

Guidelines for conducting Pre-sea Training for Personnel to man Dredger vessels, Tugs, Offshore Support Vessels, etc. on Near Coastal Voyages [NCV] (withdrawn by M.S. Notice 01 of 2014)

M.S. Notice No. 4 of 2010

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21st April,

Sub: Guidelines for conducting Pre-sea Training for Personnel to man Dredger vessels, Tugs, Offshore Support Vessels, etc. on Near Coastal Voyages [NCV]

1. The Directorate introduced training schemes for dredging sector vide M.S. Notice 1 of 2007 and M.S. Notice No.3 of 2007 but neither the industry implemented any of the provisions therein nor the guidelines in this regard were issued by the Directorate. The NCV - Engine and Deck Cadet Scheme introduced vide M.S. Notice No.14 of 2007 also did not improve the manpower availability in the dredging sector. As a result, the dredging industry continues to face acute shortage of manpower.
2. Several meetings with the stakeholders were conducted to discuss the matter and it was decided to introduce a new pre-sea training course for the dredging industry. A committee was constituted to prepare the draft guidelines. The draft guidelines for conduct of "Pre-sea Training for Personnel to man Dredger Vessels, Tugs, Offshore Support Vessels, etc. on Near Coastal Voyages [NCV]", were put up on DGS website. Based on the feedback received and discussions held with the industry, the final guidelines have been approved by the Competent Authority, which are enclosed herewith. Emphasis has been placed on more intense 'practical training' so that these personnel will be readily employed on board the Near Coastal Vessels.
3. These guidelines shall come into force with effect from the date of issue of this Training Circular.
4. This has the approval of the Director General of Shipping & Ex-Officio Additional Secretary to Govt. of India,

Yours faithfully,

Sd/-

[Ashima Gupta]

Dy. Director General of Shipping

GUIDELINES OF PRE-SEA TRAINING FOR PERSONNEL TO MAN DREDGER VESSELS, TUGS , OFFSHORE SUPPORT VESSELS Etc. ON NEAR COASTAL VOYAGES (NCV), IN HARBOURS.

1. This training scheme is based on four (4) levels i.e. knowledge, understanding, application and integration. All subjects are supported by appropriate video-training programmes.

Based on the above it can be seen that the NCV Pre-sea training scheme has a distinctive "task based" novel approach with a greater emphasis on supervised practical training of the cadets on the job. Necessary and appropriate under-pinning knowledge shall be provided by regular class room lectures to cover the proposed syllabus.

2. The training provider must have sufficient infrastructure and suitable faculty and instructors as per DGS requirements Order No. 2 of 2007 for pre sea training Institutions and in addition the following facilities:

3. This guidelines consists of:

- i. Introduction of a National Pre-sea Training Course and Competency Standards for personnel to man Dredgers Tugs and Offshore Support vessels in NCV areas and Inland waterways.
- ii. General principles
- iii. Detailed proposal containing syllabus for a six month training having generic competency requirements as well as special training needs appropriate for service on Dredgers, Tugs and Offshore Support Vessels.

3.1 General Principles

The Directorate General of Shipping's approval of the education and training of seafarers and the system of formal certification, has a dual role.

First and most important, it underpins safety by ensuring that those manning vessels have the necessary skills and knowledge to carry out vessels operations in a way that does not endanger themselves, fellow crew members or other waterways users.

Secondly, it will help to raise the profile of the Indian Maritime Industry, and vouch for the skills and professional expertise that exist within it.

The scheme intention is to augment DREDGING & Offshore man power needs of our ports and harbours (considering that we have over 7000 kms. of coastline and over 200 ports that need to remain navigable), and facilitate carriage of more freight within Indian Coastal Waters.

This pre-sea training scheme will enable to develop trade specific NCV certified cadre and thus provide a much needed boost to the man power resources required in this sector. This scheme will cover both streams, viz., nautical and marine engineers.

Entry qualification:

Minimum Xth. Standard passed from a recognized Board, physically fit male or female between the age of 17.5 to 25 years. Candidates with ITI qualification as per Engineering Circular No. "ENG/EXAM-17 (9)/99" will be given preference.

This guideline is targeted primarily for Dredger, Tugs and Offshore Support Vessels sector. The scheme can be eventually extended to cover other types of NCV / Offshore vessels.

3.2 Special Vessel Specific Training

These are designed as "add-on" modules to the generic training . Candidates will need to demonstrate both practical skills and underpinning knowledge in each special vessel category as required. The following optional special vessel training is proposed:

- i. Dredging
- ii. Towing and Pushing, and Tug Handling
- iii. Operation in Harbours, Smooth and partially smooth waters & River-Sea-Vessels (for certain operators who go outside of inland waters, but no more than 3 miles to sea and 12 miles from the point of departure);

- iv. Marine Engineering practices as applicable.
- v. Offshore Support Vessels Practices

4. Operation of Tugs, Offshore Support vessels and Dredger Vessels

The section on dredging aims to address the navigational and dredge operating considerations for that operation. The competencies for this endorsement are shown in the [Annexure-1](#), [Annexure -2](#), [Annexure-3](#), & [Annexure-4](#) of these guidelines.. Again, in addition to the generic competencies, candidates will be well trained to undergo SSTP on board ships in any stream.

