of the physical properties of liquefied gases		
3.1	Properties and characteristics (**)	0.25	
3.2	Pressure and temperature; including vapour pressure / temperature relationship	0.50	
3.3	Types of electrostatic charge generation	0.50	
3.4	Chemical symbols	0.25	
4.0	Knowledge and understanding of tanker safety culture and safety management	1.5	
Competence 2 : Take precautions to prevent hazards			
5.0	Basic knowledge of the hazards associated with tanker operations		
5.1	Health hazards	0.30	
5.2	Environmental hazards	0.10	
5.3	Reactivity hazards	0.10	
5.4	Corrosion hazards	0.10	
5.5	Explosion and flammability hazards	0.30	
5.6	Sources of ignition	0.10	
5.7	Electrostatic hazards	0.10	
5.8	Toxicity hazards	0.10	
5.9	Vapour leaks and clouds	0.10	
5.10	Extremely low temperatures	0.10	
5.11	Pressure hazards	0.10	

Knowledge, understanding and proficiency		Total hours for lectures	Total hours for exercises
6.0	Basic knowledge of hazard controls		
6.1	Inerting, drying and monitoring techniques	0.25	
6.2	Anti-static measures	0.25	
6.3	Ventilation	0.125	
6.4	Segregation	0.125	
6.5	Cargo inhibition	0.125	
6.6	Importance of cargo compatibility	0.125	
6.7	Atmospheric control	0.25	
6.8	Gas testing	0.25	
7.0	Understanding of information on a Safety Data Sheet (SDS)	1.5	

Competence 3: Apply occupational health and safety precautions and measures

8.0	Function and proper use of gas-measuring instruments and similar equipment	0.5	
9.0	Proper use of safety equipment and protective devices		
9.1	Breathing apparatus and tank-evacuating equipment (**)		0.25
9.2	Protective clothing and equipment (**)		0.25
9.3	Resuscitators (**)		0.25
9.4	Rescue and escape equipment (**)		0.25
10.0	Basic knowledge of safe working practices and procedures in accordance with legislation and industry guidelines and personal shipboard safety relevant to liquefied gas tankers		
10.1	Precautions to be taken when entering enclosed spaces (**)	0.5	
10.2	Precautions to be taken before and during repair and maintenance work	0.25	
10.3	Safety measures for hot and cold work	0.5	
10.4	electrical safety	0.25	
10.5	Ship/shore safety checklist (**)	1.5	
11.0	Basic knowledge of first aid with reference to a Material Safety Data Sheet (MSDS)	1.5	

Competence4 : Carry out fire – fighting operations

12.0	Fire safety and fire fighting operations		
12.1	Tanker fire organization and action to be taken (**)	0.25	
12.2	Special hazards associated with cargo handling and transportation of liquefied gases in bulk	0.25	
12.3	Fire-fighting agents used to extinguish gas fires (**)	0.25	
12.4	Fixed fire-fighting foam system operations	0.25	
12.5	Portable fire-fighting foam operations(#)/(**)	0.25	1.0

Knowledge, understanding and proficiency		Total hours for lectures	Total hours for exercises
12.6	Fixed dry chemical system operations(#)/(**)	0.25	2.0
12.7	Basic knowledge of spill containment in relation to other fire-fighting operations	0.50	
Competence 5 : Respond to emergencies			
13.0	Basic knowledge of emergency procedures including emergency shutdown	0.50	
Competence 6 : Take precautions to prevent pollution of the environment from the release of liquefied gases			
14.0	Basic knowledge of the effects of pollution on human and marine life	0.25	
15.0	Basic knowledge of shipboard procedures to prevent pollution	0.25	
16.0	Basic knowledge of measures to be taken in the event of spillage.		
16.1	Report relevant information to the responsible persons	0.20	
16.2	Assist in implementing shipboard spill-containment procedures	0.20	
16.3	Prevent brittle fracture	0.10	
17.0	Case Study	1.0	
17.1	Assessment	1.5	
	Subtotals	29.0	1.0
	Total for the course		30.0

Notes:-

It is suggested that relevant topics which are marked with an Asterisk (*) may be taught on a simulator, if available.

The relevant topics which are marked with a double Asterisk (**) shall be demonstrated practically and may be supplemented with videos and CBT's.

Practical fire-fighting topics (12.5, 12.6) covering 3 hrs, which are marked with a Hash (#) to be conducted separately in any facility which can conduct practical exercises and instruction under approved and truly realistic training conditions (e.g., fire-fighting mock up). The practical fire-fighting demonstrations is not part of this course and must be covered as an additional module in a Fire-fighting complex. However, the theory section to be covered within the time table frame of this course.

COURSE TIME-TABLE

	1st Period (1.5 Hours) (0900 - 1030 hrs)	2nd Period (1.5 Hours) (1100 - 1230 hrs)		3rd Period (1.5 Hours) (1330 - 1500 hrs)	4th Period (1.5 Hours) (1530 - 1700 hrs)
Day 1	1.0 Basic knowledge of liquefied gas tankers 1.1 Types of liquefied gas tankers	1.2 General arrangement and construction (*)		2.0 Basic knowledge of cargo operations: 2.1 Piping systems and valves (*)	2.2 Cargo handling equipment(*)
Day 2	3.0 Basic knowledge of the physical properties of liquefied gases 3.1 Properties and characteristics (**) 3.2 Pressure and temperature, including vapour pressure / temperature relationship 3.3 Types of electrostatic charge generation 3.4 Chemical symbols	5.0 Basic knowledge of the hazards associated with tanker operations 5.1 Health hazards 5.2 Environmental hazards 5.3 Reactivity hazards 5.4 Corrosion hazards 5.5 Explosion and flammability hazards 5.6 Sources of ignition 5.7 Electrostatic hazards 5.8 Toxicity hazards 5.9 Vapour leaks and clouds 5.10 Extremely low temperatures 5.11 Pressure hazards	MEAL BREAK (1230 – 1330 hrs)	6.0 Basic knowledge of hazard controls 6.1 Inerting, drying and monitoring techniques 6.2 Anti-Static measures 6.3 Ventilation 6.4 Segregation 6.5 Cargo inhibition 6.6 Importance of cargo compatibility 6.7 Cargo tank atmosphere monitoring 6.8 Gas Testing	7.0 Understanding of information on a Safety Data Sheet (SDS)

	1st Period (1.5 Hours) (0900 - 1030 hrs)	2nd Period (1.5 Hours) (1100 - 1230 hrs)		3rd Period (1.5 Hours) (1330 - 1500 hrs)	4th Period (1.5 Hours) (1530 - 1700 hrs)
Day 3	11.0 Basic knowledge of first aid with reference to a Safety Data Sheet (SDS)	10.0 Basic knowledge of safe working practices and procedures in accordance with legislation and industry guidelines and personal shipboard safety relevant to liquefied gas tankers 10.1 Precautions to be taken when entering enclosed spaces (**) 10.2 Precautions to be taken before and during repair and maintenance work 10.3 Safety measures for hot and cold work 10.4 Electrical safety		10.5 Ship/shore safety checklist (**)	8.0 Function and proper use of gas-measuring instruments and similar equipment 9.0 Proper use of safety equipment and protective
			MEAL BREAK (1230 – 1330 hrs)		devices 9.1 Breathing apparatus and tank evacuating equipment (**) 9.2 Protective clothing and equipment (**) 9.3 Resuscitators (**) 9.4 Rescue and escape equipment (**)
Day 4	2.4 Emergency shut Down system (ESD) (*) 2.3 Loading, unloading and care in transit (*)	2.3 Loading, unloading and care in transit (contd) (*)		2.3 Loading, unloading and care in transit(*) 2.5 Tank cleaning, purging, gas-freeing and inerting(*)	4.0 Knowledge and understanding of tanker safety culture and safety management

	1st Period (1.5 Hours) (0900 - 1030 hrs)	2nd Period (1.5 Hours) (1100 - 1230 hrs)		3rd Period (1.5 Hours) (1330 - 1500 hrs)	4th Period (1.5 Hours) (1530 - 1700 hrs)
Day 5	12.0 Fire safety and fire fighting operations 12.1 Tanker fire organization and action to be taken (**) 12.2 Special hazards associated with cargo handling and transportation of liquefied gases in bulk 12.3 Fire-fighting agents used to extinguish gas fires (**) 12.4 Fixed fire-fighting foam system operations(**) 12.5 Portable fire-fighting foam operations(**) 12.6 Fixed dry chemical system operations(**)	12.7 Basic knowledge of spill containment in relation to fire-fighting operations 13.0 Basic knowledge of Emergency procedures, including emergency shutdown 14.0 Basic knowledge of the effects of pollution on human and marine life 15.0 Basic knowledge of Shipboard procedures to prevent pollution	MEAL BREAK (1230 – 1330 hrs)	16.0 Basic knowledge of measures to be taken in the event of spillage 16.1 report relevant information to the responsible persons 16.2 assist in implementing shipboard spill-containment procedures 16.3 prevent brittle fracture 17.0 Case studies	Test and Discussions

Tea Breaks: 1030-1100 / 1500-1530

Notes:-It is suggested that relevant topics which are marked with an Asterisk (*) may be taught on a simulator, if available..

Specialised Training Programme on:

- Liquefied Natural Gas Tanker Operations

SPECIALISED TRAINING PROGRAMME ON:**LNG TANKER OPERATIONS****COURSE OUTLINE**

Subject Area		Approximate Time (Hours)	
		Lecture/ Discussion	Practical
1.	Introduction	3.0	
1.1	Introduction – The Course	0.5	
1.2	Development of Liquefied Natural Gas Transportation	0.5	
1.3	Production of Liquefied Natural Gas	1.0	
1.4	Sea transport of Liquefied Natural Gas	0.5	
1.5	Terminology	0.5	
2.	Chemistry and Physics (STCW Code, Section A-V/1 para 26)	5.0	
2.1	Properties and characteristics of liquefied gases and their vapours	1.0	
2.2	Basic Thermodynamic theory	1.0	
2.3	Properties of single liquid	1.0	
2.4	Nature and Properties of solution	1.0	
2.5	Control of boil off	1.0	
3.	Hazards (STCW Code, Section A-V/1 para 27,32)	3.0	
3.1	Health Hazards	1.0	
3.2	First Aid treatment	0.5	0.5
3.3	Reactivity , Flammability and Explosion	0.5	
3.4	Hazards	0.5	
3.5	Repairs and hot work		
4.	Rules and Regulations (STCW Code, Section A-V/1 para 23)	1.5	
4.1	International and national Codes and	0.5	
4.2	Regulations	0.5	

4.3	Gas Carrier Codes Certification and Surveys	0.5	
5.	Ship Design and Cargo Contamination (STCW Code, Section A-V/1 para 24,28)	5.0	
5.1	Construction and equipment requirements	0.5	
5.2	Ship Arrangements and Principal of Design *	1.5	
5.3	Cargo containment *	1.5	
5.4	Ship types and survival capability	1.5	
6.	Equipments and Support systems	9.0	
6.1	Water Curtain and Deck Spray	1.0	
6.2	Low Duty and High duty compressors	1.0	
6.3	Low Duty and High duty Gas Heaters	1.0	
6.4	Integrated Automation System (IAS)	1.0	
6.5	High Voltage System	1.0	
6.6	Cargo Pumps and Spray Pump	1.0	
6.7	Compressor lubricating oil system	1.0	
6.8	Fixed and Portable Gas Detection Equipment	0.5	0.5
6.9	Emergency Shut Down System (ESDS)	0.5	
6.10	Level Gauging system	0.5	
7.	Cargo Handling Systems (STCW Code, Section A-V/1 para 30)	12.0	
7.1	Tanks, piping and valves *	1.0	
7.2	Cargo ventilation system *	1.0	
7.3	Cargo Pumps and the unloading system, Spray pumps *	2.0	
7.4	Low duty and high duty compressors, Low duty and high duty Heaters *	2.0	
7.5	Reliquefaction plants, Re-gasification plants	2.0	
7.6	LNG vaporisers and Forcing vaporisers *	1.0	
7.7	Inert Gas Generator and Nitrogen Generator, Nitrogen pressurization and purge *	1.0	
7.8	Instrumentation and auxiliary systems *	1.0	
7.9	Custody transfer system (CTS),Cofferdam Heating System	1.0	
8.	Safety (STCW Code, Section A-V/1 para 25,29,32)	4.0	
8.1	Tank atmosphere evaluation *	1.0	
8.2	Fire prevention and equipment	1.0	
8.3	Pollution	1.0	
8.4	Protective and safety equipment	0.5	0.5
9.	Cargo Handling Operations (STCW Code, Section A-V/1 para 30,34)	10.0	
9.1	General Cargo Handling, Ship/Shore * preparation and Manifold Connection	1.0	

9.2	Procedures for preparation for loading and loading	2.0	
9.3	Cargo measurement and calculation *	1.0	
9.4	Loaded and ballast passage	1.0	
9.5	Procedures for preparation for unloading and * unloading, emergency discharge	2.0	
9.6	Hold Space and Cargo Tank Drying, Nitrogen * Purging ,Inerting of Cargo System	2.0	
9.7	Inerting, Cool down of cargo systems, * Warming up cargo tanks, Procedures for dry-docking	1.0	
10.	Ship/Shore Interface (STCW Code,Section A-V/1 para 30,33,34)	1.0	0.5
11.	Emergency Operation (STCW Code,Section A-V/1 para 31)	5.0	
11.1	Organizational structure	0.5	
11.2	Alarms	0.5	
11.3	Emergency procedures (Cargo Pump Failure, * Leak from Cargo Tank, Loss of primary Barrier, Ballast Tank Leakage into Containment Space, Nitrogen Supply Failure, Jettison of Cargo, Overfilling of a Cargo Tank, Loss of Cargo Pipeline Containment, Failure of Integrated Automation System, Uncontrolled Release of Cargo.	4.0	
12.	Discussions on National / Natural Gas Flag state Carriers and films	2.0	
13.	Assessment/Discussion	2.0	2.0
	Total	63.0	

Note: It is suggested that an LNG – Liquid Cargo Handling Simulator can serve as an efficient **teaching** tool. Should such a system be available, then the class / lecture hours should be adapted to incorporate such without raising the overall duration of the course. Areas that may be suitable for such training are indicated with an asterisk (*).



NAME and ADDRESS of the D.G. Approved Training Institute
INDOS No: **Tel:** **Fax:** **Email:**

Certificate No: _____

THIS IS TO CERTIFY THAT *[full name of candidate]*

Date of Birth(dd/mm/yyyy)

Hold of C.D.C. No.

Certificate of Competency, (if any) Grade : No.

Indian National Database of Seafarers (INDoS No.)

Has successfully completed a training course in

**ADVANCED TRAINING FOR
LIQUEFIED GAS TANKER CARGO OPERATION**

Held from to

The Course is approved by the Directorate General of Shipping and meets the training requirements laid down in Regulation V/1-2 paragraph 4, Section A-V/1-2 paragraph 2 and Table A-V/1-2-2 of the STCW Convention and Code as amended in 2010.

The Candidate has also met the additional criteria specified in the STCW Convention, applicable to the Shipping, Government of India.

This Certificate is issued under the authority of the Directorate General of Shipping Ministry of Shipping, Government of India.

Signature of Candidate

Date of Issue : _____

Date of Expiry :UNLIMITED

Name and Signature of Course In-charge

Colour
Photograph
(35 mm x 35 mm)

Official
Seal

Name and Signature of Dean/ Principal

Note : This is not a certificate of Proficiency In Advanced Training in Liquefied Gas Tanker Cargo Operations. This Certificate alongwith other requisite documents must be submitted to the Administration to obtain the Certificate of Proficiency.

“PASSENGER SHIP FAMILIARIZATION COURSE”

1 CROWD MANAGEMENT TRAINING

- .1 awareness of life-saving appliance and control plans, including :
 - .1.1 knowledge of muster lists and emergency instructions,
 - .1.2 knowledge of the emergency exits, and
 - .1.3 restrictions on the use of elevators ;
- .2 the ability to assist passengers en route to muster and embarkation stations, including :
 - .2.1 the ability to give clear reassuring orders.
 - .2.2 the control of passengers in corridors, staircases and passageways,
 - .2.3 maintaining escape routes clear of obstructions,
 - .2.4 methods available for evacuation of disabled persons and persons needing special assistance, and
 - .2.5 search of accommodation spaces ;
- .3 mustering procedures, including :
 - .3.1 the importance of keeping order,
 - .3.2 the ability to use procedures for reducing and avoiding panic,
 - .3.3 the ability to use, where appropriate, passenger lists for evacuation counts, and
 - .3.4 the ability to ensure that the passengers are suitably clothed and have donned their lifejackets correctly.

2 FAMILIARIZATION TRAINING

Design and operational limitations

- .1 Ability to properly understand and observe any operational limitations imposed on the ship, and to understand and apply performance restrictions, including speed limitations in adverse weather, which are intended to maintain the safety of life, ship and cargo.

Procedures for opening, closing and securing hull openings

- .2 Ability to apply properly the procedures established for the ship regarding the opening, closing and securing of side doors and to correctly operate the related systems.

Legislation, codes and agreements affecting passenger ships

- .3 Ability to understand and apply international and national requirements for passenger ships relevant to the ship concerned and the duties to be performed.

Stability and stress requirements and limitations

- .4 Ability to take proper account of stress limitations for sensitive parts of the ship and other closing devices that maintain watertight integrity and of special stability considerations which may affect the safety of passenger ships.

Procedures for the maintenance of special equipment on passenger ships

- .5 Ability to apply properly the Shipboard procedures for maintenance of equipment peculiar to passenger ships such as side doors, scuppers and associated systems.

Loading and cargo securing manuals and calculators

- .6 Ability to make proper use of the loading and securing manuals in respect of all types of cargoes.

Dangerous cargo areas

- .7 Ability to ensure proper observance of special precautions and limitations applying to designated dangerous cargo areas.

Emergency procedures

- .8 Ability to ensure proper application of emergency procedures

3 SAFETY TRAINING

Communication

- .1 Ability to communicate with passengers during an emergency, taking into account :
 - .1.1 the language or languages appropriate to the principal nationalities of passengers carried on the particular route,
 - .1.2 the likelihood that an ability to use an elementary English or Hindi vocabulary for basic instructions can provide a means of communicating with a passenger in need of assistance whether or not the passenger and crew member share a common language,
 - .1.3 the possible need to communicate during an emergency by some other means such as by demonstration, or hand signals, or calling attention to the location of instructions, muster stations, life-saving devices or evacuation routes, when oral communication is impractical,
 - .1.4 the extent to which complete safety instructions have been provided to passengers in their native language or languages, and
 - .1.5 the languages in which emergency announcements may be broadcast during an emergency or drill to convey critical guidance to passengers and to facilitate crew members in assisting passengers.

