

I N D E X

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TERM WISE BREAK UP OF CREDIT HOURS & THE DISTRIBUTION OF MARKS
NAUTICAL STUDENTS SUBJECTS IN ACCORDANCE WITH STCW-95
EFFECTIVE FROM JANUARY, 2005.

S.NO	COURSE NO	TITLE OF COURSE	TERM-I		TERM-II		TERM-III		TERM-IV		TOTAL	
			Credit Hours	Marks	Credit Hours	Marks	Credit Hours	Marks	Credit Hours	Marks	Credit Hours	Marks
1.	N-301 N-302 N-303 N-304 N-305	<u>NAVIGATION:</u>										
		Principle of Navigation.	32	100	32	100	32	100	32	100	128	400
		Ocean & Off Shore Navigation.	22	100	22	100	32	100	32	100	108	400
		Coastal Navigation.	-	-	-	-	44	100	44	100	88	200
		Radar Navigation.	-	-	-	-	32	100	32	100	64	200
		Electronic Navigation.	-	-	-	-	22	100	22	100	44	200
2.	N-306 N-307 N-308 N-309	<u>MARINE OPERATIONS:</u>										
		Seamanship (Theory).	32	80	32	80	32	100	32	100	128	360
		Seamanship (Practical).	22	20	22	20	-	-	-	-	44	40
		Watch-keeping (Colreg).	-	-	-	-	22	50	22	50	44	100
		Marine Communications (Signaling).	22	50	22	50	-	-	-	-	44	100
3.	N-310 N-311 N-312	<u>MARINE TRANSPORTATION:</u>										
		Ship Stability.	11	50	11	50	21	50	21	50	64	200
		Ship Construction. (GSK).	11	50	11	50	21	50	21	50	64	200
		Cargo Handling & Stowage. (Cargo Operations)	21	50	21	50	22	50	22	50	86	200
4.	313	<u>MARINE METEOROLOGY.</u>	22	100	22	100	-	-	-	-	44	200

COURSE NO. N301

SUBJECT: PRINCIPLES OF NAVIGATION

SCHEME OF STUDIES.

FIRST YEAR

<u>Code No.</u>	<u>Name of paper</u>	<u>Credit Hours</u>	<u>Duration Of Exam</u>	<u>Maximum Marks.</u>
Term-I N301	Principles of Navigation	32	03 Hrs	100
Term -II N301	Principles of Navigation	32	03 Hrs	100
	TOTAL	64		200

SECOND YEAR

<u>Code No.</u>	<u>Name of paper</u>	<u>Credit Hours</u>	<u>Duration Of Exam</u>	<u>Maximum Marks.</u>
Term-III N301	Principles of Navigation	32	03 Hrs	100
Term-IV N301	Principles of Navigation	32	03 Hrs	100
	TOTAL	64		200

DETAILED SYLLABUS - PRINCIPLES OF NAVIGATION

FIRST TERM

SECTION	T O P I C S	NO. OF HOURS.
1.	DESCRIPTION OF THE EARTH:	(14)
1.1	Shape of the Earth. Ellipsoid, Compression of Poles, Equator, Meridians, Latitudes, Parallels of latitudes, Prime Meridian and Longitudes, D.Lat. D.Long, Great and Small Circles, Verticals.	
1.2	Rotation of Earth's Axis, Datum provided by the Meridian, Rhumb line, Polar and equatorial circumferences.	
1.3	Direction, True, Magnetic and Compass North.	
1.4	Land and Sea miles a measure of distances.	
2.	SAILING :	(18)
2.1	Departure, D.long, Parallel Sailing and Proof of its formula, Calculation of speed of rotation of points in different latitudes, course and distances.	
2.2	Definition of true course and rhumb line, Derivation of plane sailing formula. Mean and Middle latitudes.	
2.3	Mercator chart and Mercator Sailing, Requirements of a chart appropriate of marine navigation, Principles of construction of Mercator Chart, its accuracy and limitations, Natural scale of chart, Meridional parts and D.M.P. Mercator sailing formula. Course and distance between two positions.	

SECOND TERM

3.	GENERAL ASTRONOMY:	(20)
3.1	Milky-way galaxy and its dimensions in terms of light years. Position and movement of solar system within the milky-way. Principal star types and their comparison with the sun. Recognition of stellar constellations.	
3.2	Solar system, its composition and dimensions, Inferior and superior planets, Kepler's Laws of Planetary motion. Definitions of perihelion, aphelion and eccentricity.	
3.3	Description of the Earth's elliptical orbit and its eccentricity. Inclination of Earth's axis to the plane of the orbit and formation of seasons. Solstices and equinoxes and affect of Kepler's Laws on the length of seasons.	
3.4	Earth's axial rotation and formation of day and night. Varying length of day light through the year. Daylight, Day light and darkness in various latitudes.	

3.5 Purpose of altitude correction, Visible, Sensible and rational horizons. Sextant, observed and true altitudes and relevant corrections.

4. **T I M E :** (12)

4.1 L.A.T., L.M.T., Equation of time, Solar day Lunar day-Sidereal Day, Relationship between L.H.A. and L.A.T., G.M.T., L.M.T. and Longitude Zone time and Standard time.

THIRD TERM

4.2 Twilight, Civil, Nautical and Astronomical, use of Nautical Almanac to find out twilights, Necessary conditions for twilight and night continuous day light or darkness.

5. **CELESTIAL SPHERE** (32)

5.1 Celestial sphere-true and Mean motion of sun, Ecliptic, Celestial Poles, Meridians, Equinoctial. The obliquity of the ecliptic. Equinoctial system of co-ordinates S.H.A. Declination and Polar distance. Nautical Almanac. Hour angle, G.H.A., L.H.A. and Longitude relationship.

5.2 Daily motion and horizontal system of co-ordinates Horizon, Zenith and nadir, vertical circles and Prime Vertical. Elevated and depressed poles. Altitude of elevated pole in observer's latitude, observers upper and lower meridian. Apparent daily path of all bodies.

5.3 Relationship between azimuth, quadrantal bearings and 360° notation bearings. Rising and setting points and amplitudes. Conditions for a body to be circumpolar and to cross the Prime Vertical.

5.4 Figure drawing on the plane of rational horizon and observers celestial meridian using equidistant projection and illustration of navigational problems and principles.

5.5 Amplitude formula, effects of latitude on the accuracy of amplitude observation. Theoretical and visible rising and setting of sun. Extraction of information from the Nautical Almanac about rising and setting of heavenly bodies and Meridian Passage Times.

FOURTH TERM

5.6 PZX triangle, Haversine formulae and Napier's Rules to solve PZX triangle.

6. **POSITION LINE THEORY:** (21)

6.1 Combination of equinoctial and horizon system of co-ordinates to determine centre of position circle and its direction in the vicinity of a selected position.

Assumptions made when plotting celestial position lines and the circumstances in which they become significant.

- 6.2 Meridian altitudes of celestial bodies and determination of observer's latitude from observation of bodies on the meridian above and below the pole.
- 6.3 Pole star observations to find latitude and direction of P/L. Understanding and application of relevant corrections.

SYLLABUS - PRINCIPAL OF NAVIGATION
TERM : I, II, III & IV
(NAUTICAL)

RECOMMENDED BOOKS:

S.NO.	NAME OF THE BOOK	A U T H O R
1.	Admiralty Manual of Navigation Volume - I, II, & III	H M S O
2.	Nicholas's Concise Guide Volume - I & II.	Edward J. Coolen.
3.	Navigation for Watch-keeper	L.W.J. Fifeld

SUMMARY OF SYLLABUS

SECTION	T O P I C S	NO. OF PERIODS
1.	Description of Earth	20
2.	Sailing	28
3.	General Astronomy	30
4.	Time	16
5.	Celestial Sphere	66
6.	Position Line Theory	32
T O T A L :		192

COURSE NO. N302
SUBJECT: OCEAN AND OFF SHORE NAVIGATION

SCHEME OF STUDIES.

FIRST YEAR

	<u>Code No.</u>	<u>Name of paper</u>	<u>Credit Hours</u>	<u>Duration Of Exam</u>	<u>Maximum Marks.</u>
Term-I	N302	Ocean & Off Shore Nav.	32	03 Hrs	100
Term -II	N302	Ocean & Off Shore Nav.	32	03 Hrs	100
			TOTAL 64		200

SECOND YEAR

	<u>Code No.</u>	<u>Name of paper</u>	<u>Credit Hours</u>	<u>Duration Of Exam</u>	<u>Maximum Marks.</u>
Term -III	N302	Ocean & Off Shore Nav.	32	03 Hrs	100
Term -IV	N302	Ocean & Off Shore Nav.	32	03 Hrs	100
			TOTAL 64		200

OCEAN AND OFF SHORE NAVIGATION

FIRST TERM

<u>SECTION</u>	<u>T</u>	<u>O</u>	<u>P</u>	<u>I</u>	<u>C</u>	<u>S</u>	<u>NO. OF HOURS</u>
<hr style="border-top: 1px dashed black;"/>							
1.	CALCULATING COURSES AND DISTANCES :						(22)
1.1	Use of Parallel sailing formula, Distance between two positions on the same parallel of latitude, Finding of final position using D.lat, and D.long.						
1.2	Use of plane sailing formulae. Practical problems in plane sailing. Day's work.						
1.3	Understanding layout of traverse table. Use of traverse table in Practical Sailing problems.						
1.4	Application of Variation, Deviation Compass Error to True, Magnetic & Compass Courses.						
1.5	Mercator Sailing Formulae, Comparison of mercator sailing and other sailing. use and understanding of meridional parts and finding of course and distance between tow positions.						

SECOND TERM

1.6	Finding of distance and courses by great circle sailing and composite sailing.						
2.	NAUTICAL ALMANAC:						(06)
2.1	Understanding the information contained in general in Nautical Almanac and details in the daily pages. Use of these information for Navigational problems.						
2.2	The Chronometer - Finding Mean Time at Greenwich.						
3.	ALTITUDE CORRECTIONS:						(16)
3.1	Obtaining of true altitude from sextant altitude by applying all necessary corrections. True Zenith distance.						
3.2	Use of Sextant to measure vertical and horizontal angles. Finding of index error of the sextant by Star, Sun etc.						

THIRD TERM

4.	COMPASS ERRORS - AZIMUTHS						(32)
4.1	Finding compass errors by comparing azimuths of the heavenly bodies. Solution of amplitude problems.						
4.2	Use of isogonal lines and other information on charts to obtain magnetic variation at various places.						
4.3	Finding of compass errors and deviation for ship's head.						

- 4.4 Finding times of Twilight, Rising, Setting and Meridian Passage Times of Heavenly bodies.

FOURTH TERM

5. ASTRO POSITION LINE: (32)

- 5.1 Latitude by meridian altitude in both hemispheres. Relationship between altitude of the elevated pole and the observer's latitude.
- 5.2 Circumpolar stars at upper and lower transits, position line and its direction. Pre-computation of sextant altitude of a heavenly body at the meridian. Use of Polaris to find the observers latitude by apply necessary corrections. Azimuth and direction of P/L obtained by Polaris.
- 5.3 Position line and its direction. Formation and solution of PZX triangle. Derivation of longitude of the observer from the L.H.A. and G.H.A.
- 5.4 Finding the intercept and the intercept terminal point through which to draw P/L (Mareq. St. Hilaire method).
- 5.5 Pre-computation of altitude and azimuths of heavenly bodies to determine their suitability for position fixing, using star charts.
- 5.6 Familiarity in the use of modern sight reduction tables.
- 5.7 Astronomical and terrestrial position lines, visual bearings and radio line of position. Finding of position of the observer from two or more position lines obtained simultaneously.