Practical training shall be given to facilitate trainees to make short trips on vessels during their port movements without affecting the safety of trainees or the ships.

In this novel training scheme, since great emphasis is being made for practical skill development of the trainees, attached to the proposal are a set of tables, in five annexes, depicting the on- board practical training of the cadets in each Competency function concurrently with the class room lectures and workshop training. It may be noted an attempt has been made to categorise the waters where the vessels may operate and the consequent competency requirements of the personnel is envisaged along with local area knowledge.

Training period :-

8 hours per day - 6 days a week.

There are 26 weeks in 6 months. Of this, two weeks will be utilised for examination. So there are 24 training weeks.

No. of hours = 8 x 6 x 24 = 1152 hrs.

TRAINING COURSE OUTLINE

S.No	SUBJECT	NAUTICAL (HRS)			ENGINEERING (HRS)		
		LECTURE	PRACTICAL	TOTAL	LECTURE	PRACTICAL	TOTAL
1	Introduction and Mathematics (trigonometry)	24		24	24		24
2	Meteorology	24	12	36			
3	Navigation	80	64	144			
4	Chart Work	24	96	120			
5	Bridge Equipment Familiarisation and Bridge Watchkeeping Procedures	24	64	88			
6	Types of Dredgers, Operational Characteristics, main systems and Components	36	64	100	36	64	100
7	Tug Equipment, operational and control of tug and tow, best practices	24	48	72	24	48	72
8	Naval Architecture -						
8.1	Vessel construction	12	4	16	12	4	16
8.2	Ship stability	12	4	16	12	4	16
9	Practical Seamanship including Dredger and Tug Operations	32	288	320			
10	General Engineering science and properties of materials.				120		120

11	Familiarity with basic workshop tools and their use				8	44	52
12	Basic workshop practice, fitting shop, machine shop and welding				24	160	184
13	Repair and maintenance of marine machinery				32	320	352
14	Pollution prevention, health and safety lectures	24	16	40	24	16	40
15	Four STCW Safety Courses (18 Days)	84	60	144	84	60	144
Total (Nautical & Engineering)		400	720	1120	400	720	1120
Revision, internal assessment tests, etc.				32			32
Grand Total including assessments (Hours)				1152			

Daily training schedule

Lectures/ Practical per day:	8 hours
PT/Parade:	1 hour
Games/Swimming:	1 hour
*Self study:	2 hours
Total per day:	12 hours

During these 2 hours cadets are expected to general revision, workout problems on topics taught during the day, etc.

DETAILED SYLLABUS FOR THE SIX-MONTH PRE-SEA COURSE FOR NCV Cadets

INTRODUCTION

1.Lectures: 24 hours

- i. Explain 'Sea as a career in the Merchant Navy'.
- ii. Explain duration, scope and objectives of the course.
- iii. Demonstrate and explain parts of a ship using models or suitable video films.
- iv. Basic types of merchant ships - General Cargo, tugs, self propelled barges, trailing suction hopper Dredger, (TSHD), Cutter suction Dredger, Grab Dredger, Bucket Dredger, Back-hoe Dredger.
- v. Explain basic ship organisation including the ranks and duties of all officers and crew on board.
- vi. Introduce ship-shore related organisations & persons - Shipowner, Charterer, Company's superintendent, Agent, Shipchandler, Stevedore, Shipper, Consignee, Pilot, Survey t Longshoreman, Repair workshop, etc.
- vii. Introduction of ISPS Code.

NAVIGATION FUNCTION

2. METEOROLOGY

Lectures: 24 hrs; Practical 12 hrs; Total 36 hrs.

- i. The atmosphere Explain the various layers of the atmosphere, atmospheric temperature adiabatic changes, DALR, SALR, diurnal variation of atmospheric temperature, atmospheric pressure - semi-diurnal variation barometric tendency.
- ii. Heat Explain 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. Land and sea breeze.
- iii. Water vapour in the atmosphere Explain humidity, absolute humidity, relative humidity, saturation, dew point, meteorological application to hold ventilation, Fohn wind effect.
- iv. The hydrological cycle Explain 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.
- v. Visibility: Define and explain visibility, mist, fog, haze, spray and their differences; judging and reporting visibility, types of fog - radiation fog, advection fog, smog, arctic sea orographic fog.
- vi. Clouds Explain classification & description of the ten basic types of clouds, formation turbulence, orographic lifting, convection currents & frontal lifting.
- vii. Demonstrate the ability to use the International Cloud Atlas and identify various types of clouds.
- viii. Pressure gradient, wind and waves: Explain 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.
- ix. Judging wind: Explain the methods of estimating direction and force of wind at sea by the appearance of the sea and the use of the 'State of sea card'.
- x. True and apparent wind: Explain difference between true & apparent wind.
- xi. Conduct exercises on problems involving true and apparent wind.
- xii. Pressure measuring instruments: Explain the principle, construction, corrections, errors, maintenance and precautions when using the aneroid barometer, the precision aneroid barometer and the open scale barograph.
- xiii. Conduct practical exercises on reading the aneroid barometer, the precision aneroid barometer and the open scale barograph.
- xiv. Other meteorological instruments: Explain the principle, construction, corrections, errors, maintenance and precautions when using the thermometer, the wet and dry bulb hygrometer, the Stevenson screen, the whirling psychrometer.
- xv. Conduct practical exercises on reading the thermometer, the wet and dry bulb hygrometer and the whirling psychrometer.
- xvi. The 'Ship's Weather Code': Explain the 'Ship's Weather Code'.
- xvii. Conduct exercises in coding and decoding of ship's weather reports.
- xviii. Currents and tides around the coast and in ports and harbours.

