DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MERCHANT SHIPPING SECRETARIAT
Ministry of Ports & Civil Aviation
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01. Navigation (Total number of hours - 60)

Ref No	*Knowledge, Understanding and Proficiency*	*DURATION (HRS)*	*COURSE NOTE REF. NO*
1.0	**Terrestrial Navigation**		
1.1	**Definitions - Earth**	**04**	
a)	defines 'great circle', 'small circle', 'spherical angle', 'spherical triangle', 'poles of a great circle',		
b)	defines 'earth's poles', 'equator' and 'meridians'		
c)	defines 'latitude' and 'parallels of latitude', 'prime meridian' and longitude'		
d)	defines 'difference of latitude' and 'difference of longitude'		
e)	describe the earth as an ellipsoid. defines 'compression', and states its value		
f)	defines 'international nautical mile', 'cable' and 'knot'		
1.2	**Charts**	**03**	
a)	defines 'nautical scale' of a chart		
b)	states the requirements of a chart appropriate for marine navigation		
1.3	**Datum's**	**03**	
a)	defines directions on the earth's surface		

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b)	describes the direction indicated by the gyro-compass		
c)	describes the direction indicated by the magnetic compass		
d)	describes the direction of the ship's head on a gyro-compass (gyro course)		
e)	describes the direction of the ship's head on a magnetic compass course)		
1.4	**Compass corrections**	**03**	
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 bearings of a charted object and lays the true bearing off the chart		
g)	Checks compass errors by azimuths of sun and stars		
1.5	**Distances**	**0.5**	
a)	demonstrates how to measure the distance between two positions on a Mercator chart		
1.6	**Position lines and positions**	**3.0**	
a)	defines a position		
b)	plots a position on the chart from simultaneous cross bearings and from bearing and distance off		
c)	defines 'dead reckoning position (DR)', 'estimated position' and 'fixed position'		
d)	plots a dead reckoning position on the chart		

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e)	plots an estimated position on the chart		
f)	finds a position by simultaneous bearings of two objects		
1.7	**Sailings**	**3.0**	
a)	solves problems of DR and fixing positions, using plotting charts		
1.8	**Chart work exercises**	**4.5**	
a)	defines 'course' and 'distance'		
b)	lays off true course between two positions		
c)	finds the distance between two positions		
d)	calculates the speed between two positions		
1.9	**Information from charts, lists of lights and other publications**	**3.0**	
a)	identifies the characteristics and range of lights		
b)	interprets chart abbreviations		
1.10	**Keeping a log**	**3.0**	
a)	lists the rule s, regulations and common practice regarding keeping a log		
b)	describes the proper keeping of different kinds of log during ocean passages, coastal navigation		

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c)	and in port.		
1.11	**Chronometer time**	**1.0**	
a)	demonstrates the use of time signal		
b)	calculates the error of a chronometer watch		
2.0	**Celestial Navigation**		
2.1	**Celestial sphere and equinoctial system of co-ordinates**	**3.0**	
a)	defines the celestial sphere		
b)	explains the apparent annual motion of the sun and the concept of the ecliptic		
c)	defines 'celestial poles', celestial meridians', 'equinoctial' and the 'obliquity of the ecliptic'		
2.2	**Sextant and altitude corrections**	**3.0**	
a)	defines 'sextant altitude'		
b)	demonstrates how to read a sextant		
c)	uses the sextant for taking vertical and horizontal angles		
2.3	**Relationship between GHA,LHA and Longitude**	**3.0**	
a)	finds the GHA , given the LHA and longitude of the observer		
b)	finds longitude of the observer , given the GHA and LHA		
c)	derives the LHA of a star from the LHA of Aries and the SHA of the star		

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2.4	**Relationship between hour angle and time**	**3.0**	
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**	**3.0**	
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	**Universal time and Co-ordinated Universal time**	**3.0**	
a.	relationship between the longitude and time		
b.	defines standard time		
c.	defines zone time		
d.	defines UTC and GMT		
e.	International date line and calendar line		

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2.7	**Compass errors by Astronomical observations**	**6.0**	
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 problem		
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		
2.8	**Nautical Almanac**	**3.0**	
a)	describes the information contained in general in the Nautical Almanac (NA) and in detail in the daily pages		
b)	uses the table of corrections and incremental corrections in the Nautical Almanac		

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2.9	**Theory of Astronomical position lines and position circles**	**2.0**	
a)	defines geographical position of a Heavenly body		
	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		
b)	defines astronomical position circle		
c)	defines astronomical position line		
d)	explains why the direction of an astronomical position line is at right angles to the bearing of the observed body		
e)	determines the direction of a position line through an observer and a position through which it passes		
f)	defines and evaluates the co-latitude, polar distance and zenith distance and uses them as the sides of the PZX triangle		

02. Meteorology (Total number of hours - 30)

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			NO
1.1	**Ship-borne meteorological instruments**	**6.0**	
a)	States the basic principle of an aneroid barometer		
b)	States the basic principle of a mercurial barometer		
c)	Reads the atmospheric pressure from an ordinary aneroid barometer		
d)	Reads the temperature from a thermometer		
e)	States the function of a hygrometer		
f)	States the basic principles of wind sensors, takes and logs ordinary readings of wind speed		
1.2	**The atmosphere, its composition and physical properties**	**3.0**	
a)	Describes the composition of the earth's atmosphere, mentioning dry air and its constituents, water vapour and aerosols		
b)	Draws and labels a typical vertical temperature profile through the lower 100 km of the earth's atmosphere		
c)	Defines 'troposphere', 'tropopause', 'stratosphere', 'stratopause', 'mesosphere', 'menopause' and 'thermosphere'		
d)	Describes the main features of the troposphere		
e)	States the importance of the sun as the principal energy source for atmospheric process		
f)	Describes the nature of solar radiation (scattering reflection and absorption)		
g)	Explains the effect on insulation of a variation in latitude		
h)	Explains the effect on insulation of a variation in the sun's declination		
i)	Explains the effect on insulation of a variation in the length of daylight		

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j)	Defines 'water vapour'		
k)	Describes the properties of water vapour in the atmosphere		
l)	Defines 'evaporation', 'condensation', latent heat of vaporization		
m)	Defines 'saturated air'		
n)	Describes the processes of mixing, cooling and the evaporation of water vapour, by which a sample of air may be brought to saturation		
o)	Defines 'dew point', 'absolute humidity ', 'relative humidity', 'vapour pressure'		
1.3	**Cloud and precipitation**	**6.0**	
a)	explains the components and formation of hydrological cycle		
b)	explains that clouds form when air containing water vapour rises, cools adiabatic ally and becomes saturated		
c)	states the need for and defines condensation nuclei		
d)	states that a cloud can consist of ice crystals, super-cooled water droplets, water droplets or any combination of these		
e)	names and describes the ten basic cloud types		
f)	States the probable base heights of the ten principal cloud types		
g)	Defines 'precipitation'		
h)	Defines 'rain', 'drizzle', 'hail', 'snow' and 'sleet'		
1.4	**Atmospheric pressure**	**3.0**	
a)	States that pressure equals force per unit area		