Exercises.

SYLLABUS - OCEAN AND OFF SHORE NAVIGATION

TERM : I, II, III, IV
(NAUTICAL)

RECOMMENDED BOOKS:

S.NO:	NAME OF THE BOOKS	AUTHOR
1.	Admiralty Manual of Navigation Volume - I, II & III.	H M S O
2.	Nicholl's Concise Guide Volume - I & II.	Edward J. Coolen.
3.	Navigation for Watch-keeper.	L.W.J. Fifeld.

SUMMARY OF SYLLABUS

SECTION	T O P I C S	NO. OF PERIODS
1.	Calculation Courses and Distances.	22
2.	Nautical Almanac.	06
3.	Altitude Corrections.	16
4.	Compass Errors - Azimuth.	32
5.	Astro Position Line.	32
		----- TOTAL:- 108 -----

COURSE NO. N303
SUBJECT: COASTAL NAVIGATION

SCHEME OF STUDIES.

SECOND YEAR

	<u>Code No.</u>	<u>Name of paper</u>	<u>Credit Hours</u>	<u>Duration Of Exam</u>	<u>Maximum Marks.</u>
Term-III	N303	Coastal Navigation .	44	03 Hrs	100
Term -IV	N303 .	Coastal Navigation	44	03 Hrs	100
		TOTAL	88		200

DETAILED SYLLABUS - COASTAL NAVIGATION

THIRD TERM

SECTION: T O P I C S:	NO. OF HOURS
1. CHARTS	(08)
1.1 Fathom and Metric Charts	
1.2 How charts are made, Description of Charts	
1.3 Categories of charts - Ocean charts, Coastal charts, Plans - some special types of charts. Hyperbolic lines- Lattice charts- Routing charts.	
1.4 Salient features of charts - symbols and abbreviations used. Information available from charts.	
2. MISCELLANEOUS ADMIRALTY PUBLICATION	(04)
2.1 Notices to Mariners information they contain large and small corrections.	
2.2 Other publications related to charts and navigation information they contain.	
3. FINDING POSITION, COURSE AND DISTANCE	(03)
3.1 Compass rose - use of chart work instruments	
3.2 Position by bearing and distance.	
3.3 Latitude, longitude.	
4. FIXING SHIP'S POSITION	(02)
4.1 Various methods of obtaining positions and position by cross bearings. Ranges/position D.R. position fix estimated position and fix	
5. COMPASS CORRECTIONS	(06)
5.1 True and Magnetic meridians.	
5.2 Variations - Deviation and compass error definitions.	
5.3 Conversion of compass courses and vice versa.	
5.4 Magnetic courses to true courses and vice versa.	(09)
5.5 Compass courses to true courses and vice versa.	
5.6 Gyro errors and corrections.	
6. RUNNING FIX	(02)
6.1 Simple running fix position.	

- 6.2 Double angle on the bow
- 6.3 Four point bearing selected angles.

7. **HORIZONTAL & VERTICAL ANGLES** (03)

- 7.1 Finding position by horizontal and vertical sextant angles.
- 7.2 Bearings by erroneous compass and finding compass error.
- 7.3 Dipping and rising bearing of lights.
- 7.4 Distance sailed round on arc.

8. **CURRENT AND LEEWAY** (16)

- 8.1 D.R position estimated position.
- 8.2 Set and rate of current effects of currents and
- 8.3 Examples and exercises.
- 8.4 Application of lee Way
- 8.5 Examples and exercises

FOURTH TERM

9. **POSITION LINE BY ASTRONOMICAL OBSERVATIONS** (19)

- 9.1 Position lines, Longitude by chronometer method
- 9.2 Position line, Marcq St. Helaire Method.
- 9.3 The use of a single position line to approach a position making are of current and leeway efforts.
- 9.4 Fixing position by astronomical position lines withdrawn between.
- 9.5 Exercises.

10. **PASSAGE PLANNING** (11)

- 10.1 Principles of passage planning and execution.
- 10.2 Landfalls in thick and clean weather situation of a suitable anchorages and entering measured waters.

11. **TIDES** (14)

- 11.1 Finding times of High and Low water at standard and secondary ports from the tide tables.
- 11.2 Use of tables and tide courses to find time at which tide reaches a specific height and corrections applicable to charted heights,/depths etc.
- 11.3 Exercises.
- 11.4 Exercises/Revision.

SYLLABUS - COASTAL NAVIGATION

TERM III & IV
(NAUTICAL)

S.NO:NAME OF BOOKS	A U T H O R:	ABBREVIATION
1. Nicholls's Concise Guide Vol-I	H.H.Brown	HHB
2. Nicholls's Concise Guide Vol-II	H.H.Brown	HHB
3. Navigation for Watch-keepers	L.W.J.fifield	LWJF
4. Basic Costal Navigation.	Convad Dixon	CD
5. Modern Chart Work.	W.H.Squair	WHS
6. Chart and Abbreviations	H M S O	HMSO
7. Publications Containing Navigational information	H M S O	HMSO

SUMMARY OF SYLLABUS

SECTION	T O P I C S :	NO. OF HOURS
1.	CHART	12
2.	MISCELLANEOUS ADMIRALTY PUBLICATIONS	06
3.	FINDING POSITION, COURSE AND DISTANCE	03
4.	FIXING SHIP'S POSITION	02
5.	COMPASS CORRECTIONS	09
6.	RUNNING FIX	03
7.	HORIZONTAL & VERTICAL ANGLES	05
8.	CURRENT AND LEEWAY	28
9.	POSITION LINE BY ASTRONOMICAL OBSERVATIONS	19
10.	PASSAGE PLANNING	11
11.	TIDES	14
	TOTAL :	<u>112</u>

COURSE NO. N304
SUBJECT: RADAR NAVIGATION

SCHEME OF STUDIES.

SECOND YEAR

	<u>Code No.</u>	<u>Name of paper</u>	<u>Credit Hours</u>	<u>Duration Of Exam</u>	<u>Maximum Marks.</u>
Term-III	N304	Radar Navigation	32	03 Hrs	100
Term -IV	N304	Radar Navigation	32	03 Hrs	100
		TOTAL	64		200

DETAILED SYLLABUS - RADAR NAVIGATION

THIRD TERM

SECTION:	T	O	P	I	C	S:	NO. OF HOURS
1. RADAR BASICS							(16)
1.1							Methods by which a radar installation gathers information and presents it on a visual display.
1.2							ECHO Principle and its application to radar pulses.
1.3							Components of a simple block diagram of a radar installation.
1.4							Path followed by a single radar pulse from transmitter to target, and returning echo through the receiver to its appearance on the C.R.T.
1.5							Method by which the C.R.T. is able to display an echo at the correct range and bearings.
1.6							Radar horizon and the factors which affect its distance from the observer.
1.7							Safety precautions necessary when in the vicinity of open equipment and the radiation hazards near antennae and open wave guides.
2. SETTING UP AND MAINTAINING, DISPLAYS							(12)
2.1							Setting controls to obtain and maintain an optimum display of targets. The correct switching on. Safe guards and Procedures. Ship's Head up, North up, Relative Motion and True Motion presentation. Alignment of display to a specific mode. Checking accuracy of the heading marker by comparison with visual observations.
2.2							Performance monitoring procedure and its use. Use of range and bearing measurement controls and reporting procedures. Functions of other controls. Blind and shadow sectors. Detection of poor response targets, growlers, man overboard and landfall. Radar's limitations.
3. UNWANTED AND SPURIOUS RESPONSE							(04)
3.1							Problems associated with unwanted and spurious responses. Action of limiter. Potential to detect a target beyond the rain clutter area, recognition of true echo out of multiple and indirect echoes. Radar to radar interference.

FOURTH TERM

4. **RANGE AND BEARING** **(08)**
- 4.1 Navigational information provided by radar, sources of errors in accuracy of ranges and bearing.
 - 4.2 Target features which contributes to its radar response.
 - 4.3 Introduction to active and passive Radar Responders.
 - 4.4 Comparison of the chart and P. P. I. for radar conspicuous targets.
 - 4.5 Racons and Ramarks on radar screen.
 - 4.6 Use of Radar in Passage plan and application of parallel indexing techniques.
 - 4.7 Effects of pulse length, beam width shadowing and radar horizon on charted topography. Minimum range detection limits imposed by pulse length.
 - 4.8 Comparison of positions obtained by radar and other position fixing systems.
 - 4.9 Importance of radar for warning of restricted visibility.
 - 4.10 Practical.
5. **RADAR PLOTTING** **(12)**
- 5.1 Radar as an aid for avoiding collision.
 - 5.2 Basic theory of true and relative radar plots.
 - 5.3 Limits of accuracy of information obtained from afterglow.
 - 5.4 Tracking of an echo in real time.
 - 5.5 Symbols used to indicate target movements.
 - 5.6 True and relative plot and derivation of target vessels course and speed, CPA, and time to CPA, aspect etc. Making a complete report. Detecting course and speed change of other ships. Effect of change in own ship's course and speed.
 - 5.7 Possible errors in plotting and their effects on the information from a plot.
 - 5.8 Use of reflection plotter.
 - 5.9 Factor involved in efficient radar watch-keeping especially where dual radar facilities are available.
 - 5.10 Importance of operating Radar on suitable range in relation to prevailing circumstances and hence the use of correct plotting interval.

6. **APPLICATION ON COLREG AT SEA**

(04)

- 6.1 Duties and responsibilities as required by COLREG when carrying radar.

Understanding of rules which apply when vessels are in sight of one another and when not. Need for early action and appreciation of delay between the initiation of alteration of course and speed and recognition of change by the target vessel. Recognition of dangers of assumption made on scanty information. Hazards of small alterations. Advantages of moderate speed when using radar. There is no such thing as a stand on vessel in restricted visibility. Alteration of course to port to be avoided when safe and practical.

7. **AUTOMATIC RADAR PLOTTING AID.**

(04)

- 7.1 Basic Introduction to ARPA and its limitations. Meaning of terms PPC & PAD, their construction and use in collision avoidance.

- 7.2 Introduction to T.V. like Radar display sets i.e. Raster Screen. Their advantages and limitation.

8. **Practical & Exercises**

(04)

COURSE NO. N305
SUBJECT: ELECTRONIC NAVIGATION

SCHEME OF STUDIES.

