

# **VELS INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)**

(Deemed to be University u/s 3 of the UGC Act, 1956)

**PALLAVARAM - CHENNAI - INDIA**



**VELS**  
**UNIVERSITY**



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## **B.Sc**

# **Nautical Science**

## **Curriculum and Syllabus**

**(Based on Choice Based Credit System)**

**Effective from the Academic year**

**2015 – 2016**

**Department of Nautical Science**

**School of Maritime Studies**

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# Program Source Outcome

## Department of Nautical Science

### To enable the student to emerge as:

PSO – 1: To achieve thorough knowledge within maritime courses in accordance with chapter A-II/2 of the STCW-convention and possess an overall and conscious understanding of the profession including

PSO – 2: To achieve knowledge about navigation at the operational and management level

PSO – 3: To achieve knowledge about cargo handling and stowage at the operational and management level

PSO – 5: To achieve knowledge about controlling the operation and care for persons on board at the operational and management level

PSO – 6: To achieve knowledge about shipboard administration and cultural awareness

PSO – 7: To achieve knowledge about safety management and organizational theory

PSO – 8: To achieve thorough knowledge of national and international rules and regulations concerning the handling and operation of ships.

PSO – 9: To apply knowledge of mathematics, natural science, maritime English, economics and management related to the handling and operation of ships.

PSO – 10: To achieve knowledge of the maritime history, the role of sea officers and seafarers in society, the development of maritime technology and has knowledge about social, environmental, ethical, safety and economical consequences of maritime activities.

PSO – 11: To be familiar with on-going research within nautical science and has a scholarly approach to work and considerations within nautical areas. Has knowledge about research methods and academic writing.

PSO – 12: To independently update his/hers knowledge through literature, contact with relevant work environment and by reviewing own practice.

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**VELS UNIVERSITY - SCHOOL OF MARITIME STUDIES**  
**B.SC NAUTICAL SCIENCE DEGREE COURSE**  
**CURRICULUM**

Total Number of Credits: **140**

Category	Code	Title of the Course	Hour / Week			Credit
			Lecture	Tutorial	Practical	
<b>SEMESTER - I</b>						
CORE	15BNS001	Nautical Mathematics - I	5	0	0	4
CORE	15BNS002	Nautical Physics - I	4	0	0	4
AECC	15BNS201	English - I	4	0	0	3
AECC	15BNS202	Nautical Physics Practical - I	0	0	3	2
DSE	15BNS....	Discipline Specific Elective - 1	5	0	0	3
GE	15BNS....	Generic Elective - 1	0	0	3	2
SEC	15BNS....	Skill Enhancement Elective - 1	4	0	0	3
SEC	15BNS....	Skill Enhancement Elective - 2	0	0	2	2
<b>TOTAL</b>			<b>22</b>	<b>0</b>	<b>8</b>	<b>23</b>

<b>SEMESTER - II</b>						
CORE	15BNS003	Nautical Mathematics - II	5	0	0	4
CORE	15BNS004	Nautical Physics - II	4	0	0	4
AECC	15BNS203	English - II	4	0	0	3
AECC	15BNS204	Nautical Physics Practical - II	0	0	3	2
DSE	15BNS....	Discipline Specific Elective - 2	5	0	0	3
GE	15BNS....	Generic Elective - 2	0	0	3	2
SEC	15BNS....	Skill Enhancement Elective - 3	4	0	0	3
SEC	15BNS....	Skill Enhancement Elective - 4	0	0	2	2
<b>TOTAL</b>			<b>22</b>	<b>0</b>	<b>8</b>	<b>23</b>

<b>SEMESTER – III</b>						
<b>CORE</b>	<b>15BNS005</b>	<b>Navigation – I</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>
<b>CORE</b>	<b>15BNS006</b>	<b>Navigation – I Practical</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>
<b>CORE</b>	<b>15BNS007</b>	<b>Naval Architecture - I</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>4</b>
<b>AECC</b>	<b>15BNS205</b>	<b>Voyage Planning - I (Practical)</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>3</b>
<b>AECC</b>	<b>15BNS206</b>	<b>Collision Prevention - I (Practical)</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>
<b>GE</b>	<b>15BNS....</b>	<b>Generic Elective - 3</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>SEC</b>	<b>15BNS....</b>	<b>Skill Enhancement Elective - 5</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>SEC</b>	<b>15BNS....</b>	<b>Skill Enhancement Elective - 6</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>
<b>TOTAL</b>			<b>17</b>	<b>0</b>	<b>13</b>	<b>23</b>

<b>SEMESTER – IV</b>						
<b>CORE</b>	<b>15BNS008</b>	<b>Navigation – II</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>
<b>CORE</b>	<b>15BNS009</b>	<b>Navigation – II Practical</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>
<b>CORE</b>	<b>15BNS010</b>	<b>Naval Architecture - II</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>4</b>
<b>AECC</b>	<b>15BNS207</b>	<b>Voyage Planning - II (Practical)</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>3</b>
<b>AECC</b>	<b>15BNS208</b>	<b>Collision Prevention - II (Practical)</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>AECC</b>	<b>15BNS209</b>	<b>Environmental Science</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
<b>DSE</b>	<b>15BNS....</b>	<b>Discipline Specific Elective - 3</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>SEC</b>	<b>15BNS....</b>	<b>Skill Enhancement Elective - 7</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>TOTAL</b>			<b>15</b>	<b>0</b>	<b>15</b>	<b>22</b>

<b>SEMESTER - V</b>						
<b>CORE</b>	<b>15BNS011</b>	<b>Navigation – III</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>
<b>CORE</b>	<b>15BNS012</b>	<b>Navigation – III Practical</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>
<b>CORE</b>	<b>15BNS013</b>	<b>Naval Architecture - III</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>4</b>
<b>AECC</b>	<b>15BNS210</b>	<b>Voyage Planning -III (Practical)</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>3</b>
<b>AECC</b>	<b>15BNS211</b>	<b>Collision Prevention-III (Practical)</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>
<b>DSE</b>	<b>15BNS....</b>	<b>Discipline Specific Elective - 4</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>
<b>DSE</b>	<b>15BNS....</b>	<b>Discipline Specific Elective - 5</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>SEC</b>	<b>15BNS....</b>	<b>Skill Enhancement Elective - 8</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>
<b>Total</b>			<b>17</b>	<b>0</b>	<b>13</b>	<b>24</b>
<b>SEMESTER - VI</b>						
<b>CORE</b>	<b>15BNS014</b>	<b>Bridge Procedures &amp; Legal Knowledge</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>
<b>CORE</b>	<b>15BNS015</b>	<b>Marine Communication (Practical)</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>AECC</b>	<b>15BNS212</b>	<b>Maritime Law</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>4</b>
<b>AECC</b>	<b>15BNS213</b>	<b>Maritime Commerce</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>
<b>DSE</b>	<b>15BNS....</b>	<b>Discipline Specific Elective - 6</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>
<b>DSE</b>	<b>15BNS....</b>	<b>Discipline Specific Elective - 7</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>GE</b>	<b>15BNS....</b>	<b>Generic Elective - 4</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>SEC</b>	<b>15BNS....</b>	<b>Skill Enhancement Elective - 9</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>
<b>Total</b>			<b>25</b>	<b>0</b>	<b>5</b>	<b>25</b>

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## **List of Core Courses**

<b>15BNS001</b>	<b>Nautical Mathematics - I</b>
<b>15BNS002</b>	<b>Nautical Physics - I</b>
<b>15BNS003</b>	<b>Nautical Mathematics - II</b>
<b>15BNS004</b>	<b>Nautical Physics - II</b>
<b>15BNS005</b>	<b>Navigation – I</b>
<b>15BNS006</b>	<b>Navigation – I Practical</b>
<b>15BNS007</b>	<b>Naval Architecture - I</b>
<b>15BNS008</b>	<b>Navigation – II</b>
<b>15BNS009</b>	<b>Navigation – II Practical</b>
<b>15BNS010</b>	<b>Naval Architecture - II</b>
<b>15BNS011</b>	<b>Navigation – III</b>
<b>15BNS012</b>	<b>Navigation – III Practical</b>
<b>15BNS013</b>	<b>Naval Architecture - III</b>
<b>15BNS014</b>	<b>Bridge Procedures &amp; Legal Knowledge</b>
<b>15BNS015</b>	<b>Marine Communication (Practical)</b>

# **List of Ability Enhancement Compulsory Courses**

<b>15BNS201</b>	<b>English - I</b>
<b>15BNS202</b>	<b>Nautical Physics Practical - I</b>
<b>15BNS203</b>	<b>English - II</b>
<b>15BNS204</b>	<b>Nautical Physics Practical - II</b>
<b>15BNS205</b>	<b>Voyage Planning - I (Practical)</b>
<b>15BNS206</b>	<b>Collision Prevention - I (Practical)</b>
<b>15BNS207</b>	<b>Voyage Planning - II (Practical)</b>
<b>15BNS208</b>	<b>Collision Prevention - II (Practical)</b>
<b>15BNS209</b>	<b>Environmental Science</b>
<b>15BNS210</b>	<b>Voyage Planning -III (Practical)</b>
<b>15BNS211</b>	<b>Collision Prevention-III (Practical)</b>
<b>15BNS212</b>	<b>Maritime Law</b>
<b>15BNS213</b>	<b>Maritime Commerce</b>

## **List of Discipline Specific Elective Courses**

- 15BNS101 Marine Meteorology - I**
- 15BNS102 Introduction to Shipping**
- 15BNS103 Marine Meteorology - II**
- 15BNS104 Safe Maintenance on Ships**
- 15BNS105 Basics of GMDSS**
- 15BNS106 Shipping Business**
- 15BNS107 Marine Engineering & Control Systems - I**
- 15BNS108 Deck Machinery**
- 15BNS109 Cargo Handling and Stowage - I**
- 15BNS110 Marine Engineering & Control Systems - II**
- 15BNS111 Fire Prevention, Fire Fighting & Life Saving Appliances**
- 15BNS112 Cargo Handling and Stowage - II**
- 15BNS113 Marine Engineering & Control Systems - III**
- 15BNS114 Ship Operation and Management**

## **List of Generic Elective Courses**

**15BNS151 Parade & OLQ Training - I (Practical)**

**15BNS152 Professional Practice - I**

**15BNS153 Parade & OLQ Training - II (Practical)**

**15BNS154 Professional Practice - II**

**15BNS155 Introduction to Computers**

**15BNS156 Ship Simulator Familiarization**

**15BNS157 Professional Ethics**

**15BNS158 Principles of Management**

## **List of Skill Enhancement Elective Courses**

- 15BNS251 Ship Operation Technology - I**
- 15BNS252 Ship Operation Technology - I (Practical)**
- 15BNS253 NSS - I**
- 15BNS254 Ship Operation Technology - II**
- 15BNS255 Ship Operation Technology - II (Practical)**
- 15BNS256 NSS - II**
- 15BNS257 Programming in C++**
- 15BNS258 Ship Operation Technology - III**
- 15BNS259 Ship Operation Technology - III (Practical)**
- 15BNS260 NSS - III**
- 15BNS261 Marine Engineering & Control Systems - I (Practical)**
- 15BNS262 Bridge Resource Management (Practical)**
- 15BNS263 NSS - IV**
- 15BNS264 Marine Engineering & Control Systems - II (Practical)**
- 15BNS265 Anti Pollution Lab (Practical)**
- 15BNS266 NSS - V**
- 15BNS267 Marine Engineering & Control Systems - III (Practical)**
- 15BNS268 Leadership, Team Building & Ship Security**
- 15BNS269 NSS - VI**

# CORE COURSES

**Course Objective:**

- To understand how to apply Mathematical principles to Nautical Studies
- To familiarize with graphical representations of complex numbers, matrices, spherical trigonometry
- To apply Algebra principles to Nautical Studies

**Course Outcome:**

CO – 1: To understand clearly about complex numbers

CO – 2: To be well versed with the theorems related to complex numbers

CO – 3: To get clear idea about operators of Matrices

CO – 4: To be well versed in properties of Matrices

CO – 5: To understand the fundamentals of spherical trigonometry

CO – 6: To understand the rules and formulas used in spherical trigonometry

CO – 7: To understand the operator in Vectors

CO – 8: To be well versed in types of Vectors

CO – 9: To understand trigonometric functions

CO – 10: To clearly explain the expansions of trigonometry functions

**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 Algebraic 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  $\sin n\theta$  and  $\cos n\theta$  (n being a Positive integers), Expansions for  $\tan n\theta$ , Pascal Triangle Concept- expansions for  $\cos^n \theta$  and  $\sin^n \theta$ .