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b)	States that the atmosphere exerts a pressure on any surface placed within it		
c)	States that the atmospheric pressure on a unit area of a surface is equal to the weight of the 'air column' extending from that surface to the outer fringes of the atmosphere		
d)	Explains that atmospheric pressure decreases with height above sea level		
e)	States that atmospheric pressure acts in all directions		
f)	States that the basic unit of pressure is n/m^2		
g)	State that 1 millibar = $_{1\,0}{}^{-3}$ bar = 10^2 n/m^2		
h)	States that 1 hectopascal (hpa) – 1 millibar		
i)	States that the average pressure at sea level is 1013.2 mbar		
j)	Explains that the surface pressure rises if air is added to the 'column' above the surface, and vice versa		
k)	Defines 'isobar'		
1.5	**Wind**	**6.0**	
a)	Defines ' wind '		
b)	Describes the Beaufort scale of wind force		
c)	Explains qualitatively the pressure gradient force		
d)	Explains qualitatively the Coriolis (geostrophic) force		
e)	Explains the surface wind circulation around high- and low-pressure centers		
f)	Inserts surface wind directions on a map showing pressure distribution and indicates relative wind speeds at various places within the pressure field		
g)	States buys-ballot's law		
h)	Explain the method of estimating the strength of the wind from the appearance of the sea surface, using the Beaufort wind scale		

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i)	States the factors, other than the wind speed, which affect the appearance of the sea surface		
j)	Explains the difference between apparent and true wind		
k)	Determines the true wind velocity by using a vector diagram, given the apparent wind and the ships course and speed		
l)	Describes the method of estimating the wind direction from the appearance of the sea surface		
m)	Demonstrates the use of a geostrophic wind scale		
1.6	**Visibility**	**6.0**	
a)	States that visibility is reduced by the presence of particles in the atmosphere, near the earth's surface		
b)	Defines 'fog', 'mist' , 'haze '		
c)	Applies the concept of processes leading to super saturating to a classification of fogs as mixing, cooling or evaporation fogs		
d)	Explains qualitatively the formation of radiation fog, mentioning areas, seasons and reasons for its dispersal		
e)	States the effect of pollution on the formation of radiation fog		
f)	Explains qualitatively the formation of addiction fog, mentioning areas, seasons and reasons for dispersal		
g)	Explains qualitatively the conditions leading to the formation of sea smoke, and typical areas where sea smoke may be encountered		
h)	Describes methods of estimating the visibility at sea, by day and by night, and the difficulties involved		

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03. General Ship Knowledge (Total number of hours - 30)

Ref No	*Knowledge, Understanding and Proficiency*	*DURATION (HRS)*	*COURSE NOTE REF. NO*
	SHIP CONSTRUCTION (I)		
1.	**Ship dimension and form**		
1.1	**Definitions**	**3.0**	
a)	Defines and illustrates camber, rise of floor, tumblehome, flare, sheer, rake, parallel middle body, entrance and run.		
b)	Defines Forward perpendicular FP, after perpendicular AP, Length between perpendiculars LBP, Length on the water line LWL, Length overall LOA, base line, molded depth beam and draft, extreme depth beam and draft.		
1.2	**General Arrangements of Vessels Types**	**3.0**	
a)			
b)	Illustrates the general arrangement of the following ship types. General cargo, tankers, bulk carriers , combination carriers , container , ro-ro ,passenger		
c)	Draws an elevation of a general cargo ship showing hold , engine room, peak tanks, db tanks , hatchways and positions of bulkheads.		
d)	Draws an elevation of typical crude oil carrier showing bulkheads, cofferdams pump rooms, engine room, bunker and peak tanks, cargo tanks and permanent ballast tanks.		
	Draw a plan view of a tanker showing the arrangement of tanks.		

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1.3	**Fittings**	**2.0**	
a)	Describes the bilge pumping system of a cargo ship.		
b)	States that each section is fitted with a screw down n/r suction valve.		
c)	Describes and sketches a bilge strum box		
d)	Describes the provision of sounding pipes and sketches a sounding pipe arrangement		
e)	Describes the arrangement of fittings and lashings for the carriage of containers on deck		
1.4	**Hull structure**	**2.0**	
a)	With the aid of sketches describes side shell plating		
b)	With the aid of sketches describes main deck		
c)	With the aid of sketches describes ship's keel		
d)	With the aid of sketches describes F/peak, A/peak and double bottom tanks		
2.	**STABILITY**		
2.1	**Density & Displacement**	**1.0**	
a)	Define the following		
b)	Density		
c)	Relative density		
d)	Volume		

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e)	Weight		
2.2	**Water pressure**	**1.0**	
a)	Explain what is water pressure		
b)	Define the external and internal water pressure		
c)	Explain what is thrust		
d)	Calculate the pressure acting on a point at different shapes of the tanks		
2.3	**Principle of floatation**	**1.5**	
a)	Explain the Archimedes principle		
b)	Describe the principle of floatation		
c)	States that for a ship to float it must displace a mass of water equal to its own mass.		
d)	Explains how, when the mass of a ship changes, the mass of waterdisplaced changes by an equal amount.		
e)	defines the displacement of a vessel as its mass measured in tonnes		
f)	States that displacement is represented by the symbol		
g)	Given the dimensions of different shapes of the vessel calculate the volume and weight of the vessel.		
h)	Explains what is meant by buoyancy		
i)	Defines the force of buoyancy as an upward force on a floating object created by pressure of liquid on the object		
j)	Sates that the buoyancy force is equal to the displacement of the floating object		
k)	Explains what is meant by Reserve Buoyancy		
l)	Explains the importance of reserve buoyancy		
m)	Explains how freeboard is related to reserve buoyancy		

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2.4.	**Stability definitions**	**3.0**	
a)	defines light displacement and load displacement		
b)	defines dead-weight		
c)	explain the difference of deadweight aboard and dead weight available		
d)	defines TPC		
e)	explains why TPC varies with different drafts		
f)	define coefficient of fineness		
g)	defines Block Coefficient		
h)	calculates Cb from given displacement and dimensions		
i)	calculate displacement from given Cb and dimensions		
j)	define FWA		
k)	define DWA		
l)	explains why the draft of a ship decreases when it passes from fresh water to sea-water and vice versa		
m)	states that when loading in fresh water before proceeding into sea- water, a ship is allowed a deeper maximum draft		
n)	states that the additional draft is called the fresh water allowance (FWA)		
o)	given the FWA and TPC for FW , calculate the amount which can be loaded after reaching the summer load line when loading in fresh water before sailing into sea-water.		
2.5	**Relationship of weight and COG of a vessel**	**3.0**	

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a)	States that the weight is force of gravity on amass 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 'COG'		
c)	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		
d)	states that: G moves directly towards the centre of gravity of added masses, G moves directly away from the centre of gravity of removed masses - G moves parallel to the path of movement of masses already on board.		
e)	calculate the movement of G (GG1) from		
	$GG_1 = \frac{\text{mass added or removed x distance of mass from G}}{\text{new displacement of ship}}$		
	$GG_1 = \frac{\text{mass moved x distance mass is moved}}{\text{displacement of ship}}$		
f)	performs calculations as above to find the vertical and horizontal shifts of the centre of gravity resulting from adding removing or moving masses.		
g)	states that if a load is lifted by using a ships derrick or crane the weight is immediately transferred to the point of suspension.		
h)	states that if the point of suspension is moved horizontally the COG of the ship also moves horizontally.		
i)	states that if the point of suspension is raised or lowered the COG of the ship is raised or lowered.		
j)	calculates by using moments about the keel the position of G after loading or discharging given masses at stated positions.		

