

Syllabus for Marine Officer

Note: The following syllabus is indicative and the questions in the test may include similar other topics pertaining to the level and content of essential qualification.

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, and 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 Chart work 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 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, 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. 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, by using ABC tables.

1.3 Electronic Systems of Position Fixing

- 1.3.1 Terrestrial Navigation systems: principle, block diagram, working, and errors of new terrestrialelectronic 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 papercharts. 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
 - Ship to ship data exchange
 - 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
- Authorized 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, float-free
 - Playback options
- S-VDR (Simplified VDR)
- 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.
- 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, tilt & drift, damping, 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.
- 1.3.13 Knowledge of steering control systems, operational procedures, and change over from manual to autoand vice-versa, procedure for testing of steering system. Use of Rate of Turn Indicator (ROTI).

1.4 Meteorology

- 1.4.1 Ship borne meteorological instruments: Aneroid Barometer and barograph, Hygrometer and Stevenson's Screen, Whirling Psychrometer, Wind Sensors (anemometer), sea water temperature bucket.
- 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, Isalobar, 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 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: Interpretation of Symbols and Isobaric Patterns on Weather Charts and Facsimile Charts. Identify the weather associated with the synoptic features.

Competence No.2: Maintain a safe navigational watch

- 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
 - 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 routing in accordance with the General Provisions of Ship's Routing
- 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 Equipment and Techniques used for safe navigation in restricted visibility (blind navigation /blind pilotage techniques).
- 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

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, superrefraction & 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 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 maneuver 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 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 quarters 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:
 - a thorough understanding of Electronic Navigational Chart (ENC) data, data accuracy, presentation rules, display options and other chart data formats
 - the dangers of over reliance
 - 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:
 - use of functions that are integrated with other navigation systems in various installations, including proper functioning and adjustment to desired settings
 - 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)
 - confirmation of vessel position by alternate means
 - 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
 - adjustment of settings and values to suit the present conditions
 - 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.

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 salvaging 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: Use of oil in rough weather, 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.

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)

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.

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 ropetypes 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

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, stress

limitations 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, 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, and 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.

- 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. Stress calculation on simple beams of equal leg lengths and single derricks. 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: loading and unloading operations, corrosion, 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”.

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

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, ballastwater 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 andpounding.
- 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, deadweight, 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.
- 13.2.5 Initial stability: Stability up to 10⁰ 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 oflist.
- 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, crossflooding 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 (AEE Course)

Knowledge of fire prevention; Ability to organize 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

Competence No. 15: Operate Life-saving appliances (PSCRB Course)

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.

Competence No.16 Apply medical first aid on board the ship (Medical First Aid Course)

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.

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-95 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.

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: planning and coordination, personnel assignment, time and resource constraints and prioritization
- 18.4 Knowledge and ability to apply effective resource management: allocation, assignment, and prioritization of resources; effective communication onboard and ashore; decisions reflect consideration of team experiences; assertiveness and leadership including motivation; obtaining and maintaining situational awareness.
- 18.5 Knowledge and ability to apply decision-making techniques: situation and risk assessment; identify and consider generated options; selecting course of action; evaluation of outcome effectiveness

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