SECOND YEAR

	<u>Code No.</u>	<u>Name of paper</u>	<u>Credit Hours</u>	<u>Duration Of Exam</u>	<u>Maximum Marks.</u>
Term-III	N305	Electronic Navigation	. 22	03 Hrs	100
Term -IV	N305	.Electronic Navigation	22	03 Hrs	100
			TOTAL 44		200

DETAILED SYLLABUS - ELECTRONIC NAVIGATION SYSTEMS

THIRD TERM

SECTION:	T	O	P	I	C	S:	NO. OF HOURS
1. ELECTROMAGNETIC WAVES:							(04)
1.1 Nature and Propagation of Electromagnetic Waves							
2. GYRO COMPASS:							(06)
2.1 Free gyro scope and its gimble mountings. Gyroscope inertia and precession. Courses of precession.							
2.2 Tilt Drift effects of earth's rotation.							
2.3 Making a free gyroscope north seeking by the use of gravity control and the resulting oscillation of the axis.							
2.4 Use of damping in azimuth and damping in tilt to cause settling of the axis.							
2.5 Achievement of control and damping by replacing ballistic elements with electrical signals.							
2.6 Starting of the gyro compass minimizing settling time by slowing and levelling to the correct heading.							
2.7 Settings to be made or adjusted while the compass is in use.							
2.8 Gyro inputs to the D.F. and Radar. Alarms fitted to a gyro compass.							
3. THE MAGNETIC COMPASS:							(06)
3.1 Construction of a liquid card magnetic compass, sketching a section through the compass to show the float chamber, the pivot support and arrangement of magnets.							
3.2 Keeping the card practically horizontal in all latitudes.							
3.3 Composition and allowance for change in volume of the liquid. Removing of air bubbles from the bowl.							
3.4 Support of bowl in the Binnacle-Marking of lubber line. Binnacle and arrangements of correcting devices.							
4. ECHO SOUNDERS AND SPEED MEASUREMENT:							(08)
4.1 Principles of marine echo sounding equipment							
4.2 Physical factors affecting the velocity of sound waves in sea water.							
4.3 Main components on a block diagram.							
4.4 Transducers.							

- 7.7 GPS signal characteristics.
- 7.8 GPS system segments.
- 7.9 GPS system time.
- 8. **LORAN-C SYSTEM:** (06)
 - 8.1 Basic Loran-C System - Principle of Operation
 - 8.2 Transmission pulses.
 - 8.3 Cycle matching - Measurement of the time Difference
 - 8.4 Reception of sky wave signals.
 - 8.5 Chain identification.
 - 8.6 Loran-C Charts, Tables and corrections.
 - 8.7 Coverage and accuracy of Loran-C.
- 9. **Electronic Chart Display & Information System (ECDIS) (06)**
 - 9.1 Nautical Chart.
 - 9.2 Raster Navigational Charts (RNC).
 - 9.3 Electronic Navigation Charts (ENC).
 - 9.4 Geodetic Datum.
 - 9.5 Working of system.
- 10.
 - 10.1 GPS & Ets points.
 - 10.2 Introduction of Electronic & Raster Charts.
 - 10.3 Electronic Charts display system (ECDIS)
- 11. **INTRODUCTION OF AUTOMATIC IDENTIFICATION SYSTEM (AIS): (10)**

SYLLABUS - ELECTRONIC NAVIGATION SYSTEMS.
TERM - III & IV
(NAUTICAL)

SECTION:	NAME OF BOOKS:	A U T H O R:
1.	Electronic Aids to Navigation	Appleyard
2.	Radio and Radar Aids To Navigation	Sonnenberg
3.	Admiralty Manual of Navigation Vol.I	Admiralty UK

SUMMARY OF SYLLABUS

SECTION:	T O P I C S :	NO. OF HOURS:
1.	Electromagnetic Waves	04
2.	Gyro Compass	06
3.	Magnetic Compass	06
4.	Echo Sounders & Speed Measurement	08
5.	Berthing Systems.	08
6.	Basic Principles of Hyperbolic Navigation	04
7.	Global Position System (GPS).	06
8.	LORAN-C System	06
9.	Electronic Chart Display & Information System (ECDIS).	06
10.	Automatic Identification System.	10
TOTAL:		64

COURSE NO. N306
SUBJECT: SEAMANSHIP (THEORY)

SCHEME OF STUDIES.

FIRST YEAR

	<u>Code No.</u>	<u>Name of paper</u>		<u>Credit Hours</u>	<u>Duration Of Exam</u>	<u>Maximum Marks.</u>
Term-I	N306	Seamanship (Theory)	.	32	03 Hrs	80
Term -II	N306	Seamanship (Theory)		32	03 Hrs	80
			TOTAL	64		160

SECOND YEAR

	<u>Code No.</u>	<u>Name of paper</u>		<u>Credit Hours</u>	<u>Duration Of Exam</u>	<u>Maximum Marks.</u>
Term-III	N306	Seamanship (Theory)	.	32	03 Hrs	100
Term -IV	N306	Seamanship (Theory)		32	03 Hrs	100
			TOTAL	64		200

DETAILED SYLLABUS - SEAMANSHIP THEORY

FIRST TERM

SECTION	T	O	P	I	C	S	NO. OF HOURS
1.	BASIC PERSONAL CONDUCT :						(05)
1.1	Norms of personal conduct ashore and on boardship including relationship with officers and crew members. Carrying out orders, personal appearance, pride of uniform, general smartness etc.						
1.2	Financial affairs, leaving an allotment opening a bank or other account, saving for leave, Personal Insurance, Social Security Contributions, sending letters and radio messages.						
1.3	A positive approach to using leisure time effectively by taking active interest in hobbies and recreations.						
1.4	The procedures of joining and leaving a ship, and use of personal documents.						
1.5	The need for health, personal hygiene, care of eyes in extreme climatic conditions, sunburn, heat exhaustion frostbite, general disease, alcohol, drugs, precautions in eating ashore, the ships medicine chest etc.						
1.6	Cleanliness of accommodation. Clothing and personal effects. Keeping fit, importance of exercise.						
2.	GENERAL TERMS APPLIED :						(05)
2.1	Terms applied to a ship parts of a ship i.e. Hull, Stem, Stern, Port, Stbd, Water Borne, Ship Side, Decks, etc.						
2.2	Terms applied to Hull.						
2.3	Direction and position out side the ship i.e. Relative Bearing, Ahead, Abeam, Astern Bow, Quarter, Finebow etc.						
2.4	Bearings (Compass, Gyro or True)						
2.5	Gyro & Magnetic Compass - Cards & Repeaters.						
2.6	Deck and Ships						
2.7	Glossary of Shipping Terms.						
3.	HELMS MAN SHIP						(03)
3.1	Interpretation of 0° - 360° notation						
3.2	The division of Card into 'Points' and 'Half - Points'.						
3.3	Relative bearings of objects in degrees or points on the Bow, abaft the beam and on the quarter.						

3.4 Box the Compass in half-points

3.5 Identify the meaning of standard helm-orders

4. **WATCH ORGANISATION & MUSTERS** (03)

4.1 Two watch and three watch system, Dog-watch.

4.2 Striking the bell, time indication emergency signals

4.3 Muster list, Muster & Drills, Action and Joining various signals.

5. **ROPES & WIRES** (09)

5.1 Properties of natural fibre ropes, materials in common use and their properties. Define: 'Lay'. Hawser, Cable, Plaited lays.

5.2 Properties lay gives a rope, with regard to flexibility, handling characteristics etc.

5.3 Recognises properties of synthetic fibre ropes: Materials in common use and their properties, Staple, monofilament, multifilament and Film Fibers.

5.4 Construction and characteristics of steel wire ropes.

5.5 Characteristics of combined wire/fibre and natural/synthetic ropes.

5.6 The care of ropes and wire including : Storage. Correct method of coiling and flaking. Breaking out new coils. Method of lubricating wires. Correct method of leading wires and ropes; kinking, chafing and sharp bights.

6. **LIFTING GEARS** (07)

6.1 Blocks, Parts of block, types of blocks, Care & Maintenance.

6.2 Purchase and Tackles, Types, Parts, Mechanical Advantage, Velocity Ratio.

6.3 Shackles - Parts, Types

6.4 Thimbles - Parts, Types - Hooks & their types.

6.5 Parts of a Simple Derrick, Sheer leg, Gyn.

6.6 Various types derricks in use.

SECOND TERM

7. **GENERAL SAFETY AND ACCIDENT PREVENTION** (05)

7.1 The causes of accidents including falls; sky larking; slippery decks; improper footwear - mooring ropes and wires; hold ladder; congested deck - staging - hatch covers - hatchways; steam pipes; running; lifting weights, heather.

- 7.2 Explain that accidents are caused, they do not happen. Distinguish the primary and secondary cause of accidents (i.e. self inflicted and negligence causing accidents to others). Distinguish the latent effects of negligence - human elements. The importance of following laid down procedure and 'Job Discipline' and using the correct for the job. Examples of accidents occurring when using wrong tools. Explain the need for protective clothing and equipment (goggles, face, masks, helmets etc.)
- 7.3 The hazards of entering enclosed spaces, electrical steam and compressed air systems, working aloft and overside, incorrect clothing, describes the function of ear defenders.
- 7.4 Describes the safety organisation on board ship-safety committee.
- 7.5 The need of an effective emergency organisation. Regular and effective drills.

8. ROPES AND WIRES : (08)

- 8.1 Types of whipping and their various uses.
- 8.2 Types of Seizing and their uses.
- 8.3 Stoppers and their uses
- 8.4 Splices and their uses
- 8.5 Explain Safety Precautions to be taken when handling ropes & moorings.
- 8.7 Hand lead line, marking, reporting of sounding
- 8.8 Safety Precautions to be taken when constructing, rigging and using stages and Bosun's Chair.
- 8.9 Performing the individual tasks involved in covering and uncovering, opening and closing hatches with wooden/tarpaulin, covers, steel or wooden slabs/tarpaulin covers, steel gasketed hatches, tank lids, side openings.
- 8.10 Term with reference to hatches etc. 'pontoon' 'piggyback' 'flush deck' 'roll up hatches' 'single pull', 'side ports'.
- 8.11 Safety precautions when working in holds and openings and losing hatches.

9. ANCHOR, WINDLASSES & STOWAGE OF CABLE: (08)

- 9.1 The constructional features of anchors and cables.
- 9.2 Common method of marking anchor cable.
- 9.3 Reporting the amount of cable veered
- 9.4 Performing the individual tasks required of a member of an anchor party, i.e. in securing the anchor for sea or at anchor.

- 9.5 Walking out, Weighing, Aweigh, Foul, Brought up, Compressor, Devils claw, bow stopper, Spurling pipe, Hawse pipe.
- 9.6 The common methods of sealing the spurling pipe.
- 9.7 The method of safe handling of chain cable on deck and in non-selfstowing lockers.
- 4.8 The controls of wind lasses and capstans
- 9.9 Rope and wires when warping, surging and paying out.
- 9.10 Examples of the safety precautions when working with windlasses, Capstans and handling moorings.
- 9.11 Chain lockers, methods of securing of the "bitter" end, means of cleaning and pumping chain lockers and the trim effect of (a) the quantity of cable and (b) the locker full of water.
- 9.12 Supervises the maintenance of the windleas and associated equipment.

10. CARGO HANDLING EQUIPMENT : (04)

- 10.1 The parts of a derrick including the parts of a block.
- 10.2 The purpose of a preventer
- 10.3 Leading a runner or rope to a winch correctly.
- 10.4 Operating winches and dolly winches safely
- 10.5 General precautions to be taken before and during the operation of a winch whether used for working cargo or for warping.
- 10.6 States use of single and double gearing on steam winches.
- 10.7 A winch in single and double gear.
- 10.8 The term deaman, scooner guy, steam Guys.
- 10.9 The rigging of derricks for union purchase, swinging derrick and doubling gear.
- 10.10 The operational features, the safety precautions required and the appropriate use of the following deck equipment in all climatic conditions.

Electric, Steam and hydraulic and self tensioning winches, capstans, windlasses, hoists and other lifting gear.