3. NAVIGATION

Lectures - 80 hrs; Practicals and Numericals 64 hrs; Total 144 hrs.

- i. Explain the shape of the Earth, the meaning of the terms Axis of Rotation, Pole, Equator, Parallel of Latitude, Latitude, Meridian & Longitude.
- ii. Explain the terms D'lat & D'long.
- iii. Explain the meaning of 'Nautical Mile'.
- iv. Explain the term Departure and derive the relationship between Departure, D'long & Latitude. Conduct exercises in determining Departure, D'long & D'lat between two points on the earth's surface.
- v. Explain the terms Mean Latitude & Mid-Latitude. Explain Plane Sailing Formulae & conduct exercises on their use.
- vi. Using Traverse Tables calculate the Course & Distance between two points on the earth's surface.
- vii. Explain the meaning of the Ship's Log, Log Distance, Dead Reckoned and Estimated Positions. Exercises on Day's Work.
- viii. Explain Mercator & Gnomonic Projections. Explain the meaning of Meridional Parts & DMP. Explain Mercator Sailing Formulae and conduct exercises on their use.
- ix. Explain the contents and use of the Nautical Almanac.

- x. Define the concept of Time and its relationship with Longitude on the earth's surface. Explain GMT, Zone Time, Standard Time & Apparent Time.
- xi. Define Rational Horizon, Visible Horizon & Sensible Horizon. Explain with the aid of diagrams.
- xii. Define, with the aid of diagrams, Zenith, Nadir, Vertical Circles, Prime Vertical, True Altitude, Zenith Distance, Declination, Polar Distance, Hour Angles, Aries & Azimuth. Exercises in drawing figures, reasonably to scale, on the plane Of rational horizon.
- xiii. Explain, with the aid of diagrams, correction of altitudes: Dip, Refraction, SD
- xiv. Explain 'Latitude by Meridian Altitude'. Conduct practical training in observing the Sun at meridian passage. Conduct exercises on the above.
- xv. Explain the meaning of Amplitude & Azimuth. Conduct exercises on obtaining Compass Error using the above nautical tables. Explain method of obtaining times of Twilight, Rising, Setting, & Meridian Passage from the Nautical Almanac. Conduct exercises on the above
- xvi. Demonstrate stargazing - the identification of stars with reference to the main constellations.

4. CHART WORK

Lectures 24 hrs; Practicals 96 hrs; Total 120 hrs.

- i. Explain the meaning of Compass, Magnetic & True Course and Bearing. Deviation, Variation & Deviation Card.
- ii. Explain how Variation at a place is obtained from the chart after applying change in Variation. State that the latest chart should be consulted for this.
- iii. Conduct exercises on the conversion of Courses & Bearings between Compass, Magnetic & True.
- iv. Explain the Mercator chart in detail - Latitude scale, Natural scale, Longitude scale. The relation between latitude & longitude scales. Practical determination of distance on a Mercator chart.
- v. Demonstrate chart reading. Thorough knowledge of symbols & abbreviations used on British Admiralty & Indian charts. Thorough familiarisation with B.A. NP 5011. The Compass Rose.
- vi. Explain plotting ship's position on a Mercator chart, the use of parallel ruler, Set Square, compass, divider. Stress the importance of neatness in chart work. State the appropriate pencil to use in chart work. Explain the care & maintenance of charts.
- vii. Explain the layout of the ship's chart outfit. Familiarisation with the Admiralty Chart Catalogue & the Admiralty Chart Folio System.
- viii. Explain transferring position lines and courses on Mercator charts.
- ix. Introduce the Admiralty List of Lights. Explain the characteristics of lights.
- x. Explain the Buoyage System in use worldwide with special emphasis on the IALA system.
- xi. Explain Dead Reckoned and Observed positions and the symbols used for indicating them on the chart. Explain fixing vessel's position using terrestrial cross-bearings and bearing and range.
- xii. Explain course steered, course made good, engine speed, speed made good, current, leeway, how to counteract current and leeway, estimated position (EP) and the symbol used to denote EP..
- xiii. Demonstrate and explain the use of Tide Tables at Standard Ports and secondary ports.
- xiv. Introduce the Admiralty Sailing Directions and other publications.
- xv. Conduct exercises in above chart work techniques