**TOTAL: 80h**

#### **TEXT BOOKS:**

1. Dr. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publications , 43<sup>rd</sup> 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, 2011
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



**Course Objective:**

- To understand the basic Principles, theories and laws as well as an awareness of the changing nature of Sciences.
- To analyze, interpret and evaluate scientific hypotheses and theories using Statistical and mathematical methods.
- To understand the basic Principles of Mechanics, Sound, Heat, Electrostatics and Electronics.

**Course Outcome:**

CO – 1: To be well versed in gravitation and Planetary motion.

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

CO – 3: To understand the concepts of Sound and Oscillation.

CO – 4: To clearly explain the concepts of reflection, refraction of light and telescopes.

CO – 5: To clearly understand the concepts of heat and temperature.

CO – 6: To understand the laws and concepts related to Thermodynamics.

CO – 7: To be well versed with the charges and electric field.

CO – 8: To be well versed with radio activity and concepts of nuclear fission and fusion.

CO – 9: To understand the characteristics of diodes, transistors and rectifiers.

CO – 10: To clearly explain the LED, Ruby Laser, Photo electric effect and its applications.

**UNIT I MECHANICS & HYDROSTATIC****12**

Newton's law of gravitation, Newton's Laws of motion, Kepler's 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 Charles' 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  $\alpha$  and  $\beta$ . Photoelectric effect, Einstein's equation, Opto-electronic devices – LDR, LED, 7-segment displays, photo diode, Laser principle, Ruby Laser, Laser applications.

**TOTAL: 60h**

#### **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, Reprint Edition, 2008
2. Brijlal & Subramanian, “Heat & Thermodynamics”, S. CHAND Publications, Reprint Edition, 2006
3. Halliday and Resnick , “Physics Part I & II”, Wiley Publications, Third Edition, 1978
4. V. K. Mehta , “Principles of Electronics”, S.CHAND Publications, Reprint Edition, 2008
5. Brijlal & Subramanian , “A Textbook of Sound” ,Vikas Publication, Second Revised Edition, Reprint 1997
6. D.S.Mathur , “Mechanics”, S. CHAND Publication, 2006 Edition

**Course Objective:**

- To understand how to apply Mathematical principles to Nautical Studies
- To familiarize with graphical representations of complex numbers, matrices, spherical trigonometry
- To apply Algebra principles to Nautical Studies

**Course Outcome:**

CO – 1: To understand Napier’s Rule

CO – 2: To explain clearly about Nautical Quadrants and Trigonometric Quadrants

CO – 3: To be well versed in Algebraic Operators

CO – 4: To understand about removal of Terms from the equations

CO – 5: To clearly explain about proportion and variation

CO – 6: To be well versed in interpolation

CO – 7: To understand types of distribution

CO – 8: To understand operators in Probability

CO – 9: To draw the diagrams of Parabola, Ellipse and Hyperbola

CO – 10: To find perimeter, area and volume of simple shapes

**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 Algebraic Expressions, Product, Factor, Co efficient, Power, Terms, Simple Expressions, Algebraic 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, Cumulative frequency Tables, Compound Line Graph, Bar Chart, Pictogram, Bar Chart, Pie Chart, Histogram, 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.

**TOTAL: 80h**

#### **TEXT BOOKS:**

1. Dr. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publications , 43<sup>rd</sup> Edition, 2013
2. Dr. P.R. Vittal , "Allied Mathematics", Margham Publications, Chennai, Fourth Edition, 2012

#### **REFERENCE BOOKS:**

1. Graham Lawler MA, "Understanding Maths", Viva Study Mates Publishers, Second Edition, 2003
2. Capt. H. Subramanian , "Spherical Trigonometry", Vijaya Publications, First Edition, 1994
3. Capt. G.E. Earl, Capt. D.M. Robinson , "Munro's Mathematics for Deck Officers", Glasgow : Brown, Son & Ferguson, Fifth Edition, 1983
4. Blanche, Capt A.G, "Norie's Nautical Tables", Blance & Wilson Publications, Revised Edition, 1983

**Course Objective:**

- To understand the basic Principles , theories and laws as well an awareness of the changing nature of Sciences.
- To analyze , interpret and evaluate scientific hypotheses and theories using Statistical and mathematical methods.
- To understand the basic Principles of Magnetism, Electricity, Digital Electronics and Communication.

**Course Outcome:**

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

CO – 2: To clearly explain the concept about kew magnetometer and earth inductor.

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

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

CO – 5: To be well versed with amplifiers and Piezoelectric effect .

CO – 6: To understand the laws and concepts of Operational amplifier and its applications.

CO – 7: To understand the Number systems , Logic gates, DeMorgan theorem and adder Circuits.

CO – 8: To be well versed with architecture and programming of Microprocessor 8085.

CO – 9: To understand the concepts of radio waves , skip zone and skip distance.

CO – 10: To understand the concepts of Modulation and clearly explain about the Receiver.

**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, para magnetism, Ferromagnetism, Domain Theory, Hysterisis. 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 Opamp 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. Logic gates. 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.

**TOTAL: 60h**

### **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, 53<sup>rd</sup> 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



**Course Objective:**

- To understand the shape of the Earth, Poles, Equator, Circles
- To apply Navigation principle on Ships Understand Maritime Geography
- To understand Solar Systems

**Course Outcome:**

CO – 1: To be well versed in the Shape of the Earth, Poles, Equator, great Circles.

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

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

CO – 4: To understand the concept of Principle of Mercator projection

CO – 5: To understand the concept of Spherical Triangle

CO – 6: To be well versed in the distance and vertex course on crossing equator

CO – 7: To be well versed in the Solar System

CO – 8: To familiarity in Cause of seasons and unequal length of day and night

CO – 9: To get the Practical problems on parallel sailing, plain sailing and Mercator sailing using formulas

CO – 10: To know how to use the Traverse tables to obtain the position of the Ships.

**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

**TOTAL: 60h**

#### **TEXT BOOKS:**

1. Capt.H.Subramaniam, "Practical Navigation", Vijaya Publications, Reprint Edition, 2016
2. Capt.P.M.Sarma, "Principles of Navigation", Bhandarkar Publications, 4<sup>th</sup> Edition, 1996
3. Capt.T.K.Joseph & Capt.S.S.S.Rewari, "Principles of Navigation", ARI International Pvt. Ltd. Delhi, Reprint 2012
4. Capt. H. Subramaniam, "Nautical Almanac", Vijaya Publications, Fourth Edition, 2014
5. Capt. A.G. Imray Laurie, "Norie's Tables Blance", Norie & Wilson, Reprint 2007

#### **REFERENCE BOOKS:**

1. "Admiralty Manual of Navigation Vol I & II", HMSO, Revised Edition, 1987
2. A.Frost, "Navigation", Brown Son & Ferguson Ltd, Reprint 2006
3. Alfred Nicholl, "Nicholl's Concise Guide Volumes I & II", Brown Son & Ferguson Ltd., Tenth Edition, Reprint, 1987

**Course Objective:**

- To Understand Marine Chronometer, Understand Marine Sextant
- To Understand the Marine Compass

**Course Outcome:**

CO – 1: To be well versed in the need and requirement of a chronometer

CO – 2: To well versed in Time Signals – ALRS III

CO – 3: To know how to use Chronometer Error Book Entries

CO – 4: To understand the advantages of Quartz Crystal Chronometer

CO – 5: To understand the principle, uses and parts of the Micrometer Sextant

CO – 6: To be familiarizing with the errors of the Sextant

CO – 7: To understand the Side Error and Index Error in Navigation

CO – 8: To gather the information about Variation, Deviation and Compass Error

CO – 9: To understand the position of Magnetic compass on Ships

CO – 10: To understand the Parts of the Compass

30

**Marine Chronometer:**

1. Need and requirement of a chronometer
2. Meaning of Constant Daily Rate
3. Time Signals – ALRS III
4. Chronometer Error Book entries
5. Quartz Crystal chronometers – Appearance, Setting of Hours and Minutes
6. Advantages of Quartz Crystal chronometers over Spring Tension chronometers

**Marine Sextant:**

1. Principle , Uses, Parts of the Micrometer Sextant
2. Arc of Excess; Taking readings “On the Arc” & “Off the Arc”
3. Errors of the Sextant – Adjustable Errors – What are Errors of Perpendicularity
4. Side Error and Index Error
5. Non Adjustable Errors – What are Centering, Graduation, Optical, Worm & Rack and Collimation errors

**Magnetic Compass:**

1. What is Variation, Deviation & Compass error;
2. Position of Magnetic Compass on ship
3. Parts of the Compass – Compass Bowl, Binnacle, Lubber line etc
4. Brief Description of Dry Compass Card;
5. Wet Compass Card – Placement of Card in the Bowl
6. Liquid used in Bowl, Removal of air bubble

**TOTAL: 30h**

**TEXT BOOKS:**

University Handout

**Course Objective:**

- To be well versed in how to apply various knowledge of architecture on ship operations.
- To Understand Ship Stability and Statical Stability

**Course Outcomes:**

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

CO – 2: To be well versed in the types of Ships based on nature of Cargo, Passenger Liners, etc.,

CO – 3: To understand the principles parts of Ship

CO – 4: To know the Superstructure of the Ships

CO – 5: To understand the types of Steel in Ships

CO – 6: To clearly explain the general idea of electric arc welding

CO – 7: To clearly understand the Laws of flotation

CO – 8: To clearly understand the center of gravity of ship

CO – 9: To be well versed in the Transverse Statical Stability

CO – 10: To understand the Transverse Statical Stability

**SECTION A – SHIP CONSTRUCTION****UNIT I INTRODUCTION****16**

1. Introduction – Development of ocean-going Merchant Ships. Modern Merchant Ships.
2. 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.
3. 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

