

INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM - CHENNAI
NAAC ACCREDITED WITH 'A' GRADE
Marching Beyond 25 Years Successfully

School of Maritime Studies

B.SC NAUTICAL SCIENCE

REGULATION 2021

CURRICULUM AND SYLLABUS

(Based on Choice Based Credit System)

Effective from the Academic Year

2021 - 22

Department of Nautical Science

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Program Educational Objectives (PEO)

The Program Educational Objective of the Bachelor of Nautical Science is to facilitate the students to:

PEO: 1 Become a successful navigating officer who is able to be innovative and productive in fulfilling the needs of the Industry and to pursue higher education and research as well.

PEO: 2 To grow professionally with their knowledge, understanding and proficiency skills and scale up to higher levels of competency.

PEO: 3 To demonstrate the high standard of ethical conduct, positive attitude, societal responsibilities in order to safeguard the safety of ships, safety of life, safety of cargo and the marine environment at large.

PEO: 4 To qualify students to become competent watch-keeping officers in the maritime environment, capable of navigational and cargo work duties.

PEO: 5 To ensure compliance to STCW convention and STCW Code requirements

Program Outcomes:

PO1 Knowledge - Breadth

The practical application of knowledge to the full range of navigational practices of ships in all sea areas, ship operations with regard to safety, stability and hull stresses, loading, handling and care of a wide variety of cargoes, crew and passenger care and emergency procedures.

PO2 Knowledge - Kind

The ability to apply principles of mathematics and physics to solve navigational problems: the application of principles of physics in loading ships to maintain stability and avoid excessive hull stresses; the ability to solve cargo loading, handling and care problems; the working knowledge of the legislative requirements for all aspects of ship operations and navigation.

PO3 Skill - Range

The ability to perform the duties of a ships navigation officers and officer in charge of a navigational watch and of a watch in port; the ability to operate ship's navigational equipment correctly and demonstrate an appreciation of the limitations of such equipment; the correct operation of ship's control systems; the correct operation of a ship's cargo handling and cargo care systems; the ability to manage minor emergencies and react appropriately to major ones; the ability to participate in the commercial or other operational functions of the ship.

PO4 Skill – Selectivity

The ability to plan and conduct sea passages; assimilate and assess information from different sources and exercise correct judgement when presented with complex navigational and shipping traffic situations; the ability to take charge and accept responsibility in a variety of shipboard situations.

PO5 Competence - Context

The ability to carry out the function of Officer of the Watch in a vessel of more that 500gt as specified in the International Maritime Organization’s "Standards of Training and Certification of Watchkeepers 2010"; is showing initiative when dealing with shipboard functions and situations.

PO6 Competence - Role

The ability to participate in the commercial and operational activities of a ship and solve complex problems relating to this; the competence to take charge of groups of people engaged in both routine and emergency duties; the ability to report comprehensively on normal and unusual situations on board ship, or affecting the ship and its environment; the ability to report comprehensively on the ship's and

the student's activity and interaction in the wider context such as ports, geographical areas, meteorological phenomena.

PO7 Competence - Learning to Learn

A recognition of the need for continuous training individually and in groups; a critical evaluation of procedures and systems currently in place aboard ship to improve safety and efficiency; an understanding of the process in understudying superiors to assist in advancement to the next academic and professional level.

PO8 Competence - Insight

A full and comprehensive awareness of the responsibilities of a ship's officer for the safe navigation and operation of all ship types with particular regard to personal safety of the crew, the ship, the cargo and in particular of his/her responsibility to the global community for the protection of the marine environment.

Program Source Outcome

PSO 1 Professional Leadership

Accomplish skill in all facets of shipboard operational procedures and excel in crisis management and problem solving by operating as a team and finding solutions to various problems that may arise onboard the ship.

PSO 2 Operational

Function efficiently in a qualified environment by supporting acquired knowledge and skill in ship management, voyage planning, navigation, cargo operation, collision avoidance, maintenance, safe working practices on the ship by applying available modern mechanisms and techniques.

VISTAS – SCHOOL OF MARITIME STUDIES
B.Sc Nautical Science – Regulation 2021
PROGRAM CURRICULUM

Total Credits: 146

SL	SEM	CODE	NAME OF THE COURSE	Hour/Week			Credits	Maximum Marks		
				L	T	P		CA	SEE	Total
SEMESTER – I										
1	1	21CMRN11	NAUTICAL MATHEMATICS - I	5	0	0	4	40	60	100
2	1	21BNS002	NAUTICAL PHYSICS – I	4	0	0	3	40	60	100
3	1	21DMRN11	MARINE METEOROLOGY - I	5	0	0	4	40	60	100
4	1	21PMRN11	PROFESSIONAL PRACTICE - I	0	0	3	4	40	60	100
5	1	21AMRN11	ENGLISH - I	4	0	0	3	40	60	100
6	1	21PMRN12	PRACTICAL - NAUTICAL PHYSICS - I	0	0	3	2	--	100	100
7	1	21SMRN11	SHIP OPERATION TECHNOLOGY - I	4	0	0	3	40	60	100
8	1	21PMRN13	PRACTICAL - SHIP OPERATION TECHNOLOGY - I	0	0	2	2	--	100	100
TOTAL				22	0	8	25			

SL	SEM	CODE	NAME OF THE COURSE	Hour/Week			Credits	Maximum Marks		
				L	T	P		CA	SEE	Total
SEMESTER – II										
1	2	21CMRN21	NAUTICAL MATHEMATICS – II	5	0	0	4	40	60	100
2	2	21CMRN22	NAUTICAL PHYSICS – II	4	0	0	4	40	60	100
3	2	21DMRN21	MARINE METEOROLOGY – II	5	0	0	3	40	60	100
4	2	21PMRN21	PROFESSIONAL PRACTICE - II	0	0	3	2	40	60	100
5	2	21AMRN21	ENGLISH - II	4	0	0	3	40	60	100
6	2	21PMRN22	PRACTICAL - NAUTICAL PHYSICS – II	0	0	3	2	--	100	100
7	2	21SMRN21	SHIP OPERATION TECHNOLOGY - II	4	0	0	3	40	60	100
8	2	21PMRN23	PRACTICAL - SHIP OPERATION TECHNOLOGY - II	0	0	2	2	--	100	100
TOTAL				22	0	8	23			

SL	SEM	CODE	NAME OF THE COURSE	Hour/Week			Credits	Maximum Marks		
				L	T	P		CA	SEE	Total
SEMESTER – III										
1	3	21CMRN31	NAVIGATION - I	4	0	0	4	40	60	100
2	3	21CMRN32	NAVAL ARCHITECTURE - I	5	0	0	4	40	60	100
3	3	21NMRN31	INTRODUCTION TO COMPUTERS	4	0	0	3	40	60	100
4	3	21PMRN31	PRACTICAL - VOYAGE PLANNING - I	0	0	4	3	40	60	100
5	3	21PMRN32	PRACTICAL - COLLISION PREVENTION - I	0	0	3	2	40	60	100
6	3	21PMRN33	PRACTICAL - NAVIGATION - I	0	0	3	2	--	60	100
7	3	21PMRN34	PRACTICAL - SHIP OPERATION TECHNOLOGY - III	0	0	3	2	--	60	100
8	3	21SMRN31	SHIP OPERATION TECHNOLOGY - III	4	0	0	3	40	60	100
TOTAL				17	0	13	23			

SL	SEM	CODE	NAME OF THE COURSE	Hour/Week			Credits	Maximum Marks		
				L	T	P		CA	SEE	Total
SEMESTER – IV										
1	4	21CMRN41	NAVIGATION - II	4	0	0	4	40	60	100
2	4	21CMRN42	NAVAL ARCHITECTURE - II	5	0	0	4	40	60	100
3	4	21DMRN41	MARINE ENGINEERING AND CONTROL SYSTEMS - I	4	0	0	4	40	60	100
4	4	21ENVS41	ENVIRONMENTAL SCIENCE	2	0	0	2	40	60	100
5	4	21PMRN41	PRACTICAL - VOYAGE PLANNING – II	0	0	4	4	40	60	100
6	4	21PMRN42	PRACTICAL - COLLISION PREVENTION - II	0	0	4	4	40	60	100
7	4	21PMRN43	PRACTICAL - NAVIGATION - II	0	0	3	2	--	60	100
8	4	21PMRN44	PRACTICAL - MARINE ENGINEERING AND CONTROL SYSTEMS - I	0	0	4	2	--	60	100
TOTAL				15	0	15	26			

SL	SEM	CODE	NAME OF THE COURSE	Hour/Week			Credits	Maximum Marks		
				L	T	P		CA	SEE	Total
SEMESTER – V										
1	5	21CMRN51	NAVIGATION - III	4	0	0	4	40	60	100
2	5	21CMRN52	NAVAL ARCHITECTURE - III	5	0	0	4	40	60	100
3	5	21DMRN51	CARGO HANDLING AND STOWAGE - I	4	0	0	4	40	60	100
4	5	21DMRN52	MARINE ENGINEERING AND CONTROL SYSTEMS - II	4	0	0	3	40	60	100
5	5	21PMRN51	PRACTICAL - NAVIGATION - III	0	0	3	2	--	60	100
6	5	21PMRN52	PRACTICAL - VOYAGE PLANNING - III	0	0	4	3	40	60	100
7	5	21PMRN53	PRACTICAL - COLLISION PREVENTION - III	0	0	3	2	40	60	100
8	5	21PMRN54	PRACTICAL - MARINE ENGINEERING AND CONTROL SYSTEMS - II	0	0	3	2	--	60	100
TOTAL				17	0	13	24			

SL	SEM	CODE	NAME OF THE COURSE	Hour/Week			CREDIT	Maximum Marks		
				L	T	P		CA	SEE	Total
SEMESTER – VI										
1	6	21AMRN61	MARITIME LAW	5	0	0	4	40	60	100
2	6	21AMRN62	MARITIME COMMERCE	4	0	0	4	40	60	100
3	6	21CMRN61	BRIDGE PROCEDURE AND LEGAL KNOWLEDGE	4	0	0	4	40	60	100
4	6	21DMRN61	CARGO HANDLING AND STOWAGE - II	4	0	0	4	40	60	100
5	6	21DMRN62	MARINE ENGINEERING AND CONTROL SYSTEMS - III	4	0	0	3	40	60	100
6	6	21GMRN61	PRINCIPLES OF MANAGEMENT	4	0	0	3	40	60	100
7	6	21PMRN61	PRACTICAL - MARINE COMMUNICATION	0	0	4	1	--	60	100
8	6	21PMRN62	PRACTICAL - MARINE ENGINEERING AND CONTROL SYSTEMS - III	0	0	3	2	--	60	100
TOTAL				25	0	5	25			

VISTAS – SCHOOL OF MARITIME STUDIES
B.Sc Nautical Science – Regulation 2021
PASS MARKS
Semester - 1

S.No	Code	Title of the Course	IA		SEE		Total	
			Min.	Max.	Min.	Max.	Min.	Max.
1	21CMRN11	NAUTICAL MATHEMATICS - I	--	40	24	60	40	100
2	21BNS002	NAUTICAL PHYSICS – I	--	40	24	60	40	100
3	21DMRN11	MARINE METEOROLOGY - I	--	40	24	60	40	100
4	21PMRN11	PROFESSIONAL PRACTICE - I	--	40	24	60	40	100
5	21AMRN11	ENGLISH - I	--	40	24	60	40	100
6	21PMRN12	PRACTICAL - NAUTICAL PHYSICS - I	--	--	40	100	40	100
7	21SMRN11	SHIP OPERATION TECHNOLOGY - I	--	40	36	60	60	100
8	21PMRN13	PRACTICAL - SHIP OPERATION TECHNOLOGY - I	--	--	60	100	60	100

Semester - 2

S.No	Code	Title of the Course	IA		SEE		Total	
			Min.	Max.	Min.	Max.	Min.	Max.
1	21CMRN21	NAUTICAL MATHEMATICS – II	--	40	24	60	40	100
2	21CMRN22	NAUTICAL PHYSICS – II	--	40	24	60	40	100
3	21DMRN21	MARINE METEOROLOGY – II	--	40	24	60	40	100
4	21PMRN21	PROFESSIONAL PRACTICE - II	--	40	24	60	40	100
5	21AMRN21	ENGLISH - II	--	40	24	60	40	100
6	21PMRN22	PRACTICAL - NAUTICAL PHYSICS – II	--	--	40	100	40	100
7	21SMRN21	SHIP OPERATION TECHNOLOGY - II	--	40	36	60	60	100
8	21PMRN23	PRACTICAL - SHIP OPERATION TECHNOLOGY - II	--	--	60	100	60	100

Semester - 3

S.No	Code	Title of the Course	IA		SEE		Total	
			Min.	Max.	Min.	Max.	Min.	Max.
1	21CMRN31	NAVIGATION - I	--	40	42	60	70	100
2	21CMRN32	NAVAL ARCHITECTURE - I	--	40	36	60	60	100
3	21NMRN31	INTRODUCTION TO COMPUTERS	--	40	24	60	40	100
4	21PMRN31	PRACTICAL - VOYAGE PLANNING - I	--	40	42	60	70	100
5	21PMRN32	PRACTICAL - COLLISION PREVENTION - I	--	40	42	60	70	100
6	21PMRN33	PRACTICAL - NAVIGATION - I	--	--	--	100	70	100
7	21PMRN34	PRACTICAL - SHIP OPERATION TECHNOLOGY - III	--	40	36	60	60	100
8	21SMRN31	SHIP OPERATION TECHNOLOGY - III	--	--	60	100	60	100

Semester - 4

S.No	Code	Title of the Course	IA		SEE		Total	
			Min.	Max.	Min.	Max.	Min.	Max.
1	21CMRN41	NAVIGATION - II	--	40	42	60	70	100
2	21CMRN42	NAVAL ARCHITECTURE - II	--	40	36	60	60	100
3	21DMRN41	MARINE ENGINEERING AND CONTROL SYSTEMS - I	--	40	30	60	50	100
4	21ENVS41	ENVIRONMENTAL SCIENCE	--	40	24	60	40	100
5	21PMRN41	PRACTICAL - VOYAGE PLANNING – II	--	40	42	60	70	100
6	21PMRN42	PRACTICAL - COLLISION PREVENTION - II	--	40	42	60	70	100
7	21PMRN43	PRACTICAL - NAVIGATION - II	--	--	70	100	70	100
8	21PMRN44	PRACTICAL - MARINE ENGINEERING AND CONTROL SYSTEMS - I	--	--	50	100	50	100

Semester - 5

S.No	Code	Title of the Course	IA		SEE		Total	
			Min.	Max.	Min.	Max.	Min.	Max.
1	21CMRN51	NAVIGATION - III	--	40	42	60	70	100
2	21CMRN52	NAVAL ARCHITECTURE - III	--	40	36	60	60	100
3	21DMRN51	CARGO HANDLING AND STOWAGE - I	--	40	30	60	50	100
4	21DMRN52	MARINE ENGINEERING AND CONTROL SYSTEMS - II	--	40	30	60	50	100
5	21PMRN51	PRACTICAL - NAVIGATION - III	--	40	70	100	70	100
6	21PMRN52	PRACTICAL - VOYAGE PLANNING - III	--	40	42	60	70	100
7	21PMRN53	PRACTICAL - COLLISION PREVENTION - III	--	40	42	60	60	100
8	21PMRN54	PRACTICAL - MARINE ENGINEERING AND CONTROL SYSTEMS - II	--	--	50	100	50	100

Semester - 6

S.No	Code	Title of the Course	IA		SEE		Total	
			Min.	Max.	Min.	Max.	Min.	Max.
1	21AMRN61	MARITIME LAW	--	40	24	60	40	100
2	21AMRN62	MARITIME COMMERCE	--	40	24	60	40	100
3	21CMRN61	BRIDGE PROCEDURE AND LEGAL KNOWLEDGE	--	40	30	60	50	100
4	21DMRN61	CARGO HANDLING AND STOWAGE - II	--	40	30	60	50	100
5	21DMRN62	MARINE ENGINEERING AND CONTROL SYSTEMS - III	--	--	50	100	50	100
6	21GMRN61	PRINCIPLES OF MANAGEMENT	--	40	24	60	40	100
7	21PMRN61	PRACTICAL - MARINE COMMUNICATION	--	--	50	100	50	100
8	21PMRN62	PRACTICAL - MARINE ENGINEERING AND CONTROL SYSTEMS - III	--	--	50	100	50	100

SYLLABUS

SEMESTER – I

Code	Subject	Lecture	Tutorial	Practical	Credit
21CMRN11	NAUTICAL MATHEMATICS – I	5	0	0	4

Course Objective: After successful completion of this course, cadet should be able to apply Mathematical Principles to Nautical Studies, graphical representations of complex numbers, matrices, spherical trigonometry and Algebra principles to Nautical Studies

UNIT I: GRAPHICAL REPRESENTATIONS OF COMPLEX NUMBERS 16

Terminology-Origin, Ordinate, Abscissa, Basic Definitions of Cartesian, Polar, Cylindrical, Spherical, Exponential form, De 'Moivre's Theorem and De'Moivre's Problems, Power and roots of Complex Numbers, Logarithmic Functions, Logarithmic of a Complex numbers, Separate real and imaginary of complex numbers of all types of functions.

UNIT II: MATRICES 16

Definitions and types of Matrices, Addition, Subtraction, Multiplication of Matrices, Triangular Matrices, Lower and Upper Triangular Matrices, Adjoint of a square Matrix, Inverse of a matrix, Singular and non-singular Matrix, Determinant of a Matrix, Transpose of a Matrix, Orthogonal and unitary Matrices, Hamilton and skew Hamilton Matrices, Symmetric and Skew symmetric Matrices Problems.

UNIT III: SPHERICAL TRIGONOMETRY 16

Spherical Trigonometry fundamentals; Great Circle, Small Circle, Spherical angles, Spherical Triangles, Properties of Great Circle, small Circle and spherical Triangle, Spherical Excess, Sine, Cosine formulae, Versine formula, Haversine formula and its advantage over the sine cosine formula, Definitions and Properties of Right angle Spherical Triangle, Quadrantal Spherical Triangle, Polar Spherical Triangle, Napier's Rules for Circular Parts of Right angle and Quadrantal Spherical Triangles.

UNIT IV: ALGEBRA, VECTOR ALGEBRA 16

Simple Algebric Expressions, Basic Formulas, Scalar and Vector Quantities, Addition and Subtraction of Vectors, Position Vectors, Resolution of Vectors and Applications, Scalar and Vector Triple Products, Differentiation of Vector function of a single scalar Variable Derivative of Vectors simple derivatives, Velocity and Acceleration Problems, Gradient, Curl and Divergent of a Vector Point Functions, Solenoidal and Irrotational Vectors definitions and Simple Problems.

UNIT V: TRIGONOMETRY 16

Concepts of Radian and Degrees, Trigonometric functions sine, cosine, tangent and corresponding reciprocal ratios, bisects, Acute, obtuse and reflex angles and Isosceles triangle, equilateral, scalene triangle, right angled triangle, properties of similar and congruent Triangles, Pythagoras Theorem, Expansions of Sinnθ and Cosnθ (n being a Positive integers), Expansions for tannθ, Pascal Triangle Concept- expansions for $\text{Cos}^{n}\theta$ and $\text{Sin}^{n}\theta$.

Course Outcome:

CO – 1: Understand clearly about complex numbers

CO – 2: Assess the theorems related to complex numbers

CO – 3: Evaluate clear idea about operators of Matrices

CO – 4: Understand the fundamentals of spherical trigonometry

CO – 5: Describe the knowledge of rules and formulas used in spherical trigonometry

TEXT BOOKS:

1. Dr. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publications,43rd Edition, 2013
2. Dr. P.R. Vittal , "Allied Mathematics", Margham Publications, Chennai, Reprint Edition, 2011

REFERENCE BOOKS:

1. Graham Lawler MA, "Understanding Maths", Viva Study Mates Publishers, Fourth Edition
2. Capt. H. Subramanian , "Spherical Trigonometry", Vijaya Publications, First Edition, 2011
3. Capt. G.E. Earl, Capt. D.M. Robinson , "Munro's Mathematics for Deck Officers", Glasgow Brown, Son & Ferguson, Reprint Edition, 2007
4. Blanche, Capt A.G, "Norie's Nautical Tables", Blance & Wilson Publications, Revised Edition, 2007

Web Source:

https://eduinformer.com/b-s-grewal-higher-engineering-mathematics-review-ebook/

Code	Subject	Lecture	Tutorial	Practical	Credit
21BNS002	NAUTICAL PHYSICS – I	4	0	0	4

Course Objective: After successful completion of this course, cadet should be able to demonstrate an understanding of basic scientific principles, theories, and laws as well as an awareness of the changing nature of science. Analyze, interpret, and evaluate scientific hypotheses and theories using rigorous methods (including statistical and mathematical techniques). Demonstrate an understanding of basic principles of Mechanics & Hydrostatics, Sound & Light, Heat and Thermodynamics, Electrostatics, Electronics

UNIT I MECHANICS & HYDROSTATICS **12**

Newton's law of gravitation, Newton's Laws of motion, keplers law of planetary motion, Center of gravity, Vectors, Equilibrium, Three force problems, Lami's Theorem, Triangle and Parallelogram law of forces. Machines – Weston differential pulley
Elasticity: Modulus of elasticity, Hooke's law, Tensile, compressive, shearing force, Surface tension, capillarity.
Hydrodynamics: Viscosity, streamline, turbulence, Reynold's number Bernoulli's equation and its application

UNIT II SOUND & LIGHT **12**

Wave motion – Transverse waves and longitudinal waves, measurement of velocity of sound in gases and rods, Newton's formula and Laplace correction, Effect of temperature, pressure, density and salinity on velocity of sound, Characteristics of Sound like intensity, loudness, decibel, pitch, and frequency, Doppler Effect.

Oscillations: Amplitude, frequency and period; Simple Harmonic Motion; Damped and undamped oscillations; Forced oscillations, Resonance, Conical pendulum.

Light – Propagation of light, Reflection and refraction, Laws of reflection, Shadows, Laws of refraction, Total internal reflection, propagation of light in optical fiber, Refracting and reflecting Astronomical Telescopes. Binoculars, sextant.

UNIT III HEAT AND THERMODYNAMICS **12**

Heat
Introduction of Heat, temperature, coefficient of expansion of liquid, Real and apparent expansion, Anomalous expansion of water, Effect of Salinity on the freezing point of water, Specific heat and latent heat, Change of state, Transference of heat: conduction, convection and radiation; Absorption and reflection; Thermodynamic scale; Relationship between Celsius, Kelvin and Fahrenheit scale; Introduction to Mollier diagram;.

Thermodynamics

First law of thermodynamics, Second law of Thermodynamics, Carnot cycle.The heat engine and refrigerator, Entropy. Boyle's and charle's law. Isothermal and adiabatic expansions.

UNIT IV ELECTROSTATICS **12**

Frictional electricity, charges and their conservation; Coulomb's law – forces between two point electric charges.Electric field – Electric field due to a point charge, electric field lines; Electric potential – potential difference.Electrostatic charging of oil in pipeline flow, oil mixing with water, oil splashing, various causes of formation of charges in an oil tanker, remedial measures.

Modern Physics: Radioactivity – alpha, beta and gamma radiations and their properties, half life – mean life. Artificial radioactivity – radio isotopes – effects and Uses, Radio carbon dating – biological radiation hazards Nuclear fission and fusion, nuclear reactors, nuclear powered ships, nuclear hazards and precautions.

UNIT V ELECTRONICS **12**

P and N types semiconductors, p-n junction diodes – their characteristics. Half-wave, full wave & bridge rectifiers, zener diode and its use as a voltage regulator. Thermistors - Use in temperature control. Transistors pnp,npn, 3 modes of operation, current gains α and β. Photoelectric effect, Einstein's equation, Opto-electronic devices – LDR, LED,
7 –segment displays, photo diode, Laser principle, Ruby Laser, Laser applications.

Course Outcome:

CO – 1: Define the gravitation and Planetary motion.

CO – 2: Understand the Phenomenon of Viscosity, Elasticity and Surface Tension.

CO – 3: Understand the concepts of Sound and Oscillation.

CO – 4: Explain the concepts of reflection , refraction of light and telescopes.

CO – 5: Understand the concepts heat and temperature.