5. BRIDGE EQUIPMENT Familiarisation AND WATCHKEEPING Procedures

Lectures 24 hours, Practicals 64 hours, Total 88 hours

- i. Introduce Lights & Shapes, Distress Signals. Full understanding of the Colregs and R.O.R
- ii. Explain Steering & Sailing Rules to give a good working knowledge.
- iii. Elaborate on the various methods to call the Master to the bridge when in doubt during bridge watch.
- iv. Demonstrate the use of a Sextant for observing vertical & horizontal angles.
- v. Explain the correctable errors of a sextant and demonstrate their method of correction and allowance.
- vi. Demonstrate the use & care of marine chronometers (Winding & Battery types).The importance of maintaining chronometer error log Practical exercises on accumulated rates.
- vii. Demonstrate the arrangement and reading of a Wet Card Magnetic Compass.
- viii. Demonstrate use of the Gyrocompass, Repeaters, and Course Recorder.
- ix. Navigational aids equipment to be demonstrated during ship visits AIS, ECDIS, GPS, etc.

- x. Stress the importance of measuring depths below the ship; Simple explanation of the Echo Sounder and Depth Recorder.
- xi. Explain the working principle of Marine Radar.
- xii. Explain the watch keeping duties at anchor and at sea.
- xiii. Explain the duties associated with preparing a vessel to proceed to sea.
- xiv. Explain the procedure of testing controls.
- xv. Explain the procedure of taking over watch at sea.
- xvi. Explain the importance of recording all relevant information in Logbooks.
- xvii. Explain the duties prior to arrival port.
- xviii. Describe the procedure of embarking and disembarking a pilot.
- xix. Demonstrate the use of the Signalling Lamp. Conduct exercises on visual signalling using Morse code.
- xx. Demonstrate and conduct exercises on the recognition and single letter meanings of International Code Flags.
- xxi. Introduce & conduct exercises on the use of International Code of Signals.
- xxii. Explain the proper procedure to use a walkie-talkie and a VHF set. The importance of minimal use of air time.
- xxiii. Briefly introduce the concept of GMDSS.

SPECIAL FUNCTIONS

6. Types of Dredgers, Dredging Equipment Operational Characteristics, main systems and components -

Lectures 36 hours; Practicals 64 hours; Total 100 hours

- A. Explain General introduction to dredging
 - i. Definition & History
 - ii. Types of dredgers, applications and selection
 - *Soil Characteristics and their effect on dredging
 - iii. *Soil Properties, soil investigation
 - iv. *Influence on dredging processes
- B. Trailing Suction Hopper Dredgers (TSHD)
 - i. Operational characteristics, dredging processes and Important dredging parameters.
 - ii. Main systems and components
 - Plain Suction Dredgers, Cutter Suction Dredgers and Bucket Wheel Dredgers
 - iii. Operational characteristics, dredging processes
 - iv. Main systems and components
- C. Explain the operational control panel and various instruments and automation on Bridge for Dredging operation and emergency procedures.
- D. Describe the procedure of TSHD dredging and dumping of soil through valve system.
- E. Describe briefly the procedure of dredge pump operation and safety systems in pump room.
- F. Explain the components of dredging tube, use of depth indicator, suction tube piston indicator, hopper door panel, valve system for dumping soil.
- G. Specific stability problems - managing
- H. Loading and discharging - best principles
 - I. Managing operation to maintain personal safety
 - J. Specific stability problems - awareness of
- K. Free-surface effects - awareness of
 - L. Bottom hazards, including power cables, gas pipes, objects retrieved - proper procedures to follow.
- M. Air draft considerations including power cables.
- N. Navigational hazard - awareness of causing/being one; - displaying appropriate warning signs.
- O. Liaison with navigation authorities and other users. Personal safety - awareness of risks to.
- P. Awareness of requirements and procedures for disposal of spoil.

Q. Centrifugal DREDGE Pumps and Slurry Transportation Pipeline Behavior, Relation between Pump and Pipeline

7. Tug Equipment, operational and control of tug and tow, best practices - lectures -24 hrs, practicals -48hrs , Total 72 hrs

- i. Tug equipment - prepare for towing - Keep in general terms
- ii. Tow - control, connection, adjustment and disconnection of Manoeuvre and manage tug under normal conditions - Includes thrusters techniques and limitations.
- iii. Turning tugs and tows short round; turning circles for tugs
- iv. Manoeuvring tugs and tows in confined waters - use of propeller and rudder to manoeuvre tows
- v. Emergency tug manoeuvres with and without tows [(including cutting tow-line)]
- vi. Understand tow procedures and best practice in towing operations
- vii. Communications during towing operations
- viii. Towrope configurations; securing tow rope, wires and connections; best tow lengths for different circumstances
- ix. Safe and efficient towing operations - appropriate equipment
- x. Tug towing equipment - knowledge of and maintenance
- xi. Tug tankage, machinery spaces, propulsion systems and steering arrangements, types of propulsion system commonly installed in tugs - general understanding
- xii. Deckwork with lines and lines under stress - knowledge of Towing hooks, towing winches and spooling devices - understand construction, operating parameters and maintenance.
- xiii. Effects of current, wind and tide on tows
- xiv. Types of tows - knowledge of (eg lighters)
- xv. Barges towing or pushing other barges - awareness of principles and distinction from tug operations

CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR PERSONS ON BOARD FUNCTION

8. NAVAL ARCHITECTURE

8.1. SHIP CONSTRUCTION

Lectures 12 hrs; Practical: 4 hrs; Total 16 hours.