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k)	calculates the change in KG during a passage resulting from consumption of fuel and stores		
2.6	**Buoyancy**	**1.5**	
a)	Defines the Centre of Buoyancy COB as being the centre of the underwater volume of the ship		
b)	States that the force of buoyancy always acts vertically upwards		
c)	Explains that the total force of buoyancy can be considered as a single force acting through B		
d)	State that the position of COB will change when the draft changes and when heeling occurs.		
2.7	**Transverse statical stability**	**4.5**	
a)	Labels a diagram of amidship cross section of an upright ship to show the weight acting through G and the buoyancy force acting through B		
b)	States that the buoyancy force is equal to the weight of the ship		
c)	Defines the lever GZ as the horizontal distance between the vertical forces acting through G and B.		
d)	States that the magnitude of the couple is Displacement x Lever.		
e)	Explains how variation in displacement and GZ affect the stability of the ship On a diagram of a heeled ship, shows the forces at G and B , the lever GZ		
f)	States that the length of GZ will be different at different angles of heel		
g)	States that if the couple Displacement x GZ tends to turn the ship towards the upright , the ship is stable		
h)	States that for a stable ship Displacement x GZ is called the Righting Moment and GZ is called the Righting Lever.		
i)	States that it is a common practice to describe the stability of a ship by its reaction to heeling to small angles (upto approx. 15 deg)		

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j)	Defines the transverse metacentre M as the point of intersection of successive buoyancy force vectors as the angle of heel increase by a small angle.		
k)	States that, for small angles of heel , M can be considered as a fixed point on the centre line. On a diagram of a ship heeled to small angles indicate G, B, and M		
l)	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.		
m)	Shows that for small angles of heel θ , GZ = GM x Sine θ		
n)	Sates that the value of GM is a useful guide to the stability of the ship.		
o)	Describe the effect on a ships behaviour of a large GM (stiff ship) and a small GM (tender ship)		
2.8	**Equilibrium of ships**	**3.0**	
a)	Define the:		
	• Stable equilibrium		
	• Unstable equilibrium		
	• Neutral equilibrium		
b)	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.		
c)	States that in this condition, GM is said to be negative and Displacement x GZ is called the upsetting moment or capsizing moment		
d)	Explains how B may move sufficiently to reduce the capsizing moment to Zero at some angle of heel.		
e)	States that the angle at which this becomes stable is known as the Angle of Loll.		
f)	States that the ship will roll about its angle of loll instead of the upright.		
g)	States that an unstable ship may loll to either side.		
h)	Explains why the conditions described when GM is negative is potentially dangerous		

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i)	Explain the effect on stability for timber deck cargo vessels		
2.9	**Free surface effect**	**1.5**	
a)	Define the FSE		
b)	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 shows by means of diagrams how the centre of gravity of liquid in a partly filled tank moves during rolling		
c)	states that when the surface of a liquid is free to move, there is a virtual increase in KG, resulting corresponding decrease in GM		

04. Applied Science (Total number of hours - 30)

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1.	**Units and Measurements**	**1.0**	
a)	International systems of units-length, mass, and time.		
b)	Changing units		
1.2	**Scalars and Vectors**	**2.0**	
a)	Introduction of scalar quantities and scalars,		
b)	introduction of vector quantities and vectors.		

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1.3	**Newton's Equations of Motion**	**4.0**	
a)	Displacement – time graphs, Velocity- time graphs.		
	$v = u + at,$		
	$s = \frac{(u+v)}{2}t,$		
b)	Constant acceleration equations		
	$s = ut + \frac{1}{2}at^2,$		
	$v^2 = u^2 + 2as$		
c)	Motion in a straight line with constant acceleration/deceleration (retardation).		
1.4	**Newton's Laws of Motion**	**6.0**	
a)	Newton's first law, second law, equation of motion $F = ma$, third law.		
b)	Motion under frictional force, friction and coefficient of friction. $F = \mu R.$		
c)	Uniform circular motion		
	$a = \frac{v^2}{r},$		
	$F = m\frac{v^2}{r}$		
d)	Newton law's of gravitation, gravitational force between two bodies.		

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	$F = G\frac{Mm}{r^2}$		
1.5	**Gravity**	**2.0**	
a)	Vertical/ horizontal motion under gravity.		
b)	Vertical/ horizontal motion under gravity.		
c)	Projectiles.		
d)	Gravitation near Earth's surface, gravitation inside the Earth, gravitational potential energy, Satellite motion.		
e)	Work done against gravity		
f)	Kinetic energy, potential energy, change of energy of a particle.		
g)	Resultant force, finding the projectiles.		
h)	Newton's first law, second law, equation of motion $F = ma$, third law.		
1.6	**Work, Energy , Power and Efficiency**	**4.0**	
a)	Static Moment of a force.		

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b)	Problem involving pulleys		
c)	Conservation of momentum.		
1.7	**Motion of two connected particles**	**4.0**	
a)	Kinetic energy, potential energy, change of energy of a particle.		
b)	Resultant force, finding the resultant of more than two forces, resolving forces into components,		
c)	Finding the resultant of several forces by resolving them into components, equilibrium of coplanar forces.		
1.8	**Fluid Dynamics and Static**	**4.0**	
a)	What is a fluid, density and pressure, measuring pressure, Pascal's principle, Archimedes' Principle, ideal fluids in motion, the equation of continuity, Bernoulli's equation, surface		
b)	tension, viscosity, fluid flow patterns.		
1.9	**Introduction to Material Science**	**3.0**	
	Atoms and molecules, measurement of molecules, states of matter intermolecular forces, behaviour of solids		

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05. Watchkeeping / Bridge Equipment (Total number of hours - 60)

Ref No	*Knowledge, Understanding and Proficiency*	*DURATION (HRS)*	*COURSE NOTE REF. NO*
01	**Watchkeeping**		
1.1	**The content, application and intent of COLREG 72 as amended**	**25.0**	
a)	explains the application of the rules as set out in Rule 1		
b)	defines the term 'traffic separation scheme'		
c)	states the responsibility to comply with the rules as set out in Rule 2		
d)	gives examples of circumstances which may make a departure from the rules necessary		
e)	states the general definitions which apply throughout the rules		
f)	explains the term 'vessel constrained by her draught'		
g)	distinguishes between 'under way' and 'making way'		
h)	explains 'a proper look-out' and interprets the intent of 'full appraisal of the situation and the risk of collision'		
i)	explains the use of radar in the context of Rule 5		
j)	explains what is meant by a safe speed		
k)	states the factors to be taken into account in determining a safe speed		
l)	explains what is meant by risk of collision		

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m)	describes the proper use of radar equipment in determining weather a risk of collision exists		
n)	explains the dangers of making assumptions on the basis of scanty information, citing examples from clear weather as well as the use of radar		
o)	illustrates, using examples from court decisions, the following actions to avoid collision referred to in Rule 8:		
p)	positive action in ample time large enough to be readily apparent alteration of course alone ,passing at a safe distance		
q)	checking the effectiveness of action taken ,reduction of speed ,taking all way off		
r)	demonstrates an understanding of Rule 9 by:		
s)	defining the terms 'narrow channel' and 'fairway'		
t)	describing how to proceed along the course of a narrow channel		
u)	describing the navigation of small craft and sailing vessels in a narrow channel stating the restrictions on crossing the channel or fairway		
v)	describing the conduct of vessels engaged in fishing		
w)	defines 'traffic lane', separation line', 'separation zone', 'inshore traffic zone'		
x)	describes how to navigate in a traffic separation scheme with reference to: entering and leaving the traffic separation scheme entering and leaving traffic lanes, crossing lanes, the use of inshore traffic zones ,crossing separation lines or entering separation zones other than when crossing, joining or leaving a lane		
y)	states the requirements for vessels: navigating in areas near the terminations of traffic ,separation schemes, anchoring, not using a traffic separation scheme, engaged in fishing		
z)	explains what is meant by 'vessels in sight of one another'		
aa)	explains how to decide when a vessel is an overtaking vessel		
bb)	compares and analyses the various avoiding actions which may be taken by an overtaking vessel		
cc)	explains the application of Rule 14, Head-on Situation		