TEXT BOOKS:

1. J.H. Clough-Smith, "Applied Physics", Brown, Son & Ferguson Ltd Publications, Second Edition, 1994
2. R.K. Gaur , "Basic Applied Physics", Dhanbat Rai & Sons publication. Second Edition, 1984
3. University Handout

REFERENCE BOOKS:

1. R.S. Khurmi , "A Text book of Engineering Mechanics",S.CHAND Publications, 53rd Edition, 2014
2. Brijlal & Subramanian,"Heat & Thermodynamics",S. CHAND Publications, Revised Edition, 2014
3. Halliday and Resnick , "Physics Part I & II", Wiley Publications, Third Edition, 1978
4. V. K. Mehta , "Principles of Electronics", S.CHAND Publications, Revised Edition, 1980
5. Brijlal & Subramanian , "A Textbook of Sound" ,Vikas Publication, Illustrated Edition, 1986
6. D.S.Mathur , "Mechanics", S. CHAND Publication, Edition 2006
7. Vasudevan , "Light", S. CHAND Publication, Edition 2011

Web Source:

https://www.khanacademy.org/science/physics

Code	Subject	Lecture	Tutorial	Practical	Credit
21DMRN11	MARINE METEOROLOGY – I	5	0	0	4

Course Objective: After successful completion of this course, cadet should be able to understand the dynamics of the ocean and the atmosphere Foundation for students in understanding the physical processes in the ocean and atmosphere Understanding factors affecting atmospheric motion and resulting windows

UNIT I EARTH ATMOSHPHERE **16**

1. Characteristics of the Earth's Atmosphere
2. Composition, equation of state for dry air and moist air. Density variation. Vertical layers of the atmosphere.
3. Energy Budget-Temperature: Diurnal, seasonal and geographical variation of temperature

UNIT II WATER VAPOUR IN ATMOSPHERE **16**

1. Water Vapour in the Atmosphere: Changes of state, specific, absolute and relative humidity, dew point temperature, humidity mixing ratio, unsaturated and saturated states, super cooling, frost point. Diurnal and seasonal variation of water vapour.
2. Adiabatic Processes: Dry and saturated lapse rates, potential temperature. Tephigram and its uses.

UNIT III CONDENSATION AND PRECIPITATION **16**

1. Condensation and Precipitation Phenomena: Condensation and freezing nuclei, condensation forms: Dew, frost, mist, fog, haze and clouds- Visibility - Development and classification of clouds.
2. Precipitation: Processes, forms and types. Principles and methods of surface meteorological observations.

UNIT IV ATMOSPHERIC MOTION **16**

1. Factors affecting atmospheric motion and the resulting winds. Basic pattern of air movement.
2. Horizontal and vertical distribution of atmospheric pressure and the resulting circulation. Recent advances in the knowledge of general circulation: upper air waves and jet stream.

UNIT V AIR MASSAES **16**

1. Air masses: Basic concepts, Factors governing development & properties, Classification, Convergence & Divergence.
2. Fronts: Types: Associated weather, Frontal Depressions – Origin, life and movement; Forecasting Techniques, Non – Frontal Depressions
3. Tropical Revolving Storms : Characteristic areas & Nomenclature: Origin, Structure & movements; associated weather, Forecasting Techniques – past & present; Cyclone Tracking & warning bulletins for

merchant ships under International conventions; Practical rules of navigation for maneuvering in the vicinity of a T.R.S

4. Dynamics of Indian Monsoon
5. Weather forecasting: methods and techniques. Constraints in accurate forecast for Tropical areas, Storm warning signals

Course Outcome:

CO – 1: Understand the characteristics of the Earth's Atmosphere

CO – 2: Understand the composition, equation of state for dries air and moist air.

CO – 3: Understand the water vapour in the Atmosphere.

CO – 4: Explain the Tephigram and its uses.

CO – 5: Undestand the development and classification of clouds

TEXT BOOKS:

1. Capt.H.Subramaniam , "Marine Meteorology", Vijaya Publications
2. A.D Ravisankar, "Environmental Science Made Easy For Mariners"

REFERENCE BOOKS:

1. "Meteorology for Mariners", HMSI, London, HMSO
2. "Marine Observer's",HMSO, London Academic press
3. "Elementary Meteorology", HMSO, London, HMSO
4. James.R. Holoton ,"An Introduction to Dynamic Meteorology", Academic Press,
5. Petterson.B, "Introduction to Meteorology", MC Graw Hill
6. University Handout

Web Sources:

https://www.libramar.net/news/marine_meteorology/2021-06-18-3901

Code	Subject	Lecture	Tutorial	Practical	Credit
21PMRN11	PROFESSIONAL PRACTICE – I	0	0	3	4

Course Objective: The objective of the course is designed to introduce and develop the knowledge and skills required to engage in the work-based learning process. This will enable the cadet to gain inquiry-related skills including critical analysis, evaluation and appraisal. These skills will help the cadet to select, develop and apply appropriate methods of inquiry for work-based projects.

UNIT 1 COMMERCIAL ENVIRONMENT **6**

Showing how you and your qualifications fit into the professional maritime world.

UNIT II PURPOSE **6**

Obligations in protecting the environment, appropriate planning and situational awareness.

UNIT III SELF AWARENESS **6**

Deal with some of the more personal dimensions of students' ongoing learning development.

UNIT IV PERSONALITY TRAITS **6**

To help leaders choose compatible team members

UNIT V ABC OF EFFECTIVE COMMUNICATION **6**

Essential communication for managing and working in a productive and efficient workplace. This results in confidence in their work and getting the desired results more quickly and efficiently.

Course Outcome:

CO – 1: Understand you and your qualification

CO -2: Describe how to appropriate planning and situational awareness

CO-3: Understand ongoing learning development

CO-4: Evaluate the leaders choose compatible team members

CO-5: Apply the confidence in work environment

TEXT BOOKS:

University Study Material

Code	Subject	Lecture	Tutorial	Practical	Credit
21AMRN11	ENGLISH – I	4	0	0	3

Course Objective: After successful completion of this course, cadet should be able to effectively make oral and written communication, understanding the concepts of Grammar, Improving Reading and Communication Skills

UNIT I INTRODUCTION **12**

How do you feel?
We haven't got time.
The Tourist Trade.
Born to be wild.
Home truths – Decisions and Choices.

UNIT II GRAMMAR **12**

Question forms.
Present Continuous, Present Simple.
Present Perfect Continuous, Present perfect.
Past Perfect.
The Future, Present Continuous. If – Zero condition.

UNIT III SKILLS **12**

Reading, Listening, Speaking & Writing.

UNIT IV MARITIME ENGLISH **12**

Contents of IMO model course 3.17 – Core Section 1

UNIT V COMMUNICATION **12**

Communication Skills – Group Discussion

Course Outcome:
CO – 1: Understand well versed in the Tourist Trade
CO – 2: Understand the Home Truths – Decisions and Choices
CO – 3: Understand the different types of Question forms
CO – 4: Define the different types of Tense
CO – 5: Develop the Reading and Listening Skills

TEXT BOOKS:

Chris Redston & Gillie Cunningham , "face2face – Intermediate Students Book", Cambridge University Press, Edition 2014
Chris Redston & Gillie Cunningham, "face2face – Intermediate work book", Cambridge University Press, Edition 2014

REFERENCE BOOKS:

Tony Lynch, "Study Listening", Cambridge University Press, 2004
Kenneth Anderson, Joan Maclean & Tony Lynch , "Study Speaking", Cambridge University Press, 2004
Francoise Grellet , "Developing Reading Skills", Cambridge University Press, 2004
Liz Hamp-Lyon & Ben Heasley , "Study Writing", Cambridge University Press, 2004
Raymond Murphy, "Murphy's English Grammar" Cambridge University, 2004
Nancy Lumban Batu, "Model Course - Maritime English 3.17" ,IMO, 2000

Code	Subject	Lecture	Tutorial	Practical	Credit
21PMRN12	NAUTICAL PHYSICS PRACTICAL – I	0	0	3	2

Course Objective: After successful completion of this course, cadet should be able to *u*nderstanding the basic electronics devices working conditions, understanding the concept of CRO, understanding the basic principles of Rectifier

LIST OF EXPERIMENTS **30**

1. Semi conductor diode – Characteristics
2. Zener diode - Characteristics
3. Spectrometer – Refractive index of the prism
4. Surface tension of liquid by capillary rise method
5. Moment of Inertia of Flywheel and Frictional torque
6. Use of CRO to study the characteristics of an audio oscillator (frequency, period, Amplitude)
7. Thermistor as a Thermometer
8. CB characteristics, current amplification factor.
9. Newton's rings – interference
10. Young's modulus – non-uniform bending – pin & Microscope.
11. Half wave Rectifier (with & without Ripple)
12. Full wave Rectifier (with & without Ripple)
13. Bridge Rectifier (with & without Ripple)
14. CE Characteristics of Transistor, Current amplification factor.

NOTE: A minimum of 8 experiments to be performed.

Course Outcome:

CO – 1: Understand the Semi conductor diode – Characteristics

CO – 2: Understand the Zener Diode – Characteristics

CO – 3: Understand the Spectrometer – Refractive index of the Prism

CO – 4: Handle Use of CRO

CO – 5: Understand the Thermistor as a Thermometer

TEXT BOOKS:

1. M. Nelkon & J.M. Ogborn , "Advanced level practical Physics", Heinemann Educational Books
2. Zabar, "Electronics – A Text Lab Manual"
3. M.N. Srinivasan, S. Balasubramanian, R.Ranganathan, "A Text book of Practical Physics", Sultan Chandan Sons

Code	Subject	Lecture	Tutorial	Practical	Credit
21SMRN11	SHIP OPERATION TECHNOLOGY – I	4	0	0	3

Course Objective: After successful completion of this course, cadet should be able to name of various of ships, Safety Appeal, Apply various life-saving, Fire fighting, Deck appliances on ship operations, Life jacket, Thermal Protective Aid

UNIT I GENERAL 12

Names of various parts of a ship, Types of Merchant vessels, Names and timings of watches, Ranks of Officers, Sea terms – glossary and explanation.
Safety apparel – goggles, helmet, gloves, safety shoes and importance of adherence to safety procedures. Look out, Compass points.
Ships name, port of registry and IMO number.
Preparing metal surfaces – De-scaling and de-rusting – causes of rusting and corrosion. Manual and pneumatic chipping of plate surfaces, tools used in each case, advantages and disadvantages of each method. Wire-brushing, tools used in manual and pneumatic wire-brushing, advantages. Degree of surface preparation.
Paints – types of paint used on board ships. Composition, features and mode of use of each type of paint. Effect of sea and weather on different types of coats. Difference between primers and finish coats. Paint additives, their features and mode of use. Types of brushes and their features. Methods of paint application – Measurement of paint thickness – description and tools used.
Grease – types of grease used on board ships. Composition, features and mode of use of each type of grease. Greasing schedule on board ships.
Cleaning of wooden decks, polishing of brass and copper.

UNIT II CLASSIFICATION OF SHIPS 12

Classification of ships for carriage of LSA, LSA requirement for cargo ships and tankers.
Lifeboat – Description, methods of construction, parts of a lifeboat, buoyancy tanks, types of lifeboats, means of propulsion, lifeboat equipment, rations, pyrotechnics and distress signals, determination of carrying capacity of a lifeboat. Types of lifeboat davits and their operational procedure. Launching and boarding procedures. Duties of boat crew during launching and recovery of lifeboats
Life raft – Description of inflatable and rigid life rafts, construction and salient parts, equipment, rations, pyrotechnics and distress signals, repair of leaks and punctures for inflatable life rafts, launching and boarding procedures, Inflatable chutes.
SART – Description, features, tests and mode of use.
EPIRB – Description, features, tests and mode of use.
Lifebuoy - Description, features, tests and mode of use.
Lifejacket - Description, features, tests and mode of use.
Thermal Protective Aid (TPA) Description, features, tests and mode of use.
Immersion Suit - Description, features, tests and mode of use.
Line Throwing Apparatus (LTA) Description, features, tests and mode of use.

Pyrotechnics - Description, features, tests and mode of use. Carriage requirements for ships as per SOLAS.
Safety, care, testing maintenance of all LSA.

UNIT III FIRE FIGHTING APPLIANCES (FFA) 12

Causes and types of fire, the Fire Triangle, principle of firefighting and methods of extinguishing each type of fire. Defining terms like flash point, ignition point, oxidation, spontaneous combustion, LFL, UFL etc.
Fire hoses, hydrants and nozzles - Description, features, tests and mode of use.
International Shore Connection - Description, features, tests and mode of use.
Portable Fire extinguishers – Description of various types and their suitability for various types of fire. Operation and refilling of each type of extinguisher.
Fireman's Suit - Description, features, tests and mode of use, checks and maintenance.
Smoke Helmet and Self-contained Breathing Apparatus SCBA - Description, features, tests and mode of use, checks and maintenance.
Safety Lamp & Fire axe - Description, features, mode of use and maintenance.
Lifeline and harness - Description, features, mode of use and maintenance.
Safety, care, testing and maintenance of all FFA

UNIT IV ROPES & WIRES 12

Fibre ropes – types of material used, natural and synthetic fibres, types of lay and their advantages, plaited ropes, characteristics of different types of fibre ropes. Comparison of strength and elasticity of different types of ropes. Damages caused to ropes. Care and maintenance of ropes. Small cordages: Explanation of terms as marlin, spun yarn, tarred hemp, 2 and 3 ply twines, halyards, loglines and lead lines.
Steel wire ropes – grades of steel used in manufacture of ropes, construction of wire ropes, explanation of wire core and fibre core, advantages of fibre core, factors determining flexibility, explanation of terms malleable and ductile, meaning of – 6/12, 6/24, 6/37. Plaited wire rope, plastic sheathed rope, and non-rotating wire rope. Damages caused to wire ropes, care and maintenance of wire ropes.
Rigging – explanation of running and standing rigging and the rope used in each case.
Safe Working Load – Explanation of Safe Working Load and Breaking Strength of ropes, wire and chains.
Size – Measuring size of various ropes, wires and chains, tools and methods used.

UNIT V FLAGS AND MOORING 16

Flags and Flag etiquettes – Types of flags and ensigns, courtesy flag, Meaning of bunting, halyards etc., Penalties for not using or wrong using of ensign.
Location of jack staff, ensign staff, gaff, foremast yardarm, main masthead. Use of halyards – close up, at the dip, half mast. Positions of hoisting flags.
Mooring a ship alongside a wharf – Different types of ropes used for mooring.
Rat guards – Description and usage, Rope and chain stoppers – Mode of use.
Securing ropes on bitts, securing more than one rope on a single bollard.

Throwing the heaving line, passing the messenger line.
Mooring a vessel to the buoys.
Mooring terms, general safety precautions while mooring a vessel.

Course Outcome:

CO – 1: Understand the various parts of a Ship
CO – 2: Define the types of brushes and their features
CO – 3: Differentiate the classification of ships for carriage of LSA, LSA requirement for cargo ships and tankers
CO – 4: Understand the Safety, care, testing maintenance of all LSA
CO – 5: Understand the Causes and types of fire

TEXT BOOKS:

Capt. V.K.Bhandarkar, "Seamanship Primer", Bhandarkar Publications
Kemp and young, "Seamanship notes" , Butterworth Heinemann

REFERENCE BOOKS:

Capt. S.K.Puri, "Survival in life boat and life raft", Publisher Maritime Progress
A.N.Cockcroft , "Nicholl's seamanship and nautical knowledge", Brown Son & Ferguson Publisher
Capt. V.K.Bhandarkar ,"Life saving appliances rules", Bhandarkar publications
Capt. V.K.Bhandarkar ,"Fire fighting appliances rules", Bhandarkar publications
Graham Danton, "Theory and practice of seamanship", Publisher: Routledge , 11th Edition, 1996
C.H.Wright, "Survival at sea", BROWNSON & FERGUSON, LTD.

WEBSOURCE:

http://www.breizhbook.com/photo/albums/seamanship-bhandarkar-pdf-373

Code	Subject	Lecture	Tutorial	Practical	Credit
21PMRN13	SHIP OPERATION TECHNOLOGY – I PRACTICAL	0	0	2	2

Course Objective: After successful completion of this course, cadet should be able to apply various life-saving, Fire fighting, Deck appliances on ship operations, use of Safety belt and safety harness, cleaning and polishing of copper and brass items on board ships

List of Experiments **30**

1. Demonstrate and conduct practice on the use of various types of cordage, fiber and wire ropes used on ships.
2. Demonstrate and conduct practice on various knots, bends and hitches.
3. Demonstrate and conduct practice on various types of whippings.
4. Demonstrate and conduct practice on types of splices on fiber and wire ropes
5. Demonstrate the use of bulldog grips and bottle screws / turnbuckles in joining wires.
6. Explain the care and maintenance of fiber and wire ropes including uncoiling, coiling, stowing etc.
7. Use of safety belt and safety harness.
8. Donning of life jackets, TPA and Immersion suit.
9. Donning of SCBA and Smoke helmet apparatus; Checks to be carried out.
10. Explain mooring arrangements, throwing a heaving line
11. Worming, Parceling and Serving of hawsers
12. To apply rope and chain stoppers
13. De – scaling and De – rusting of a metal surface, Preparation for painting
14. Demonstrate various types of paint brushes, types of paints, painting procedures and defects
15. Cleaning and polishing of copper and brass items on board ship
16. Recognition of National flags of countries
17. Recognition of flags denoting alphabets, numerals and substitutes
18. Bend or unbend a flag from the halyard, breaking a flag, flag hoisting practice at colours and sunset.

Course Outcome:

CO – 1: Demonstrate and conduct practice on the use of various types of cordage, fiber and wire ropes used on ships

CO – 2: Demonstrate and conduct practice on various knots, bends and hitches

CO – 3: Demonstrate the use of bulldog grips and bottle screws / turnbuckles in joining wires

CO – 4: Understand the how to use of safety belt and safety harness

CO – 5: Define the apply rope and chain stoppers

TEXT BOOKS:

Capt. V.K.Bhandarkar, "Seamanship Primer", Bhandarkar Publications
Kemp and young, "Seamanship notes" , Butterworth Heinemann

REFERENCE BOOKS:

Capt. S.K.Puri, "Survival in life boat and life raft", Publisher Maritime Progress
A.N.Cockcroft , "Nicholl's seamanship and nautical knowledge", Brown Son & Ferguson Publisher
Capt. V.K.Bhandarkar ,"Life saving appliances rules", Bhandarkar publications
Capt. V.K.Bhandarkar ,"Fire fighting appliances rules", Bhandarkar publications
Graham Danton, "Theory and practice of seamanship", Publisher: Routledge, 11th Edition, 1996
C.H.Wright, "Survival at sea", BROWNSON & FERGUSON, LTD.

SEMESTER - II

Code	Subject	Lecture	Tutorial	Practical	Credit
21CMRN21	NAUTICAL MATHEMATICS – II	5	0	0	4

Course Objective: After successful completion of this course, cadet should be able to apply Mathematical Principles to Nautical Studies, graphical representations of complex numbers, matrices, spherical trigonometry and Algebra principles to Nautical Studies

UNIT I NAPIER'S RULES 16

Napier's Rules for Circular Parts of Right angle Spherical Triangle and Quadrantal Spherical Triangle properties, Sine formula, Cosine Formula, Haversine formula General format and Specific Format, Solutions of Spherical triangles, Versine formula simple problems. Congruency, Circumcentre and In centre of a Triangle, Nautical Quadrants and Trigonometric Quadrants, Wallsided Formula, Attwood's Formula, Moments of Statistical Forces in Small and Large angles.

UNIT II ALGEBRA AND THEORY OF EQUATIONS 16

Simple Algebric Expressions, Product, Factor, Co efficient, Power, Terms, Simple Expressions, Algebric Formulae's, Fractions, Simultaneous Equations, Quadratic Equations - Simple Problems, Theory of Equations, Relation Between the Roots and Co efficient of an equation, Imaginary and Irrational Roots Problems, Reciprocal Equations and Solutions of Reciprocal Equations, Diminishing the Roots of an equation(Increased by, Decreased by)Problems, Removal of Terms from the equations - Problems.

UNIT III PROPORTION, VARIATION AND SIMPSON'S RULE 16

Ratio's of two quantities, Direct and Inverse and joint Variation, formula for Simpson's Rule for finding Areas and Volumes of the Ships, Centroids and Center of Gravity, Interpolation with Critical Tables, Interpolation in various types of Nautical tables, Indices, finite differences and interpolation, forward, Backward and Central difference of Interpolation.

UNIT IV STATISTICS AND PROBABILITY 16

Scope of Statistics, frequency Distributions; Polygon, Cummulative frequency Tables, Compound Line Graph, Bar Chart, Pictogram, Bar Chart, Pie Chart, Histrogram, Symmetric Distribution, Skewed Distribution, Frequency Polygon, Frequency Ogive, Measures of Central Tendency; Calculation of Mean, Median, Mode Problems, Basic Terminology, Principle of Counting, Permutations, Combinations, Probability and set Notations, Addition law of Probability and Bay's Theorem .

UNIT V MENSURATION AND SOLID GEOMETRY 16

Standard and general equations of circles tangent to a circle, Definitions of Arc, Chord, Segment and a Sector, Definitions and Diagrams of Parabola, Ellipse and hyperbola. Determination of Median, Centroids, incentre and Circumference of a Triangle, Surface areas and Volume of Simple Shapes, Cube, Sphere, Cone and Cylinder; Perimeter and area of Square, Rectangle, Parallelogram, Trapezium, Rhombus, circle, Area of sectors and segments of a circle.

Course Outcome:

CO – 1: Understand Napier's Rule

CO – 2: Explain clearly about Nautical Quadrants and Trigonometric Quadrants

CO – 3: Define Algebric Operators

CO – 4: Understand about removal of Terms from the equations

CO – 5: Explain about proportion and variation

TEXT BOOKS:

1. Dr. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publications,43rd Edition, 2013
2. Dr. P.R. Vittal , "Allied Mathematics", Margham Publications, Chennai, Reprint Edition, 2011

REFERENCE BOOKS:

1. Graham Lawler MA, "Understanding Maths", Viva Study Mates Publishers, Fourth Edition
2. Capt. H. Subramanian , "Spherical Trigonometry", Vijaya Publications, First Edition, 2011
3. Capt. G.E. Earl, Capt. D.M. Robinson , "Munro's Mathematics for Deck Officers", Glasgow Brown, Son & Ferguson, Reprint Edition, 2007
4. Blanche, Capt A.G, "Norie's Nautical Tables", Blance & Wilson Publications, Revised Edition, 2007

Web Source:

https://eduinformer.com/b-s-grewal-higher-engineering-mathematics-review-ebook/

Code	Subject	Lecture	Tutorial	Practical	Credit
21CMRN22	NAUTICAL PHYSICS – II	4	0	0	4

Course Objective: After successful completion of this course, cadet should be able to demonstrate an understanding of basic scientific principles, theories, and laws as well as an awareness of the changing nature of science. Analyze, interpret, and evaluate scientific hypotheses and theories using rigorous methods (including statistical and mathematical techniques).Demonstrate an understanding of basic principles of Magnetism, Electricity, Digital Electronics

UNIT I MAGNETISM 12

Susceptibility - permeability - intensity of magnetization ,Magnetic effect of electric current with special reference to straight conductor, parallel conductors, coil and solenoid; Magnetic properties of materials- dia, paramagnetism, Ferromagnetism, Domain Theory, Hysteresis. Magnetic elements of earth, Determination of variations. Dip circle, Errors in measurement of Dip. Kew magnetometer to find H. Earth Inductor, Isogonic and Isoclinic lines.

UNIT II ELECTRICITY 12

Current and Static Electricity: Electric current, EMF, PD, power and energy etc; Ohm's law; simple electrical circuits, Kirchoff's Law, simple calculation, Wheatstone bridge. Effect of temperature on resistance -Series and parallel combination of resistance and power supply (secondary cells) , Static electricity, Heating effect of electric current and applications.

Chemical effect of current: Faraday's Law of electrolysis, Chemical effect – corrosion and electrolysis, Cathodic protection, Primary cells and accumulators, Care and rating of accumulators.

Electromagnetic induction and Alternating Current : Faraday's law of electromagnetic induction, Lenz's law ; Principle, construction and basic working of AC and D.C. generators and motors, Transformers; AC Supply (average and RMS value of ac current); Power and power factor; Self / mutual inductance, series and parallel combinations of inductors, resistance and Capacitance; Hazards associated with use of electrical energy (including high voltage) and the appropriate safe working practices; Electric shock; Various types of electric cables and their uses including earthing and bonding

UNIT III ELECTRONICS 12

Amplification in electronic circuits- Practical amplifier circuits, Voltage, Power and current gains; Oscillator- LC tank circuit, Piezo Electric effect and use of crystal in Frequency control.