**TOTAL: 80h**

### **TEXT BOOKS:**

1. Capt. Errol Fernandes , “Ship Construction”, Marinez Enterprises, Mumbai, Seventh Edition, 2015
2. Kemp & Young , “Ship Construction Notes” , Reprint Edition, 2008
3. Capt. Subramanian.H, “Ship Stability I, II, & III”, Vijaya Publications, 2013
4. Capt. Joseph & Capt. Rewari , “Problems on M.V.Hindship”, ARI Publication, Reprint 2012
5. Capt.Bhandarkar, “Stability Tables M/V Hindship Data Booklet”, Bhandarkar Publications, Reprint 2010

### **REFERENCE BOOKS:**

1. Derrett, “Merchant Ship Stability for Master and Mates”, Butterworth Heinemann, 2012
2. Martin A. Rhodes, “Ship Stability for Mates & Masters”, Seamanship International Ltd, Reprint, 2003
3. La Dage&Gemert, “Stability and Trim for Ships Officer”, DVAN Nostrand Company, 2<sup>nd</sup> Edition, 1946
4. Thomas Reeds, “Ship construction for Marine Students”, Thomas Reed Publications, Illustrated Fifth Edition, 1985
5. Kemp and Young, “Ship construction” , Butterworth Heinemann, Reprint 2008

**Course Objective:**

- To understand the shape of the Earth, Poles, Equator, Circles
- To apply Navigation principle on Ships Understand Maritime Geography
- To understand Solar Systems

**Course Outcome:**

CO – 1: To understand the Celestial Sphere

CO – 2: To be well versed in familiarity with contents of nautical almanac and their use

CO – 3: To understand the Solar Time

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

CO – 5: To be well versed in Azimuths of Sun, Stars and Planets

CO – 6: To understand the principles of azimuth mirrors

CO – 7: To be well versed in the principles of position lines

CO – 8: To understand the position to draw the PL

CO – 9: To find the true azimuth of a heavenly body

CO – 10: To find the direction of position line from an observation of sun, star and planets (Intercept method).

**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  $\sin \text{Amp.} = \text{Sec. Lat} \times \sin \text{Dec.}$  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).

**TOTAL: 60h**

#### **TEXT BOOKS:**

1. Capt.H.Subramaniam , “Practical Navigation”, Vijaya Publications, Reprint Edition, 2016
2. Capt.P.M.Sarma , “Principles of Navigation”,Bhandarkar Publications, 4<sup>th</sup> Edition, 1996
3. Capt.T.K.Joseph & Capt.S.S.S.Rewari, “Principles of Navigation”, ARI International Pvt. Ltd. Delhi, Reprint 2012
4. Capt. H. Subramaniam, “Nautical Almanac”, Vijaya Publications, Fourth Edition, 2014
5. Capt. A.G. Imray Laurie , “Norie’s Tables Blance”, Norie & Wilson, Reprint 2007

#### **REFERENCE BOOKS:**

1. “Admiralty Manual of Navigation Vol I & II” ,HMSO, Revised Edition, 1987
2. A.Frost , “Navigation”, Brown Son & Ferguson Ltd, Reprint 2006
3. Alfred Nicholl, “Nicholl’s Concise Guide Volumes I & II”, Brown Son & Ferguson Ltd., Tenth Edition, Reprint, 1987

## 15BNS009 NAVIGATION – II PRACTICAL 0 0 3 2

### **Course Objective:**

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

### **Course Outcome:**

CO – 1: To be well versed in description of Greenwich Mean Time, Local Time and Standard Time

CO – 2: To understand the division of the earth into various zones

CO – 3: To find the UT and Correct Date

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

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

CO – 6: To briefly describe the description and positions of the corrector magnets

CO – 7: To understand the limitations of the Magnetic compass, care and maintenance of magnetic compass

CO – 8: To understand Description of Compass projector; Advantages of Compass projector

CO – 9: To understand the Parts of Azimuth ring; Use of Azimuth mirror

CO – 10: To understand the guidelines of Stars

30

### **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;

**TOTAL: 30h**

### **TEXT BOOKS:**

University Study Materials

**Course Objective:**

- To understand Ship Stability, Simpson's Rule
- To understand Ship Construction

**Course Outcome:**

- CO – 1: To be well versed in Simpson's Rule and use of Simpson's Rule in the computation of Centroids for area and volume
- CO – 2: To 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: To understand the Change of density effects
- CO – 4: To understand how to use of stability, Hydrostatic and Stress data supplied to Ships
- CO – 5: To understand the Cross curves of stability
- CO – 6: To understand the Carriage of deck cargoes and their effect on stability
- CO – 7: To understand shell plating, Numbering system of hull and deck Plating, Shell expansion plan
- CO – 8: To be well versed in General pumping arrangements - Bilge and Ballast line systems Pumping arrangement on tankers
- CO – 9: To be well versed the Simple sketch of stern frame
- CO – 10: To understand the causes and methods of corrosion control in steel work and also between dissimilar metals including cathodic protection, Impressed current system

**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**

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

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.

**TOTAL: 80h**

**TEXT BOOKS:**

1. Capt. Errol Fernandes , “Ship Construction”, Marinez Enterprises, Mumbai, Seventh Edition, 2015
2. Kemp & Young , “Ship Construction Notes” , Reprint Edition, 2008
3. Capt. Subramanian.H, “Ship Stability I, II, & III”, Vijaya Publications, 2013
4. Capt. Joseph & Capt. Rewari , “Problems on M.V.Hindship”, ARI Publication, Reprint 2012
5. Capt.Bhandarkar, “Stability Tables M/V Hindship Data Booklet”, **Bhandarkar** Publications, Reprint 2010

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1. Derrett, “Merchant Ship Stability for Master and Mates”, Butterworth Heinemann, 2012
2. Martin A. Rhodes, “Ship Stability for Mates & Masters”, Seamanship International Ltd, Reprint, 2003
3. La Dage&Gemert, “Stability and Trim for Ships Officer”, DVAN Nostrand Company, 2<sup>nd</sup> Edition, 1946
4. Thomas Reeds, “Ship construction for Marine Students”, Thomas Reed Publications, Illustrated Fifth Edition, 1985
5. Kemp and Young, “Ship construction” , Butterworth Heinemann, Reprint 2008
6. Evers, “Ship construction” , Butterworth Heinemann, 6<sup>th</sup> Edition, Reprint 2010
7. Pursey, “Ship construction” Brownson & Ferguson, 7<sup>th</sup> Edition, Reprint 2002
8. Taylor, “Ship construction” , Jmarest Publication, Fourth Edition, Reprint 2000

**Course Objective:**

- To understand the Birth of the Universe
- To understand the Earth-Moon System

**Course Outcome:**

CO – 1: To be well versed the Birth of the Universe, Stars, Planets and their Satellites.

CO – 2: To understand the Recognition of Navigation stars.

CO – 3: To familiarize with Keplers Laws

CO – 4: To understand the Inferior and Superior Planets

CO – 5: To get familiarize with Earth – Moon System

CO – 6: To understand how to calculate moonrise/moonset/meridian passage using almanac

CO – 7: To understand the conditions necessary for twilight all night

CO – 8: To Calculate of time of twilight by perusal of the almanac with appropriate corrections

CO – 9: To obtain a position by use of position lines obtained from two or more observations with or without a run (simultaneous or staggered)

CO – 10: To understand fixed errors in sight calculations, computation of altitudes

**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 KEPLERS LAWS**

**12**

Keplers 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 penumbra. 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.

**TOTAL: 60h**

### **TEXT BOOKS:**

1. Capt.H.Subramaniam , “Practical Navigation”, Vijaya Publications, 2013
2. Capt.P.M.Sarma , “Principles of Navigation”,Bhandarkar Publications, 2013
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, 2002
5. Capt. A.G. Imray Laurie , “Norie’s Tables Blance”, Norie & Wilson, 2002

### **REFERENCE BOOKS:**

1. “Admiralty Manual of Navigation Vol I & II” ,HMSO, 2002
2. A.Frost , “Navigation”, 2002
3. “Nicholl’s Concise Guide Volumes I & II”, Brown Son & Ferguson Ltd., 2002



**Course Objective:**

- To understand Marine Chronometer, Master and Slave Clocks
- To find the sextant Altitude of the Sun and Gyro compass

**Course Outcome:**

CO – 1: To be well versed in advancing / retarding of clocks with change in Longitude

CO – 2: To understand the International Date Line

CO – 3: To understand Master / Slave Clocks

CO – 4: To understand the care and maintenance of Chronometer

CO – 5: To find the Sextant Altitude of the Sun

CO – 6: Converting Sextant Altitude to True Altitude for astronomical calculations.

CO – 7: To understand the Properties of a free Gyroscope

CO – 8: To understand the procedure of starting and stopping a Gyro

CO – 9: To understand the Gyroscopic Inertial and Gyroscopic Precession

CO – 10: To understand the methods of finding Gyro Error

**Marine Chronometer:**

**10**

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

**Micrometer Sextant:**

**10**

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

**Gyro Compass:**

**10**

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

**TOTAL: 30h**

**TEXT BOOKS:**

University Study Materials

**Course Objective:**

- To understand Ship Stability
- To understand how to use Simpson's Rule, Dynamic Stability, Bilging
- To understand the types of Ships.

**Course Outcome:**

- CO – 1: To be well versed with the use of Simpson's Rule for the computation second moment of areas.
- CO – 2: To understand the centre of pressure for regular shapes and combination of regular shapes
- CO – 3: To be well versed with Dynamic Stability – Calculation by GZ Curve
- CO – 4: To understand the theory of rolling synchronization
- CO – 5: To understand the Calculation on bilging of a compartment – amidship, end and intermediate compartments
- CO – 6: To understand Calculations based on the foregoing and on the syllabi of Naval Architecture in the first and second year
- CO – 7: To gather information on types of Ships
- CO – 8: To get an out-line knowledge of shipyard practice and procedure
- CO – 9: To understand the classification functions and their societies
- CO – 10: To understand the Classes of fire divisions

**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:**

1. 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.

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.