Life-saving appliances

- .2 Ability to demonstrate to passengers the use of personal life-saving appliances.

COURSE DURATION

2 ¹/₂ days

PASSENGER SHIP FAMILIARISATION COURSE

COURSE FRAMEWORK

SCOPE

This course is intended for Ratings and other personnel (support level) who will be serving on passenger ships as part of the ship's complement and covers the mandatory training requirements prescribed as follows:

- STCW 95, Reg. V/3 ;
- STCW Code Section A-V/3; para 1,2 & 3
- MS (STCW) Rules, 1998, chapter V, rule 32 ; and

The course includes an introduction to passenger ships, familiarisation training, safety training, emergency preparedness, communication, crowd and crisis management.

OBJECTIVE

On successful completion of the course, the candidates would be able to serve in the capacity of ratings or other personnel (support level) on passenger ships. In addition to their normal duties as ratings they would be able to assist in handling passengers in an emergency on board.

ENTRY STANDARDS

This course is open to ratings and other personnel (support level) who will be serving on a passenger ship and also those already serving on passenger ships and have not done this course before.

COURSE CERTIFICATE

On successful completion of the course, the candidate will be issued a certificate approved by the Directorate General of Shipping attesting that he has completed the course specified in STCW 95 Reg. V/3 and STCW Code Section A-V/3 Para. 1 to 3.

COURSE INTAKE LIMITATION

The number of trainees per course will not exceed 24.

STAFF REQUIREMENTS

The training staff would consist of two Master Mariners for lectures and assisted by one instructor for practical demonstration.

TEACHING FACILITIES

Ordinary classroom facility with an overhead projector and facility for projecting video films.

TEACHING AIDS/REFERENCES

- SOLAS 74 as amended
- Background – SOLAS Convention
- Shipboard SMS Manual for Passenger Ships
- Understanding Human Behaviour in emergencies
- Shipboard Muster list
- Films as indicated.

“PASSENGER SHIP FAMILIARIZATION COURSE”

COURSE PLAN

Duration: 2 ½ days

MODULE	SUBJECT AREA	HOURS	
		Lecture	Practical Drill
1.0	Registration and Introduction		
	<u>PASSENGER SHIP DISASTERS – LESSONS</u>	1.5	
	1.1 Brief History of Passenger Ship Disasters, leading to SOLAS 74 as amended		
2.0	1.2 Recent Passenger Ship Disasters and Lessons to be learned		
	<u>BASIC PASSENGER SHIP REQUIREMENTS</u>	1.5	
	2.1 Basic LSA requirements – SOLAS’74 as amended		
3.0	2.2 Basic FFA requirements – SOLAS’74 as amended		
	2.3 Explains typical LSA/FFA plans (m.v. NICOBAR or similar passenger ship)		
	2.4 Film: Personal Safety on Passenger Ships (20 mins.)		
3.0	<u>EMERGENCY PREPAREDNESS</u>	1.5	
	3.1 Emergency Organisation		
	3.2 Alarm and initial response		
	3.3 Organisation of emergency teams		
	3.4 Location of muster		
	3.5 Duties of emergency teams		
	3.6 Communication & Reporting on board		
	3.7 Emergency Drills		
	3.8 Film: Preparing for abandonment (17 mins.)		

4.0	<u>FAMILIARISATION TRAINING</u> 4.1 <u>Design and Operational limitations</u> Basic ability to understand and observe any operational limitations imposed on the ship, and to understand and apply performance restrictions, including speed limitations in adverse weather, which are intended to maintain the safety of life, ship and cargo. 4.2 <u>Basic Procedures for opening, closing and securing hull openings</u> Ability to apply properly the procedures established for the ship regarding the opening, closing and securing of side doors and to correctly operate the related systems. 4.3 <u>Basic Stability and stress requirements and limitations</u> Ability to take proper account of stress limitations for sensitive parts of the ship and other closing devices that maintain watertight integrity and of special stability considerations which may affect the safety of passenger ships. 4.4 <u>Procedures for the maintenance of special equipment on passenger ships</u> Ability to apply properly the Shipboard procedures for maintenance of equipment peculiar to passenger ships such as side doors, scuppers and associated systems, evacuation shutes, low deck lighting etc. 4.5 <u>Loading and cargo securing</u> Ability to understand the importance of securing of cargo loaded in hold 4.6 <u>Dangerous cargo areas</u> Ability to ensure proper observance of special precautions and limitations applying to designated dangerous cargo areas 4.7 <u>Emergency procedures</u> Ability to ensure proper application of emergency procedures	1.5	

5.0	<u>PASSENGER SAFETY, CARGO SAFETY AND HULL INTEGRITY</u> 5.1 Embarking and dis-embarking passengers with special attention to disabled persons and persons needing assistance 5.2 Ability to apply any special safeguards, procedures and requirements regarding carriage of dangerous goods on board passenger ships. 5.3 Elementary knowledge of the Code of Safe Practice for Cargo Stowage & Securing of Cargo. Use properly cargo securing equipment and materials provided. 5.4 Understanding procedures for opening, closing and securing of W/T doors, side doors, port holes/dead lights below W/T deck. 5.5 Make proper use of stability and stress information's provided. 5.6 Understand stability and trim for different conditions of loading. Understand the impact of ballast and fuel transfers on stability	1.5	
6.0	<u>COMMUNICATION WITH PASSENGERS</u> 6.1 Ability to communicate with passengers during an emergency, taking into account : .1 the language or languages appropriate to the principal nationalities of passengers carried on the particular route, .2 the likelihood that an ability to use an elementary English or Hindi vocabulary for basic instructions can provide a means of communicating with a passenger in need of assistance whether or not the passenger and crew member share a common language,	1.5	

	.3 the possible need to communicate during an emergency by some other means such as by demonstration, or hand signals, or calling attention to the location of instructions, muster stations, life saving devices or evacuation routes, when oral communication is impractical. .4 the extent to which complete safety instructions have been provided to passengers in their native language or languages, and		

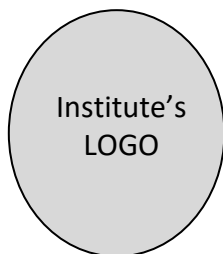
7.0	.5 the languages in which emergency announcements may be broadcast during an emergency or drill to convey critical guidance and to passenger and to facilitate crew members in assisting passengers <u>CROWD MANAGEMENT</u> 7.1 Awareness of life-saving appliance and control plans, including : .1 knowledge of muster lists and emergency instructions, .2 knowledge of the emergency exits, and .3 restrictions on the use of elevators ; 7.2 The ability to assist passengers enroute to muster and embarkation stations, including : .1 the ability to give clear reassuring orders, .2 the control of passengers in corridors, staircases and passageways, .3 maintaining escape routes clear of obstructions, .4 methods available for evacuation of disabled persons and persons needing special assistance, and .5 search of accommodation spaces ; 7.3 mustering procedures, including : .1 the importance of keeping order, .2 the ability to use procedures for reducing and avoiding panic, .3 the ability to use, where appropriate, passenger lists for evacuation counts, and	1.5	

8.0	.4 the ability to ensure that the passengers are suitably clothed and donned their lifejackets correctly.		
	<u>CROWD MANAGEMENT (PRACTICAL DRILLS)</u>		1.5
	8.1 Donning of life jackets & protective clothing		
	8.2 Exercises in evacuation, guidance and assistance to passengers		

9.0	8.3 Exercises to help injured, elderly persons etc.	1.5	
	8.4 Exercise in use of internal communication system.		
	<u>CRISIS MANAGEMENT</u>		
	9.1 Crisis management and human behaviour		
10.0	9.2 Film based interactive session to demonstrate crisis	1.5	
	<u>ASSESSMENT/DISCUSSION</u>		
	10.1 Objective test		
	10.2 Course Discussion		
	10.3 Course Evaluation		
	Total Time	13.5	1.5
		15 hrs.	

TIMETABLE: “PASSENGER SHIP FAMILIARIZATION COURSE”
FOR RATINGS - DURATION: 2 ½ DAYS

DATE	SESSION I 1000 TO 1130	1130 TO 1145	SESSION II 1145 TO 1315		SESSION III 1415 TO 1545	1545 TO 1600	SESSION IV 1600 TO 1730
DAY 1	- HISTORY OF PASSENGER SHIP DISASTERS LEADING TO SOLAS 74 AS AMENDED - RECENT PASSENGER SHIP DISASTERS LESSONS TO BE LEARNED	T E A	- BASIC PASSENGER SHIP REQUIREMENTS UNDER SOLAS 74 AS AMENDED - TYPICAL LSA/FFA PLANS - FILM	L U N C H	- EMERGENCY PREPAREDNESS - FILM PREPARING FOR ABANDONMENT (17 MINS.)	T E A	FAMILIARISATION TRAINING - OPENING, CLOSING AND SECURING HULL OPENINGS - BASIC STABILITY/STRESS - LOW DECK LIGHTING - EVACUATION SHUTES/SLIDES - RESCUE BOATS
DAY 2	<u>PASSENGER SAFETY CARGO SAFETY AND HULL INTEGRITY</u> - EMBARKATION OF PASSENGERS - CARRIAGE OF DANGEROUS GOODS - SECURING CARGO - HULL INTEGRITY	B R E A K	COMMUNICATION WITH PASSENGERS - USE OF LOCAL LANGUAGE - USE OF ELEMENTARY ENGLISH AND HINDI - BY DEMONSTRATION - LANGUAGE IN EMERGENCY ANNOUNCEMENT - ABILITY TO DEMONSTRATE USE OF LSA TO PASSENGERS	B R E A K	CROWD MANAGEMENT - PASSENGER SHIPS MUSTER LISTS - SYMBOLS USED FOR COMMUNICATION REG 111/9.2.3 SOLAS - MUSTER STATIONS - ESCAPE ROUTES	B R E A K	- CROWD MANAGEMENT PRACTICAL DRILLS - CRISIS MANAGEMENT - ASSESSMENT/DISCUSSION
DAY 3	- CRISIS MANAGEMENT AND HUMAN BEHAVIOUR - FILM BASED INTERACTIVE SESSION		- OBJECTIVE TEST - COURSE EVALUATION				



NAME and ADDRESS of the D. G. Approved Training Institute

INDOS No:

Tel:

Fax:

E-mail:

Certificate No: _____

THIS IS TO CERTIFY THAT *[full name of candidate]*.....

Date of Birth

Holder of C.D.C. No.

Passport No.

Certificate of Competency, (if any) Grade : No.

Indian National Data base (INDoS No.)

has successfully completed a training course for

PASSENGER SHIP OF FAMILIARISATION

(CROWD MANAGEMENT, PASSENGER SAFETY AND SAFETY TRAINING FOR PERSONNEL

PROVIDING DIRECT SERVICE TO PASSENGERS IN PASSENGER SPACES)

held from to and has been found qualified.

The course is approved by the Directorate General of Shipping and meets the requirements laid down in Regulation V/2 paragraphs 4 & 5, Section A-V/2 paragraphs 1 & 2 of the STCW Convention and code as amended in 2010.

The candidate has also met the additional criteria specified in the STCW Convention, applicable to the issue of the certificate.

This certificate is issued under the authority of the Directorate General of Shipping Ministry of Shipping, Government of India, Mumbai.

Signature of Candidate

Date of Issue : _____

Name and Signature of Course In-charge

Colour Photograph
(35 mm x 35 mm)

Official
Seal

Name and Signature of Dean / Principal

ADVANCED TRAINING FOR PASSENGER SHIPS “PASSENGER SHIP SAFETY COURSE”

1 CROWD MANAGEMENT TRAINING

- .1 awareness of life-saving appliance and control plans, including :
 - .1.1 knowledge of muster lists and emergency instructions,
 - .1.2 knowledge of the emergency exits, and
 - .1.3 restrictions on the use of elevators ;
- .2 the ability to assist passengers en route to muster and embarkation stations, including :
 - .2.1 the ability to give clear reassuring orders.
 - .2.2 the control of passengers in corridors, staircases and passageways,
 - .2.3 maintaining escape routes clear of obstructions,
 - .2.4 methods available for evacuation of disabled persons and persons needing special assistance, and
 - .2.5 search of accommodation spaces ;
- .3 mustering procedures, including :
 - .3.1 the importance of keeping order,
 - .3.2 the ability to use procedures for reducing and avoiding panic,
 - .3.3 the ability to use, where appropriate, passenger lists for evacuation counts, and
 - .3.4 the ability to ensure that the passengers are suitably clothed and have donned their lifejackets correctly.

2 FAMILIARIZATION TRAINING

Design and operational limitations

- .1 Ability to properly understand and observe any operational limitations imposed on the ship, and to understand and apply performance restrictions, including speed limitations in adverse weather, which are intended to maintain the safety of life, ship and cargo.

Procedures for opening, closing and securing hull openings

- .2 Ability to apply properly the procedures established for the ship regarding the opening, closing and securing of side doors and to correctly operate the related systems.

Legislation, codes and agreements affecting passenger ships

- .3 Ability to understand and apply international and national requirements for passenger ships relevant to the ship concerned and the duties to be performed.

Stability and stress requirements and limitations

- .4 Ability to take proper account of stress limitations for sensitive parts of the ship and other closing devices that maintain watertight integrity and of special stability considerations which may affect the safety of passenger ships.

Procedures for the maintenance of special equipment on passenger ships

- .5 Ability to apply properly the Shipboard procedures for maintenance of equipment peculiar to passenger ships such as side doors, scuppers and associated systems.

Loading and cargo securing manuals and calculators

- .6 Ability to make proper use of the loading and securing manuals in respect of all types of cargoes.

Dangerous cargo areas

- .7 Ability to ensure proper observance of special precautions and limitations applying to designated dangerous cargo areas.

Emergency procedures

- .8 Ability to ensure proper application of emergency procedures

3 SAFETY TRAINING

Communication

- .1 Ability to communicate with passengers during an emergency, taking into account:
 - .1.1 the language or languages appropriate to the principal nationalities of passengers carried on the particular route,
 - .1.2 the likelihood that an ability to use an elementary English or Hindi vocabulary for basic instructions can provide a means of communicating with a passenger in need of assistance whether or not the passenger and crew member share a common language,
 - .1.3 the possible need to communicate during an emergency by some other means such as by demonstration, or hand signals, or calling attention to the location of instructions, muster stations, life-saving devices or evacuation routes, when oral communication is impractical,
 - .1.4 the extent to which complete safety instructions have been provided to passengers in their native language or languages, and
 - .1.5 the languages in which emergency announcements may be broadcast during an emergency or drill to convey critical guidance to passengers and to facilitate crewmembers in assisting passengers.

Life-saving appliances

- .2 Ability to demonstrate to passengers the use of personal life-saving appliances.

4 PASSENGER SAFETY, CARGO SAFETY AND HULL INTEGRITY TRAINING

Loading and embarkation procedures

- .1 Ability to apply properly the procedures established for the ship regarding :
 - .1.1 loading and discharging cargo including related communications, and
 - .1.2 embarking and disembarking passengers, with special attention to disabled persons and persons needing assistance.

Carriage of dangerous goods

- .2 Ability to apply any special safeguards, procedures and requirements regarding the carriage of dangerous goods on board passenger ships.

Securing cargoes

- .3 Ability to :
 - .3.1 apply correctly the provisions of the Code of Safe Practice for Cargo Stowage and Securing to cargo and other cargo transport units carried; and
 - .3.2 use properly the cargo-securing equipment and materials provided, taking into account their limitations.

Stability, trim and stress calculations

- .4 Ability to :
 - .4.1 make proper use of the stability and stress information provided,
 - .4.2 calculate stability and trim for different conditions of loading, using the stability calculators of computer programs provided,
 - .4.3 calculate load factors for decks, and
 - .4.4 calculate the impact of ballast and fuel transfers on stability, trim and stress.

Opening, closing and securing hull openings

- .5 Ability to :
 - .5.1 apply properly the procedures established for the ship regarding the opening, closing and securing of side doors, port holes/dead lights below W/T deck and to correctly operate the associated systems, and
 - .5.2 conduct surveys on proper sealing.

5 CRISIS MANAGEMENT AND HUMANBEHAVIOUR TRAINING

6 COURSE DURATION

5 days

ADVANCED TRAINING FOR PASSENGER SHIPS
PASSENGER SHIP SAFETY COURSE
COURSE FRAMEWORK

SCOPE

This course is intended for masters and officers (management and operational level) who will be serving on passenger ships as part of the ship's complement and covers the mandatory training requirements prescribed as follows:

- STCW 95, Reg. V/3 ;
- STCW Code Section A-V/3; para 1 to 5
- MS (STCW) Rules, 1998, chapter V, rule 32 ;
- META manual, chapter V, Section M-V/3.

The course includes an introduction to passenger ships, familiarisation training, safety training, passenger safety training, hull integrity and stability, emergency preparedness, communication, crowd management, crisis management and human behaviour training.

OBJECTIVE

On successful completion of the course, the candidates would be able to serve in the relevant capacity of master or officers on passenger ships. In addition to their normal duties as master or officers in their respective disciplines, they would be able to assist, as well as direct crew in handling passengers in an emergency on board.

ENTRY STANDARDS

This course is open to masters and officers (management and operational levels), holding appropriate certificates of competency, who will be serving on passenger ships and also those already serving on passenger ships and have not done this course before.

COURSE CERTIFICATE

On successful completion of the course, the candidate will be issued a certificate approved by the Directorate General of Shipping attesting that he has completed the course specified in STCW 95 Reg. V/3 and STCW Code Section A-V/3 Para. 1 to 5.

COURSE INTAKE LIMITATION

The number of trainees per course will not exceed 24.

STAFF REQUIREMENTS

The training staff would consist of two Master Mariners and a Marine Engineer for lectures. They would be assisted by one instructor for practical demonstration.

TEACHING FACILITIES

Ordinary classroom facility with an overhead projector and facility for projecting video films.

TEACHING AIDS/REFERENCES

- SOLAS 74 as amended
- Background – SOLAS Convention
- Shipboard SMS Manual for Passenger Ships
- Understanding Human behaviour in emergencies
- Shipboard Musterlist
- Trim, Stability and other data as example from a passenger ship
- Films as indicated.