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dd)	explains why the give-way vessel in a crossing situation shall, if the circumstances admit, avoid crossing ahead of the other vessel		
ee)	explains the application of Rule 15 when crossing narrow channels and traffic lanes		
ff)	explains how Rule 16 and Rule 8 relate regarding the action by a give-way vessel gg) explains the position of stand-on vessel in cases where a risk of collision exists between more than two vessels		
gg)	explains how to decide when to take avoiding action as stand-on vessel		
hh)	describes the actions which may be taken by the stand-on vessel		
ii)	states the avoiding action which must be taken by the stand-on vessel		
jj)	explains the responsibilities between vessels with reference to Rule 18 and 3 ll) explains the application of Rule 19		
kk)	states the application of the rule concerning lights and shapes) and states the definitions in rule 21		
ll)	states the visibility of lights as prescribed by Rule 22 and describes the shapes required by the rules		
mm)	describes the sound signals to be used by vessels in sight of one another		
nn)	describes the sound signals to be used by vessels in or near an area of restricted visibility		
oo)	describes the use of signals to attract attention		
pp)	lists the distress signals set out in Annex IV of COLREG 72		
qq)	describe the usage of Buoyage systems & explain the IALA system of Buoyage		
1.2	**Keeping a safe navigational watch**	**2.0**	
a)	states that the officer of the watch is responsible for navigation safety, with particular regard to avoiding collision and stranding		
b)	describes the principles to be observed in keeping a navigational watch as set out in section A-VIII/2 regarding:		

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	• navigation		
	• navigational equipment		
	• navigational duties and responsibilities		
	• handing over and taking over the watch		
	• look-out		
	• navigation with a pilot embarked		
	• protection of the marine environment		
c)	describes the recommendation on operational guidance for officers in charge of a navigational watch contained in section B-VIII/2:		
	• maintenance of an efficient look-out		
	• the use f engines and sound signalling apparatus		
	• taking over the navigational watch		
	• periodic checks of navigational equipment		
	• compliance with SOLAS V/19 regarding the use of the automatic pilot and the change-over to manual steering and vice-versa		
	• electronic navigational aids		
	• the use of radar		
	• navigation in coastal waters		
	• conduct of the watch in clear weather		
	• actions to take in restricted visibility		
	• the circumstances in which the officer of the watch should call the master		
	• navigation with a pilot embarked		
	• briefing of Watchkeeping personnel		

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1.3	**Keeping an effective deck watch in port under normal circumstances**	**3.0**	
a)	states that arrangements for keeping watch in port should:		
	• ensure the safety of life, ship, cargo and port		
	• observe international, nautical and local rules		
	• 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 himself 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)	lists the entries which should be made in the log-book		
f)	Precautions to be observed when Loading Dangerous cargo		
.			
1.4	**Keeping a Watch at Anchor**	**1.5**	
a.	describes taking over the watch and lists the information which the officer being relieved should pass to the relieving officer		
b.	Maintaining of a safe anchor watch		
c.	Entries to be made on log book		
02	**BRIDGE EQUIPMENT**		
2.1	**GPS System**	**1.5**	

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a)	What is GPS		
b)	Data can be obtained		
c)	segments of GPS		
d)	Accuracy of GPS		
e)	WGS 84		
f)	Differential GPS		
2.2	**Radar**	**3.0**	
a)	Purpose of having a Radar		
b)	3 Cm. And 10 cm.		
c)	Starting up procedure		
d)	main controls		
e)	Basic radar plotting		
f)	Brief description of ARPA		
2.3	**Sextant**	**4.5**	
a)	Principle of the sextant		
b)	Use of sextant and its limitations		
c)	Reading the Sextant		
d)	Error of Perpendicularity		
e)	Side Error		
f)	Index Error		

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g)	Interaction between screws		
h)	Finding Value of I.E.		
2.4	**Use chronometers for accurate time keeping and measurement**	**1.5**	
a)	Use of chronometers		
b)	Obtaining a Time signals.		
c)	Chronometer Error/ Daily Rate		
d)	Chronometer Log		
e)	Care and maintenance		
Ref No	*Knowledge, Understanding and Proficiency*	*DURATION (HRS)*	*COURSE NOTE REF. NO*
2.5	**Use echo sounders to determine the under-keel clearance and the profile of the sea bed**	**1.5**	
a)	Echo sounders and their use		
b)	Principle		
c)	Simple block diagram		
d)	Scales		
2.6	**The magnetic compass**	**1.5**	
a)	Types of magnetic compasses		
b)	Directional Force		
c)	Care and maintenance.		

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d)	Compass error		
e)	Comparisons of compasses		
2.7	**The gyro compass**	**1.5**	
a)	Free gyroscope		
b)	Speed / latitude inputs		
c)	Alarms fitted to a gyro-compass		
2.8	**The Automatic Pilot**	**1.5**	
a)	Change-over from automatic to manual steering and vice versa		
b)	Off course alarm		
c)	Other alarms fitted to the system		
d)	states that the automatic pilot should be included in the steering gear testing prior to the ship's departure		
e)	explains the need for regular checking of the automatic pilot to ensure that it is steering the correct course		
f)	states that the automatic pilot should be tested manually at least once per watch		
2.9	**Automatic Identification System – AIS**	**1.5**	
a)	What is AIS		
b)	Data can be obtained by AIS		

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2.10	**Course Recorder**	**1.5**	
a)	What is a Course Recorder		
b)	Purpose		
c)	Starting of a course recorder		
2.11	**ECDIS**	**1.5**	
a)	Types of Electronic charts approved		
b)	Advantages of having ENC over paper charts		
c)	Dangers associated when using ENC charts		
2.12	**GMDSS**	**1.5**	
a)	Purpose of having GMDSS System		
b)	How the system works		
c)	Coverage areas		
2.13	**The Weather Facsimile**	**1.5**	
a)	What is Facsimile		
b)	Use of ALRS to obtain wx map.		
c)	Reading of weather map		

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2.14	**Voyage Data Recorder**	**1.5**	
	What is VDR		
	Data recorded by VDR Purposes of VDR		
	What is VDR		
2.15	**Long Range Identification and tracking (LRIT)**	**1.5**	
a)	What is LRIT and how it operates Purpose		
b)	Contents of a LRIT message		
c)	What is LRIT and how it operates Purpose		
2.16	**Bridge Navigation Watch Alarm System (BNWAS)**	**1.5**	
a)	Describes the purpose and the operation of BNWAS		

06. Mathematics (Total number of hours - 30)

1. ALGEBRA (Total 7.5 hrs)

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1.1 Number Systems
Defines the following numbers
1.1.1.1 Real numbers
1.1.1.2 Whole numbers,
1.1.1.3 Natural number
1.1.1.4 Integers
1.1.1.5 Rational numbers
1.1.1.6 Irrational numbers
1.1.2 Defines the following notations
1.1.2.1 Absolute value
1.1.2.2 ε - notation
1.1.2.3 Interval notation
1.1.2.4 Set notation

