



Detailed syllabus (Phase – III)

TOTAL 36.0 Hrs

- 1. PLAN AND CONDUCT A PASSAGE AND DETERMINE POSITION**
(STCW 2010, A-II/1) (TOTAL - 34.0 hrs)
- 1.1 Ability to determine the ship's position by use of: (6.0 hrs)**
- 1.1.1 Landmarks
 - 1.1.2 aids to navigation, including lighthouses, beacons and buoys
 - 1.1.3 dead reckoning, taking into account winds, tides, currents and estimated speed
- a) Position Lines and Positions**
- i. defines a position
 - ii. defines a position line
 - iii. identifies charted objects suitable for position fixing
 - iv. plots the position of the vessel on a chart using latitude and longitude
 - v. describes the most appropriate position fixing methods to be utilised in various Navigational circumstances including the use of radar
 - vi. discusses the factors that determine the appropriate interval between fixes
 - vii. gives the radar distance off a charted object and plots its position circle on a chart



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- viii. plots a position on the chart from simultaneous cross bearings and from bearing and distance off
- ix. explains the methods used to obtain simultaneous cross bearings with least error
- x. defines 'dead reckoning position (DR)', 'estimated position (EP)' and 'fixed position'
- xi. defines a transit bearing line
- xii. plots a dead reckoning position on the chart and marks accordingly
- xiii. plots an estimated position on the chart and marks accordingly
- xiv. plots position lines - straight line, circle
- xv. finds a position line by horizontal angle (when angle is below 90^0 , equals to 90^0 and more than 90^0), vertical sextant angle, and transit bearing line
- xvi. determines a position by a combination of bearing, distance and the methods in the above objective
- xvii. finds a position by simultaneous bearings of two objects
- xviii. explains how a single position line may be used when entering to a harbour (as leading lights)

b) Chartwork Exercises

(8.0 hrs)

- i. defines 'course' and 'distance'
- ii. lays off true course between two positions and marked with appropriate symbols
- iii. finds the distance between two positions
- iv. calculates the speed between two positions
- v. defines 'set', 'rate', 'drift' and 'leeway' due to current and wind



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- vi. describes 'ship's speed', 'effective speed', 'course made good', distance made good' and 'applied leeway'
- vii. finds the course and distance made good with a tidal stream or current
- viii. finds the course to steer, allowing for tidal stream or current
- ix. explains how a position line is transferred
- x. explains the term 'running fix' and uses the method to plot a position
- xi. Transfer of position circles
 - explains the method of transferring of a position circle
 - uses this method to plot a position
- xii. vertical sextant angles
 - finds the position line by vertical sextant angle

1.2 Thorough knowledge of and ability to use nautical charts, and publications, such as sailing directions, tide tables, notices to mariners, radio navigational warnings and ships' routeing information

1.2.1 Information from Charts and Lists of Lights (3.0 hrs)

- a) recognises and demonstrates the use of the symbols and abbreviations on a chart, especially lighthouses, buoys, beacons, radio beacons and other navigational marks
- b) identifies the characteristics, colours sound signals and range of lights



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- c) identifies the symbols for chart depths and nature of the bottom and explains the use of soundings
- d) describes the contents and the use of Routeing charts
- e) describes the use and the contents of BA 5011
- f) describes the use and the contents of Gnomonic charts
- g) recognises coastlines, coast and radar-responsive targets
- h) recognises traffic lanes and separation zones
- i) demonstrates the use of a chart catalogue
- j) demonstrates the correcting of charts according to Notices to Mariners

1.2.2 Other navigational publications

(2.0hrs)

- a) describes the use of Ocean Passage for the World
- b) describes the use and the contents of Mariners Hand Book
- c) describes the use and the contents of Admiralty list of radio signals
- d) describes the use and the contents of distance tables



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- e) describes the procedures for and making necessary corrections to update the publications

1.2.3 Passage Planning

(6.0hrs)

- a) explains appraisal, planning, execution and monitoring of a passage plan
- b) obtains and appraises information from navigational publications including sailing directions, notices to mariners, radio navigational warnings and ship's routing information
- c) describes the selection of the appropriate route for a given passage
- d) explains the factors to be taken into account when determining an appropriate route for a given passage
- e) describes the procedure for monitoring and executing a passage plan
- f) explains the procedure for monitoring the progress of the vessel on a pre-planned track
- g) explains the precautions to be taken when making a landfall
- h) explains the danger of approaching navigational aids too closely
- i) explains the danger of placing implicit reliance upon floating navigational aids



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- j) explains the requirements when navigating in or near traffic separation scheme
- k) explains the precautions to be taken when navigating in or near the vicinity of offshore installations, safety zones and safety fairways
- l) knowledge of the types of service available to aid vessels, entering ports, berthing, VTIS and VTS services, as indicated in The Admiralty List of Radio Signals - Vessel Traffic Services, Port Operations and Pilot Stations

1.2.4 Tides

(6.0 hrs)

- a) explains the basic theory of tides
- b) defines 'spring tides', 'neap tides', 'height of tide' 'high water' and 'low water', 'mean high water springs', 'mean high water neaps', 'mean low water springs', 'mean low water neaps', 'range', 'chart datum' , drying height & height of charted objects
- c) calculates the spring and neap ranges for standard
- d) finds the predicted time and height of high and low water at standard
- e) finds the tidal information at standard ports - Worldwide
 - i. calculates the height of tide at a given time using tide tables and tidal curves
 - ii. calculates the time the tide will reach a given height using tide tables and tidal curves



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1.3 Ability to determine errors of the magnetic and gyro-compasses, using terrestrial means, and to allow for such errors

1.3.1 Compass Corrections

(1.5 hrs)

- a) defines true, magnetic and compass north
- b) finds deviation and variation from tables and charts
- c) calculates true course from compass course
- d) calculates compass course from true course
- e) applies compass error to the ship's head and compass bearings to convert to true
- f) takes a compass bearing of a charted object and lays the true bearing off on the chart

1.3.2 Gyro compass corrections

(0.5 hrs)

- a) defines gyro error
- b) applies gyro compass errors to convert True to gyro Compass and vice versa for ship's head and bearings



2. MAINTAIN A SAFE NAVIGATIONAL WATCH

2.1 The use of information from navigational equipment for maintaining a safe navigational watch (1.5 hrs)

- a) Use of radar information
- b) Use of echo sounder information
- c) Use of GPS information

2.2 Keeping a Log (1.5hrs)

- a) describes the rules, regulations and common practice regarding keeping of a navigational log and voyage records
- b) describes the proper keeping of different kinds of logs during ocean passages, coastal navigation and in port in line with the requirement in the compan's ISM Safety Management System

TOTAL 36.0 Hrs

1. PLAN AND CONDUCT A PASSAGE AND DETERMINE POSITION. ABILITY TO USE AND INTERPRET INFORMATION OBTAINED FROM SHIP BORNE METEOROLOGICAL EQUIPMENT

1.1 The use of ship borne meteorological equipment (3.0hrs)



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- a) describes the basic principle of an aneroid barometer
- b) reads the atmospheric pressure from an ordinary aneroid barometer and precision aneroid barometer if available
- c) describes the function of a hygrometer
- d) demonstrates ordinary readings of wind speed

**2. KNOWLEDGE OF THE CHARACTERISTIC OF THE VARIOUS WEATHER SYSTEMS,
REPORTING PROCEDURES AND RECORDING SYSTEMS (33.0 hrs)**

2.1 condition and stability of the air (3.0hrs)

- a) Explains the conditions required to form a cloud
- b) Explains what is meant by stability of the air
- c) Describes the stable, unstable and conditional stability of the air
- d) Explains how to determine the stability of the air
- e) Describes how the clouds formed according to the different stability condition
- f) Explains the development of cloud types according to stableness of air

2.2 Cloud and Precipitation (3.0hrs)



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- a) states that clouds form when air containing water vapour rises, cools adiabatically and becomes saturated
- b) describes the need for and defines condensation nuclei
- c) states that a cloud can consist of ice crystals, supercooled water droplets, water droplets or any combination of these
- d) lists and describes the ten basic cloud types
- e) describes the probable base heights of the ten principal cloud types

2.3 Ocean currents

(3.0hrs)

- a) explains the main types of ocean currents
- b) explains the formation of each type of current
- c) describes how each type has been named according to its characteristics
- d) describes the location of such current on a world map
- e) explains the formation of tidal currents
- f) explains the available information sources on ocean currents



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2.4. The Wind and Pressure Systems over the Oceans

(3.0hrs)

- a) explains qualitatively, with the aid of sketches, the circulation cells which would exist on a rotating earth, not inclined to its orbit of rotation around the sun, and with a homogeneous surface
- b) draws the mean surface pressure and wind distribution over the earth's surface in January and July
- c) describes a monsoon regime
- d) lists the areas which experience a true monsoon regime
- e) applies previous concepts to a qualitative explanation of the causes of monsoon regimes
- f) applies previous concepts to a qualitative explanation of the weather associated with the January and July monsoons of the Indian Ocean, China Sea, north coast of Australia and west coast of Africa
- g) applies the concept of horizontal temperature differences to a qualitative explanation of the formation of land and sea breezes
- h) explains the formation of anabatic and katabatic winds
- i) lists the regions of occurrence of anabatic and katabatic winds
- j) describes methods of estimating the visibility at sea, by day and by night, and the difficulties involved



2.5 Structure of Depressions

(6.0hrs)

2.5.1 air masses

- a) defines 'air mass'
- b) explains the formation of an air mass
- c) defines 'source region'

2.5.2 fronts

- a) defines 'warm front', 'cold front'
- b) knows the symbols for warm and cold fronts and identifies them on a weather map
- c) describes, with the aid of a diagram, the weather experienced during the passage of an idealized warm front
- d) describes, with the aid of a diagram, the weather experienced during the passage of an idealized cold front
- e) defines 'depression'
- f) identifies a depression on a surface synoptic or prognostic chart
- g) describes the stages in the life cycle of a polar front depression



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- h) draws a diagram of a polar front depression, for both northern and southern hemispheres, showing isobars, warm and cold fronts, wind circulation and warm sector
- i) draws a cross-section through a polar front depression, on the poleward and equatorial side of the centre, showing fronts, cloud and precipitation areas
- j) describes the usual movement of a polar front depression
- k) applies previous concepts to an explanation of the weather changes experienced when a frontal depression passes with its centre on the pole ward side of an observer in the northern hemisphere and in the southern hemisphere
- l) applies previous concepts to an explanation of the weather changes experienced when a frontal depression passes with its centre on the equatorial side of an observer in the northern hemisphere and in the southern hemisphere
- m) identifies a trough of low pressure on a surface synoptic or prognostic chart
- n) describes the weather associated with the passage of a trough

2.6 Tropical Cyclones

(6.0hrs)

- a) defines a tropical revolving storm
- b) describes the ideal conditions and formation of a TRS
- c) describes the structure of a TRS



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- d) describes the warning signs of a approaching TRS
- e) describes the single observer method of ascertaining the vessels position in relation to the centre of the storm and its path
- f) describes the evasive action to be taken for safe navigation in vicinity of a TRS

2.7 Anticyclones and Other Pressure Systems (3.0hrs)

- a) defines 'anticyclone'
- b) draws a synoptic pattern of an anticyclone, for both northern and southern hemispheres, showing isobars and wind circulation
- c) identifies an anticyclone on a surface synoptic or prognostic chart
- d) describes the weather associated with anticyclones
- e) describes a ridge of high pressure
- f) draws a synoptic pattern for a ridge, showing isobars and wind directions
- g) describes a typical weather sequence during the passage of a ridge between depressions across the observer's position
- h) describes a col



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2.8 Weather Services for Shipping

(3.0hrs)

- a) describes the organization, functions and objectives of the World Meteorological Organisation
- b) describes the sources of weather information available to shipping including internet and email
- c) describes the information flow between merchant ships and Meteorological Offices
- d) describes the services provided for shipping by Meteorological Offices
- e) describes the appropriate weather bulletin and the contents of each of its sections
- f) describes the types of information received by facsimile machine
- g) describes the services provided for storm warnings

2.9 Recording Weather Observations

(3.0hrs)

- a) explains the need for meteorological codes
- b) uses the Ship's Code and Decode Book to code a ship's full report
- c) uses the Ship's Code and Decode Book to decode a ship's full report



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- d) uses the Ship's Code and Decode Book to decode a reduced report from a shore station
- e) uses Beaufort letter abbreviations for present and past weather and total cloud amount
- f) interprets a ship or shore station plot

TOTAL 36.0 Hrs

1. MONITOR THE LOADING, STOWAGE, SECURING, CARE DURING THE VOYAGE AND THE UNLOADING OF CARGOES

1.1 Cargo handling Stowage and Securing

(1.0hrs)

- a) explains the need for solid stow and securing of all cargoes
- b) states that cargo liable to slide during rolling, such as steel rails, should be stowed fore and aft
- c) describes methods of blocking, lashing, shoring, chocking and tombing cargo
- d) describes methods of stowing and securing vehicles and trailers



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- e) states that unitized, containers, trailers, portable tanks and other cargo units should be secured in accordance with the ship's cargo securing arrangements manual

1.2 Knowledge of safe handling ,stowage and securing of cargoes including dangerous, hazardous and harmful cargoes and their effect on the safety of life and of the ship

1.2.1 Cargo Care - Inspection and Preparation of Holds (1.0hrs)

- a) outlines the reasons for a general inspection of holds
- b) lists items to be inspected
- c) describes how to clean holds after discharge of a general cargo
- d) describes the reasons for using dunnage
- e) describes the types and sizes of material used for dunnage
- f) describes the methods of dunnaging a hold for various cargoes and how to dispose of old dunnage
- g) states that dirty dunnage may taint or contaminate the next cargo
- h) describes the fitting or spar ceiling and explains its purpose



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- i) states that bilges or drain wells should be clean, dry and sweet-smelling disinfectants used
- j) explains how bilge suction should be checked for efficient working scuppers and sounding pipes
- k) describes how limbers and drain well covers should be treated to prevent suction being blocked by small debris, but ensuring free drainage to the suction
- l) states that the ballast lines to deep tanks should be blanked when preparing to load dry cargo

1.2.2 Segregation and Separation of Cargoes

(1.0hrs)

- a) explains the need for the segregation of different cargoes with reference to:
 - i. dangerous goods
 - ii. dry cargo
 - iii. wet cargo
 - iv. clean cargo
 - v. dirty cargo
 - vi. delicate cargo
 - vii. valuable cargo, e.g. bank notes, personal effects
- b) describes how the cargoes in the above objectives can be segregated
- c) explains that separation between parcels of cargo for different consignees or different ports of discharge is required