11. MOORING OPERATIONS : (07)

- 11.1 The average mooring arrangements
- 11.2 States the use of head ropes, stern ropes, breast rope and springs.

- 11.3 Demonstrating ability to make a mooring rope fast mooring bits
- 11.4 Identifying the hazards involved in handling mooring and knows the correct working practice.
- 11.5 Explaining the importance of correct maintenance of leads, rollers winch drums etc.

THIRD TERM

12. SHIP MANOEUVERING AND HANDLING : (10)

- 12.1 Recounting the basic principles involved in executing the following manoeuvre: Coming to a single anchor emergency use of anchors; turning vessel short round with effect of trim; wind, displacement and type of machinery; turning vessel in heavy weather; Berthing and unberthing under various conditions of wind and tide; Approaching a pilot vessel with due regard to weather and tide; handling a vessel in rivers, estuaries and other shallow waters, having regard to the effects of current, wind an restricted room on the response to the helm also back rejection, square effects and interaction between passing vessels.
- 12.2 Choice of anchorage, the operation of anchoring to two anchors in unrestricted and limited anchorages.
- 12.3 Explaining the factors to consider when determining the scope of anchor cable to be used.
- 12.4 Describes the remedies for dragging anchors and clearing foul anchors.
- 12.5 Explaining the precautions when maneuvering for launching boats and or liferafts in heavy weather.
- 12.6 Enumerating the methods of taking on board survivors from lifeboats and / or liferafts.
- 12.7 Demonstrating familiarity with the maneuvering characteristics of a ship e.g. stopping distances, turning, circles.
- 12.8 Outlining the use of and navigation in traffic separation schemes
- 12.9 Enumerating practical measures to be taken when navigating in ice or condition of ice accretion.
- 12.10 Explaining the procedures of dry-docking in both the intact and damaged conditions.
- 12.11 Explaining means of lessening drift when "Hove to" in heavy weather.
- 12.12 Describes the uses of oil on water in heavy weather.
- 12.13 Stressing the importance of moderate speed in situations where own ships wake could cause damage.

13. **SEARCH AND RESCUE :** (10)

- 13.1 Explains merchant ship position reporting systems that are available, their value and the use of these systems.
- 13.2 Paraphrasing regulation 10 chapter V of the SOLAS Convention.
- 13.3 Categorizing types of distress incidents.
- 13.4 Distinguishing the various agencies that will be involved in a distress incident.
- 13.5 Outlining the co-ordination procedures for on-scene co-ordination
- 13.6 Outlining the action to be taken by the ship in distress.
- 13.7 Explaining the signals likely to be received by the assisting vessels.
- 13.8 Explaining immediate action by assisting vessels
- 13.9 Describing the action to be taken whilst proceeding to the distress.
- 13.10 Describing the strict radio discipline necessary in inter-ship communications.
- 13.11 The necessary actions on approaching the scene.
- 13.12 The possible search procedures on arrival at the scene.
- 13.13 The co-ordination with the SAR aircraft in planning the search.
- 13.14 The special problems connected with restricted visibility
- 13.15 Outlining the co-ordination procedures when land-based authorities are involved.
- 13.16 Analysing evidence of a casualty and interprets this to judge if the search should be continued.
- 13.17 Illustrating the conclusion of a search, both successful and unsuccessful.
- 13.18 The special problems and characteristics of an aircraft casualty at sea.
- 13.19 The routine of questioning survivors.

14. **EMERGENCY PROCEDURES :** (12)

- 14.1 Summarizing the precautions to be taken prior to beaching a vessel.
- 14.2 Action to be taken prior to and after grounding
- 14.3 Action to be taken when floating a grounded vessel, with or without assistance.

- 14.4 Action to be taken following a collision.
- 14.5 Action to be taken regarding temporary plugging of leaks.
- 14.6 Precautions for the protection and safety of passengers and crew in various emergency situations.
- 14.7 Methods of rigging and use of : Emergency steering, jury steering and where practicable the rigging of a jury rudder.
- 14.8 The action to be taken when an emergency arises in port; including sources of assistance from ashore.
- 14.9 The arrangements for towing, and being taken in tow in an emergency.
- 14.10 The role of a junior officer when assisting a vessel in distress.
- 14.11 The lowering and recovery of an emergency boat to pick up a man overboard
- 14.12 Producing an organizational plan for personnel and shipboard facilities to assist in damage control
- 14.13 The procedures to be followed in the event of a total or partial electrical failure
- 14.14 The need to seek sea room in the event of an adverse weather forecast
- 14.15 Drawing up a comprehensive roster and emergency station and explaining safety recommendations
- 14.16 Identifying and uses the lifesaving appliances on passenger carrying and cargo carrying ships
- 14.17 Demonstrating and understanding of the minimum scale of provision of distress signals and explains how they are operated and how to dispose of time expired pyrotechnics
- 14.18 Summarising the requirements for line throwing equipment
- 14.19 Enumerating the dangers inherent in the use of line throwing gear
- 14.20 Procedures in wind and with tankers, special signals for tankers
- 14.21 Explaining how the breaches buoy rescue equipment can be set up and used
- 14.22 Types of helicopters used in search and rescue and commercial operations and describes their operational limitations
- 14.23 Supervision of deck party engaged in working with a helicopter

FOURTH TERM

15. **OFFICER-ON-WATCH DUTIES AT SEA & HARBOUR :** (06)
- 15.1 Basic principles to be observed in keeping a Navigational Watch.
 - 15.2 Look out their duties & additional duties - Officer-on-Watch as a look out - conditions.
 - 15.3 Operational guidance for officer incharge of a Navigational Watch.
 - 15.4 Taking over a watch
 - 15.5 Periodic checks of Navigational Equipment.
 - 15.6 Navigation in Coastal Water
 - 15.7 Restricted visibility
 - 15.8 Navigation with Pilot Embarked.
 - 15.9 Ship at Anchor.
 - 15.10 Taking over watch in port - keeping a watch
 - 15.11 Preparation prior proceeding to sea.
 - 15.12 Scral Entries.
 - 15.13 Embarking and Disembarking of Pilot - Pilot ladder.
 - 15.14 Navigation into ice.
 - 15.15 Hearing to, Turning a vessel in heavy weather.

16. **PREVENTION OF POLLUTION OF THE MARINE ENVIRONMENT:** (08)

All objectives refer to the IMO Conference on Marine Pollution 1973.

GENERAL POLLUTION.

- 16.1 Classifying liquid and noxious substances which can give rise to pollution.
- 16.2 Outlines the definitions used in the Conference.
- 16.3 The requirements concerning the duty to report an incident, when to report, how to report and the contents of the report.]
- 16.4 The procedure for reporting incidents involving harmful substances

TANKER POLLUTION:

- 16.5 The regulations for the prevention of pollution by oil.
- 16.6 Familiarity with the use of the oil record book (both Tanker and Non-Tanker)

- 16.7 The regulations concerning the issue of the International Oil Pollution Prevention Certificate (1973) i.e. form, duration, survey, issue.
- 16.8 The regulations concerning the control of discharge of oil, and the requirements of special areas with regards to reception facilities.
- 16.9 The regulations concerning segregated ballast tanks
- 16.10 The regulations concerning the size and arrangements of cargo tanks.

POLLUTION BY SUBSTANCES IN BULK - NON PETROLEUM:

- 16.11 The regulations for the prevention of pollution by substances carried in bulk
- 16.12 Familiarity with the use of the cargo record book for ships carrying noxious substance in bulk.
- 16.13 The regulations concerning the issue of the International Pollution Prevention Certificate for the Carriage of Noxious Liquid Substances in Bulk (1973).
- 16.14 The regulations for the prevention of pollution by harmful substances in packaged forms or in containers or wagons.

POLLUTION BY SEWAGE AND GARBAGE: (03)

- 16.15 The regulations concerning pollution by sewage and garbage from ships.
- 16.16 The regulations concerning the issue of International Sewage Pollution Prevention Certificate (1973).
- 16.17 The regulations concerning the discharge of sewage, the exceptions, and reception facilities.
- 16.18 The regulations concerning the disposal of garbage from ships, including special areas and reception facilities.

17. INTERNATIONAL MARITIME ORGANIZATION: (04)

- 17.1 What is I.M.O., its functions and working.
- 17.2 Members & Associate member Countries.
- 17.3 I.M.O. Conventions, Protocols, Agreements
 - a) S T C W
 - b) M A R P O L
 - c) S O L A S
 - d) U N C L O S
- 17.4 Names and outline of contents of the conventions ratified by Pakistan.

18. **THE AUTOMATIC PILOT:** (04)
- 18.1 Principles of an Auto Pilot System
 - 18.2 Manual settings and their functions
 - 18.3 Procedures for change over from Auto to Manual and vice versa.
 - 18.4 Course mounter and off course alarm.
 - 18.5 Regulations and performance standards of Automatic Pilot.
 - 18.6 Maintenance and listing of Auto Pilot
19. **KEEPING A LOG:** (03)
- 19.1 Rules and Regulations and common practice regarding Keeping A Log.
 - 19.2 Proper keeping of different kinds of log, during ocean passages. Coastal Navigation and in ports
- REVISION** (07)

SYLLABUS - SEAMANSHIP (THEORY)
TERM : I, II, III & IV
(NAUTICAL)

RECOMMENDED BOOKS:

S.NO.	NAME OF BOOKS	A U T H O R S
01.	Nicholl's Seamanship & Nautical Knowledge	A.N. Cockeroft.
02.	The Theory and Practice of Seamanship	Danton
03.	Mariners Hand Book	H. M. S. O.
04.	Survival at Sea	Cdre.N.F. Keens
05.	Survival at Sea	C.H. Wright
06.	Personal Safety on Ships	D O T.
07.	The Collision Regulations explained	C.H. Wright
08.	Code of Safe Practice.	H. M. S. O.
09.	Seamanship notes	Kemp & Young
10.	Efficient Deck Hand	C.H. Wright
11.	A Pocket guide for cold water survival	I. M. O.
12.	Ship Fire Gi Fighting Manual	Polytech-International
13.	Boat Work	L. G. Taylor
14.	Search & Rescue Manual	I. M. O.
15.	Manual on Oil Pollution	I. M. O.
16.	Marine Pollution 1973	I. M. O.
17.	Safety of Life at Sea	I. M. O.
18.	Prevention of Marine Pollution	I. M. O.
19.	Tanker Safety & Pollution Prevention	I. M. O.
20.	The Inert Gas System	I. M. O.

SUMMARY OF SYLLABUS

SECTION	T O P I C S	NO. OF HOURS
01.	Basic Personal Conduct	07
02.	General Terms Applied	08
03.	Helms-Man Ship	05
04.	Watch Organisation & Musters	04
05.	Ropes & Wires	14
06.	Lifting Gears	10
07.	General Safety and Accident Prevention	08
08.	Ropes and Wires	12
09.	Anchor, Windlasses & Stowage of Cable	13
10.	Cargo Handling Equipment	05
11.	Mooring Operations	05
12.	Ship Manoeuvring and Handling	13
13.	Search and Rescue	12
14.	Emergency Procedures	18
15.	Officer-on-Watch duties at sea & harbour	06
16.	Prevention of Pollution of the Marine Environment	08
17.	International Maritime Organization	10
18.	The Automatic Pilot	07
19.	Keeping a Log	03
	Revision	10
		192

20.	Basic Oil Tanker Safety (Covered at PMA in Mandatory Course as per STCW-95)
21.	Survival at Sea
22.	Types of Survival Crafts (boats)
23.	Inflatable Life Raft
24.	Life buoy & Life Jackets in buoyant apparatus.
25.	Abandoning ship and after actions
26.	Basic Training in Fire Fighting

Note : Sr. No. 21 to 26 to be covered at Seaman Training Centre in mandatory courses as per STCW'95.