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	1.2 Mathematical Operations and their Order
1.2.1	Explain forms sums, differences, products and quotients of simple algebraic expressions, including simple fractions.
1.2.2	Explains rules of order of operations
	i. Brackets, division, multiplication, addition and subtraction
	1.3 Functions
1.3.1	Defines the function
1.3.2	Explains Vertical line test
1.3.3	Explains Domain and range of a function
	1.4 Expansions, Factorization
1.4.1	Expands the following
1.4.1.1 $(x + a)^2$	
1.4.1.2 $(x + a)^3$	
1.4.1.3 $(x + a)(x - a)$	
1.4.1.4 $(x + a)(x + b)$	

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1.4.2 Factorizes the following
1.4.2.1 X^2-a^2
1.4.2.2 X^3-a^3
1.4.2.3 X^3+a^3
1.4.3 Simplifies expressions by extracting common factors
1.4.4 Simplifies expressions in brackets and collects common terms
1.5 Indices
1.5.1 Explains rules of indices
1.5.1.1 $a^m \times a^n = a^{m+n}$
1.5.1.2 $a^m/a^n = a^{m-n}$
1.5.1.3 $(a^m)^n = (a^n)m = a^{mn}$
1.5.1.4 $a^{-n} = 1/a^n$
1.5.1.5 $a^o = 1$

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	1.6 Surds
1.6.1	Define $a^{1/n}$ as the nth root of a
1.6.2	Explain rules of surds
1.6.2.1	$\sqrt[n]{a}\ \sqrt[n]{b} = \sqrt[n]{ab}$
	1.7 An Introduction to Matrix Algebra
1.7.1	Defines order of a matrix
1.7.2	States matrix addition
1.7.3	States matrix subtraction
1.7.4	States matrix multiplication
1.7.5	Introduces Inverse of 2×2 matrix
	1.8 Simultaneous Equations
1.8.1	Solve problems leading to linear equations
1.8.2	Geometrical interpretation of simultaneous equations

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1.8.3	Solves simultaneous linear equations in two unknowns
1.8.4	Solves simultaneous equations using matrices
	1.9 Polynomials
1.9.1	Identifies the followings
1.9.1.1	Terms
1.9.1.2	Coefficients
1.9.1.3	Degree of a polynomial
1.9.2	Carry out Addition, subtraction, and multiplication of polynomials
	1.10 Quadratic Equations and Roots
1.10.1	Solve quadratic equations by factorization
1.10.2	Completing the square method and formula (real roots only)
1.10.3	Define the discriminate $b^2 - 4ac$ for real, equal, and non-real roots

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2. GRAPHS (Total 3.0hrs)
2.1 2-D and 3-D Coordinates
2.1.1 Explain axis of reference, scales, coordinates
2.2 Determining Suitable Scales from Data Given
2.2.1 Plot a smooth curve through plotted points
2.2.2 Sketch linear and quadratic graphs
2.3 Sketching and Plotting
2.3.1 Explain equation of a straight line
2.3.2 Show on a graph the significance of m and c in the equation y = mx + c
2.4 Independent and Dependent Variables
2.4.1 Introduce independent and dependent variables
2.5 The Best Fit

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2.5.1 Explain the least squares regression line method
2.6 Data Analysis Using Statistical Methods
2.6.1 Determine the slope at a given point of a curve by drawing a tangent to the curve
3. RATIO, PROPORTION, VARIATION (Total 3.0hrs)
3.1 Definitions
3.1.1 Define the ratio of two quantities
3.1.2 Uses the notation a : b = $\frac{a}{b}$
3.1.3 Define direct, inverse, and joint variation
3.2 Properties
3.2.1 Use the notation a:b = c:d and states that it is equivalent to
3.3 Applications

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3.3.1 Solve problems on direct, inverse and joint variation
4. EXPONENTIALS AND LOGARITHMS (Total 3.0hrs)
4.1 Exponential
4.1.1 Introduce rules of exponents
4.1.2 Graphing exponential functions
a c
b = d
4.1.2.1
$y = e^x$.
4.2 Logarithms
4.2.1 $Y = \log_a x$ implied $x = a^y$
4.2.2 Explain graphs of logarithmic functions

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4.2.3 Change Logarithmic bases using $\log_a x=\log_b x/\log_b a$
4.3 Laws of Logarithms
4.3.1 State laws of logarithms
4.3.1.1 $\text{Log}_a a=1$
4.3.1.2 $\text{Log}_a 1=0$
4.3.1.3 $\text{Log}_a x^k=k \log_a x$
4.3.1.4 $\text{Log}_a x+\log_a y=\log_a(xy)$
4.3.1.5 $\text{Log}_a(x/y)=\log_a x-\log_a y$
4.4 Exponential and Logarithmic Equations
4.4.1 State $\ln x=\log_e x$ and $\log x=\log_{10} x$
4.4.2 Solve logarithmic and exponential equations
4.5 Graphing with Logarithmic Scales

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5. EUCLIDEAN GEOMETRY	**(Total 3.0hrs)**
5.1 Angles	
5.1.1 Explain the types of angles	
5.1.1.1 Acute angles	
5.1.1.2 Obtuse angles	
5.1.1.3 Reflex angles	
5.1.2 Introduce relationships between angles formed by a transversal to two parallel straight lines	
5.2 Triangles and their properties	
5.2.1 Define properties of following triangles	
5.2.1.1 Equilateral triangles	
5.2.1.2 Isosceles triangles	
5.2.1.3 Right-angled triangles	
5.2.1.4 Scalene triangles	

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5.2.2	Define sum of the angles of a plane triangle
5.2.3	Explain property of exterior angles
5.2.4	Introduce Pythagoras's theorem, and applications
5.3	Polygons and their properties
5.3.1	Define a quadrilateral, a parallelogram, a trapezium and a rhombus
5.4	Circle, Sector, Segment, Arcs, Chord
5.4.1	Introduce an arc (of a sector), a chord and a segment of a circle
5.4.2	Determine arc length, given radius and angle of sector
5.5	Constructions
5.5.1	Divide a line into two equal parts
5.5.2	Draw a perpendicular from a given point on a straight line
5.5.3	Draw a perpendicular line from a given point which is not on the line
5.5.4	Construct an angle of 60^o

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5.5.5 Bisect a given angle
5.5.6 Draw the circumscribed and inscribed circle of a given triangle
6. TRIGONOMETRY (Total 6.0hrs)
6.1 Hexadecimal System
6.1.1 Converts from hexadecimal to binary and binary to hexadecimal
6.1.2 Converts from hexadecimal to decimal and decimal to hexadecimal
6.2 Circular Measure of the Angle
6.2.1 Measurement of angle in degrees and radians between degree and radian measure
$(180^0 = \pi)$, converting
6.3 Definitions of Trigonometric Ratios
6.3.1 Defines sine, cosine and tangent as ratios of the sides of a right-angled triangle and their applications
6.3.2 Defines the reciprocal ratios cosecant, secant and cotangent