**TOTAL: 80h**

**TEXT BOOKS:**

1. Capt. Errol Fernandes , “Ship Construction”, Marinez Enterprises, Mumbai, 2002
2. Kemp & Young , “Ship Construction Notes” , 2012
3. Capt. Subramanian.H, “Ship Stability I, II, & III”, Vijaya Publications, 2002
4. Capt. Joseph & Capt. Rewari , “Problems on M.V.Hindship”, 2002
5. “M/V Hindship Data Booklet”, 2002

**REFERENCE BOOKS:**

1. Derrett, “Merchant Ship Stability for Master and Mates”, 2002
2. Martin A. Rhodes, “Ship Stability for Mates & Masters”, 2002
3. La Dage&Gemert, “Stability”, 2002
4. Reeds, “Ship construction for Marine Students”, 2002
5. Kemp and Young, “Ship construction”, 2002
6. Evers, “Ship construction”, 2002
7. Pursey, “Ship construction”, 2005
8. Taylor, “Ship construction” , 2006

**Course Objective:**

- To understand the concept of Bridge Procedure and Equipment
- To understand the concept of Bridge Watch Keeping
- To understand the International Conventions and Codes

**Course Outcome:**

CO – 1: To be well versed with RADAR & ARPA – Description, Features, and Operating Procedure

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

CO – 3: To understand the Bridge Layout and Watch Keeping Methods

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

CO – 5: To understand the Bridge Team Management: Principles & Application

CO – 6: To be well versed in Bridge Resource Management: Principles & Application

CO – 7: To be well versed in 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

CO – 8: To understand the concept of The International Ship and Port Security (ISPS) code

CO – 9: To understand the Merchant Ship Act 1958

CO – 10: To be well versed in ILO regulations with respect to shipboard hygiene

**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 Routing.
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.

**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.

**TOTAL: 60h****TEXT BOOKS:**

1. Capt. H. Subramaniam, “Nautical Watchkeeping”, 2<sup>nd</sup> Edition, Reprint 2012
2. Capt. H. Subramaniam, “Shipborne Radar”, 4<sup>th</sup> Edition, Reprint 2013
3. Sonnenberg, “Electronic Navigation Aids”, 3<sup>rd</sup> Edition, 2000
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, 2002
4. “STCW 2010”, IMO publication, 2010
5. “Bridge Procedures Guide”, ICS publication, 3<sup>rd</sup> Edition, 1988

**Course Objective:**

- To understand the Knowledge of Morse Code
- To understand the familiarization with Bridge Equipment During Ship Visits
- To understand IMP Phrases for Marine Communication

**Course Outcome:**

CO – 1: To be well versed in the Knowledge of Morse Code

CO – 2: To be well versed with the Aldis Lamp

CO – 3: To be well versed with Visual Transmission and decoding of Morse Signals

CO – 4: To familiarized with bridge equipment during ship visits

CO – 5: To understand the 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**

**TEXT BOOKS:**

University Study Materials



# **ABILITY ENHANCEMENT COMPULSORY COURSE**

**Course Objective:**

- To understand the concept of oral and written communication more effectively
- To understand the concept of Grammar
- To improve the Reading and Communication Skills

**Course Outcome:**

CO – 1: To be well versed in the Tourist Trade

CO – 2: To be well versed with Home Truths – Decisions and Choices

CO – 3: To understand the different types of Question forms

CO – 4: To understand the different types of Tense

CO – 5: To be well versed in Reading and Listening Skills

CO – 6: To be well versed in Speaking and Writing Skills

CO – 7: To understand the content of IMO Model Course – Core Section 1

CO – 8: To be well versed in Communication Skills and Group Discussions

**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

**TOTAL: 60h**

### **TEXT BOOKS:**

1. Chris Redston & Gillie Cunningham , “face2face – Intermediate Students Book”, Cambridge University Press, Edition 2014
2. Chris Redston & Gillie Cunningham, “face2face – Intermediate work book”, Cambridge University Press, Edition 2014

### **REFERENCE BOOKS:**

1. Tony Lynch, “Study Listening”, Cambridge University Press, Second Edition, 2004
2. Kenneth Anderson, Joan Maclean & Tony Lynch , “Study Speaking”, Cambridge University Press, 2004 Edition
3. Francoise Grellet , “Developing Reading Skills”, Cambridge University Press, Revised Edition, 2006
4. Liz Hamp-Lyon & Ben Heasley , “Study Writing”, Cambridge University Press, Second Edition, 2006
5. Raymond Murphy, “Murphy’s English Grammar” Cambridge University, Third Edition, 2004
6. Nancy Lumban Batu, “Model Course - Maritime English 3.17” ,IMO, 2000

**Course Objective:**

- To be well versed to understand the basic electronics devices working conditions
- To understand the concept of CRO
- To understand the basic principles of Rectifier

**Course Outcome:**

CO – 1: To be well versed in Semi conductor diode – Characteristics

CO – 2: To understand the Zener Diode – Characteristics

CO – 3: To understand the Spectrometer – Refractive index of the Prism

CO – 4: To familiarize with the Use of CRO

CO – 5: To understand the Thermistor as a Thermometer

CO – 6: To familiarize with the CB Characteristics, current amplification factor

CO – 7: To understand the Newton’s Rings

CO – 8: To be well versed in Young’s modulus – non-uniform bending – pin & Microscope

CO – 9: To understand the concept of Full, Half and Bridge Rectifiers

CO – 10: To understand the CE Characteristics of Transistor, Current amplification factor

**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.

**TOTAL: 30h**

**TEXT BOOKS:**

1. M. Nelkon & J.M. Ogborn , “Advanced level practical Physics”, Heinemann Educational Books, Second Edition, 1964
2. Zabar, “Electronics – A Text Lab Manual”, MC Graw Hill, 14<sup>th</sup> Reprint, 1999
3. M.N. Srinivasan, S. Balasubramanian, R.Ranganathan, “A Text book of Practical Physics”, Sultan Chandan Sons, 2011

**Course Objective:**

- To understand Phonetics, Real or Imagery
- To be well versed in Quantifiers
- To understand the Active and Passive, Modal Verbs
- To be well versed in Reported Speech, Lexis, Function, Grammar, Skills

**Course Outcome:**

CO – 1: To understand the technology in Phonetics, Lexis, Functions

CO – 2: To be well versed in Real or Imagery

CO – 3: To be well versed in Quantifiers

CO – 4: To be well versed in Active & Passive Voice

CO – 5: To be well versed in Reading and Listening Skills

CO – 6: To be well versed in Speaking and Writing Skills

CO – 7: To understand the Contents of IMO model course 3.17 – Core Section 2

CO – 8: To be well versed in Communication Skills and Debates

**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

**TOTAL: 60h**

### **TEXT BOOKS:**

1. Chris Redston & Gillie Cunningham , “face2face – Intermediate Students Book”, Cambridge University Press, Edition 2014
2. Chris Redston & Gillie Cunningham, “face2face – Intermediate work book”, Cambridge University Press, Edition 2014

### **REFERENCE BOOKS:**

1. Tony Lynch, “Study Listening”, Cambridge University Press, Second Edition, 2004
2. Kenneth Anderson, Joan Maclean & Tony Lynch , “Study Speaking”, Cambridge University Press, 2004 Edition
3. Francoise Grellet , “Developing Reading Skills”, Cambridge University Press, Revised Edition, 2006
4. Liz Hamp-Lyon & Ben Heasley , “Study Writing”, Cambridge University Press, Second Edition, 2006
5. Raymond Murphy, “Murphy’s English Grammar” Cambridge University, Third Edition, 2004
6. Nancy Lumban Batu, “Model Course - Maritime English 3.17” ,IMO, 2000

**Course Objective:**

- To understand the basic electronics devices working conditions
- To understand the concept of Microprocessor
- To understand the basic principles of Logic Gates

**Course Outcome:**

- CO – 1: To understand the LCR – Series circuit to find the resonance frequency. Determination of Quality factor for different R combinations
- CO – 2: To be well versed in Demorgan’s Theorem and Associative Laws – Verification
- CO – 3: To be well versed in OPAMP
- CO – 4: To understand how to do Microprocessor – Addition & Subtraction (8 Bit)
- CO – 5: To understand how to do Microprocessor – Addition & Subtraction (16 Bit)
- CO – 6: To design an Astable Multivibrator using IC 555 Timer
- CO – 7: To understand LCR – Parallel circuit to find the resonance frequency
- CO – 8: To understand the Effective Resistance – Series and Parallel combination
- CO – 9: To be well versed in Study of Logic gates and construction of Boolean expressions
- CO – 10: To be well versed in Construction of Universal building block

**List of Experiments**

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 Astable Multivibrator 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.

**TOTAL: 30h**

**TEXT BOOKS:**

1. M. Nelkon & J.M. Ogborn , “Advanced level practical Physics”, Heinemann Educational Books, Second Edition, 1964
2. Zabar, “Electronics – A Text Lab Manual”, MC Graw Hill, 14<sup>th</sup> Reprint, 1999
3. M.N. Srinivasan, S. Balasubramanian, R.Ranganathan, “A Text book of Practical Physics”, Sultan Chandan Sons, 2011

**Course Objective:**

- To understand how to apply Voyage Planning knowledge during practice and working
- To understand the types of Projections
- To understand Nautical Chart
- To understand Winds and Current Effect

**Course Outcome:**

CO – 1: To be well versed in the Nautical Chart

CO – 2: To understand the types of Projection in Voyage Planning

CO – 3: To understand the Compass Points

CO – 4: To be well versed in the Deviation of Compass and the Deviation card

CO – 5: To be well versed in the effect of wind and current

CO – 6: To be well versed in the depths and lights

CO – 7: To find compass error/gyro error by transit bearing

CO – 8: To plot ship's position given the compass bearings/gyro bearings of two or more shore objects.

The cocked bat and the reasons for its formation

CO – 9: To plot ship's position, given vertical sextant angles and bearing of a lighthouse

CO – 10: 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

**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**

Compass points. 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 COMPASS**

**12**

1. To find compass error/gyro error by transit bearing
2. To find the position of a point on the chart by its latitude and longitude
3. To find the position of a point on the chart by its bearing and distance from a navigational mark.
4. To plot ship's position given the compass bearings/gyro bearings of two or more shore objects. The cocked hat and the reasons for its formation.
5. To plot ship's position given the rising or dipping bearing of light. Caution during abnormal refraction.
6. 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 SEXTANT ANGLES AND BEARING OF A LIGHTHOUSE**

**12**

1. To plot ship's position, given vertical sextant angles and bearing of a lighthouse.
2. To plot a position line obtained by an astronomical observation.
3. To find compass course/gyro course between two positions on the chart.
4. 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'
5. 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.
6. 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**

### **TEXT BOOKS:**

1. Capt.S.K.Puri, "Chart Work for Mariners", Marine Publications, Reprinted March 2011
2. J.A.L Myres, "B.A Chart 5011", Admiralty Chart and Publications, 2006
3. Alexander Wang Young, "Extracts of ATT", 2010

**REFERENCE BOOKS:**

1. Capt. M.V.Naik & Capt.Varty , “Voyage Planning & Chartwork”, 2003
2. Capt. S.S.Chaudhari , “Chartwork”, AS Publications, 6<sup>th</sup> Edition, 2000
3. Capt W.H.Squair, “Modern Chartwork”, Brownson & Ferguson Ltd, ”, 6<sup>th</sup> Edition, 1992

**Course Objective:**

- To apply the Collision Prevention during practice and working
- To understand International Regulations for preventing collisions
- To understand Maintenance of safe speed

**Course Outcome:**

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

CO – 2: To be well versed in responsibility for the consequence of neglect of rules

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

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

CO – 5: To be well versed in maintenance of safe speed

CO – 6: To understand the factors to be considered for determining safe speed

CO – 7: To understand the types of actions to be taken to avoid collision or close quarter situation.

CO – 8: To understand the action of avoid collision

CO – 9: To determination of risk of collision when another vessel is detected by radar alone

CO – 10: To take Action when fog signal of another vessel is heard but vessel is not seen though it may have been detected by radar

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**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 manoeuvre’ ‘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 separation 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.