COURSE NO. N307
SUBJECT: SEAMANSHIP (PRACTICAL)

SCHEME OF STUDIES.

FIRST YEAR

<u>Code No.</u>	<u>Name of paper</u>	<u>Credit Hours</u>	<u>Duration Of Exam</u>	<u>Maximum Marks.</u>
Term-I N307	Seamanship (Practical)	22	03 Hrs	20
Term-II-N307	Seamanship (Practical)	22	03 Hrs	20
	TOTAL	44		40

DETAILED SYLLABUS - SEAMANSHIP (PRACTICAL)
FIRST TERM

SECTION	T O P I C S	NO. OF HOURS
1.	ROPE WORK:	(04)
1.1	Construction of Natural and Synthetic ropes-lay of rope.	
1.2	Small Stuff.	
1.3	Rope work and cordage tools. Fids-Marline spikes serving board - serving Mallet, Palm and needles.	
1.4	Seizing, worming, Parcelling and serving.	
1.5	Whipping.	
2.	BOAT WORK:	(04)
2.1	Types of Boats.	
2.2	Parts & Equipments of Boats	
3.	BENDS AND HITCHES:	(04)
3.1	Bends and Hitches in common use on board ships.	
4.	ROPE WORK ROPE SPLICING VARIOUS TYPES OF SPLICES USED ON BOARD SHIPS:	(04)
5.	BOAT WORK:	(06)
5.1	Boat pulling terms. Practical Boat pulling-lowering and hoisting boats.	
5.2	Types and parts of Davits.	
<u>SECOND TERM</u>		
6.	ROPE WORK:	(01)
6.1	Steel wire ropes, construction, uses on board.	
7.	TACKLES AND PURCHASE:	(03)
7.1	Type of blocks - wooden steel, their parts.	
7.2	Reeving various blocks, tackles to advantage dis-advantage.	
7.3	Use of - shackles thimbles hooks, wire rope grips, clips, turn buckles etc.	
8.	BOAT WORK:	(04)
8.1	Power boat handling lowering hoisting.	

- 9. **ROPE WORK:** (04)
 - 9.1 Opening a new coil of fibre - steel wire Rope.
 - 9.2 Mousing a hook, shackle pin.
 - 9.3 Passing rope and chain stoppers.
 - 9.4 Putting and removing mooring ropes on the bits.
- 10. **RIGGING AND USING BOSUNS CHAIR AND STAGES FOR WORKING ALOFT AND OVERSIDES:** (04)
- 11. **BOAT WORK:** (04)
 - 11.1 Sails - Sailing terms, Sail boat handling
- 12. **PILOT LADDER:**
 - 12.1 Detailed construction of pilot ladder. (02)

SYLLABUS-SEAMANSHIP (PRACTICAL)

TERM : I & II

(NAUTICAL)

SECTION	NAME OF THE BOOK	A U T H O R
1.	The Theory & Practice of Seamanship.	DANTON.
2.	Nicholas Seamanship & Nautical Knowledge A.N.	Cockeraft.
3.	Knots splices & fancy work.	C.L. Spencer.

SUMMARY OF SYLLABUS

SECTION	T O P I C S	NO. OF HOURS
1.	ROPE WORK - FIBRE ROPES	08
2.	BOAT WORK-TYPES	08
3.	BENDS AND HITCHES	04
4.	ROPE WORK-SPLICING	04
5.	BOAT WORK-PRACTICAL	08
6.	ROPE WORK-STEEL WIRE ROPES	01
7.	TACKLES AND PURCHASE	07
8.	BOAT WORK-POWER BOAT	08
9.	ROPE WORK-GENERAL	04
10.	BOSUNS CHAIR & STAGES	04
11.	BOAT WORK-SAIL BOAT	08
TOTAL:		64

COURSE NO. N308
SUBJECT: WATCH KEEPING (COLREG)

SCHEME OF STUDIES.

SECOND YEAR

	<u>Code No.</u>	<u>Name of paper</u>	<u>Credit Hours</u>	<u>Duration Of Exam</u>	<u>Maximum Marks.</u>
Term-III	N308	Watch-keeping (Colreg)	22	Oral	50
Term -IV	N308	Watch-keeping (Colreg)	22	Oral	50
			TOTAL	44	100

DETAILED SYLLABUS - WATCHKEEPING

THIRD & FOURTH TERMS

SECTION	T	O	P	I	C	S	NO. OF HOURS
1. WATCHKEEPING ARRANGEMENTS AND PROCEDURES:							(58)
1.1							The content, application and intent of COLREG 72.
1.2							Keeping a safe navigational watch.
2. KEEPING A WATCH IN PORT:							(03)
2.1							Keeping an effective deck watch in port under normal circumstances.
2.2							Keeping a safe deck watch in port when carrying hazardous cargo.
3. IALA MARITIME BUOYAGE SYSTEMS:							(03)

SYLLABUS - WATCH KEEPING
TERM : III & IV
(NAUTICAL)

RECOMMENDED BOOKS:

SECTION	NAME OF THE BOOK	A U T H O R
1.	International Light, Shape & Sound Signal	D.A. Moore.
2.	The Collision Regulations fully explained	C.H. Wright.
3.	Basic Principles to be observed in keeping a Navigational Watch.	I. M. O.

SUMMARY OF SYLLABUS

SECTION	T O P I C S	NO. OF HOURS
1.	Watchkeeping Arrangements and Procedures	58
2.	Keeping a safe Navigational Watch	03
3.	IALA Maritime Buoyage System	03
T O T A L :		64

COURSE NO. N309
SUBJECT: MARINE COMMUNICATIONS & SIGNALS.

SCHEME OF STUDIES.

FIRST YEAR

	<u>Code No.</u>	<u>Name of paper</u>	<u>Credit Hours</u>	<u>Duration Of Exam</u>	<u>Maximum Marks.</u>
Term-I	N309	Marine Communications and Signals.	22	02 Hrs	50
Term-II	N309	Marine Communications and Signals.	22	02 Hrs	50
			TOTAL 44		100

DETAILED SYLLABUS - MARINE COMMUNICATIONS

FIRST TERM

SECTION	T	O	P	I	C	S	NO. OF HOURS
1. BASIC DEFINITIONS:							(02)
The purpose of international code of signal							
1.1	Addressee, Group, Hoist, Identity signal originator procedure signal, receiving station, Station of origin, tack line, transmitting station, visual signalling.						
2. MORSE CODE, LETTER AND FIGURE SPELLING:							(02)
2.1	Morse Code from A to Z and 1 to 0 letter and figure spelling from A to Z and 1 to 0						
03. DESCRIPTION OF FLAGS:							(02)
3.1	Recognizing Alphabetical flags, Numeral pendants and substitutes. Sending & receiving MORSE BY HAND FLAGS OR ARMS.						
04. TYPES OF SIGNAL LETTERS:							(01)
4.1	Single letter signals, and meaning two letter signal, three letter signals, four letter signals, five letter signals.						
05. METHODS OF SIGNALLING:							(02)
Flag signalling, flashing light and sound signalling, voice over loud hailer, radio telegraphy and radio telephony.							
5.1	PARTS OF SIGNAL MADE BY FLASHING						
5.2	PRACTICAL						
Reception and transmission of signal by flashing light at the rate of 15 characters per minute.							
06. GLOBAL MARITIME DISTRESS & SAFETY SYSTEM (GMDSS):							()
Introduction of GMDSS & Familiarization with Equipment. Flashing Light time or silence period distress frequency what signal transmission on distress frequency during silence what circumstances ships may call distress frequency procedure on arrival and departure by port and international communication.							
07. CODING AND DE-CODING:							(02)
Coding with single letter signals, coding with two letter signals, coding with three letter signals, coding with table of completing printing of some groups on right side of the book. Communications with port operation, coast station and vessel traffic services in the form of traffic lists and Trans Receiver.							

08 **FLAG SIGNALING:** (02)

How to call, how to answer, how to complete a signal, to act when signal is not understood. The uses of substitutes, communication by local signal code, communications by flags between men-of-war and merchant vessels, Position of hoists on different positions. Use of Answering pendant.

8.1 Practical

Reception and transmission of signal by flashing light at the rate of 15 characters per minute.

09. **SIGNALING:** (03)

How to spell word in plain language, use of answer pendant, procedure when using "Affirmative" "Negative" and "interrogative". Means of group "YU", "YZ", "YV".

9.1 How to signal numbers, single letter signals with compliment.

Azimuth or bearing, course, date, latitude, longitude, distance, speed, time, communication by local signal code.

How time of origin may be included.

10. **RADIO TELEPHONY:** (04)

Method of calling, Form of reply to calls, calling all stations in vicinity. Use of international code group follow.

Full-stop, decimal point, canceling the last word transmitted, call for un-known station or general call, transmission of a radio telegram, transmission of telegram when communication becomes difficult.

SECOND TERM

11. **MORSE SIGNALLING:** (04)

Procedure signals and signs, form of message. Describing how to signal depths.

11.1 Practical

Transmission and reception of signal by flashing light.

11.2 Signalling

The ships radio telephone station must be licensed by the administration.

Transmission may only be made on those frequency listed in the ships licensed.

What transmission permitted from ships in island and harbour.

Control of communication in ships to shore and ships to ships, working procedure arrival and departure port and internal communication on board.

12. **SOUND SIGNALLING:** (03)

Procedure for transmission of sound signals:

Signal between ice breaker and assisted vessels.

Procedure for intership working and end of work between two stations. Mute must be lifted from the filtered loud speaker.

Entries should be made in the radio log, receiving station, SAR operations.

13. **PRACTICAL:** (15)

Procedure for sending a message to unknown ship in plain language are coded errors, repeat, AA, AB, WA, WB, BN, AS, C, N, RQ and AR.]

Explain the use of identity signal and KK, KN.

Note:

Cadets will be examined in transmitting and receiving actual messages where they will be declared pass only if they obtain at least 90% marks.

SYLLABUS-MARINE COMMUNICATIONS

TERM : I & II
(NAUTICAL)

RECOMMENDED BOOKS:

SECTION	T O P I C S	NO. OF HOURS
01.	Basic definitions.	02
02.	Explanation of morse code, letter and figure spelling.	02
03.	Description of flags.	03
04.	Types of Signal letters.	01
05.	Methods of Signalling.	02
06.	Distress Signals.	02
07.	Coding and De-coding.	02
08.	Flag Signalling.	05
09.	How to Signal numbers and Signal letter Signals with complements.	03
10.	Radio Telephony, VHF, etc.	08
11.	Morse Signalling.	04
12.	Sound Signalling.	03
13.	Practical.	27
	T O T A L :	<hr/> 64 <hr/> <hr/>

COURSE NO. N310
SUBJECT: SHIP STABILITY.

SCHEME OF STUDIES.