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6.3.3 States the values of trigonometric functions for angles 0^o, 30^o, 45^o, 60^o and 90^o
6.3.4 Find Trigonometric functions of any angle
6.4 Graphs of Trigonometric Functions
6.4.1 Sketches graphs of the trigonometric functions
6.4.2 States the period and amplitude of the functions sine, cosine and tangent.
6.4.3 Sketches graphs of $a \sin b\theta$
and $a \cos b\theta$
6.5 Trigonometric Identities
6.5.1 Derives the identities considering a right-angled triangle of unit hypotenuse
6.5.2 Uses identities to solve equations
6.5.3 Simplifies identities.
$\sin^2\theta + \cos^2\theta = 1,$

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$\tan\theta = \frac{\sin\theta}{\cos\theta}$,	
$\cot\theta = \frac{\cos\theta}{\sin\theta}$, $1+\cot^2\theta = \csc^2\theta$,	
$1+\tan^2\theta = \sec^2\theta$.	
6.5.4 Introduces inverse trigonometric functions arcsine, arccos and arctan	
6.6 Polar and Cartesian Coordinates	
6.6.1 Explains Polar co-ordinates	
	6.6.1.1
	6.6.1.2
	6.6.1.3
$r = a\cos\theta$,	
$r = a(1+\cos\theta)$	
$r = a\sin 2\theta$	
6.6.2 Converts polar co-ordinates to Cartesian and vice versa	

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6.7 Important Results
6.7.1 Approximate $\sin\theta = \tan\theta = \theta$ and $\cos\theta = 1 - (\theta^2/2)$,where θ is a small angle in radians
7. MENSURATION (Total 4.5hrs)
7.1 Perimeter
7.1.1 Define the perimeters of following
7.1.1.1 Square
7.1.1.2 Rectangle
7.1.1.3 Parallelogram
7.1.1.4 Trapezium
7.1.1.5 Rhombus
7.1.1.6 Triangle
7.1.1.7 Circle
7.2 Area

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7.2.1 Define the areas of following
7.2.1.1 Square
7.2.1.2 Rectangle
7.2.1.3 Parallelogram
7.2.1.4 Trapezium
7.2.1.5 Rhombus
7.2.1.6 Triangle
7.2.1.7 Circle
7.2.1.8 Sectors
7.2.1.9 Segments
7.3 Volume of Standard Geometrical Shapes
7.3.1 States the surface areas and volumes of followings
7.3.1.1 Cube

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7.3.1.2 Rectangular
7.3.1.3 Triangular prism
7.3.1.4 Cylinder
7.3.1.5 Right circular cone
7.3.1.6 Sphere
7.3.2 Solves problems involving the applications

07. Communication (Total number of hours - 30)

Ref No	*Knowledge, Understanding and Proficiency*	*DURATION (HRS)*	*COURSE NOTE REF. NO*
1.1	**Signaling by Morse Code**	**10.0**	
a)	Morse symbols for the alphabet and numerals		
b)	sends and receives Morse Signals by flashing light		
c)	lists the parts of a signal made by flashing		
d)	Use of the 'erase- signal		
e)	Use of the 'repeat' signal		
f)	single-letter signals sounded only in compliance with the requirements of the International Regulations for Preventing Collisions at Sea		

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g)	distress signal when made by flashing light .		
1.2	**International Code of Signals**	**10.0**	
a)	all International Code flags and pendants		
b)	purpose of the International Code of signals		
c)	uses substitute flags		
d)	demonstrates how to call, using flags		
e)	demonstrates the use of the answering pendant		
f)	actions to take when signals are not understood		
g)	names in the text of a signal are to be spelt out in plain language		
h)	use of identity signals		
i)	in flag signaling, the answering pendant is used to indicate the decimal point in numbers		
j)	meanings of single-letter signals		
k)	International Code Signal of distress		
1.3	**Use of VHF Communication at sea**	**10.0**	
a)	all calls must contain the identity of the station		
b)	International distress frequency is VHF channel 16		
c)	VHF watch which must be maintained on the above frequency		
d)	circumstances ships may call on the above frequency		
e)	procedure for calling and establishing communications with a shore station /ship		
f)	procedure for replying to call from a shore station/ship		

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g)	signal for the end of work between two stations		
h)	demonstrates ability to use the phonetic and figure code		
i)	demonstrates the ability to use the standard marine vocabulary		
j)	distress call has absolute priority over all other transmission		
k)	radiotelephone		
l)	distress signal		
m)	urgency signal		
n)	safety signal		
o)	navigational warning signal transmitted by cost station		

08. Seamanship (Total number of hours - 150)

Ref No	*Knowledge, Understanding and Proficiency*	*DURATION (HRS)*	*COURSE NOTE REF. NO*

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1.0	**SEAMANSHIP PRACTICAL**		
1.1	**Rope and rope work**	**120**	
a)	types of ropes.		
b)	Construction of fibre ropes		
c)	construction of steel wire ropes		
d)	practices knots, bends & hitches and their usage.		
e)	practices splicing, natural fibre, synthetic fibre and wire ropes		
f)	caring for ropes		
g)	practices seizing and parcelling		
h)	practices whippings		
i)	Knowledge & usage ofladders, pilot ladders, stages and fenders.		
j)	handling of mooring ropes.		
2.0	**SEAMANSHIP THEORY**		
2.1	**Rope and rope work types of ropes.**	**10**	
a)	Construction of fibre ropes		
b)	construction of steel wire ropes		
c)	usage of knots, bends & hitches.		
d)	caring for ropes		
e)	Knowledge & usage ofladders, pilot ladders, stages and fenders.		
f)	handling of mooring ropes		

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2.2	**Helm orders**	**03**	
a)	Importance of listening carefully - understanding without doubt and acknowledgement.		
b)	Procedure of execution of common helm orders.		
c)	Necessity of paying attention, and usefulness of the execution of helm orders.		
2.3	**Cargo Handling Equipment - Lifting Gear**	**06**	
a)	different types of blocks		
b)	construction of blocks		
c)	function and usage of blocks		
d)	different types of purchases		
e)	function of purchases		
f)	use of purchases to advantage and disadvantage		
g)	types of derricks		
h)	function of derricks and their usage		
i)	Operation of derricks		
j)	function and usage of cranes		
k)	Operation of cranes		
l)	use of shackles, bottle screws		
2.4	**Preparation of Surfaces and Painting, Maintenance**	**03**	
a)	prepare surfaces for Painting		

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b)	application of Painting		
c)	care of Paint brushes and rollers		
2.5	**Preparation for Heavy weather**	**1.5**	
a)	rigging lifelines and preparations for heavy weather		
2.6	**Anchor work**	**05**	
a)	operates mooring winches, windlass and capstans		
b)	preparation of anchors for letting go		
c)	weighing anchor and securing for sea		
2.7	**Pilot ladder**	**1.5**	
a)	rigs the pilot ladder and stands by while the pilot boards or leaves		

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09. Operational Safety (Total number of hours - 60)

Ref No	*Knowledge, Understanding and Proficiency*	*DURATION (HRS)*	*COURSE NOTE REF. NO*
1.1	**Types of Ships**	**1.5**	
	• Explain the following types of ships including its design features, limitations, characteristics and cargo types it carries;		
	• General cargo vessel		
	• Bulk Carrier		
	• Container Cargo vessel		
	• Oil tanker		
	• Gas carrier		
	• Livestock carrier		
	• Reefer carrier		