ADVANCED TRAINING FOR PASSENGER SHIPS
"PASSENGER SHIP SAFETY COURSE"
COURSE PLAN

Duration: 5 days

MODULE	SUBJECT AREA	HOURS
1.0	<u>INTRODUCTION</u> 1.1 Definitions : Passenger ship, Passenger, Special Trade Passenger ship 1.2 Inspections and Surveys 1.3 Passenger ship certificates 1.4 Special Training Requirements for personnel on passenger ships	1.5
2.0	<u>PASSENGER SHIP DISASTERS</u> 2.1 Brief history of Passenger Ship Disasters from Titanic leading to SOLAS 74 as amended. 2.2 "Herald of Free Enterprise" – Lessons 2.3 "Scandinavian Star" – Lessons 2.4 "ESTONIA" – Lessons	1.5
3.0	<u>FAMILIARISATION TRAINING</u> 3.1 Design and operational limitations .1 Ability to properly understand and observe any operational limitations imposed on the ship, and to understand and apply performance restrictions, including speed limitations in adverse weather, which are intended to maintain the safety of life, ship and cargo. 3.2 Procedures for opening, closing and securing hull openings .2 Ability to apply properly the procedures established for the ship regarding the opening, closing and securing of side doors, dead lights below W/T deck and to correctly operate the related systems.	3.0

	3.3 Legislation, codes and agreements affecting passenger ships .3 Ability to understand and apply international and national requirements for passenger ships relevant to the ship concerned and the duties to be performed. 3.4 Stability and stress requirements and limitations .4 Ability to take proper account of stress limitations for sensitive parts of the ship and other closing devices that maintain watertight integrity and of special stability considerations which may affect the safety of passenger ships.	
	3.5 Procedures for maintenance of special equipment on passenger ships .5 Ability to apply properly the shipboard procedures for maintenance of equipment peculiar to passenger ships such as side doors, scuppers and associated systems. 3.6 Loading and cargo securing manuals and calculators .6 Ability to make proper use of the loading and securing manuals in respect of all types of cargoes. 3.7 Dangerous cargo areas .7 Ability to ensure proper observance of special precautions and limitations applying to designated dangerous cargo areas. 3.8 Emergency procedures	

	.8 Ability to ensure proper application of emergency procedures	
4.0	<u>SAFETY TRAINING</u> (for personnel providing direct service to passengers in passenger spaces) 4.1 Communication Ability to communicate with passengers during an emergency, taking into account : .1 the language or languages appropriate to the principal nationalities of passengers carried on the particular route, .2 the likelihood that an ability to use an elementary English or Hindi vocabulary for basic instructions can provide a means of communicating with a passenger in need of assistance whether or not the passenger and crew member share a common language, .3 the possible need to communicate during an emergency by some other means such as by demonstration, or hand signals, or calling attention to the location of instructions, muster stations, life-saving devices or evacuation routes, when oral communication is impractical, .4 the extent to which complete safety instructions have been provided to passengers in their native language or languages, and .5 the languages in which emergency announcements may be broadcast during an emergency or drill to convey critical guidance to passengers and to facilitate crew members in assisting passengers.	1.5

	4.2 Life-saving appliances Ability to demonstrate to passengers the use of personal life-saving appliances.	
5.0	<u>LIFE-SAVING APPLIANCES AND ARRANGEMENTS</u> (Ref. SOLAS Chapter III and LSA Code) Examples from m.v. NICOBAR or similar passenger ship 5.1 Part B – Ship requirements Section I – Passenger ships and cargo ships 5.2 Passenger ships additional requirements 5.3 Part C – Life-saving appliance requirements 5.4 Film: SOLAS Ch. III amendments (20 mins.)	3.0
6.0	<u>FIRE SAFETY MEASURES FOR PASSENGER SHIPS</u> (Ref. SOLAS Chapter II – 2) Examples from m.v. NICOBAR or similar passenger ship 6.1 Structure, main vertical and horizontal zones 6.2 Fire integrity of bulkheads and decks 6.3 Means of escape 6.4 Protection of stairways and lifts in accommodation and service spaces 6.5 Ventilation systems 6.6 Restricted use of combustible materials 6.7 Fixed fire detection and fire alarm systems and automatic sprinkler, fire detection and fire alarm systems 6.8 Fire patrols, detection, alarms and public address systems	3.0

7.0	<u>PASSENGER SAFETY, CARGO SAFETY AND HULL INTEGRITY TRAINING</u> Examples from m.v. NICOBAR or similar passenger ship 7.1 Loading and Embarkation Procedures Ability to apply properly the procedures established for the ship regarding : .4 loading and discharging cargo including related communications, and .5 embarking and disembarking passengers, with special attention to disabled persons and persons needing assistance.	4.5
	7.2 Carriage of dangerous cargoes Ability to apply any special safeguards, procedures and requirements regarding the carriage of dangerous goods on board passenger ships. 7.3 Securing Cargoes Ability to : .5 apply correctly the provisions of the Code of Safe Practice for Cargo Stowage and Securing to cargo and to cargo transport units carried ; and .6 use properly the cargo-securing equipment and materials provided, taking into account their limitations. 7.4 Stability, trim and stress calculations Ability to : .1 make proper use of the stability and stress information provided, .2 calculate stability and trim for different conditions of loading, using the stability calculators or computer programs provided, .3 calculate load factors for decks, and	

	.4 calculate the impact of ballast and fuel transfers on stability, trim and stress. 7.5 Opening, closing and securing hull openings Ability to : .1 apply properly the procedures established for the ship regarding the opening, closing and securing of side doors and to correctly operate the associated systems, and .2 conduct surveys on proper sealing. 7.6 Film: Personal Safety on Passenger Ships (20 mins.)	
8.0	<u>POLLUTION PREVENTION</u> 8.1 Application of MARPOL 73/78 Annexes I, III & IV to passenger ships 8.2 Application of MARPOL 73/78 Annex V, Garbage Management Plan to passenger ships.	1.5
9.0	<u>CROWD MANAGEMENT TRAINING</u> 9.1 Awareness of life-saving appliance and control plans, including : .1 knowledge of muster lists and emergency instructions, .2 knowledge of the emergency exits, and .3 restrictions on the use of elevators ; 9.2 The ability to assist passengers en route to muster and embarkation stations, including : .1 the ability to give clear reassuring orders, .2 the control of passengers in corridors, staircases and passageways, .3 maintaining escape routes clear of obstructions, .4 methods available for evacuation of disabled persons and persons needing special assistance, and	3.0

- .5 search of accommodation spaces;

9.3 Mustering procedures, including :

- .1 the importance of keeping order,
- .2 the ability to use procedures for reducing and avoiding panic,
- .3 the ability to use, where appropriate, passenger lists for evacuation counts, and
- .4 the ability to ensure that the passengers are suitably clothed and have donned their lifejackets correctly.

10.0

CRISIS MANAGEMENT AND HUMAN BEHAVIOUR

6.0

Examples from m.v. NICOBAR or similar passenger ship

10.1 Organise shipboard emergency procedures

- .1 the general design and layout of the ship;
- .2 safety regulations;
- .3 emergency plans and procedures.

The importance of the principles for the development of ship specific emergency procedures including :

- .1 the need for pre-planning and drills of shipboard emergency procedures;
- .2 the need for all personnel to be aware of and adhere to pre-planned emergency procedures as carefully as possible in the event of an emergency situation.

10.2 Optimise the use of resources

Ability to optimise the use of resources, taking into account :

- .1 the possibility that resources available in an emergency may be limited ;
- .2 the need to make full use of personnel and equipment immediately available and, if necessary, to improvise.

Ability to organise realistic drills to maintain a state of

	readiness, taking into account lessons learnt from previous accidents involving passenger ships ; debriefing after drills	

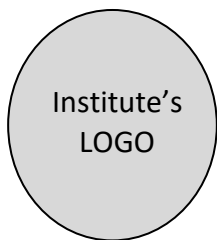
	10.3 Control response to emergencies Ability to make an initial assessment and provide an effective response to emergency situations in accordance with established emergency procedures. Leadership skills Ability to lead and direct others in emergency situations, including the need : .1 to set an example during emergency situations; .2 to focus decision making, given the need to act quickly in an emergency; .3 to motivate, encourage and reassure passengers and other personnel. Stress handling Ability to identify the development of symptoms of excessive personal stress and those of other members of the ship's emergency team. Understanding that stress generated by emergency situations can affect the performance of individuals and their ability to act on instructions and follow procedures. 10.4 Control passengers and other personnel during emergency situations Human behaviour and responses Ability to control passengers and other personnel in emergency situations, including : .1 awareness of the general reaction patterns of passengers and other personnel in emergency	

	situations, including the possibility that : .1.1 generally it takes some time before people accept the fact that there is an emergency situation ; .1.2 some people may panic and not behave with a normal level of rationality, that their ability to comprehend may be impaired and they may not be as responsive to instructions as in non-emergency situations; .2 awareness that passengers and other personnel may, inter alia: .2.1 start looking for relatives, friends and/or their belongings as a first reaction when something goes wrong; .2.2 seek safety in their cabins or in other places on-board where they think that they can escape danger; .2.3 tend to move to the upper side when the ship is listing; .3 appreciation of the possible problem of panic resulting from separating families.	
11.0	10.5 Film based interactive session to demonstrate crisis handling “in the unlikely event”. <u>ASSESSMENT/DISCUSSION</u> 11.1 Objective Test 11.2 Course Discussion 11.3 Course Evaluation	1.5
	Total Time	30.0

TIMETABLE: "PASSENGER SHIP SAFETY COURSE"
FOR OFFICERS: DURATION: 5 DAYS

DATE	SESSION I 1000 TO 1130	1130 TO 1145	SESSION II 1145 TO 1315		SESSION III 1415 TO 1545	1545 TO 1600	SESSION IV 1600 TO 1730
DAY 1	REGISTRATION 1.0 INTRODUCTION	T E A	2.0 PASSENGER SHIP DISASTERS	L U N C H	3.0 FAMILIARIZATION TRAINING 3.1 Design and operational limitations 3.2 Procedures for opening, closing and securing hull openings 3.3 Legislation, codes and agreements affecting passenger ships 3.4 Stability and stress requirements and limitations	T E A	3.0 FAMILIARIZATION TRAINING (CONTD.) 3.5 Procedures for maintenance of special equipment on passenger ships 3.6 Loading and cargo securing manuals and calculators 3.7 Dangerous cargo areas 3.8 Emergency procedures
DAY 2	4.0 SAFETY TRAINING 4.1 Communication 4.2 Life-saving appliances	B R E A K	5.0 LIFE-SAVING APPLIANCES AND ARRANGEMENTS 5.1 Part b – ship requirements section I– passenger ships and cargo ships 5.2 Passenger ships additional requirements	B R E A K	5.0 LIFE-SAVING APPLIANCES AND ARRANGEMENTS (CONTD.) 5.3 Part C – life-saving appliance requirements 5.4 Film: SOLAS Ch. III amendments (20 mins.)	B R E A K	6.0 FIRE SAFETY MEASURES FOR PASSENGER SHIPS 6.1 Structure, main vertical and horizontal zones 6.2 Fire integrity of bulkheads and decks 6.3 Means of escape 6.4 Protection of stairways and lifts in accommodation and service spaces

DAY 3	6.0 FIRE SAFETY MEASURES FOR PASSENGER SHIPS (CONTD.) 6.5 Ventilation systems 6.6 Restricted use of combustible materials 6.7 Fixed fire detection and fire alarm systems and automatic sprinkler, fire detection and fire alarm systems 6.8 Fire patrols, detection, alarms and public address systems	T E A	7.0 PASSENGER SAFETY, CARGO SAFETY AND HULL INTEGRITY TRAINING 7.1 Loading and embarkation procedures 7.2 Carriage of dangerous cargoes 7.3 Securing cargoes	L U N C H	7.0 PASSENGER SAFETY, CARGO SAFETY AND HULL INTEGRITY (CONTD.) 7.4 Stability, trim and stress calculations	T E A	7.0 PASSENGER SAFETY, CARGO SAFETY AND HULL INTEGRITY (CONTD.) 7.5 Opening, closing and securing hull openings 7.6 Film : personal safety on passenger ships
DAY 4	8.0 POLLUTION PREVENTION	B R E A K	9.0 CROWD MANAGEMENT TRAINING	B R E A K	9.0 CROWD MANAGEMENT TRAINING (CONTD.)	B R E A K	10.0 CRISIS MANAGEMENT AND HUMAN BEHAVIOUR 10.1 Organise shipboard emergency procedures 10.2 Optimise the use of resources
DAY 5	10.0 CRISIS MANAGEMENT AND HUMAN BEHAVIOUR (CONTD.) 10.3 Control response to emergencies		10.0 CRISIS MANAGEMENT AND HUMAN BEHAVIOUR (CONTD.) 10.4 Control passengers and other personnel during emergency situations		10.0 CRISIS MANAGEMENT AND HUMAN BEHAVIOUR (CONTD.) 10.5 Film based interactive session to demonstrate crisis handling "in the unlikely event"		11.0 ASSESSMENT/DISCUSSION 11.1 Objective test 11.2 Course discussion 11.3 Course evaluation



NAME and ADDRESS of the D. G. Approved Training Institute

INDOS No:

Tel:

Fax:

E-mail:

Certificate No: _____

THIS IS TO CERTIFY THAT *[full name of candidate]*

Date of Birth

Holder of C.D.C. No.

Passport No.

Certificate of Competency, (if any) Grade : No.

Indian National Data base (INDoS No.)

**CERTIFICATE OF PROFICIENCY IN PASSENGER SHIP SAFETY,
CARGO SAFETY AND HULL INTEGRITY AND
CRISIS AND CROWD MANAGEMENT AND HUMAN BEHAVIOUR**

Held from to.....and has been found qualified.

The course is approved by the Directorate General of Shipping and meets the requirements laid down in:

Regulation V/2 paragraphs 4 to 7, Section A-V/2 paragraphs 1 to 4 and Table A-V/2 of the STCW Convention and code as amended in 2010.

The candidate has also met the additional criteria specified in the STCW Convention, applicable to the issue of the certificate.

Signature of Candidate

Name and of Course In-charge

Date of Issue : _____

Date of Expiry :Five years from the date
of issue

Colour Photograph
(35 mm x 35 mm)

Official
Seal

Name and Signature of Dean / Principal

TYPE RATING CERTIFICATE FOR HIGH SPEED CRAFTS.**General :**

The International Code of Safety for High Speed Craft (HSC) 2000, as amended (2000 HSC Code), was adopted by the International Maritime Organization (IMO), by Resolution No. MSC.97(73). This Code is required to be implemented for passenger high speed crafts, irrespective of their size and also for cargo high speed crafts of 500 gross tonnage (GT) and above, as per Chapter-X of the Safety of Life at Sea (SOLAS) Convention, 1974, as amended, of the IMO.

1. Purpose:

- 2.1. The '2000 HSC Code' requires, amongst other stipulations, that all crew members on HSCs should be appropriately trained and that their officers (including Masters) should hold Type Rating Certificates (TRCs), in addition to valid Certificates of Competency (CoCs) that may be required by the Safe Manning Document (SMD) of such crafts.
- 2.2. This Circular sets out the requirements and procedures in respect of training and certification of Masters and Officers working on high speed crafts registered in India.

2. Reference:

Sr.No.	Reference	Detail
(1)	(2)	(3)
1.	SOLAS	International Convention for the Safety of Life at Sea, 1974, as amended (Chapter-X – safety measures for high-speed crafts).
2.	2000 HSC Code	International Code of Safety for High Speed Craft, 2000, as amended (2000 HSC Code). This Code was adopted by the International Maritime Organization (IMO), by Resolution No. MSC.97(73).

3. Applicability:

The provisions of this Circular are applicable to all cargo high speed crafts of 500 GT and above and also to all passenger high speed crafts irrespective of their size, operating in the coast of India, unless otherwise specifically exempted from these requirements by the Directorate General of Shipping (DGS), Govt. of India (GOI).

4. Requirements of training:

- 5.1. HSC operators are responsible for ensuring that appropriate training is given to the Masters and all other officers of such crafts, having an operational role, so that they may qualify for the issue of TRCs. The training required by the HSC Code includes, amongst other things, knowledge of the craft's propulsion & control systems, handling characteristics, communication & navigational procedures, including night navigation (if applicable), intact stability and survivability of the craft.
- 5.2. Companies operating the HSCs are required to nominate a person responsible for the said training. This person will be designated as the Type Rating Officer (TRO) and may be appointed from within their organisation operating the HSC or from an outside source. The TROs should be holding Certificates of Competency (CoCs) as Masters or Chief Engineers, as the case may be, of the respective types of such crafts and shall have a minimum of one year of sailing experience or two years of experience as Technical Superintendents directly involved in the operations of the respective types of such crafts.

5. Seafarers training and certification :

- 6.1. High Speed Craft owners/managers shall submit their 'Record of Training', in the prescribed form [HSC FORM TR-1](#), after satisfactory completion of onboard training (i.e., 5 days for Masters/Senior Officers of the management level and 3 days for other officers through parallel sailing). Such training must be imparted under the direct supervision of the Master / Chief Engineer, as the case may be, who has a TRC for the respective type of such craft. The training records should be endorsed by the respective company's Type Rating Officer and submitted to the Principal Officer (PO) of any Mercantile Marine Department (MMD), along with the requisite fee for the issuance of a 'Provisional Type Rating' certificate valid for 3 months.
- 6.2. After satisfactory completion of atleast 1 month of service onboard an appropriate type / route of high speed craft, its Master or Officer may make an application for a 'Type Rating Certificate' to the PO of any MMD, in the prescribed application form '[HSC FORM-TR2](#)', along with requisite fee. After satisfactory assessment of such an application, the Master and Officers thereof, if found eligible, shall be issued with 'Type Rating Certificates in '[HSC FORM-TR3](#)', valid for 2 years (which is the period prescribed under the IMO's 2000 HSC Code).
- 6.3. All Masters and Officers of such crafts must have atleast 2 months of service on an appropriate type / route of high speed craft for revalidating their Type Rating Certificates. All Masters and Officers of such crafts shall make their applications to the PO of any MMD for the revalidation of their certificates, along with service details and requisite fee, not later than 3 months prior to the date of expiry of the existing TRC.
- 6.4. Masters and Officers of such crafts who fail to comply with the service requirements as at para 6.3 hereinbefore shall follow the instructions comprised in paras 6.1 and 6.2.
- 6.5. All Masters and Officers, currently sailing onboard such vessels, but having a minimum of 3 months of sailing experience on such crafts, may make their applications to the Principal Officers of any MMD for the issue of TRCs, with service details and training records endorsed by their respective companies which are managing the HSCs, on or before the **30th of April, 2014**, for the issuance of the certificates indicated at para 6.2 hereinabove.
- 6.6. The fee and the application/revalidation procedures shall be the same as being followed by the EAC Branch of the DGS, GOI from time to time for 'Special Training & Certification', viz. Dangerous Cargo Endorsements for oil tankers / gas carriers.