**TOTAL: 30h**

## **TEXT BOOKS:**

1. Capt. Bhandarkar, “Rules for the Prevention of Collision at Sea”, Bhandarkar publications, 2012

## **REFERENCE BOOKS:**

1. Capt.puri.S.K , “Rule of the Road Manual”
2. Moore.D.A , “International Lights, Shape, and Sound Signals”, 4<sup>th</sup> Edition, 2005
3. Capt. Chabra, “A Mariners Guide to preventing collisions”, Marex India Pvt Ltd, Reprint 2012

**Course Objective:**

- To understand Elementary knowledge of passage planning and its execution
- To understand basic theory of tides
- To understand the interpretation of chart

**Course Outcome:**

CO – 1: To be well versed in Elementary Knowledge of Passage Planning and its execution

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

CO – 3: To get knowledge on the basic theory of tides

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

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

CO – 6: To be well versed in the use of radar in Navigation

CO – 7: To understand the Association of Lighthouse Authorities (IALA) Maritime Buoyage System

CO – 8: To understand the Rising and dipping distances Characteristics and range of lights

CO – 9: To determine ships position by running fix method with or without current

CO – 10: To find the ships position by doubling angle on the bow

**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**

**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**

**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. Aids to radar

navigation; use of passive and active aids, RACONS and SARTS. 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**

**12**

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

#### **UNIT V SHIP POSITION BY RUNNING FIX METHOD**

**12**

1. To determine ship's position by running fix method with or without current.
2. To find the ship's position by doubling angle on the bow.
3. Use of single position line obtained from a celestial observation when near a coast to keep safe distance off the coast.
4. To find course made good using the three point bearing
5. Practical's of Voyage Planning I to be included.

**TOTAL: 60h**

#### **TEXT BOOKS:**

1. Capt. S.K. Puri, "Chart Work", 2002
2. B.A Chart 5011, HMSO, 2002
3. Extracts of ATT, 2000

#### **REFERENCE BOOKS:**

1. Capt. M.V. Naik & Capt. Varty, "Voyage Planning & Chartwork", 2002
2. Capt. S.S. Chaudhari, "Chartwork", 2002
3. Capt W.H. Sauair, "Modern Chartwork", Admiralty Publications, 2014



**Course Objective:**

- To complete understanding and application of all rules of convention of International collision prevention at Sea
- To understand Collision Situations by day and night
- To understand recognition of various buoys and marks

**Course Outcome:**

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

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

CO – 3: To take precautions while floating navigational aids such as light vessels etc

CO – 4: To get practice with Radar plotting

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

CO – 6: To deal with collision situation broadly under the heading recognition

CO – 7: To understand the collision situations in restricted visibility with or without radar.

CO – 8: To understand the Recognition of various buoys and marks under IALA system and appropriate action required under the rules

**UNIT I RULES OF CONVENTION**

**6**

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**

**6**

The students will be required to identify 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**

**6**

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**

**6**

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

## **UNIT V RECOGNITION OF VARIOUS BUOYS**

**6**

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

**TOTAL: 30h**

### **TEXT BOOKS:**

1. Capt. Bhandarkar, "Rules for the Prevention of Collision at Sea", Bhandarkar publications, 2002

### **REFERENCE BOOKS:**

1. Capt.puri.S.K , "Rule of the Road Manual", 2<sup>nd</sup> Edition, 2000
2. Moore.D.A , "International Lights, Shape, and Sound Signals", 2<sup>nd</sup> Edition, 1996  
Capt. Chabra, "Guide to collision avoidance", 1997

**Course Objective:**

- To able to understand need for public awareness on Environmental Science
- To understand the Ecosystems and Environmental Pollutions
- To understand Human Population and the environment

**Course Outcome:**

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

CO – 2: To be well versed in scope and importance of Environmental Science

CO – 3: To get the need for public awareness

CO – 4: To understand the Natural Resources

CO – 5: To understand the Ecosystems

CO – 6: To understand the Environmental pollution

CO – 7: To understand the social issues and the environment

CO – 8: To understand the Human population and the environment

**UNIT I DEFINITION**

**6**

- a. Definition
- b. Scope and importance.
- c. Need for public awareness

**UNIT II NATURAL RESOURCES**

**6**

- a. Natural resources
- b. Ecosystems

**UNIT III ENVIRONMENTAL POLLUTION**

**6**

- a. Environmental pollution

**UNIT IV SOCIAL ISSUES**

**6**

- a. Social issues and the environment

**UNIT V HUMAN POPULATION**

**6**

- a. Human population and the environment

**TOTAL: 30h**

**TEXT BOOKS:**

1. S.N. Chary , “Environmental Studies”, Macmillan India Limited, 2002
2. M. Prasanthrajan , “A text book on Ecology and Environmental Science”, 2000
3. Erach Bharucha, “Environmental Studies”, UGC, 2004

**Course Objective:**

- To understand the elementary knowledge of passage planning and its execution
- To understand the basic theory of Tides
- To understand the interpretation of chart

**Course Outcome:**

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

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

CO – 3: To be well versed a systematic knowledge and use of the contents of the documents in relation to safety

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

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

CO – 6: To be well versed in comparison of ECDIS and paper charts

CO – 7: To understand the concept of Automatic Identification System (AIS)

CO – 8: To understand the use of precautions during use of AIS for collision avoidance

CO – 9: To understand the use of ECDIS and GPS for passage planning

CO – 10: To 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

**UNIT I TIME AND HEIGHT**

**12**

1. To find the time and height of HW and LW at Secondary ports by tidal differences
2. 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**

**12**

1. A systematic knowledge and use of the contents of the following documents in relation to safety.
  - a. Sailing directions.
  - b. List of lights & fog signals.
  - c. List of radio signals.
  - d. Ocean passages of the world.

- e. Notices to mariners/Weekly/Cumulative/Annual.
  - f. M &Ms notices
  - g. Guide port entry.
  - h. Mariners Hand Book
  - i. Routing Charts
  - j. Ship's Routing.
2. Selection of ocean routes, shore based weather routing, planning & executing a coastal passage.
  3. Navigation in pilot age waters, approaching and passing through a traffic separation scheme.

### **UNIT III ELECTRONIC SYSTEMS OF POSITION FIXING**

**12**

1. Electronic Systems of Position Fixing. GNSS (Global Navigation Satellite System) GPS, DGPS, GLONASS, GALLILEO, Basic principles and errors of GPS and DGPS.
2. Development of ECDIS. Comparison of ECDIS and paper charts. Difference between Raster and Vector charts Difference between ECS and ECDIS. Electronic Chart Symbols.

### **UNIT IV PURPOSE OF AIS**

**12**

1. 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
2. LRIT (Long Range Identification and Tracking) purpose and difference between LRIT and AIS .
3. VDR (Voyage Data Recorder) concept and purpose S-VDR(Simplified VDR)

### **UNIT V ECDIS & GPS**

**12**

1. Position fixing by various methods, current & leeway, running fix and three point bearing  
Astronomical position lines and use of ECDIS and GPS for passage planning.
2. 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.,

**TOTAL: 60h**

#### **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", Reprint Edition, 1997
2. Capt. S.S.Chaudhari , "Chartwork", 2<sup>nd</sup> Edition, 2000
3. Capt W.H.Sauair, "Modern Chartwork", Admiralty Publications, 3<sup>rd</sup> Edition, 2002

**Course Objective:**

- To understand the use of Radar
- To be well versed the annexes of International regulations for prevention of collision and IALA buoy age system
- To understand the Radar Plotting Exercise
- To understand the use of ARPA for collision

**Course Outcome:**

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

CO – 2: To understand the Radar plotting exercises

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

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

CO – 5: To obtaining the information from ARPA Displays

CO – 6: To identify various collision situations by day and night using magnetic board, wooden models or any other aid to simulate such conditions

CO – 7: To deal with each collision situation broadly under the heading recognitions

CO – 8: To be well versed the Recognition of various buoys & marks under IALA system and appropriate action required under the rules

**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.

4. 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.

5. 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.

**TOTAL: 30h**

**TEXT BOOKS:**

1. Capt. Bhandarkar, "Rules for the Prevention of Collision at Sea", Bhandarkar publications, 2000
2. Capt.H.Subramaniam , "Ship borne Radar", Vijaya Putblications, 2012

**REFERENCE BOOKS:**

1. Moore D.A , "International Light, Shape & Sound Signals", 2000
2. A.N.Cockroft, "A Guide to Collision Avoidance", 2002
3. IALA, "Maritime Buoy age System", 2001

**Course Objective:**

- 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

**Course Outcome:**

CO – 1: To understand the concept of Law

CO – 2: To be well versed in various branches of Law

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

CO – 4: To be well versed in Criminal Law

CO – 5: To be well versed in UNO – Organisation, Role and Functions

CO – 6: To be well versed in IMO – Organisation, Role and Functions

CO – 7: To understand the Active Legislation and Passive Legislation

CO – 8: To understand the Law of Contracts

CO – 9: To understand the legal remedies in common law

CO – 10: To understand the aims of investigation

**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



**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 Possessory 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

**TOTAL: 80h**

**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”
9. Gopalan Nair , “Maritime Law of India”

**Course Objective:**

- To understand the international trade and shipping
- To understand the roles of customs, Organization of Shipping Company
- To understand the know the Maritime frauds

**Course Outcome:**

CO – 1: To understand the International Trade and Shipping

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

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

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

CO – 5: To be well versed in the procedures and documentation relating chartering

CO – 6: To understand the Organization of shipping company - manpower planning - business and cargo management - statutory regulations to be complied with like foreign exchange regulation

CO – 7: To understand the difference between principals and intermediaries

CO – 8: To understand the Customs act and documents relating to customs relating to ship operations and trade

CO – 9: To be well versed in maritime administration in India and India's shipping policy

CO – 10: To understand the Safeguards to be taken to prevent frauds with special reference to shipping industry, operators and seafaring personnel

**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 lading, 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. India's 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

**TOTAL: 80h**

#### **TEXT BOOKS:**

1. DR.A.V.Athalye , “Basic Marine Management”, Bhandarkar Publications, 2000
2. University Handout

#### **REFERENCE BOOKS**

1. Dr. S.N. Saklecha , “Economics of Shipping & Other Papers” , 2002
2. Ellen and Campbell, “International Maritime Fraud”, Witherby Publications, 2000
3. Alan Branch , “Elements of Shipping”, Chapman and Hall, 1989
4. Dr.K.V.Hariharan, “Containerization era in India”, 2000

# **DISCIPLINE SPECIFIC ELECTIVE COURSES**

**Course Objective:**

- To understand the dynamics of the ocean and the atmosphere
- To understand the physical processes in the ocean and atmosphere
- To be well versed the factors affecting atmospheric motion and resulting winds

**Course Outcome:**

CO – 1: To understand the characteristics of the Earth’s Atmosphere

CO – 2: To understand the composition, equation of state for dry air and moist air.

CO – 3: To understand the water vapour in the Atmosphere.

CO – 4: To be well versed in the Tephigram and its uses.