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1.2	**Identification of ships parts including lifting gear**	**4.5**	
	• Sketch and explain following Cargo Hold and its components		
	• Swan neck , Goose neck		
	• Hatch cover		
	• Ventilator		
	• Ladderway / Hatch entrance		
	• Scupper		
	• Scupper valve		
	• Companion hatchway		
	• Ladder steps, ladder rungs, Hold ladder		
	• Bilge		
	• Manhole		
	• Manhole cover		
	• Drainage well		
	• Docking plug, Drain plug		
	• Striker plate, doubling plate		
	• Bilge strum		
	• Bilge suction pipe , Branch bilge suction		
	• Sounding pipe		
	• Air pipe		
	• Discharge , Overboard discharge		
	• Sea connection, sea valve, kingston valve		

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	• Sea valve grating		
	• Inlet, Water inlet		
	• Mud box		
	• Sea chest		
	• Scavenging pipe line		
	• Cowl		
	• Grub screw, pressure screw		
	• Bearing ring		
	• Standard , Ventilator coaming		
	• Cover		
	• Vent line, vent duct, trunk		
	• Threaded brass inset , Ullage plug		
	• Sounding rod, gauge , Pump gauge , Ullage foot, ullage stick		
1.3	Sketch and explain following Deck Crane and its components		
	• crane pillar		
	• slewing ring		
	• crane housing		
	• crane cabin		
	• jib		
	• lower cargo block		
	• cargo runners/hoisting ropes		
	• cargo winch/hoisting winch		

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	• span ropes/ luffing ropes		
	• span winch/luffing winch		
	• sheaves		
	• container spreader		
	• marking		
1.4	Sketch and explain following Ladder types		
	• Pilot ladder		
	• Hold ladder		
	• Accommodation ladder		
	• Lifeboat ladder		
	• Bulwark ladder , Portable ladder		
	• Gangway		
1.5	**Definitions**	**03**	
1.5.1	Sketch and explain the following basic definitions and ship geometry		
	• Hull		
	• Afterbody		
	• Forebody		
	• Bow		
	• Stern		
	• Port		

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	• Starboard		
	• Forward Perpendicular (FP)		
	• After Perpendicular (AP)		
	• Midships		
1.5.2	Sketch and explain the ships Principal Dimensions		
	• Length Overall (LOA)		
	• Length Between Perpendiculars (LBP)		
	• Moulded Beam or Breadth		
	• Maximum Beam or Breadth		
	• Draught		
	• Trim		
	• Depth Moulded		
	• Freeboard		
	• Moulded Displacement		
	• Air draught		
	• Principle Measurement		
	• Light displacement tonnage		
	• Deadweight		
	• Load Displacement		
	• Bale Capacity		
	• Grain Capacity		
	• Lane meter		
	• TEU		
	• Gross tonnage		

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	• Net tonnage		
1.6	**Basic principles of cargo stowage**	**06**	
a)	Explain scope of ship's staff relationship to the safe carriage of cargo including Planning, Loading, Stowing, Carrying and Discharging		
b)	Explains the need for the segregation of different cargoes with reference to		
	• Dangerous goods		
	• Dry cargo		
	• Wet cargo		
	• Clean cargo		
	• Dirty cargo		
	• Delicate cargo		
	• Valuable cargo, e.g. Bank notes, personal effects		
c)	Describes how the cargoes in above could be segregated		
d)	Explains that separation between parcels of cargo for different consignees or different ports of discharge is often required		
e)	Describes methods of separating adjacent parcels of cargo		
f)	Describes the use of port marking to separate parcels for discharge at different ports		
1.6.1	**Hold preparations**	**04**	
a)	Outlines the reasons for a general inspection of holds		
b)	Lists items to be inspected		

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c)	Explains the importance of cleaning holds before loading		
d)	Describes how to clean holds after discharge of a general cargo		
e)	States the reasons for using dunnage		
f)	Describes the types and sizes of material used for dunnage		
g)	States the methods of dunnaging a hold for various cargoes and how to dispose of old dunnage.		
h)	Explains that dirty dunnage may taint or contaminate the next cargo		
i)	Describes the fitting of spar ceiling and explains its purpose		
j)	States that bilges or drain wells should be clean, dry and sweet- smelling disinfectants used.		
k)	Explains how bilge suctions should be checked for efficient working scuppers and sounding pipes		
l)	Describes how limbers and drain well covers should be treated to prevent suctions being blocked by small debris, but ensuring free drainage to the suctions		
m)	States that the ballast lines to deep tanks should be blanked when preparing to load dry cargo		
n)	States that the use of a deodorising wash or ozonator may be necessary to remove strong odours from a previous cargo		
1.6.2	**Care of cargo during carriage**	**01**	
a)	Explain the basic care required during the carriage of cargo to prevent damages to the condition of cargo including:		
	• Taint damage		
	• Moisture damage		
	• Heat damage		
b)	Explain the available methods to overcome such damages		

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1.6.3	**Ventilation and Control of Sweat**	**02**	
a)	Define the hygroscopic cargo and non hygroscopic cargo		
b)	Give examples of each type		
c)	Lists the factors involved in the control of sweat by ventilation		
d)	Distinguishes between ship's sweat and cargo sweat and explains the conditions in which each is experienced		
e)	Describes the system of natural ventilation and how it should be controlled to minimise the formation of sweat		
f)	Describes forced ventilation and humidity control for cargo holds and states the properties measured and recorded at the control panel		
g)	Explains how to operate the ventilation system described in above		
h)	States that ventilation is also required for the removal of heat, gases and odours		
i)	Gives examples of cargoes requiring special ventilation		
1.7	**Basic Cargo calculations**	**16**	
a)	Distinguishes between bale capacity and grain capacity.		
b)	Defines "stowage factor".		
c)	Explains "broken stowage" and states how an allowance for it is made.		
d)	Given the capacity of a hold and the stowage factor of the cargo, calculates the weight that the hold 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		

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	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.		
h)	Given the maximum permissible loading and height of a "twin-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)	Uses tank calibration tables and given cargo density to calculate the weight in a tank.		
k)	Corrects densities for temperature.		
l)	Uses 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 allowing for expansion of cargo.		
1.8	**Introduction to container and container vessels**	**04**	
a)	Describes the method of safe stowage and securing of containers on deck on vessels not specially designed for the carriage of containers		
b)	Explain the unitisation and containerisation		
c)	Explain the types of unitisation		
d)	Describes the arrangement of a container ship and explains how the position of a particular container is designated		
e)	Explain the definitions associated with containers and container cargo		
f)	Explains briefly the sequence of operations during discharging and loading at a terminal		
g)	Explains the factors involved in planning a container stow with reference to:		

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	• Stability, trim and list		
	• Stresses		
	• Stack height and weight		
	• Dangerous goods,		
	• Special stowage restrictions		
h)	Describes methods of securing containers on deck		
i)	Describes the types and sizes of container in use		
j)	Describe the container identification system used onboard container ship		
k)	Describe the safe operation procedure relating to container cargo		
1.9	**Blocks and Tackles**	**03**	
a)	Define the following		
	• SWL		
	• Breaking stress or breaking strain		
	• Factor of safety		
	• Purchase		
	• Tackle		
b)	Describe the types of tackles		
c)	Explain the advantage of a purchase		
d)	Explain the disadvantage of a purchase		
e)	Explain the procedure of receiving new fibre and wire ropes on board		
f)	Explain the care and maintenance of fibre and wire ropes		
g)	Explain the method of measuring Breaking stresses of wires		
h)	Explain the method of measuring of Breaking stresses of fibre ropes		