TRAINING RECORD ON HIGH-SPEED CRAFTS

AS PER CHAPTER 18.3.3, HSC CODE 2000

Name of the candidate:

Grade & Certificate NO.:

All Masters/officers should be proficient/familiar with the location and operation of the following:

HSC Code 18.3.3	Description	Training Imparted P = Proficiency F = Familiarization	Considered Competent for Rank _____	
			Initials Training officer	Date
.1	a. Propulsion and control systems* b. communication equipment** c. navigational equipment** (including night navigation equipment as applicable) d. steering* e. electrical* f. hydraulic and pneumatic systems* g. bilge and fire pumping*			
.2	The failure mode of the control, steering and propulsion systems and proper response to such failures;			
.3	Handling characteristics of the craft and the limiting operational conditions;**			
.4	Bridge communication and			

	navigation procedures;**			
.5	Intact and damage stability and survivability of the craft in damage condition;**			
.6	Location and use of the craft's life-saving appliances, including survival craft equipment;			
.7	Location and use of escapes in the craft and the evacuation of passengers;			
.8	Location and use of fire protection and fire extinguishing appliances and systems in the event of fire on board;			

.9	Location and use of damage control appliances and systems, including operation of watertight doors and bilge pumps;			
.10	Cargo and vehicle stowage and securing systems; if applicable			
.11	Methods for control of and communication with passengers in an emergency;			
.12	Location and use of all other items listed in the training manual			

Period of Training on board, From To.....

This is to certify that the above candidate has successfully completed the training and found satisfactory for operation of the High Speed Craft in the following route:

Between

Signature of the Master Signature of Chief Engineer.....

Name of Master Name of Chief Engineer.....

(Ship's seal)

(Type rating Training officer of the company)
(Company seal)

Note:

- 1** All Navigating officers should be able to demonstrate proficiency in operation of the equipment
- 2* All Engineer officers should be able to demonstrate proficiency in operation of the equipment
- 3. All crew should familiarize with operation specified under code 18.3.3.6 to 18.3.3.12

Nationality:

INDOS NO.

PASSPORT NO.

Application for Issuance of Type Rating Certificate for Service on High Speed Craft

(Refer to Instructions and Guidelines given overleaf for filling up application from)

To,

The Principal Officer, Mercantile Marine Department, ...**SUB: Application for issuance of Type Rating Certificate for Service on High Speed Craft****Particulars of Candidate:**

1. Name: (In Block letters)	First	Middle	Last	2. Date of Birth:	DD	MM	YY
3. C.D.C: Number:		Date of issue:		Place of Issue			

4. Certificate of Competency / Service

Grade:

No.:

Yes	No

5. Medical Certificate (Format as per ILO Convention) : (photocopy to be attached)

6. Modular Courses Done: (Photocopies to be attached)

(a) Fire Prevention and Fire Fighting / Advanced Fire Fighting		
(b) Elementary First Aid/ Medical First Aid		
(c) Personal Survival Techniques/ PSCRB		
(d) Personal Safety and Social Responsibility		
(e) Passenger Ship Familiarization / Safety* Course :		

7. Record of Service: (On Type of HSC for which Certificate is sought)

High Speed Craft Particulars	Rank Served	Duration Served	Total Time	Certificate of

Name	Type	Port of Registry				Served	Competency held
				From	To		

8. Issuance of Type Rating Certificate for Service on HSC requested as follows:

Type of High Speed Craft	Level #	Route of Craft
Category A	Level 1* (operational) / Level 2**(management)	

* Delete as appropriate

*Level 1 = Qualified to be assigned duties at operational level.

** Level 2 = Qualified to be assigned for duties with immediate responsibility at management level.

I hereby declare that the particulars given above are correct and true to the best of my knowledge and belief. I have read the instructions given overleaf.

Date:..... Place:..... Signature of Applicant:

(FOR OFFICIAL USE)

Fees paid: Receipt No.: Office Assistant:.....

I have scrutinized above application in line with the Para 18.3.3 of International Safety Code for HSC, 2000.

Candidate is Eligible / Not Eligible for Issuance of Type Rating Certificate.

Certificate No.:..... Signature of Duty Authorized Officer:.....

Dated :..... Name of Officer

Level :..... Designation

INSTRUCTIONS & GUIDELINES

(Instructions for filling the application form for Issuance of Type Rating Certificate for service on high speed C)

1. Application should be accompanied by photocopies of following Documents

- C.D.C.
- Certificate of Competency (for others)
- Medical Certificate
- Fire Prevention and Fire Fighting / Advanced Fire Fighting
- Elementary First Aid/ Medical First Aid
- Personal Survival Techniques/ PSCRB

- g) Personal Safety and Social Responsibility
- h) Passenger Ship Familiarization / Safety* Course:
- i) Indos Receipt or Indos Certificate.
- j) Passport.

2. Applicant has to produce all the above mentioned certificates in original with valid medical certificate for verification.

3.

Application for Provisional Type Rating Certificate (Restricted for 3 months)	Training Certificate issued by the Type Rating Training Officer of the company on completion of training requirements in form HSC FORM-TR 1.
Application for Type Rating Certificate	1 month service on board appropriate level/ type/ route of High Speed Craft
Revalidation of Type Rating Certificate	At lease 2 months service during last two years on appropriate type of HSC

4. Record of Sea-service in HSC Crafts

- i) Sea Service records duly signed by Master / Chief Engineer
- ii) Sea Service letter from the company.
- iii) Training Record duly completed in Form No.HSC FORM TR-1 or Type Rating Certificate held (HSC FORM TR-3) in case of renewal.

5. Candidate should ensure that form is correctly filled up and all required documents are attached otherwise candidate will be declared ineligible for certification.

6. 2 Recent passport size photographs to be submitted along with the application.

7. Any person who makes any false information is liable for punishment for cheating section under 182 and 420 of the Indian Penal Code.

8. Fees Rs. 1000/- shall be paid by Demand Draft drawn in favour of "The pay & Accounts Officer (Shipping), Mumbai/Kolkata/Chennai/Kochi/Kandla. DD shall be payable at any bank in Mumbai/Kolkata//Chennai/Kochi/Kandla.

Candidates are reminded that Fees once paid cannot be reimbursed, hence ensure prior payment that he is meeting the requirement applicable for certification.



GOVERNMENT OF INDIA

Type Rating Certificate (High Speed Craft)

Issued under the provisions of International Code of Safety for High Speed Craft, 2000, as amended

The Government of India certified that **Shri**..... has completed a course of training as required by Chapter 18.3.3 of the International Code of Safety for High Speed Craft, commensurate with operational tasks on board the craft and routes detailed below and has been found duly qualified to perform the functions at the Level, Type and Route of HSC craft specified. This certificate is valid until (not more than 2 years from the date of issue)

Level #	Type of HSC Craft	Route of Craft
Level 1 / Level 2	Category	



INDOS No.....

Seal CDC No.....

Date of birth of the holder of this certificate:.....

Signature of the holder of this certificate:.....

Certificate No..... issued on

AMENDMENTS Details of additional routes

Issued by Mercantile Marine Department : Mumbai/ Kolkata/ Chennai/ Kochi/Kandla

Signature of duly authorized official

Name of duly authorized officer

LEVEL #

Level 1 = Qualified to be assigned for duties at operational level.

Level 2 = Qualified to be assigned for duties at management level.



GOVERNMENT OF INDIA

Type Rating Certificate (High Speed Craft)

CONTINUED PROFICIENCY AND UP-DATING OF KNOWLEDGE

The validity of this Type Rating Certificate is hereby extended until:.....

Signature of duly authorized official

Name of duly authorized official

Date of Revalidation

The validity of this Type Rating Certificate is hereby extended until:.....

Signature of duly authorized official

Name of duly authorized official

Date of Revalidation

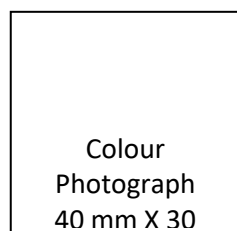
Certificate (Endorsement) for service on Passenger Ships

Issued under the provision of International Convention on Standards of Training, Certification and Watchkeeping for seafarers 1978, as amended in 2010

The **Government of India** certifies that _____ has been found duly qualified in accordance with the provisions of regulation V/3 of the above Convention, to perform the functions at the **Level** specified on **Passenger ships**, until _____ (not more than 5 years from the date of issue.)

Level #	Types of Ship
Level 1* / Level 2*	Passenger Ship

* delete as appropriate



Seal

Date of birth of the holder of this endorsement _____

Signature of the holder of this endorsement _____ Official

Endorsement No. _____ Issued on _____ Issued at _____

Signature of duly authorized official

Name of duly authorized Officer

Level

Level 1 = Operational/Support Level

Level 2 = Management Level

The validity of this endorsement is hereby extended until

(Official seal)

Signature of duly authorised official

Date of revalidation

Name of duly authorised official

Chapter VI
Emergency, Occupational Safety, Security, Medical Care, and Survival Functions
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SPECIFICATION OF MINIMUM STANDARD OF COMPETENCE IN PERSONAL SURVIVAL TECHNIQUES

Knowledge, Understanding & Proficiency / Course Covered	Methods of demonstrating competence	Criteria for evaluating competence
Competence: Survival at sea in the event of ship abandonment Types of emergency situations which may occur, such as collision, fire, foundering. Types of life-saving appliances normally carried on ships. Equipment in survival craft. Location of personal life-saving appliances. Principles concerning survival, including: .1 value of training and drills. .2 personal protective clothing and equipment. .3 need to be ready for any emergency. .4 actions to be taken when called to survival craft stations. .5 actions to be taken when required to abandon ship. .6 actions to be taken when in the water. .7 actions to be taken when aboard a survival craft. .8 main dangers to survivors. 1 Introduction, Safety and Survival 1.1 Safety guidance 1.2 Principles of survival at sea 1.3 Definitions, survival craft and appliances 2 Emergency Situations 2.1 Types of emergencies 2.2 Precautions 2.3 Fire provisions 2.4 Foundering 2.5 Crew expertise	Assessment of evidence obtained from approved instruction or during attendance at an approved course or approved in-service experience and examination, including practical demonstration of competence to: .1 don a lifejacket .2 don and use an immersion suit .3 safely jump from a height into the water .4 right an inverted liferaft while wearing a lifejacket .5 swim while wearing a lifejacket .6 keep afloat without a lifejacket .7 board a survival craft from ship and water while wearing a lifejacket .8 take initial actions on boarding survival craft to enhance chance of	Action taken on identifying muster signal is appropriate to the indicated emergency and complies with established procedures. The timing and sequence of individual actions are appropriate to the prevailing circumstance and conditions and minimize potential dangers and threats to survival. Methods of boarding survival craft are appropriate and avoid dangers to other survivors. Initial actions after leaving the ship and procedures and actions in water minimise threats to survival.

2.6 Muster list and emergency signals 2.7 Crew and emergency instructions 2.8 Extra equipment and survival 2.9 Abandoning ship complications 3 Evacuation 3.1 Abandoning ship - last resort 3.2 Personal preparation for abandoning ship 3.3 Need to prevent panic 3.4 Crew duties to passengers 3.5 Crew duties – launching survival craft 3.6 Master's orders to abandon ship 3.7 Means of survival 4 Survival Craft and Rescue Boats 4.1 Lifeboats 4.2 Liferafts 4.3 Rescue boats 5 Personal Life-saving Appliances 5.1 Lifebuoys 5.2 Lifejackets 5.3 Immersion suits 5.4 Thermal protective aids 6 Personal Life-saving Appliances (Demonstrations) 6.1 Lifebuoys 6.2 Lifejackets 6.3 Inflatable lifejackets 6.4 Immersion suits 6.5 Thermal protective aids 6.6 Personal survival without a lifejacket 6.7 Boarding survival craft 7 Survival at Sea	survival .9 stream a drogue or sea-anchor .10 operate survival craft equipment .11 operate location devices, including radio equipment.	

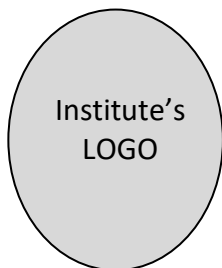
7.1 Dangers to survivors 7.2 Best use of survival craft facilities 8 Helicopter Assistance 8.1 Communicating with the helicopter 8.2 Evacuation from ship and survival craft 8.3 Helicopter pick-up 8.4 Correct use of helicopter harness 9 Emergency Radio Equipment 9.1 Radiotelegraph installation for lifeboats 9.2 Portable radio apparatus for survival craft 9.3 Emergency position-indicating radio beacons (EPIRBs) 9.4 Search and Rescue Transponder (SART) 10 Review and Final Assessment		

**PERSONAL SURVIVAL TECHNIQUES
COURSE OUTLINE**

Duration: 2 ½ days

Subject Area	Hours	
	Lecture	Demonstrations
1. Introduction, Safety and Survival 1.1 Safety guidance 1.2 Principles of survival at sea 1.3 Definitions, survival craft and appliances	0.75	
2. Emergency Situations 2.1 Types of emergencies 2.2 Precautions 2.3 Fire provisions 2.4 Foundering 2.5 Crew expertise 2.6 Muster list and emergency signals 2.7 Crew and emergency instructions 2.8 Extra equipment and survival 2.9 Abandoning ship – complications	1.5	
3. Evacuation 3.1 Abandoning ship - last resort 3.2 Personal preparation for abandoning ship 3.3 Need to prevent panic 3.4 Crew duties to passengers 3.5 Crew duties - launching survival craft 3.6 Master's orders to abandon ship 3.7 Means of survival	0.75	
4. Survival Craft and Rescue Boats 4.1 Lifeboats 4.2 Liferafts 4.3 Rescue boats	2.25	
5. Personal Life-saving Appliances 5.1 Lifebuoys 5.2 Lifejackets 5.3 Immersion suits 5.4 Thermal protective aids	0.75	
6. Personal Life-saving Appliances (Demonstrations) 6.1 Lifebuoys 6.2 Lifejackets 6.3 Inflatable lifejackets 6.4 Immersion suits 6.5 Thermal protective aids 6.6 Personal survival without lifejacket 6.7 Boarding survival craft		3.75
7. Survival at Sea 7.1 Dangers to survivors 7.2 Best use of survival craft facilities	0.75	
8. Helicopter Assistance 8.1 Communicating with the helicopter 8.2 Evacuation from ship and survival craft 8.3 Helicopter pick-up 8.4 Correct use of helicopter harness	1.0	0.5
9. Emergency Radio Equipment 9.1 Radiotelegraph installation for lifeboats 9.2 Portable radio apparatus for survival craft 9.3 Emergency position-indicating radio beacons (EPIRBs) 9.4 Search and Rescue transponder (SART)	1.0	1.0

Subject Area		Hours	
		Lecture	Demonstrations
10. Review and Final Assessment		1.0	
Subtotals		9.75	5.25
Total		15.0	



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Passport No.

Certificate of Competency, (if any) Grade : No.

Indian National Data base (INDoS No.)

has successfully completed a training course for Certificate of Proficiency in

SPECIFICATION OF MINIMUM STANDARD OF COMPETENCE IN FIRE PREVENTION AND FIRE FIGHTING

Knowledge, Understanding & Proficiency / Course Covered	Methods of demonstrating competence	Criteria for evaluating competence
Competence No. 1: Minimize the risk of fire and maintain a state of readiness to respond to emergency situations involving fire 1 Shipboard fire-fighting organization 2 Location of fire-fighting appliances and emergency escape routes 3 The elements of fire and explosion (the fire triangle) 4 Types and sources of ignition 5 Flammable materials, fire hazards and spread of fire 6 The need for constant vigilance 7 Actions to be taken on board ship 8 Fire and smoke detection and automatic alarm systems 9 Classification of fire and applicable extinguishing agents	Assessment of evidence obtained from approved instruction or attendance at an approved course.	Initial actions on becoming aware of an emergency conform with accepted practices and procedures. Action taken on identifying muster signals is appropriate to the indicated emergency and complies with established procedures.
Competence No. 2: Fight and extinguish fires 1 Fire-fighting equipment and its location on board Instruction in: .1 fixed installations .2 fire-fighter's outfits .3 personal equipment .4 fire-fighting appliances and equipment .5 fire-fighting methods .6 fire-fighting agents .7 fire-fighting procedures .8 use of breathing apparatus for fighting fires and effecting rescues	Assessment of evidence obtained from approved instruction or during attendance at an approved course, including practical demonstration in spaces which provide truly realistic training conditions (e.g. simulated shipboard conditions) and, whenever possible and practical, in darkness, of the ability to: .1 use various types of portable fire extinguishers .2 use self-contained breathing apparatus .3 extinguish smaller fires, e.g. electrical fires, oil fires, propane fires .4 extinguish extensive fires with water, using jet and spray nozzles .5 extinguish fires with foam, powder or	Clothing and equipment are appropriate to the nature of the fire-fighting operations. The timing and sequence of individual actions are appropriate to the prevailing circumstances and conditions. Extinguishment of fire is achieved using appropriate procedures, techniques and fire-fighting agents. Breathing apparatus procedures and techniques comply with accepted practices and procedures.

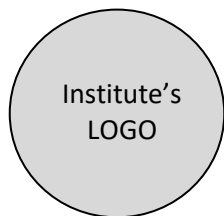
	any other suitable chemical agent .6 enter and pass through, with lifeline but without breathing apparatus, a compartment into which high-expansion foam has been injected .7 fight fire in smoke-filled enclosed spaces wearing self-contained breathing apparatus .8 extinguish fire with water fog or any other suitable fire-fighting agent in an accommodation room or simulated engine-room with fire and heavy smoke .9 extinguish oil fire with fog applicator and spray nozzles, dry chemical powder or foam applicators .10 effect a rescue in a smoke-filled space wearing breathing apparatus	

**FIRE PREVENTION AND FIRE FIGHTING
COURSE OUTLINE**

Duration: 3 days.