Operational Amplifier: - The basic differential and Common Mode Operation, Basic Op amp Specifications, Inverting and Non-inverting amplifiers, voltage follower, summing amplifier, Difference Amplifier. Integrator and Differentiator.

UNIT IV DIGITAL ELECTRONICS 12

Binary number systems, Binary to decimal conversion, Binary addition and subtraction.Logicgates.Boolean algebra, DeMorgan's Theorem, Universal Building block.Half adder, Full adder. Integrated Circuits – Fabrication. Microprocessor 8085 - Block diagram and functional organisation of 8085.Assembly and Machine Language, Applications of microprocessor.

UNIT V COMMUNICATION 12

Propagation of Radio waves - Ground wave, Sky wave propagation, Space wave Propagation. Ionosphere - effect on radio waves. Skip distance, Skip zone, Fading, MUF and Critical frequency.

Modulation- Basic concepts, Carrier wave, Amplitude modulation, Frequency modulation, Advantages and disadvantages of AM and FM, Comparison between A.M and F.M. Single side band transmission, its advantages over double side transmission. Principle of super heterodyne receivers, Characteristics of radio receiver.

Transmitters: Radio transmitter and receiver; Antennas- straight (whip), and Yagi; Sensors and transducers for temperature, pressure, level, flow rate; Radar transmitters, receivers and antenna.

Course Outcome:

CO – 1: Understand the concepts of magnetism and theory related to that.

CO – 2: Explain the concept about kew magnetometer and earth inductor.

CO – 3: Explain the concepts of electricity and laws related to electric and chemical effect.

CO – 4: Understand the principles of Generator, Transformer and RLC Circuit.

CO – 5: Well versed with amplifiers and Piezoelectric effect .

TEXT BOOKS:

1. J.H. Clough-Smith, “Applied Physics”, Brown, Son & Ferguson Ltd Publications, Second Edition, 1994
2. R.K. Gaur, “Basic Applied Physics”, Dhanbat Rai & Sons publication, Second Edition, 1984
3. University Handout

REFERENCE BOOKS:

1. R.S. Khurmi , “A Text book of Engineering Mechanics”,S.CHAND Publications,53rd Edition, 2014
2. Brijlal & Subramanian,”Heat & Thermodynamics”,S. CHAND Publications, Revised Edition, 2014
3. Halliday and Resnick , “Physics Part I & II”, Wiley Publications, Third Edition, 1978
4. V. K. Mehta , “Principles of Electronics”, S.CHAND Publications, Revised Edition, 1980
5. Brijlal & Subramanian , “A Textbook of Sound” ,Vikas Publication, Illustrated Edition, 1986
6. D.S.Mathur , “Mechanics”, S. CHAND Publication, Edition 2006
7. Vasudevan, “Light”, S. CHAND Publication, Edition 2011

Web Source:

https://www.khanacademy.org/science/physics

Code	Subject	Lecture	Tutorial	Practical	Credit
21DMRN21	MARINE METEOROLOGY – II	5	0	0	3

Course Objective: After successful completion of this course, cadet should be able to understand the dynamics of the ocean and the atmosphere, foundation for students in understanding the physical processes in the ocean and atmosphere, Understanding factors affecting atmospheric motion and resulting windows

UNIT I FORMATION OF THE EARTH 16

1. Formation of the earth and its structure – Evolution of continents and ocean basins - Continental drift hypothesis – concept of isotasy and its application to surface phenomena – Recent ideas on drift: plate tectonics – practical significance of recent information. Earth Quakes-Seismic waves-Volcanoes.
2. Rocks and Minerals.
3. Weathering - Marine land forms — classification of coasts.

UNIT II PHYSICAL PROPERTIES OF SEA WATER 16

1. Physical properties of Sea Water: Temperature, salinity density and pressure – their relationship and measurement. Optical Properties, sound and light in the sea. Colour of the Sea water.
2. The Energy Budget of the Oceans: Spatial variation of temperature and evaporation Heat balance.
3. Salinity and Density: Distribution in surface layers of the ocean. Controlling processes.

UNIT III OCEANIC CIRCULATION SYSTEM 16

1. Oceanic Circulation System: Causes and spatial distribution of surface circulation seasonal changes. Causes of ocean currents. The currents of pacific, Atlantic and Indian oceans.
2. Sub – Surface Circulation: Formation, source region and movement of water masses
3. Ocean Waves and Tides: Types of waves, wave energy. Behaviour of waves in deep and shallow waters. Tide – producing forces. Types of tides. Tide prediction and analysis, tidal streams. Co-tidal charts-Tidal Curves.
4. Major relief features of the ocean floor - Bottom relief of Indian, Atlantic and Pacific oceans properties of ocean water: temperature, salinity and density – Their vertical and horizontal distribution – ocean currents: factors and patterns – Ocean deposits: types and their work.
5. Sea level changes

UNIT IV VOGAGE PLANNING 16

1. Voyage planning & Weather Routing of ships;

2. Basic considerations in Voyage Planning; selection and use of data.
3. Weather Routing; Basic parameters; least time track and ship's performance curves.
4. Onboard weather coding and decoding.

UNIT V ENVIRONMENTAL POLLUTION 16

1. Environmental pollution: ozone depletion.
2. Basic causes; common pollutants; greenhouse effect and global warming
3. Pollution by micro-organisms in ballast water - preventive measures.
4. Atmospheric pollution by marine transportation, Nuclear hazards, Role of IMO in preventing oil spills-MARPOL annexes and amendments.
5. Meteorological Instruments: The principles, construction and uses of various meteorological instruments maximum and minimum thermometers, psychrometer / hygrometer. Anemometer. Wind vane barometers (aneroid and mercury) and barograph.

Course Outcome:

CO – 1: Understand the formation of the earth and its structure

CO – 2: State the Evolution of continents and ocean basins

CO – 3: Understand the physical properties of Sea Water

CO – 4: Uderstand the energy budget of the ocean

CO – 5: State the causes and spatial distribution of surface circulation seasonal changes

TEXT BOOKS:

1. Capt.H.Subramaniam , "Marine Meteorology", Vijaya Publications

REFERENCE BOOKS:

1. "Meteorology for Mariners", HMSI, London, HMSO
2. "Marine Observer's",HMSO, London Academic press
3. "Elementary Meteorology", HMSO, London, HMSO

4. James.R. Holoton ,“An Introduction to Dynamic Meteorology”, Academic Press
5. Petterson.B, “Introduction to Meteorology”, MC Graw Hill
6. University Handout

Web Sources:

https://www.libramar.net/news/marine_meteorology/2021-06-18-3901

Code	Subject	Lecture	Tutorial	Practical	Credit
21PMRN21	PROFESSIONAL PRACTICE – II	0	0	3	2

Course Objective: The objective of the course is designed to introduce and develop the knowledge and skills required to engage in the work-based learning process. This will enable the cadet to gain inquiry-related skills including critical analysis, evaluation and appraisal. These skills will help the cadet to select, develop and apply appropriate methods of inquiry for work-based projects.

UNIT I MAINTAIN AND ENHANCE CADETS PROFESSIONAL KNOWLEDGE & EXPERTISE 6

Continuing education as required by the rules of the Society

UNIT II MAINTAIN INDEPENDENCE, INTEGRITY & OBJECTIVITY 6

Endeavor to present facts and opinions without prejudice.

UNIT III AVOID PREJUDICE AND CONFLICT OF INTEREST 6

Avoid assignments that would create a conflict of interest.

UNIT IV TEAM BUILDING 6

Improving interpersonal relations and social interactions.

UNIT V TIME MANAGEMENT 6

Exercising conscious control over the amount of time spent on specific activities, especially to increase effectiveness, efficiency or productivity.

Course Outcome:

CO – 1: Maintain and Enhance cadets' professional knowledge and expertise

CO – 2: Understand how to continue education as required by the rules of the society

CO – 3: Maintain independence, integrity and objectivity

CO – 4: Understand the endeavor to present facts and opinions without prejudice.

CO – 5: Understand to avoid prejudice and conflict of interest

TEXT BOOKS:

University Study Materials

Code	Subject	Lecture	Tutorial	Practical	Credit
21AMRN21	ENGLISH – II	4	0	0	3

Course Objective: After successful completion of this course, cadet should be able to Understand Phonetics, Real or Imagery, Quantifiers, Active & Passive, Modal Verbs, Reported Speech, Lexis, Function, Grammar, Skills

UNIT I PHONETICS, LEXIS, FUNCTION 12

Technology.

One World.

Look after yourself.

Happy ever after.

All part of the job – Real or Imagery.

UNIT II GRAMMAR 12

If second condition.

Quantifiers.

Active & Passive.

Modal Verbs.

Reported speech. If – Third condition.

UNIT III SKILLS 12

Reading, Listening, Speaking & Writing.

UNIT IV MARITIME ENGLISH 12

Contents of IMO model course 3.17 – Core Section 2

UNIT V COMMUNICATION 12

Communication Skills – Debates

Course Outcome:

CO – 1: Understand the technology in Phonetics, Lexis, Functions

CO – 2: Define Real or Imagery

CO – 3: Define Quantifiers

CO – 4: Understand Active & Passive Voice

CO – 5: Reading and Listening Skills

TEXT BOOKS:

Chris Redston & Gillie Cunningham , “face2face – Intermediate Students Book”, Cambridge University Press, Edition 2014

Chris Redston & Gillie Cunningham, “face2face – Intermediate work book”, Cambridge University Press, Edition 2014

REFERENCE BOOKS:

Tony Lynch, “Study Listening”, Cambridge University Press, 2004

Kenneth Anderson, Joan Maclean & Tony Lynch , “Study Speaking”, Cambridge University Press, 2004

Francoise Grellet , “Developing Reading Skills”, Cambridge University Press, 2004

Liz Hamp-Lyon & Ben Heasley , “Study Writing”, Cambridge University Press, 2004

Raymond Murphy, “Murphy’s English Grammar” Cambridge University, 2004

1. Nancy Lumban Batu, “Model Course - Maritime English 3.17” ,IMO, 2000

Code	Subject	Lecture	Tutorial	Practical	Credit
21PMRN22	NAUTICAL PHYSICS PRACTICAL – II	0	0	3	2

Course Objective: After successful completion of this course, cadet should be able to understanding the basic electronics devices working conditions, understanding the concept of Microprocessor, understanding the basic principles of Logic Gates

List of Experiments 30

1. LCR – Series circuit to find the resonance frequency. Determination of Quality factor for different R combinations.

2. Demorgan's theorem and Associative laws -Verification

3. OPAMP – Non inverting and inverting amplifier, voltage Follower.

4. OPAMP - Subtract or and summing amplifier (inverting and non inverting)

5. OPAMP – Integrator and differentiator.

6. Microprocessor – Addition, Subtraction (8 bit)

7. Microprocessor – Addition, Subtraction (16 bit)

8. Microprocessor – Square root

9. Microprocessor - Multiplication, Division (8 bit)

10. To design an AstableMultivibrator using IC 555 Timer.

11. LCR – Parallel circuit to find the resonance frequency.

12. Effective Resistance – Series and Parallel combination.

13. Study of Logic gates and construction of Boolean expressions.

14. Construction of Universal building block.

NOTE: A minimum of 8 experiments to be performed.

Course Outcome:

CO – 1: Get knowledge about the LCR – Series circuit to find the resonance frequency. Determination of Quality factor for different R combinations

CO – 2: Understand Demorgan's Theorem and Associative Laws – Verification

CO – 3: Understand OPAMP

CO – 4: Understand how to do Microprocessor – Addition & Subtraction (8 Bit)

CO – 5: Understand how to do Microprocessor – Addition & Subtraction (16 Bit)

TEXT BOOKS:

1. M. Nelkon & J.M. Ogborn , "Advanced level practical Physics", Heinemann Educational Books

2. Zabar, “Electronics – A Text Lab Manual”, MC Graw Hill

3. M.N. Srinivasan, S. Balasubramanian, R.Ranganathan, “A Text book of Practical Physics”, Sultan Chandan Sons

Code	Subject	Lecture	Tutorial	Practical	Credit
21SMRN21	SHIP OPERATION TECHNOLOGY – II	4	0	0	3

Course Objective: After successful completion of this course, cadet should be able to Anchors and Anchoring Procedures, Apply various life-saving, Life Saving Appliance and Survival at sea, Fire fighting Deck appliances on ship operations

UNIT I ANCHORS AND ANCHORING PROCEDURES 12

Description of different types of anchors.

Description of different parts of an anchor. Description of markings on an anchor.

Description of anchor cables, joining shackles and lug less shackle.

Markings of the anchor cables. Reading off and reporting the length of the cable paid out.

Description of features of forecastle deck in the vicinity of the anchors – hawse pipe, spurling pipe, chain locker, connection of bitter end, bow stopper and gypsy wheel.

Anchoring procedure – basic, running moor, standing moor, open moor.

Reporting of cable paid out, cable scope, cable direction and when a vessel is brought up.

Indications that vessel is dragging anchor.

Actions when vessel dragging anchor.

Fouled hawse or anchor – description and remedial measures.

Procedure for hanging off the anchor, opening and restoring a lugless shackle during changing an intermediate length of cable, slipping the cable.

Measurement of size of studded cable link, joining shackle.

Knowledge of common damages of an anchor cable.

UNIT II LIFE SAVING APPLIANCES & SURVIVAL AT SEA 12

Outline knowledge of SOLAS 74 and requirements as per SOLAS for LSA

Boat drills and musters – Description and frequency as per SOLAS.

Procedures to be followed before and after abandoning a ship.

Managing survival craft and personnel in the craft.

Survival techniques in survival craft.

Basic knowledge of Search and rescue by ships / Helicopters.

UNIT III FIRE PREVENTION AND FIRE FIGHTING 12

Outline knowledge of SOLAS 74 requirements for FFA

Fire drills and musters – Description and frequency as per SOLAS

Causes of fire in tankers during various operations carried out on tankers and their preventive methods.

Procedures for fighting coal fires, paint fires.

UNIT IV DERRICKS AND CRANES / CARGO APPLIANCES 12

Description of parts of derrick.

Union Purchase – description of parts of a union purchase system and working principle. Importance of preventer guys. Relation between Load and the angle between the runner wires.

Swinging derricks and powered ('steam') guys.

Yo–yo gear – description and working principle.

Heavy lift derricks – Jumbo, Stulcken derricks – Description and operation.

Precautions during hoisting, lowering and securing of derricks.

Check, test and maintenance of derricks.

Calculations of the Stresses in various parts of derrick rig.

Calculations of the tension of various ropes and wires of a purchase.

Description of parts of a crane. Description of various types of cranes.

Principle of operation, precautions while handling cranes and routine maintenance.

Blocks – types of blocks, parts of a block, internal and external binding and strapping, Size of a block, sheave and the corresponding size of rope to be used. Relation between sheave diameter and rope diameter. Markings on a block, Care and maintenance of blocks.

Tackles – names of types of tackles and purchases used on ships. Parts of a tackle, usage to advantage and disadvantage, Velocity ratio or 'power gained' and efficiency of a tackle. Relation between Load and Effort for each type of tackle. Calculation of size of rope / wire to be used on a particular tackle for a given load.

Shackles – types of shackles, Areas of usage for lugged and lugless shackles. Marking on shackles, Difference between tested and untested shackles. Care and maintenance.

Cargo hooks – various types of cargo hooks. Marking on hooks.

Turnbuckles – types of turnbuckles. Modes of use. Care and maintenance.

Slings – types of slings. Precautions during use. Care and maintenance.

UNIT V DECK APPLIANCES / RIGGINGS 12

Hand lead line and deep sea lead line – Description and method of taking a cast.

Sounding rod/tape and ullage tape – Description and mode of use. Difference between sounding and ullage.

UTI (Ullage/Temperature/Interface) tapes – Description and mode of use.

Different types of speed logs – Brief description of patent log, Description of Impeller log, Pitot log, Electromagnetic log and Doppler log – Principles and their operation.

Bridge / Engine room telegraph – Brief description and its operation.

Windlass - Brief description and its operation.

Cargo winches - Brief description and its operation.

Rigging – rigging a stage, name of parts and mode of use. Bosun chair – description and mode of use.

Ladders – Pilot ladders – Description, mode of use and maintenance. Description of 'Combination ladder' and when it is used. Description of various types of ladders (Jacob's, coolie, jump and metal telescopic) and their mode of use.

Course Outcome:

CO – 1: Understand the types of anchors

CO – 2: State different parts of anchors

CO – 3: Outline knowledge of SOLAS 74 and requirements as per SOLAS for LSA

CO – 4: Understand the Basic knowledge of Search and rescue by ships / Helicopters

CO – 5: Outline knowledge of SOLAS 74 requirements for FFA

TEXT BOOKS:

Capt. V.K.Bhandarkar, "Seamanship Primer", Bhandarkar Publications

Kemp and young, "Seamanship notes" , Butterworth Heinemann

REFERENCE BOOKS:

Capt. S.K.Puri, “Survival in life boat and life raft”, Publisher Maritime Progress

A.N.Cockcroft , “Nicholl’s seamanship and nautical knowledge”, Brown Son & Ferguson Publisher

Capt. V.K.Bhandarkar ,“Life saving appliances rules”, Bhandarkar publications

Capt. V.K.Bhandarkar ,“Fire fighting appliances rules”, Bhandarkar publications

Graham Danton, “Theory and practice of seamanship”, Publisher: Routledge

C.H.Wright, “Survival at sea”, BROWNSON & FERGUSON, LTD

WEBSOURCE:

http://www.breizhbook.com/photo/albums/seamanship-bhandarkar-pdf-373

Code	Subject	Lecture	Tutorial	Practical	Credit
21PMRN23	SHIP OPERATION TECHNOLOGY – II PRACTICAL	0	0	2	2

Course Objective: After successful completion of this course, cadet should be able to apply various life-saving, Rigging Stages, Handling of Life Boats, Hoisting a Life Boat, Fire fighting, Deck appliances on ship operations

List of Experiments 30

1. Rigging stages, Precautions when using stages
2. Rigging of Bosun's Chair, Greasing of wire ropes
3. Heaving a lead line and calling out the soundings
4. Explain the parts of an anchor
5. Explain the following terms with respect to anchor work – cable, link swivel, joining shackle, shackle as a term of length, bitter end
6. Rigging, climbing of a Jacob's ladder and a pilot ladder. Use of manropes
7. Identification of various types of tackles and purchases
8. Reeving of a tackle/Purchase to advantage and disadvantage
9. Demonstration of the use of various blocks, snatch blocks and chain blocks
10. Different types of tackles and purchases and the power gained in each case
11. Given a block, to determine permissible rope diameter based on sheave diameter
12. Swinging out and lowering a lifeboat from gravity davits
13. Handling of lifeboat under oars – Coming alongside, getting away from the ship and picking up a man overboard
14. Hoisting a lifeboat on davits, Checking working of "Cut off" switch
15. Launching of life rafts, Inflating life rafts
16. Boarding a life raft, method of righting an upturned life raft
17. Given a studded link, to determine the size of the link
18. Explain use of anchor, dropped, hoisted and secured
19. Reporting of scope and direction of an anchor cable

Course Outcome:

CO – 1: Understand the Rigging stages, Precautions when using stages

CO – 2: Differentiate the parts of an anchor

CO – 3: Understand how to Rigging, Climbing of a Jacob's ladder and a Pilot Ladder

CO – 4: Identify various types of tackles and purchases

CO – 5: Demonstrate of the use of various blocks, snatch blocks and chain blocks

TEXT BOOKS:

Capt. V.K.Bhandarkar, "Seamanship Primer", Bhandarkar Publications

Kemp and young, "Seamanship notes" , Butterworth Heinemann

REFERENCE BOOKS:

Capt. S.K.Puri, "Survival in life boat and life raft", Publisher Maritime Progress

A.N.Cockcroft , "Nicholl's seamanship and nautical knowledge", Brown Son & Ferguson Publisher

Capt. V.K.Bhandarkar ,"Life saving appliances rules", Bhandarkar publications

Capt. V.K.Bhandarkar ,"Fire fighting appliances rules", Bhandarkar publications

Graham Danton, "Theory and practice of seamanship", Publisher: Routledge.

C.H.Wright, "Survival at sea", BROWNSON & FERGUSON, LTD

SEMESTER - III

Code	Subject	Lecture	Tutorial	Practical	Credit
21CMRN31	NAVIGATION – I	4	0	0	4

Course Objective: After successful completion of this course, cadet should be able understand the shape of the Earth, Poles, Equator, Circles, to apply Navigation principle on Ships Understand Maritime Geography**,** Understand Solar System

UNIT I SHAPE OF THE EARTH **12**

1. The shape of the earth, Poles, Equator, Great circles, Small circles, parallels of Latitude, D'Lat, meridians of Longitude, prime meridian, D'long, position by Latitude and Longitude.
2. Measurement of distance: Nautical, geographical and statute mile, Knot. Effect of polar compression on nautical mile
3. Familiarity with contents of Nautical Tables and their use
4. Maritime Geography: Locate Oceans, Continents, Seas, Canals, Straits, Navigable Rivers, and Major ports of the world

UNIT II RELATIONSHIP BETWEEN DEPARTURE AND D'LONG **12**

1. Departure. Relationship between Departure and D'long, Parallel sailing
2. Rhumb Line. Mean Latitude, Plane sailing. Relationship between Departure, D'lat, course and distance. Middle latitude.
3. Principle of Mercator projection: meridional parts, DMP, Latitude and Longitude scales, conversion from one to the other: Mercator sailing. Relationship between course D' long and DMP

UNIT III SPHERICAL TRIANGLE **12**

1. Spherical triangle. Great circle sailing initial course, final course, distance and vertex course on crossing equator. Composite great circle sailing. Figure drawing of a GC track to approximate scale

UNIT IV SOLAR SYSTEM **12**

1. Solar System: Rotation and revolution. Equinoxes and Solstices. Cause of seasons and unequal length of day and night

UNIT V NAUTICAL CALCULATIONS 12

1. Practical problems on parallel sailing using formulae
2. Practical problems on plane sailing using formulae
3. Practical problems on mercator sailing using formulae
4. The use of Traverse Tables to obtain the position of the ship at any time, given compass course, variation ,deviation, and the run recorded by the log or estimated speed or engine speed allowing for the effects of wind and current, if any. Day's work
5. To find initial course, final course and distance between two positions on the earth's surface by Great Circle Sailing. To calculate the position of the vertex and intermediate points on the Great Circle Track

Course Outcome:

CO – 1: Define the Shape of the Earth, Poles, Equator, great Circles.

CO – 2: Familiarity with contents of Nautical Tables and their use.

CO – 3: Understand the relationship between Departure and D'long, Parallel sailing

CO – 4: Obtain the concept of Principle of Mercator projection

CO – 5: Understand the concept of Spherical Triangle

TEXT BOOKS:

1. Capt.H.Subramaniam , "Practical Navigation", Vijaya Publications
2. Capt.P.M.Sarma , "Principles of Navigation",Bhandarkar Publications, 4th Edition, 1996
3. Capt.T.K.Joseph & Capt.S.S.S.Rewari, "Principles of Navigation", ARI International Pvt. Ltd. Delhi
4. Capt. H. Subramaniam, "Nautical Almanac", Vijaya Publications
5. Capt. A.G. Imray Laurie , "Norie's Tables Blance", Norie & Wilson

REFERENCE BOOKS:

1. "Admiralty Manual of Navigation Vol I & II" ,HMSO
2. A.Frost , "Navigation", Brown Son & Ferguson Ltd
3. Alfred Nicholl, "Nicholl's Concise Guide Volumes I & II", Brown Son & Ferguson Ltd.

Web Source:

https://www.libramar.net/news/practical_navigation/2021-06-15-4293

Code	Subject	Lecture	Tutorial	Practical	Credit
21CMRN32	NAVAL ARCHITECTURE – I	5	0	0	4

Course Objective: After successful completion of this course, cadet should be able to apply various knowledge of architecture on ship operations, Modern Merchant Ships, Understand Ship Stability**,** understand Statically Stability

SECTION A – SHIP CONSTRUCTION

UNIT I INTRODUCTION 16

Introduction – Development of ocean-going Merchant Ships. Modern Merchant Ships.
Types of Ships – Types of ships based on nature of cargo, Passenger Liners, Ferries, Specialized carriers for General Cargo, Bulk, Oil (Crude Oil Products) OBO's. Container, Ro-Ro, Lash, LPG, LNG, Cattle Carrier, Car Carrier etc., Special features of above types of ships.
Definition and Meanings: LOA, LBP, EB, MB, Extreme Depth, Molded Depth, Draft, Freeboard, Camber, Sheer, Rake, Rise of Floor, Flare, etc.