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1.10	**Single slewing and union purchase derricks**	**03**	
a)	Describes the rigging of derricks for loading and discharging cargo :		
b)	• Using married falls (union purchase)		
c)	• By single swinging derrick		
d)	Explains how to set up guys and preventers for working with married falls.		
e)	States that gear should be set up in accordance with the ship's rigging plan and explains limitations and effect of angles between runners		
f)	Describes how to top and lower derricks safely.		
g)	Describes the use of slings, snotters, canvas slings, trays, pallets, nets, chain slings, cant hooks, bale hooks and vehicle slings.		
h)	States the precautions to take when lifting bales with hooks in the bale bands and damage caused by hooks generally		
i)	Describes the handling of common unitised and pre-slung loads.		
j)	Compares the advantages and disadvantages of ships' cranes and derricks		
1.11	**Safe work practices**	**03**	
a)	Explain the Personal protective equipments use for		
	• Head protection		
	• Hearing protection		
	• Face and eye protection		
	• Respiratory protective		

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	• Hand and foot protection		
	• Body protection		
	• Protection against drowning		
	• Protection against hypothermia		
b)	Explain the safe working aloft and outboard procedure		
c)	Explain the Permit-to-work systems		
d)	Explain the Identifying of Potential Hazards for following conditions		
	• Oxygen deficiency		
	• Painting		
	• Anchoring and weighing anchor		
2.0	**Cargo Handling safety**	**03**	
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)	Describe the requirements applicable to cargo-handling gear		
c)	Explain according to the dock labour regulations, Lifting plant inspection, testing and documentation		
d)	States that the load on cargo gear should never exceed its safe working load.		
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 decide that 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.		

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h)	Explains 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 m.		
k)	States that it is the ship's responsibility to cover or fence hatches when notice of completion of work for the day is given by the stevedore in charge.		
l)	States that no person should use a ladder in the square of a hatch whole 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)	Explains that unattended portable lights are potential fire hazards.		
2.1	**Dangers involving enclose spaces**	**02**	
a)	'Confined space' is defined		
b)	Explain Health and safety hazards associated with confined spaces		
c)	Explain the testing of atmosphere for oxygen content, flammability and toxicity is outlined and demonstrated.		
d)	Explain the confined space entry permit		
e)	Explain confined space entry operations and procedures		

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f)	Lists potentially dangerous spaces, including :		
	• Cargo spaces		
	• Cargo, fuel and ballast tanks		
	• Pump-rooms		
	• Cofferdams		
	• Duct keels		
g)	States that enclosed spaces should be entered only with authorisation and after appropriate safety checks have been carried out.		
h)	States that an enclosed space may be lacking in oxygen or contain flammable or toxic gases.		
i)	States that the master or responsible officer must ensure that a space is safe for entry by:Ensuring that the space has been thoroughly ventilated, Testing at several levels for oxygen content and the presence of harmful vapour, Requiring breathing apparatus to be worn when there is any doubt about the adequacy of ventilation or testing		
j)	States that the oxygen content should be 21% by volume before entry is permitted.		
k)	Explains 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.		
l)	Describes a permit-to-enter system using safety checklists to be followed by the responsible officer and the person(s) entering the space.		
m)	Lists the items appearing on the checklists.		
n)	Describes the protective clothing and equipment which should be used by or be available to those entering the space.		
o)	States that mechanical ventilation should be maintained throughout the time persons are in an enclosed space.		
p)	Explains why periodical tests of the atmosphere should be made by persons working in an enclosed		

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	space.		
q)	States that all safety checks should be repeated before re-entering a space after a break.		
2.2	**Prevention of pollution**	**02**	
a)	Explain in generally the International Convention for the Prevention of Pollution from Ships, 1973, and the Protocol of 1978 (MARPOL 73/78)		
b)	Define the following		
	• Pollution		
	• Industrial waste		
	• Operational waste		
	• Oil		
	• Noxious substances		
	• Sewage		
	• Garbage		
	• Special area		
c)	State under any circumstances garbage should not discharge without proper approval from a responsible officer.		
d)	Explain the procedure of discharging of garbage onboard ships		
e)	State plastics are prohibited to discharge to sea		
f)	Explain the special areas relation to garbage.		
g)	Explain the wider Caribbean requirements relation to garbage.		
2.3	**Basic knowledge of the following Conventions and Codes**	**1.5**	
a	SOLAS		

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b	ISM Code (shall include the use of SMS and the importance of compliance with the company SMS)		
c	ISPS Code		
d	IMDG Code		
e	IMSBC Code		
f	STCW Code		
g	MLC 2006		
h	International ballast water convention		
2.4	**IMO & industry guidelines on protection against Covid-19**	**0.5**	
3.0	**New amendments**		

10. International Computer Driving License (ICDL) (Total number of hours - 60)

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11. Chart work (Total number of hours - 24)

Ref No	*Knowledge, Understanding and Proficiency*	*DURATION (HRS)*	*COURSE NOTE REF. NO*
11.1	**Basic introduction to nautical charts which includes type of charts**		
11.1.1	Describes the purpose of nautical charts		
11.1.2	Lists the different chart publishers with their identification system		
11.1.3	Describes how the charts are identified		
11.1.4	Defines chart datum		
11.1.5	Describes the contents of charts, such as publisher's name, date of edition, units used, important notices, chart datum, scale etc.		
11.1.6	Describes the purpose of having large and small scale charts		
11.2	**Introduction to upkeep of charts**		
11.2.1	Describes the purpose of updating charts		
11.2.2	Briefly describes the method of updating charts manually		
11.3	**Introduction to BA 5011**		
11.3.1	Describes the purpose of BA 5011		
11.3.2	Demonstrates ability to read and understand common chart abbreviations and symbols		
11.3.3	Demonstrates ability to read and understand light characteristics		

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11.4	**Introduction to NP 131**		
11.4.1	Describes the purpose of NP 131		
11.4.2	Lists the contents of a NP 131		
11.5	**Position fixing by means of latitude and longitude**		
11.5.1	Lists the types of pencils that can be used on charts		
11.5.2	States that the chart users must take due care of the charts		
11.5.3	Demonstrates the use of dividers, protractor, parallel ruler/setsquare		
11.5.4	Demonstrates ability to read latitudes and longitudes of positions		
11.5.5	Demonstrates ability to plot positions by means of latitudes and longitudes		
11.6	**Position fixing by means of range and bearing**		
11.6.1	States that the distance is read from the latitude scale on a chart		
11.6.2	States that one nautical mile equals to one minute on the latitude scale		
11.6.3	Demonstrates ability to read distances on charts		
11.6.4	Defines 'bearing'		
11.6.5	Demonstrates ability to read and plot bearings from given positions		
11.6.6	Demonstrates ability to read positions from range and bearing		
11.6.7	Demonstrates ability to plot positions by means of range and bearing from given positions		
11.6.8	States that only the true bearings to be plotted on charts		

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11.7	**Plotting of courses**		
11.7.1	Defines 'course'		
11.7.2	Describes the purpose of plotting courses on charts		
11.7.3	Demonstrates ability to plot and read courses		
11.7.4	States that only the true courses to be plotted on charts		

12. Safe mooring, anchoring, rigging/securing of gangway & entering/working in enclosed spaces (Total number of hours - 36)

Ref No	*Knowledge, Understanding and Proficiency*	*DURATION (HRS)*	*COURSE NOTE REF. NO*
11.1	Mooring operations practical	12	
11.2	Anchoring practical	12	
11.3	Enclose space entry and working in an enclosed spaces	09	
11.4	Rigging and securing of gangway	03	