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- d) describes methods of separating adjacent parcels of cargo
- e) describes the use of port marking to separate parcels for discharge at different ports

1.2.3 Ventilation and Control (1.0hrs)

- a) lists the factors involved in the control of sweat by ventilation
- b) distinguishes between ship's sweat and cargo sweat and explains the conditions in which each is experienced
- c) describes the system of natural ventilation and how it should be controlled to minimise the formation of sweat
- d) describes forced ventilation and humidity control for cargo holds and states the properties measured and recorded at the control panel
- e) states that ventilation is also required for the removal of heat, gases and odours
- f) gives examples of cargoes requiring special ventilation

1.2.4 Refrigerated Cargo (1.0hrs)

- a) explains how holds and lockers are prepared for loading
- b) explains the need for the pre-cooling of spaces and dunnage to be used



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- c) describes the dunnaging requirements for refrigerated cargo
- d) gives examples of commodities carried chilled
- e) gives examples of frozen cargoes
- f) lists the inspections of the cargo which should be made before and during the loading
- g) describes the use of brine traps in compartment drains - before this stage
- h) explains the purpose of compartment temperature recordings

1.2.5 Dangerous, Hazardous and Harmful Cargoes (1.0hrs)

- a) explains the different types of containment covered by the term "packaged form"
- b) describes the classification of dangerous goods in the International Maritime Dangerous Goods (IMDG) Code
- c) explains the properties, characteristics and physical state of the different substances, materials and articles covered by the 9 classes of the IMDG Code
- d) identifies the marking, labelling and placarding of dangerous goods as required by the IMDG Code and DGs in limited quantities, e.g. schedule 18



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- e) states that the duty officer should have information on the quantities, types of package, proper shipping names (correct technical names), classification, stowage and segregation of the dangerous goods to be handled
- f) states that the duty officer should have information on the special measures to be taken when a certain dangerous cargo is handled
- g) states that the measures to be taken in the event of an incident or accident should be made known and that any necessary equipment and sufficient crew to operate it should be available
- h) explain where to look for damage and defects most commonly encountered due to:
 - i. loading and unloading operation
 - ii. corrosion
 - iii. severe weather conditions
- i) states that any incident or accident during the handling of dangerous goods should be reported immediately to the person in charge of the operation and all cargo operations to be ceased
- j) states the fire precautions which should be taken when carrying dangerous goods
- k) describes the precautions which should be taken while loading or discharging explosives

1.2.6 Cargo Handling Equipment

(1.0hrs)



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- a) describes the care and maintenance of:
 - i. standing rigging
 - ii. topping lifts, cargo runners, guys and preventers - cargo blocks and topping lift blocks
 - iii. derrick heel fittings
- b) describes the rigging of derricks for loading and discharging cargo:
 - i. using married falls (union purchase)
 - ii. by single swinging derrick
- c) explains how to set up guys and preventers for working with married falls
- d) states that gear should be set up in accordance with the ship's rigging plan and explains limitations and effect of angles between runners
- e) describes how to change the rig from single runners to gun tackles
- f) describes how to top and lower derricks safely
- g) describes means of securing derricks for sea
- h) describes the precautions to take when lifting bales with hooks in the bale bands and damage caused by hooks generally
- i) describes the precautions to be taken when fork-lift trucks or similar devices are used in the 'tween-decks or holds

1.2.7 Cargo Handling Safety

(1.0hrs)



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- a) states that all cargo gear should be visually inspected before the start of cargo operations each day and awareness of test certifications and registration
- b) describes the importance of having a Safe Working Load (SWL) for the cargo gear
- c) explains why the load on cargo gear should never exceed its safe working load
- d) states that all ropes and wires should come with the certificate of their properties
- e) states that ropes, wires, blocks and loose gear should be subject to frequent inspections while in use for cargo operations
- f) explains how to determine when a cargo runner needs replacing
- g) states that mechanically or hydraulically operated hatches should be opened or closed by the ship's crew under the supervision of a responsible person
- h) states that hatch covers should be secured by locking devices to prevent them moving accidentally
- i) states that beams and covers of partially opened hatches should be secured to prevent their accidental displacement
- j) states that hatch openings should be securely fenced to a minimum height of 1 metre
- k) states that it is the ship's responsibility to cover hatches when notice of completion of work for the day is given by the stevedore in charge



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- l) states that no person should use a ladder in the square of a hatch while cargo is being hoisted or lowered in that square
- m) states that no person should stand or pass under a suspended load
- n) describes the provision of adequate lighting for working spaces, portable lights and precaution with dangerous cargoes, e.g. jute
- o) states that portable lights should be removed from cargo spaces as soon as they are no longer required
- p) states that unattended portable lights are potential fire hazards
- q) describes the importance of maintaining close communication with the shore during the loading and unloading stage
- r) describes the information that should be agreed between ship and shore before any loading or unloading operation

1.2.8 Oil Tanker Piping and Pumping Arrangements

(2.0hrs)

- a) describes, for crude carriers and product tankers, the general arrangement of:
 - i. cargo tanks
 - ii. pump-rooms
 - iii. segregated ballast tanks
 - iv. slop tanks
 - v. cofferdams - peak tanks - deep tanks
 - vi. accommodation



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- b) describes the direct pipeline arrangement in crude carriers
- c) describes the ring-main system in a product tanker
- d) describes the piping arrangements in a pump-room
- e) describes the system of individual deep-well pumps for a product tanker
- f) explains the arrangement and use of:
 - i. deck lines
 - ii. drop lines
 - iii. stripping lines
 - iv. crossovers
 - v. bypasses
 - vi. master valves
 - vii. tank suction valves
 - viii. sea suction valves
- g) describes how eductors work and gives examples of their use
- h) describes the conditions for which the pumps are being used such as stripping
- i) describes the safe handling of chemical cargoes
- j) describes the safe handling of liquefied gas cargoes
- k) describes the used of ship/shore checklist



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- l) describe the importance of setting the right pumping rate during the loading and unloading operation

1.2.9 Precautions before Entering Enclosed or Contaminated Spaces (1.0hrs)

- a) lists potentially dangerous spaces, including:
 - i. cargo spaces
 - ii. cargo, fuel and ballast tanks
 - iii. pump-rooms
 - iv. cofferdams
 - v. duct keels, peak tanks, double bottom tanks
- b) states that enclosed spaces should be entered only with authorization and after appropriate safety checks have been carried out
- c) states that an enclosed space may be lacking in oxygen or contain flammable or toxic gases.
- d) states that the master or responsible officer must ensure that a space is safe for entry by:
 - i. ensuring that the space has been thoroughly ventilated
 - ii. testing at several levels for oxygen content and the presence of harmful vapours
 - iii. requiring breathing apparatus to be worn when there is any doubt about the adequacy of ventilation or testing



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- e) states that the oxygen content should be 21 % by volume before entry is permitted
- f) defines TLV, TWA, and STEL, and gives examples of their value
- g) states that the concentration of harmful vapour should be below its threshold limit value (TLV)
- h) states that a space where the atmosphere is known to be unsafe should be entered only in an emergency, after safety checks have been carried out, and wearing breathing apparatus
- i) describes a permit-to-enter system using safety checklists to be followed by the responsible officer and the person(s) entering the space
- j) states that risk assessment must be carried out before the entry into enclosed spaces
- k) lists the items appearing on the checklists
- l) describes the protective clothing and equipment which should be used by or be available to those entering the space
- m) states that mechanical ventilation should be maintained throughout the time persons are in an enclosed space
- n) explains why periodical tests of the atmosphere should be made by persons working in an enclosed space



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- o) states that all safety checks should be repeated before re-entering a space after a break
- p) states that a permit-to-work system should only be for the specific duration of the work for that particular day and not valid for the following day
- q) states that after work is completed, the area must be closed and secured

1.2.10 Cargo Calculations and Cargo Plans

(6.0hrs)

- a) distinguishes between bale capacity and grain capacity
- b) defines 'stowage factor'
- c) defines 'broken stowage' and states how an allowance for it is made
- d) given the capacity to hold and the stowage factor of the cargo, calculates the weight that the holds will contain
- e) given the weights and stowage factors of one or more cargoes, calculates the space required
- f) calculates the number of packages of given dimensions which can be loaded in a stated space, making allowance for broken stowage
- g) given the maximum permissible loading of a 'tween-deck, calculates the maximum height to which cargo of stated stowage factor can be loaded



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- h) given the maximum permissible loading and height of a 'tween-deck, and the stowage factors of two commodities, calculates the depth of each required to fill the space at the maximum permitted deck loading.
- i) defines 'ullage'
- j) describes the use of tank calibration tables and given cargo density to calculate the weight in a tank
- k) corrects densities for temperature
- l) describes the uses of tank calibration tables and given weights and densities of cargo to determine the ullages required
- m) determines the ullage to leave to produce a given minimum ullage after allowing for expansion of cargo
- n) extracts information from cargo plans of general cargo ships or container ships
- o) draws up a cargo plan from given information

2. ENSURE COMPLIANCE WITH POLLUTION PREVENTION REQUIREMENTS

2.1 Knowledge of the precaution to be taken to prevent pollution of the marine environment

2.1.1 International Convention for the Prevention of Pollution from Ships, 1973, and the Protocol of 1978 relating thereto (5.0hrs)



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- a) defines, for the purpose of MARPOL 73/78:
 - i. harmful substance
 - ii. discharge
 - iii. ship
 - iv. incident
- b) states that violations of the Convention are prohibited and that sanctions should be established for violations, wherever they occur, by the Administration of the ship concerned
- c) describes the inspections which may be made by port State authorities and outlines actions which they may take
- d) describes the provisions for the detection of violations and enforcement of the Convention
- e) states that reports on incidents involving harmful substances must be made without delay

Annex I - prevention of pollution by oil

- a) defines, for the purposes of Annex I:
 - i. oil
 - ii. oily mixture
 - iii. oil fuel
 - iv. oil tanker
 - v. combination carrier
 - vi. nearest land



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- vii. special area
 - viii. instantaneous rate of discharge of oil content
 - ix. wing tank
 - x. centre tank
 - xi. slop tank
 - xii. clean ballast
 - xiii. segregated ballast
-
- b) describes the surveys and inspections required under the provisions of MARPOL 73/78
 - c) describes the steps which may be taken if a surveyor finds that the condition of the ship or its equipment is unsatisfactory
 - d) states that the condition of the ship and its equipment should be maintained to conform with the provisions of the Convention
 - e) states that the certificate issued after survey is the International Oil Pollution Prevention (IOPP)
 - f) states that the IOPP Certificate should be available on board the ship at all times
 - g) lists the conditions under which oily mixtures may be discharged into the sea from an oil tanker
 - h) lists the condition under which oily mixtures from machinery-space bilges may be discharged into the sea
 - i) states that the provisions do not apply to the discharge of clean or segregated ballast



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- j) describes the conditions under which the provisions do not apply to the discharge of oily mixtures from machinery spaces where the oil content without dilution does not exceed 15 parts per million
- k) states that residues which cannot be discharged into the sea in compliance with the regulations must be retained on board or discharged to reception facilities
- l) states that the special areas for the purposes of Annex I as the Antarctic area, the Baltic Sea area, Mediterranean sea area, Black Sea area, The Gulf area, Gulf of Aden area, Red Sea area and north-west European waters
- m) states that any discharge into the sea of oil or oily mixtures from an oil tanker or other ships of 400 tons gross tonnage and above is prohibited while in a special area
- n) describes the conditions under which a ship, other than an oil tanker, may discharge oily mixtures in a special area
- o) states that the regulation does not apply to the discharge of clean or segregated ballast
- p) describes the exceptional circumstances in which the regulations on the discharge of oil or oily mixtures do not apply
- q) states that ballast water should not normally be carried in cargo tanks of tankers provided with segregated ballast tanks



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- r) explains the exceptions in which ballast may be carried in cargo tanks
- s) states that every oil tanker operating with crude oil washing systems should be provided with an Operations and Equipment Manual
- t) describes the requirements for the provision of Oil Record Books
- u) lists the entries required for machinery space operations in part A of the Oil Record Book
- v) lists the entries required in respect of cargo or ballast operations in oil tankers
- w) describes the entries required for accidental or other exceptional discharge of oil
- x) states that the Oil Record Book should be kept on board readily available for inspection and should be preserved for a period of three years after the last entry has been made

Annex II - prevention of pollution by noxious Liquid Substances in Bulk

- a) describes the requirements of Annex II apply to all ships carrying noxious liquid substances in bulk
- b) states that noxious liquid chemicals are divided into four categories, X, Y, Z and OS such that substances in category X pose the greatest threat to the marine environment and those in category Z the least
- c) states that the conditions for the discharge of any effluent containing substances falling in those categories are specified



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- d) states that more stringent requirements apply in special areas, which for the purposes of Annex II are the Baltic Sea area and the Black Sea area
- e) states that pumping and piping arrangements are to be such that, after unloading, the tanks designated for the carriage of liquids of category Z do not retain more than certain stipulated quantities of residue
- f) states that the discharge operations of certain cargo residues and certain tank cleaning and ventilation, operations may only be carried out in accordance with approved procedures and arrangements based on standards developed by IMO
- g) states that each ship which is certified for the carriage of noxious liquid substances in bulk should be provided with a Procedures and Arrangements Manual
- h) states that the Manual identifies the arrangements and equipment needed to comply with Annex II and specifies the operational procedures with respect to cargo handling, tank cleaning, slops handling, residue discharging, ballasting and deballasting which must be followed in order to comply with the requirements of Annex II
- i) states that each ship should be provided with a Cargo Record Book which should be completed, on a tank-by-tank basis, whenever any operations with respect to a noxious liquid substance take place

Annex III - prevention of pollution by Harmful Substances Carried by Sea in Packaged Forms



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- a) states that for the purpose of this annex, empty receptacles, freight containers and portable road and rail tank wagons which have been used previously for the carriage of harmful substances are treated as harmful substances themselves unless precautions have been taken to ensure that they contain no residue that is hazardous to the marine environment
- b) states that packaging, containers and tanks should be adequate to minimize hazard to marine environment
- c) describes the requirements for marking and labelling packages, freight containers, tanks and wagons
- d) describes the documentation relating to the carriage of harmful substances by sea
- e) states that certain harmful substances may be prohibited for carriage or limited as to the quantity which may be carried aboard anyone ship
- f) states that jettisoning of harmful substances is prohibited except for the purpose of securing the safety of the ship or saving life at sea

Annex IV - prevention of pollution by sewage from ships

- a) describes the provisions regarding the discharge of sewage into the sea

Annex V - prevention of pollution garbage from ships

- a) defines, for the purposes of Annex V:



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- i. garbage
 - ii. nearest land
 - iii. special area
- b) states that the provisions of Annex V apply to all ships
- c) states that the disposal into the sea of all plastics is prohibited
- d) states the regulations concerning the disposal of other garbage

Annex VI – prevention of air pollution from ships

- a) defines, for the purposes of Annex VI:
- i. - continuous feeding
 - ii. - emission
 - iii. - new installations
 - iv. - NOX technical code
 - v. - Ozone depleting substances
 - vi. - sludge oil
 - vii. - shipboard incineration
 - viii. - shipboard incinerator
 - ix. - SOX emission control area
- b) describes the types of inspection required under Annex VI
- c) describes the provision for the issuance of International Air Pollution Prevention certificate



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- d) describes the duration of validity of the certificate
- e) describes the regulation regarding NOX in Regulation 13 of Annex VI
- f) describes the requirement for SOX emission control area
- g) describes the requirement for fuel oil quality in Regulation 18 of Annex VI

2.1.2 Convention of the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Dumping Convention) (LDC) (1.0hrs)

- a) explains the aims of the Convention
- b) defines, for the purpose of the Convention:
 - i. dumping
 - ii. wastes or other matter
 - iii. special permit
 - iv. general permit
- c) states that the dumping of wastes or other matter in whatever form or condition, as listed in annex I, is prohibited
- d) states that the dumping of wastes or other matter listed in annex II requires a prior special permit
- e) states that the dumping of all other wastes or matter requires a prior general permit



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- f) states that the provisions of Article IV do not apply when it is necessary to secure the safety of human life or of vessels in cases of force majeure caused by stress of weather, or in any case which constitutes a danger to human life or a real threat to vessels
- g) states that such dumping should be done so as to minimize the likelihood of damage to human or marine life and must be reported immediately
- h) states that the Addendum to Annex I contains regulations on the incineration of wastes at sea

2.1.3 International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969 (1.0hrs)

- a) describes the rights of Parties to the Convention to intervene on the high seas following a maritime casualty

2.2 Anti-Pollution Procedures and all associated equipment

2.2.1 Basic knowledge of Regulation 26 Annex 1 MARPOL 73/78 (1.0hrs)

- a) describes the key points in a typical shipboard oil pollution emergency plan

3. MONITOR COMPLIANCE WITH LEGISLATIVE REQUIREMENTS



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3.1 IMO Conventions concerning safety of life at sea and protection of the marine environment

3.1.1 Introduction to Maritime Law (2.0hrs)

- a) states that maritime law is based partly on generally accepted customary rules developed over many years and partly on statute law enacted by states
- b) states that matters of safety, protection of the marine environment and conditions of employment are covered by statute law
- c) states that the main sources of maritime law are international conventions
- d) states that the adoption of international conventions and agreements is intended to provide uniform practice internationally
- e) states that a convention is a treaty between the States which have agreed to be bound by it to apply the principles contained in the convention within their sphere of jurisdiction
- f) states that, to implement a convention or other international agreement, a State must enact national legislation giving effect to and enforcing its provisions
- g) states that recommendations which are not internationally binding may be implemented by a State for ships flying its flag
- h) lists the main originators of international conventions concerned with maritime law as are:
 - i. International Maritime Organisation (IMO)
 - ii. International Labour Organisation (ILO)



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- iii. Committee Maritime International (CMI)
- iv. United Nations

- i) describes:
 - i. flag State jurisdiction
 - ii. coastal State jurisdiction
 - iii. port State jurisdiction

- j) describes main elements of relevant IMO Conventions, e.g. SOLAS, MARPOL and STCW

- k) explains the significance of the 'no more favourable treatment' clause in the SOLAS, MARPOL, STCW and ILO Minimum Standards in Merchant Ships Conventions

- l) states that the operation of a ship is governed by the national laws and regulations of the flag State, including those laws and regulations giving effect to international conventions

- m) states that differences of detail usually exist in the national laws of different states implementing the same convention

- n) states that, when serving in a ship flying a foreign flag, it is essential that the master and chief mate familiarise themselves with the laws and regulations of the flag State

- o) states that, when in port, a ship must also comply with the appropriate laws and regulations of the port State



3.1.2 Safety

International Convention on Load Lines, 1966 (LL 1966), as amended (6.0 hrs)

- a) states that no ship to which the Convention applies may proceed to sea on an international voyage unless it has been surveyed, marked and provided with an International Load Line Certificate (1966) or an International Load Line Exemption Certificate, if appropriate
- b) explains to which ships the Convention applies
- c) describes the duration of validity of an International Load Line Certificate (1966)
- d) explains the circumstances in which an International Load Line Certificate (1966) would be cancelled by the Administration
- e) states the control to which ships holding an International Load Line Certificate (1966) are subject when in the ports of other Contracting Governments
- f) defines describes for the purposes of the Regulations:
 - i. freeboard
 - ii. freeboard deck
 - iii. superstructure
- g) describes the position, dimensions and marking of:
 - i. the deck line
 - ii. the load Line Mark



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- iii. lines to be used with the load Line Mark
- h) states that the ring, lines and letters are to be painted in white or yellow on a dark ground or in black on a light ground and that they should be permanently marked on the sides of the ship
- i) states that the International load Line Certificate (1966) will not be delivered to a ship until the surveyor has certified that the marks are correctly and permanently indicated on the ship's sides
- j) explains the terms 'position 1' and 'position 2' with regard to the positions of hatchways, doorways and ventilators
- k) states that hatchway covers made of mild steel are constructed for assumed loads or not less than 1.75 tonnes/m² in position 1 and of not less than 1.30 tonnes/m² in position 2
- l) describes the requirements concerning the provision of closing appliances for ventilators
- m) states that means, permanently attached, should be provided for closing the openings of air pipes to ballast tanks and other tanks
- n) describes the provisions for the protection of the crew
- o) states that deck cargo should be so stowed as to allow for the closing of openings giving access to crew's quarters, machinery space and other parts used in the necessary work of the ship



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International Convention for the Safety of Life at Sea, 1974 as amended (SOLAS) - General Provisions (4.0 hrs)

- a) states that unless expressly provided otherwise, the regulations apply only to ships engaged on international voyages
- b) defines 'international voyage'
- c) defines:
 - i. passenger
 - ii. passenger ship
 - iii. cargo ship
 - iv. tanker
- d) explains who may carry out surveys for the enforcement of the provisions of SOLAS
- e) describes the powers of a nominated surveyor
- f) describes the procedures which apply if the surveyor finds that the ship does not comply with the provisions or is in such a condition that it is not fit to proceed to sea without danger to the ship or to persons on board
- g) describes the requirements for surveys of life-saving appliances and other equipment of cargo ships, including mandatory annual surveys
- h) describes the requirements for surveys of radio and radar installations of cargo ships



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- i) states that the condition of the ship and its equipment must be maintained to conform with the provisions of the regulations
- j) states that after any survey of a ship required by SOLAS, no change should be made in the structural arrangements, machinery, equipment or other items covered by the survey without the sanction of the Administration
- k) states that any accident to a ship or defect affecting the safety of the ship or the efficiency or completeness of the life-saving appliances or equipment should be reported to the Administration or organisation responsible for issuing the relevant certificate, who will decide whether a survey is required
- l) states that an accident or defect should also be immediately reported, by the master or owner, to the appropriate authorities of the port State when the ship is in a port of another Party to the SOLAS Convention

SOLAS - Subdivision and Stability, Machinery and Electrical Installation

- a) defines, with reference to chapter 11-1:
 - i. subdivision load line
 - ii. deepest subdivision load line
 - iii. length
 - iv. breadth
 - v. draught
 - vi. bulkhead deck
 - vii. margin line
 - viii. permeability of a space
 - ix. machinery space



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- x. passenger spaces
 - xi. weathertight
- b) describes the requirements for drills, operation and inspection of watertight doors and other openings in passenger ships
 - c) states that valves, doors and mechanisms should be suitably marked to ensure that they may be properly used to provide maximum safety
 - d) lists the entries which should be made in the log-book regarding the opening and closing of doors, sidescuttles and other openings and the drills and inspections required by the regulations

SOLAS - Fire Protection, Fire Detection and Fire Extinction

- a) outlines the basic principles of the regulations on fire protection
- b) explains briefly the properties of class 'A' and class 'B' divisions
- c) defines:
 - i. main vertical zones
 - ii. accommodation spaces
 - iii. public spaces
 - iv. service spaces
 - v. cargo spaces
 - vi. ro-ro cargo spaces, open and closed
 - vii. special category spaces
 - viii. machinery spaces of category A
 - ix. control stations



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- d) states that fire hoses should be used only for the purposes of extinguishing fires or testing the apparatus at fire drills and surveys
- e) describes the information included in fire control plans or booklets

SOLAS - Life-Saving Appliances and Arrangements

- a) defines, with reference to chapter III of SOLAS:
 - i. certificated person
 - ii. float-free launching
 - iii. inflatable appliance
 - iv. inflated appliance
 - v. launching appliance or arrangement
 - vi. rescue boat
 - vii. survival craft
- b) states that life-saving appliances and arrangements required by chapter III of SOLAS must be approved by the Administration
- c) states the requirements for exhibiting muster lists
- d) describes the illustrations and instructions to be displayed in passenger cabins and other spaces
- e) lists the items to be included in muster lists and emergency instructions
- f) describes the provision of operating instructions for life-saving appliances



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- g) explains how the crew should be assigned to survival craft to ensure satisfactory manning and supervision of survival craft
- h) describes the requirements for passenger muster stations
- i) states that, on passenger ships, an abandon ship drill and a fire drill must take place weekly

SOLAS - Radiocommunications (amended chapter IV)

- a) states that the 1988 amendments to the 1974 SOLAS Convention replace the existing Chapter IV with a new Chapter IV covering the global maritime distress and safety system (GMDSS)
- b) states that the amended Chapter IV applies to passenger ships, irrespective of size, and cargo ships of 300 tons gross tonnage and upwards engaged on international voyages
- c) states that every ship must comply with the regulations concerning NAVTEX and satellite EPIRB
- d) states that every ship constructed on or after 1 February 1995 must comply with all applicable requirements
- e) explains the applicability to ships built before 1 February 1995
- f) explains the meanings, for the purpose of the amended Chapter IV, of:



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- i. bridge to bridge communications
 - ii. continuous watch
 - iii. digital selective calling (DSC)
 - iv. direct-printing telegraphy
 - v. general radiocommunications
 - vi. international NAVTEX service
 - vii. locating
 - viii. maritime safety information
 - ix. polar orbiting satellite service
 - x. sea area A1
 - xi. sea area A2
 - xii. sea area A3
 - xiii. sea area A4
- g) states that every ship, while at sea, must be capable of:
- h) lists the radio equipment to be carried by all ships
- i) describes the requirements regarding the installation and operation of the satellite EPIRB
- j) lists the additional equipment required by ships engaged on voyages exclusively within sea area A1
- k) lists the additional equipment required by ships engaged on voyages within sea areas A1 and A2
- l) lists the additional equipment required by ships engaged on voyages within sea areas A1, A2, and A3



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- m) states that equipment using the INMARSAT geostationary satellite service is not an acceptable alternative for ships engaged on voyages which include sea area A4
- n) states the requirements for maintaining watch on distress frequencies
- o) states that every ship, while at sea, must maintain a watch for broadcasts of maritime safety information
- p) describes how the availability of radio equipment required by the regulations is to be ensured
- q) states that every ship must carry personnel qualified for distress and safety radio communications purposes who hold certificates specified in the Radio Regulations
- r) states that one person is designated to have primary responsibility for radio communications during distress incidents
- s) states that a record must be kept of all incidents connected with the radio communication service which appear to be of importance to the safety of life at sea

The International Safety Management (ISM)

- a) states that a Safety Management System in compliance with the ISM Code must be in place on board all passenger ships, tankers and bulk carriers of 500gt and upwards



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- b) states that a Safety Management System in compliance with the ISM Code must be in place on board all vessels of 500gt and upwards from 1 July 2002
- c) states that the details of the ship's system may be found in the ship's Safety Management Manual

International Convention on Standards of Training, Certification and Watch keeping for Seafarers,

- a) explains the general obligations under the Convention
- b) defines, for the purpose of the Convention:
 - i. Certificate of Competency
 - ii. Certificate of Proficiency
 - iii. certificated
 - iv. seagoing ship
 - v. Radio Regulations
- c) explains the application of the Convention
- d) describes the issue of certificates and their endorsement by the issuing Administration
- e) describes the conditions under which dispensations may be granted
- f) states that ships, when in a port of a party to the Convention, are subject to control to verify that all seafarers serving on board who are required to be certificated are so certificated or hold a valid dispensation



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- g) states that a ship which extends its voyage beyond what is defined as a near-coastal voyage by a Party must fulfill the requirements of the Convention without the relaxation allowed for near-coastal voyages
- h) describes the control which may be exercised by a duly authorized control officer
- i) describes the circumstances in which the control officer should supply written information to the master regarding deficiencies and the grounds under which the ship may be detained
- j) explains that the regulations contain:
- k) mandatory minimum requirements for the certification of masters, officers, radiotelephone operators, able seafarers deck or engine and ratings forming part of a navigational watch or an engineering watch
- l) mandatory minimum requirements for the training and qualifications of masters, officers and ratings of oil, chemical and gas tankers
- m) mandatory minimum requirements to ensure the continued proficiency and updating of masters and deck, engineer, and radio officers and ratings
- n) basic principles to be observed in keeping navigational and engineering watches
- o) mandatory minimum requirements for the issue of a Certificate of Proficiency in Survival Craft and Rescue Boats other than Fast Rescue Boats



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3.1.3 Security

(3.0hrs)

- a) describe SOLAS Ch XI -2 and requirements to enhance security.
- b) explain following
 - i. Three levels of security
 - ii. Ship Security Plan
 - iii. Continuous Synopsis Record
 - iv. Company Security Officer
 - v. Ship Security Officer
 - vi. ISSC and related verifications

TOTAL 36.0 Hrs

1. MAINTAIN SEAWORTHINESS OF THE SHIP

1.1 General knowledge of the principal structural members of a ship and the proper names for the various parts

1.1.1 Ship dimensions and form

(3.0hrs)

- a) illustrates the general arrangement of the following ship types:
 - i. general cargo
 - ii. tankers
 - iii. bulk carriers
 - iv. combination carriers
 - v. container



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- vi. ro-ro
- vii. passenger

- b) reproduces an elevation of a general cargo ship, showing holds, engine-room, peak tanks, double-bottom tanks, hatchways, tween deck and position of bulkheads

- c) reproduces an elevation of a typical crude oil carrier, showing bulkheads, cofferdams, pump-room, engine-room, bunker and peak tanks, cargo tanks, slop tank and permanent ballast tanks