- i. Explain in general terms the basic types of ships, i.e. General Cargo, Dredger, Tug, self propelled barges.
- ii. Explain the principal dimensions of a ship - LOA, LBP, , GT, NT. Name and explain the principal parts of ship including Peak Tanks, Double Bottom Tanks, Deep Tanks, Hopper tank, Ballast Tanks, etc.
- iii. Introduce the following ship plans: General Arrangement, Fire-fighting Appliances, Life Saving Appliances, Pumping & Piping Arrangements.
- iv. Explain the following parts: Beam, Frame, Bulkhead, Hatch, Hoppers, Tank, Coaming, Hatch- Cover, Rudder, Deck, Hull, Bilge, Sounding Pipe, Air Pipe and Ventilator. Show where these are to be found on a ship.
- v. Explain Draft Marks & Load Lines. Explain the method of reading draft marks in feet and in metres.
- vi. Conduct practical exercises on reading draft by use of a suitable model.
- vii. Explain the causes and simple methods of prevention of corrosion in a ship's structure. Brief notes on paint technology & anti-corrosion techniques.
- viii. Explain the term Dry Dock, the reasons for dry docking a vessel and give a general idea of the activities in a dry dock.

8.2. SHIP STABILITY

Lectures 12 hrs; Practical: 4 hrs; Total 16 hours.

- i. Explain the principle of flotation and the meaning of terms: Displacement, Deadweight, Form Coefficients, Reserve Buoyancy, Light Ship, Draft, Air Draft and Freeboard and trim
- ii. Explain TPC. Explain Free Surface Effect
- iii. Explain the effect of density on the draft of a vessel and meaning of the terms Fresh Water Allowance and Dock Water Allowance.
- iv. Define COG and KG of a ship. Explain the factors that affect KG.
- v. Elements of ship's transverse and longitudinal stability and effects of free surface effect
- vi. Define COB. Explain the factors that affect KB.
- vii. Conduct practical exercises in calculations based on the above topics after each has been explained.
- viii. Water tight integrity - ensuring and maintaining, including location, maintenance and testing of deck openings, water tight doors, hatches, hoppers, side scuttles and scuppers.
- ix. Bilge pumping arrangements including maintenance.
- x. Collision, grounding, weather or accidental damage, hull breaches and leaks or flooding - measures to be taken including shoring.

9. PRACTICAL SEAMANSHIP including Dredger and Tug Operations -

lectures 32 hrs, practicals 288 , Total 320 hrs

- i. Demonstrate and conduct practice on the use of various types of cordage, fibre and wire ropes used on ships. Various types of whippings.
- ii. Demonstrate & conduct practice on various types of Knots, Bends & Hitches.
- iii. Demonstrate & conduct practice on types of splices on fibre and wire ropes.
- iv. Demonstrate the use of bulldog grips and bottlescrews/turnbuckles in joining wires.
- v. Explain the care & maintenance of fibre and wire ropes including uncoiling, coiling, stowing, etc.
- vi. Conduct practical exercises on the use of blocks, snatch blocks and the differential pulley (chain blocks).
- vii. Conduct practical exercises on the maintenance of various types of blocks, tackles, shackles & bottlescrews/turnbuckles, including opening, greasing, etc.
- viii. 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.
- ix. Explain Anchor Work. Explain the parts of a windlass.
- x. Explain the following terms in connection with anchor work: Cable, Link, Joining Shackle, Shackle as a term of length, Bitter End.
- xi. Demonstrate the ability to use a sledgehammer.
- xii. Conduct practical exercises on opening a lug and a lugless anchor shackle.
- xiii. Explain the uses of an anchor, how it is walked back, let go, heaved, housed and secured.
- xiv. Demonstrate the ability to climb a ship's mast
- xv. Demonstrate ability in rope climbing.
- xvi. Boat-work - conduct exercises in rowing and manoeuvring a boat under oars..
- xvii. Explain the parts of a sail and sailing terms.
- xviii. Conduct practical exercises on chipping & painting. Demonstrate all tools and gear available for the maintenance steel parts of a ship..
- xix. Explain the various cargo gear used. Explain SWL and Breaking Stress. Conduct simple exercises on cargo gear rigging.
- xx. Conduct practical exercises on rigging and climbing pilot ladders and Jacob's ladders. Maintenance of the same.
- xxi. Demonstrate the use of the bosun's chair.
- xxii. Demonstrate the use of overside staging for shipside maintenance.
- xxiii. Demonstrate the use of the safety belt and safety harness during the earlier two operations.
- xxiv. Demonstrate the methods of dealing with an oil spill on deck.
- xxv. Demonstrate the plugging of scuppers during bunkering, loading and discharging of oil cargo.
- xxvi. Demonstrate the use and construction of a cement box to stop leaks.
- xxvii. Carry out instructional Visits to ships for basic familiarisation.
- xxviii. Demonstrate proficiency in Canvas work
- xxix. Demonstrate the use of hydrants, hoses and nozzles etc.