Subject Area	Hours		
	Lecture	Demonstration & Practicals	Films
Registration	0.25		
1. Introduction, Safety and Principles	0.50		
2. Theory of Fire 2.1 Conditions for fires 2.2 Properties of flammable materials 2.3 Fire hazard and spread of fire 2.4 Classification of fires and appropriate extinguishing agents	1.00		0.5
3. Fire Prevention 3.1 Fire prevention principles 3.2 Ship construction arrangements 3.3 Safe practices	1.50		
4. Fire Detection System & Alarms 4.1 Fire and smoke detection systems 4.2 Automatic fire alarm	0.75		
5. Fixed Fire-extinguishing Systems 5.1 General 5.2 Smothering effect systems: carbon dioxide (CO ₂), foams 5.3 Inhibitor effect systems: powders 5.4 Cooling effect systems: sprinklers, pressure spray 5.5 Emergency fire pump (cargo ships) 5.6 Chemical powder applicants	1.75		
6. Fire-fighting Equipment 6.1 Fire hoses and nozzles 6.2 Mobile apparatus 6.3 Portable fire extinguishers 6.4 Fireman's outfit 6.5 Breathing apparatus 6.6 Resuscitation apparatus 6.7 Fire blankets	1.00	1.50	

Subject Area	Hours		
	Lecture	Demonstration & Practicals	Films
7. Ship Fire-fighting Organisation 7.1 General emergency alarm 7.2 Fire control plans and muster list 7.3 Communications 7.4 Personnel safety procedures 7.5 Periodic shipboard drills 7.6 Patrol systems	0.75		
8. Fire-fighting Methods 8.1 Knowledge of fire safety arrangements 8.2 Fire alarms and first actions 8.3 Fire fighting	0.75		1.00
9. Fire-fighting procedures	0.75		
10. Fire-fighting Drills 10.1 Small fires 10.2 Extensive fires 10.3 Drills in smoke-filled spaces		4.50	
11. Review and Final Assessment	1.50		
Subtotals	10.50	6.00	1.50
Total	18.00		



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Passport No.

Certificate of Competency, (if any) Grade : No.

Indian National Database of Seafarers (INDoS No.)

has successfully completed a training course for Certificate of Proficiency in

FIRE PREVENTION AND FIRE FIGHTING

held from to.....

The course is approved by the Directorate General of Shipping and meets the requirements laid down in Regulation VI/1 paragraph 1, Section A-VI/1 paragraphs 2.1.2 and Table A-VI/2 of the STCW Convention and code as amended in 2010.

The candidate has also met the additional criteria specified in the STCW Convention, applicable to the issue of the certificate.

This certificate is issued under the authority of the Directorate General of Shipping Ministry of Shipping, Government of India.

Name and Signature of Course In-charge

Signature of Candidate

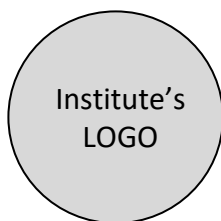
Date of Issue : _____

Date of Expiry: Unlimited, subject to

Colour Photograph
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Name and Signature of Dean / Principal



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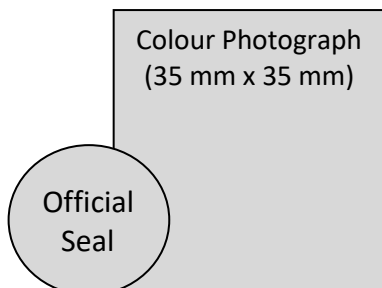
This certificate is issued under the authority of the Directorate General of Shipping Ministry of Shipping, Government of India.

Signature of Candidate

Date of Issue : _____

Date of Expiry: Unlimited, subject to refresher training every 5 years.

Name and Signature of Course In-charge



Name and Signature of Dean / Principal

SPECIFICATION OF MINIMUM STANDARD OF COMPETENCE IN ELEMENTARY FIRST AID

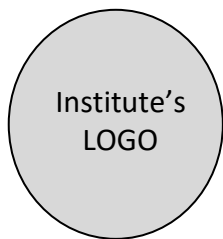
Knowledge, Understanding & Proficiency / Course Covered	Methods of demonstrating competence	Criteria for evaluating competence
Competence: Take immediate action upon encountering an accident or other medical emergency 1 Assessment of needs of casualties and threats to own safety 2 Appreciation of body structure and functions 3 Understanding of immediate measures to be taken in cases of emergency, including the ability to: .1 position casualty apply resuscitation techniques .3 control bleeding .4 apply appropriate measures of basic shock management .5 apply appropriate measures in event of burns and scalds, including accidents caused by electric current .6 rescue and transport a casualty .7 improvise bandages and use materials in emergency kit	Assessment of evidence obtained from approved instruction or during attendance at an approved course.	The manner and timing of raising the alarm is appropriate to the circumstances of the accident or medical emergency. The identification of probable cause, nature and extent of injuries is prompt and complete and the priority and sequence of actions is proportional to any potential threat to life. Risk of further harm to self and casualty is minimised at all times.

Elementary First Aid (EFA) Course

Duration: 2.5 working days

Total hours: 15 hours

Sr. No	Topic	Methods of teaching	Duration
1	General Principles	Lecture / Presentation	1.0 Hours
2	Body Structure and Functions	Lecture / Presentation;	2.0 Hours
3	Positioning of Casualty	Lecture / Presentation;	1.5 Hours
4	The Unconscious Casualty	Lecture/Presentation/Workshop/Exercises	1.0 Hours
5	Resuscitation	Lecture/Demonstration of Equipments	2.0 Hours
6	Bleeding	Lecture/Presentation/Workshop/Exercises	1.5 Hours
7	Management of Shock	Lecture/Presentation/Workshop/Exercises	1.0 Hours
8	Burns and Scalds, and Accidents caused by Electricity	Lecture/Presentation/Workshop/Exercises	1.0 Hours
9	Rescue and Transport of Casualty	Lecture/Presentation/Exercises/Contingency plans for various security related emergencies	1.5 Hours
10	Other Topics	Lecture / Presentation	2.0 Hours
TOTAL			15.0 Hours



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ELEMENTARY FIRST AID

held from to.....

The course is approved by the Directorate General of Shipping and meets the requirements laid down in Regulation VI/1 paragraph 1, Section A-VI/1 paragraphs 2.1.3 and Table A-VI/1-3 of the STCW Convention and code as amended in 2010.

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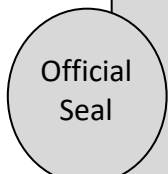
This certificate is issued under the authority of the Directorate General of Shipping Ministry of Shipping, Government of India.

Name and Signature of Course In-charge

Signature of Candidate

Date of Issue : _____

Colour Photograph
(35 mm x 35 mm)



Name and Signature of Dean / Principal

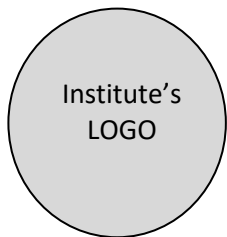
Appendix – V I-2D

PSSR Course Outline (Revised)

	Knowledge, understanding and proficiency	Approximate time (Hours) Lectures, demonstrations and practical work
1.	Observe safe working practices 1.1 Introduction 1.2 Importance of the course 1.3 Ship familiarization 1.4 Nature of shipboard hazards 1.5 Groups the equipment provided on board to counter these hazards 1.6 Use and demonstration of PPE 1.7 Lists operations that take place on board which can be hazardous 1.8 Loading and unloading of cargoes 1.9 Mooring and unmooring 1.10 Enclosed spaces 1.11 Hot work 1.12 Working aloft 1.13 Engine-room watch keeping and maintenance	3.0
2.	Contribute to effective human relationships on board ship - Human relationships on board ship 2.1 Interpersonal relationships 2.2 Team building 2.3 Team working skills and conflict resolution	3.0
3.	Contribute to effective communication on board ship 3.1 Fundamentals of communication 3.2 Methods of communication 3.3 Barriers in communication 3.4 Effective transmission skills 3.5 Effective listening skills 3.6 Effects and consequences of wrong communication 3.7 Communication sum-up	3.0
4.	Comply with emergency procedures 4.1 Explains the term 'emergency' 4.2 Types of emergency: collision, fire, foundering. 4.3 Shipboard contingency plans for respond to emergencies.	4.0

	4.4 Action to take on discovering potential emergency including fire, collision, foundering and ingress of water into the Ship. 4.2 Drills and muster 4.3 Value and need of drills and training 4.4 Knowledge of escape routes and internal communication and alarm system	
5.	Take precautions to prevent pollution of the marine environment 5.1 Define the term pollution 5.2 Describe the industries dependent on the marine environment, namely fisheries, coastal tourism, coastal urban development 5.3 Basic knowledge of complexity and diversity of the marine environment 5.4 Explain how marine pollution results in an economic loss to these industries 5.5 Describe the overall contribution, and effects, to global marine pollution from ship operations 5.6 Introduction to International measures undertaken for prevention of marine pollution from ship operations, namely MARPOL 73/78 (Annexes I to VI) 5.7 Introduction to Ballast Water Management, Anti-Fouling Systems 5.8 Contents of Oil Record Book	2.0
6.	Contribute to effective human relationships on board ship (concluded) -Social responsibilities 6.1 Rights and obligation of crew 6.2 Employment conditions, etc. 6.3 Drugs and alcohol 6.4 Health and hygiene on board 6.5 Summing up	3.0
7.	Understand and take necessary actions to control fatigue 7.1 Highlights accidents and incidents that have been attributed to fatigue and lack of adequate rest. 7.2 Explains the importance of obtaining the necessary rest 7.3 Describes the effects of sleep, schedules and the circadian rhythm on fatigue 7.4 Describes the effects of physical stressors on seafarers 7.5: Highlights the environmental stressors which have the potential to effect performance of seafarers 7.6: Describes the schedule changes on seafarer fatigue 7.7 Lists measures that can be taken to reduce fatigue and stress on board	2.0
	Review and Assessment	1.0
	TOTAL (3 days)	21.0

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PERSONAL SAFETY AND SOCIAL RESPONSIBILITIES

held from to.....

The course is approved by the Directorate General of Shipping and meets the requirements laid down in Regulation VI/1 paragraph 1, Section A-VI/1 paragraphs 2.1.4 and Table A-VI/1-4 of the STCW Convention and Code as amended in 2010.

The candidate has also met the additional criteria specified in the STCW Convention, applicable to the issue of the certificate.

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Signature of Candidate

Date of Issue: _____

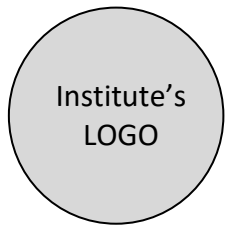
Date of Expiry: UNLIMITED

Name and Signature of Course In-charge

Name and Signature of Dean / Principal

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Name and Signature of Dean / Principal

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PROFICIENCY IN SURVIVAL CRAFT & RESCUE BOATS OTHER THAN FAST

RESCUE BOATS (PSCRB)

BASIC DETAILS OF THE COURSE

Aims:

This course aims to provide the training for candidates to launch and take charge of a survival craft or rescue boat in emergency situations, in accordance with Section A-VI/2 of the STCW Code.

Objectives:

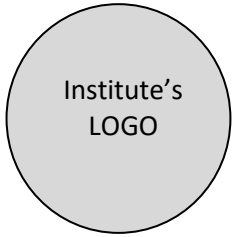
This syllabus cover the requirements of the 1995 STCW convention Chapter VI, Section A-VI/2, Table A-VI/2-1 and META manual Vol. II, Appendix M-VI/2A. On meeting the minimum standard of competence in survival craft and rescue boats other than fast rescue boats, a trainee will be competent to operate life-saving appliance and take charge of a survival craft or rescue boat during or after launch. They will also be able to operate a survival craft engine and manage survivors and survival craft after abandoning ship. Trainees will know the correct use of all locating devices, including communication and signalling apparatus and pyrotechnics, how to apply first aid to survivors and the actions to take to preserve the lives of those in their charge.

COURSE OUTLINE			
PROFICIENCY IN SURVIVAL CRAFT AND RESCUE BOATS OTHER THAN			
FAST RESCUE BOATS (PSCRB) COURSE			
Duration: 5 working days Total hours: 31.5 hours			
Sr.No.	Topic	Methods of teaching	Duration
1.	Introduction and Safety ^ Introduction ^ Safety Guidance	Lecture / Presentation	0.5 Hours
2.	General ^ Emergency situations ^ Training, drills and operational readiness ^ Actions to be taken when called to survival craft stations	Lecture / Presentation	1.5 Hours
3.	Abandon ship ^ Actions to be taken when required to abandon ship ^ Actions to be taken when in the water	Lecture/ Presentation	0.5 Hours

4.	Survival Craft and Rescue boats ^ Lifeboats ^ Liferafts ^ Rescue boats	Lecture/ Presentation/ Workshop/ Exercises	0.75 Hours
5.	Launching Arrangements ^ Boats davits ^ Liferafts davits ^ Rescue boat davits ^ Free-fall ^ Float-free arrangements ^ Marine evacuation systems	Lecture/ Demonstration of Equipments	1.25 Hours
6.	Evaluation and recovery of survival craft and rescue boats ^ Launching ^ Clearing the ship's side ^ Marshalling the liferafts and rescuing survivors from the sea ^ Recovery of survival craft and rescue boats ^ Launching survival craft and rescue boats in rough sea ^ Recovery of rescue boats in rough sea	Lecture/ Presentation/ Workshop/ Exercises	1.25 Hours
7.	Actions to take when clear of the ship	Lecture/ Presentation/ Workshop/ Exercises	0.25 Hours
8.	Lifeboat engine and accessories ^ Starting the engine ^ Cooling systems ^ Battery charging ^ Fire extinguisher ^ Water spray system ^ Self-contained air support system	Lecture/ Presentation/ Workshop/ Exercises	1.5 Hours
9.	^ Rescue boat outboard engine	Lecture/ Presentation/ Exercises/ Contingency plans for various security related emergencies	1.0 Hours

Sr. No.	Topic	Methods of teaching	Duration
10.	Handling survival craft and rescue boats in rough weather ^ Boats ^ Liferafts ^ Beaching	Lecture / Presentation	0.75 Hours
11.	Actions to take when aboard a survival craft ^ Initial actions ^ Routines for survival ^ Use of equipment ^ Apportionment of food and water ^ Action to take to maximize detectability and location of survival craft	Lecture / Presentation	1.5 Hours
12.	Methods of Helicopter rescue ^ Communicating with the helicopter ^ Evacuation from ship and survival craft ^ Helicopter pick-up	Lecture/ Presentation	1.25 Hours
13.	^ Hypothermia, Resuscitation, use of First Aid Kit	Lecture/ Presentation/ Workshop/ Exercises	1.0 Hours
14.	Radio equipment ^ Two-way VHF radiotelephone apparatus ^ Emergency position-indicating radio beacons (EPIRBs) ^ Search and rescue transponder beacons (SARTs) ^ Distress signals, signalling equipment and pyrotechnics	Lecture/ Demonstration of Equipments	1.5 Hours
15.	First aid ^ Resuscitation techniques ^ Use of first-aid kit	Lecture / Presentation	2.0 Hours
16.	Drills in launching and recovering boats	Lecture / Presentation	3.0 Hours
17.	Drills in launching liferafts ^ Davit-launched liferafts ^ Throw-overboard liferafts ^ Boarding a liferaft from the water ^ Righting an inverted liferaft	Lecture/ Presentation	3.0 Hours
18.	Drills in launching and recovering rescue boats	Lecture/ Presentation/ Workshop/ Exercises	3.0 Hours
19.	Practical exercises and evaluation	Lecture/ Demonstration of Equipments	6.0 Hours
TOTAL			31.5 Hours

Note: Teaching staff should note that outlines are suggestions only as regards sequence and length of time allocated to each objective. These factors may be adapted by lecturers to suit individual group of trainees depending on their experience, ability, equipment and staff available for training.



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PROFICIENCY IN
SURIVAL CRAFT AND RESCUE BOATS

heldfrom to.....

The course is approved by the Directorate General of Shipping and meets the requirements laid down in Regulation VI/2 paragraph 1, Section A-VI/2 paragraphs 1 to 4 and Table A-VI/2-1 of the STCW Convention and Code as amended in 2010.

The candidate has also met the additional criteria specified in the STCW Convention, applicable to the issue of the certificate.

This certificate is issued under the authority of the Directorate General of Shipping Ministry of

Signature of Candidate

Name and Signature of Course In-charge

Date of Issue: _____

Date of Expiry: Unlimited, subject to refresher training every 5 years

Colour Photograph
(35 mm x 35 mm)



Name and Signature of Dean / Principal

Proficiency in FAST RESCUE BOAT (FRB) TRAINING COURSE
- COURSE OUTLINE

Duration: 3 working days

Total hours: 24 hours

Block	Specific Learning Objective (Topics)	Methodology		
		Theory Hrs	Practical / Exercise Hrs	No. of days
Fast rescue boat	1. Introduction	0.5		3
	2. Construction and outfit of FRB	1.0		
	3. Various aspects of Boat Handling 4. FRB Maintenance 5. Emergency Equipments, Survival, Communication	2.0 0.5 0.5		
	6. Exercise on Launching, Rescue and Recovery 7. Assessment and feedback	1.0	18.5	
		5.5	18.5	
	Grand Total	24		3

Note: Teaching staff should note that outlines are suggestions only as regards sequence and length of time allocated to each objective. These factors may be adapted by lecturers to suit individual group of trainees depending on their skill, experience, ability and familiarity with the fast rescue boat systems.

FAST RESCUE BOAT (FRB) TRAINING COURSE

- DETAILED TEACHING SYLLABUS

Learning Objectives		
1. Introduction (Refer to the Table of Specifications)		
1	Know the requirement of the course and carryout registration and other formalities	0.5:0:0
1.1	Describe SOLAS and LSA code requirement for FRB.	
	Describe STCW requirements related to FRB – STCW'95 Section A-VI/2	
	and Table A-VI/2-2 (Amendment 2006)	
1.2	State the use of FRB on Merchant ships	
2. Construction and outfit of FRB (Refer to the Table of Specifications)		
2	Understand Construction and outfit of FRB	1:0:0
2.1	Explain construction, characteristics and limitations of FRB	
2.2	Explain outfit of various types of FRB. Emergency repairs to fast rescue boat, inflation and deflation of inflatable FRBs	
3. Various aspects of Fast Rescue Boat Handling (Refer to the Table of Specifications)		
3	Understand the Various aspects of Fast Rescue Boat Handling	2:0:0
3.1	Explain safety precautions during launch and recovery of Fast Rescue Boats, launching and recovery during prevailing and adverse weather conditions	
3.2	Explain boat handling in varying weather conditions, including righting a capsized boat.	
3.3	Explain the berthing and un-berthing of the boat under different wind and tide conditions	
3.4	Explain how to carry out a rescue operation, Search Patterns	
4. FRB Maintenance (Refer to the Table of Specifications)		
4	Know how to carry out maintenance of the Fast Rescue Boat and associated equipments,	0.5:0:0
4.1	Identify the parts and describe the methods of carrying out maintenance as per the manufacturer's requirement.	
4.2	Explain the operation and limitations of various equipments	
5. Emergency Equipments, Survival, Communication (Refer to the Table of Specifications)		
5	Understand how to use the Emergency and communication Equipments and survival techniques	0.5:0:0
5.1	Explain the use of various FRB equipments, including navigational and safety equipments.	
5.2	Explain the procedure for communication	

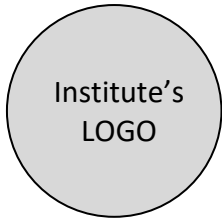
5.3	Explain the survival techniques relevant to MOB situation; care of casualty.	
6. Applying the above knowledge carry out Practical Exercise Launching, Rescue and Recovery. (Refer to the Table of Specifications)		18.5:0:0
6	Apply the above knowledge of Launching, Recovery and Maintenance	
6.1	Identify, through checklists, the readiness of the Boat and associated equipments	
6.2	Participants to Operate the Fast Rescue Boat and demonstrate:	

	• Methods of starting and operating FRB and accessories • Coming alongside and maneuvering away from jetty • Maneuvering alongside a casualty • MOB Rescue and Casualty transfer to vessel • Night maneuvering exercises • Execution of search patterns and steering by compass	
7 Assessment and Feedback (Refer to the Table of Specifications)		1:0:0
7	Carry out assessment and Feedback in the classroom.	