- d) reproduces a plan view of a tanker, showing the arrangement of tanks

- e) defines and illustrates:
 - i. camber
 - ii. rise of floor
 - iii. tumblehome
 - iv. flare
 - v. sheer
 - vi. rake
 - vii. parallel middle body
 - viii. entrance
 - ix. run

- f) defines:
 - i. forward perpendicular (FP)
 - ii. after perpendicular (AP)
 - iii. length between perpendiculars (LBP)
 - iv. length on the waterline (LWL)
 - v. length overall (LOA)



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- vi. base line
- vii. moulded depth, beam and draught
- viii. extreme depth, beam and draught

1.1.2 Ship Stresses

(3.0hrs)

- a) describes in qualitative terms shear force and bending moments
- b) explains what is meant by 'hogging' and by 'sagging' and distinguishes between them
- c) describes the loading conditions which give rise to hogging and sagging stresses
- d) describes how hogging and sagging stresses are caused by the sea state
- e) explains how hogging and sagging stresses result in tensile or compressive forces in the deck and bottom structure
- f) describes water pressure loads on the ship's hull
- g) describes liquid pressure loading on the tank structures
- h) calculates the pressure at any depth below the liquid surface, given the density of the liquid
- i) describes qualitatively the stresses set up by liquid sloshing in a partly filled tank
- j) describes racking stress and its causes



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- k) explains what is meant by 'pounding' or 'slamming' and states which part of the ship is affected
- l) explains what is meant by 'panting' and states which parts of the ship are affected
- m) describes stresses caused by localised loading
- n) describes corrosion
- o) describes the causes of corrosion on board
- p) describes the various methods being used to minimize the effect of corrosion

1.1.3 Hull, Shell Plating and Framing

(3.0 hrs)

- a) identifies structural components on ships' plans and drawings:
 - i. frames, floors, transverse frames, deck beams, knees, brackets
 - ii. shell plating, decks, tank top, stringers
 - iii. bulkheads and stiffeners, pillars
 - iv. hatch girders and beams, coamings, bulwarks
 - v. bow and stern framing, cant beams, breast hooks
- b) describes the types of materials that are used in the construction of a ship



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- c) describes and illustrates standard steel sections:
 - i. flat plate
 - ii. offset bulb plate
 - iii. equal angle
 - iv. unequal angle
 - v. channel
 - vi. tee
- d) describes with aid of sketches the longitudinal, transverse and combined systems of framing on transverse sections of ships
- e) sketches the arrangement of frames, webs and transverse members for each system

1.1.4 Bow and Stern

(3.0hrs)

- a) describes the provision of additional structural strength to withstand pounding
- b) describes and illustrates the structural arrangements forward to withstand panting
- c) describes the function of the stern frame
- d) describes and sketches a stern frame for a single-screw ship
- e) describes and illustrates the construction of a transom stern, showing the connections to the stern frame



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1.1.5 Fittings

(3.0hrs)

- a) describes and sketches an arrangement of modern weather-deck mechanical steel hatches
- b) describes how water tightness is achieved at the coamings and cross joints
- c) describes the cleating arrangements for the hatches above
- d) describes the arrangement of portable beams, wooden hatch covers and tarpaulins
- e) sketches an oil tight hatch cover
- f) describes the construction and attachment to the deck of tension winches and explains how they are used
- g) describes the anchor handling arrangements from hawse pipe to spurling pipe
- h) describes the construction of chain lockers and how the bitter-ends are secured in the lockers
- i) explains how to secure anchors and make spurling pipes watertight in preparation for a sea passage
- j) describes the construction and use of a cable stopper

1.1.6 Rudders and Propellers

(3.0hrs)



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- a) describes the action of the rudder in steering a ship
- b) reproduces drawings of modern rudders: semi-balanced, balanced and spade
- c) explains the purpose of the rudder carrier and pintles
- d) explains how the weight of the rudder is supported by the rudder carrier
- e) describes the rudder trunk
- f) describes the arrangement of a watertight gland round the rudder stock
- g) explains the principle of screw propulsion
- h) compares fixed-pitch with controllable-pitch propellers

1.1.7 Load Lines and Draught Marks

(1.0 hours)

- a) explains where the deck line is marked
- b) defines 'freeboard'
- c) explains what is meant by 'assigned summer freeboard'
- d) draws to scale the load line mark and the load lines for a ship of a given summer moulded draught, displacement and tonnes per centimetre immersion in salt water



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- e) explains how the chart of zones and seasonal areas is used to find the applicable load line
- f) explains that the freeboard, measured from the upper edge of the deck line to the water on each side, is used to check that the ship is within its permitted limits of loading

1.1.8 Double bottom structure

(1.0hrs)

- a) describes Transversely framed double bottom
- b) describes Longitudinally framed double bottom

1.1.9 Bulkheads

(1.0hrs)

- a) States that transverse bulkheads serve to subdivide a ship against flooding and spread of fire, to support decks and superstructures and to resist racking stresses
- b) Distinguishes between watertight, non-watertight and oil tight or tank bulkheads
- c) Defines:
 - i. Margin line
 - ii. Bulkhead deck
 - iii. Weather tight



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- d) States that watertight floors are fitted directly below main watertight bulkheads
- e) Explains that oil tight bulkheads and bulkheads forming boundaries of tanks are built with heavier scantlings than watertight bulkheads
- f) Describes how bulkheads are tested for tightness
- g) Gives examples of non-watertight bulkheads
- h) Explains the purpose of wash bulkheads in cargo tanks or deep tanks
- i) States that openings in watertight bulkheads must be fitted with watertight doors

2. MAINTAIN SEAWORTHINESS OF THE SHIP

2.1 Working knowledge and application of stability

2.1.1 Displacement

(1.0 hrs)

- a) Define the following
 - i. Density
 - ii. Relative density



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- iii. Volume
- iv. Weight

- b) Water pressure
 - i. explain what is water pressure
 - ii. define the external and internal water pressure
 - iii. explain what is thrust
 - iv. calculate the pressure acting on a point at different shapes of the tanks

- c) Explain the Archimedes principle

- d) Describe the principle of floatation

- e) states that, for a ship to float, it must displace a mass of water equal to its own mass

- f) explains how, when the mass of a ship changes, the mass of water displaced changes by an equal amount

- g) states that the displacement of a vessel as its mass and that it is measured in tonnes

- h) states that displacement is represented by the symbol " Δ "

- i) explains the relationship between the displacement and mean draught of a ship by using the graph or scale

- j) defines 'light displacement' and 'load displacement'

- k) defines 'deadweight'



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- l) explain the difference of deadweight aboard and dead weight available
- m) defines 'tonnes per centimetre immersion' (TPC)
- n) defines 'block coefficient' (C_b)
- o) calculates C_b from given displacement and dimensions
- p) calculates displacement from given C_b and dimensions

2.1.2 Buoyancy

(1.0 hrs)

- a) explains what is meant by 'buoyancy'
- b) states that the force of buoyancy as an upward force on a floating object created by the pressure of liquid on the object
- c) states that the buoyancy force is equal to the displacement of a floating object
- d) describes reserve buoyancy
- e) explains the importance of reserve buoyancy
- f) explains how freeboard is related to reserve buoyancy
- g) explains the purpose of load lines
- h) explains the requirements for maintaining water tight integrity



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- i) states where the deck line is marked
- j) defines 'freeboard'

2.1.3 Fresh Water Allowance & Dock Water Allowance

(2.5 hrs)

- a) explains why the draught of a ship decreases when it passes from fresh water to seawater and vice versa
- b) states that when loading in fresh water before proceeding into seawater, a ship is allowed a deeper maximum draught
- c) describes what it meant by the fresh water allowance (FWA)
- d) given the FWA and TPC for fresh water, calculates the amount which can be loaded after reaching the summer load line when loading in fresh water before sailing into seawater
- e) describes what it meant by the Dock Water Allowance (DWA)
- f) describes the uses a hydrometer to find the density of dock water
- g) describes the effect of changes of tide and rain on dock water density
- h) explains how to obtain the correct dock water density



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- i) given the density of dock water and TPC for seawater, calculates the TPC for dock water
- j) given the density of dock water and FWA, calculates the amount by which the appropriate load line may be submerged
- k) given the present draught amidships and the density of dock water, calculates the amount to load to bring the ship to the appropriate load line in seawater

2.1.4 Statical Stability

(1.0 hrs)

- a) states that weight is the force of gravity on a mass and always acts vertically downwards
- b) states that the total weight of a ship and all its contents can be considered to act at a point called the centre of gravity (G)
- c) states that the centre of buoyancy (B) as being the centre of the underwater volume of the ship
- d) states that the force of buoyancy always acts vertically upwards
- e) explains that the total force of buoyancy can be considered as a single force acting through B
- f) states that when the shape of the underwater volume of a ship changes, the position of B also changes



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- g) states that the position of B will change when the draught changes and when heeling occurs
- h) labels a diagram of a midship cross-section of an upright ship to show the weight acting through G and the buoyancy force acting through B
- i) states that the buoyancy force is equal to the weight of the ship
- j) labels a diagram of a midship cross-section of a ship heeled to a small angle to show the weight acting through G and the buoyancy force acting through B
- k) describes stability as the ability of the ship to return to an upright position after being heeled by an external force
- l) states that the lever GZ as the horizontal distance between the vertical forces acting through B and G
- m) states that the forces of weight and buoyancy form a couple
- n) states that the magnitude of the couple is displacement (Δ) \times GZ
- o) explains how variations in displacement and GZ affect the stability of the ship
- p) on a diagram of a heeled ship, shows:
 - i. the forces at B and G
 - ii. the lever GZ
- q) states that the length of GZ will be different at different angles of heel



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- r) states that if the couple $\Delta \times GZ$ tends to turn the ship toward the upright, the ship is stable
- s) states that for a stable ship:
 - i. $\Delta \times GZ$ is called the righting moment
 - ii. GZ is called the righting lever

2.1.5 Initial Stability

(1.0 hrs)

- a) states that it is common practice to describe the stability of a ship by its reaction to heeling to small angles (up to approximately 15°)
- b) defines the transverse metacentre (M) as the point of intersection of successive buoyancy force vectors as the angle of heel increases by a small angle
- c) states that, for small angles of heel, M can be considered as a fixed point on the centre line
- d) on a diagram of a ship heeled to a small angle, indicates G, B, Z and M
- e) shows on a given diagram of a stable ship that M must be above G and states that the metacentric height GM is taken as positive
- f) shows that for small angles of heel (θ), $GZ = GM \times \sin \theta$
- g) states that the value of GM is a useful guide to the stability of a ship
- h) describes the effect on a ship's behaviour of:
 - i. a large GM (stiff ship)



- ii. a small GM (tender ship)
- i) uses hydrostatic curves to find the height of the metacentre above the keel (KM) at given draughts
- j) states that KM is only dependent on the draught of a given ship

2.1.6 Equilibrium of ships (1.5 hrs)

- a) Define the:
 - i. Stable equilibrium
 - ii. Unstable equilibrium
 - iii. Neutral equilibrium

2.1.7 Angle of Loll (0.5 hrs)

- a) shows that if G is raised above M, the couple formed by the weight and buoyancy force will turn the ship further from the upright
- b) states that in this condition, GM is said to be negative and $B \times GZ$ is called the upsetting moment or capsizing moment
- c) explains how B may move sufficiently to reduce the capsizing moment to zero at some angle of heel
- d) states that the angle at which the ship becomes stable is known as the angle of loll



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- e) states that the ship will roll about the angle of loll instead of the upright
- f) states that an unstable ship may loll to either side
- g) explains why the condition described in the above objective is potentially dangerous
- h) Explain the effect on stability for timber deck cargo vessels

2.1.8 Movement of the Centre of Gravity & KG calculations

(3.0 hrs)

- a) states that the centre of gravity (G) of a ship can move only when masses are moved within, added to, or removed from the ship
- b) states that:
 - i. G moves directly towards the centre of gravity of added masses
 - ii. G moves directly away from the centre of gravity of removed masses
 - iii. G moves parallel to the path of movement of masses already on board
- c) calculates the movement of G (GG_1) from:
 - i. $GG_1 = \text{mass added or removed} \times \text{distance of mass from G} / \text{new } \Delta$
 - ii. $GG_1 = \text{mass moved} \times \text{distance mass is moved} / \Delta$
- d) performs calculations as in the above objective to find the vertical and horizontal shifts of the centre of gravity resulting from adding, removing or moving masses
- e) states that if a load is lifted by using a ship's derrick or crane, the weight is immediately transferred to the point of suspension



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- f) states that if the point of suspension is moved horizontally, the centre of gravity of the ship also moves horizontally
- g) states that if the point of suspension is raised or lowered, the centre of gravity of the ship is raised or lowered
- h) calculates, by using moments about the keel, the position of G after loading or discharging given masses at stated positions
- i) calculates the change in KG during a passage resulting from:
 - i. consumption of fuel and stores
 - ii. absorption of water by a deck cargo
 - iii. accretion of ice on decks and superstructures given the masses and their positions

2.1.9 List and its Correction

(1.5 hrs)

- a) shows on a diagram the forces which cause a ship to list when G is to one side of the centre line
- b) states that the listing moment is given by displacement x transverse distance of G from the centre line
- c) shows on a diagram that the angle of list (θ) is given by

$$\tan \theta = GG_1 / (\Delta \times GM)$$

Where,

GG₁ is the transverse shift of G from the centre line



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- d) states that in a listed condition the range of stability is reduced
- e) given the displacement, KM and KG of a ship, calculates the angle of list resulting from loading or discharging a given mass at a stated position, or from moving a mass through a given transverse distance
- f) explains with reference to moments about the centre line how the list may be removed
- g) given the displacement, GM and the angle of list of a ship, calculates the mass to load or discharge at a given position to bring the ship upright
- h) given the displacement, GM and angle of list of a ship, calculates the mass to move through a given transverse distance to bring the ship upright
- i) given the draught, beam and rise of the floor, calculates the increase in draught resulting from a stated angle of list

2.1.10 Effect of Slack Tanks

(1.5 hrs)

- a) states that if a tank is full of liquid, its effect on the position of the ship's centre of gravity is the same as if the liquid were a solid of the same mass
- b) explains by means of diagrams how the centre of gravity of the liquid in a partly filled tank moves during rolling
- c) Define the FSE



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- d) states that when the surface of a liquid is free to move, there is a virtual increase in KG, resulting in a corresponding decrease in GM
- e) states that the increase in KG is affected mainly by the breadth of the free surface and is not dependent upon the mass of liquid in the tank
- f) states that in tankers the tanks are often constructed with a longitudinal subdivision to reduce the breadth of free surface
- g) explain the application of FSC to obtain fluid KG