CO – 5: To be well versed in the development and classification of clouds

CO – 6: To understand the Principles and methods of surface meteorological observations

CO – 7: To be well versed in the Basic concepts, Factors governing development & properties of Air  
Masses

CO – 8: To understand the Classification, Convergence & Divergence

CO – 9: To be well versed in Forecasting Techniques

CO – 10: To understand the Practical rules of navigation for maneuvering in the vicinity of a T.R.S

**UNIT I EARTH ATMOSPHERE**

**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 MASSSES** **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

**TOTAL: 80h**

#### **TEXT BOOKS:**

1. Capt.H.Subramaniam , “Marine Meteorology”, Vijaya Publications, Reprint 2014

#### **REFERENCE BOOKS:**

1. “Meteorology for Mariners”, HMSI, London, HMSO, First Edition, 1956
2. “Marine Observer’s”, HMSO, London Academic press, 10Edition, 1977
3. “Elementary Meteorology”, HMSO, London, HMSO, First Edition, 1956
4. James.R. Holton , “An Introduction to Dynamic Meteorology”, Academic Press, Fourth Edition, 2004
5. Petterson.B, “Introduction to Meteorology”, MC Graw Hill, 1958
6. University Handout



**Course Objective:**

- To understand the reason for sea transport, Port State, Control, Dry Cargo,
- To be well versed with the Ship Sale and Purchases
- To understand the different shipping markets and operations of ships

**Course Outcome:**

CO – 1: To understand the reason for Ship transport

CO – 2: To be well versed the conclusion the supply of Ships

CO – 3: To be well versed why to operate ships

CO – 4: To description of various tonnage and types of Ships, cargo gears, crude oil and product tankers

CO – 5: To understand the Bill of Lading Terms & Conditions

CO – 6: To understand the Practitioners in Shipping Business

CO – 7: To understand the Ship Sale & Purchase

CO – 8: To be well versed with the Maritime Geography

CO – 9: To be well versed with Liner Bill of Lading

CO – 10: To understand the Breach of Warranty of Authority

**UNIT I REASON FOR SEA TRANSPORT**

**12**

The reasons for Sea Transport – Introduction – Why Ships – Different Shipping markets – Who Trades – Conclusion The Supply of Ships – Brief History – Supply of Shipping – Why operate Ships – Protectionism – Ship Registration – Port State Control – Ship Classification

**UNIT II HISTORY OF SHIPS**

**12**

The Ship – History of ships , why to operate ships , ship registration Tonnage & Load lines – description of various tonnage and types of Ships, cargo gears , crude oil and product tankers ,The Dry Cargo Chartering market – Introduction – Chartering – various charter parties and description of charter parties.

**UNIT III LINERS**

**12**

Introduction – The Development of Tankers & the Tanker Market – Types of tankers – Tanker Charter Parties - Negotiating Charter, Brief History of Containerisation – Conferences & Freight Tariffs – Liner Documentation - Bill of Lading Terms & Conditions

## **UNIT IV PRACTITIONERS IN SHIPPING BUSINESS**

**12**

The Practitioners in Shipping Business – The Institute of Chartered Ship Brokers – Ship Sale & Purchase – Ship Management, Maritime Geography – Introduction – Ocean & Seas – Ports – Geography of trade

## **UNIT V ACCOUNTS**

**12**

Accounts – Introduction – Accounting – Capital – Credit- management accounting – Cash Flow- Costs – Different types of Companies- Exchange Rates- Company accounts, Law of Carriage – Introduction – Fundamentals of English Law – Arbitration – The Contract – Remedies for breach of Contract – TORT- Contracts Relating to the carriage of goods by sea – Liner Bill of Lading – the Hague visby Rules – Hamburg rules – Agency- Breach of Warranty of Authority – Protection & Indemnity Associations

**TOTAL: 60h**

### **TEXT BOOKS:**

1. Introduction to Shipping, Institute Of Chartered Shipbrokers, Witherby Seamanship International Ltd, 2nd Revised edition, 2009.
2. Jacob Kamm, Sean Connaughton, Gustaf Erikson, Robert Moran, Sir George Renwick, "Shipping Biography Introduction", 1st Baronet, Llc Book, 1994.

### **REFERENCE BOOKS:**

1. Lambert M Surhone, Miriam T. Timpledon, Susan F. Marseken VDM Verlag Dr.Mueller Ag & Co Ka., Nov 2010

**Course Objective:**

- To understand the dynamics of the ocean and the atmosphere
- To understand the physical processes in the ocean and the atmosphere
- To understand the factors affecting atmospheric motion and resulting winds

**Course Outcome:**

CO – 1: To understand the formation of the earth and its structure

CO – 2: To be well versed in the Evolution of continents and ocean basins

CO – 3: To understand the physical properties of Sea Water

CO – 4: To understand the energy budget of the ocean

CO – 5: To be well versed in the causes and spatial distribution of surface circulation seasonal changes

CO – 6: To understand the Major relief features of the ocean floor

CO – 7: To understand the Basic considerations in Voyage Planning; selection and use of data

CO – 8: To be well versed the Basic causes; common pollutants; greenhouse effect and global warming

CO – 9: To understand the Atmospheric pollution by marine transportation

CO – 10: To gather information on Role of IMO in preventing oil spills

**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 VOYAGE 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. , 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.

**TOTAL: 80h**

### TEXT BOOKS:

1. Capt.H.Subramaniam , “Marine Meteorology”, Vijaya Publications, Reprint 2014

### REFERENCE BOOKS:

1. “Meteorology for Mariners”, HMSI, London, HMSO, First Edition, 1956
2. “Marine Observer’s”, HMSO, London Academic press, 10 Edition, 1977
3. “Elementary Meteorology”, HMSO, London, HMSO, First Edition, 1956
4. James.R. Holton , “An Introduction to Dynamic Meteorology”, Academic Press, Fourth Edition, 2004
5. Petterson.B, “Introduction to Meteorology”, MC Graw Hill, 1958
6. University Handout

## **15BNS104 SAFE MAINTENANCE ON SHIPS 5 0 0 3**

### **Course Objective:**

- To able to general Safety and Cleanliness on board, personal Protective Equipment, Risk Assessment, Personal Protective Equipment
- To understand Work Activities and Maintenance

### **Course Outcome:**

CO – 1: To understand the general safety and cleanliness on board

CO – 2: To be well versed in the guidance on main elements of risk assessment

CO – 3: To be well versed the uses and care of Personal protective equipment

CO – 4: To understand the use of helmets and goggles in specific work areas

CO – 5: To understand the safe systems of Work

CO – 6: To know how to use portable ladders

CO – 7: To understand the machinery maintenance

CO – 8: To be well versed in the high voltage systems

CO – 9: To understand the use of safety signs

CO – 10: To understand the International color coding of signs

### **UNIT I GENERAL SAFETY AND CLEANLINEES ON BOARD**

**12**

General safety and cleanliness on board. Risk Assessment – Introduction – Key terms – Principles – What and when to assess and by whom-Elements of risk assessment – Guidance on main elements of risk assessment.

### **UNIT II PERSONAL PROTECTIVE EQUIPMEN**

**12**

Personal protective equipment. Its use and care – Introduction – employer duties – worker duties-types of equipment – head protection-hearing protection-face and eye protection-respiratory protective equipment-head and foot protection-protection from falls-body protection. Carriage of tools.Use of helmets and goggles in specific work areas. Reporting and standard communication systems between individuals and between work stations.

### **UNIT III WORK ACTIVITIES**

**12**

Work Activities – Safe Systems of Work – Introduction – Working aloft and outboard – portable ladders – cradles and stages – Bosun’s chair-Working from punts – work in machinery spaces-Boilers – Unmanned Machinery spaces – Refrigeration Machinery – Scaffolding-

### **UNIT IV MAINTENANCE**

**12**

Maintenance – Introduction – General – Floorplates and hand rails – Machinery maintenance- Boilers – Auxiliary machinery and equipment-Main engines-Refrigeration machinery and refrigerated compartments-steering gear – hydraulic and pneumatic equipment-electrical equipment-Main switch boards-distribution switchboards-electrical machinery- High Voltage systems-storage batteries –general – lead acid-alkaline batteries- radio and associated equipment – valves and semi-conductor devices

### **UNIT V USE OF SAFETY SIGNS**

**12**

Use of Safety Signs –Introduction – Signs and notices – Occasional signs – Electrical wiring-Gas cylinders – pipe lines – portable fire extinguishers – International color coding of signs – Permit to work systems – Introduction – Sanction-to-test systems – Permit to work in UMS, enclosed space, machinery equipment, Hot Work – Working aloft – General electrical – HV electricity – Sanction to test above 1000V.

**TOTAL: 60h**

#### **TEXT BOOKS:**

Code of Safe Practices for Merchant Seamen – IMO Publications Consolidated Edition 2010

**Course Objective:**

- To understand the basic concept of the Global Maritime Distress and Safety System (GMDSS) is that search and rescue authorities ashore, as well as shipping in the immediate vicinity of a ship in distress, will be rapidly alerted to a distress incident so they can assist in a coordinated search and rescue operation with the minimum of delay.

**Course Outcome:**

CO – 1: To understand the radio communication equipment on board ships

CO – 2: To be well versed the principles of operation and selection of frequencies

CO – 3: To understand VHF/MF/HF DSC Distress alert, sending, receiving and acknowledgement, cancellation of distress message. Distress relay

CO – 4: To understand VHF/MF/HF DSC urgency, safety calls and subsequent R/T traffic

CO – 5: To be well versed in VHF/MF/HF calling and replying frequencies

CO – 6: To understand how to use DSC to establish initial call

CO – 7: To be well versed in MF/HF lifeboat radio

CO – 8: To be well versed in Emergency Position Radio Beacons (EPIRBs).

CO – 9: To understand the Principles and actual applications of Worldwide Navigational Warning System

CO – 10: To understand the Maritime Safety Information (MSI) for basic NAVTEX system concept and NAVAREAs

**UNIT I INTRODUCTION****6**

1. Radio communication equipment on board ships – introduction to various equipment, principle of operation, selection of frequencies.
2. Radio regulations relating to Maritime Services including maritime frequency allocation.
3. Satellite communication and alerting systems – equipment aboard ship and ashore. Methods of communication used.
4. Global Maritime Distress and Safety System (GMDSS) – Principles and actual applications.
5. MERSAR, IAMSAR and AMVER
6. Inmarsat communication systems – Sat B, Sat C, Sat M and recent development of advanced communication systems. EGC messages.

**UNIT II DISTRESS, URGENCY AND SAFETY COMMUNICATIONS****6**

1. VHF/MF/HF DSC Distress alert, sending, receiving and acknowledgement, cancellation of distress message. Distress relay.
2. VHF/MF/HF DSC urgency, safety calls and subsequent R/T traffic.

3. On-scene communication and SAR operations.
4. R/T Distress subsequent traffic. Urgency and Safety communications.

**UNIT III OPERATIONAL PROCEDURES FOR GENERAL COMMUNICATIONS 6**

1. VHF/MF/HF calling and replying frequencies.
2. Using DSC to establish initial call.
3. Transmission and reception of routine R/T communications.

**UNIT IV SURVIVAL CRAFT RADIO EQUIPMENT 6**

Basic Operational Specifications, Characteristics and Routine Testing:

1. Portable (immersion proof) VHF radios.
2. MF/HF lifeboat radio.
3. Search and Rescue Radar Transponders (SARTs).
4. Emergency Position Radio Beacons (EPIRBs).

**UNIT V NAVTEX 6**

1. Worldwide Navigational Warning System - Principles and actual applications.
2. Maritime Safety Information (MSI) for basic NAVTEX system concept and NAVAREAs.
3. NAVTEX receiver operational characteristics, set up procedures and message format and use as an aid to safe navigation.