UNIT II PRINCIPLE PARTS OF SHIP 16

1. Principle Parts of Ship: Bow, Stern, Shell plating, Double Bottom Tanks, Cargo Holds, Tween Decks, Deep tanks, Fore-peak and After Peak store rooms and tanks, Plate Keels and Duct Keels. Forecastle deck, Quarter Deck, Main/Whether decks, Hatch covers, Cargo Gear, anchoring and mooring equipment, Mast House.
2. Machinery Spaces – Engine Room Layout, Engine Casing, Subdivisions of Engine Room, Steering Gear, Pump Rooms, Mast houses, Work-Shops, etc.
3. Superstructure – Wheel House, Accommodation Spaces, Cabins, Galley, Pantry, Dining Saloons, Recreation Rooms, Various Stores and Lockers, Cold storage spaces etc.
4. General Layout of ships – General Cargo Ship, Bulk Carrier, Oil Tanker, Container Ship, Passenger ship, RO RO ship, Chemical Tanker, Gas Tanker, Combination Carrier. Sketches of these ships.
5. Principles of Design – Common principles governing design and construction of various types of steel ships with respect to :
    1. Longitudinal, Transverse and Vertical Strength.
    2. Continuity of Strength
    3. Strength under static and dynamic conditions
    4. Stability
    5. Water-tightness and Weather-tightness
    6. Conformity with Statutory Requirements

UNIT III STEEL FOR SHIP CONSTRUCTION **16**

1. Steel for Ship Construction – Types of steel in ship construction. Steel manufacture Blast Furnace method and Electric arc furnace method. Steel plate treatment. Rolled section – Various shapes and standard sizes. Testing of materials – various tests at production and building stages.
2. Riveting – Riveting as joining process. Types of joints.
3. Welding – General Ideas of Electric Arc Welding, Equipment, Electrodes, methods used etc, welding its predominant use in ship construction. Advantages of welding over riveting. Precautions while welding and Gas cutting.

SECTION B – SHIP STABILITY

UNIT IV LAWS OF FLOTATION **16**

1. Laws of flotation, Buoyancy, Reserve buoyancy, Displacement, Deadweight, Change of draft due to change of density.
2. Tonnes per Cm. Immersion(TPC), Fresh Water Allowance (FWA), Dock Water Allowance (DWA), Calculations of TPC, FWA & DWA in various densities.
3. The meaning of the terms Block co-efficient, water-plane co-efficient, Mid-ship Coefficient, Prismatic Coefficient and relationship between them.
4. The center of gravity of ship and factors affecting the same. Calculation involving KG of a Ship
5. The center of buoyancy and factors affecting the same. Calculation involving KB of a ship.
6. Use of displacement and TPC curves and scales to determine weights of cargo or ballast from draughts or freeboards.

UNIT V TRANSVERSE STATICAL STABILITY **16**

1. Transverse Statical Stability: Metacentric height, Righting lever, Righting Moment. Calculations of Moment of Statical Stability.
2. Equilibrium of Ships: Stable, Unstable and Neutral equilibrium.
3. Free Surface effect: Free surface effect, Effect of Slack Tanks on stability and its Calculations, Calculation of GM (fluid), Stiff and Tender ships.
4. List: Difference between and list heel, List and its corrections, Calculation of List while Loading, Discharging and/or shifting weights, Correction of List. Numerical involving above.
5. Hydrostatic curves and tables: Use of hydrostatic tables and curves as supplied to ships, Displacement / Draft-curve and table, Light displacement & Load displacement,

General for all Stability Units

Calculations based on the foregoing including those based on "Trim & Stability Particulars" of a given ship

Course Outcomes:

CO – 1: Understand the development of Ocean-going Merchant Ships

CO – 2: Differentiate the Ships based on nature of Cargo, Passenger Liners, etc.,

CO – 3: Understand the principles parts of Ship

CO – 4: Know the Superstructure of the Ships

CO – 5: Understand the types of Steel in Ships

TEXT BOOKS:

Capt. Errol Fernandes , "Ship Construction", Marinez Enterprises, Mumbai
Kemp & Young , "Ship Construction Notes", Reprint Edition, 2006
Capt. Subramanian.H, "Ship Stability I, II, & III", Vijaya Publications
Capt. Joseph & Capt. Rewari , "Problems on M.V.Hindship", ARI Publication
Capt.Bhandarkar, "Stability Tables M/V Hindship Data Booklet", Bhandarkar Publications

REFERENCE BOOKS:

1. Derrett, "Merchant Ship Stability for Master and Mates", Butterworth Heinemann
2. Martin A. Rhodes, "Ship Stability for Mates & Masters", Seamanship International Ltd.
3. La Dage&Gemert, "Stability and Trim for Ships Officer", DVAN Nostrand Company
4. Thomas Reeds, "Ship construction for Marine Students", Thomas Reed Publications
5. Kemp and Young, "Ship construction" , Butterworth Heinemann

Web Source:

https://inlib.in/doc/c552274/ship-solitons--arxiv

Code	Subject	Lecture	Tutorial	Practical	Credit
21GMRN31	INTRODUCTION TO COMPUTERS	4	0	0	3

Course Objective: After successful completion of this course, cadet should be able to Basic Definitions of Computers, Understand MS Word for Document Typing and Excel for Calculation**,** Understand MS PowerPoint for preparing Presentations

UNIT I COMPUTER FUNDAMENTALS 12

Historical development of computers an as evolution. Classification of computers on different norms such as generations, technology, etc., Different functional part of a computer and their functions. Computer peripherals: Monitor, Printer, Key board, Floppy disk drive, Floppy Hard disk, and Mouse. Computer arithmetic: Binary, Octal, Decimal & Hexadecimal number systems and mutual conversion: Addition, 1's & 2's complementation in binary only. Units of memory measurement: Bits, Bytes, KB, MB, GB, TB. Unit of run-time measurement: Sec, ms, us, ns, ps, fs, as. Different computer environments: Batch processing time sharing, Interactive & Network their functional details and difference. Computer connectivity: LAN, MAN, WAN, Internet. Internet activity in India and various facilities available on Internet, Satellite based communication.

UNIT II DOS / WINDOWS 95 / WINDOWS 98/WINDOWS XP/LINUX 12

Role and function of D'S. MS-DOS- (DISKETTE OPERATING SYSTEM) what is Ms-Dos, DOS Internal, External commands. Wild cards/pipes/redirections.Graphic user interphase.Windows 95/98, Features of WINDOWS 95/98, Control panel and display properties, Mouse, Icons and selection. Accessories, DOS prompt and My briefcase, Desktop, Settings control panel, Explorer, Find utility, Overview of Networking options. Introduction to Windows XP and Linux. Basic trouble shooting of software crashes. Open source software introduction.

UNIT III MS – OFFICE – WORD & EXCEL 12

MS-OFFICE

Introduction to OFFICE concept. Role of MS-OFFICE in Office productivity.

MS Word (Word Processor)

Starting MS-WORD. Creating of documents. Menus and functions. Mouse operations / keyboard operations. Designing Document. Typing text. Formatting features. Block operations. Tool bars. Saving and Printing. Creating a document / template, Creating Tables, Insert columns / rows. Formatting text (Fonts / justification). Inserting and aligning pictures. Inserting spreads sheets / graphs. Saving and Printing. Creating documents based on template. Mail merge. Concept of mail merge. Creating data source. Creating document, Merging and printing of mails.

MS Excel (Spread Sheet)

Introduction to Excel, Navigating selecting cells. Entering and editing numbers / text / formulae / date / formatting rows / columns. Excel standard, format, drawing tool bars, series fill copying / pasting values / formulae. Insert / delete rows / columns. Renaming worksheets, Copying data between worksheets. Auto fit selection. Creating a chart, Saving / opening / closing a file.

Functions

ROUND ( ) SORT ( ) AVERAGE ( ) MAX ( ) MIN ( ) COUNT ( ) SUM ( ) IF ( ) ABS ( ) ROMAN ( ) UPPER ( ) LOWER ( ) CELL ( ) TODAY ( ) NOW ( )

UNIT IV MS OFFICE – POWEPOINT & ACCESS 12

A. MS POWER POINT

Role of presentation. Working with power point, Parts of power point windows, Power point standard / formatting / drawing / drawing + / auto shapes tool bars. Text formatting, Insert clipart / picture. Manipulation of clipart / picture inserting new slide, Creating and manipulating animations, Organization chart. Table, Design template, Master slide, Colour box, Saving the presentation. Auto content wizard template.

B. MS ACCESS (Data Base)

Data, Data base, Data forms, Data sort, Filters, Valid / invalid redundant criteria.

UNIT V INTERNET 12

Internet. Getting connected, Introduction to network, important features of internet, Introduction to protocols, Setting up internet connection. Configuring TCP / IP connection. Netscape Navigator, Internet Explorer, Logging in to internet service provider, Concept of E-mails, creating accounts sending / receiving / replaying the e-mails attachments surfing and download of data.

PRACTICAL TASKS

MS-WORD:

1. Usage of Bullets and Numbering
2. Header and Footer
3. Usage of Spell check and Grammar
4. Find and Replace
5. Symbol, picture insertion and Alignment
6. Mail Merge
7. Text Manipulation
8. Text and document formatting

MS – EXCEL

1. Pivot table
2. Multiplication table
3. Subtotal
4. Functions – Date, Mathematical & trigonometry. Text Logical and Statistical
5. Chart

MS-POWERPOINT

1. Auto content wizard
2. Selecting and editing text
3. Creating and Saving presentation and slide
4. Working with text
5. Formatting text
6. Printing and Running slide shows

Course Outcome:

CO – 1: Understand the Historical development of computers as an evolution

CO – 2: Understand the different functional parts of a computer and their functions

CO – 3: Understand the role and functions of DOS

CO – 4: State basic trouble shooting of software crashes

CO – 5: Understand how to use Mail Merge in Microsoft Word

TEXT BOOKS:

1. Ananathi Sheshasaayee, "Computer programming and application in business and management",Margham Publications, Reprint 2007
2. University Handout

REFERENCE BOOKS:

1. Jain S. "Introduction To Computer Science Vol I & II", BPB Publications
2. Mehta S , "Introduction To Computer I ,II & III", BPB Publications

Web Source:

https://www.tutorialspoint.com/

Code	Subject	Lecture	Tutorial	Practical	Credit
21PMRN31	PRACTICAL - VOYAGE PLANNING – I	0	0	4	3

Course Objective: After successful completion of this course, cadet should be able to apply this knowledge during practice and working, Types of Projections, Understand Nautical Chart, Understand Winds and Current Effect

UNIT I THE NAUTICAL CHART 12

The Nautical Chart : Types of projections, Principle of Mercator projection - Mercator chart, natural scale. Principle of Gnomonic projection - Gnomonic Chart.Title of Chart, Number of Chart and Date of Publication. Deciphering the symbols and abbreviations used on a nautical chart. Units of soundings used. How to read latitude and longitude. The use of parallel rulers to lay down or read courses and using the nearest latitude scale for measuring distance. Chart Correction from Notices to Mariners. To find the date the chart was last brought up to date. Small and large corrections.Degree of reliability of information shown on the chart. Types of charts, Ocean charts, coastal charts, harbour plans and routing charts. The use of the Admiralty Chart catalogue to identify the charts required for voyage.

UNIT II COMPASS POINTS 12

Boxing the Compass - Compass points. Definitions - True, Magnetic and compass North. Magnetic variation and Changes in annual value - rate of change. How to obtain variation from date given on the compass rose, Isogonals. Deviation of the compass. The Deviation Card. True, magnetic and compass bearings & courses. Conversion of one to another. The compass error for the ship’s head. Gyro Error, high and low, conversion of gyro courses to true course and vice versa.

UNIT III WIND AND CURRENT EFFECT, DEPTHS AND LIGHTS 12

A. Wind and Current effect

The effect of current on course made good. Set and drift. The effect of wind on course made good. Leeway, the Dead Reckoning position, Estimated position and Observed position.

B. Depths and Lights

Meaning of Chart Datum - Reference point used for heights, Nature of bottom. Depth contours, Information regarding lights. Height, colour and characteristics of lights. Use of leading lights for safe navigation in harbour. Horizontal sectors of lights and their use by navigators in keeping clear of submerged dangers to

navigation. Use of sectors in laying courses. Use of clearing marks and horizontal and vertical danger angles. Sailing round an arc.

UNIT IV BASIC METHODS OF FINDING SHIP'S POSITION 12

To find compass error/gyro error by transit bearing

To find the position of a point on the chart by its latitude and longitude

To find the position of a point on the chart by its bearing and distance from a navigational mark.

To plot ship's position given the True bearings of two or more shore objects. The cocked hat and the reasons for its formation.

To plot ship's position given the rising or dipping bearing of light. Caution during abnormal refraction.

To plot ship's position using three shore objects by horizontal sextant angles (given horizontal sextant angles less than 90, equal to 90 or greater than 90)

UNIT V METHODS OF FINDING SHIP'S POSITION 12

To plot ship's position, given vertical sextant angels and bearing of a lighthouse.

To plot a position line obtained by a astronomical observation.

To find compass course/gyro course between two positions on the chart.

To find compass course to steer between two positions on the chart so as to counteract the given set and drift of current and given 'leeway'

To find the course and speed made good and the set and drift. Given the course steered, speed, duration and the initial and final observed positions.

To find the course from a given position so as to pass a lighthouse at a given position so as to pass lighthouse at a given distance when a beam.

TOTAL: 60h

Course Outcome:

CO – 1: Evaluate versed in the Nautical Chart

CO – 2: State and define the types of Projection in Voyage Planning

CO – 3: Evaluate the Compass Points

CO – 4: Understand the Deviation of Compass and the Deviation card

CO – 5: Understand the effect of wind and current

TEXT BOOKS:

1. Capt.S.K.Puri, "Chart Work for Mariners", Marine Publications,

2. J.A.L Myres, “B.A Chart 5011”, Admiralty Chart and Publications

3. Alexander Wang Young, “Extracts of ATT”

REFERENCE BOOKS:

1. Capt. M.V.Naik & Capt.Varty , “Voyage Planning & Chartwork”

2. Capt. S.S.Chaudhari , “Chartwork”, AS Publications

3. Capt W.H.Squair, “Modern Chartwork”, Brownson & Ferguson Ltd,”

Web Source:

https://thebookee.net/ch/chart-work-for-mariners-by-capt-s-k-puri-free-download

Code	Subject	Lecture	Tutorial	Practical	Credit
21PMRN32	PRACTICAL - COLLISION PREVENTION – I	0	0	3	2

Course Objective: After successful completion of this course, cadet should be able to Apply this knowledge during practice and working, Understand International regulations for preventing collisions, Understand Maintenance of safe speed

UNIT I DEFINITIONS AND APPLICATIONS 10

International regulations for preventing collisions at sea. Application Exceptions for local rules or harbours etc. Exceptions for special class of ships. Responsibility for the consequence of neglect of rules. Definitions of term 'vessel' 'power driven vessel' 'sailing vessel' 'fishing vessel' 'seaplanes' 'vessel not under command''vessel restricted in ability to manoeurvre' 'constrained by draft' 'underway''restricted visibility' 'steering and sailing rules'

UNIT II CONDUCT OF VESSELS IN ANY CONDITION OF VISIBILITY 20

A. Conduct of vessels in any condition of visibility:
Maintenance of proper look out. Maintenance of safe speed. Factors to be considered for determining safe speed. Determination of risk of collision with another vessel.Use of radar in determining risk of collision.Use of visual bearings.Types of actions to be taken to avoid collision or close quarter situation. Conduct of vessels in narrow channels and when approaching blind bends. Conduct of vessel in traffic seperation schemes on International Maritime Organisation.

B. Conduct of vessels in sight of one another :
Responsibility to keep out of way when two sailing vessels are on collision course. Responsibility to keep out of way when one vessel is overtaking another vessel of any type .Action to be taken by a vessel when meeting another vessel head on. Responsibility to keep out of way when two vessels are crossing each other. Action to avoid collision. Duty of the vessel which has the right of way, Action to be taken by such vessel required to keep out of way is not taking avoiding action. Right of way between a normal power driven vessel, a vessel not under command, a vessel restricted in the ability to maneuver, a vessel engaged in fishing , a sailing vessel and a vessel constrained by her draft.

C. Conduct of vessels in restricted visibility
Applicability . Determination of risk of collision when another vessel is detected by radar alone. Actions to be taken / avoid to prevent close quarter situation with a vessel detected on radar alone. Action to be taken when fog signal of another vessel is heard but vessel is not seen though it may have been detected by radar.

Course Outcome:

CO – 1: Understand the International regulations for preventing collisions at sea

CO – 2: Define the responsibility for the consequence of neglect of rules

CO – 3: Evaluate the factors to be considered for determining safe speed

CO – 4: Understand the conduct of Vessels in any conditions of visibility

CO – 5: Define maintenance of safe speed

TEXT BOOKS:

1. Capt. Bhandarkar, "Rules for the Prevention of Collision at Sea", Bhandarkar publications

REFERENCE BOOKS:

1. Capt.Puri.S.K , "Rule of the Road Manual"
2. Moore.D.A , "International Lights, Shape, and Sound Signals"
3. Capt. Chabra, "A Mariners Guide to preventing collisions", Marex India Pvt Ltd

Web Source:
http://www.mar.ist.utl.pt/mventura/Projecto-Navios-I/IMO-Conventions%20(copies)/COLREG-1972.pdf

Code	Subject	Lecture	Tutorial	Practical	Credit
21PMRN33	PRACTICAL NAVIGATION – I	0	0	3	2

Course Objective: After successful completion of this course, cadet should be able to Understand Marine Chronometer, Understand Marine Sextant, and Understand Marine Compass, Apply this knowledge during working and on ship

MARINE CHRONOMETER: **30**

Need and requirement of a chronometer
Meaning of Constant Daily Rate

1. Time Signals – ALRS III
2. Chronometer Error Book entries
3. Quartz Crystal chronometers – Appearance, Setting of Hours and Minutes
4. Advantages of Quartz Crystal chronometers over Spring Tension chronometers

MARINE SEXTANT:

Principle , Uses, Parts of the Micrometer Sextant
Arc of Excess; Taking readings "On the Arc" & "Off the Arc"
Errors of the Sextant – Adjustable Errors – What are Errors of Perpendicularity
Side Error and Index Error
Non Adjustable Errors – What are Centering, Graduation, Optical, Worm & Rack and Collimation errors

MAGNETIC COMPASS:

What is Variation, Deviation & Compass error;
Position of Magnetic Compass on ship
Parts of the Compass – Compass Bowl, Binnacle, Lubber line etc
Brief Description of Dry Compass Card;
Wet Compass Card – Placement of Card in the Bowl
Liquid used in Bowl, Removal of air bubble
Course Outcome:
CO – 1: Understand the need and requirement of a chronometer
CO – 2: Understand Time Signals – ALRS III
CO – 3: Use Chronometer Error Book Entries
CO – 4: Understand the advantages of Quartz Crystal Chronometer
CO – 5: Understand the principle, uses and parts of the Micrometer Sextant

TEXT BOOKS:
University Handout

Code	Subject	Lecture	Tutorial	Practical	Credit
21SMRN31	SHIP OPERATION TECHNOLOGY – III	0	0	3	2

Course Objective: After successful completion of this course, cadet should be able to Understand Ship Maneuvering, Understand Maintenance on Ships and Dry Docking, Understand Pollution Prevention and Damage Control

UNIT I SHIP MANOEUVERING **12**

Motion of a vessel at sea – rolling, pitching, heaving, panting, pounding and corkscrewing.

Motion of a vessel at anchor or alongside a berth – heeling, listing, surging, yawing and heaving.

Effect of rudder – Turning circles. Effect of vessel size, load or ballast condition on rate of turn and vessel response to helm.

Effect of propeller – transverse thrust, other hydrodynamic effects.

Manoeuvering characteristics of a vessel, changes due to wind, current, tides, sea, swell in load or ballast condition of the vessel.

Crash stop distance. Cruising range.

Shallow water – definition of shallow water, shallow water effects.

Interaction between vessels in a narrow channel and in shallow water.

Mooring procedures and patterns. Berthing and unberthing operations.

Man overboard – Williamson's turn and other maneuvers for recovery of victim.

UNIT II MAINTENANCE **12**

Inspection and maintenance of ship and equipment:

Items to be cover include Hull, Bulkheads, DBs, Deep and Peek tanks, Bilges, Pipelines, rudders, Anchors, Cables. Davits, safety equipment, derricks and other cargo gear, Navigation lights. A practical knowledge of sitting and screening of Ships Navigational lights.

Planned Maintenance System:

Inspection and maintenance of the ship and equipment; purpose of pms; types of pms. Hatch-covers Types of hatch covers; operation and maintenance of hatch covers; side cleats and cross-joint wedge mechanism, weather tightness and hose testing before loading.

Maintenance of crew accommodation:

Methods of port control. Fumigation of holds and living spaces. Safe guards in applying various methods.

Contingency plans for response to emergencies:

List the Contents of muster list, State that the duties are assigned to remote control operations.

Describe the divisions of the crew into a command team, emergency team, back-up team and engine room team.

Measures which should be taken in emergencies for the protection and safety of the ship, passengers and crew

Actions to be taken on stranding. Initial damage, assessment and control, sounding of compartments, sounding depths all round the ship using hand-lead.

State the Actions to be taken following a collision considering Initial damage, assessment and control, stoppage of engine, preparing life boat, sending distress or urgency signal

Precautions for the protection and safety of passengers in emergency situations :

Means of limiting damage and salving the ship following a fire or explosion: Cooling of compartment boundaries, inspection for damage

Use of emergency steering: Arrangement of emergency steering.

Rescue of persons from sea or from a vessel in distress: waiting for day light, providing a lee, method of rescue when sea conditions are too dangerous to use boat.

Respond to distress signal at sea:

Measures for assisting a vessel in distress: Knowledge of the contents of the IAMSAR, various search pattern and signals to be made by ships & aircraft.
Man-overboard procedures: Initial actions, use of man-overboard function in GPS for homing in to the man in the water, preparations for rescuing man, picking up man and picking up boat.

UNIT III DRY – DOCKING **12**

General preparation for dry – docking of a vessel.
Hot work Permit – issuance, validity and authorizing body.
Vessel's stability criteria prior docking.
Dry - docking procedure – Critical period, critical moment, use of side shores, bilge blocks and bilge shores.
Precautions during drying of dock with vessel on the blocks.
Bottom plugs – location, indication on the ship's plan. Opening, closing and securing.
Bottom cleaning and painting procedure in dry – dock. Modern systems for cleaning, blasting, water washing of hull bottom.
Treatment and disposal of oily residues.
Re – floating procedure.

UNIT IV POLLUTION PREVENTION AND DAMAGE CONTROL **12**

Preparation to be observed to prevent pollution in port and high seas.
Anti – pollution equipment – Deployment and characteristics on various ships, Measures to be taken to prevent spillage of oil during cargo work, bunkering and oil transfers, SOPEP – precautionary preventions – drop valves, scuppers, portable pumps. Action in case of leaks / fires.
Oil record book.
Damage control – Action to be taken following collision and grounding.
Management of ships in heavy weather – use of oil.
Basic overview on towing and being towed.

UNIT V COURSE MODULE ON RPSL VIDE DGS ORDER NO 6 OF 2006 **12**

MS Act 1958 Overview, Section 95 (registration of recruitment and Placement agencies)
Recruitment and placement rules 2005 - Introduction & definitions
Significance of the RPS, Rules, 2005 - Purpose of the rule, Benefit to seafarers under the rule,
Responsibilities of employer, Rights and responsibilities of the seafarer,
How to access information regarding registered recruitment and placement agencies
Article of Agreement (Indian Ships)
Responsibilities of employer & seafarer
Responsibilities of foreign employer & seafarer
Article of Agreement (foreign flag ships)
Relevance of RPS Rule 2005 on foreign ships
Responsibilities of foreign employer & seafarer.