MARINE ENGINEERING

10. General Engineering science and properties of materials: 120 hrs

i. Kinematics

Definition of Velocity, Acceleration; falling bodies; vectors and their applications to velocities; relative velocity; composition and resolution of acceleration; angular displacement velocity and acceleration.

ii. The Laws of Motion

Newton's First law : inertia : weight ; momentum; second law impulse; third law ; motion of connected bodies.

iii. Work Power and Energy

work units; power ; moment of a force; work of a torque; energy potential kinetic principal of work.

iv. Motion in a Circle

simple Harmonic Motion- Uniform circular motion: centripetal and centrifugal forces,

v. Static-Friction

Friction angle of friction; sliding friction action of brakes, adhesion; friction of screw.

vi. Static of Rigid Bodies

Parallel forces; moments; moment of resultants ; principle of moments; couples reduction of a coplanar system; conditions of equilibrium; of three forces.

vii. Centre of gravity

Centre of parallel forces; center of mass center of gravity of two bodies; straight rod; triangular plate; rectilinear figures; lamina with part removed. Properties of center of gravity; center of gravity of distributed load, body resting on a plane; stable, unstable and neutral equilibrium; work done in lifting a body.

viii. Simple Machines

Velocity ratio; mechanical advantage; efficiency; Wheel and axle; differential pulley blocks; worm and work wheel; screw jack; Hydraulic Jack Torque wrench.

ix. Stress and Strain

Ultimate tensile strength; working stress; factor of safety; strain; Modulus of elasticity; safe working load of lifting devices.

x. Pressure Vessels

Circumferential and longitudinal stresses in thin cylinders; working pressure.

xi. Bending of Beams

Conditions of equilibrium; Simply supported beams and cantilevers; Concentrated and distributed loading; Shearing force and bending moment diagrams.

xii. Torsion

Fundamental knowledge of torsion equation; Relationships between torque, stress and power, , Maximum and min. torque; Coupling bolts; Hydraulic steering gear.

xiii. Hydraulics

Density; specific gravity; Principle of Archimedes; Apparent loss of weight; floating bodies flotation and buoyancy; conditions of equilibrium of floating bodies;

xiv. Partial immersion

stability of floating bodies; Metacentre and Metacentric height; Pressure head; pressures on immersed surface; center of pressure; centrifugal pump.

xv. Applied Heat

Measurement of temperature and pressure; absolute temperature absolute, gauge & partial pressures, Heat, work, power, energy conservation of energy; Fuels, calorific values basic knowledge.

Thermal expansion , expansion & contraction of solids and liquids: Expansion and compression of perfect gasses; Boyle's Law: Charles' Law: relationship between pressure, volume and temperature - basic knowledge

xvi. Thermal processes

isothermal adiabatic. Polytropic processes

xvii. Energy, Transfer

Work transfer heat energy supplied and work done;

xviii. Ideal Cycles

Constant volume, diesel, dual combustion; Clearance and stroke volumes.

xix. Elementary principles of IC Engines

Cycle of operation of 2 and 4 stroke engines; Mean effective pressure; indicated & brake power - basic knowledge ;

xx. Reciprocating Air Compressors

Basic theory, safe operations, safety device, basic maintenance.

xxi. Refrigeration and air conditioners

basic knowledge of operations and maintenance.

ELECTRO-TECHNOLOGY

xxii. Electrical units of current

quantity voltage resistance; Electromotive force and terminal p.d. of voltage.

xxiii. Ohm's law

Kirchhoff's laws : wheat Stone Bridge : Resistance of a conductor : variation with dimensions material and temperature. Temperature coefficient of resistance: Series and parallel circuits: Relations between mechanical, heat energy and electrical energy; Thermocouple; Bimetal strips: Ammeters and voltmeters.

xxiv. Electrolysis Electrolytic cells

Quantitative laws of electrolysis, Electro-chemical equivalent.

xxv. Primary and secondary cells

Internal resistance, cell e.m.f., Polarisation The Leclanche cell (wet and dry types); The secondary cell, construction, capacity and efficiency; Charging procedure; Grouping of cells.

xxvi. Natural and artificial magnets

The magnetic field; flux and flux-density; Current-carrying, conductor, loop and solenoid; iron core; Force on a current-carrying conductor in a magnetic field; Flux-linkages; State induction, e.m.f. of self and mutual induction. The Weber; Direction of induced e.m.f.; Fleming's right-hand rule.

xxvii. The simple mangneto-dynamo

The simple d.c. generator; commutation and practical requirements, winding.

xxviii. D.C. Generator field

armature, armature winding arrangements, e.m.f., equation; Shunt, series and compound connected generators.