3.1 Explain the fundamentals of watertight integrity (0.5 hrs)

TOTAL 36.0 Hrs

1. MAINTAIN A SAFE NAVIGATIONAL WATCH

- 1.1 Thorough knowledge of the content, application and intent of the International Regulations for Preventing Collisions at Sea, 1972, as amended (18.0 hrs)**



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- a) explains the application of the rules as set out in Rule 1
- b) defines the term 'traffic separation scheme'
- c) describes the responsibility to comply with the rules as set out in Rule 2
- d) cites examples of precautions which may be required by the ordinary practice of seamen or by the special circumstances of the case
- e) gives examples of circumstances which may make a departure from the rules necessary
- f) describes the general definitions which apply throughout the rules
- g) explains the term 'vessel constrained by her draught'
- h) distinguishes between 'under way' and 'making way'
- i) explains 'a proper look-out' and interprets the intent of 'full appraisal of the situation and the risk of collision'
- j) explains the use of radar in the context of Rule 5
 - i. explains what is meant by a safe speed
 - ii. describes, with reference to court cases, how 'proper and effective action' and 'within a distance appropriate to the prevailing circumstances and conditions' may be interpreted
 - iii. describes the factors to be taken into account in determining a safe speed
 - iv. explains how the use of radar affects the determination of safe speed
- k) explains what is meant by risk of collision



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- i. describes the proper use of radar equipment in determining whether a risk of collision exists
 - ii. explains the dangers of making assumptions on the basis of scanty information, citing examples from clear weather as well as the use of radar
 - iii. illustrates, using examples from court cases, how failure to plot may lead to a lack of appreciation of a developing situation
- l) illustrates, using examples from court decisions, the following actions to avoid collision referred to in Rule 8
- i. positive action in ample time large enough to be readily apparent
 - ii. alteration of course alone
 - iii. passing at a safe distance
 - iv. checking the effectiveness of action taken
 - v. reduction of speed
 - vi. taking all way off
- m) demonstrates an understanding of Rule 9 by:
- i. defining the terms 'narrow channel' and 'fairway'
 - ii. describing how to proceed along the course of a narrow channel
 - iii. describing the navigation of small craft and sailing vessels in a narrow channel
 - iv. stating the restrictions on crossing the channel or fairway describing the conduct of vessels engaged in fishing
 - v. stating the procedure for overtaking in a narrow channel
 - vi. describing the actions to be taken on nearing a bend in a narrow channel or fairway
- n) defines 'traffic lane', 'separation line', 'separation zone', 'inshore traffic zone'



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- o) describes how to navigate in a traffic separation scheme with reference to:
 - i. entering and leaving the traffic separation scheme
 - ii. entering and leaving traffic lane
 - iii. crossing lanes
 - iv. the use of inshore traffic zones
 - v. crossing separation lines or entering separation zones other than when crossing, joining or leaving a lane

- p) describes the requirements for vessels:
 - i. navigating in areas near the terminations of traffic separation schemes
 - ii. anchoring
 - iii. not using a traffic separation scheme
 - iv. engaged in fishing

- q) states that a vessel of less than 20 metres in length or a sailing vessel must not impede the safe passage of a power-driven vessel following a traffic lane

- r) states that the exemptions for vessels restricted in their ability to manoeuvre when engaged in an operation for the
 - i. maintenance of safety of navigation
 - ii. laying, servicing or picking up of a submarine cable

- s) explains the meaning of 'precautionary area'

- t) defines 'deep water route' and describes for whom such a route is intended

- u) explains what is meant by 'vessels in sight of one another'



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- v) demonstrates, with the use of models displaying proper signals or lights, a navigation light simulator or otherwise, the proper action to take to avoid collision with other vessels in sight
- w) explains how to decide when a vessel is an overtaking vessel
- x) compares and analyses the various avoiding actions which may be taken by an overtaking vessel
- y) explains the application of Rule 14, Head-on Situation
- z) explains why the give-way vessel in a crossing situation shall, if the circumstances admit, avoid crossing ahead of the other vessel
- aa) explains the application of Rule 15 when crossing narrow channels and traffic lanes
- bb) explains how Rule 16 and Rule 8 relate regarding the action by a give-way vessel
- cc) explains the position of stand-on vessel in cases where a risk of collision exists between more than two vessels
- dd) explains how to decide when to take avoiding action as stand-on vessel
- ee) describes the actions which may be taken by the stand-on vessel
- ff) describes the avoiding action which must be taken by the stand-on vessel
- gg) states that a potential collision situation may be divided into the following four stages:



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- i. at long range, before risk of collision exists and both vessels are free to take any action
 - ii. risk of collision applies, the give-way vessel is required to take action and the other vessel must keep her course and speed
 - iii. the give-way vessel is not taking appropriate action
 - iv. collision cannot be avoided by the action of the give-way vessel alone
-
- hh) explains the responsibilities between vessels with reference to Rules 18 and 3
 - ii) explains the application of Rule 19
 - jj) compares Rule 6 and Rule 19 regarding the determination of safe speed
 - kk) explains how courts have interpreted 'a close-quarters situation'
 - ll) describes the application of the rules concerning Lights and shape
 - mm) explains the definitions in Rule 21
 - nn) identifies the lights and shapes carried by any type of vessel and the operation or circumstances signified by them, including the additional signals for fishing vessels fishing in close proximity
 - oo) describes the shapes required by the rules
 - pp) describes the sound signals to be used by vessels in sight of one another
 - qq) describes the sound signals to be used by vessels in or near an area of restricted visibility



- rr) describes the use of signals to attract attention
- ss) lists the distress signals set out in Annex IV of COLREG 72

1.2 IALA Maritime Buoyage System (2.0 hrs)

- a) explains the principles and rules of the International Association of Lighthouse Authorities (IALA) Maritime Buoyage System, Systems "A" and "B"
- b) recognises the lights and shapes displayed on lateral and cardinal marks
- c) recognises the lights and shapes displayed on other types of buoys in the system

1.3 Thorough knowledge of the Principles to be observed in keeping a navigational watch

1.3.1 Keeping a safe navigational watch (2.0 hrs)

- a) states that the officer of the watch is responsible for navigating safely, with particular regard to avoiding collision and stranding
- b) describes the principles to be observed in keeping a navigational watch as set out in regulation A-VIII of STCW, 1978 as amended regarding:
 - i. navigation
 - ii. navigational equipment
 - iii. navigational duties and responsibilities
 - iv. handing over and taking over the watch
 - v. look-out



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- vi. navigation with a pilot embarked
- c) describes the recommendation on operational guidance for officers in charge of a navigational watch contained in Chapter VIII, Section A-VIII/2 of the International Conference on Training and Certification of Seafarers,1978:
 - i. maintenance of an efficient look-out
 - ii. the use of engines and sound signalling apparatus
 - iii. taking over the navigational watch
 - iv. periodic checks of navigational equipment
 - v. compliance with SOLAS V/19 regarding the use of the automatic pilot and the change-over to manual steering and vice-versa
 - vi. electronic navigational aids
 - vii. the use of radar
 - viii. navigation in coastal waters
 - ix. conduct of the watch in clear weather
 - x. actions to take in restricted visibility
 - xi. the circumstances in which the officer of the watch should call the master
 - xii. navigation with a pilot embarked
 - xiii. briefing of watchkeeping personnel
- d) describes the duties of the officer of the watch while at anchor
- e) lists the entries which should be made in the log-book

2. Respond to emergencies

2.1 Contingency plans for response to emergencies (2.0 hrs)

- a) states that duties are assigned for the operation of remote controls such as:



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- i. main engine stop
 - ii. ventilation stops
 - iii. lubricating and fuel oil transfer pump stops
 - iv. dump valves
 - v. CO2 discharge
 - vi. watertight doors and operation of essential services such as:
 - emergency generator and switchboard
 - emergency fire and bilge pumps
- c) describes the division of the crew into a command team, all emergency team, a back-up emergency team and an engine-room emergency team
- d) states that crew members not assigned to emergency teams would prepare survival craft, render first aid, assemble passengers and generally assist the emergency parties as directed
- e) states that the engine-room emergency team would take control of ER emergencies and keep the command team informed
- f) states that good communications between the command team and the emergency teams are essential
- g) describes the actions to take to deal with:
- i. fire in specific areas such as galley, accommodation, engine-room or cargo space, including co-ordination with shore facilities in port, taking account of the ship's fire-control plan
 - ii. rescue of victims of a gassing accident in an enclosed space
 - iii. heavy weather damage, with particular reference to hatches, ventilators and the security of deck cargo
 - iv. rescue of survivors from another ship or the sea



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- v. leakages and spills of dangerous cargo
- h) explains the importance of drills and practices

2.2 Precautions for the protection and safety of passengers in emergency situations
(1.0 hrs)

- a) states that some crew members will be assigned specific duties for the mustering and control of passengers lists the duties as:
 - i. warning the passengers
 - ii. ensuring that all passengers spaces are evacuated
 - iii. guiding passengers to muster stations
 - iv. maintaining discipline in passageways, stairs and doorways
 - v. checking that passengers are suitably clothed and that life jackets are correctly donned
 - vi. taking a roll-call of passengers
 - vii. instructing passengers on the procedure for boarding survival craft or jumping into the sea
 - viii. directing them to embarkation stations
 - ix. instructing passengers during drills
 - x. ensuring that a supply of blankets is taken to the survival craft

2.3 Initial action to be taken following a collision or a grounding; initial damage assessment and control

2.3.1 Actions on stranding/grounding (1.0hrs)



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- a) states that, on stranding, the engines should be stopped, watertight doors closed, the general alarm sounded and, if on a falling tide, the engines should be put full astern to see if the ship will immediately refloat
- b) states that the engineers should be warned to change to high-level water intakes
- c) states that a distress or urgency signal should be transmitted and survival craft prepared if necessary
- d) states that all tanks and compartments should be sounded and the ship inspected for damage
- e) states that soundings should be taken to establish the depth of water round the ship and the nature of the bottom
- f) describes measures which can be taken to prevent further damage to the ship and to assist with subsequent refloating
- g) explains how ballast or other weights may be moved, taken on or discharged to assist refloating
- h) describes the use of ground tackle for hauling off
- i) describes ways in which tugs may be used to assist in refloating
- j) describes the use of the main engine in attempting to refloat and the danger of building up silt from its use

2.3.2 Actions following a collision

(1.0hrs)



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- a) states that after impact the engines should be stopped, all watertight doors closed, the general alarm sounded and the crew informed of the situation
- b) states that in calm weather the colliding ship should generally remain embedded to allow the other ship time to assess the damage or prepare to abandon ship
- c) states that survival craft should be made ready for abandoning ship or assisting the crew of the other ship
- d) states that damage to own ship should be determined
- e) states that a distress or an urgency signal should be made, as appropriate
- f) states that, if not in danger, own ship should stand by to render assistance to the other for as long as necessary
- g) describes measures to attempt to limit damage to save own ship
- h) states that all details of the collision and subsequent actions should be entered in the log-book

2.3.3 Procedures for abandoning ship

(1.0hrs)

- a. states that a ship should only be abandoned when imminent danger of sinking, breaking up, fire or explosion exists or other circumstances make remaining on board impossible



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- b. states that a distress call should be transmitted by all available means until acknowledged
- c. lists the information to include in the distress message
- d. describes other distress signals which may be used to attract attention
- e. states that extra food and blankets should be placed in boats when time allows
- f. states that the emergency radio should be placed in a survival craft to which a radio officer, where one is carried, is assigned .
- g. states that warm clothing and life jackets should be worn
- h. describes the launching of boats including free fall lifeboats and life rafts when the ship is listing heavily
- i. describes the launching of boats including free fall lifeboats and life rafts in heavy weather
- j. describes the on load release system of davit launched boats
- k. describes the use of oil to calm the sea surface and explains why fuel oil is not suitable
- l. states that the lifeboats with motors should be used to tow craft clear of ship, pick up survivors from the water and marshal survival craft
- m. states that survival craft should remain together in the vicinity of the sinking ship to aid detection and rescue



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n. describes the use of rocket line-throwing appliances and breeches buoy

3. MANOEUVRE THE SHIP

3.1 Knowledge of (relevant to ship manoeuvring and handling)

3.1.1 the effects of deadweight, draught, speed and under-keel clearance on turning circles and stopping distances (2.0 hrs)

- a) outlines the provision and display of manoeuvring information recommended in Assembly resolution A.601(15)
- b) defines the terms:
 - i. advance
 - ii. transfer
 - iii. drift angle
 - iv. tactical diameter
 - v. track reach
 - vi. head reach
 - vii. side reach
- c) compares the turning circles of a ship in the loaded and ballasted conditions
- d) compares turning circles for differing speeds



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- e) states that the size of the turning circle increases as the under-keel clearance reduces
- f) compares the stopping distances of a ship in the loaded and ballasted conditions
- g) explains why a loaded ship carries her way longer than when in ballast
- h) states that the stopping distance for a loaded ship may be up to three times the stopping distance when in ballast
- i) states that in shallow water a ship will carry her way longer than in deep water

3.1.2 the effects of wind and current on ship handling

(1.0hrs)

- a) states that the effect of wind on a given ship depends upon:
 - i. the wind strength
 - ii. the relative direction of the wind
 - iii. the above-water area and profile
 - iv. the draught and trim
 - v. the ship's fore-and-aft movement
- b) describes the behaviour of a ship moving ahead with a wind from various directions
- c) states that, as a ship is slowed, a speed is reached at which the wind prevents maintaining course
- d) describes the effect of current on the motion of a ship



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- e) states that in rivers and narrow channels the current is usually stronger in the centre of a straight channel or at the outside of bends
- f) describes how to make use of different current strengths when turning in a channel
- g) describes how a current may be used to control lateral movement towards or away from a river berth

3.1.3 Manoeuvres and procedures for the rescue of person overboard (1.0hrs)

- a) distinguishes between "immediate action", "delayed action" and "person missing" situations
- b) describes the single turn, Williamson turn and Scharnow turn manoeuvres
- c) explains the situations in which each turn is appropriate
- d) states that the standard manoeuvres are not guaranteed to return a ship into its wake because of the effects of particular ship characteristics and environmental conditions on the ship and the person in the water
- e) lists the sequence of actions to take when a person is seen to fall overboard
- f) lists the actions to take when a man-overboard report is received on the bridge
- g) Demonstrates the ability to manoeuvre the vessel for the rescue of a person overboard



3.1.4 proper procedures for anchoring and mooring (1.0 hrs)