FIRST YEAR

	<u>Code No.</u>	<u>Name of paper</u>	<u>Credit Hours</u>	<u>Duration Of Exam</u>	<u>Maximum Marks.</u>
Term-I	N310	Ship Stability.	11	01 Hrs	50
Term -II	N310	Ship Stability.	11	01 Hrs	50
			TOTAL 22		100

SECOND YEAR

	<u>Code No.</u>	<u>Name of paper</u>	<u>Credit Hours</u>	<u>Duration Of Exam</u>	<u>Maximum Marks.</u>
Term-III	N310	Ship Stability.	21	01 Hrs	50
Term -IV	N310	Ship Stability.	21	01 Hrs	50
			TOTAL 42		100

THIRD TERM

5. **EFFECT OF DENSITY ON DRAUGHT** (03)
- 5.1 Change of draught and density calculations for box shaped vessels. The Marine Hydrometer and its use.
- 5.2 FWA and derivation of formula $FWA = \frac{\text{Displacement}}{4 \text{ TPC}}$
- 5.3 Solution of problems involving FWA and DWA.
- 5.4 Bilgins-Permenability (Paper 2 para a)
6. **LOADING/DISCHARGING AND SHIFTING WEIGHTS** (11)
- 6.1 Definition of C of G and effect on C of G when loading, weights at a distance from the original C of G.
- 6.2 Effects on C of G when discharging weights from a certain distance from the original G.
- 6.3 Effects on C of G due to shifting weights.
- 6.4 Derivation of formula $CG_1 = \frac{w \times d}{W}$
- 6.5 Solution of problems involving loading, discharging and shifting of weights in a ship.
- 6.6 Moments about the keel and centre line.
- 6.7 Loading or discharging required weights to obtain given KG or GM.
- 6.8 Explanation of list. Sketch showing forces through G and B on listed ships, hence triangle GG₁M.
- 6.9 Derivation of formula $\tan \theta = \frac{GG_1}{BM}$
- 6.10 Problems involving loading weights off the centre-line and calculating list and bringing the listed ship upright.
- 6.11 Effective C of G suspended weights and Prediction of maximum list. Increase of draft with list.
- 6.12 Use of the Rolston stability indicator.
- 6.13 Short comings of traditional methods of stability calculations.
7. **TRANSVERSE STABILITY (SMALL ANGLES)** (06)
- 7.1 Definition of C of B and movement of C of B in a vessel heeled.
- 7.2 Forces through C of B and C of B at a small angle of heel.
- 7.3 Transverse metacentre, metacentric height (GM) and righting lever (GZ).
- 7.4 Proof of formula $GZ = GM \sin \text{heel}$ (Small angle) and righting moment = $W \times GZ$ (for small angle of heel).

- 7.5 Calculation of Righting moments in numerical problems.
- 7.6 Stable, Unstable and neutral equilibrium and angle of loll.

8. TRANSVERSE STABILITY (LARGE ANGLE) (06)

- 8.1 Gross curves of stability and their use to obtain GZ.
- 8.2 Use of KN curves to obtain KN values.
- 8.3 Derivation of formula $GZ = KN - KG \sin \theta$.
- 8.4 Information obtained from GZ curves i.e. range of stability, max GZ and angle, angle of vanishing stability, initial GM, angle of deck edge immersion.
- 8.5 GM alone is not sufficient for the safety of ship.
- 8.6 Difference in typical curves for stiff and tender ships at angle of heel and angle of loll.
- 8.7 Solution of numerical problems on above.
- 8.8 Effect of quartering and beam seas on Ship's stability.

FOURTH TERM

9. INCLINING EXPERIMENT (03)

- 9.1 Purpose of experiment and necessary conditions.
- 9.2 Proof of formula $GM = \frac{wxd}{W} \times \frac{\text{length}}{\text{list}}$ using plumb line and $GM = \frac{wxd}{W} \cot \theta$ using list.
- 9.3 Application of above to "Last Parcel" checks on GM.
- 9.4 Problems involving inclining experiment.

10. FREE SURFACE EFFECT (05)

- 10.1 Movement of C of G due to slack tanks.
- 10.2 Virtual movement of G to obtain equivalent reduction in righting lever.
- 10.3 Dangers of slack tanks with tender ships and the precautions to take during voyage.
- 10.4 Solution of KG Problems involving correction for free surface.
- 10.5 Method of correcting an angle of loll and Precautions to avoid one.
- 10.6 Effect of longitudinal sub-division of tanks.

11. LONGITUDINAL STABILITY (05)

- 11.1 Definitions of trim, LCF, GML, trimming moment and MCTC. Change of Trim with Density.

11.2 Derivation of formula $MCTC = \frac{Disp \times GML}{100 L}$

11.3 Solution of Problems involving loading, discharging and moving weights with LCF amidships & not amidships. True Mean Draft.

11.4 Calculation of changes of trim, LCF not amidship. (Use of Hydrostatic Data)

12. **LOAD-LINES** (06)

12.1 Reasons for allocation of load lines.

12.2 Zone chart and its use.

12.3 Rule regarding ships on Passage which pass through several zones.

12.4 Drawing of load line marks to scale.

12.5 Calculating distances between load lines marks.

12.6 Solution of Problems involving ships on passage, consumption of fuel and stores between zone.

12.7 Stability Problems relating to modern ships.

13. **STABILITY INFORMATION CARRIED ON SHIPS** (02)

13.1 Statutory requirements to carry stability info information.

13.2 List of information to be carried.

13.3 IMO's resolution regarding Stability requirements for various type of ships. Use of stability data. Using electronic stability calculators.

SYLLABUS - SHIP STABILITY
TERM: I, II, III & IV
(NAUTICAL)

RECOMMENDED BOOKS:

S.NO.	NAME OF BOOKS	A U T H O R	ABBREVIATION
1.	Ship Stability		D.R.Derrett.
2.	Merchant Ship Stability.		H.J.Pursey
3.	Know Your Own Ship		B.Baxter
4.	Seamanship and Nautical Knowledge		A.N.Cockroft.
5.	Ship Stability Notes and Examples.		J.F. Kemp

SUMMARY OF SYLLABUS

SECTION	T O P I C S:	NO. OF HOURS
1.	Hydrostatic Principle	13
2.	From Coefficients.	03
4.	Tones Per Cm Immersion	16
5.	Effect of density on draught	03
6.	Loading & Discharging and Shifting of Weights.	11
7.	Transverse stability (Small angles)	09
8.	Transverse stability (Large angles)	09
9.	Inclining Experiment	05
10.	Free Surface Effects	08
11.	Longitudinal Stability	08
12.	Load Lines.	08
13.	Stability Information Carried on Ships	03
TOTAL:		96

COURSE NO. N311
SUBJECT: SHIP CONSTRUCTION.

SCHEME OF STUDIES.

FIRST YEAR

	<u>Code No.</u>	<u>Name of paper</u>	<u>Credit Hours</u>	<u>Duration Of Exam</u>	<u>Maximum Marks.</u>
Term-I.	N311	Ship Construction.	11	01 Hrs	50
Term-II	N311	Ship Construction.	11	01 Hrs	50
		TOTAL	22		100

SECOND YEAR

	<u>Code No.</u>	<u>Name of paper</u>	<u>Credit Hours</u>	<u>Duration Of Exam</u>	<u>Maximum Marks.</u>
Term-III	N311	Ship Construction.	21	01 Hrs	50
Term -IV	N311	Ship Construction.	21	01 Hrs	50
		TOTAL	42		100

2.7 Stresses Caused by discontinuity at hatch ways and Super-structures. Stresses during buildings.

3. **FRAMING SYSTEMS** (04)

3.1 Longitudinal, Transverse, Combined and Reason for using different framing, Arrangement of frames side girders.

3.2 Transverse members in each system of framing.

THIRD TERM

4. **DOUBLE BOTTOM TANKS** (09)

4.1 Function and Construction: Transverse half section through D.B. Tank of transverse framed and longitudinal framed ship, types of floors.

4.2 Bilge drainage systems. Bilge piping. Ballast system, Sounding & Air pipes.

4.3 Duct Keel.

4.4 Pounding - Structural Compensation, Areas requiring strengthening, arrangement of frame floors and side girders to combat pounding stresses.

4.5 Panting - Structural Compensation Strengthening and form of stiffening, details at forward end. Transverse section of above arrangements, Alternate panting arrangements, Panting arrangements at after end.

5. **STRUCTURE AT UPPER DECK** (12)

5.1 Sheer strake and stringer plates, rounder sheer strake.

5.2 Hatch coamings and deepwebs. Tank lids and coamings of oil tankers with details.

5.3 Hatch covers of Dry Cargo Ship. Various types. Loss and Compensation of hatch opening in decks. Details of Structure. Connections of Superstructure to hull at ship side. Fashion plate - Bulwark plate. Bulwarks, Guard rails, Freeing arrangements, Scuppers, Freeing ports. Bilge Keels.

FOURTH TERM

6. **STERN STRUCTURE** (05)

6.1 Functions of Stern Frames, Stern frames, single screw ship's. Transom stern - connection to stern frame.

6.2 Functions of stern tubes, Oil Lubricated stern tubes.

6.3 Rudders & Propellers. Types; principle of screw propulsion shaft tunnel.

7. **BULK HEADS** (12)

7.1 Purpose of sub-division and basic requirements positioning of bulkheads, various types of bulkheads. Continuity of strength through oil tight bulkheads. Corrugated and stiffened bulkhead. Half cross sections of cargo compartment of dry cargo ship with details. Half cross section of cargo compartment of bulk carrier. Half cross section of cargo compartment of tanker showing web-framing and longitudinal stiffeners. Cross section of cellular container ship. Deck fittings, lashings. Half cross section of passenger ship, Combination Carrier, RO/RO.

8. **MOORINGS & FITTINGS** (04)

8.1 Fairleads - Mooring bits - Winches - Anchors arrangement for mooring & anchoring forward.

8.2 Description of Construction: Derricks, Deck Cram Masts, Sampson Posts - support at base.

9. **CORROSION**

Care and precaution against corrosion in a ships structure (para a).

SYLLABUS - SHIP CONSTRUCTION
(GENERAL SHIP KNOWLEDGE)
TERM: I, II, III & IV
(NAUTICAL)

RECOMMENDED BOOKS:

S.NO:NAME OF BOOKS	A U T H O R:	ABBREVIATION
1. Ship Construction	D.J.Eyres	
2. Merchant Ship Construction	H.J. Puresy	
3. Ship Construction Sketches and Notes.	J.F.Kemp	
4. Seamanship & Nautical Knowledge	A.N. Cockroft	
5. Reed's Ship Construction Vol-5 F.	Stoke	

SUMMARY OF SYLLABUS

SECTION	T O P I C S	NO. OF HOURS
1.	General Description of Ships.	16
2.	Stresses in Ship's Structures	10
3.	Farming Systems	06
4.	Double Bottom Tanks	14
5.	Structure at Upper Deck	18
6.	Stern Structure	08
7.	Bulkheads	18
8.	Moorings & Fittings	06
	T O T A L :	96

COURSE NO. N312
SUBJECT: CARGO HANDLING & STOWAGE (CARGO OPERATIONS).

SCHEME OF STUDIES.