SMCP
Use and understand the IMO Standard Marine Communication Phrases (SMCP)
SAFETY COMMITTEE MEETING:
Importance of personnel health and hygiene on board ship;

Work permit system - hot work, cold work, entry in enclosed space permit, working aloft working over side , electrical isolation, lockout and tag out.

HRDP MODULE:

Pre-sea human resource development and life skills program

Introduction to the Industry

Behavioural patterns & Attitudes with due cognizance to implementation of legislation eg. ISM Code/ISPS/PSC

Communication and the Art of listening

Prioritization, Time Management & Planning

Mental Gymnastics & Creative Problem solving

Anger/Violence Prevention/Aggression Control &Conflict Management

Management of Stress, Distress situations, Accidents proneness.

Emotional Management, Management of Depression / Fear / Fatigue / Revenge v/s Forgiveness, Coping with anxiety of being away from home.

Use of Drugs &Alcohol. Sexual health

Team Bonding

SECURITY TRAINING FOR SEAFARERS:

Security training for seafarers with designated Security Duties as per Section A - VI/6 (para 4, 5,& 6) of STCW 2010

Content of the topic as DGS circular 5 of 2011

Course Outcome:

CO – 1: State and define the Motion of a Vessel at Sea

CO – 2: Interact between vessels in a narrow channel and in shallow water

CO – 3: State the Inspection and maintenance of ship and equipment

CO – 4: Understand the Planned Maintenance System

CO – 5: Understand the Maintenance of crew accommodation

TEXT BOOKS:

Capt. V.K.Bhandarkar, "Seamanship Primer", Bhandarkar Publications

Kemp and young, "Seamanship notes" , Butterworth Heinemann

REFERENCE BOOKS:

Capt. S.K.Puri, "Survival in life boat and life raft", Publisher Maritime Progress

A.N.Cockcroft , "Nicholl's seamanship and nautical knowledge", Brown Son & Ferguson Publisher

Capt. V.K.Bhandarkar ,"Life saving appliances rules", Bhandarkar publications

Capt. V.K.Bhandarkar ,"Fire fighting appliances rules", Bhandarkar publications,

Graham Danton, "Theory and practice of seamanship", Publisher: Routledge.

C.H.Wright, "Survival at sea", BROWNSON & FERGUSON, LTD.

WEBSOURCE:

http://www.breizhbook.com/photo/albums/seamanship-bhandarkar-pdf-373

Code	Subject	Lecture	Tutorial	Practical	Credit

21PMRN34	PRACTICAL – SHIP OPERATION TECHNOLOGY – III	0	0	3	2

Course Objective: After successful completion of this course, cadet should be able to Practical Oriented on Maintenance of Ships, Cargo gear used, Measuring freeboards and drafts, Understands Safe working Load, Understands Rigging

List of Experiments **30**

1. Maintenance of various turnbuckles, blocks and purchases
2. Opening and restoring a lugless joining shackle
3. Cargo gear used, Safe working load and breaking stress
4. Construction of cement box to arrest leaks
5. Seizing – Flat, round, racking and par buckling.
6. Canvass sewing – Changing canvass cover on lifebuoy.
7. Flaking out, coiling and stowage of fibre ropes.
8. Flaking out, coiling, stowage and cutting of wire ropes.
9. Charging of various types of fire extinguishers.
10. Measuring sounding and ullage of tanks
11. Measuring freeboards and drafts
12. Demonstrate ability in rope climbing
13. Demonstrate ability to climb ship's mast
14. Rigging a breeches buoy.
15. Operating windlass and mooring winches
16. Boat and fire drills, Understand the shipboard alarms – General, Emergency and Abandon ship
17. Detailing crew as per muster list and Shipboard emergency list stating duties
18. Steering practice and helm orders
19. Artificial respiration.

Course Outcome:

CO – 1: Understand the maintenance of various turnbuckles, blocks and purchases

CO – 2: Understand the construction of cement box to arrest leaks

CO – 3: Understand how to change canvass cover in lifebuoy

CO – 4: Understand the Flaking Out, Coiling and Stowage of Fibre ropes

CO – 5: Understand the measuring sounding and ullage of tanks

TEXT BOOKS:

Capt. V.K.Bhandarkar, "Seamanship Primer", Bhandarkar Publications
Kemp and young, "Seamanship notes" , Butterworth Heinemann

REFERENCE BOOKS:

Capt. S.K.Puri, "Survival in life boat and life raft", Publisher Maritime Progress
A.N.Cockcroft , "Nicholl's seamanship and nautical knowledge", Brown Son & Ferguson Publisher
Capt. V.K.Bhandarkar ,"Life saving appliances rules", Bhandarkar publications
Capt. V.K.Bhandarkar ,"Fire fighting appliances rules", Bhandarkar publications
Graham Danton, "Theory and practice of seamanship", Publisher: Routledge.
C.H.Wright, "Survival at sea", BROWNSON & FERGUSON, LTD.

SEMESTER - IV

Code	Subject	Lecture	Tutorial	Practical	Credit
21CMRN41	NAVIGATION – II	4	0	0	4

Course Objective: After successful completion of this course, cadet should be able understand the shape of the Earth, Poles, Equator, Circles, to apply Navigation principle on Ships Understand Maritime Geography, Understand Solar System

UNIT I THE CELESTIAL SPHERE 12

1. The celestial sphere, celestial poles, Equinoctial, declination, celestial meridian, vertical circles, prime vertical, the Ecliptic, first point of Aries, RA, SHA, GHA. LHA, v and d corrections for moon and planets. Position of heavenly body on celestial sphere by its declination and GHA or by its altitude and azimuth or its celestial latitude and longitude.
2. Familiarity with contents of nautical almanac and their use.
3. Visible, sensible and rational horizons. Zenith, nadir, sextant altitude, apparent altitude, correction of altitude, dip, refraction, semi-diameter, parallax in altitude, artificial horizons and correction of altitudes there from, back-angle altitudes, principle of sextant, computation of sextant errors

UNIT II TRUE AND APPARENT MOTION OF BODIES 12

1. True and apparent motion of bodies. Solar time, solar day, apparent sun, mean sun, dynamical sun. Equation of time, time and hour angle, hour circles, Greenwich time, local time and standard time, keeping time at sea, advancing and retarding of clocks with change of longitude. International date line.
2. Sidereal time, sidereal day, why stars rise four minutes earlier each day. Conversion of solar time to sidereal time and vice-versa.

UNIT III AZIMUTH OF SUN, STARS AND PLANETS 12

1. Azimuths of sun, stars and planets. Amplitudes, derivation of formula sin Amp. = Sec. Lat x sin. Dec. apparent altitude of sun at time of theoretical rising and setting. Principle of azimuth mirrors.
2. Rising, culmination and setting of heavenly bodies. To find time of meridian passage, sunrise, sunset by calculation and perusal of nautical almanac with appropriate corrections.

UNIT IV PRINCIPLES OF POSITION LINES 12

1. Principles of position lines. Geographical position, circle of position, why PL is at right angles to the azimuth – exceptions. Position to draw the PL – intercept method, Longitude by chronometer method and ex-meridian method. Effect of change of DR position on position for PL and practical application

UNIT V COMPASS 12

1. To find the true azimuth of a heavenly body, the compass error and hence the deviation of the magnetic compass for the direction of the ship's head. (ABC tables)
2. To find the compass error and deviation from the amplitude of the sun.
3. To find the latitude by meridian altitude of the sun, stars and planets. To calculate the meridian passage time and approximate meridian altitude for setting of the sextant (computed altitude).
4. Latitude and position line by observation of Polaris.
5. From an observation of sun, star and planets near the meridian, to find the direction of the position line and the latitude corresponding to the DR longitude through which it passes
6. To find the observed longitude corresponding to the DR latitude through which the position line passes and the direction of the PL from an observation of sun, star and planets (Long by Chron).
7. To find the direction of position line from an observation of sun, star and planets (Intercept method).

Course Outcome:

CO – 1: State and define the Celestial Sphere

CO – 2: Familiarity with contents of nautical almanac and their use

CO – 3: State and define the Solar Time

CO – 4: Evaluate the concept of Greenwich Time, Local Time and Standard Time

CO – 5: Define the Azimuths of Sun, Stars and Planets

TEXT BOOKS:

1. Capt.H.Subramaniam , "Practical Navigation", Vijaya Publications
2. Capt.P.M.Sarma , "Principles of Navigation",Bhandarkar Publications
3. Capt.T.K.Joseph & Capt.S.S.S.Rewari, "Principles of Navigation", ARI International Pvt. Ltd. Delhi
4. Capt. H. Subramaniam, "Nautical Almanac", Vijaya Publications
5. Capt. A.G. Imray Laurie , "Norie's Tables Blance", Norie & Wilson

REFERENCE BOOKS:

1. "Admiralty Manual of Navigation Vol I & II" ,HMSO
2. A.Frost , "Navigation", Brown Son & Ferguson Ltd
3. Alfred Nicholl, "Nicholl's Concise Guide Volumes I & II", Brown Son & Ferguson Ltd.,

Web Source:

https://www.libramar.net/news/practical_navigation/2021-06-15-4293

Code	Subject	Lecture	Tutorial	Practical	Credit
21CMRN42	NAVAL ARCHITECTURE – II	5	0	0	4

Course Objective: After successful completion of this course, cadet should be able to Understand Ship Stability, Simpson's Rule, Determination and Position of longitudinal centre of gravity, Understand Ship Construction

SECTION A – SHIP STABILITY

UNIT I SIMPSON'S RULE 16

1. Simpson's Rule- First Rule, Second Rule & Third Rule. Use of Simpson's Rule in the computation of Areas. Use of Simpson's Rule in the computation of volumes. Use of Simpson's Rule in the computation of Centroids for area & volume. Numerical involving above.
2. Determination of position of the longitudinal centre of gravity of a ship for different conditions of load & ballast. The effect on the position of centre of gravity of a ship by adding, removing and/or shifting weights Numerical involving above.
3. Longitudinal center of buoyancy, longitudinal met centre and center of flotation and factors affecting their positions.

UNIT II THEORY OF TRIM 16

1. Theory of Trim- Changes in the position of COG & COB. Role of COF in change of trim. Trimming Moment, MCTC, Changes of drafts & Trim due to Loading discharging & shifting weights. Calculation of forward & aft drafts using Trim Tables. Numerical involving above.
2. Change of density effects – Change of underwater volume, Bodily sinkage or rise, Location of COG, COB & COF, Change of Trimming Moment.
3. Change of trim due to change of density.
4. Calculations of F & A drafts due to change of density
5. Use of stability, Hydrostatic and Stress data supplied to Ships.

UNIT III CROSS CURVES OF STABILITY **16**

1. Cross curves of stability- GZ curves, GZ tables, KN values & KN Curves, Determination of Righting moment using K.N. Values, Curve of Statical Stability & its practical usage.
2. Carriage of deck cargoes and their effect on stability.
3. Definition of Grain, Angle of Repose, Document of Authorization, Volumetric Heeling Moment, Hazards associated with respect to ship stability, while loading grain. Stowage of grain and stability, Aspects in respect thereof with particular reference to calculations involved & the manner of presentation of the information relating to grain heeling, Moments and the resulting angle of heel as presented in the National, Statutory Regulations.

General for all Stability Units:

1. Calculations based on the foregoing topics those based on "Trim and Stability Particulars" of a given ship.

SECTION B - SHIP CONSTRUCTION

UNIT IV SHIP CONSTRUCTION **16**

Longitudinal and Transverse framing, Beams and Beam Knees.
Functions, Construction and stiffening of Water-tight bulkheads including collision bulkheads.
To understand shell plating, Numbering system of hull and deck Plating, Shell expansion plan.
Purpose and construction of Bilge Keel.
Purpose of Double Bottom Tank, Sketch and construction of Double Bottom Tank
Purpose of Peak tanks, Sketch and construction of Forepeak and Aft peak tanks.
Purpose and construction of Wing tanks and Bilges
Construction, stiffening & closing arrangement of openings on deck & Superstructures, Water tightness of Hatches, Opening in Oil, Chemical & Gas tankers.
Chain lockers and attachment of Cables, Hawse pipes, Spurling Pipes & their securing arrangements.
Purpose and construction of Sounding pipes, Air Pipes, Ventilators.
General pumping arrangements - Bilge and Ballast line systems Pumping arrangement on tankers.
Methods adopted to maintain integrity of divisions and opening in the hull including stern, side and bow doors.

UNIT V RUDDERS **16**

1. Rudders, construction and support, stern frame, propellers and propeller shaft, stern tube, and adjacent structure.
2. Sketch of Balanced, Semi-balanced rudders
3. Simple sketch of stern frame
4. Simple sketch of Propeller & Propeller shaft
5. Simple sketch of Stern tube & adjacent structure
6. General ideas on various plans supplied by shipyard.
7. Midship sections sketches of General cargo ship, Tanker, Bulk carrier, Container, OBO, Gas carrier, Chemical Carrier.
8. Stress and strains in ships in still water and in a seaway. Parts of ship specially strengthened and stiffened to resist such stresses including panting & pounding (slamming).
9. Causes and methods of corrosion control in steel work and also between dissimilar metals including cathodic protection, impressed current system.

Course Outcome:

CO – 1: Understand Simpson's Rule and use of Simpson's Rule in the computation of Centroids for area and volume

CO – 2: Understand the effect on the position of centre of gravity of a ship by adding, removing and/or shifting weights Numerical involving above

CO – 3: Understand the Change of density effects

CO – 4: Understand how to use of stability, Hydrostatic and Stress data supplied to Ships

CO – 5: Understand the Cross curves of stability

TEXT BOOKS:

Capt. Errol Fernandes , "Ship Construction", Marinez Enterprises, Mumbai
Kemp & Young , "Ship Construction Notes"
Capt. Subramanian.H, "Ship Stability I, II, & III",Vijaya Publications
Capt. Joseph & Capt. Rewari , "Problems on M.V.Hindship", ARI Publication
Capt.Bhandarkar, "Stability Tables M/V Hindship Data Booklet", Bhandarkar Publications

REFERENCE BOOKS:

1. Derrett, "Merchant Ship Stability for Master and Mates", Butterworth Heinemann
2. Martin A. Rhodes, "Ship Stability for Mates & Masters", Seamanship International Ltd, Reprint
3. La Dage&Gemert, "Stability and Trim for Ships Officer", DVAN Nostrand Company
4. Thomas Reeds, "Ship construction for Marine Students", Thomas Reed Publications
5. Kemp and Young, "Ship construction" , Butterworth Heinemann
6. Eyers, "Ship construction" , Butterworth Heinemann
7. Pursey, "Ship construction" Brownson & Ferguson

Web Source:
https://inlib.in/doc/c552274/ship-solitons--arxiv

Code	Subject	Lecture	Tutorial	Practical	Credit

21DMRN41	MARINE ENGINEERING & CONTROL SYSTEMS – I	4	0	0	4

Course Objective: After successful completion of this course, cadet should be able to Understand Strength of Materials**,** Understand Thermodynamics**,** Understand Marine Engineering Practices, and Mechanical Properties of Materials

UNIT I STRENGTH OF MATERIALS 12

1. Hook's Law, stress & strain
2. Tensile, Compressive and Shear forces
3. Failure of materials under tension, compression, shear & fatigue.
4. Examples related to Marine Engineering.
5. Simply supported beams, shear force & calculation of stresses & B.M. diagrams for above and other system of ship

MECHANICAL PROPERTIES OF MATERIALS

1. Hardness
2. Ductility
3. Malleability
4. Melting Point etc.,

FLUID MECHANICS

1. Flow of liquid & gases, laminar & turbulent flow, resistance to flow
2. Loss of energy of fluid due to bends, friction, valves, etc.,
3. Simple hydraulic equipment

UNIT II THERMODYNAMICS 12

1. Properties of steam, boiling point & effect of pressure on it, saturated, dry 7 superheated steam, dryness fraction
2. Meaning of sensible heat & latent heat

UNIT III TANKER TECHNOLOGY 12

1. Density of liquids & gases, flammability, solubility in water, volatility, toxicity, viscosity & related implications.
2. Electrostatic charge generators & precautions to prevent fire & explosion
3. Firefighting principles & preparedness, flame screen & flame arrestors, cargo heating, hot work & enclosed space as hazards & relevant precautions, entry permit systems
4. Gas measuring instruments viz; O_2 meter, explosimeter, tankscope and multi gas detector viz; Dragger PP and tubes
5. Tank level gauges, loading/unloading precautions, tank cleaning, gas freeing and venting procedures.
6. ODMCS, Interface detector, Oil Record Book, cargo pumps & correct handling of cargo pumps, cargo calculation, OWS, handling & disposing of oily residues from machinery spaces. IOPP certificate

UNIT IV ELECTRICAL ENGINEERING SCIENCE **12**

1. Electrostatics, Electro-magnetism & Electricity
2. Electric current, Voltage, EMF, Ohm's Law
3. Simple calculations, Wheatstone bridge
4. Procedure of maintenance of batteries
5. Purpose & operation of purifier drive
6. Navigation light circuit with indicators / alarms & alternative power supply
7. Services to be supplied from emergency generator
8. Procedure for starting emergency generator manually

UNIT V MARINE ENGINEERING PRACTICE **12**

1. Classification of ship as per propulsion plants
2. General layout of ship's engine room & machinery
3. Main Engine Plants & supporting systems
4. Introduction about ship's Auxiliary Systems
5. Electrical Power Generation Plants, its supporting system & importance

Course Outcome:

CO – 1: State and Evaluate the strength of materials
CO – 2: Understand the Failure of materials under tension, compression, shear & fatigue
CO – 3: Understand the Properties of steam, boiling point & effect of pressure on it, saturated, dry 7 superheated steam, dryness fraction
CO – 4: Understand the Meaning of sensible heat & latent heat
CO – 5: Understand the Density of liquids & gases, flammability, solubility in water, volatility, toxicity, viscosity & related implications

TEXT BOOKS:

1. Reed, "Engineering Knowledge for Deck Officers", 2nd Edition, Reprint 1996
2. Reed, "General Engineering Knowledge Vol 8"14th Edition, Reprint 2009
3. Hannah & Hiller, "Mechanical Engineering Science"
4. Souchette& Smith, "Marine Auxiliary Machinery", 7th Edition, Reprint 2010
5. JK Dhar, "Engineering Knowledge", 10th Edition

REFERENCE BOOKS:

1. L. Jackson & T. Morton, "General Engineering Knowledge for Marine Engineer", IME Publications, Reprint 1997
2. "Basic Electro Technology", Thomas Reed Publications, 8th Edition, 2014
3. Gth Flanogan, "Marine Engineering Series – Marine Boilers", Henemann Professional Publication, Reprint Edition, 2009
4. Wharton A.S, "Marine Engineering Series Diesel Engines", Henemann Professional Publication, 6th Edition, Reprint, 2008
5. D.W. Smith, "Marine Auxiliary Machinery", Thomas Reed Publications, 3rd Edition

6. G.O. Watson, “Marine Electrical Practice”, Thomas Reed Publications

Web Source:
https://fdocuments.in/document/marine-engineering-adme-2-of-31-introduction-to-the-programme-details-name-of.html

Code	Subject	Lecture	Tutorial	Practical	Credit
21ENVS41	ENVIRONMENTAL SCIENCE	2	0	0	2

Course Objective: After successful completion of this course, cadet should be able to understand need for public awareness, Understand Ecosystems and Environmental Pollutions, Understand Human Population and the environment

UNIT I DEFINTION **06**

a. Definition

b. Scope and importance.

c. Need for public awareness

UNIT II NATURAL RESOURCES **06**

a. Natural resources

b. Ecosystems

UNIT III ENVIRONMENTAL POLLUTION **06**

a. Environmental pollution

UNIT IV SOCIAL ISSUES **06**

a. Social issues and the environment

UNIT V HUMAN POPULATION **06**

a. Human population and the environment

Course Outcome:

CO – 1: Understand, what do you mean by Environmental Science

CO – 2: Define scope and importance of Environmental Science

CO – 3: Analyze the need for public awareness

CO – 4: Understand the Natural Resources

CO – 5: Understand the Ecosystems

TEXT BOOKS:

1. S.N. Chary , “Environmental Studies”, Macmillan India Limited
2. M. Prasanthrajan , “A text book on Ecology and Environmental Science”
3. Erach Bharucha, “Environmental Studies”, UGC, 2004

Code	Subject	Lecture	Tutorial	Practical	Credit
21PMRN41	PRACTICAL – VOYAGE PLANNING – II	0	0	4	4

Course Objective: After successful completion of this course, cadet should be able to Understand Elementary knowledge of passage planning and its execution, Understand Basic Theory of Tides, Understand the interpretation of chart

UNIT I ELEMENTARY KNOWLEDGE OF PASSAGE PLANNING 12

Elementary knowledge of passage planning and its execution, Principles of passage Planning, landfall in thick and clear weather, suitable anchorage. Use of gnomonic chart for planning great circle and composite sailings. Traffic lanes and Separation zone. Narrow channels Ship's Routing. Current, Tidal stream, set rate drift leeway due to wind. Catalogue of Admiralty Charts, Chart folios. Identification of ocean currents.

UNIT II BASIC THEORY OF TIDES & STANDARD PORT TIDE CALCULATION 12

Basic theory of Tides, Spring tide ,Neap tide, Range of tide, HW, LW, MHWS. Chart Datum.To find the time and height of high and low water at standard ports. The use of admiralty tide tables and tidal curves to find the time and at which the tide reaches a specified height or heights of tide at a given time and hence the corrections to be applied to chart soundings and of charted heights of shore objects. Tidal information given on a chart.

UNIT III THE INTERPRETATION OF A CHART, RADAR, SART 12

The interpretation of a chart or plan, particularly the information given about lights, buoys, radio beacons and other navigational aids. Depths and height contours, tidal streams, traffic lanes and separation zones. Chart corrections Recognition of the coast and radar responsive targets. The use of radar in Navigation. Obtaining position fix by radar bearings and ranges, possible errors, reliability of fix; use of passive and active aids, Aids to Radar navigation - Radar Reflectors, Ramark, Racons, Comparison between Ramark and Racon, SART. Explain AIS overlay on radar/ARPA.

The use of parallel indexing technique in radar navigation; wheel over positions and safety margins.

UNIT IV ASSOCIATION OF IALA, RANGE & CHARACTERISTCS OF LIGHT 12

Association of Lighthouse Authorities(IALA)Maritime Bouyage System, System'A' and 'B', Floating Navigational Aids Admiralty list if lights ,Geographical range, luminous range, nominal range and their significance. Raising and dipping distances, Characteristics and range of lights; Luminous Range Diagram. Clearing Bearing and Ranges.

UNIT V METHODS OF FINDING SHIP'S POSITION 12

To determine ships position by running fix method with or without current.
To find the ships position by doubling angle on the bow.

Use of single position line obtained from a celestial observation or bearing of a light house when near a coast to keep safe distance off the coast.

To find course made good using the three point bearing
Revision of Practical's of Voyage Planning I: -
To plot ship's position, given vertical sextant angels and bearing of a lighthouse.
To plot a position line obtained by a astronomical observation.
To find compass course/gyro course between two positions on the chart.

To find compass course to steer between two positions on the chart so as to counteract the given set and drift of current and given 'leeway'

To find the course and speed made good and the set and drift. Given the course steered, speed, duration and the initial and final observed positions.

To find the course from a given position so as to pass a lighthouse at a given position so as to pass lighthouse at a given distance when a beam.

To plot ship's position using three shore objects by horizontal sextant angles (given horizontal sextant angles less than 90, equal to 90 or greater than 90)

Course Outcome:

CO – 1: Understand the Elementary Knowledge of Passage Planning and its execution

CO – 2: Understand the use of gnomonic chart for planning great circle and composite sailings

CO – 3: Understand knowledge on the basic theory of tides

CO – 4: Learn how the find the time and height of high and low water at standard ports

CO – 5: Understand the interpretation of a chart or plan, particularly the information given about lights, buoys, radio beacons and other navigational aids

TEXT BOOKS:

1. Capt.S.K.Puri, "Chart Work"

2. B.A Chart 5011, HMSO

3. Extracts of ATT

REFERENCE BOOKS:

1. Capt. M.V.Naik & Capt.Varty , "Voyage Planning & Chartwork"

2. Capt. S.S.Chaudhari , "Chartwork"

3. Capt W.H.Sauair, "Modern Chartwork", Admiralty Publications

Web Source:

https://thebookee.net/ch/chart-work-for-mariners-by-capt-s-k-puri-free-download

Code	Subject	Lecture	Tutorial	Practical	Credit
21PMRN42	PRACTICAL – COLLISION PREVENTION – II	0	0	4	4

Course Objective: After successful completion of this course, cadet should be able to complete understanding and application of all rules of convention of International collision prevention at Sea; Understand Collision Situations by day and night, Understand recognition of various buoys and marks

UNIT I RULES OF CONVENTION **06**

1. Complete understanding and application of all rules of Convention of International collision prevention at Sea
2. IALA system of buoyage – lateral and cardinal system
3. Precautions while floating navigational aids such as light vessels etc
4. Radar plotting exercises, relative plot, action by own ship. Action by target ship set and drift.