- a) describes how anchors should be cleared away ready for use
- b) states that anchors should be walked back clear of the hawse pipes when approaching the anchorage
- c) describes the use of anchor buoys
- d) describes the safety measures to be taken by the anchor party
- e) describes the marking of the cable and the reports to be made to the bridge
- f) explains how to determine when the ship is brought up
- g) states that the lights or shape for a vessel at anchor should be displayed as soon as the ship is brought up
- h) describes the securing of anchors on the completion of anchoring
- i) describes the preparation for and procedure during heaving up
- j) explains how to secure anchors and seal spurling pipes for a sea passage
- k) lists the preparations to be made for berthing alongside
- l) describes the use of head ropes, stern ropes, breast ropes and springs



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- m) describes the safety measures to be taken when handling mooring ropes and wires
- n) describes typical mooring arrangements
- o) states the importance of keeping mooring lines clear of the propeller and notifying the bridge when the propeller is not clear
- p) explains how to use a messenger to pass a wire or chain to a buoy
- q) describes the procedures for singling up and letting go from berths
- r) describes how to stow mooring ropes and wires for a sea passage
- s) explains how to rig and light the pilot ladder
- t) states what equipment should be at hand ready for use at the pilot ladder
- u) states that the rigging of the ladder and the embarkation and disembarkation of the pilot should be supervised by a responsible officer

4. KEEPING A WATCH IN PORT

4.1 Keeping an Effective Deck Watch in Port under Normal Circumstances

(1.0hrs)

- a) states that arrangements for keeping watch in port should:
 - i. ensure the safety of life, ship, cargo and port



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- ii. observe international, national and local rules
- iii. maintain order and the normal routine of the ship

- b) describes taking over the watch and lists the information which the officer being relieved should pass to the relieving officer

- c) lists the matters on which the relieving officer should satisfy themselves before assuming charge of the watch

- d) describes how the watch should be kept and lists the points to which attention should be paid

- e) describes the actions to take on receiving a storm warning or in an emergency threatening the safety of the ship

- f) lists the entries which should be made in the log-book

4.2 Keeping a Safe Deck Watch in Port When Carrying Hazardous Cargo

(1.0hrs)

- a) defines 'hazardous cargo'

- b) states that sufficient personnel should be readily available on board when carrying hazardous cargo in bulk

- c) states that special requirements may be necessary for special types of ships or cargo, particularly with respect to:
 - i. the number of crew required on board



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- ii. the state of readiness of fire-fighting appliances and other safety equipment
 - iii. special port regulations
 - iv. communications with the shore in the event of an emergency arising
 - v. special precautions to prevent pollution of the environment
- d) states that the officer of the watch should be aware of the nature of the hazards and any special precautions necessary for the safe handling of cargo
- e) states that the officer of the watch should be aware of the appropriate action in the event of a spillage or fire
- f) describes the procedure for entry into enclosed spaces using a 'permit to work', and the monitoring of work in progress
- g) describes the arrangements and procedures for rescue from an enclosed space in an emergency

5.0 New amendments



TOTAL 36.0 Hrs

1.0 TERRESTRIAL NAVIGATION

1.1 Definitions - Earth (3.0 hrs)

- a) describes the earth as an ellipsoid
- b) states the approximate polar and equatorial circumferences of the earth
- c) defines 'great circle', 'small circle', 'spherical angle', 'poles of a great circle',
- d) defines axis of the Earth, 'earth's poles', 'equator' and 'meridians'
- e) defines 'parallels of latitude' and 'latitude', 'prime meridian' and 'longitude'
- f) defines 'difference of latitude' and 'difference of longitude'
- g) defines 'international nautical mile', 'cable' and 'knot'

1.2 Charts (3.0 hrs)

- a) demonstrates basic knowledge of chart projections
- b) identifies the Mercator chart as a mathematical projection and understands the principles of its construction.
- c) defines meridional parts and difference in meridional parts



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- d) defines natural scale of a chart
- e) discusses the use, advantages and limitations of a Gnomonic chart
- f) demonstrates the use of gnomonic charts for plotting the great circle between two points
- g) transfers the great circle to a Mercator chart

1.3 Sailing's

(6.0 hrs)

- a) defines rhumb line ,departure and middle latitude
- b) explains the relationship between departure and difference of longitude in cases involving a change of latitude, by using mean latitude
- c) proof of parallel sailing formula
$$\frac{\text{departure}}{\text{diff. of longitude}} = \text{cosine of latitude}$$
- d) calculates the distance between two positions on the same parallel of latitude
- e) calculates the difference of longitude for a given distance run along a parallel of latitude
- f) derives the final position after sailing along a parallel of latitude
- g) derives the plane sailing formula



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- h) applies the plane sailing formula in practical examples
- i) states the meaning of, and derives ,mean latitude
- j) applies the Mercator sailing formula in practical examples

1.4 Tides (1.0 hrs)

- a) explains the basic theory of tides

2.0 CELESTIAL NAVIGATION

2.1 Celestial sphere (3.0 hrs)

- a) classifies stars by apparent magnitude
- b) defines the celestial sphere
- c) defines 'celestial poles', celestial meridians', 'equinoctial' and the parallels of declination
- d) explains the apparent annual motion of the sun and the concept of the ecliptic
- e) defines obliquity of the ecliptic and Zodiac belt
- f) explains the equinoctial as a fixed reference plane and the direction of the first point of Aries as a reference direction (ignoring the effect of precession)
- g) explains the importance of the First Point of Aries
- h) defines the first point of libra, the observer's Zenith & Nadir, vertical circle and prime vertical



2.2 Equinoctial system of co-ordinates

(1.0 hrs)

- a) describes the equinoctial system of co-ordinates and defines declination, Sidereal hour angle and right ascension
- b) defines 'Greenwich Hour Angle (GHA)', 'Local Hour Angle (LHA)' and longitude, and explains their relationship

2.3 HORIZONTAL SYSTEM OF CO-ORDINATES

(1.5 hrs)

- a) describes the Horizontal system of co-ordinates and defines Rational horizon, True Altitude, Zenith distance, and Azimuth,
- b) recognises rising and setting points and defines amplitude
- c) determines the geographical position of a body for any given GMT

2.4 SOLAR SYSTEM AND KEPLER'S LAWS OF PLANETARY MOTION

(1.5 hrs)

- a) describes the composition and dimensions of the solar system
- b) names inferior and superior planets
- c) identifies planets useful for navigation



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- d) describes the earth's elliptical orbit and states approximate perihelion and aphelion distances and dates
- e) explain the eccentricity of the earth's orbit
- f) states the laws of planetary motion enunciated by Kepler

2.5 Day and night and the seasons on the Earth

(3.0 hrs)

- a) explains how the day and night occurs on the earth
- b) explains how the seasons occur on the earth
- c) describe the effects of seasons

2.6 APPARENT MOTION OF CELESTIAL BODIES

(3.0 hrs)

- a) describes the concept of the earth's axial rotation causing change in the hour angle of bodies
- b) states the rate of change of GHA of the sun and Aries
- c) distinguish between apparent motion and true motion of planets
- d) defines elongation, superior conjunction, inferior conjunction, opposition, and quadrature of a planet or the moon

2.7 NAUTICAL ALMANAC

(1.0 hrs)



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- a) explains the importance of the First point of Aries
- b) finds the LHA of Aries , given the date, GMT and longitude of the observer
- c) explains what is meant by the sidereal hour angle of a star and obtains it from the Nautical Almanac

2.8 Time and equation of time (3.0 hrs)

- a) defines sidereal day and states that it is a fixed time interval
- b) defines the apparent solar day and states the relationship between LHA (sun) and LAT (Local Apparent Time)
- c) explains the reasons for the variation in the duration of the apparent solar day and hence the necessity to adopt the astronomical mean sun for timekeeping purposes
- d) defines mean solar day
- e) defines GMT, LMT,GAT (Greenwich Apparent Time) and LAT (Local Apparent Time)
- f) states the relationship between longitude and the time
- g) defines standard time and Zone time
- h) explains what is meant by International Date Line



- i) explains how to alter the ship's time during a passage with increasing or decreasing longitude

2.9 SEXTANT AND ALTITUDE CORRECTIONS (3.0 hrs)

- a) describes the purpose of altitude correction
- b) defines Observer's visible horizon, sensible horizon, and rational horizon
- c) defines sextant altitude, observed altitude and true altitude
- d) defines dip, index error and apparent altitude
- e) defines 'dip', 'refraction', 'semi-diameter' and 'parallax', and explains their causes
- f) defines Augmentation of the moon's semi-diameter.
- g) defines parallax in altitude and horizontal parallax
- h) proves that parallax in altitude = Horizontal parallax X cos.app. altitude
- i) applies the corrections for the items listed as above and explains the factors determining their magnitude
- j) illustrates the effect of terrestrial refraction on the dip and distance of the sea horizon

2.10 AMPLITUDE (1.5 hrs)



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- a) extracts information from the tabulation of the rising and setting of the sun in the nautical almanac

2.11 POLE STAR OBSERVATIONS

(1.5 hrs)

- a) identifies Polaris
- b) describes the motion of the stars about Polaris
- c) describes the relationship between the altitude of Polaris and the observer's latitude
- d) deduces from above that the true altitude of Polaris can be used to find the latitude of the observer

TOTAL 36.0 Hrs

1.
1. TERRESTRIAL NAVIGATION

1.1 Definitions - Earth (2.7 hrs)

- a) defines Geographic poles and Equator



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- b) defines 'latitude' and 'parallels of latitude', 'prime meridian' and 'longitude'
- c) defines d'lat, d'long and mean latitude
- d) calculates the difference of latitude, difference of longitude and mean latitude between two positions

1.2 Position Reference

(0.3 hrs)

- a) defines dead reckoning position (DR), estimated position and fixed position

1.3 The Compass Error

(3.0 hrs)

- a) defines true, magnetic and compass north
- b) finds deviation and variation from tables
- c) calculates true course from compass course
- d) calculates compass course from true course
- e) measures compass error, using a transit bearing
- f) applies compass error to the ship's head and compass bearings to convert to true
- g) calculates the gyro compass error from a solar, stellar or planetary observation
- h) demonstrates the use of azimuth mirror, pelorus etc. for taking bearings



1.4 Sailing's

(6.0 hrs)

- a) explains the relationship between departure and difference of longitude in cases involving a change of latitude, by using mean latitude
- b) uses the parallel sailing formula:
$$\frac{\text{departure}}{\text{diff. of longitude}} = \cosine \text{ of latitude}$$
- c) calculates the course and distance between two positions on the same parallel of latitude
- d) calculates the difference of longitude for a given distance run along a parallel of latitude
- e) derives the final position after sailing along a parallel of latitude
- f) uses the plane sailing formulae
- g) calculates the correct departure to use in a plane sailing problem
- h) calculates the course and distance between two positions, using the plane sailing formula
- i) calculates a DR position or an estimated position by using the plane sailing formula, given compass course and compass error, distance by log, estimated speed, tidal and current information and leeway
- j) describes the layout of a traverse table



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- k) derives the information required in a parallel or plane sailing problem, using a traverse table or calculator
- l) solves problems of plane sailing, using a calculator
- m) applies the plane sailing formula in practical examples
- n) states the meaning of and derives mean latitude

1.5 Great Circles and Great Circle Sailings (2.5 hrs)

- a) calculates initial course and distance in great-circle sailing
- b) calculates the final course in great circle sailing
- c) describes the use of Napier's Rules
- d) defines the vertex of a great circle
- e) calculates the position of the vertex between two positions

1.7 Chronometer time (0.5 hrs)

- a) demonstrates the use of time signal
- b) calculates the error of a chronometer watch



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2. CELESTIAL NAVIGATION

2.1 The Celestial sphere and the nautical Almanac (3.5 hrs)

- a) defines the celestial sphere
- b) defines celestial poles, equinoctial, celestial meridians, and declination
- c) defines GHA, and LHA,
- d) explains what is meant by the sidereal hour angle of a star and obtains it from the Nautical Almanac
- e) derives the LHA of a star from the LHA of Aries and the SHA of the star
- f) describes the information contained in general in the Nautical Almanac (NA) and in detail in the daily pages
- g) uses the tables of corrections and incremental corrections in the Nautical Almanac
- h) identifies the tabulation of SHA, GHA, and declination (and 'd' and 'v' corrections) in the Nautical Almanac for all celestial bodies

2.2 Sextant and altitude corrections (0.5 hrs)

- a) defines 'sextant altitude'
- b) demonstrates how to read a sextant



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- c) shows how to correct a sextant into which has been introduced one or more of error of perpendicularity, side error or index error
- d) demonstrates how to find the index error of the sextant by the horizon
- e) describes how to find the index error of the sextant by the sun
- f) defines 'visible', 'sensible' and 'rational' horizons
- g) defines 'observed altitude, and 'true altitude'
- h) defines 'dip', 'refraction', 'semi-diameter' and 'parallax', and explains their causes
- i) applies index error
- j) applies the corrections for the items listed in above and explains the factors determining their magnitude
- k) uses the altitude correction tables in the Nautical Almanac, including reference to critical tables, interpolation tables and low-altitude correction tables
- l) obtains the true zenith distance from the true altitude of the body

2.3 Relationship between GHA, LHA and Longitude

(1.0 hrs)

- a) finds the GHA , given the LHA and longitude of the observer
- b) finds longitude of the observer , given the GHA and LHA



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- c) derives the LHA of a star from the LHA of Aries and the SHA of the star

2.4 Relationship between hour angle and time (1.0 hrs)

- a) defines GMT and LMT
b) finds the LHA , given the date, GMT and longitude of the observer
c) finds the LHA of Aries, given the date, GMT and longitude of the observer

2.5 Relationship between Local and Greenwich time (1.0 hrs)

- a) finds the LMT , given the GMT and longitude of the observer
b) finds the GMT , given the LMT and longitude of the observer
c) finds the longitude of the observer , given the GMT and LMT
d) defines zone times and standard times
e) explains how to alter the ship's time during a passage with increasing or decreasing longitude

2.6 Compass errors by Astronomical observations (6.0 hrs)



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- a) obtains the error of the magnetic compass or gyro-compass by comparing the compass bearing of the body with the true azimuth of the body obtained at the time of observation
- b) obtains the azimuth of the body from tables, using GMT of observation, information from the Nautical Almanac, LHA of the body and the observer's DR position
- c) obtains from tables or by calculation, using the observer's DR position and information from the Nautical Almanac, the true bearing of a heavenly body on rising or setting, i.e. solves an amplitude question.
- d) determines the observed altitude of the sun when the true altitude is zero
- e) explains the effect of latitude on the accuracy of amplitude observations
- f) calculates the LAT and LMT of the theoretical and visible rising and setting of the sun
- g) extracts information from the tabulation of the rising and setting of the sun in the Nautical Almanac