FIRST YEAR

	<u>Code No.</u>	<u>Name of paper</u>	<u>Credit Hours</u>	<u>Duration Of Exam</u>	<u>Maximum Marks.</u>
Term-I	N312	Cargo Handling & Stowage (Cargo Operations).	21	01 Hrs	50
Term -II	N312	Cargo Handling & Stowage (Cargo Operations).	21	01 Hrs	50
		TOTAL	42		100

SECOND YEAR

	<u>Code No.</u>	<u>Name of paper</u>	<u>Credit Hours</u>	<u>Duration Of Exam</u>	<u>Maximum Marks.</u>
Term-III	N312	Cargo Handling & Stowage (Cargo Operations).	22	01 Hrs	50
Term -IV	N312	Cargo Handling & Stowage (Cargo Operations).	22	01 Hrs	50
		TOTAL	44		100

DETAILED SYLLABUS - CARGO HANDLING & STOWAGE

(CARGO OPERATIONS)

FIRST TERM

SECTION:	T	O	P	I	C	S:	NO. OF HOURS
1. BASIC DEFINITIONS							(02)
1.1 Understanding hold, hatch covers, Dunnage, Spar Ceiling, Bilge Wells, Deep Tanks, Broken Stowage, Stowage Factor, Freight, Bale and grain capacity, measurement of Cargo/Spaces.							
2. PREPARATION OF HOLDS							(03)
2.1 Cleaning hold, Dunnaging, Preparations for loading cargo, Separation, Marking of cargoes. Securing, Lashing.							
2.2 General Inspection, infestation, Hygienic standards of bilges.							
2.3 Deep tanks, Preparations for loading/discharging of liquid cargoes.							
3. CARGO HANDLING EQUIPMENT							(16)
3.1 Deck Machinery:							
i) Winches : Steam & Electric self tensioning.							
ii) Capstans.							
3.2 Derricks:							
Single, Swinging derrick, Union purchase rig, Finding of Stresses on different gears by Parallelogram of forces.							
3.3 Hatch Covers:							
i) Steel hatch covers types.							
ii) Hydraulic hatch covers.							
iii) Pontoon hatch covers. Opening, Closing and battening down of hatch covers.							
3.4 Heavy lifting cargo gears:							
Details of:							
i) Hallen Derrick						ii) Stulken derrick	
iii) Velle Crane						iv) Thompson derrick and their comparison with each other.	

SECOND TERM

3.5 Methods of Slinging.

3.6 Care and maintenance of all cargo gears, their correct use and safety requirements.

3.7 Introduction to horizontal & vertical systems.

4. **CARGO STOWAGE ORGANIZATIONS** (15)

4.1 **Cargo Plans:**

- i) Distribution of Cargo to avoid Stresses.
- ii) Employment of gangs to advantage.

4.2 Calculations of Cargo Stowage.

4.3 Stowage of different Commodities.

4.4 Precautions to be taken when loading/discharging heavy lifts.

4.5 Prevention of overstowage and sequence of discharge.

4.6 Other Documents.

5. **VENTILATION AND SWEAT** (06)

5.1 Factors to control sweat.

5.2 **Ventilation:**

- i) Natural
- ii) Forced various methods of controlling humidity.
- iii) Operation of various forced ventilation systems.

5.3 Cargoes requiring special ventilation techniques.

THIRD TERM

6. **SAFETY AT WORK** (04)

6.1 Factors effecting safety, Check lists for maintenance of Cargo Gears.

6aw Paraphrasing "Code of Safe practice for Merchant Seamen".

6.3 Entry into enclosed spaces.

7. **CARRIAGE OF DRY CARGOES** (04)

7.1 Calculations for charging freight. Amount of Cargoes to be loaded, Permissible heights, Volume limited and Dead weight limited ships. Full and Down.

8. **CARRIAGE OF BULK CARGOES** (04)

8.1 General requirements of "IMO" Code of safe practice for the carriage of Bulk Cargoes.

8.2 Main hazards associated with the carriage of Bulk Cargoes.

9. **CARRIAGE OF GRAIN CARGOES** (02)
- 9.1 IMO Regulations, recommendation, procedures and ventilation.
10. **CARRIAGE OF COAL CARGOES & DECK CARGO INCLUDING TIMBER** (04)
- 10.1 Various types of coals carried, specific hazards spontaneous combustion, ventilation procedures precautions during loading/discharging and carriage.
- 10.2 IMO code of safe practice for ships carrying timber deck cargo.
11. **CARRIAGE OF DANGEROUS CARGOES** (04)
- 11.1 Classification of dangerous cargoes, IMDG, Code.
- 11.2 Labelling of dangerous cargoes.
- 11.3 Precautions to be taken during loading/discharging.
- 11.4 Construction of magazines.

FOURTH TERM

1. **CARRIAGE OF SPECIAL CARGOES** (01)
- 1.1 Tallying, Check lists. Precautions, Pilferage.
2. **UNITIZED CARGOES** (04)
- 2.1 Cargoes suitable for unitization.
- 2.2 Description of Pallets and equipment to handle them.
- 2.3 Container types and equipment to handle them. Hazards involved.
- 2.4 Lashing techniques for containers & trailers.
3. **CARRIAGE OF REFRIGERATED CARGOES** (06)
- 3.1 Hold and locker preparations prior loading.
- 3.2 Types of cargoes which are carried chilled.
- 3.3 Types of cargoes which are carried Frozen.
- 3.4 Points to inspect in a Cargo:
a) Prior loading (b) During loading.
c) During Carriage.
4. **OIL CARGOES SAFETY** (11)
- 4.1 Precautions during cargo operations and gas freeing-safety check list.
- 4.2 Explosimeter - Chemical absorption gas detectors.
- 4.3 Toxic effects of Petroleum gases and skin ailments.

- 4.4 Health hazards while carrying hydrogen sulphide and Benzine.
- 4.5 Marine Pollution Convention (MARPOL 73/78) Coverage: Annex 1 (Oil Pollution Prevention)
- 4.6 Control of oil from Machinery spaces Oil Record Book.
- 4.7 Precaution to be taken to prevent Accidental Pollution by oil.

SYLLABUS - CARGO HANDLING & STOWAGE

(CARGO OPERATIONS)

TERM : I, II, III & IV

(NAUTICAL)

RECOMMENDED BOOKS :

S.NO:	NAME OF BOOKS	A U T H O R:	ABBREVIATION
1.	Thomas	Capt.O.O.Thomas	OOT
2.	Cargo Work	Capt.L.D.Conway	LDW
3.	Cargo Access Equipment for Merchant Ships.	I.L.Buxton	ILB
4.	Tanker Cargo Handling	D.Rutherford	DR
5.	Code of safe practices for Solid Build Cargoes	I.M.O.	IMO
6.	Code of Safe practices for Merchant Seamen	H.M.S.O.	HMSO
7.	Code of Safe Practice for ships carrying timber deck cargoes	I.M.O.	IMO
8.	Grain Rules	I.M.O.	IMO
9.	Emergency Procedures for ships carrying dangerous, goods.	I.M.O.	IMO
10.	International Maritime Dangerous goods code (IMDG Code)	I.M.O.	IMO
11.	International Safety Guide for Oil Tankers and Terminals	I.Chamber of Shipping I.Association of Ports and Harbours.	ICS

SUMMARY OF SYLLABUS

SECTION	T O P I C S	NO. OF HOURS
1.	Basic Definition	03
2.	Preparation of Holds	06
3.	Cargo Handling Equipment	31
4.	Cargo Stowage Organisation	16
5.	Ventilation and Sweat	08
6.	Safety at Work	06
7.	Carriage of dry cargoes	06
8.	Carriage of Bulk cargoes	06
9.	Carriage of Grain cargoes	02
10.	Carriage of Coal cargoes	06
11.	Carriage of Dangerous cargoes	06
13.	Carriage of Special cargoes	02
14.	Carriage of Unitized cargoes	06
15.	Carriage of Refrigerated cargoes	08
16.	Oil cargoes - Safety	16
	TOTAL:	----- 128 -----

COURSE NO. N313
SUBJECT: MARINE METEOROLOGY.

SCHEME OF STUDIES.

FIRST YEAR

	<u>Code No.</u>	<u>Name of paper</u>	<u>Credit Hours</u>	<u>Duration Of Exam</u>	<u>Maximum Marks.</u>
Term-I	N313	Marine Meteorology.	22	03 Hrs	100
Term -II	N312	Marine Meteorology.	22	03 Hrs	100
			TOTAL	44	200

DETAILED SYLLABUS – MARINE METEOROLOGY

FIRST TERM

SECTION:	T	O	P	I	C	S:	NO. OF HOURS
1. GENERAL INTRODUCTION TO "MARINE METEOROLOGY" AS A SCIENCE							(01)
1.1	Marine Meteorology as a Science, what does it mean.						
1.2	Meteorological elements and meteorological phenomena.						
1.3	Importance of meteorology to mariners.						
1.4	The terms atmosphere, air mass, air and air parcel.						
2. MERCURIAL BAROMETER-THEORETICAL AND PRACTICAL ASPECTS							(02)
2.1	Introduction to mercurial barometer.						
2.2	Basic principles of mercurial barometer.						
2.4	Adaptation of mercurial barometer for marine purposes.						
2.5	Use and care of marine mercurial barometer.						
2.6	How to read the scales.						
2.7	Importance of correct readings, and necessary precautions.						
3. THE ANEROID BAROMETER-THEORETICAL AND PRACTICAL ASPECTS							(02)
3.1	Introduction to aneroid barometer.						
3.2	Basic principles of aneroid barometer.						
3.3	Diagram describing construction of aneroid barometer.						
3.4	Accuracy of ordinary aneroid barometer.						
3.5	Possible errors, and calibration by comparison with mercurial barometer.						
3.6	Use and care of aneroid barometer.						
3.7	How to read the indications.						
3.8	Effects of positioning of aneroid barometer; precautions						
4. THE BAROGRAPH-PRINCIPLES, THEORETICAL AND PRACTICAL ASPECTS							(02)
4.1	Introduction to Barograph.						
4.2	Basic Principles on which the instrument is based.						
4.4	Purpose of Barograph.						

- 4.5 Daily variations (diurnal-scale) of pressure.
- 4.6 Care and attention to barograph.
- 4.7 How to read the indications.
- 4.8 Initial calibration, and frequent checks against the readings of an accurate barometer.

5. **THERMOMETRY-DIFFERENT TYPE OF THERMOMETERS AND TEMPERATURE SCALES IN USE (02)**

- 5.1 Introduction to Thermometry.
- 5.2 Different temperature scales in normal use and their relationships.
- 5.3 General principles and construction of thermometers.
- 5.4 Different types of thermometer.
- 5.5 Maximum thermometer and minimum thermometer.
- 5.6 Combined maximum and minimum thermometer.

6. **HYGROMETERS AND PSYCHROMETER (01)**

- 6.1 Introduction to Hydrometer and Psychrometer.
- 6.2 Principle, construction and use of "Mason's" Hygrometer".
- 6.3 Care and attention to Mason's Hygrometer.
- 6.4 Construction need for, and correct position of "Marine Screen".
- 6.5 Precautions for assuring accurate reading of Wet-bulb temperature.
- 6.6 Importance of relative humidity and dew point.