Table of Specifications for conduct of Fast Rescue Boat Training Course: **Distribution of weightage for various topics should be as follows:**

	Topics	Weightage %				Total	I
		K	U	A			
1	Introduction, regulations related to FRB	5				5	
2	Construction and outfit of FRB		5			5	
3	Various aspects of Boat Handling		5			5	
4	FRB Maintenance	5				5	
5	Emergency Equipments, Survival, Communication		5			5	
6	Exercise on Launching, Rescue and Recovery.	15		60		75	
7	Assessment and Feedback						
	Total					100	

K: Knowledge; U: Understanding; A: Application; I: Integration



NAME and ADDRESS of the D. G. Approved Training Institute

INDOS No:

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Certificate No: _____

THIS IS TO CERTIFY THAT *[full name of candidate]*

Date of Birth

Holder of C.D.C. No.

Passport No.

Certificate of Competency, (if any) Grade : No.

Indian National Data base (INDoS No.)

has successfully completed a training course for Certificate of

PROFICIENCY IN FAST RESCUE BOATS

heldfrom to.....

The course is approved by the Directorate General of Shipping and meets the requirements laid down in Regulation VI/2 paragraph 2, Section A-VI/2 paragraphs 7 to 10 and Table A-VI/2-2 of the STCW Convention and Code as amended in 2010.

The candidate has also met the additional criteria specified in the STCW Convention, applicable to the issue of the certificate.

This certificate is issued under the authority of the Directorate General of Shipping Ministry of Shipping, Government of India.

Signature of Candidate

Name and Signature of Course In-charge

Date of Issue : _____

Date of Expiry : Unlimited, subject
to refresher training every 5 years

Colour Photograph
(35 mm x 35 mm)

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Name and Signature of Dean / Principal

SPECIFICATION OF MINIMUM STANDARD OF COMPETENCE IN ADVANCED FIRE FIGHTING COURSE

Knowledge, Understanding & Proficiency / Course Covered	Methods of demonstrating competence	Criteria for evaluating competence
Competence No. 1: Control fire fighting operations aboard ships Fire-fighting procedures at sea and in port with particular emphasis on organisation, tactics and command. Use of water for fire-extinguishing, the effect on ship stability, precautions and corrective procedures. Communication and co-ordination during fire-fighting operations. Ventilation control, including smoke extractor. Control of fuel and electrical systems. Fire-Fighting process hazards (dry distillation, chemical reactions, boiler uptake fires, etc.). Fire fighting involving dangerous goods. Fire precautions and hazards associated with the storage and handling of materials (paints, etc.). Management and control of injured persons. Procedures for co-ordination with shore-based fire fighters. 1 Introduction, Safety and Principles 2 Theory of Fire 2.1 Conditions for fires 2.2 Principles of fire fighting 2.3 Properties of flammable materials 2.4 Fire hazard and spread of fire 2.5 Classification of fires and appropriate extinguishing agents 3 Fire Control aboard Ships 3.1 Areas of fire hazard 3.2 Fire precautions 4 Training of Seafarers in Fire Fighting	Practical exercises and instruction conducted under approved and truly realistic training conditions (eg., simulated shipboard conditions) and, whenever possible and practicable, in darkness	Actions taken to control fires are based on a full and accurate assessment of the incident, using all available sources of information The order of priority, timing and sequence of actions are appropriate to the overall requirements of the incident and to minimise damage and potential damage to the ship, injuries to personnel and impairment of the operational effectiveness of the ship Transmission of information is prompt, accurate, complete and clear Personal safety during fire control activities is safeguarded at all times

4.1 Regular fire fighting drills 4.2 Contingency plan. 5 Procedures for Fire Fighting 5.1 Ship at sea 5.2 Ship in port 5.3 Ship having cargo of dangerous goods 5.4 Oil tankers 6 Fire-fighting Process Hazards 6.1 Dry distillation 6.2 Chemical reactions 6.3 Boiler uptake fires 6.4 Fires in water-tube boilers 7 First Aid 7.1 Procedures to be taken immediate after rescue of injured persons		
Competence No. 2: Organise and train fire parties Preparation of contingency plans Composition and allocation of personnel to fire parties Strategies and tactics for control of fires on various parts of the ship. 1 Ship Fire-fighting Organisation 1.1 Exercise on preparation of contingency plan.	Practical exercises and instruction conducted under approved and truly realistic training conditions, e.g. simulated shipboard conditions	Composition and organisation of fire control parties ensure the prompt and effective implementation of emergency plans and procedures
Competence No.3: Inspect and service fire-detection and extinguishing systems and equipment Fire-detection systems; fixed fire-extinguishing systems; portable and mobile fire-extinguishing equipment including appliances, pumps and rescue, salvage, life-support, personal protective and communication equipment Requirements for statutory and classification surveys 1 Inspection and Servicing of Fire Appliances and Equipment 1.1 Theoretical knowledge of all portable and fixed fire fighting appliances including fire pumps, hydrants, hoses and nozzles. 1.2 Practical demonstration in fighting	Practical exercise using approved equipment and systems in a realistic training environment	Operational effectiveness of all fire detection and extinguishing systems and equipment is maintained at all times in accordance with performance specifications and legislative requirements

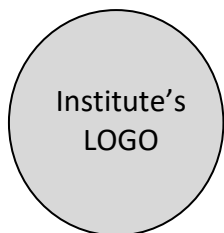
small fires and large fires 1.3 Practical demonstration and use of life support equipments such as breathing apparatus while fighting fires		
Competence No.4: Investigate and compile reports on incidents involving fire Assessment of cause of incidents involving fire 1 Fire Investigation and Reporting 2 Case Studies 2.1 Trainees' experience of fires on ships 2.2 Documented reports of fires on ships and lessons learned 3 Review and Final Assessment	Practical exercise in a realistic training environment	Causes of fire are identified and the effectiveness of countermeasures is evaluated

**ADVANCED FIRE FIGHTING
COURSE OUTLINE**

Duration: 6 days

Subject Area	Hours		
	Lecture	Demonstration & Practical's	Films
Registration	0.50		
1. Introduction, Safety and Principles	0.75		
2. Theory of Fire 2.1. Conditions for fires 2.2. Principles of fire fighting 2.3. Properties of flammable materials 2.4. Fire hazard and spread of fire 2.5. Classification of fires and appropriate extinguishing agents	1.25		0.50
3. Fire Control aboard Ships 3.1. Areas of fire hazard 3.2. Fire precautions	1.50		
4. Ship Fire - fighting Organisation 4.1. Preparation of contingency plans 4.2. Composition & allocation of personnel to fire parties 4.3. Strategies and tactics for control of fires on various parts of the ship.	1.50	4.50	
5. Training of Seafarers in Fire Fighting	3.00	3.00	
6. Procedures for Fire Fighting 6.1. Ship at sea 6.2. Ship in port 6.3. Ship having cargo of dangerous goods 6.4. Oil tankers	1.50	3.00	1.50
7. Inspection and Servicing of Fire Appliances and Equipment 7.1. Fire alarms 7.2. Fire - detection equipment 7.3. Fixed fire - extinguishing equipment 7.4. Fire main, hydrants, hoses and nozzles 7.5. Portable & mobile fire-extinguishing equipment 7.6. Fireman's outfits 7.7. Fire - control plans	3.00		
8. Fire-fighting Process Hazards 8.1. Dry distillation 8.2. Chemical reactions 8.3. Boiler uptake fires 8.4. Fires in water - tube boilers	1.50		1.50

9. First Aid	1.50	1.50	
10. Fire investigation and Reporting	1.50		
11. Case Studies 11.1. Trainee's experience of fires on ships 11.2. Documented reports of fires on ships and lessons learned	1.50		
12. Review and Final Assessment	1.50		
Subtotals	20.50	12.00	3.50
Total	36.00		



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Certificate No: _____

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Holder of C.D.C. No.

Passport No.

Certificate of Competency, (if any) Grade : No.

Indian National Database of Seafarers (INDoS No.)

has successfully completed a training course for Certificate of Proficiency in

ADVANCED FIRE FIGHTING

held from to.....

The course is approved by the Directorate General of Shipping and meets the requirements laid down in Regulation VI/3 paragraph 1, Section A-VI/3 paragraphs 1 to 4 and Table A-VI/3 of the STCW Convention and code as amended in 2010.

The candidate has also met the additional criteria specified in the STCW Convention, applicable to the issue of the certificate.

This certificate is issued under the authority of the Directorate General of Shipping Ministry of Shipping, Government of India.

Signature of Candidate

Name and Signature of Course In-charge

Date of Issue : _____

Date of Expiry: Unlimited. subject

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(35 mm x 35 mm)

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Seal

Name and Signature of Dean / Principal

MEDICAL FIRST AID COURSE OUTLINE

Tables that follow list the competences and areas of knowledge, understanding and proficiency together with total hours required for lectures and practical exercises. Timings given in the Course Outline may be adapted to suit individual groups of students depending on their ability, experience, equipment and staff available for training.

Course Outline	Approximate time (Hours)
Knowledge, understanding and proficiency	Lectures, demonstrations and practical work
1. Introduction	1.0
2. Immediate action	2.0
3. First Aid Kit	1.5
4. Body structure and function	2.0
5. Toxicological hazards aboard Ship	1.5
6. Examination of Patient	1.5
7. Spinal Injuries	1.5
8. Burns, scalds and effects of heat and cold	2.0
9. Fracture, dislocations and muscular injuries	1.5
10. Medical care of rescued persons, including distress, hypothermia and cold exposure	1.0
11. Radio Medical Advice	1.0
12. Pharmacology	1.5
13. Sterilisation	1.0
14. Cardiac arrest, drowning and asphyxia	2.0
15. Psychological/Psychiatric Problems	2.0
16. Aids, SARS, Hepatitis & other infectious diseases	1.0
17. Addition to Medical First Aid as per MLC 2006	3.0

A) Dressing wounds, Care of cuts, wounds, burns and scalds. B) Temporary immobilization in case of fractures / dislocations. C) Treatment and care in case of eye injury D) Immediate care in case of accidents involving dangerous Goods.	
17. Review and assessment	1.0
TOTAL	28.0

Medical First Aid --DETAILED TEACHING SYLLABUS

Detailed teaching syllabus given below is based on theoretical and practical knowledge specified in the STCW Code. It is written as a series of learning objectives in other words, what a student is expected to be able to do as a result of teaching and training. Each of the objectives is expanded to define a required performance of knowledge, understanding and proficiency.

Knowledge, Understanding and Proficiency

1. Immediate action (2.0 hours)

Required performance:

- i) Revises, as necessary, important aspects of the Elementary First aid training course

2. First Aid Kit (1.5 hours)

- i) Describes and lists the contents of the first aid kit required by national regulations

- ii) Lists location of first aid kits

- iii) Describes contents of lifeboat kit

- iv) Demonstrates use of the first aid box in appropriate medical situations

3. Body structure and functions (2.5 hours)

- i) uses a chart, dummy, human body or other suitable medium, such as audio- visual aids, to describe and explain the structure of the human body and functions of the important parts and systems; in particular:

For the skeletal system:

- Lists the major parts of the skeleton
- Describes the different kinds of bones
- Explains the function of the skeleton

For the muscular system:

- Lists the major muscles of the human body
- Explains their operation and function

For the cardiovascular system:

- States the location of the heart
- Describes the distribution of arteries and veins
- Describes the physiological function of blood
- Describes the heart as a pump
- Explains how the blood circulatory system operates
- States the location of the arterial pressure points and explains how they can be effectively used in an emergency involving bleeding

For respiratory system:

- States the location of the lungs
- Explains the function of the lungs in terms of gas exchange
- States the importance of respiratory rate
- Explains the importance of the composition of inspired/expired air

For the digestive system and abdomen:

- Describes in simple terms the digestive system and its operation
- List the abdominal organs and describes their function

4. Toxicological hazards aboard ship (1.5 hours)

- i) States that there are important regulations to be observed for the transport of dangerous cargo aboard ship as required by the IMO/IMDG Code
- ii) Applies first aid measures in accordance with Medical First Aid Guide for use in

Accidents Involving dangerous goods (MFAG) or its national equivalent:

- TWA/TLV levels

iii) Uses, in particular, the appropriate First Aid Guide for:

- Identifying the symptoms and clinical aspects of poisoning
- Applying first aid in cases of poisoning by ingestion, inhalation, or skin contact/eye injuries
- Applying therapy in cases of acid and caustic burns

iv) Use of oxygen resuscitator:

- Parts of the resuscitator
- Operation of resuscitator
- Changing cylinders
- CPR with resuscitator
- After use care and servicing

5. Examination of patient (1.5 hours)

i) Makes detailed observations of a casualty, based on medical precepts

ii) Forms a diagnosis from a large variety of individual facts based on::

- Information derived from medical history
- General appearance
- Answers to specific questions
- Physical examination

6. Spinal injuries (1.5 hours)

i) Recognises the symptoms of spinal injury

- Bladder control in spinal injuries

ii) Identifies the complications which may be caused by unconsciousness

iii) Applies appropriate first aid measures, including:

- Control of sensitivity in the extremities appearance
- Appropriate rescue, transport, and treatment for cases of suspected fracture of the spine

iv) Head injuries: Levels of consciousness/unconsciousness

7. Burns, scalds and effects of heat and cold (2.0 hours)

i) Recognises the signs of:

- Burns
- Scalds
- Heatstroke
- Hypothermia
- Frostbite

ii) Applies appropriate first aid measures, including the definition, complications and therapy of the general condition of burns

iii) Distinguishes between burns and scalds

iv) Describes differences between first degree, second degree & third degree burns

v) Applies the correct first aid procedures for burns and scalds

vi) States the importance of sterile dressings

vii) Describes the effects of heat and states the importance of positioning the patient in the shade, providing the increased fluid requirement and careful cooling of the body.

viii) Distinguishes between hypothermia and frostbite and applies the correct first aid procedures, including rewarming and attention to possible tissue damage.

8. Fractures, dislocation and muscular injuries (1.5 hours)

i) Applies practical first aid procedures for the diagnosis and treatment of fractures,

dislocations and muscular injuries

ii) Describes types of fracture as:

- Open (or compound)
- Closed (or simple)
- Complicated

iii) Describes the treatment for injured parts and explains the importance of immobilization of the injured part

iv) States the importance of immobilization of the injured part.

v) Describes the special requirements for the treatment of pelvic and spinal injuries and demonstrates the correct procedure for transporting the casualty.

vi) Describes the symptoms and therapy of sprains, strains and dislocations

vii) Demonstrates the correct procedures to be used in cases of fractures, dislocations and muscular injuries

viii) States the necessary precautions while issuing pneumatic splints.

9. Medical care of rescued persons, including distress, hypothermia and cold exposure

(1.0 hours)

i) Applies basic skill in the care of rescued persons

ii) Recognises the special problems in cases of:

- Hypothermia, applying the correct treatment and taking precautions against heat loss and taking into account the effects of wind and humidity.

- Congelation, applying the correct treatment for cold injury, immersion foot etc.

- Seasickness, describing the cause and applying the correct therapy.

- Sunburn, describing the cause and applying the correct therapy and prophylaxis

dehydration and nutrition in rescue situations, describing frequent errors and hazards

- Rewarming.

10. Radio medical advice

(1.0 hours)

i) states that radio medical advice is available using GMDSS Bmed 1

ii) describes the methods used to obtain radio medical advice

iii) interprets advice obtained from external sources

iv) helicopter evacuation.

11. Pharmacology

(1.5 hours)

i) Drug list on board:

- Usage

- Dosages

- Injections sc/im

- Test dose for penicillin

12. Sterilization

(1.0hours)

i) Demonstrates disinfection of surgical instruments:

13. Cardiac arrest, drowning and asphyxia

(1.5 hours)

i) States the cause of and applies the appropriate treatment for:

- Cardiac arrest

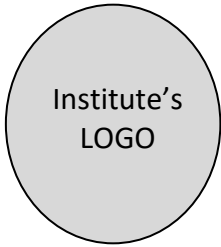
- Asphyxia

- Drowning

Addition to Medical First Aid as per MLC 2006

(Duration of 3 Hours)

- E) Dressing wounds, Care of cuts, wounds, burns and scalds.
- F) Temporary immobilization in case of fractures / dislocations.
- G) Treatment and care in case of eye injury
- H) Immediate care in case of accidents involving dangerous Goods.



NAME and ADDRESS of the D. G. Approved Training Institute

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E-mail:

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Passport No.

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Indian National Data base (INDoS No.)

has successfully completed a training course for Certificate of Proficiency in

MEDICAL FIRST AID

held from to and has been found qualified.

The course is approved by the Directorate General of Shipping and meets the requirements laid down in Regulation VI/4 paragraph 1, Section A-VI/4 paragraphs 1 to 3 and Table A-VI/4-1 of the STCW Convention and Code as amended in 2010.

The candidate has also met the additional criteria specified in the STCW Convention, applicable to the issue of the certificate.

This certificate is issued under the authority of the Directorate General of Shipping Ministry of Shipping, Government of India.