**TOTAL: 30h**

**TEXT BOOKS:**

1. Clifford Merchant, "GMDSS for GOC", Shorelines Innovations India Pvt. Ltd., 2007
2. University Handout

**REFERENCE BOOKS:**

1. GMDSS Handbook - 2007



**Course Objective:**

- To Understand Various Business Entities, Port Agents
- To Understand Geography of Trades
- To Understand International Shipping Organizations

**Course Outcome:**

CO – 1: To understand the business entity

CO – 2: To be well versed in the practitioners in Shipping Business

CO – 3: To be well versed with port agents

CO – 4: To understand the ethics in Shipping Business

CO – 5: To be well versed with the Geography of Trade

CO – 6: To be well versed in the International Terms of sale

CO – 7: To understand the Finance in International Trade

CO – 8: To gather the knowledge of the Transaction cost in International Trade

CO – 9: To be well versed with the International Shipping Organizations

CO – 10: To understand the Basic Principals of Business Communication, Modes of Communication

**UNIT I THE BUSINESS ENTITY****6**

The business entity – Sole Trader, Partnerships, Limited liability companies, Horizontal and Vertical integration, Company organization and management, Management accounts, Statutory Accounts, Quality Management. The Practitioners in Shipping Business – The Merchant, The Chartering Markets, The Charter Party, The Anatomy of Charter Parties, Time Charters, The Market at Work, The Tanker Market, Chemicals and Other Products, Tanker Charter Parties, The Practitioners. The Practitioners (Contd...) – Ship Sale & Purchase, Scrapping- Mothballing, New buildings, Second hand tonnage, Financing the purchase, Valuations, Ship Managers, Crewing, Total Management, Technical, Operations, Administration, The contract.

**UNIT II PORT AGENTS****6**

Port Agents, The Agents fee, European Community, The Agents Duties, Liner Agency, Dealing with the Ship, Dealing with outward Cargo, Dealing with Inward Cargo. Business Ethics – What are ethics?, Ethics in Shipping business, Maritime Fraud, Insurance Fraud, Documentary Fraud, Other areas of Fraud, Other Criminal Activities, Detecting and Avoiding Fraud.

**UNIT III THE GEOGRAPHY OF TRADE****6**

The Geography of Trade – Sea Borne Trade, Oil, Coal, Ores, Grains, Other dry Bulk Cargoes, Unitised Cargo, Ports, LOA, Beam, Draft, Air Draft, SWAD, FWAD, BWAD, Bar Draft, ST Lawrence Seaway, Panama Canal, Snez Canal, Political Restrictions, Trade Union Disputes, Natural Phenomena Tides, Weather and Navigation, Ocean currents, Ice, Weather Routine, Oceans, Navigational and Seasonal Zones

International Trade and Finance : International Terms Of Sale – The Basic Contract, Goods, Property, Risk, International Contracts of Sale - Incoterms, FAS, FOB, Variants on FOB Contract, CIF, CFR, DES, DEQ, EXW, FCA, CPT, CIP, DAF, DDV, DDP, Remedies for Breach of Contract, Remedies of the Seller, Stoppage in Transitu, Lien, Remedies of the Buyer, Specific Performance, Law & Jurisdiction, Postscript.

#### **UNIT IV FINANCE IN INTERNATION TRADE**

**6**

Finance in International Trade – Methods of Payment, Cash with Order, Open Account, Bill of Exchange, Documentary Letter of Credit, Documents Confirming Houses, Foreign Exchange Fluctuations, Spot Rate, Forward Exchange Contracts, Foreign Currency options, Transaction cost in International Trade, Insurance, Insurable Interest, Trade Terms in Export Sales, Warranties, Types of policies for Cargo, Effecting Insurance, The Assessing of a Risk, Conditions of Insurance, Institute Cargo Clauses, Institute War Clauses, Premiums, Claims Procedures, The Principal of Average.

#### **UNIT V INTERNATIONAL SHIPPING ORGANIZATIONS**

**6**

International Shipping Organizations – Ship owners’ Organization, Intercargo, INTERTANKO, BIMCO, Brokers & Agents Organizations, The Institute of Chartered Ship Brokers, The Baltic Exchange, Ethics, FONASBA, FIATA, United Nations Organizations, IMO, UNCTAT, ICC, IMB, The Corporations of Lloyds, Lloyds Agents, Classification Societies, Lloyds Register of Shipping, IACS, ITF. Communication in business – Basic Principals of Business Communication, Modes of Communication, Public Speaking and Broadcasting, The Telephone, Punctuation, Grammar & Syntax, Letters, Writing for the Media, Memoranda, Visual Communication, Graphs, Charts, Communication by computer, Electronic Mail, Electronic Data Interchange, Data Storage and Retrieval, The Internet & e-commerce

**TOTAL: 30h**

#### **TEXT BOOKS:**

1. “Shipping Business by institute of chartered ship brokers”, UK, 2012
2. University Handout

#### **REFERENCE BOOKS:**

1. Jacob Kamm, Sean Connaughton, Gustaf Erikson, Robert Moran, Sir George Renwick, “Shipping Biography Introduction”, 1st Baronet, Llc Book, 1994.

**Course Objective:**

- To understand Strength of Materials, Understand Thermodynamics,
- To understand Marine Engineering Practices, and Mechanical Properties of Materials

**Course Outcome:**

CO – 1: To understand the strength of materials

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

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

CO – 4: To understand the Meaning of sensible heat & latent heat

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

CO – 6: To be well versed in 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

CO – 7: To understand the Services to be supplied from emergency generator

CO – 8: To understand the Procedure for starting emergency generator manually

CO – 9: Classification of ship as per propulsion plants

CO – 10: General layout of ship's engine room & machinery

**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 & 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<sub>2</sub> 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
5. Navigation light circuit with indicators / alarms & alternative power supply
6. Services to be supplied from emergency generator
7. 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

**TOTAL: 60h**

**TEXT BOOKS:**

1. Reed, “Engineering Knowledge for Deck Officers”, 2<sup>nd</sup> Edition, Reprint 1996
2. Reed, “General Engineering Knowledge Vol 8” , 14<sup>th</sup> Edition, Reprint, 2009
3. Hannah & Hiller, “Mechanical Engineering Science”
4. Souchette& Smith, “Marine Auxiliary Machinery”, 7<sup>th</sup> Edition, Reprint 2010
5. JK Dhar, “Engineering Knowledge”, 10<sup>th</sup> 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, 8<sup>th</sup> Edition, 2004
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, 6<sup>th</sup> Edition, Reprint 2008
5. D.W. Smith, “Marine Auxiliary Machinery”, Thomas Reed Publications, 3<sup>rd</sup> Edition
6. G.O. Watson, “Marine Electrical Practice”, Thomas Reed Publications, 3<sup>rd</sup> Edition

**Course Objective:**

- To understand the principles and operations of Deck Machinery
- To understand Hydraulic and Mechanical Hatch-Cover operation
- To understand Steering Gears

**Course Outcome:**

CO – 1: To understand Windlass and Mooring Winches

CO – 2: To draw the circuit diagram of hydraulic systems

CO – 3: To be well versed with Electro-hydraulic systems

CO – 4: To understand the various movements of the cranes and safety features installed on Cranes

CO – 5: To understand the operations of Hydraulic Ramps

CO – 6: To understand the operation of large bore ballast system valves using hydraulics

CO – 7: To understand the Life Boat Winch and accommodation Ladder Winch

CO – 8: To understand the Life Boat Winch constructional features, operation and maintenance required

CO – 9: To be well versed with Hydraulic Transmitter and receiver

CO – 10: To understand how to use Emergency steering Gear

**Principles and operation of the following types of Deck Machinery:**

**UNIT I WINDLASS AND MOORING WINCHES**

**12**

Windlass and Mooring Winches – construction, operation and precautions while operating. Routine maintenance of these machines. Circuit diagrams of hydraulic systems. Bow-Thruster Systems and their Remote Control.

**UNIT II CARGO CRANES**

**12**

Cargo Cranes – Electro-hydraulic and totally hydraulic systems. Various movements of the cranes and the safety features installed on such Cranes.

**UNIT III HYDRAULIC AND MECHANICAL HATCH COVER OPERATION**

**12**

Hydraulic and Mechanical hatch-cover operation. Operation of hydraulic ramps, bow-doors on ferries. Operation of large bore Ballast System valves using hydraulics. Hydraulic Circuit diagrams.

## **UNIT IV LIFE BOAT WINCH**

**12**

Life Boat Winch and accommodation Ladder Winch. Constructional features, operation and maintenance required.

## **UNIT V STEERING**

**12**

Steering Gear 4ram and 2 ram type – Hydraulic Transmitter and receiver. Electrical Telemotor. Line diagrams of Steering Gear systems. Rotary vane type Steering. Emergency steering Gear. Testing of Steering departure and arrival port.

**TOTAL: 60h**

### **TEXT BOOKS:**

Marine Auxiliary Machinery – University Handout

### **REFERENCE BOOKS:**

McGeorge , “Marine Auxiliary Machinery”, MC Graw Hill, 2002

**Course Objective:**

- To understand the introduction to ships and cargos
- To understand the basic aspects of cargo operations
- To understand the basics of deck cargo

**Course Outcome:**

CO – 1: To be well versed with various common types of ships, the type of cargoes they carry and the method of cargo operations unique to each

CO – 2: To understand the Refrigerated ships and reefer cargoes

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

CO – 4: To be well versed with Duties of the Officer on Cargo Watch

CO – 5: To understand the importance of Importance of checking bilge suction

CO – 6: To understand how to protect deck machinery from dust

CO – 7: To understand the type of containers

CO – 8: To be well versed with the General outline of refrigeration systems (Direct, Indirect and air-cooled systems)

CO – 9: To understand the precautions when handling dangerous goods,

CO – 10: To understand the dangerous cargo manifest

**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.**

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

**Introduction to Basic Aspects of Cargo Operations**



1. Importance of cargo care to economical operation of ship. Care of cargo on board ship.
2. The hazard of fire and its prevention, control and extinction in cargo operations.
3. Interaction between cargoes and the resultant contamination and tainting. Separation of cargoes by natural bulkheads or artificial divisions.
4. Stowage and handling to prevent breaking, chafing, crushing.
5. Temperature variations leading to sweat damage, ship and cargo sweat, monitoring of dew-point temperature and ventilation to prevent sweat.
6. Sea water damage, importance of structural integrity and hatch cover water tightness.
7. Shifting of cargo, toppling, and methods of securing to prevent the same viz. blocking, chocking and lashing.
8. Dunnage and its use to increase friction, prevent damage from sweat and in separating cargoes. Shifting boards.
9. Ballasting and deballasting operations.
10. Duties of the Officer on Cargo Watch.
11. Log Book Entries.
12. Bale and Grain Capacity.
13. Stowage factor, Broken stowage.
14. Load density; Cargo density.
15. Ullage and soundings.
16. Deadweight and displacement; Measurement cargo.
17. Safe working load (SWL); Breaking strength; Proof Load; Factor of Safety
18. Load lines.
19. 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 tommying 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.