7. **SEA-SURFACE TEMPERATURE, AS DISTINCT FROM SURFACE AIR TEMPERATURE (02)**

- 7.1 Introduction to sea-surface temperature, as distinct from surface air temperature.
- 7.4 Obtaining sea-water temperature, by using distinct reading thermometer.
- 7.5 Obtaining sea-water temperature, by using engine room intake.
- 7.6 Relative accuracies of various observational methods.
- 7.7 Revision. (02)

8. **EARTH'S ATMOSPHERE; PHYSICAL CHARACTERISTICS AND DIVISION:**

(02)

- 8.1 General physical characteristics of Earth's Atmosphere.
- 8.2 Construction of Earth's Atmosphere with respect to dry air, water vapour, and aerosols.
- 8.3 Typical (average) vertical temperature distribution at the very lower levels (upto about 100 km).
- 8.4 Troposphere, tropopause, stratosphere, stratopause.
- 8.5 Mesosphere, mesopause, and thermosphere.
- 8.6 Principal features of the troposphere (w.r.t. marine operations).

9. **HEAT-EXCHANGE BETWEEN THE EARTH AND ITS ATMOSPHERE: THE "LAPSE RATE"**

(02)

- 9.1 Induction of heat-energy from sun into Earth's Atmosphere.
- 9.2 Solar radiation-insolation, scattering, reflection, absorption.
- 9.3 Insolation varies with Latitude, length of day light, Sun's declination.
- 9.4 "Specific-Heat" variation over land/sea surface.
- 9.5 Amplitude of annual/diurnal variation of surface air temperature over land stations, and factors affecting it.
- 9.6 Meaning of "Lapse Rate" of temperature (LR). Sign of LR.
- 9.7 "Isothermal" condition or isothermal layer.
- 9.8 "Inversion" condition or inversion layer.

10. **WATER-VAPOUR IN ATMOSPHERE; HUMIDITY AND ITS PARAMETERS (02)**

- 10.1 Introduction to (invisible) water-vapour in Atmosphere.
- 10.2 Understanding of the terms "evaporation", "Condensation" and "Latent Heat of Vaporization".
- 10.3 "Saturation"; "Supersaturation".
- 10.4 "Absolute Humidity"; "definition, characteristics, and variations.
- 10.5 "Dew Point" temperature, Characteristics and variations.
- 10.6 "Relative Humidity", definition, characteristics, and variations.
- 10.7 "Vapour Pressure", definition, characteristics, and variations.

10.8 Effect of introduction of water-vapour on air density, and thus on atmospheric pressure.

11. ATMOSPHERIC PRESSURE & ITS RELATED ASPECTS (03)

11.1 Introduction to "atmospheric pressure" (as force per unit area).

11.2 Definition of "atmospheric pressure"; and its units.

11.3 Normal variation at M.S.L.; and value of M.S.L. pressure.

11.4 Isobars; pressure gradient, high and low pressure systems.

11.5 Pressure-tendency; and isallobars.

11.6 Diurnal variation of atmospheric pressure.

12. THE PROCESSES OF "CONDENSATION" AND "PRECIPITATION" (01)

12.1 Introduction to the processes of "Condensation".

12.2 Formation of dew; hoar-frost, rime; glazed ice.

12.3 Definition of "Precipitation"; forms of "Precipitation".

12.4 Drizzle, rain, showers; snow, sleet, and hail.

13. FORMATION OF FOG, AND CLOUD TYPES OF CLOUD (02)

13.1 Introduction to Fog formation (as distinct from) cloud formation).

13.2 Definition of "haze", "mist" and "Fog" ("Smog", type of Fog").

13.3 Formation of cloud-basically by ascending and cooling of humid but unsaturated air form surface and becoming saturated.

13.4 The ten basic cloud types, their names, features and characteristics.

14. CORRELATION BETWEEN "WIND" AND "PRESSURE" THE FORCES, INVOLVED (02)

14.1 Introduction to co-relation between "pressure" and "wind".

14.2 Definition of "wind".

14.3 Statement of "Buys Ballots Law".

14.4 Mean pressure-distribution over Earth; and associated surface winds.

14.5 Forces acting in "Surface air-motion", Effects of land/sea masses.

14.6 Revision. (02)

SECOND TERM

REVIEW OF BASIC METEOROLOGY COVERED IN TERM-I

Summarized review of the Basic meteorological knowledge obtained in the previous term.

The review to be followed by a quick Quiz-type Test, to assess the retention of the background knowledge, with a view to assure their assimilation of the subject, in second term.

15. **MEAN SYNOPTIC SURFACE PRESSURE AND WIND DISTRIBUTION - BELTS**

(02)

15.1 Introduction to "Idealised" planetary system of wind and pressure.

15.2 The mean synoptic surface pressure and wind distribution belts over the Earth (discussion with the aid of Jan/Jul charts).

15.3 Doldrums, ITCZ, trade winds, anti-trades, subtropical oceanic highs, the westerlies, the "horse-latitudes", and the polar easterlies, their locations and individual characteristics (Jan/Jul charts).

15.4 The "Monsoon regimes", and the areas affected by them.

16. **THE PRINCIPAL CLOUD TYPES ACCORDING TO "MODE OF FORMATION"**

(02)

16.1 The principal cloud types according to "mode of Formation", as distinct from the classification bases upon heights and forms.

16.2 Clouds formed by turbulence; characteristics and types.

16.3 Clouds formed by convection, characteristics and types.

16.4 Clouds formed by convection, characteristics and types.

16.5 Clouds formed by Frontal ascent; characteristics and types.

17. **BASIC CONCEPTS RELATING TO "LOW PRESSURE" AND "HIGH PRESSURE" SYSTEMS**

(02)

17.1 Basic ideas relating to "Low-pressure-system" and "high-pressure-system".

17.2 How these are formed.

17.3 Their general characteristics,

17.4 Their associated weather.

18. **ELEMENTARY CONCEPTS REGARDING "AIR MASSES" AND ALLIED ASPECTS**

(02)

18.1 Introduction to "air masses" and "Fronts".

18.2 What is meant by "air mass", "origin", and "Source region".

18.3 Characteristics required of a "source-region".

- 18.4 Source-regional characteristics of polar, tropical, and equatorial air masses.
- 18.5 Interaction between air masses, leading to Formation of Front.
19. **ELEMENTARY CONCEPTS ABOUT "FRONTS" AND RELATED ASPECTS (03)**
- 19.1 Introduction to Fronts; definition of a "front".
- 19.2 "Front surface", "surface front"; "Sharp/diffuse" front.
- 19.3 Active/Feeble (inactive) Front; criteria.
- 19.4 Definition of "Warm front"; associated weather.
- 19.5 Definition of "cold front"; associated weather.
- 19.6 Diagrammatic representation of associated weathers, at "idealized warm front" and "idealized cold front".
- 19.7 Symbolic representation of MET - charts.
20. **ELEMENTARY CONCEPTS REGARDING "HIGH LATITUDE FRONTAL DEPRESSION" (02)**
- 20.1 Introduction to "high-latitude frontal depression".
- 20.2 Theory and mechanism of their formation.
- 20.3 Vertical section through a typical frontal depression, showing the two fronts, the two sectors, and sequence of associated weather
- 20.4 The sections to be drawn for both northern hemisphere, and southern hemisphere frontal depressions.
21. **"OCCLUSION" - MECHANISM, TYPES (02)**
- 21.1 Introduction to "Occlusion" of frontal depression.
- 21.2 Causes for occlusion.
- 21.3 Synoptic pattern of a frontal depression, showing isobars, and the occluded front.
- 21.4 Types of occlusion, and their different using features.
- 21.5 Symbolic representation on charts.
- 21.6 V-shaped depression, COL.
22. **ELEMENTARY THEORETICAL AND PRACTICAL CONCEPTS ABOUT TRS (03)**
- 22.1 Introduction to Tropical Revolving Storm (TRS).
- 22.2 Localities/Regions in which TRS are obtained.

- 22.3 Seasonal occurrence, and tracks of TRS.
- 22.4 Rules for avoiding TRS.
- 22.5 How single-station barometric observations, together with trends in the weather changes can be used to combat TRS situation.
- 23. **THE BEAUFORT WIND SCALE; WEATHER NOTATION USED AT SEA (02)**
 - 23.1 The Beaufort wind scale; and weather notation in use at sea.
- 24. **INTRODUCTION TO MET-REPORTING (03)**
 - 24.1 Introduction to MET-reporting.
 - 24.2 Meteorological log; coding and decoding weather messages.
 - 24.3 Introduction and use of synoptic and prognostic sea surface and weather charts.
 - 24.4 Introduction to facsimile recorders.
- 25. **THE PRINCIPAL OCEAN CURRENTS - GENERAL IDEAS (02)**
 - 25.1 Introduction to Ocean currents.
 - 25.2 General idea of the principal ocean currents; the Gulf Stream.
 - 25.3 Basic concept of weather routing.
- 26. **"FLOATING ICE" - GENERAL BASIC IDEAS (02)**
 - 26.1 Introduction to "Floating Ice".
 - 26.2 Localities and seasons general basic ideas.
 - 26.3 Elementary aspects of navigational problems in the vicinity of ice.
 - 26.4 Ice/snow accretion on ships structure and related problems.
- 27. **REVISION (11)**

SYLLABUS - MARINE METEOROLOGY

TERM : I & II.

(NAUTICAL)

RECOMMENDED BOOKS

S.NO:	NAME OF BOOKS	A U T H O R:	PUBLISHER
1.	Notes on Marine Meteorology	Kemp & Young	Stanford Maritime London
2.	Marine Meteorology for Mariners	Marine Div.(M.O) Meteorological Office (U.K)	H.M.S.O. London
3.	Marine Meteorology at Sea	Ray Sanderson	Stanford Maritime London

SUMMARY OF SYLLABUS

SECTION	T O P I C S	NO. OF HOURS
1.	General Introduction to "Marine Meteorology" as a Science	01
2.	The mercurial barometer-theoretical and practical aspects.	02
3.	The aneroid barometer-theoretical and practical aspects.	02
4.	The Barograph-Principles, theoretical and practical aspects.	02
5.	Thermometry-Different type of thermometers, and temperature scales in use.	02
6.	Hygrometers and Psychrometer.	01
7.	Sea-Surface temperature, as distinct from surface air-temperature.	02
8.	Earth's Atmosphere; physical characteristics and divisions.	02
9.	Heat-Exchange between the Earth and its Atmosphere; the "lapse Rate".	02
10.	Water-vapour in Atmosphere; Humidity and its parameters.	02
11.	Atmospheric Pressure, and its related aspects.	03
12.	The processes of "condensation" and "precipitation"	01

13.	Formation of Fog and cloud, types of cloud.	02
14.	Correlation between "Wind" and "Pressure" the force involved	02
15.	Mean Synoptic Surface Pressure and wind distribution Belts.	02
16.	The principal cloud types according to "Mode of Formation".	02
17.	Basic Concepts Relating to "Low-pressure" and High pressure" systems.	02
18.	Elementary concepts regarding "Air Masses" and allied aspects.	02
19.	Elementary Concepts about "Fronts" and related aspects.	03
20.	Elementary Concepts regarding "High-latitude Frontal Depression".	02
21.	"Occlusion" mechanism, types.	02
22.	Elementary theoretical and practical concepts about TRS	03
23.	The Beaufort Wind Scale; weather notations used at Sea.	02
24.	Introduction to MET - reporting.	03
25.	The principal Ocean Currents - general basic ideas.	02
26.	"Floating Ice" - general basic ideas.	02
27.	Revisions	11

TOTAL: 64