xxix. The D.C. Motor

Back e.m.f. of a motor; Voltage; current and speed equations; Speed controlling factors; Types of d.c. motor, shunt, series and compound; Motor starter Speed control, field and voltage control.

xxx. Basic A.C. Theory

The a.c. waveform; Representation of sinusoidal alternating quantities; Root mean square and average values, Form Factor; The A.C. Circuit-Impedance, inductance inductive reactance; Capacitance, Capacitive reactance, Simple; series; parallel Circuits with resistance; inductance and capacitance. Three phase system: A.C. Induction motor and speed control - basic principles; AC. Generator - basic knowledge; Power factor; knowledge of KW, KVA and KVA_r.

xxxi. Electronics- Semi-conductor theory

The fluorescent lamp; Transistors Basic theory; Transistors as amplifiers N-type, P-type. The P-N junction; Diode and Rectifier operation; static and dynamic operation.

xxxii. Common electric circuit faults/ fault tree.

xxxiii. Pneumatics

Fundamentals principles of pneumatics; fluid flow, types of control valves and pneumatic control devices used on ships and their care, maintenance and fault tracing

11. Familiarity with basic workshop tools and their use - Lectures 8 hrs,

Practicals 44 hrs Total 52 hrs

- i. Carpentry: 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, wood planer, etc. Repairs to fibreglass surfaces such as boats, etc. Uses of various adhesives in joining of materials.
- ii. Plumbing: 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 of

leaks, use of various sealants for stopping small leaks in pipelines, pipe clamps, cutting of threads in pipelines, clearing of choked water pipelines.

- iii. Use of proper hand tools for shipboard maintenance and repair: 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, portable drilling machine; use of coolants such as water, oil and safety aspects etc., during grinding and drilling. Use of measuring devices - feeler gauges, callipers, screw gauges, vernier gauge etc. Overhauling of sluice valves, globe valves, SDNR valves and butterfly valves. The importance of lubricating oil and grease in reducing friction in machines.
- iv. Electrical shop: 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 indents for purchase. Theory & practical of soldering. Cargo clusters, safe use of hand held lamps. Use of electrical and electronic measuring devices for locating and repairing faults and malfunctions: Megger, testing for insulation test; charging of batteries and associated safety aspects. Knowledge of different types of electric motors and circuit breakers used on vessels.
- v. Hotwork: Basic theory and practical experience of gas cutting, gas welding, soldering and electric arc welding. Gas heating to free rusted nuts and bolts. The proper precautions to be taken during each of these processes.

12. Basic workshop practice, fitting shop, machine shop and welding -

Lectures - 24 hrs, Workshop Practicals - 160 hrs Total - 184 hrs

- 1. Marine Fitting Shop: Learn the use of hand tools, bench vice and measuring tools and fabricate out of mild steel plates, "T" piece, "L" fitting, hexagon on a " bolt. Exercise in fabricating cross fitting, shaft key, tongue and groove fitting and square fitting. Exercises in cutting flange joints for fitting pipes and valves and learn to fit gland packings on valve spindles and small pump shafts etc.
- 2. Welding and gas cutting: Learn gas cutting safety and preparations for gas cutting operations and adjusting the oxy-acetylene flame. Learn the use of filler material.

Learn the use of equipment used for electric arc welding, simple operations and the associated safety measures. Learn to carry out butt weld, "T" joint and 'bead' welding and identify defects in welding. Exercise in joining two 3" M.S. pipes by welding.

- 3. Introduction to operation and use of a lathe machine and drill machine. Learn the types of lathe tools used and care required. Learn various operations like turning, threading, parting and facing etc. Speed selection for chuck as per metal, depth of cut and type of operation. Arranging gears for thread operation. Learn the importance of cleanliness, good house-keeping and use of PPE. Exercise in machining a " bolt out of m.s. round bar, a taper plug from 40 mm M.S. round bar. Etc.

13. Repair and maintenance of marine machinery - lectures 32 hours,

Practicals 320 hrs Total- 352 hrs

- i. Ability to transmit information relating to machinery components by means of simple drawings with supplementary notes and specification :
- ii. Basic knowledge of materials of machinery and equipment of coastal vessels, dredgers, tugs, and offshore support vessels
- iii. Knowledge of fault tracing and methods of repair of various machinery items
- iv. The construction use and principle involved in working of pressure gauges; thermometers; pyrometers and other measuring instruments commonly used on board vessels.
- v. Construction, operation and maintenance of different types of pumps and general requirements of different pumping systems; damage control to prevent engine room flooding. Oily water separators -