UNIT II COLLISION SITUATION **06**

The students will be required to identity various collision situations by day and night, using magnetic board, wooden models, overhead projections, video tapes or any other aid to simulate such conditions.

UNIT III HEADINGS RECOGNITION **06**

Candidates will be required to deal with each collision situation broadly under the headings recognition, responsibility, action, appropriate sound signal and ordinary practice of seaman.

UNIT IV STATUTORY OBLIGATIONS **06**

Collision situations in restricted visibility with or without radar, statutory obligations under both circumstances.

UNIT V RECOGNITION OF VARIOUS BUOYS **06**

Recognition of various buoys and marks under IALA system and appropriate action required under the rules.

Course Outcome:

CO – 1: Complete understanding and application of all rules of convention of International collision prevention at sea.

CO – 2: Understand the precautions while floating navigations aids such as light vessels etc

CO – 3: Precautions while floating navigational aids such as light vessels etc

CO – 4: Practice with Radar plotting

CO – 5: Identify the various collision situations by day and night

TEXT BOOKS:

1. Capt. Bhandarkar, “Rules for the Prevention of Collision at Sea”, Bhandarkar publications

REFERENCE BOOKS:

1. Capt.Puri.S.K , “Rule of the Road Manual”
2. Moore.D.A , “International Lights, Shape, and Sound Signals”
3. Capt. Chabra, “Guide to collision avoidance”

Web Source:
http://www.mar.ist.utl.pt/mventura/Projecto-Navios-I/IMO-Conventions%20(copies)/COLREG-1972.pdf

Code	Subject	Lecture	Tutorial	Practical	Credit
21PMRN43	PRACTICAL - NAVIGATION – II	0	0	3	2

Course Objective:

After successful completion of this course, cadet should be able to

- Apply Navigation principle on Ships
- Understand Marine Chronometer
- Understand Marine Sextant and Magnetic Compass

MARINE CHRONOMETER:

- Description of Greenwich Mean Time, Local time and Standard time
- Division of the earth into various zones
- Finding UT and Correct Date

MARINE SEXTANT:

Method of taking HSA of three or more Terrestrial points
Finding position of the ship by bearing and VSA of a shore object

MAGNETIC COMPASS:

Brief description and positions of the corrector magnets
Limitations of the Magnetic compass; Care and maintenance of Magnetic compass;
Description of Compass projector; Advantages of Compass projector

AZIMUTH MIRROR

- Parts of Azimuth ring; Use of Azimuth mirror;
- Checking the accuracy of Azimuth mirrors;
- Procedure of taking bearing of terrestrial objects;
- Procedure of taking Azimuth of celestial bodies;
- Procedure of taking bearings with Pelorus

STAR RECOGNITION

- Magnitude of stars – Absolute / Apparent Magnitude; Index to selected stars;
- Guidelines to identify stars

Course Outcome:

CO – 1: Understand the description of Greenwich Mean Time, Local Time and Standard Time

CO – 2: Understand the division of the earth into various zones

CO – 3: Find the UT and Correct Date

CO – 4: Understand the method of tasking HAS of three or more Terrestrial points

CO – 5: Find the position of the ship by bearing and VSA of a shore object

TEXT BOOKS:

University Study Materials

Code	Subject	Lecture	Tutorial	Practical	Credit
21PMRN44	PRACTICAL – MARINE ENGINEERING & CONTROL SYSTEMS – I	0	0	4	2

Course Objective: After successful completion of this course, cadet should be able to understand basic principles of mechanical drawing**,** Understand Orthographic Projection, Solid Isometric Projections, Simple assembly drawing

1. **Mechanical Drawing:** Brief description of drawing papers, pencils, instruments and their uses. Types of lines and dimensions Loci of point, Orthographic projection, projection of points, straight lines, planes, solid Isometric Projection. Concept of Form and Shape, plane Elevation and End View of Objects. Contours, Change of Sections, hidden (internal) construction, dotted lines etc. Discussion on ship's plans. Isometric views, cut/cross section. Simple assemble drawings. Engineering drawing by free and sketching.
2. **Carpentry Workshop:** Various types of tools and their uses e.g., nails, wood screw, screw drivers, hammers (including claw, ball-plane, sledge, mallet), crowbars, saws, chisels, wood files, drills, vice clamps, jack-planes, etc. Repairs to fiberglass such as boats etc. Uses of various adhesives in joining of materials.
3. **Plumbing Workshop:** Proper use of tools – spanners, wrenches, hacksaws, files, etc. The use of T-joints, bends and coupling in pipelines. Dismantling and joining various types of pipelines. Repair of water taps. Types of pipes, pipelines, their sizes, joints, cutting of simple gaskets/packing for pipe flanges, treatment leaks, use of various sealants for stopping small leaks in pipelines, pipe clamps, cutting of threads in pipe lines, clearing of chocked water pipelines.

4. **Machine Workshop:** Familiarization with and proper use of various tools e.g., open spanners, ring spanners, socket spanners, rachet spanners, torsion spanners. All keys screw drivers, files, hammers, chisels, punches, reamers., vice, taps and dies, etc. Special practice to be given on use of sledge hammer. Type of nuts and bolts, studs: methods of freeing rusted nuts and bolts; proper use of the grinding machines, drilling machines (portable and mounted); use of coolants such as water, oils, etc., during drilling. Use of measuring devices – feeler gauges, calipers. Screw gauges, etc. Overhauling of gate valves, butterfly valves and hydrants. The importance of lubricating oil and grease in reducing friction in machines.

5. **Electrical Workshop:** Precautions when using electrical appliances; fuses and circuits breakers and their uses, danger of loose or improper connections (line, neuter and earth) in various joints. Types and specification of electrical wire when making indents for purchase. Theory & practicals of soldering.

6. **Hot-work Workshop:** Basic theory and practical experience of gas cutting, gas welding and electrical arc welding, gas heating to free rusted nuts and bolts. The proper precautions to be taken during each of this process.

Course Outcome:

CO – 1: Understand the strength of materials

CO – 2: Understand the Failure of materials under tension, compression, shear & fatigue

CO – 3: Understand the Properties of steam, boiling point & effect of pressure on it, saturated, dry 7 superheated steam, dryness fraction

CO – 4: Understand the Meaning of sensible heat & latent heat

CO – 5: Understand the Density of liquids & gases, flammability, solubility in water, volatility, toxicity, viscosity & related implications

TEXT BOOKS:

University Study material

SEMESTER - V

Code	Subject	Lecture	Tutorial	Practical	Credit
21CMRN51	NAVIGATION – III	4	0	0	4

Course Objective: After successful completion of this course, cadet should be able to understand the Birth of the Universe**,** Kepplers laws, Understand Earth-Moon System, Twilight Civil, Nautical and Astronomical, Identification of Stars

UNIT I BIRTH OF THE UNIVERSE **12**

Birth of the Universe, stars, planets and their satellites. Signs of the Zodiac. Recognition of navigational stars with reference to their constellations. Stellar magnitudes

UNIT II KEPPLERS LAWS **12**

Kepplers laws, distance of planets from the sun, Bode's law. Inferior and superior planets. Axial revolution of planets. Relative motion of planets in their orbits. Elongation, morning and evening stars. Reasons for change of SHA/RA of sun, moon and planets. Direct and retrograde motion of planets. Solar prominences, solar spot cycle and its effects on terrestrial magnetism.

UNIT III EARTH – MOON SYSTEM **12**

Earth-moon system, the moon's orbital and axial rotation, phases of the moon, liberation, and lunar month. Eclipses – solar and lunar. Conditions necessary for occurrence of solar and lunar eclipse. Umbra and pen-umbra. Path of totality. Occultation of a planet or star. Precession of equinoxes. Amplitude and azimuth of moon. Horizontal parallax. Augmentation of semi-diameter of moon and effect on true altitude. Calculations of moonrise/moonset/meridian passage using almanac. Relationship between tides and phases of the moon. Spring and neap tides. Priming and lagging.

UNIT IV TWILIGHT **12**

Twilight – civil, nautical and astronomical. Conditions necessary for twilight all night. Calculation of time of twilight by perusal of the almanac with appropriate corrections. Simple calculations based on the above. Circumpolar bodies, condition necessary for a body to be circumpolar, maximum azimuth. Problems based on these topics.

UNIT V IDENTIFICATION OF STARS **12**

To obtain a position by use of position lines obtained from two or more observations with or without a run (simultaneous or staggered). The cocked hat and its interpretations. Moon's amplitude, azimuth and sight calculations by latitude by meridian altitude, longitude by chronometer and intercept methods. Fixed errors in sight calculations, computation of altitudes.

Identification of stars.

Course Outcome:

CO – 1: Define Birth of the Universe, Stars, Planets and their Satellites.

CO – 2: Understand the Recognition of Navigation stars.

CO – 3: Familiarize with Kepplers Laws

CO – 4: Understand the Inferior and Superior Planets

CO – 5: Familiarize with Earth – Moon System

TEXT BOOKS:

1. Capt.H.Subramaniam , "Practical Navigation", Vijaya Publications
2. Capt.P.M.Sarma , "Principles of Navigation",Bhandarkar Publications
3. Capt.T.K.Joseph & Capt.S.S.S.Rewari, "Principles of Navigation", ARI International Pvt. Ltd. Delhi
4. Capt. H. Subramaniam, "Nautical Almanac", Vijaya Publications
5. Capt. A.G. Imray Laurie , "Norie's Tables Blance", Norie & Wilson

REFERENCE BOOKS:

1. “Admiralty Manual of Navigation Vol I & II” ,HMSO
2. A.Frost , “Navigation”
3. “Nicholl’s Concise Guide Volumes I & II”, Brown Son & Ferguson Ltd.

Web Source:

https://www.libramar.net/news/practical_navigation/2021-06-15-4293

Code	Subject	Lecture	Tutorial	Practical	Credit
21CMRN52	NAVAL ARCHITECTURE – III	5	0	0	4

SECTION A – SHIP STABILITY

UNIT I SIMPSON'S RULE 16

1. Use of Simpson's Rules for the computation second moment of areas (Moment of inertia), moments of volumes and centroids.
2. Centre of Pressure for regular shapes & combination of regular shapes. Centre of pressure of parabolic shapes, when given horizontal and vertical co-ordinates.
3. Derivations of the formulae for TPC
4. Derivation of formula for FWA
5. Derivation of formula for BM (Transverse)
6. Derivation of formula for MCTC
7. Derivation of formula for Angle of Loll.
8. Derivation of formula for virtual loss of GM due to Freesurface effect.
9. Derivation of formula for virtual loss of GM on dry-docking,
10. Derivation of formula for list with zero GM,
11. Derivation of formula for wall-sided formula
12. Derivation of formula for Attwood formula.
13. Stability at moderate and large angles of heel. Use of the wall-sided formula.
14. Effect of beam and freeboard on stability.

UNIT II DYNAMIC STABILITY 16

1. Dynamical Stability – calculation by the GZ curve.
2. Stability and Trim when Dry-docking or Grounding.
3. Theory of rolling Synchronization
4. Definition of "Angle of Loll", Danger to a ship at the angle of loll, Formulae for Angle of Loll, Causes & Remedial Actions for Angle of Loll (Ballasting sequence to rectify same), Simple Calculations on above.

5. Dangers to a ship with a heavy list. Dangers associated with deck cargoes including timber. Preventive and corrective actions.

UNIT III BILGING **16**

1. Bilging - Effects of Bilging of a Compartment, Permeability of a compartment, Calculation on bilging and flooding of a compartment, symmetrical about center line anywhere along the ship's length for a box-shaped vessel, Actions to be taken in the event of partial loss of intact buoyancy. Closing of watertight doors, cross flooding arrangement.
2. Calculation on bilging of a compartment – amidship, end and intermediate compartments.
3. The inclining experiment.
4. Shearing forces and Bending moments. The ship as a box girder. The calculation and graphical representation of the SF and BM for box-shaped vessels on even keel under various conditions of load.
5. Modern methods of determining the effect of different conditions of Loll and ballast on the ship's structure and stability – Loadicator.
6. Calculations based on the foregoing and on the syllabi of Naval Architecture in the first and second year.

General for all Stability Units:

Calculations based on the foregoing topics those based on "Trim and Stability Particulars" of a given ship.

SECTION B – SHIP CONSTRUCTION

UNIT IV TYPES OF SHIPS **16**

1. Types of ships. General ideas on strength and construction, Midship sections of specialized carriers - Passenger ships, LASH, RoRo, Refrigerated cargo carrier, Liquefied gas carrier (LPG & LNG),Chemical tankers.
2. An out-line knowledge of shipyard practice and procedure, Preparing Drawing, Place and section marking, Lines plan prior construction of a vessel, Process control and Prefabrication. Launching and Sea trials.

UNIT V CLASSIFICATION SOCIETIES AND THEIR FUNCTIONS **16**

1. Classification Societies and their functions.
2. Cargo ship construction Rules
3. Surveys for assignment and retention of Class.
4. Harmonized system of surveys and certification (HSSC)
5. Port State Control (PSC)
6. Outline knowledge of Tonnage regulations.
7. Loadline regulations. Assignment of Freeboards.
8. Sub divisional load lines on passenger ships

9. Structural fire protection on Passenger and Cargo ships.
10. Classes of fire divisions
11. Knowledge of application of floodable length curves. Factor of subdivision. Criterion of service numeral. Permissible length affecting hull division on passenger ships.

Course Outcome:

CO – 1: Define the use of Simpson's Rule for the computation second moment of areas.

CO – 2: Understand the centre of pressure for regular shapes and combination of regular shapes

CO – 3: Define Dynamic Stability – Calculation by GZ Curve

CO – 4: Understand the theory of rolling synchronization

CO – 5: Understand the Calculation on bilging of a compartment – amidship, end and intermediate compartments

TEXT BOOKS:

Capt. Errol Fernandes , "Ship Construction", Marinez Enterprises, Mumbai
Kemp & Young , "Ship Construction Notes"
Capt. Subramanian.H, "Ship Stability I, II, & III",Vijaya Publications
Capt. Joseph & Capt. Rewari , "Problems on M.V.Hindship"
"M/V Hindship Data Booklet"

REFERENCE BOOKS:

1. Derrett, "Merchant Ship Stability for Master and Mates"
2. Martin A. Rhodes, "Ship Stability for Mates & Masters"
3. La Dage&Gemert, "Stability"
4. Reeds, "Ship construction for Marine Students"
5. Kemp and Young, "Ship construction"
6. Eyers, "Ship construction"
7. Pursey, "Ship construction"
8. Taylor, "Ship construction"

Web Source:

https://inlib.in/doc/c552274/ship-solitons--arxiv

Code	Subject	Lecture	Tutorial	Practical	Credit
21DMRN51	CARGO HANDLING AND STOWAGE – I	4	0	0	4

Course Objective: After successful completion of this course, cadet should be able to understand the introduction to ships and cargos, understand the basic aspects of cargo operations, and understand the basics of deck cargo

UNIT I INTRODUCTION TO SHIP AND CARGOES 16

Introduction to various common types of ships, the type of cargoes they carry and the method of cargo operations unique to each.

General cargo ship, basic ship's cargo gear – derricks and cranes, types of general cargo e.g. bales, boxes, bags, crates, cases, pallets,
Bulk carrier, examples of bulk cargoes and method of loading by conveyor and discharging by grab.
Container ship with cell guides.
Tankers for liquid cargoes. Example of oil, products, chemicals and gas cargoes.
Heavy lift ships and heavy lift cargoes
Refrigerated ships and reefer cargoes
Dangerous goods
Multipurpose ships
Ro-Ro ships and their cargoes

Introduction to Basic Aspects of Cargo Operations

Importance of cargo care to economical operation of ship. Care of cargo on board ship.
The hazard of fire and its prevention, control and extinction in cargo operations.
Interaction between cargoes and the resultant contamination and tainting. Separation of cargoes by natural bulkheads or artificial divisions.
Stowage and handling to prevent breaking, chafing, crushing.
Temperature variations leading to sweat damage, ship and cargo sweat, monitoring of dew-point temperature and ventilation to prevent sweat.
Sea water damage, importance of structural integrity and hatch cover water tightness.
Shifting of cargo, toppling, and methods of securing to prevent the same viz. blocking, chocking and lashing.
Dunnage and its use to increase friction, prevent damage from sweat and in separating cargoes. Shifting boards.
Ballasting and deballasting operations.
Duties of the Officer on Cargo Watch.
Log Book Entries.
Bale and Grain Capacity.
Stowage factor, Broken stowage.
Load density; Cargo density.
Ullage and soundings.
Deadweight and displacement; Measurement cargo.

Safe working load (SWL); Breaking strength; Proof Load; Factor of Safety
Load lines.
Calculation of cargo quantities given height, area or volume of hold, stowage factor, broken stowage, load density, bale or grain capacity.

UNIT II CARGO OPERATIONS, DOCK LABOUR REGULATIONS & HATCH COVERS 16

Inspection and preparation of holds

1. Need for inspection of holds,
2. Items to be inspected,
3. Importance of cleaning holds,
4. Checking weather tightness of hatch covers
5. Use of dunnage& spar ceiling,
6. Disposal requirements of dunnage
7. Importance of checking bilge suction
8. Use of deodorising wash
9. Blanking of ballast lines

Segregation and separation of cargoes

1. Segregation of different cargoes with reference to dangerous goods, dry, wet, delicate, dirty, valuable cargo.
2. Separation between parcels of cargo and methods of separation.
3. Separation between parcels of cargo for different ports.

Ventilation and control of sweat

1. Need for ventilation of cargo spaces
2. Ship sweat and cargo sweat, and difference between them.
3. Factors affecting sweat.
4. Control of sweat by ventilation,
5. Operation of ventilation system
6. Cargoes requiring special ventilation due to emission of gases, absorption of oxygen, dust, release of moisture

Securing cargoes

1. Contents of Lashing Code and Cargo Securing Manual.
2. Need for solid stow and securing.
3. Methods of blocking, lashing, shoring and tomming cargo.
4. Method of securing heavy loads, vehicles, containers.

Deck cargo

1. Dangerous Cargoes not permitted below deck
2. Various types of Deck Cargo
3. Efficient means of securing of deck cargoes,
4. Need of battening of cargo before loading deck cargo,

5. Safe access to equipment and spaces
6. Maximum permissible load
7. Unobstructed view from the navigating bridge

The Dock Labour Regulations

1. Competent person, authorized person, responsible person, loose gear, lifting appliance.
2. Duties and powers of the Dock Safety Inspector.
3. Annual thorough examination of cargo gear;
4. Maintenance of cargo gear;
5. Markings of ship's lifting appliances and cargo gear;
6. Requirements for initial and periodical testing of cargo gear and annealing;
7. Register of lifting appliances and cargo handling gear (Chain Register);
8. Infrastructure in ports for loading and discharging such as shore cranes, gantries and conveyor belts;
9. The requirements of guarding dangerous parts of the machinery.
10. Precautions to be used when using forklifts, bulldozers, grabs and other heavy gear on board.

Hatch-covers

1. Types of hatches.
2. Opening and closing of chain-pull and hydraulic hatch covers. Closing arrangements.
3. Battening down a hatch.
4. Maintenance of hatch covers:
5. Procedures to check weather tightness of hatch covers
6. Securing of hatch pontoons
7. Maintenance and use of side cleats and cross-joint wedge mechanism
8. Importance of clear drainage channels and drain holes.
9. Importance of compression bars and sealing gaskets
10. Need to check hydraulic system for leakages
11. Procedure for securing hatches in open position to guard against accidental movement.

UNIT III DETAILED STUDY ON BULK, GRAIN AND TIMBER CARGO SHIPS 16

Bulk Cargoes

1. Aim and objective, contents and information available in IMSBC code.
2. Angle of repose, moisture migration, flow moisture point, flow state, transportable moisture limit, dry and wet shift, spontaneous combustion
3. Preparations of holds prior to loading bulk cargoes,
4. Hazards associated with bulk cargoes
5. Precautions prior, during and after loading of: Coal, sulphur, iron ore, urea.
6. Protection of deck machinery from dust.
7. Preparations of holds prior to loading bulk cargoes; Use of various equipment for hold cleaning;
8. Testing for weather tightness of hatch covers; Log Book entries
9. Classification of cargoes as per IMSBC Code
10. Main hazards and precautions with the shipment of bulk solids (Ores, Concentrates, HBI/DRI)
11. Documentation required prior loading

12. Hazards associated with and precautions to be taken whilst loading/ carrying high density cargoes, Maximum allowable weight for single and adjacent holds, Block Loading
13. Purpose and objectives of Bulk carrier loading and unloading (BLU) code
14. Loading, discharging, ballasting and deballasting operations;
15. Test for determining angle of Repose and FMP on board.
16. MSDS Sheets;
17. Cargo stow plan;
18. Precautions to be taken prior entering cargo holds when pesticides are used for fumigation;
19. Ship/Shore safety checklist.

Grain Cargoes

1. Definition of Grain,
2. Filled and Partly filled compartments,
3. Trimmed and untrimmed cargo,
4. Specially suitable compartment.
5. Preparation of holds for carriage of grain cargo especially for insect or rodent infestation;
6. Pre loading inspections/surveys;
7. Securing free grain surface in filled and partly filled compartments,
8. Separation of different grain cargoes loaded in same compartment;
9. Use of Shifting boards and bundling arrangements
10. Document of Authorization
11. Grain loading stability criteria for ships with and with a DoA
12. Contents of Grain loading booklet.
13. Methods to reduce Grain heeling moments in order to meet Grain stability criteria.

Timber

1. Contents of Code of safe practice for ships carrying timber deck cargoes.
2. Stowage and securing of deck timber cargoes
3. Hazards involved with the carriage of deck timber cargo
4. Effect on stability due to absorption of water or ice accretion
5. Lashing arrangement of Timber cargo
6. Need for regular inspection of lashing arrangements
7. Need for controlling height of deck cargo
8. Need for provision of walkways and access to the top of the cargo.
9. Describe action if cargo is lost overboard
10. Describe action if vessel gets a list
11. Stability criteria to be fulfilled
12. Rolling period test for determining ship's stability and limitations of the method.

Container cargo

1. Parts of a container
2. Features of a container
3. Types of containers
4. Segregation and care of containers carrying dangerous goods, reefer containers and out-of-gauge(OOG) cargoes
5. Stowage and securing gear of containers viz. container shoes, stacking cones, interlayer stackers, twistlocks, bottlescrews and turnbuckles
6. Arrangement of a container ship, and how the position of container is designated
7. Factors affecting a container stow:
8. Stability, trim, list, stresses, stack height, weight, dangerous goods, special requirements, out of gauge containers.
9. Types, sizes and markings of containers.
10. Bay plans and stack weight,
11. Anti-heeling tanks
12. Torsional stresses
13. Code of Safe Practice for Carriage of Containers (CSC Code).
14. Special requirements of Dangerous 1.4.10 Cargo, reefer containers and out-of-gauge containers
15. Securing and lashing arrangement of containers.

Refrigerated cargo

1. Cooled, chilled and frozen cargoes with examples.
2. Preparation of holds
3. Dunnaging requirements
4. Inspections of the cargo,
5. Use of brine traps,
6. Purpose of temperature recording.

Reefer Ships

1. General outline of refrigeration systems (Direct, Indirect and air-cooled systems)
2. Care, monitoring and records of cargo during passage
3. Inspection of cargo and brine traps
4. Pre-cooling and preparation of cargo spaces
5. General precautions to be observed whilst working cargo
6. Heavy Lifts
7. Effect of the heavy lifts on the seaworthiness and the stability of the ship;
8. Precautions to be taken whilst loading/discharging heavy lifts.
9. Ro- Ro Vehicles
10. Preparation of the car decks for the loading of trailers and vehicles,
11. Floating decks.
12. Procedures for opening, closing, securing of bow, stern and side doors and ramps
13. Care and maintain the systems.
14. Maintaining water-tight integrity of the cargo decks.