Signature of Candidate

Name and Signature of Course In-charge

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Date of Expiry: Unlimited , subject
to refresher training every 5 years

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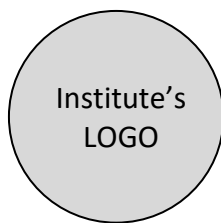
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**STCW 2010 Convention
TEAP VOL. B**

**MEDICAL CARE COURSE
COURSE OUTLINE**

Subject Area	HOURS	
	Practicals/Lecture	Exercises
1. General Principles	0.5	--
2. Body structure and functions	1.5	0.5
3. Casualty, Immediate action in case of casualty, position of casualty, unconscious casualty, bleeding, resuscitation, Management of shock, rescue and transportation of casualty	4	4
4. Toxicological Hazards aboard ships, Poisoning	2.0	0.5
5. Examination of patient	1.0	1.5
6. Spinal injuries	1.0	0.5
7. Fracture, dislocations and muscular injuries	1.0	1.0
8. Burns, scalds and accidents caused by electricity and effects of heat and cold	1.0	1.0
9. Medical care of rescued persons including distress, hypothermia, cold exposure	1.0	0.5
10. Radio medical advice	1.0	0.5
11. Pharmacology	3.0	--
12. Sterilization	0.5	1.0
13. Cardiac arrest, drowning and asphyxia	0.5	1.0
14. Management of acute abdomen conditions	1.5	1.0
15. Techniques of sewing & clamping Minor surgical procedures	0	1.5
16. Aspects of Nursing (Injection, BP)	2	0.5
17. Diseases of various systems; Tropical & infectious diseases, Prevention	4	0
18. STD, skin diseases, AIDS	2.5	0
19. Alcohol & drug abuse	2	0
20. Dental Care	1	1
21. Gynae, Pregnancy, Childbirth	2	0
22. Death at sea, Environmental control on board ship	1.5	0
23. Keeping of records, regulations	0.5	1
24. Hospital Visit	0	6.0
A) Addition to Medical Care	3.0	

Course as per MLC 2006 B) Cardio Pulmonary resuscitation (CPR) C) Intravenous and Intra-muscular injections. D) Make use of Medical advice by Radio or satellite communication and to participate effectively in co-ordinate schemes for medical assistance at sea.		
24. Assessment	1.5	0.5
Total	39.5	23.5
Total Course	63 hrs	



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MEDICAL CARE

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Signature of Candidate

Name and Signature of Course In-charge

Date of Issue : _____

Date of Expiry : Unlimited, subject to
refresher training every 5 years.

Colour
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(35 mm x 35 mm)

Name and Signature of Dean / Principal

Official
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STCW Table A-VI/6-2

**Security Training for Seafarers with Designated Security Duties
(STSDSD)**

Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence
Maintain the conditions set out in a ship security plan	Working knowledge of maritime security terms and definitions, including elements that may relate to piracy and armed robbery. Knowledge of international maritime security policy and responsibilities of Governments, companies and persons, including working knowledge of elements that may relate to piracy and armed robbery. Knowledge of maritime security levels and their impact on security measures and procedures aboard ship and in the port facilities. Knowledge of security	Assessment of evidence obtained from approved instruction or during attendance at an approved course	Procedures and actions are in accordance with the principles established by the ISPS Code and the SOLAS, 1974, as amended. Legislative requirements relating to security are correctly identified. Communications within the area of responsibility are clear and understood

	reporting procedures. Knowledge of procedures and requirements for drills and exercises under relevant conventions, codes and IMO circulars, including working knowledge of those that may relate to piracy and armed robbery. Knowledge of the procedures for conducting inspections and surveys and for the control and monitoring of security activities specified in a ship security plan. Knowledge of security-related contingency plans and the procedures for responding to security threats or breaches of security, including provisions for maintaining critical operations < the ship/port interface, and including also working knowledge of those that may relate to piracy and armed robbery		
Recognition of security risks and threats	Knowledge of security documentation, including the Declaration of Security. Knowledge of techniques used to circumvent security measures, including those	Assessment of evidence obtained from approved instruction or during attendance at an approved course	Procedures and actions are in accordance with the principles established by the ISPS Code and the SOLAS, 1974, as amended.

	used by pirates and armed robbers. Knowledge enabling recognition of potential security threats. Knowledge enabling recognition of weapons, dangerous substances and devices and awareness of the damage they can cause. Knowledge of crowd management and control techniques, where appropriate. Knowledge in handling security-related information and security-related communications. Knowledge of the methods for physical searches and non-intrusive inspections.		
Undertake regular security inspections of the ship	Knowledge of the techniques for monitoring restricted areas. Knowledge of controlling access to the ship and to restricted areas on board ship. Knowledge of methods for effective monitoring of deck	Assessment of evidence obtained from approved instruction or during attendance at an approved course	Procedures and actions are in accordance with the principles established by the ISPS Code and the SOLAS Convention, as amended

	areas and areas surrounding the ship. Knowledge of inspection methods relating to the cargo and ship's stores. Knowledge of methods for controlling the embarkation, disembarkation and access while on board of persons and their effects.		
Proper usage of security equipment and systems, if any	General knowledge of various types of security equipment and systems, including those that could be used in case of attacks by pirates and armed robbers, including their limitations. Knowledge of the need for testing, calibrating, and maintaining security systems and equipment, particularly whilst at sea	Assessment of evidence obtained from approved Instruction or during attendance at an approved course	Equipment and systems operations are carried out in accordance with established equipment operating instructions and taking into account the limitations of the equipment and systems
			Procedures and actions are in accordance with the principles established by the ISPS Code and the SOLAS, 1974, as amended

COURSE OUTLINE

Security Training for Seafarers with Designated Security Duties (STSDSD)

Duration: 2 working days

Total hours: 14 hours

Subject Area	Methods of teaching	Hours	
		Lecture	Exercise
1. Introduction XXXV. Course overview XXXVI. Competences to be achieved XXXVII. Current security threats and patterns XXXVIII. Ship and port operations and conditions	Lecture / Presentation	1.0	
2. Maritime Security Policy .25 Familiarity with relevant international conventions, codes, and recommendations .26 Familiarity with relevant government legislation and regulations .27 Definitions .28 Handling sensitive security-related information and communications	Lecture / Presentation	0.75	
3. Security Responsibilities .1 Contracting governments .2 Recognized Security Organizations .3 The company .4 The Ship .5 The port facility .6 Ship Security Officer .7 Company Security Officer .8 Port Facility Security Officer .9 Seafarers with designated security duties .10 Port Facility personnel with designated security duties .11 Other personnel	Lecture / Presentation	1.25	

Subject Area	Methods of teaching	Hours	
		Lecture	Exercise
4. Ship Security Assessment – Assessment tools – On-scene security surveys	Lecture / Presentation	1.0	
5. Security Equipment .4 Security equipment and systems .5 Operational limitations of security equipment and systems .6 Testing, calibration and maintenance of security equipment and systems	Lecture/ Demonstration of Equipments	1.0	0.25
6; Threat Identification, Recognition, and Response I. Recognition and detection of weapons, dangerous substances and devices II. Methods of physical searches and non-intrusive inspections III. Execution and coordination of searches IV. Recognition, on a non-discriminatory basis, of persons posing potential security risks V. Techniques used to circumvent security measures VI. Crowd management and control techniques	Lecture/ Demonstration of Equipments	1.0	0.5
7. Ship Security Actions – Actions required by different security levels – Maintaining security of the ship/port interface – Familiarity with the Declaration of Security – Reporting security incidents – Execution of security procedures	Lecture/ Demonstration of Equipments	0.5	0.25
8. Emergency Preparedness, Drills, and Exercises (I) Execution of contingency plans (II) Security drills and exercises	Lecture / Presentation	1.0	

Subject Area	Methods of teaching	Hours	
		Lecture	Exercise
8.3 Use of Citadel where provided onboard.			
9. Security Administration 9,1 Documentation and records	Lecture / Presentation	0.5	
ANTI-PIRACY 10. Piracy Awareness - Prior to Entering Areas of Risk I. Appraise the strengths and vulnerabilities of crews and ships. II. Know the Anti-piracy measures (civilian and military) III. Understand the contents of the Best Management Practices (BMP) IV. Pirates Business Model	Lecture / Presentation	1.3	
11. Pirate Attack .1 Examine the implications of a piracy attack .2 Assess how to defend the crew and the ship .3 Coping in a Hostage Situation	Lecture / Presentation	2.0	
12. The Release Process 12.1 Discuss the additional dangers associated with the release process	Lecture / Presentation	0.5	
13. Seafarers' Family .5 Enable seafarers to consider what they may wish to share with their family concerning the risks of piracy .6 Discussion with participants and closing session	Lecture / Presentation	0.7	
Assessment and Feedback		0.5	
GRAND TOTAL		13.0	1.0
TOTAL		14	

DETAILED TEACHING SYLLABUS

Security Training for Seafarers with Designated Security Duties (STSDSD)

Duration: 2 working days

Total hours: 14 hours

Learning Objectives	Hours
1. Introduction 1.1. Course overview .1 describes the topics and emphasis of the course 1.2. Competences to be achieved .1 describes the competences that will be achieved through completion of the course 1.3. Current security threats and patterns .1 summarizes threats to the maritime transportation industry, such as: • piracy and armed robbery • terrorism • contraband smuggling • stowaways and refugees • cargo theft • collateral damage 1.4. Ship and port operations and conditions .1 characterizes the intermodal nature of transportation and the interfaces between ships and other modes	1.0 hour
2. Maritime Security Policy 2.1. Familiarity with relevant international conventions, codes, and recommendations .1 summarizes previous efforts of IMO toward maritime security, such as MSC/Circ.443, SUA Act, etc. .2 summarizes the rapidity with which IMO acted to enhance	0.75 hour

Learning Objectives	Hours
maritime security following 9/11 .3 summarizes the amendments to SOLAS Chapter XI and the contents of the ISPS Code .4 summarizes the security-related provisions of the amendments to the STCW Code .5 summarizes IMO guidance on preventing and suppressing acts of piracy and armed robbery against ships 2.2. Familiarity with relevant government legislation and regulations summarizes the requirements of relevant national legislation and regulations. 2.3. Definitions es • Vessel Security Plan • Company Security Officer • Vessel Security Officer • Port facility • Vessel-to-facility interface • Vessel-to-port interface • Vessel-to-vessel activity • Facility Security Officer • Designated Authority • Recognized Security Organization • Declaration of Security • Security incident • Security Level • the three security levels • terms relating to piracy and armed robbery 2.4. Handling sensitive security-related information and communications es security-sensitive information and the importance of keeping it confidential	
3. Security Responsibilities 3.1, Contracting governments summarizes the responsibilities of contracting governments with respect to SOLAS Chapter XI-2 ,the ISPS Code and the STCW code. 3.2. Recognized Security Organizations	1.25 hours

Learning Objectives		Hours
3.3.	.1 surveys the role of the Recognized Security Organization The company .1 summarizes the responsibilities of the company with respect to: • ensuring that the Master has documents on board relating to the crewing of the ship and its employment • ensuring that the Ship Security Plan contains a clear statement emphasizing the master's authority designating a Company Security Officer and a Ship Security officer and ensuring that they are given the necessary support to fulfil their duties and responsibilities	
3.4.	The Ship .1 states that the vessel shall comply with the requirements of the Ship Security Plan as per the security level set	
3.5.	The port facility .1 states that facilities shall comply with the relevant requirements of the Chapter XI-2 of SOLAS and the ISPS Code .2 states that the port facility shall act upon the security levels set by the Administration within whose territory it is located.	
3.6.	Ship Security Officer .1 states that the company shall designate a Ship Security Officer for each vessel .2 lists the duties and responsibilities of the Ship Security Officer	
3.7.	Company Security Officer .1 states that the company shall designate a Company Security Officer .2 describes that the person designated as Company Security Officer may act as Company Security Officer for one or more vessels provided that it is clearly identified for which ships he is responsible .3 indicates that the company may designate several persons as Company Security Officer provided that it is clearly identified for which ships each is responsible .4 lists the duties and responsibilities of the Company Security Officer	
3.8.	Port Facility Security Officer	

Learning Objectives	Hours
that the Port Facility Security Officer shall be designated for each facility that a person may be designated as the Port Facility Security Officer for one or more facilities the duties and responsibilities of the Port Facility Security Officer 3.9. Seafarers with designated security duties that members of the ship's crew other than the SSO may have designated security duties in support of the Ship Security Plan 3.10. Port Facility personnel with designated security duties that port facility personnel other than the PFSO may be assigned security duties in support of the Port Facility Security Plan 3.11. Other personnel that other ship and port facility personnel may have a role in the enhancement of maritime security that personnel other than ship or port facility personnel may have a role in the enhancement of maritime security that military, industry, and intergovernmental organizations may have a role in the prevention, suppression, and reporting of piracy and armed robbery against ships.	
4. Ship Security Assessment 4.1. Assessment tools discusses the use of checklists in conducting security assessments 4.2. On-scene security surveys . 1 lists the preparations required prior to an on-scene survey .2 lists the procedures and measures and operations to be evaluated during an on-scene survey .3 discusses the security aspects of ship layout .4 divides the survey into the following sections: 3. Physical Security 4. Structural Integrity 5. Personnel Protection Systems 6. Procedural Policies 7. Radio and Telecommunication Systems 8. Other Areas discusses the importance and elements of physical security	1.0 hour

Learning Objectives	Hours
aboard ships describes the significance of structural integrity for ships and other structures describes the components and operations of systems to protect shipboard personnel describes the role of proper procedures in preventing and mitigating security incidents, including attacks by pirates and armed robbers. describes the use of information technology and communications systems in ship operations and in maintaining security identifies other areas that may, if damaged or used for illicit observation, pose a risk to persons, property, or operations aboard the ship or within a port facility discusses the identification of vulnerabilities in the above areas and the preparation of counter measures to address them emphasizes the importance of having in place emergency plans to deal with contingencies	
5. Security Equipment 5.1. Security equipment and systems demonstrates familiarity with the various types of security equipment and systems that can be used aboard vessels and in facilities describes the security equipment and systems that may be used to prevent and suppress attacks by pirates and armed robbers 5.2. Operational limitations of security equipment and systems describes the limitations of individual items of equipment and security systems describes the risks and benefits of security equipment and systems that may be used to prevent and suppress attacks by pirates and armed robbers 5.3. Testing, calibration and maintenance of security equipment and systems describes the testing, calibration and maintenance requirements for the above security equipment and systems	1.25 hours
6. Threat Identification, Recognition, and Response 6.1. Recognition and detection of weapons, dangerous substances and devices	1.5 hours

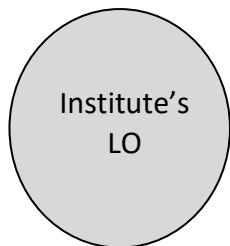
Learning Objectives		Hours
6.2. .1 describes the various types of weapons, dangerous substances and devices, the damage they can cause, and their appearance Methods of physical searches and non-intrusive inspections 6.3. .1 demonstrates how to carry out physical searches and non- intrusive inspections. Execution and coordination of searches .1 summarizes how important it is to plan a search and practice carrying out searches as a drill. .2 explains how to plan a search using a system of check cards .3 describes the equipment the search team should carry for 6.4. conducting a search .4 describes the procedures to be followed for an efficient search .5 describes the various places of concealment on board a ship Recognition, on a non-discriminatory basis, of persons posing potential security risks 6.5. .1 describes the general characteristics and behavioural patterns of persons who are likely to threaten security .2 states how important it is to be observant to recognize such persons Techniques used to circumvent security measures 6.6. .1 describes the techniques that may be used to circumvent security measures .2 explains the methods used by pirates and armed robbers to undertake attacks against ships Crowd management and control techniques .1 explains the basic psychology of a crowd in a crisis situation .2 states the importance of clear communication with crew and passengers during an emergency		
7. Ship Security Actions 7.1. Actions required by different security levels .1 states the three security levels and the actions required for each level. .2 identifies recommended actions in response to attacks and attempted attacks by pirates and armed robbers 7.2. Maintaining security of the ship/port interface .1 lists the reporting requirements for ships prior to entering port 7.3. Familiarity with the Declaration of Security . 1 explains the Declaration of Security and what it addresses. 7.4. Reporting security incidents		0.75 hour

Learning Objectives	Hours
.1 summarizes the reporting requirements in case of a security incident, including protocols for reporting attacks and attempted attacks by pirates and armed robbers 7.5. Execution of security procedures . 1 states the requirements for the Ship Security Officer to carry out regular security inspections .2 lists the security measures and procedures at the three security levels required to: • ensure the performance of all ship security duties • control access to the ship • control the embarkation of persons and their effects • monitor restricted areas to ensure only authorized persons have access • monitor deck areas and areas surrounding the ship • coordinate the security aspects of the handling of cargo and ship stores; and • ensure that security communication is readily available	
8. Emergency Preparedness, Drills, and Exercises 8.1. Execution of contingency plans .1 discusses action to take in case of a breach of security .2 discusses contingency plans for: • damage to, or destruction of, the ship or of a port facility, e.g., by explosive devices, arson, sabotage or vandalism; • hijacking or seizure of the ship or of persons on board; • attacks by armed robbers; • tampering with cargo, essential ship equipment or systems or ship's stores; • unauthorized access or use, including presence of stowaways; • smuggling weapons or equipment, including weapons of mass destruction; • use of the ship to carry persons intending to cause a security incident, or their equipment; • use of the ship itself as a weapon or as a means to cause damage or destruction; • attacks from seaward while at berth or at anchor; and attacks while at sea. 8.2. Security drills and exercises	1.0 hour

Learning Objectives	Hours
. 1 states the requirements for, and importance of, conducting drills and exercises, including those relating to prevention and suppression of piracy and armed robbery against ships. 8.3. Use of Citadel where provided onboard .1 understands the meaning of Citadel .2 knows how and when a citadel is to be used	
9. Security Administration 9.1. Documentation and records .1 states the documents that shall be available on board at all times .2 states the activities for which records shall be kept on board and the duration for which they should be retained.	0.5 hour
Anti-Piracy	
10. Piracy Awareness - Prior to Entering Areas of Risk 10.1. Appraise the strengths and vulnerabilities of crews and ships 10.1.1 Ship to be like a fortress - to discuss the available strengths of the ship to defend a pirate attack 10.1.2 Being slow moving, a ship is a vulnerable target with limited deterrent in terms of returning an attack Discuss factors such as ship size, speed, freeboard, sea state, visibility, day/night condition affecting the vulnerability to an attack 10.2. Know the Anti-piracy measures (civilian and military) 10.2.1 Discuss the anti-piracy measures that can be adopted to make the ship less vulnerable to pirates boarding it 10.2.2 Adopting self-protecting measures to detract, deter or delay a piracy attack. 10.2.3 Transiting the high risk area in the recommended zone and preferably in a convoy 10.2.4 Communication with the flag state, coastal authority and task force to update ships position frequently. 10.3. Understand the contents of the Best Management Practices (BMP) guide as issued by industries bodies and updated from time to time 10.4. Pirates Business Model 10.4.1 Know that Piracy has grown into a business which sustains	1.3 hour

Learning Objectives	Hours
and fuels it Understand the Somali Pirates business model Understand the W. Africa piracy business model	
11. Pirate Attack 11.1. Examine the implications of a piracy attack Know some of the recent cases of ship hijack and crew being hostage Know that individuals will react in different ways during a piracy attack 11.2. Assess how to defend the crew and the ship Highlight relevant methods provided in the BMP and the contingency measures as given in the Ship's Security Plan in the event of an attack. Discuss the step by step actions to be taken during an attack Discuss the importance of retreating to the citadel in the event pirates board the ship Communication channels must be kept open with task forces and local co-ordination authorities to update situation periodically. 11.3. Coping in a Hostage Situation Examine possible personal reactions to activities of pirates during a hostage situation Reiterate the importance of obedience to the pirates orders. There are no dead heroes. Understand possible personal reactions in immediate crisis situation, post crises situation, short term after crises situation Understand provocations from pirates and possible techniques to cope with the ensuing hostage situation. Coping in the long term in the captive situation	2.0 hours

Learning Objectives	Hours
12. The Release Process 12.1. Understand what happens prior to the release 12.2. Discuss the additional dangers associated with the release process 12.3. Know the safeguards to adopt during the release process 12.4. Discuss the practical needs of the crew after release 12.5. Be aware of the various parties and their involvement in the postrelease	0.5 hours
13. Seafarers' Family 13.1. Discuss advantages of seeking employment with reputed shipowner/manager 13.2. Enable seafarers to consider what they may wish to share with their family concerning the risks of piracy 13.3. Understand the worries and concerns of family members about piracy 13.4. Know the seafarers own specific responsibility towards his family and the importance of correct information being passed on to them 13.5. Be aware of the reactions of the family members when informed about the seafarer being taken hostage. 13.6. Discussion with participants and closing session	0.7 hours
Feedback & Assessment	0.5 hours
Total:	14.0 hours

**NAME and ADDRESS of the D. G. Approved Training Institute****INDOS No:****Tel:****Fax:****E-mail:****Certificate No:** _____THIS IS TO CERTIFY THAT *[full name of candidate]*

Date of Birth

Holder of C.D.C. No.