2.7 Theory of Astronomical position lines and position circles

(2.0 hrs)

- a) defines geographical position of a Heavenly body
- b) explains that the latitude of the GP of a heavenly body is equal to the declination of the body and that the longitude of the GP of the body corresponds to its GHA
- c) defines astronomical position circle
- d) defines astronomical position line
- e) explains why the direction of an astronomical position line is at right angles to the bearing of the observed body



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- f) combines the equinoctial and horizon system of co-ordinates to determine the centre and radius of a position circle and its direction in the vicinity of a selected position
- g) applies the principles of a method of enabling the navigator to draw a small part of the position circle in his vicinity to a practical problem
- h) states the assumptions made when plotting celestial position lines and the circumstances in which they may become significant
- i) determines the direction of a position line through an observer and a position through which it passes
- j) defines and evaluates the co-latitude, polar distance and zenith distance and uses them as the sides of the PZX triangle

2.8 Astronomical Position lines

(6.0 hrs)

2.8.1 Intercept method of sight reduction for

- i. sun
- ii. stars
- iii. planets
- iv. moon

- a) applies this calculated zenith distance to the true zenith distance of the body to find the intercept and the intercept terminal point through which to draw the position line (Marcq St. Hilaire method)
- b) determines the true azimuth of the body from tables and hence determines the direction of the position line

2.8.2 Latitude by meridian altitude method for

- i. sun
- ii. stars
- iii. planets



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iv. moon

- a) uses the information in the Nautical Almanac to obtain the LMT of the meridian passage of a body to the nearest minute and interpolates for the observer's longitude when necessary
- b) applies the true zenith distance of a body when it is on the observer's meridian to the declination of the body, to obtain the observer's latitude
- c) applies these correctly when the declination and latitude have the same name
- d) applies these correctly when the declination and latitude have different names
- e) states the direction of the position line through the observer when taking a meridian altitude



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TOTAL 36.0 Hrs

1. PLAN AND CONDUCT A PASSAGE AND DETERMINE POSITION

1.1 Ability to determine the ship's position by use of electronic navigational aids

1.1.1 ELECTRONIC SYSTEMS OF POSITION FIXING AND NAVIGATION

1.1.1.a Basic Principles of Hyperbolic Navigation Systems (2.0 hrs)

1.1 .1b Global Navigational Satellite systems

1.11b.1 GPS SYSTEM (2.0 hrs)

- a) describes the basic principles of the Global Positioning System
- b) describes the system configuration
- c) states the frequencies that are used
- d) describes the Dilution of Precision (DOP)
- e) states the various DOPs that are used
- f) describes the various errors of GPS
- g) describes the reasons for selective availability and the effect it has on the accuracy of a fix
- h) states the accuracy obtainable with GPS and how the accuracy can be downgraded



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1.1.4d.2 DGPS- Differential GPS (2.0 hrs)

a) describe the differential GPS system

1.1.4d.3 GLONASS (2.0 hrs)

a) describe the glonass system

1.1.4d.4 Galileo (2.0 hrs)

a) describe the Galileo System

1.2 ECHO SOUNDERS

1.2.1 Ability To Operate The System And Apply The Information (2.0 hrs)

- a) explains the types of echo sounders and their use
- b) explains the requirements with regard to the performance of echo sounders and identifies their limitations
- c) describes the basic principles of marine echo-sounding equipment
- d) identifies the main components on a simple block diagram of an echo-sounder, and states the function of each
- e) states the accepted value of the velocity of sound in sea-water and the limits within the true value may lie
- f) states the physical factors which affect the velocity of sound in sea-water



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- g) operates a typical echo-sounder and demonstrates an ability to carry out basic user maintenance, e.g. clean platen, change paper, change and adjust stylus
- h) distinguishes between range and phase, and demonstrates an awareness of the dangers of using the wrong phase
- i) recognises the various types of 'false' echo that may be observed, describes their formation and states the possible action to remove them from the trace
- j) describes the potential errors due to trim, heel and transducer separation

1.3 Speed measurement logs

Doppler and Electro magnetic Logs (3.0hrs)

Use Doppler and Electromagnetic logs to measure the speed and distance travelled, and speed of approach of the ship

- a) states the difference between ground-reference speed and water-reference speed
- b) describes the basic principles of the electromagnetic speed log
- c) describes the basic principles of the pressure-tube log
- d) explains the necessity of withdrawal of the tube before entering port
- e) describes the basic principles of the acoustic-correlation log
- f) describes the basic principles of the Doppler speed log



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- g) explains the 'Janus' configuration to counteract the effect of ship's trim
- h) explains the dual-axis configuration and its use during docking operations
- i) lists the main error sources on the various types of the logs
- j) states the accuracies of the various systems
- k) describes how ship's speed is transmitted to remote displays
- l) draws a schematic diagram showing how an indication of distance run is derived from a speed log
- m) outlines the requirements with regard to the performance of logs

1.4 THE MAGNETIC COMPASS (2.0 hr)

- a) describes the construction of a liquid card magnetic compass
- b) sketches a section through the compass to show the float chamber, the pivot support and the arrangement of magnets
- c) explains how the card is kept practically horizontal in all latitudes
- d) states the composition of the liquid and explains how allowance is made for changes in volume of the liquid



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- e) describes how to remove an air bubble from the compass bowl
- f) describes how to check that the card is turning freely on its pivot
- g) explains how the compass bowl is supported in the binnacle
- h) describes the marking of the lubber line and its purpose
- i) describes a binnacle and the arrangement of correcting devices provided
- j) describes 'deviation' and states how it is named
- k) explains the need for regular checking of the compass error
- l) explains why regular comparisons of standard compass, steering compass and gyro-compasses should be made
- m) explains that the approximate error of the standard compass can be obtained by comparison with the gyro-compass if no other means is available
- n) demonstrates taking bearings of celestial bodies and landmarks

1.5 THE GYRO COMPASS (2.0 hr)

- a) describes a free gyroscope and its gimbals mountings
- b) states that in the absence of disturbing forces the spin axis of a free gyroscope maintains its direction in space



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- c) explains what is meant by gyroscopic inertia and precession
- d) describes the precession resulting from a torque about axes perpendicular to the spin axis
- e) explains that friction at gimbal pivots produces torque's which give rise to precession
- f) states that the rate of precession is proportional to the applied torque
- g) states the necessary time for the compass to settle after switching on prior to sailing
- h) lists the settings to be made or adjusted while the compass is in use
- i) explains how the repeater system is switched on and aligned with the master gyro-compass
- j) describes the alarms fitted to a gyro-compass

2.0 Maintaining a Safe Navigational Watch

2.1 The use of information from navigational equipment for maintaining a safe navigational watch

2.1.1 AUTOMATIC IDENTIFICATION SYSTEM - AIS (3.0 hrs)

- a) explains the carriage requirement of AIS
- b) explains the basic principle of AIS



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- c) describes the AIS communication scheme
- d) describes the AIS Messaging types
- e) explains the interface of other shipboard equipment to AIS
- f) explains the AIS Standards
- g) explains the operational maintenance to be carried out to AIS equipment

2.1.2 VOYAGE DATA RECORDER (3.0 hrs)

- a) explains the carriage requirement of VDR and SVDR
- b) explains the principle of VDR and SVDR
- c) explains the difference between VDR and SVDR
- d) describes the VDR standards

2.1.3 LONG RANGE IDENTIFICATION AND TRACKING (LRIT) (3.0 hrs)

- a) explains the carrying requirement of the LRIT
- b) describes the operational requirements
- c) explains the principle of operation



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- d) describes the contents of a LRIT message

2.1.4 SEXTANT (5.0 hrs)

- a) explains the principle of the sextant
- b) explains the Principles of operations of the sextant
- c) describes the use of sextant and its limitations
- d) lists and identifies the errors of the sextant
- e) demonstrates how to read a sextant
- f) demonstrates how to find the index error of the sextant
- g) uses the sextant for taking vertical and horizontal angles.
- h) demonstrates the elimination of adjustable errors.
- i) identifies the care and maintenance requirements of sextants.

**2.1.5 USE CHRONOMETERS FOR ACCURATE TIME KEEPING AND MEASUREMENT
(2.0 hrs)**

- a) explains the use of chronometers



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- b) explains identification of Significant of time signals
- c) explains and demonstrates the obtaining of appropriate time signals.
- d) demonstrates the method of obtaining the error of a chronometer
- e) and error record keeping.
- f) identifies the care and maintenance requirements for chronometers

2.1.6 Bridge Navigation Watch Alarm System (BNWAS) (1.0hrs)

TOTAL 36.0 Hrs

1.

1.1 GEOMETRY

(6.0 hrs)

1.1.1. types of angles (acute, obtuse and reflex angles).

1.1.2. Relationships between angles formed by a transversal to two parallel straight lines.



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1.1.3. Properties of equilateral, isosceles, right-angled and scalene triangles.

1.1.4. Define polygon

1.1.5. Define Sum of the angles of a plane triangle and polygon, property of exterior angles.

1.1.6. Pythagoras's theorem and applications.

1.1.7. An arc (of a sector), a chord and a segment of a circle.

1.1.8. Angles subtended by a chord and their properties.

1.1.9. define a quadrilateral, a parallelogram, a trapezium and a rhombus.

1.1.10. Constructions:

To divide a line in to two equal parts, to draw a perpendicular from a given point on a straight line, to draw a perpendicular line from a given point which is not on the line, to construct an angle of 60° , to bisect a given angle, to draw the circumscribed and inscribed circle of a given triangle.



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1.2 TRIGONOMETRY

(15.0 hrs)

- 1.2.1 describes the measurement of angles in degrees and radians
- 1.2.2 sketches and names the following angles: obtuse, right, complementary, Supplementary and reflex
- 1.2.3 defines a degree as $1/360$ of a revolution and a minute as $1/60$ of a degree
- 1.2.4 defines a radian
- 1.2.5 converts angular measurement into radians and vice versa
- 1.2.6 defines sine, cosine and tangent
- 1.2.7 applies positive and negative values as appropriate to the sines, cosines and Tangents of angles between 00 and 360
- 1.2.8 applies numerical solutions in respect of the side and angles of a right-angled Triangle
- 1.2.9 solves problems, given the equations, using the sine rule, the cosine rule



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1.2.10 demonstrates trigonometric identities

1.2.11 states double angle, half angle and triple angle formulas

1.2.12 Graphing trigonometric functions

1.3 MENSURATION

(4.5 hrs)

1.3.1 states and applies formulae to find the area of the following

1.3.1.1 A circle

1.3.1.2 A sector of a circle

1.3.1.3 A triangle

1.3.1.4 A parallelogram

1.3.1.5 A trapezium

1.3.1.6 A rhombus

1.3.2 states the position of the centroid of common regular shapes



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- 1.3.3 State a formula for the areas of a segment of a circle
- 1.3.4 defines volume, for shapes having a constant cross-sectional area, as the Product of area and length
- 1.3.5 applies formulae to find the volume of the following:
- 1.3.5.1 A cube
 - 1.3.5.2 A cuboid
 - 1.3.5.3 A cylinder
 - 1.3.5.4 A sphere
 - 1.3.5.5 A prism
 - 1.3.5.6 A cone
 - 1.3.5.7 A pyramid
- 1.3.6 defines centre of volume
- 1.3.7 states the position of the centre of volume of common solids



1.4 CONIC SECTIONS

(4.5 hrs)

- 1.4.1 Define conic section
- 1.4.2 Defines an ellipse
- 1.4.3 Explain centre, vertex, locus, foci, directrix
- 1.4.4 Explain major/minor axis, semi-major/semi-minor axis of an ellipse
- 1.4.5 State properties of an ellipse.
- 1.4.6 Define eccentricity
- 1.4.7 the eccentricity of an ellipse $0 < e < 1$
- 1.4.8 State equation of ellipse
- 1.4.9 application of ellipses.
- 1.4.10 Solve questions from ellipse



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1.5 VECTOR ALGEBRA

(6.0 hrs)

1.5.1 Define vector.

1.5.2 uses the notations \overline{AB} or \underline{v} to indicate vectors and AB or \underline{v} or level to indicate the lengths of vectors.

1.5.3 the vector sum of two or more vectors.

1.5.4 states that $-a$ is a vector of the same magnitude but opposite direction to \underline{a} .

1.5.5 difference between two vectors by graphical methods.

1.5.6 shows that $c(a + b) = ca + cb$, where c is a scalar constant.

1.5.7 resolves a given vector into components in two specified perpendicular directions.

1.5.8 expresses a vector in terms of components, $\underline{r} = x\mathbf{i} + y\mathbf{j}$. where: x and y are scalar position vectors.

1.5.9 solves problems involving vectors



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TOTAL 36.0 Hrs

1.1 1.

GENERAL PHYSICS

25.5 hrs

1.1.1 Units and Measurements

1.1.1.1 Explain international systems of units-length, mass, and time.

1.1.1.2 Explain changing units

1.1.2 SCALARS AND VECTORS

1.1.2.1 introduction of scalar quantities and scalars, introduction of vector quantities and vectors.

1.1.3 EQUATIONS OF MOTION

1.1.3.1 Introduce displacement - time graphs, Velocity- time graphs

1.1.3.2 State constant acceleration equations

1.1.3.3 Calculation of motion in a straight line with constant acceleration/deceleration (retardation).

1.1.4 NEWTON'S LAWS OF MOTION

1.1.4.1 State Newton's first law, second law, third law.

1.1.4.2 Explain motion under frictional force, friction and coefficient of friction.

1.1.4.3 Explain uniform circular motion



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1.1.5 GRAVITY

- 1.1.5.1 Explain vertical/ horizontal motion under gravity.
- 1.1.5.2 Explain vertical/ horizontal motion under gravity.
- 1.1.5.3 Introduce projectiles.
- 1.1.5.4 Define Newton's law of gravitation, gravitation force between two bodies
- 1.1.5.5 Explain gravitation near Earth's surface, gravitation inside the Earth, gravitational potential energy, Satellite motion.
- 1.1.5.6 Explain work done against gravity
- 1.1.5.7 Explain kinetic energy, potential energy, change of energy of a particle.

1.1.6 WORK, ENERGY , POWER AND EFFICIENCY

- 1.1.6.1 State static Moment of a force.
- 1.1.6.2 problem involving pulleys
- 1.1.6.3 Explain conservation of momentum.