Multi-purpose ships

1. Cargoes common to multipurpose ships
2. Features of multipurpose ships that make them suitable for a variety of cargoes

UNIT V DANGEROUS GOODS AND ASSESSMENT OF DEFECTS AND DAMEAGE 16

Dangerous goods in packaged form

1. Classification of IMDG cargo with distinctive labels and examples
2. Use of IMDG Code, UN No., General Index
3. MFAG
4. EmS
5. Compatibility and segregation, Use of segregation table
6. Precautions when handling dangerous goods,
7. Dangerous cargo manifest,
8. Inspections before loading dangerous goods
9. Construction of magazine for carriage of explosives
10. Limitations on carriage of explosives
11. Precautions during stowage, handling, loading and carriage of explosives

Assess reported defects and damage to cargo spaces, hatch covers and ballast tanks and take appropriate action

1. Knowledge of the limitations on strength of the vital constructional parts of a standard bulk carrier and ability to interpret given figures for bending moments and shear forces.
2. Outline and describe the common damage/defects that may occur on watertight transverse bulkheads situated at the ends of dry cargo holds of a bulk carrier
3. Cracks may often be found at or near the connection of the stool of the transverse bulkhead and the tank top in bulk carriers having combination cargo/ballast holds
4. Ability to explain how to avoid the detrimental effects on bulk carriers of corrosion, fatigue and inadequate cargo handling.
5. Actions to be taken to avoid the detrimental effects on bulk carriers of corrosion, fatigue and Inadequate cargo handling

Course Outcome:

CO – 1: State various common types of ships, the type of cargoes they carry and the method of cargo operations unique to each

CO – 2: Understand the Refrigerated ships and reefer cargoes

CO – 3: Understand the Importance of cargo care to economical operation of ship

CO – 4: Define the Duties of the Officer on Cargo Watch

CO – 5: Understand the importance of Importance of checking bilge suction

TEXT BOOKS:

1. Capt.Errol fernandes , “Cargo Work for Ship Officers”, Gyan Books Private Ltd.
2. David J House, “Cargo Work for Maritime operations”, Elsevier Publications
3. Kemp and Young, “Cargo Work”, Kandy Publications
4. L.G.Taylor, “Cargo Work”, Admiralty Publications
5. P.J. Samson, “Safe Cargo Handling Procedures (Solid Cargo), Vol – 1”,Samson Publications

REFERENCE BOOKS:

1. IBC Code – I.M.O
2. ISGOTT - OCIMF
3. Int. Gas Tanker Code - IMO
4. Capt. C. Baptist, “Tanker Handbook for Deck Officers”, 8th Edition, 2008

Code	Subject	Lecture	Tutorial	Practical	Credit
21DMRN52	MARINE ENGINEERING & CONTROL SYSTEMS – II	4	0	0	3

Course Objective: After successful completion of this course, cadet should be able to understand the common engineering materials, understand the ship-board power systems, and understand the transformers and power distributions

UNIT 1 MATERIALS **12**

1. Common engineering materials
2. Various metals & alloys
3. Properties & uses
4. Ceramics & their uses
5. Elementary metallurgy of steels
6. Steel production- smelting & refining
7. Iron- carbon diagram to show role of carbon in steels & effect on properties
8. Types of steel & use
9. Heat treatment of steels
10. Obtaining desired properties from steel for use in different areas

UNIT II SHIP-BOARD POWER SYSTEMS **12**

AC & DC MACHINES

1. Meaning of frequency, phase & power factor
2. Parallel running & load sharing
3. Prime mover-Diesel engine, steam turbines
4. AC & DC motors.

TRANSFORMERS

1. High and Low voltage transformers
2. Step up/step down Transformers
3. Transformer efficiency and maintenance & care

POWER DISTRIBUTION

1. Main switch boards, power distribution boards
2. Circuit breakers, measuring instruments
3. Overload trip, short circuit trip, fuses other protections.

UNIT III MARINE ENGINEERING (AUXILIARIES) 12

1. Fresh water: Methods of generation of freshwater from seawater at sea. Principle, construction & operation of freshwater generator, steam evaporator, flash evaporator & reverse osmosis plant. Treatment of water for obtaining portable water. Storage and supply of fresh water in ships. Fresh water and sanitary water. Hydrophor systems.
2. Compressed air : Air compressor, uses of compressed air. Storage and distribution of compressed air.
3. Steam : Types of marine steam boiler. Construction and operation of water tube and smoke tube boiler. Boiler mountings. Accessories, safety features. Waste heat recovery boilers. Boilers maintenance. Importance of boiler, feed water chemical treatment
4. Refrigeration & Air conditioning: Principle of refrigeration, compression refrigeration cycle, components & operation. Arrangement of cold storage holds.
5. Pumps: Working principle, construction of different types of pumps. Selection of Pumps for different duties on board the ship. Hydraulic Aggregate pump(Hydraulically driven submerged pump-Framo), submersible, and deep well pumps, fire pumps emergency fire pump and its pumping arrangement, typical bilge system & ballast system of a ship
6. Steering : Common types of steering gear, electro hydraulic steering gears, 2 & 4 Ram systems, Telemotor and control systems. Safety features. Emergency arrangements. Legislation national and international, Operations and maintenance
7. Hydraulic systems: Ram & rotary vane actuators, common failures of hydraulic systems and remedial measures, necessity for cooling / heating of hydraulic oil

UNIT IV INTERNAL COMBUSTION ENGINES 12

1. Working principles: Classification of various types of engines, various types of modern diesel engines. Basic principles of cycles, P-V diagrams. Work done etc. four stroke and two stroke engine
2. Components: Construction, main components and working of two and four stroke engines

UNIT V BOILERS & STEAM TURBINES 12

1. Boilers—Types of Main Boilers—Construction & operation of Water Tube & Smoke Tube Boilers—Boiler Mountings—Safety features—Waste Heat Recovery Boilers—Importance of Boiler Feed Water Chemical Treatment
2. Steam Turbines—Basic principle of operation—Simple Impulse & Reaction Turbines.

Course Outcome:

CO – 1: Understand the common engineering materials

CO – 2: Understand the Properties & uses of Materials

CO – 3: Understand Meaning of frequency, phase & power factor

CO – 4: To understand the Circuit breakers, measuring instruments

CO – 5: Understand the methods of generation of freshwater from seawater at sea

TEXT BOOKS:

1. Reed, "Engineering Knowledge for Deck Officers", 2nd Edition, Reprint 1996
2. Reed, "General Engineering Knowledge Vol 8"14th Edition, Reprint 2009
3. Hannah & Hiller, "Mechanical Engineering Science"
4. Souchette& Smith, "Marine Auxiliary Machinery", 7th Edition, Reprint 2010
5. JK Dhar, "Engineering Knowledge", 10th Edition

REFERENCE BOOKS:

1. L. Jackson & T. Morton, "General Engineering Knowledge for Marine Engineer", IME Publications, Reprint 1997
2. "Basic Electro Technology", Thomas Reed Publications, 8th Edition, 2014
3. Gth Flanogan, "Marine Engineering Series – Marine Boilers", Henemann Professional Publication, Reprint Edition, 2009
4. Wharton A.S, "Marine Engineering Series Diesel Engines", Henemann Professional Publication, 6th Edition, Reprint, 2008
5. D.W. Smith, "Marine Auxiliary Machinery", Thomas Reed Publications, 3rd Edition
6. G.O. Watson, "Marine Electrical Practice", Thomas Reed Publications

Code	Subject	Lecture	Tutorial	Practical	Credit
21PMRN51	PRACTICAL – NAVIGATION – III	0	0	3	2

Course Objective: After successful completion of this course, cadet should be able to understand Marine Chronometer, Master and Slave Clocks, To find the sextant Altitude of the Sun, Understand Micrometer Sextant , Understand Gyro compass

MARINE CHRONOMETER: 10

Advancing / Retarding of clocks with change in Longitude;
International Date Line;
Master / Slave Clocks.
Care and maintenance of Chronometer.

MICROMETER SEXTANT: 10

To find the Sextant Altitude of the Sun;
Converting Sextant Altitude to True Altitude for astronomical calculations.

GYRO COMPASS: 10

Properties of a free Gyroscope – Gyroscopic Inertia and Gyroscopic Precession; Procedure of Starting and stopping a Gyro;
Methods of finding Gyro Error.

Course Outcome:

CO – 1: Well versed in advancing / retarding of clocks with change in Longitude

CO – 2: Understand the International Date Line

CO – 3: Understand Master / Slave Clocks

CO – 4: Understand the care and maintenance of Chronometer

CO – 5: Find the Sextant Altitude of the Sun

TEXT BOOKS:

University Study Materials

Code	Subject	Lecture	Tutorial	Practical	Credit
21PMRN52	PRACTICAL – VOYAGE PLANNING – III	0	0	4	3.

Course Objective: After successful completion of this course, cadet should be able to Understand Elementary knowledge of passage planning and its execution**,** Understand Basic Theory of Tides,_Understand the interpretation of chart

UNIT I SECONDARY PORT TIME AND HEIGHT OF TIDE CALCULATION 12

To find the time and height of HW and LW at Secondary ports by tidal differences

The use of admiralty tide tables and tidal curves to find the time and at which the tide reaches a specified height or heights of tide at a given time and hence the corrections to be applied to chart soundings and of charted heights of shore objects.

UNIT II SYSTEMATIC KNOWLEDGE OF NAUTICAL PUBLICATION 12

A systematic knowledge and use of the contents of the following documents in relation to safety.

Sailing directions.
List of lights & fog signals.
List of radio signals.
Ocean passages of the world.
Notices to mariners/Weekly/Cumulative/Annual.
M &Ms notices
Guide port entry.
Mariners Hand Book
Routing Charts
Ship's Roueting.

Selection of ocean routes, shore based weather routing, planning & executing a coastal passage.
Navigation in pilotage waters, approaching and passing through a traffic separation scheme.

UNIT III ELECTRONIC SYSTEMS OF POSITION FIXING AND ECDIS 12

Electronic Systems of Position Fixing. GNSS (Global Navigation Satellite System) GPS,DGPS, GLONASS, GALLILEO, Basic principles and errors of GPS and DGPS.

Development of ECDIS. Comparison of ECDIS and paper charts. Difference between Raster and Vector charts, Difference between ECS and ECDIS. Electronic Chart Symbols. Advantages of ECDIS over conventional paper charts. Integration of radar/arpa picture with ECDIS.

UNIT IV PURPOSE OF AIS, LRIT, VDR **12**

Automatic Identification System(AIS) .Purpose of AIS, Information exchanged and types of messages, Ship to Ship data exchange, Information displayed on AIS screen, Limitations of AIS, and precautions during use of AIS for collision avoidance

LRIT (Long Range Identification and Tracking) purpose and difference between LRIT and AIS .

VDR (Voyage Data Recorder) concept and purpose S-VDR(Simplified VDR)

UNIT V SHIP'S POSITION FIXING METHODS, ECDIS AND PASSAGE PLANNING **12**

Position fixing by various methods, current & leeway, running fix and three point bearing, Astronomical position lines.

Use of ECDIS and GPS for passage planning - Demonstration of ability to plan passage taking into consideration important factors such as depth of water, distance off dangers, current, traffic separation schemes, navigational aids available etc.,

Course Outcome:

CO – 1: Find the time and height of HW and LW as secondary ports by tidal differences.

CO – 2: Understand the use of admiralty tide tables and tidal curves.

CO – 3: Define systematic knowledge and use of the contents of the documents in relation to safety

CO – 4: Well versed in the navigation in pilot age waters, approaching and passing through a traffic separation scheme.

CO – 5: Understand the concept of GNSS (Global Navigation Satellite System)

TEXT BOOKS:

1. Capt.S.K.Puri, "Chart Work"

2. B.A Chart 5011, HMSO

3. Extracts of ATT

REFERENCE BOOKS:

1. Capt. M.V.Naik & Capt.Varty , "Voyage Planning & Chartwork"

2. Capt. S.S.Chaudhari , “Chartwork”
3. Capt W.H.Sauair, “Modern Chartwork”, Admiralty Publications

Code	Subject	Lecture	Tutorial	Practical	Credit
21PMRN53	PRACTICAL – COLLISION PREVENTION – III	0	0	3	2

Course Objective: After successful completion of this course, cadet should be able to use of Radar, annexes of international regulations for prevention of collision and IALA buoy age system, understand Radar Plotting Exercise Understand the use of ARPA for collision

UNIT I RADAR 15

1. Through knowledge of all rules, annexes of international regulations for prevention of collision and IALA buoy age system.

2. Radar plotting exercises, True plot, Relative plot

3. Action for collision avoidance taking into consideration the rules of the road.

4. Use of Radar and ARPA for Collision Avoidance .Risk of over reliance on ARPA. Obtaining information from ARPA Displays: critical targets, relative and true course and speed of target, CPA, and TCPA targets.

5. The relationship of COLREG 1972 to the use of radar, Lookout, safe speed, plotting of targets and actions to be taken to avoid collision in clear and bad visibility conditions.

UNIT II IALA SYSTEM 15

1. The students will be required to identify various collision situations by day and night using magnetic board, wooden models or any other aid to simulate such conditions.
2. Candidates will be required to deal with each collision situation broadly under the heading recognitions, responsibility, action, appropriate sound signal and ordinary practice of seamanship. Recognition of various buoys & marks under IALA system and appropriate action required under the rules. Collision situations in restricted visibility with or without radar. Stationary obligations under both circumstances.

Course Outcome:

CO – 1: Understand the knowledge of all rules, annexes of International Regulations for prevention of collision and IALA buoy age system

CO – 2: Understand the Radar plotting exercises

CO – 3: Well versed the action for collision avoidance taking into consideration the rules of the road

CO – 4: Understand the use of Radar and ARPA for collision Avoidance

CO – 5: Obtaining the information from ARPA Displays

TEXT BOOKS:

1. Capt. Bhandarkar, "Rules for the Prevention of Collision at Sea", Bhandarkar publications
2. Capt.H.Subramaniam , "Ship borne Radar", Vijaya Publications

REFERENCE BOOKS:

1. Moore D.A , "International Light, Shape & Sound Signals"

2. A.N.Cockroft, "A Guide to Collision Avoidance"

3. IALA, "Maritime Buoy age System"

Code	Subject	Lecture	Tutorial	Practical	Credit
21PMRN54	PRACTICAL – MARINE ENGINEERING & CONTROL SYSTEMS - II	0	0	3	2

Course Objective: After successful completion of this course, cadet should be able to understand the concept of Machine Workshop, Understand the basic electrical workshop, Danger of loose or improper connection

UNIT – I MACHINE WORKSHOP **15**

Familiarization with, and proper use of, various tools e.g., open spanners, ring spanners, socket spanners, ratchet spanners, torsion spanners. Allen keys, screw drivers, files, hammers, chisels, punches, reamers, vice, taps and dies, etc.
Special practice to be given on use of a sledgehammer.
Types of nuts and bolts, studs: methods of freeing rusted nuts and bolts; proper use of the grinding machine, drilling machine (portable and mounted)
Use of coolants such as water, oil, etc., during drilling.
Use of measuring devices – feeler gauges, calipers, screw gauge, etc.
Overhauling of gate valves, butterfly valves and hydrants.
The importance of lubricating oil and grease in reducing friction in machines.
Cutting filing, preparation of level surfaces on metals.
Drilling, taping, reamer operation.
Shaping, drilling, grinding operation.
Edge preparation on steel objects for welding
Welding of simple joints.
Removal & fittings of ball; bearing
Cutting & planning, Dove tail joints.

UNIT II BASIC ELECTRICAL WORKSHOP **15**

Precautions when using electrical appliances; fuses and circuit breakers and their uses
Danger of loose or improper connection
Use of insulated hand tools, insulation tape, insulated footwear;
Danger of wet surfaces; proper connections (line, neuter and earth) in various joints.
Types and specifications of electrical wire when making indents for purchase.
Theory & practical of soldering
Electrical wiring diagrams and fittings of simple circuits.
Fuses, earthings, tube & other light fittings, etc – practice training

Course Outcome:

CO – 1: Familiarity with parts of internal combustion engine-medium and large size.

CO – 2: Familiarity with parts of pumps, compressor heat exchangers, valves and valves fittings.

CO – 3: Assembly of certain engine components.

CO – 4: Well versed with Starting and running operations of motor boat engines, emergency fire pump engine.

CO – 5: Well versed with Starting, running and care of centrifugal pumps and air compressors.

TEXT BOOKS:

University Study Material

SEMESTER - VI

Code	Subject	Lecture	Tutorial	Practical	Credit
21AMRN61	MARITIME LAW	5	0	0	4

Course Objective: After successful completion of this course, cadet should be able to understand the concept of Law, to understand the branches of Law, to understand the process of Litigation, to understand the law of contracts, to understand the legal remedies of common law.

UNIT I CONCEPT & BRANCHES OF LAW 16

A. Concept of Law

1. Origin
2. Source
3. Definition
4. Advantage
5. Private and public law
6. International Law
7. Municipal law

B. Branches of Law

1. Civil Law – Public and Private Laws – Brief outline
2. Criminal Law - Brief outline
3. Law of Torts - Brief outline

UNIT II INTERNATIONAL MARITIME LAW 16

A. International Maritime Law

1. UNO – Organisation, role and functions
2. IMO – Organisation, role and functions
3. Treaties, Conventions, Protocols, Amendments, Codes, Guidelines, Circulars and Notifications
4. Diplomatic Relations and Immunities
5. UNCLOS – zones of jurisdiction (inland waters, territorial sea, contiguous zone, Exclusive economic zone (EEZ), extended fisheries zone, continental shelf, archipelagic waters and artificial islands
6. Innocent Passage – when terminated due circumstance.

B. Indian National Legal System

1. Constitution of India – an overview
2. Hierarchy of courts – Supreme court of India, High courts of the states and other courts
3. Jurisdiction of courts – territorial, pecuniary, original and appellate
4. Admiralty jurisdiction

UNIT 3 PROCESS OF LITIGATION 16

A. Active Litigation

1. Suits, petitions, applications, complaints and appeals
2. Litigants – plaintiff, defendant, petitioner and respondent etc.

3. Mode of preferring a complaint and related procedure of adjudication
4. Award and execution

B. Passive Litigation

1. Arbitration
2. Conciliation
3. Good offices
4. Mediation
5. Negotiations
6. Reconciliations

UNIT 4 LAW OF CONTRACTS **16**

A. Law of Contracts

1. Offer and Acceptance
2. Agreement and Contract
3. Consideration
4. Consent
5. Communication
6. Capacity to contract
7. Valid, Void and Voidable contracts
8. Quasi-Contracts
9. Breach of contracts and remedies for breach
10. Discharge of contracts
11. Special contracts – Bailments and Liens
12. Contract of affreightment – Overview of carriage of Goods Act 1925, Indian Multimodal Transport of Goods Act 1993, Hague Visby Rules, Hamburg Rules, Charter Parties and brief interpretation of various clauses.
13. Law of agency

B. Marine Insurance Act 1963

1. Scope, content and application
2. Insurable interests.
3. Types of insurance contracts – policy covers, floating policy, run off, open cover
4. Gaming and wagering policy
5. Marine adventures
6. Maritime queries
7. Losses not covered by perils of the sea
8. Mode of contracting marine insurance
9. Procedure for marine insurance claims
10. 'Inch Maree' clause
11. Disclosure
12. Warranty and institute warranty
13. Assignment
14. York-Antwerp rules 1994

UNIT 5 LEGAL REMEDIES IN COMMON LAW 16

A. Legal Remedies in Common Law

1. Liens – Maritime liens and Possessary liens
2. Maritime Bailments

B. Wrecks, Salvage and Claims

1. Definition of coastline
2. Receiver – duties, powers and responsibilities
3. Power to Passover adjoining land
4. Suppression of plunder and disorder
5. Procedure to follow on locating wreck
6. Notification
7. Sale of wreck
8. Claims of owners
9. Search warrants
10. Prohibitions
11. Salvage – brief outline

C. Investigations and Inquiries

1. Aims of investigation
2. Master's role in collecting evidence
3. Importance of operational records, all log books, photographs, videos and policies

Course Outcome:

CO – 1: Understand the concept of Law

CO – 2: Well versed in various branches of Law

CO – 3: understand the Civil Law – Public and Private Laws

CO – 4: Well versed in Criminal Law

CO – 5: Well versed in UNO – Organisation, Role and Functions

TEXT BOOKS:

University Handout

REFERENCE BOOKS:

1. "Carriage of Goods by Sea Act 1925", Govt. Of India publication
2. "Marine Insurance Act 1963", Govt. Of India publication
3. "The Indian Contract Act 1879", Govt. Of India publication
4. "STCW convention 2010", IMO Publication
5. "Hague Visby Rules Hamburg Rules", IMO Publication
6. "Relevant Shipping Manuals, Conventions & Rules", IMO Publication
7. "Maritime Law", Bhandarkar Publications

8. Scrutton , “Charter Parties”

Code	Subject	Lecture	Tutorial	Practical	Credit
21AMRN62	MARITIME COMMERCE	4	0	0	4

Course Objective: After successful completion of this course, cadet should be able to understand the international trade and shipping, understand the roles of customs, Organization of Shipping Company and Man Power Planning, know the Maritime frauds

UNIT – I INTERNATIONAL TRADE AND SHIPPING **16**

1. International Trade and Shipping: Seaborne trade of the world composition and direction of cargoes – different types of ships which carry them – Technological developments – Role of Shipping on national economic development.
2. Basic structure of shipping industry: Types of shipping services – Liner and tramp – Role of intermediaries in shipping business; Freight brokers, Clearing and Forwarding Agents – Stevedores – Ship brokers, Bunker and Stores suppliers etc. Shipping Agencies.

UNIT- II LINER TRADES AND TRAMP TRADES **16**

1. Liner Trades – characteristics – liner conferences – how freight rates are fixed components of liner freight – non conference lines – competition. Procedures of shipping cargoes and related documentations; mate's receipt, bill of landing, unit load systems – containerization and multimodal transport.
2. Tramp Trades – chartering different types of chartering ships – their relevance to trades – procedures and documentation relating chartering – charter markets of the world – how freight / charter hire is fixed.

UNIT – III ORGANIZATION OF SHIPPING COMPANY **16**

1. Organization of shipping company - manpower planning - business and cargo management - statutory regulations to be complied with like foreign exchange regulation.
2. Understand the difference between principals and intermediaries. Understand the role and function:- Principals – ship-owners, charterers, shippers and NVOCs (non vessel operating carriers) Intermediaries - Brokers in dry cargo chartering, tanker chartering, ship sale and purchase. Port agents and liner agents and the differences between them
3. Ship managers and freight forwarders.
4. Role of ports: Port locations - functions and range of services - financial aspects of utilisation and cargo handling. Indias ports, their organisation and administration. Modernisation and development of ports.

UNIT – IV ROLE OF CUSTOMS **16**

1. Role of customs: Customs act and documents relating to customs relating to ship operations and trade.
2. Indian shipping development: India's merchant fleet - role of government - maritime administration in India - India's shipping policy.

UNIT – V MARITIME FRAUDS **16**

1. Maritime frauds: Safeguards to be taken to prevent frauds with special reference to shipping industry, operators and seafaring personnel.
2. Role of international organizations: IMF, World Bank, IMO, UNCTAD, WTO, BIMCO, FONASBA, INTERCRAGO, INTERTANKO, IMB, ITF, ISF
3. Introduction lay time calculations

Course Outcome:

CO – 1: Understand the International Trade and Shipping

CO – 2: Understand the Role of Shipping on National Economic Development

CO – 3: Understand how freight rates are fixed components of liner freight

CO – 4: Understand the procedures of shipping cargoes and related documentation

CO – 5: Well versed in the procedures and documentation relating chartering

TEXT BOOKS:

1. DR.A.V.Athalye , “Basic Marine Management”, Bhandarkar Publications
2. University Handout

REFERENCE BOOKS

1. Dr. S.N. Saklecha , “Economics of Shipping & Other Papers”
2. Ellen and Campbell, “International Maritime Fraud”, Witherby Publications
3. Alan Branch , “Elements of ShippinG”, Chapman and Hall, 1989
4. Dr.K.V.Hariharan, “Containerization era in India”

Code	Subject	Lecture	Tutorial	Practical	Credit
21CMRN61	BRIDGE PROCEDURE & LEGAL KNOWLEDGE	4	0	0	4

Course Objective: After successful completion of this course, cadet should be able to understand the concept of Bridge Procedures and Equipment, concept of Bridge Watch Keeping, Understand the International Conventions and Codes

UNIT I: BRIDGE PROCEDURES **12**

1. RADAR & ARPA – Description, features, operating procedure with respect to position fixing and collision avoidance.
2. Echo sounder - Description, features, working principle and operating procedure. Causes for false readings.
3. Course Recorder – Description of types, features, working principle.
4. Speed log – Basic working principle and operating procedure of EM log / Doppler Speed log and their limitations
5. Steering Control: Basic knowledge of steering control systems, change over from manual to auto, Auto pilot alarm, Use of rudder angle indicator and Rate of Turn Indicator (ROTI)
6. Satellite Navigation system - Description, features, working principle and operating procedure
7. GPS & DGPS - Description, features, working principle and operating procedure. Advantages of the GPS over other commercial satellite navigation systems
8. EPIRB – types and areas of coverage, description, features, working principle including transmission pattern and operating procedure. Methods of testing the equipments. Activation of distress signal and consequent events including location and rescue.
9. Automatic Identification System (AIS) - Description features, working principle and operating procedure.
10. Introduction to e-navigation. IBS, VDR, SVDR, LRIT and BWNAS: Introduction, principle of operation and use onboard.