Passport No.

Certificate of Competency, (if any) Grade : No.

Indian National Data base (INDoS No.)

has successfully completed a training course for Certificate of Proficiency in

SECURITY TRAINING FOR SEAFARERS WITH DESIGNATED SECURITY DUTIES

held on and has been found qualified.

The course is approved by the Directorate General of Shipping and meets the requirements laid down in:
Regulation VI/6 Paragraph 4 to 6, Section A-VI/6 Paragraph 6 to 8 and Table A-VI/6-2 of STCW Convention as amended in 2010.

The candidate has also met the additional criteria specified in the STCW Convention, applicable to the issue of the certificate.

This certificate is issued under the authority of the Directorate General of Shipping, Ministry of Shipping, Government of India.

Signature of Candidate_____
Name and Signature of Course In-charge

Date of Issue : _____

Date of Expiry : Unlimited, subject to
refresher training every 5 years.

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Official
Seal

Name and Signature of Dean / Principal

ANNEXURE - B

COURSE OUTLINE

Ship Security Officer (SSO) Course

Duration: 3 working days

Total hours: 18 hours

Sr. No.	Topic	Methods of teaching	Duration
1.	Introduction • Course Overview • Competencies to be achieved • Historical Perspective • Current Security threats & Patterns • Ship & Port operations and conditions	Lecture / Presentation	1.5 Hours
2.	Maritime Security Policies • Relevant International Conventions, Codes & Recommendations • Relevant Govt. Legislation and Regulations • Definitions • Legal Implications of action or non-action by security personnel • Handling sensitive security related information and communications	Lecture / Presentation	1.0 Hour
3.	Security Responsibilities • Contracting Governments • Recognized Security Organizations • The Company • The Ship • The Port Facility • Ship Security Officer • Company Security Officer • Port Facility Security Officer • Seafarers with designated security duties • Port Facility personnel with designated security duties • Other personnel	Lecture/ Presentation	1.5 Hours
4.	Ship Security Assessment • Risk assessment methodology • Assessment tools • On-scene security surveys • Security assessment documentation	Lecture/ Presentation/ Workshop/ Exercises	1.5 Hours

5.	Security Equipment • Security Equipment and systems • Operational limitations of Security Equipment and systems • Testing, calibration and maintenance of Security Equipment & systems	Lecture/ Demonstration of Equipments	1.5 Hours
6.	Ship Security Plan • Purpose of the Ship Security Plan • Contents of the Ship Security Plan • Confidentiality issues • Implementation of the Ship Security Plan • Maintenance and modifications of the Ship Security Plan	Lecture/ Presentation/ Workshop/ Exercises	2.0 Hours
7.	Threat Identifications, Recognition & Response • Recognition & detection of weapons, dangerous substances and devices • Methods of physical searches and non-intrusive inspections • Implementing and coordinating searches • Recognition on a non-discriminatory basis, of persons posing potential security risks • Techniques used to circumvent security measures • Crowd management and control techniques	Lecture/ Presentation/ Workshop/ Exercises	3.0 Hours
8.	Ship Security Actions • Actions required by different security Levels • Maintaining security of the ship/port interface • Usage of the Declaration of Security • Reporting security incidents • Implementation of security procedures	Lecture/ Presentation/ Workshop/ Exercises	2.0 Hours
9.	Emergency Preparedness, Drills and Exercises • Contingency planning • Security drills and exercises • Assessment of Security drills and exercises	Lecture/ Presentation/ Exercises/ Contingency plans for various security related	1.5 Hours

		emergencies	
10.	Security Administration • Documentation & Records • Monitoring and Control • Security Audits and Inspections • Reporting nonconformities	Lecture/ Presentation/ Workshop/ Exercises	1.0 Hour
11.	Security Training • Training requirements	Lecture/ Presentation	0.5 Hour
12.	Assessment and Feedback		1.0 hour
	TOTAL		18.0 Hours

ANNEXURE- C

DETAILED TEACHING SYLLABUS

Learning Objectives	Hours
1. Introduction 1.1. Course overview .1 describes the topics and emphasis of the course 1.2. Competences to be achieved .1 describes the competences that will be achieved through completion of the course 1.3. Historical perspective .1 describes representative incidents involving criminal activity in the maritime environment .2 summarizes incident statistics and discusses underlying motivation and results 1.4. Current security threats and patterns .1 identifies threats to the maritime transport industry, such as: ▪ piracy and armed robbery ▪ terrorism ▪ contraband smuggling ▪ stowaways and refugees ▪ cargo theft ▪ collateral damage 1.5. Ship and port operations and conditions .1 characterizes the intermodal nature of transportation and the interfaces between ships and other modes	1.5 hours
2. Maritime Security Policy 2.1. Relevant international conventions, codes, and recommendations .1 lists previous efforts of IMO toward maritime security, such as MSC/Circ.443, SUA Act, etc.	1.0 hours

Learning Objectives	Hours
.2 describes the rapidity with which IMO acted to enhance maritime security following 9/11 .3 summarizes the amendments to SOLAS Chapter XI and the contents of the ISPS Code .4 discusses the security-related provisions of the amendments to the STCW Code .5 identifies IMO guidance on preventing and suppressing acts of piracy and armed robbery 2.2. Relevant government legislation and regulations .1 states the requirements of relevant national legislation and regulations. 2.3. Definitions .1 defines ▪ Ship Security Plan ▪ Company Security Officer ▪ Ship Security Officer ▪ Port facility ▪ Ship / Port Interface ▪ Ship to ship activity ▪ Port Facility Security Officer ▪ Designated Authority ▪ Recognized Security Organization ▪ Declaration of Security ▪ Security incident ▪ Security Level ▪ the three security levels ▪ Terms relating to piracy and armed robbery 2.4. Legal implications of action or non-action by security personnel .1 identifies the legal limits of authority and the obligations of the ship security officer and other personnel with security duties 2.5. Handling sensitive security-related information and communications .1 defines security-sensitive information and the importance of keeping it confidential	

Learning Objectives	Hours
3. Security Responsibilities 3.1. Contracting governments .1 describes the responsibilities of contracting governments with respect to SOLAS Chapter XI-2 and the ISPS Code and the STCW code 3.2. Recognized Security Organizations .1 characterizes the role of the Recognized Security Organization and identifies the extent of its function 3.3. The company .1 describes the responsibilities of the company with respect to: ▪ ensuring Master has documents on board relating to the crewing of the vessel and its employment ▪ ensuring that the Ship Security Plan contains a clear statement emphasizing the master's authority ▪ designating a Company Security Officer and a Ship Security officer and ensuring that they are given the necessary support to fulfill their duties and responsibilities 3.4. The ship .1 states that the ship shall comply with the requirements of the Ship Security Plan as per the security level set 3.5. The port facility .1 states that port facilities shall comply with the relevant requirements of Chapter XI-2 of SOLAS and the ISPS Code .2 states that the port facility shall act upon the security levels set by the Administration within whose territory it is located 3.6. Ship Security Officer .1 states that the company shall designate a Ship Security Officer for each ship .2 lists the duties and responsibilities of the Ship Security Officer	1.5 hours

Learning Objectives	Hours
3.7. Company Security Officer .1 states that the company shall designate a Company Security Officer .2 describes that the person designated as Company Security Officer may act as Company Security Officer for one or more ships provided that it is clearly identified for which ships he is responsible .3 indicates that the company may designate several persons as Company Security Officer provided that it is clearly identified for which ships each is responsible .4 lists the duties and responsibilities of the Company Security Officer 3.8. Port Facility Security Officer .1 states that the Port Facility Security Officer shall be designated for each port facility .2 states that a person may be designated as the Port Facility Security Officer for one or more port facilities .3 lists the duties and responsibilities of the Port Facility Security Officer 3.9. Seafarers with designated security duties .1 states that members of the ships crew may have designated security duties in support of the Ship Security Plan 3.10. Port facility personnel with designated security duties .1 states that port facility personnel other than the PFSO may have designated security duties in support of the port facility Security Plan 3.11. Other personnel .1 states that other shipboard and port facility personnel may have a role in the enhancement of maritime security .2 states that personnel other than ship or facility personnel may have a role in the enhancement of maritime security	

Learning Objectives	Hours
4. Ship Security Assessment 4.1. Risk assessment methodology .1 states the basic principles of risk assessment in day-to-day operations 4.2. Assessment tools .1 discusses the use of checklists in conducting security assessments 4.3. On-scene security surveys .1 lists the preparations required prior to an on-scene survey .2 lists the procedures and measures and operations to be evaluated during an on-scene survey .3 discusses the security aspects of ship layout .4 divides the survey into the following sections: ▪ Physical Security ▪ Structural Integrity ▪ Personnel Protection Systems ▪ Procedural Policies ▪ Radio and Telecommunication Systems ▪ Other Areas .5 discusses the importance and elements of physical security aboard ship .6 describes the significance of structural integrity for ships and other structures .7 discusses the components and operations of systems to protect shipboard personnel .8 states the role of proper procedures in preventing and mitigating security incidents, including attacks by pirates and armed robbers .9 describes the use of information technology and communications systems in ship operations and in maintaining security	1.5 hours

Learning Objectives	Hours
.10 identifies other areas that may, if damaged or used for illicit observation, pose a risk to persons, property, or operations aboard the ship or within a port facility .11 discusses the identification of vulnerabilities in the above areas and the preparation of countermeasures to address them .12 states the importance of having in place emergency plans to deal with contingencies .13 explains and demonstrates how to carry out a security assessment with new measures in place and checks if further mitigating measures are required 4.4. Security assessment documentation .1 describes proper form and practice for recording day-to-day security assessment results	
5. Security Equipment 5.1. Security equipment and systems .1 lists the various types of security equipment and systems that can be used aboard ships and in port facilities .2 describes the security equipment and systems that may be used to prevent and suppress attacks by pirates and armed robbers 5.2. Operational limitations of security equipment and systems .1 explains the limitations of individual items of equipment and security systems 5.3. Testing, calibration and maintenance of security equipment and systems .1 describes the testing, calibration and maintenance requirements for the above security equipment and systems.	1.5 hours

Learning Objectives	Hours
6. Ship Security Plan 6.1. Purpose of the Ship Security Plan .1 states that each ship shall carry a Ship Security Plan approved by the Administration .2 explains that the Ship Security Plan addresses the security measures that should be taken at each security level 6.2. Contents of the Ship Security Plan .1 lists the required elements of a Ship Security Plan including those that relate to the prevention and suppression of piracy and armed robbery .2 states that the Ship Security Plan shall establish procedures for the performance of ship security duties. 6.3. Confidentiality issues .1 states that the Ship Security Plan is confidential .2 states that the Ship Security Plan is not generally subject to inspection by Port State Control .3 describes the circumstances under which certain sections of the plan may be shown to Port State Control Authorities 6.4. Implementation of the Ship Security Plan .1 explains procedures to be employed in implementing the Ship Security Plan .2 explains the requirement to coordinate implementation of the Ship Security Plan with the Company Security Officer and the Port Facility Security Officer .3 discusses the importance of giving due regard to the effect that security measures may have on shipboard personnel who may remain on board the ship for long periods 6.5. Maintenance and modification of the Ship Security Plan .1 explains mechanisms for ensuring the continuing effectiveness and updating of the Ship Security Plan	2.0 hours

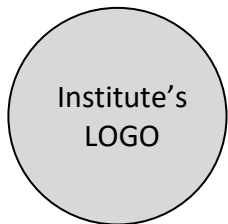
Learning Objectives	Hours
.2 explains the procedures for implementing any corrective actions .3 states that amendments to the plan shall not be implemented unless approved by the Administration	
7. Threat Identification, Recognition, and Response 7.1. Recognition and detection of weapons, dangerous substances and devices .1 describes the various types of weapons, dangerous substances and devices, the damage they can cause, and their appearance 7.2. Methods of physical searches and non-intrusive inspections .1 demonstrates how to carry out physical searches and non-intrusive inspections. 7.3. Implementing & coordinating searches .1 describes how important it is to plan a search and practice carrying out searches as a drill. .2 explains how to plan a search using a system of check cards .3 describes the equipment the search team should carry for conducting a search .4 describes the procedures to be followed for an efficient search .5 describes the various places of concealment on board a ship 7.4. Recognition, on a non-discriminatory basis, of persons posing potential security risks .1 describes the general characteristics and behavioural patterns of persons who are likely to threaten security .2 states how important it is to be observant to recognize such persons	3.0 hours

Learning Objectives	Hours
7.5. Techniques used to circumvent security measures .1 describes the techniques that may be used to circumvent security measures .2 explains the methods used by pirates and armed robbers to undertake attacks against ships 7.6. Crowd management and control techniques .1 explains the basic psychology of a crowd in a crisis situation .2 states the importance of clear communication with crew and passengers during an emergency	
8. Ship Security Actions 8.1. Actions required by different security levels .1 states the three security levels and the actions required for each level. .2 identifies recommended actions in response to attacks and attempted attacks by pirates and armed robbers 8.2. Maintaining security of the ship/port interface .1 lists the reporting requirements for the ship prior entering port 8.3 Usage of the Declaration of Security .1 explains the Declaration of Security and what it addresses. .2 states who determines when it should be completed .3 lists the situations in which the ship can request that the Declaration of Security be completed. .4 states who is required to complete it 8.4 Reporting security incidents .1 states the reporting requirements in case of a security incident, including protocols for reporting attacks and attempted attacks by pirates and armed robbers	2.0 hours

Learning Objectives	Hours
8.5. Implementation of security procedures .1 states the requirements for the Ship Security Officer to carry out regular security inspections .2 lists the security measures and procedures at the three security levels required to: ▪ ensure the performance of all ship security duties ▪ control access to the ship ▪ control the embarkation of persons and their effects ▪ monitor restricted areas to ensure only authorized persons have access ▪ monitor deck areas and areas surrounding the ship ▪ coordinate the security aspects of the handling of cargo and ship's stores; and ▪ ensure that security communication is readily available	
9. Emergency Preparedness, Drills, and Exercises 9.1. Contingency planning .1 discusses action to take in case of a breach of security .2 discusses contingency plans for: ▪ Damage to, or destruction of, the ship or of a port facility, e.g. by explosive devices, arson, sabotage or vandalism; ▪ Hijacking or seizure of the ship or of person on board; ▪ Attacks by armed robbers ▪ Tampering with cargo, essential ship equipment or systems or ship's stores; ▪ Unauthorized access or use, including presence of stowaways; ▪ Smuggling weapons or equipment, including weapons of mass destruction; ▪ Use of the ship to carry persons intending to cause a security incident, or their equipment; ▪ Use of the ship itself as a weapon or as a means to cause damage or destruction; ▪ Attacks from seaward while at berth or at anchor, and ▪ Attacks while at sea.	1.5 hours

Learning Objectives	Hours
9.2. Security drills and exercises .1 states the requirements for, and importance of, conducting drills and exercise, including those relating to prevention and suppression of piracy and armed robbery against ships 9.3. Assessment of security drills and exercises .1 states the purpose of carrying out an assessment at the end of each drill	
10. Security Administration 10.1. Documentation and records .1 states the documents that shall be available on board at all times .2 describes the International Ship Security Certificate, its validity and verification requirements .3 states the requirements of the Continuous Synopsis Record and what it shall contain .4 states the activities for which records shall be kept on board and the duration for which they should be retained. 10.2. Monitoring and control .1 states the explicit requirement for the Ship Security Officer to review the Ship Security Plan and the implicit responsibility of the Master in this regard. 10.3. Security audits and inspections .1 states the requirements for carrying out internal audits and inspections 10.4. Reporting nonconformities .1 states the requirements for reporting nonconformities and deficiencies identified during internal audits, periodic reviews, and security inspections	1.0 hours

Learning Objectives	Hours
11. Security Training 11.1. Training requirements .1 Explains which personnel must receive training and in what subjects they must be trained .2 Explains the requirement for enhancing security awareness and vigilance onboard	0.5 hours
12. Assessment and Feedback	1.0 hours
Total:	18.0 hours



NAME and ADDRESS of the D. G. Approved Training Institute

INDOS No:

Tel:

Fax:

E-mail:

Certificate No: _____

THIS IS TO CERTIFY THAT *[full name of candidate]*

Date of Birth

Holder of C.D.C. No.

Passport No.

Certificate of Competency/Proficiency Grade : No.

Indian National Data base (INDoS No.)

has successfully completed a training course for certificate of proficiency in

SHIP SECURITY OFFICER

held from..... to

The course is approved by the Directorate General of Shipping and meets the requirements laid down in Regulation VI/5, Section A-VI/5 and Table A-VI/5 of STCW Convention as amended in 2010.

The Candidate has also met the additional criteria specified in the STCW Convention, applicable to the issue of the certificate.

This certificate is issued under the authority of the Directorate General of Shipping, Ministry of Shipping, Government of India.

Signature of Candidate

Name and Signature of Course In-charge

Date of Issue : _____

Date of Expiry : UNLIMITED

Colour Photograph
(35 mm x 35 mm)

Name and Signature of Dean / Principal

Official
Seal