1.2 THERMAL PHYSICS

(4.5 hrs)

- 1.2.1 conversion between Kelvin, Celsius and Fahrenheit scales
- 1.2.2 Explain linear expansion, volume expansion
- 1.2.3 Explain the absorption of heat by solids and liquids
- 1.2.4 State Boil's law in thermodynamics



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1.2.5 State Charles's law in thermodynamics

1.3 WAVES

(6.0 hrs)

- 1.3.1 Explain types of waves (Mechanical, electromagnetic, matter waves), transverse and longitudinal waves, wavelength.
- 1.3.2 Explain sound waves, the speed of sound, the speed of a traveling sound waves.
- 1.3.3 Explain light and, reflection and refraction laws of light



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ENVIRONMENTAL AWARENESS

TOTAL 18.0 Hrs

Competence	Ref. No	Knowledge, understanding and proficiency	Course Notes ref. no
11.1 Ensure compliance with pollution-prevention requirements	11.1.1 11.1.1.1 11.1.1.1.1 11.1.1.1.2 11.1.1.2 11.1.1.2.1	MARINE ENVIRONMENTAL AWARENESS Importance of protective measures to protect the marine environment Introduction Global context Recognize the importance of shipping for the world economy Recognize the environment impact of shipping Sustainable shipping Describe sustainable shipping <ul style="list-style-type: none">• Define sustainable development as a balance of three Ps - People, Planet, Profit• Explain the meaning of the three Ps• Recognize the need for sustainable shipping	



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	11.1.1.3 11.1.1.3.1 11.1.1.4	Marine environmental awareness Recognize the role of the human element (people in shipping) in pollution prevention Course review	
	11.1.2 11.1.2.1 11.1.2.2	Personal opinions Express a personal opinion about current environmental challenges (problems) for the shipping industry Relate his/her opinion to the opinions of others trainees	
	11.1.3 11.1.3.1 11.1.3.1.1	Marine environment Importance of the oceans Describe why the oceans are of vital importance for humankind <ul style="list-style-type: none"> • Recognize that 60% of the world population lives near the sea • Explain the importance of the oceans as a source of food • Explain the importance of the oceans for the global climate 	
	11.1.3.2 11.1.3.2.1	Marine ecology Describe the basic principles of marine ecology	



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		<ul style="list-style-type: none">• Recognize the importance of phytoplankton (primary production) as the basis of sea life• Give an example of a food chain• Describe the principle of energy flow in the food chain• Describe the principle of energy loss in the food chain (10% rule)• Describe the importance of bacteria and viruses (nutrient cycle)• Recognize that food chains are connected in complex food webs	
	11.1.3.3	Difference between coastal seas and open oceans	
	11.1.3.3.1	Compare coastal seas and open oceans <ul style="list-style-type: none">• Describe the difference in living circumstances between open oceans and coastal seas, including but not limited to availability of nutrients• Describe the difference in food chain length between open oceans and coastal seas• Recognize the diversity and abundance	



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	11.1.3.4 11.1.3.4.1	of life in coastal seas Particularly Sensitive Sea Areas (PSSAs) Recognize that IMO has established Particularly Sensitive Sea Areas (PSSAs) to protect marine areas from shipping activities <ul style="list-style-type: none"> • List existing PSSAs • List potential protective measures in PSSAs 	
	11.1.4 11.1.4.1	Regional marine area Describe a regional or local marine area of choice <ul style="list-style-type: none"> • Describe the area • List forms of marine life that live there • Give an example of a food chain in this area • Give an example of the importance of the area for humans 	
	11.1.5 11.1.5.1 11.1.5.1.1	Discharges to the sea Environmental impact of oil, chemicals, sewage and solid waste Describe the impact of oil in the marine environment <ul style="list-style-type: none"> • Recognize the varied and complex 	



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	11.1.5.1.2	<p>composition of oil and oil products</p> <ul style="list-style-type: none">• List processes that determine the fate of oil in the marine environment• Describe ecological impacts of oil in the marine environment• Describe economic impacts of oil in the marine environment• Recognize the contribution of shipping to the discharge of oil to the sea• Describe the relative contribution of accidents and operational discharge of oil from ships <p>Describe the impact of chemicals in the marine environment</p> <ul style="list-style-type: none">• Describe ways chemicals enter the marine environment from a ship• List reasons why a chemical might be hazardous• Define the terms acute toxicity and chronic toxicity• Define the term bioaccumulation• Define the term biodegradation• Describe ecological impacts of chemicals in the marine environment	
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	11.1.5.1.3	Describe the impact of sewage in the marine environment <ul style="list-style-type: none">• Define the term sewage• Describe the ecological impact of sewage in the marine environment	
	11.1.5.1.4	Describe the impact of solid waste in the marine environment <ul style="list-style-type: none">• Define the term solid waste• Describe how long it takes for plastic to degrade in the marine environment• Recognize the worldwide distribution of marine environment• Recognize the existence of pools of garbage in the Pacific (plastic soup)• Describe ecological impacts of marine litter• Give examples of ingestion of marine litter• Give examples of entanglement• Describe the problem of micro plastics• List economic sectors that are affected by marine litter• Describe the contribution of shipping to	



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		the marine litter problem	
	11.1.5.2	Pollution prevention measures	
	11.1.5.2.1	List procedures designated to prevent discharges to the sea, including but not limited to waste collection procedures in ports and waste treatment on board	
	11.1.5.2.2	List technical installations or innovations designated to prevent discharges to the sea, including but not limited to oil waste separators	
	11.1.6	Reputation of shipping	
	11.1.6.1	Recognize the value IMO places on a good reputation	
	11.1.6.2	State his/her personal opinion about the image (reputation) of shipping <ul style="list-style-type: none"> • Describe his/her views on the image of shipping; how other people see the shipping sector • List factors that influence the image of shipping • Recognize how a good reputation can be a valuable asset for the shipping sector • List actions he/she can take to improve the reputation of shipping 	



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11.1.6.3	Relate his/her opinion to the opinions of other trainees	
11.1.7	Emissions to air, greenhouse gases	
11.1.7.1	Environmental impact of emissions of greenhouse gases	
11.1.7.1.1	Describe the impact of greenhouse gases on the global climate <ul style="list-style-type: none">• Define climate change• Describe the greenhouse effect• Explain the connection between CO₂ emissions and climate change• Recognize the contribution of mankind to climate change• Recognize the difficulty of predicting the future consequences of climate change• List (potential) consequences of climate change	
11.1.7.1.2	State the contribution of shipping to worldwide CO ₂ emissions	
11.1.7.2	Pollution prevention measures <ul style="list-style-type: none">• List procedures and/or technical	



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		installation designed to minimize the emissions of greenhouse gases from shipping	
	11.1.8	Other emissions to the air	
	11.1.8.1	Environmental impact of engine emissions (SO _x , NO _x , PM)	
	11.1.8.1.1	List main chemical compounds in air emissions from ship engines (SO _x , NO _x , PM)	
	11.1.8.1.2	Recognize how these compounds are formed in ships engines	
	11.1.8.1.3	Describe the environmental impacts of engine emissions <ul style="list-style-type: none"> • Describe the process of acidification • List effects of acidification • Explain the connection between SO_x and NO_x emissions and acidification 	
	11.1.8.1.4	Describe the main human health hazards connected to air quality <ul style="list-style-type: none"> • Explain the direct connection between PM and human health • Explain the contribution of SO_x, NO_x and PM emissions to smog • Recognize the adverse impact of smog 	



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	11.1.8.1.5	to human health Describe the contribution of shipping to the problems with air emission <ul style="list-style-type: none">• Identify engine emissions as an important source of air emissions from ships• Describe the link between fuel quality and ship emissions	
	11.1.8.2	Other air pollutants from ships <ul style="list-style-type: none">• List other air pollutants from ships, including Ozone Depletion Substances	
	11.1.8.3	Pollution prevention measures <ul style="list-style-type: none">• List procedures and/or technical installations designed to minimize engine emissions (SOx, NOx, PM)	
	11.1.9	Introduction of invasive species and the ballast water convention	
	11.1.9.1	Environmental impact of transfer of species Describe the impact of the introduction of invasive species <ul style="list-style-type: none">• Define the term invasive species• Describe the transfer of species through	



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		<p>ballast water</p> <ul style="list-style-type: none">• Describe problems associated with the interdiction of alien species• Give examples of the ecological impact of invasive species• Give examples of the economic impact of invasive species• Give examples of the impact of invasive species on human health	
	11.1.9.2	Pollution prevention measures	
	11.1.9.2.1	Describe the procedure of mid ocean ballast water mammals	
	11.1.9.2.2	Explain the advantages/disadvantages of mid ocean ballast water exchange	
	11.1.9.2.3	List ballast water treatment methods	



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	11.1.10 11.1.10.1 11.1.10.2 11.1.10.3	<p>Other impacts to the marine environment</p> <p>Environmental impact of underwater noise</p> <ul style="list-style-type: none"> Describe the impact of underwater noise on marine mammals <p>Environmental impact of antifouling paint</p> <ul style="list-style-type: none"> Describe the list of hazardous material on ships <p>Environmental impact of recycling of ships</p> <ul style="list-style-type: none"> Describe the impact of recycling of ships 	
	11.1.11 11.1.11.1 11.1.11.2 11.1.11.3	<p>Pollution prevention measures</p> <p>Recognize the importance of MARPOL regulations and other relevant IMO conventions in minimizing the impact of shipping on the marine environment</p> <p>Recognize the wide range of pollution prevention measures (procedures, technical installations and innovation) available to prevent pollution to the marine environment</p> <p>State his/her personal opinion:</p> <ul style="list-style-type: none"> Identify available pollution prevention measures for (a selection of) environmental challenges Identify who is responsible for (a 	



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11.1.11.4	selection of) pollution prevention measures Relate his/her opinion to the opinions of other trainees	
11.1.12	Personal involvement and personal responsibilities	
11.1.12.1	Personal behaviour Describe the role of personal responsibility towards the environment <ul style="list-style-type: none">• Recognize the importance of officer and crew behavior for pollution prevention• Give examples where proper behavior contributes significantly to pollution prevention	
11.1.12.2	Personal responsibility Recognize his/her personal responsibility towards the environment <ul style="list-style-type: none">• Describe his/her (future) responsibilities with regard to environment care of shipping• List actions he/she (can) take to ensure compliance with requirements	
11.1.12.3	Officer responsibility Be aware of his/her (future) position as an	



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		officer as an example for the rest of the crew <ul style="list-style-type: none">• Recognize the influence he/she has on the environmental behavior of ratings• Recognize the need to motivate the crew to commit themselves to their tasks and to further improve competence, attitudes and motivation of individuals at all levels, as stated in the ISM Code• Identify actions he/she can take to ensure better compliance by ratings	
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COMPUTER NETWORKING AND HARDWARE

TOTAL 60.0 Hrs

Competence	Ref. No	Knowledge, understanding and proficiency	Course Notes ref. no
N/A	1.1	Introduction to computers	
	1.1.1	Explain the functionality of CPU / Microprocessors	
	1.1.2	Components of a simple central processing unit	
	1.1.3	Identify the Memory types (RAM, ROM, PROM, CACHE)	
	1.1.4	Identify HDD, Floppy drive , CD drive	
	1.1.5	Input devices (Keyboard, Mouse, Scanner, Microphone, Barcode reader etc.)	
	1.1.6	Output devices (VDU , Speaker, Plotter etc.)	
	1.1.7	Printers :- Dot Matrix, Laser, Inject	
	1.2	Using special purpose application programs	
	1.2.1	Installing Windows, Virus Guard (Practical)	
	1.2.2	Taking back up before reinstalling windows or Virus guard	
	1.2.3	Updating virus guard and repair	



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	1.2.4	Using recovery	
	2.0	Operating systems (MS Windows 2000/XP / Vista)	
	2.1	What is the windows	
	2.2	The windows 2000/xp/vista desktop	
	2.3	Explain window navigation (Open / Close / Minimize / Maximize)	
	2.4	Describes Icons and Group	
	2.5	Explain Start and shutdown procedure	
	2.6	Perform My computer / control panel / Printer setup options	
	2.7	Explain Windows explorer	
	3.0	MS Excel	
	3.1	Introduction to spread sheet package	
	3.2	Moving around in a work sheet	
	3.3	Formula bar	
	3.4	Entering, editing, formatting data	
	3.5	Copy, cut, paste the data	
	3.6	Basic mathematical calculations	
	3.7	Make tables & graphs.	
	3.8	Printing worksheet and graphs.	



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	3.9	Making Megger insulation test reports	
	3.10	Work done reports	
	4.0	MS Access	
	4.1	Introduction to Database management soft wear	
	4.2	Introduction to MS Access	
	4.3	Components of a database	
	4.4	MS Access Application	
	5.0	Number System& Logic Gates	
	5.1	An Introduction to: <ul style="list-style-type: none">• Decimal• Binary• Octal• Hexadecimal	
	5.2	Gates <ul style="list-style-type: none">• AND• OR• NAND,• NOR• XOR,	



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5.3	Simplification of, truth tables	
6.0	Computer Networking	
6.1	Types of Topologies <ul style="list-style-type: none">• Bus• Star• Ring• Mesh• Tree	
6.2	Types of Networks <ul style="list-style-type: none">• LAN• MAN• CAN• PAN• WAN	
6.3	Net working <ul style="list-style-type: none">• Explains OSI/ISO Model 7 Layers• Introduction to types of – lan / wan lasses –Advantage Disadvantage Ethernet Switch• Introduction to ethernet Switch Cable Type / Connector	



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		<ul style="list-style-type: none"> • Explain to Cable Type / Connector Cable Color Code <ul style="list-style-type: none"> • Explain to Cable Color Code Network Card <ul style="list-style-type: none"> • Introduction to type of network card • Introduction to PC interfacing • Explain to using of interfacing. Pc interfacing in large network systems <ul style="list-style-type: none"> • Explain to network systems • Explain how to make network systems 	
	7.0	Internet & Email	
	7.1	Mail Concepts	
	7.1.1	Emails and their uses, Structure of an email address	
	7.1.2	Sending attachments	
	7.1.3	To, Cc, Bcc fields and recognize their appropriate use	
	7.1.4	Unsolicited emails	
	7.1.5	Define the term phishing	
	7.2	Using E-mail	
	7.2.1	Sending E-mail, Access an Email account	
	7.2.2	Inbox, outbox, send, Deleted/Trash Items, Draft, Spam/Junk	
	7.2.3	Create an e mail & distribution list	



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	7.2.4	Enter an appropriate title in the subject field and enter, paste text into the body of an e mail.	
	7.2.5	Add, remove a file attachment, Send on e mail with without priority	
	7.3	Receiving E – Mail	
	7.3.1	Open, Close an e-mail	
	7.3.2	Reply & Forward	
	7.3.3	Open, save a file attachment to a location.	
	7.3.4	Enter an appropriate title in the subject field and enter, paste text into the body of an e mail.	
	7.3.5	Add, remove a file attachment, Send on e mail with without priority	