- operation, maintenance and repairs. Construction and behavior of Centrifugal Dredge pumps - operation, maintenance and wear aspects
- vi. Operation and maintenance of steering gears; deck machinery (including Towing Winch) and hydraulic and pneumatic devices and automatic control equipment - on Dredgers and Tugs.
- vii. Work relating to dry docking including different types of propellers operation and maintenance; tail shaft, rudder and sea connections.
- viii. Knowledge of construction, operation and maintenance of fire fighting appliances and equipment.
- ix. Methods of and aids for fire prevention, detection and extinction; their construction; operation and maintenance.
- x. Location of fuel oil, ballast water tanks and their venting arrangements; stern tube ,stern gland maintenance - basic knowledge. etc.
- xi. Principles of working of two and four stroke Internal combustion engines (supercharged and naturally aspirated).
- xii. Construction and operational details of Internal combustion engines normally fitted on coastal vessels, Dredgers, Tugs and Offshore Support vessels.
- xiii. Running and routine maintenance of marine diesel engines with particular reference to safety devices, means of cooling pistons and cylinder heads starting and reversing arrangements.
- xiv. Detection of faulty operation of engines; location of the fault and remedial measures to be taken.
- xv. Dismantling, overhauling and repairs to Internal combustion engines all components and testing thereafter including fuel injection system and components.
- xvi. Principles of working; construction; operation testing and maintenance of marine gearboxes; clutches, heat exchangers, filters, pumps and other ancillary equipment used on board coastal vessels, Dredgers, Tugs and Offshore Support vessels.
- xvii. Construction; running and maintenance of single and multi stage air compressors (both air and water cooled); precautions before starting safety devices provided on them.
- xxviii. Properties of fuel and lubricating oils used in Internal combustion engines, flash point - basic knowledge
- xix. Fuel system lubricating oil system and hydraulic systems operations and maintenance
- xx. Precaution against explosion due to oil; vapour, gas; Dangers due to oil leakage; Precaution while bunkering.
- xxi. Explosions in crankcases and air starting systems, precautions to prevent them and safety devices provided.
- xxii. Elementary calculation regarding consumption of fuel, lub, oil and fresh water, maintenance of simple engine room log book and safe watchkeeping.
- xxiii. Operation and maintenance of domestic refrigerating plants and vessel's air conditioning system//air conditioner units
- xxiv. Detection of faulty operation of A.C and Refer plants and its rectification; methods of charging and purging of refrigerating and air conditioning system
- xxv. Safety devices fitted on the refrigerating and air conditioning systems - their operation and maintenance.
- xxvi. Engine monitoring - good practices while underway; starting all services; pre-checks for starting propulsion unit and starting same.

14. Pollution prevention, health and safety

lectures - 24 hrs, practicals 16 hrs Total - 40 hrs

Pollution Prevention and Waste Management

i. Bunkering

Measures to be taken to prevent pollution

ii. Pollution incidents on board

Anti-pollution measures in case of Pollution incidents - Appropriate action in response, including reporting procedures

iii. Principals of Pollution prevention

oil and garbage including bilge pumping - Restrictions within specified areas and procedures in ports.

iv. Pollution

basic knowledge of MARPOL Regulations and Annexes; Practical knowledge of duties, responsibilities and liabilities under DGS Regulations ; precautions to be taken for prevention of marine environment pollution.

v. Waste disposal

knowledge of facilities for waste, garbage and sewage disposal - regulations and codes.

Health and Safety

- vi. Safe access for crew; Safe access to enclosed spaces Precautions Permit to work documentation - use and issue of Healthy and safe working environment - Maintenance as regulated by DGS
- vii. Re-fuelling or decanting highly flammable substances - procedures
- viii. Life-line and safety harness - don and use
- ix. Safety maintenance checklist
 - x. Code of Safe Working Practice - Knowledge and application
- xi. Health & Safety responsibilities of employer, worker, Master and crew - principles of risk and risk assessment
- xii. Permit to work procedures - theory
- xiii. Stowing work equipment - inflammable or hazardous substances - Knowledge of associated hazards
- xiv. Dangers associated with enclosed spaces including oxygen depletion, noxious gases and explosive mixtures
- xv. Petrol - maximum permitted amount to carry
- xvi. Awareness of COSHH (Control of Substances Hazardous to Health) requirements Safety procedures for gas, domestic appliances and the carriage of petrol
- xvii. Machinery spaces on board - Principal hazards and areas of risk
- xviii. Hot work and gas free procedures and requirements.
- xix. Access to restricted spaces
 - xx. Use and maintenance of Personal Protective Equipment (PPE)
- xxi. Health and hygiene - knowledge of
- xxii. Accident recording and near miss reporting - understanding of ISM Code and ISPS Code for implementation on ships.

15. Four STCW Safety Courses (18 Days) Total - 144hrs

1. PERSONAL SURVIVAL TECHNIQUES COURSE

(44.00 Hrs)

This course is given as per Course Specifications given in Personal Survival Techniques Course.

2. FIRE PREVENTION & FIRE FIGHTING COURSE

(36.00 Hrs)

This course is given as per Course Specification given in Fire Prevention & Fire Fighting Course.

3. PROFICIENCY IN ELEMENTARY FIRST AID COURSE

(24.00 Hrs)

This course is given as per Course Specification given in Proficiency in Elementary First Aid Course

4. Personal safety & Social Responsibilities COURSE

(40.00 Hrs)

This course is given as per Course Specification given in Personal safety & Social Responsibilities Course.