UNIT II BRIDGE WATCH KEEPING **12**

1. Bridge Layout and watch keeping arrangements.
2. Keeping a safe navigational watch as per Section A-VII/2,and B-VII/2 of STCW : Principles observed in keeping safe navigational watch, Effective Lookout, Relieving of duties, Procedures of taking over watches, action on receiving storm warning, entries in logbook. Bridge Procedures Guide and checklists.
3. Circumstances when to call the Master.
4. Procedures to be followed under pilotage.
5. Emergency action to be taken by OOW when there is a failure of critical navigational aid equipment, Bridge Control Equipment, Vessel's navigation lights, Vessel's autopilot and steering system, Vessel Propulsion system, Vessel's alarm system.
6. Preparation of navigational bridge prior arrival of port and proceed to sea. (Pre-arrival and Pre-Departure checklist)
7. Testing of Bridge Controls. Procedure for testing of steering system.

8. Anchor watch: Relieving of duties, procedures of taking over watches, action on receiving storm warning, entries in logbook.
9. Bridge team work procedures and maintaining situational awareness.
10. Effective use of Ship's Routeing.
11. Use of reporting in accordance with general principles for ship reporting systems and VTS reporting procedures.
12. Emergency action to be taken by OOW in emergency situations; Man overboard, Fire, Collision, Stranding or grounding, Flooding and stability emergency and Piracy.

UNIT III BRIDGE EQUIPMENT & MARINE COMMUNICATION **16**

1. ECDIS: Introduction, application to Merchant ships as per SOLAS. Equipment Set – up and operation.
2. Bridge Team Management: Principles & Application
3. Bridge Resource Management: Principles & Application
4. Human Element in Marine Navigation & Watch Keeping
5. Gyro Compass: Introduction & Basics
6. Magnetic Compass: Introduction & Basics
7. Radio communication equipment on board ships – introduction to various equipment, principle of operation, selection of frequencies
8. Radio regulations relating to Maritime Services including maritime frequency allocation
9. Satellite communication and alerting systems – equipment aboard ship and ashore. Methods of communication used
10. Global Maritime Distress and Safety System (GMDSS) – Principles and actual applications.
11. Worldwide Navigational Warning System – Principles and actual applications. The Navtex receiver – description, working principle and use as an aid to safe navigation
12. Search and Rescue (SAR) communications including relay of distress messages (MERSAR, IAMSAR and AMVER)
13. Inmarsat communication systems – Sat B, Sat C, Sat M and recent development of advanced communication systems, ECG messages.

UNIT IV LEGAL KNOWLEDGE **08**

International Conventions and Codes

1. The International Safety Management (ISM) code (Chapter IX of SOLAS) – Brief outline, salient features, increase of shore-based accountability. Understanding of definitions and related certification for ship and shore-based company. Processes of verification and control.
2. The International Ship and Port Security (ISPS) code - Brief outline, salient features. Understanding of definitions and related certification for ship, owner/company and shore-based port facility. Processes of verification and control. SSAS.
3. The Ballast Water Management code - Brief outline, salient features. Understanding of definitions and related certification for ship and shore-based company. Processes of verification and control.

UNIT V MERCHANT SHIPPING ACT 1958 **12**

1. Registry of ships, Flag state, Port of registry – jurisdiction of flag state with respect to a vessel. Overseas representation of Flag state interest. Significance of courtesy flag when a foreign vessel enters national port or waters.
2. Certification of Officers, Seamen and Apprentices. Engagement, management and discharge of crew. Manning scales. Contracts of employment, conditions of service, wages and other remuneration. Advances and allotments. Desertion, deceased seaman, repatriation.
3. The Official Log book – Entries to be recorded and laws relating to the entries. Entries related to indiscipline and misconduct. Treatment of disciplinary offences. The importance of entries in the Official Log Book as evidence in the case of a maritime enquiry or litigation.
4. ILO regulations with respect to shipboard hygiene. Related inspections and reports. Port Health requirements. Quarantine procedures. Maritime Declaration of Health. Ship Sanitation Health Exemption Certificate (SSHEC).
5. Custom House procedure – entering and clearing a ship.
6. Port State Control – Overview, reasons for detention of vessels.

Course Outcome:

CO – 1: Well versed with RADAR & ARPA – Description, Features, and Operating Procedure

CO – 2: Understand the concept of Echo Sounder – Description, Features and Operating Procedure

CO – 3: Understand the Bridge Layout and Watch Keeping Methods

CO – 4: Understand the Effective use of Ship's Routeing

CO – 5: Understand the Bridge Team Management: Principles & Application

TEXT BOOKS:

1. Capt. H. Subramaniam, "Nautical Watchkeeping", 2nd Edition, Reprint 2012
2. Capt. H. Subramaniam, "Shipborne Radar", 4th Edition, Reprint 2013
3. Sonnenberg, "Electronic Navigation Aids",3rd Edition
4. Govt. of India Publication, "Merchant Shipping Act 1958", Reprint 2007

REFERENCE BOOKS:

1. "SOLAS (Consolidated edition)" ,IMO publication, 2014
2. "ISPS code", IMO publication, 2003
3. "Ballast Water Management code", IMO publication
4. "STCW 2010", IMO publication, 2010
5. "Bridge Procedures Guide", ICS publication, 3rd Edition, 1998

Code	Subject	Lecture	Tutorial	Practical	Credit
21DMRN61	CARGO HANDLING AND STOWAGE – II	4	0	0	3

Course Objective: After successful completion of this course, cadet should be able to understand the different oil products, understand the operation of Ship to Ship, and know the importance of Chemical Tankers and Gas Tankers

UNIT I CRUDE OIL 16

1. Crude oil, Refined products, Spiked crude, Sour crude
2. Reid vapour pressure, Pour point.
3. Upper and lower flammable limits
4. Flammability diagram, Flammable Range, Lower and Upper flammable limits.
5. Threshold Limit Value.
6. Tanker arrangement (tanks, pump rooms, slop tanks, cofferdams, deep tanks)
7. Cargo piping system for various types of tankers.

UNIT II SHIP TO SHIP OPERATIONS 16

1. Ship to Ship operations – Lightering, Bunkering and offshore replenishment. Brief description of each operation, related precautions.
2. MARPOL regulations as applicable to Oil, Chemical and Gas carriers in brief.
3. Procedure for man entry in enclosed spaces on tanker
4. The use of Oxygen analyser, Explosimeter, Tankscope, Multigas detector using tubes
5. Pumps – Brief description of various types of cargo pumps used on board tankerships. Working principle. Explanation of terms – cavitation, pump racing, suction head, discharge head, priming of pumps and testing of pumps.
6. Eductors – Description of parts of an eductor, working principle, precautions for operation.

UNIT III HISTORY OF OIL CARRIAGE 16

History of oil carriage and pollution prevention.
Segregated ballast, Clean ballast, Dirty ballast,
Slop tank and handling of slops, Load-on-top, ODMCS
Inert gas system including boiler uptake valve, scrubber, blowers, oxygen analyser, deck seal, non-return valve, PV valve, PV breaker and mast riser.

Crude Oil Washing, its hazards and benefits,
Items of COW checklist
MARPOL regulations for COW
Tank cleaning, Purging and gas freeing procedures
Items of pre-arrival checklist
Ship shore safety checklist of tankers
Loading and discharging operations on an oil tanker.
Contents and application of the International Safety Guide for Oil Tankers and Terminals ISGOTT
Cargo calculations for quantity and ullage of oil cargo based on volume and height of space, density of cargo and temperature change.
Deep tank cargoes: Procedures for cleaning and preparation of deep tanks for loading.
1 Securing of deep tank lids

UNIT IV CHEMICAL TANKERS 16

1. Type 1, Type 2 and Type 3 chemical tankers
2. Various categories (X,Y,Z, OS) of cargoes
3. Hazards associated with chemical cargoes and control measures
4. Various types of tank coatings
5. Purpose and use of IBC code.
6. Purpose and objective of P & A manual
7. Equipment for evaluation of tank atmosphere (flammable gas detector,
8. O_2analyser and measurement of concentration of toxic gas)
9. Threshold limit value (TLV) of product
10. Odour threshold
11. Information available in cargo data sheets
12. With the aid of a simple diagram, explain a "closed circuit" loading operation using vapour- return line
13. Items of pre-arrival checklist
14. Entries made in Cargo Record Book
15. Independent, integral, gravity and pressure cargo tanks
16. Typical tank arrangements with piping
17. Tank cleaning and control of pollution in chemical tankers:
18. Hazards involved with tank cleaning
19. Use of slop tanks

UNIT V GAS TANKERS 16

1. Type A, Type B and Type C tanks;
2. High level alarm and auto- shut off.
3. Purpose and objectives of the IGC Code
4. Boiling point, cargo area, cargo containment systems, gas carrier, gas/dangerous zone, gas- safe space, hold space, inter barrier space, MARVS, primary and secondary barrier, tank dome
5. Various types of ships (Fully pressurized, Semi pressurized, Fully refrigerated and Semi refrigerated)
6. Various types of tanks (integral, membrane, semi-membrane, independent and internally insulated tank)
7. Detection of cargo leakage through primary barrier
8. Deepwell pump

9. Re-liquefaction plant
10. Contents of pre-cargo loading checklist
11. Tank cleaning procedure for gas tankers

Course Outcome:

CO – 1: Understand the Crude oil, Refined products, Spiked crude, Sour crude

CO – 2: Well versed with Cargo piping system for various types of tankers

CO – 3: Brief knowledge in MARPOL regulations as applicable to Oil, Chemical and Gas carriers

CO – 4: Gather information on the procedure for man entry in enclosed spaces on tanker

CO – 5: Understand the History of oil carriage and pollution prevention

TEXT BOOKS:

1. Capt.Errol fernandes , "Cargo Work for Ship Officers", Gyan Books Private Ltd.
2. David J House, "Cargo Work for Maritime operations", Elsevier Publications
3. Kemp and Young, "Cargo Work", Kandy Publications
4. L.G.Taylor, "Cargo Work", Admiralty Publications
5. P.J. Samson, "Safe Cargo Handling Procedures (Solid Cargo), Vol – 1",Samson Publications

REFERENCE BOOKS:

1. IBC Code – I.M.O
2. ISGOTT – OCIMF
3. Int. Gas Tanker Code – IMO
4. Capt.C.Baptist, "Tanker Handbook for Deck Officers", 8th Edition, 2000

Code	Subject	Lecture	Tutorial	Practical	Credit
21DMRN62	MARINE ENGINEERING & CONTROL SYSTEMS – III	4	0	0	3

Course Objective: After successful completion of this course, cadet should be able to understand the concept of Marine Engineering Auxiliaries, understand the Main Propulsion units, understand the automation and control engineering

UNIT I MARINE ENGINEERING (AUXILIARIES) 12

1. Fuels: Different types and properties. Fuel storage and supply on board the ship. Treatment of fuel.
2. Turbines: Impulse and reaction turbine, gas, turbines, steam turbine operations and care. Turbines as prime movers for various duties including as cargo pumping operations of tankers
3. Propellers and main shafting: types of propeller, fixed pitched and variable pitch propellers. Pitch, pitch angle, real and apparent slips, propeller efficiency, calculations. Shafting tail end shaft, thrust block, intermediate shaft, alignment. Effect of condition of hull, tips of propeller on fuel coefficient, fuel consumption and propeller efficiency. Calculate bunker fuel required for the voyage, speed for a given daily consumption, speed required to complete a voyage with given consumption
4. Deck machinery; cargo winch, windlass, lifeboat winch. Hydraulic, pneumatic electric drives. Safety features
5. Pollution control: Sewage disposal, methods, limits, regulation. Bilge oil water separator, regulations. Control of pollution form machinery exhausts, block diagram for the operation of a waste incinerator regulations

UNIT II MAIN PROPULSION UNITS (IC ENGINES & OTHERS) 12

1. Process of exhausting, scavenging and supercharging. Scavenge fire.
2. Lubricating oil, jacket (and other) cooling water system. Types of lubricating oils for different duties. Simple CW, L.O. and F.O. flow circuit for large diesel engine. Reasons and method of chemical treatment of CW system. Testing of jacket cooling water.
3. Operations of IC engine as main propulsion engine. Warning up, starting maneuvering, reversing and full power running of the main engine. Limitations and care required on IC engine during maneuvering and at full power. Purpose of turbocharger and need to control rpm whilst carrying out turbocharger washing.
4. Selection criterion of IC engines, power weight ratio, specific fuel consumption, indicated power, brake power, shaft power, delivered power, thrust power, effective power.
5. Various efficiencies, calculation. Maximum continuous rating (MCR). Calculation of fuel consumption, economic speed. Heat balance, various losses and calculations
6. Other Propulsion units: Steam turbine, gas turbine as main propulsion units. Advantage and disadvantages. Maneuvering operations

Steam Turbines

1. Impulse & Reaction Turbines- Use of Steam Turbine for Main Propulsion & also for
2. Other duties including Cargo Pumping—Steam Turbine operation &care.
3. Typical Lay-Out of Closed Steam Cycle—Boiler & Steam Turbine arrangement
4. Gas Turbines- Gas Turbine as main Propulsion Unit-Its basic principle of operation

UNIT III PROPELLERS & MAIN SHAFTING **12**

1. Types of Propellers-Fixed Pitch & Variable Pitch Propellers- Pitch, Pitch Angle, Real & Apparent Slip-Propeller efficiency & calculations.
2. Shafting- Thrust Shaft-Intermediate Shaft-Propeller Shaft—Thrust Block- Plummer Block—Stern Tube Bearing & Gland- Lubrication & Sealing arrangement. Alignment of Shafts

UNIT IV AUTOMATION & CONTROL ENGINEERING **12**

1. Introduction & growth in shipboard operations-Understanding terminology-Sensors & Measuring elements for Temperature, Pressure, Level Flow etc- Transmitters & Actuators.
2. Automatic control systems- Open & Closed Loop Systems- Controllers & Proportional Controllers.
3. Pneumatic, Hydraulic, Electric & Electronic Control Systems- Applications to various shipboard operations.
4. Bridge Control of Main Propulsion System- Electric Telegraph operation- manoeuvering aids –Operation of Control Pitch Propeller & Bow Thruster.
5. Arrangements necessary for appropriate and effective engineering watches to be maintained for the purpose of safety under normal circumstances and UMS operations. Arrangements necessary to ensure a safe engineering watch is maintained when carrying dangerous cargo.
6. Liquid Cargo Loading—Storage & Discharge Operations- Monitoring—Remote Level Gauges & Control of Valves. Remote Control Operation of Hatch Covers- Remote operation of Ballast System.
7. Information Display, Data Logging & Alarm Systems—Testing & Maintenance

UNIT V SAFETY ARRANGEMENTS **12**

1. Fire detectors, smoke, heat, flame etc. fire alarm circuits
2. Firefighting systems. Fixed firefighting installation for engine room, accommodation and cargo holds. CO2 flooding, high pressure water system, water sprinkler system, bulk dry powder and foam systems.
3. Inert gas for cargo. Inert gas production, generation from boiler fuel gas etc. inert gas system plant. Use of O2 analyzer, explosive meter, dragger pump and other portable measuring instruments.

4. Smoke helmets, breathing apparatus, fire suit and other safety equipment
5. Lifeboat engine, emergency fire pump engine, lifeboat winch, operation and care

Course Outcome:

CO – 1: Calculate bunker fuel required for the voyage, speed for a given daily consumption, speed required to complete a voyage with given consumption

CO – 2: Understand the Deck machinery; cargo winch, windlass, lifeboat winch. Hydraulic, pneumatic electric drives. Safety features

CO – 3: Understand the Process of exhausting, scavenging and supercharging. Scavenge fire

CO – 4: Understand the Selection criterion of IC engines, power weight ratio, specific fuel consumption, indicated power, brake power, shaft power, delivered power, thrust power, effective power

CO – 5: Understand the types of propellers

TEXT BOOKS:

1. Reed, "Engineering Knowledge for Deck Officers", 2nd Edition, Reprint 1996
2. Reed, "General Engineering Knowledge Vol 8"14th Edition, Reprint 2009
3. Hannah & Hiller, "Mechanical Engineering Science"
4. Souchette& Smith, "Marine Auxiliary Machinery", 7th Edition, Reprint 2010
5. JK Dhar, "Engineering Knowledge", 10th Edition

REFERENCE BOOKS:

1. L. Jackson & T. Morton, "General Engineering Knowledge for Marine Engineer", IME Publications, Reprint 199
2. "Basic Electro Technology", Thomas Reed Publications, 8th Edition, 2014
3. Gth Flanogan, "Marine Engineering Series – Marine Boilers", Henemann Professional Publication, Reprin Edition, 2009
4. Wharton A.S, "Marine Engineering Series Diesel Engines", Henemann Professional Publication, 6th Edition Reprint, 2008
5. D.W. Smith, "Marine Auxiliary Machinery", Thomas Reed Publications, 3rd Edition
6. G.O. Watson, "Marine Electrical Practice", Thomas Reed Publications

Code	Subject	Lecture	Tutorial	Practical	Credit
21GMRN61	PRINCIPLES OF MANAGEMENT	4	0	0	3

Course Objective: After successful completion of this course, cadet should be able to understand the concept of Managing & Managers, understand the Planning and Strategic management, and understand communications and negotiations

UNIT I MANAGING & MANAGERS **12**

1. Managing & Managers: Organization and the need for management; the management process, types of managers, management level and skills, managerial roles, the challenge of management.
2. The evolution of management theory: Why study management theory? The classical management theories, the behavioural school, the quantitative school – operations research and management science; the evolution of management theory.
3. The external environment of organizations: The external environment and its importance: elements of the direct-action environment; elements of the indirect-action environment; theories of total organization environments, managing the total environment.

UNIT II PLANNING AND STRATEGIC MANAGEMENT **12**

1. Planning and strategic management: planning – an overview, the formal planning process; the evolution of the concept of strategy.
2. Social responsibility and ethics: The changing concept of social responsibilities; the shift to ethics; the tools of ethics; the challenge of relativism.
3. Strategy implementation: Matching strategy implementation to strategy; matching structure and strategy; institutionalizing strategy.
4. Decision making : Problem and opportunity finding; the nature of managerial decision making; the rational model of decision making; challenges to the rational model; improving the effectiveness of decision making and problem solving.
5. Planning and decision making tools & techniques: The management science approach; the management science process; planning for the future – forecasting; planning for the future scheduling; planning to meet goals with uncertainty.

UNIT III ORGRANIZATIONAL STRUCTURE **12**

1. Organizational structure, coordination and design: Organizational structure, types of organizational structures, coordination, organizational design.
2. Authority, delegation and decentralization: Authority, power and influence, line and staff authority, delegation, job design, decentralization.
3. Human resource management: The HRM process – a traditional view, human resource planning, recruitment, selection, orientation or socialization, training and development, performance appraisal, promotions, transfer, demotions and separation, HRM and strategy.
4. Managing organizational change and innovation: Why planned change in needed. A model of the change process, types of planned change, organizational development, managing creativity and innovation.

UNIT IV THEORIES OF MOTIVATION **12**

1. Motivation, performance and job satisfaction: Theories of motivation – an overview, content theories of motivation, process theories of motivation: reinforcement theory, a system view of motivation in organizations.
2. Leadership: Defining leadership the trait approach of leadership, the behavioural approach to leadership, contingency approaches to leadership, the future of leadership theory.
3. Groups and committees: Types of groups, characteristics of groups, problem solving in groups, making formal groups effective.

UNIT V COMMUNICATION AND NEGOTIATION 12

1. Communication and negotiation: The importance of communication, interpersonal communication, barriers to effective interpersonal communication, communication in organizations, using communication skills – negotiating to manage conflicts.
2. Effective control: The meaning of control, types of control methods, designing control systems, financial controls, budgetary control methods.
3. Operations management: The nature of operations, the importance of operations management, designing operations systems, operational planning and control decisions, quality control.
4. Information systems: Information and control, management information systems, designing a computer based MIS, implementing a computer based MIS, end user computing, the impact of computers and MIS on managers and organizations.

Course Outcome:

CO – 1: Understand the Organization and the need for management

CO – 2: State evolution of management theory

CO – 3: State Planning and strategic management

CO – 4: Understand the Planning and decision making tools & techniques

CO – 5: Understand the Human resource management

TEXT BOOKS:

1. DR.A.V.Athalye, “Basic Marine Management”, Bhandarkar publications
2. C B Gupta, “Management Theory & Practice”, Sultan Chand & Sons Publications, 2013

REFERENCE BOOKS:

1. Stoner & Freeman, “Management”, Pearson Publication
2. Drucker P, “The Practice of Management”
3. Mitchell, Teerence P, “People in Organisation, an Introduction to Organisation Behaviour”,
4. Dwivedi R.S, “Manpower Management”, Prentice-Hall of India, 1984

Code	Subject	Lecture	Tutorial	Practical	Credit
21PMRN61	PRACTICAL – MARINE COMMUNICATION	0	0	4	1

Course Objective: After successful completion of this course, cadet should be able to understand the Knowledge of Morse Code**,** understand Familiarization with Bridge Equipment during ships visits**,** and understand IMO Phrases for Marine Communication

1. Knowledge of Morse Code (6)
2. Morse signaling with the Aldis Lamp (6)
3. Visual transmission and decoding of morse signals (6)
4. Familiarization with bridge equipment during ship visits. (6)
5. IMO Phrases for Marine Communication (6)

TOTAL: 30h

Course Outcome:

CO – 1: Define the Knowledge of Morse Code

CO – 2: Define Aldis Lamp

CO – 3: State Visual Transmission and decoding of Morse Signals

CO – 4: Familiarized with bridge equipment during ship visits

CO – 5: Understand the IMO Phrases for Marine Communication

TEXT BOOKS:

University Study Materials

Code	Subject	Lecture	Tutorial	Practical	Credit
21PMRN62	PRACTICAL – MARINE ENGINEERING & CONTROL SYSTEMS – III	0	0	3	2

Course Objective: After successful completion of this course, cadet should be able to familiar with basic operations, familiarity with parts of Internal combustion engine, assembly of engine components, simple turning operations on lathe machine

BASIC OPERATIONS **40**

1. Familiarity with parts of internal combustion engine-medium and large size.
2. Familiarity with parts of pumps, compressor heat exchangers, valves and valves fittings.
3. Assembly of certain engine components.
4. Starting and running operations of motor boat engines, emergency fire pump engine.
5. Starting, running and care of centrifugal pumps and air compressors.
6. Simple turning operations on lathe machine.
7. Use of instruments like portable Oxygen analyzer, explosimeter, Draeger apparatus.

WORKSHOP: HOT-WORK **20**

1. Basic theory and practical experience of gas cutting, gas welding and electric arc welding.
2. Gas heating to free rusted nuts and bolts.
3. The proper precautions to be taken during each of these processes.

Course Outcome:

CO – 1: Familiarity with parts of internal combustion engine-medium and large size.

CO – 2: Familiarity with parts of pumps, compressor heat exchangers, valves and valves fittings.

CO – 3: Assembly of certain engine components.

CO – 4: Define Starting and running operations of motor boat engines, emergency fire pump engine.

CO – 5: Define Starting, running and care of centrifugal pumps and air compressors.

TEXT BOOKS:

University Study Material