## **UNIT IV DETAILED STUDY ON CONTAINER, REFER & MULTIPURPOSE CARGO SHIPS 16**

### **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 DAMEAGES 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

**TOTAL: 80h**

**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, Seventh Edition
3. Kemp and Young, “Cargo Work”, Kandy Publications, 1990
4. L.G.Taylor, “Cargo Work”, Admiralty Publications, 1998
5. P.J. Samson, “Safe Cargo Handling Procedures (Solid Cargo), Vol – 1”,Samson Publications, 1995

**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”, 2012

**Course Objective:**

- To understand the common engineering materials
- To understand the ship-board power systems
- To understand the transformers and power distributions

**Course Outcome:**

CO – 1: To be well versed with common engineering materials

CO – 2: To understand the Properties & uses of Materials

CO – 3: To be well versed with Meaning of frequency, phase & power factor

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

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

CO – 6: To understand the working principle, construction of different types of pumps

CO – 7: To understand the various types of engines

CO – 8: To understand the construction, main components and working of two and four stroke engines

CO – 9: To understand the types of boilers

CO – 10: To be well versed with the importance of Boiler Feed Water Chemical Treatment

**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  
AC & DC MACHINES**

**12**

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.



**TOTAL: 60h**

**TEXT BOOKS:**

1. Reed, "Engineering Knowledge for Deck Officers", 2012
2. Reed, "General Engineering Knowledge Vol 8" ,2000
3. Hannah & Hiller, "Mechanical Engineering Science",2002
4. Souchette& Smith, "Marine Auxiliary Machinery",2000
5. JK Dhar, "Engineering Knowledge", 2000

**REFERENCE BOOKS:**

1. L. Jackson & T. Morton, "General Engineering Knowledge for Marine Engineer", Thomas Reed Publications, 4<sup>th</sup> Edition, Reprint 2012
2. "Basic Electro Technology", Thomas Reed Publications, 3<sup>rd</sup> Edition, Reprint 2010
3. Gth Flangan, "Marine Engineering Series – Marine Boilers", Henemann Professional Publication, 3<sup>rd</sup> Edition, 2002
4. Wharton A.S, "Marine Engineering Series Diesel Engines", Henemann Professional Publication, 3<sup>rd</sup> Edition, 2002
5. H.D.George, "Marine Auxiliary Machinery", Thomas Reed Publications, 7<sup>th</sup> Edition, 2000
6. H.D. George, "Marine Electrical Practice", Thomas Reed Publications, 7<sup>th</sup> Edition, 2000

**Course Objective:**

- To understand how to prevent fire
- To understand how to implement in fire fighting
- To understand the life saving appliances, SOLAS Convention, Firefighting equipment

**Course Outcome:**

CO – 1: To understand the Advantages of various fire extinguishing agents including vaporizing fluids and their suitability for ship's use

CO – 2: To be well versed with the Controls of Class A, B, C & class D fires

CO – 3: To understand the Fire protection built in the ships

CO – 4: To be well versed with Types of detectors

CO – 5: To understand the various firefighting equipment

CO – 6: To understand the fire appliance survey

CO – 7: To understand the Action required and practical techniques adopted for extinguishing fires in accommodation, machinery spaces, boiler rooms, cargo holds galley, etc

CO – 8: To understand the Special precautions for prevention, inert gas systems, fighting fire in tankers, chemical carriers and gas carriers

CO – 9: To understand the Ship's lifeboats- their construction, operation and maintenance

CO – 10: To be well versed with construction and maintenance of EEBDs in Engine Rooms and Pump Rooms Neil Robertson stretcher - its use, and maintenance

**UNIT I FIRE HAZARD ABOARD SHIPS****12**

Fire hazard aboard ships: Fire triangle, fire tetrahedron, fire chemistry, spontaneous combustion, and limits of inflammability. Advantages of various fire extinguishing agents including vaporizing fluids and their suitability for ship's use. Controls of Class A, B, C & class D fires, combustion products & their effects on life safety.

**UNIT II FIRE PROTECTION BUILT IN THE SHIPS****12**

Fire protection built in the ships: SOLAS convention, requirements in respect of materials of construction and design of ships, (class A,B, type BHDS.)

Detection and Safety Systems: Types of detectors, selection of fire detectors and alarm systems and their operational limits. Commissioning and periodic testing of sensors and detection system. Description of various systems fitted on ships.

## **UNIT III FIRE FIGHTING EQUIPMENT**

**12**

Firefighting equipment: Fire pumps, hydrants and hoses, couplings, nozzles and international shore connection, construction, operation and merits of different types of portable, non-portable and fixed fire extinguishers installations for ships. Properties of chemicals used, water mist fire suppression system. Bulk carbon-dioxide. Fireman's outfit, its use and care. Maintenance, testing and recharging of appliances, preparation, fire appliance survey. Breathing apparatus types, uses, and principle.

## **UNIT IV PRACTICAL TECHNIQUES FOR FIRE EXTINGUISHING**

**12**

Action required and practical techniques adopted for extinguishing fires in accommodation, machinery spaces, boiler rooms, cargo holds galley, etc. fire fighting in port and dry dock. Procedure for re-entry after putting off fire, rescue operations from affected compartments. Ship board organization for fire and emergencies, fire control plan, human behavior. Special precautions for prevention, inert gas systems, fighting fire in tankers, chemical carriers and gas carriers.

## **UNIT V SHIP'S LIFEBOATS**

**12**

Ship's lifeboats- their construction, operation and maintenance. Equipment renewal intervals. Life-boat surveys. Life boat launching using Davits. Construction operation and maintenance of davits and LB Winches and associated gear. Life Rafts - construction, operation and maintenance. Maintenance routines required on gravity davits. Function, location, construction and maintenance of EEBDs in Engine Rooms and Pump Rooms Neil Robertson stretcher - its use, and maintenance.

**TOTAL: 60h**

### **TEXT BOOKS:**

1. H.D. McGeorge , "Marine Auxiliary Machinery" , 7th Edition from H D MCGEORGE. ISBN-9780080511030
2. " LSA and FFA Codes", Published By IMO, 2000

### **REFERENCE BOOKS:**

1. Dr J. Cowley, "Running and Maintenance of Marine Auxiliary Machinery" , 2000
2. Rushbrooke, "Fire Aboard", Sheridan House Inc; 2 edition (December 1997)

**Course Objective:**

- To understand the different oil products
- To understand the operation of Ship to Ship
- To know the importance of Chemical Tankers and Gas Tankers

**Course Outcome:**

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

CO – 2: To be well versed with Cargo piping system for various types of tankers

CO – 3: To get the brief knowledge in MARPOL regulations as applicable to Oil, Chemical and Gas carriers

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

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

CO – 6: To understand the Cargo calculations for quantity and ullage of oil cargo based on volume and height of space, density of cargo and temperature change

CO – 7: To understand the Deep tank cargoes: Procedures for cleaning and preparation of deep tanks for loading

CO – 8: To be well versed with Various categories (X,Y,Z, OS) of cargoes

CO – 9: To understand the Threshold limit value (TLV) of product

CO – 10: To be well versed with the Detection of cargo leakage through primary barrier

**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**

- 1 History of oil carriage and pollution prevention.
- 2 Segregated ballast, Clean ballast, Dirty ballast,
- 3 Slop tank and handling of slops, Load-on-top, ODMCS
- 4 Inert gas system including boiler uptake valve, scrubber, blowers, oxygen analyser, deck seal, non-return valve, PV valve, PV breaker and mast riser.
- 5 Crude Oil Washing, its hazards and benefits,
- 6 Items of COW checklist
- 7 MARPOL regulations for COW
- 8 Tank cleaning, Purging and gas freeing procedures
- 9 Items of pre-arrival checklist
- 10 Ship shore safety checklist of tankers
- 11 Loading and discharging operations on an oil tanker.
- 12 Contents and application of the International Safety Guide for Oil Tankers and Terminals ISGOTT
- 13 Cargo calculations for quantity and ullage of oil cargo based on volume and height of space, density of cargo and temperature change.
- 14 Deep tank cargoes: Procedures for cleaning and preparation of deep tanks for loading.
- 15 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<sub>2</sub>analyser 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**

- 2 Type A, Type B and Type C tanks;
- 3 High level alarm and auto- shut off.
- 4 Purpose and objectives of the IGC Code
- 5 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
- 6 Various types of ships (Fully pressurized, Semi pressurized, Fully refrigerated and Semi refrigerated)
- 7 Various types of tanks (integral, membrane, semi-membrane, independent and internally insulated tank)
- 8 Detection of cargo leakage through primary barrier
- 9 Deepwell pump
- 10 Re-liquefaction plant
- 11 Contents of pre-cargo loading checklist
- 12 Tank cleaning procedure for gas tankers

**TOTAL: 60h**

**TEXT BOOKS:**

1. Capt. Errol Fernandes, "Cargo Work for Ship Officers", Gyan Books Private Ltd., 2001
2. David J House, "Cargo Work for Maritime operations", Elsevier Publications, Seventh Edition, 2002
3. Kemp and Young, "Cargo Work", Kandy Publications, 2003
4. L.G. Taylor, "Cargo Work", Admiralty Publications, 2002
5. P.J. Samson, "Safe Cargo Handling Procedures (Solid Cargo), Vol – 1", Samson Publications, 2000

**REFERENCE BOOKS:**

1. IBC Code – I.M.O, 2000
2. ISGOTT – OCIMF, 5<sup>th</sup> Edition, 2001
3. Int. Gas Tanker Code – IMO, 2000
4. Capt. C. Baptist, "Tanker Handbook for Deck Officers", 8<sup>th</sup> Edition, 2000

**Course Objective:**

- To understand the concept of Marine Engineering Auxiliaries
- To understand the Main Propulsion units
- To understand the automation and control engineering

**Course Outcome:**

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

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

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

CO – 4: To 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: To understand the types of propellers

CO – 6: To be well versed with Alignment of Shafts

CO – 7: To understand the Automatic control systems- Open & Closed Loop Systems

CO – 8: To be well versed with 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

CO – 9: To understand the Fire detectors, smoke, heat, flame etc. fire alarm circuits

CO – 10: To be well versed with the operation and care of Lifeboat engine, emergency fire pump engine, lifeboat winch

**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 from 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- manoeuvring 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

**TOTAL: 60h**

### **TEXT BOOKS:**

1. Reed, “Engineering Knowledge for Deck Officers”,2000
2. Reed, “General Engineering Knowledge Vol 8”,2000
3. Hannah & Hiller, “Mechanical Engineering Science” ,2003
4. Souchette& Smith, “Marine Auxiliary Machinery”,2001
5. JK Dhar, “Engineering Knowledge”,2000

### **REFERENCE BOOKS:**

1. L. Jackson & T. Morton, “General Engineering Knowledge for Marine Engineer”, Thomas Reed Publications,2002
2. “Basic Electro Technology”, Thomas Reed Publications,2005
3. Gth Flanogan, “Marine Engineering Series – Marine Boilers”, Henemann Professional Publication,2005
4. Wharton A.S, “Marine Engineering Series Diesel Engines”, Henemann Professional Publication,2005
5. D.W. Smith, “Marine Auxiliary Machinery”, Thomas Reed Publications,2000
6. G.O. Watson, “Marine Electrical Practice”, Thomas Reed Publications,2000

**Course Objective:**

- To understand the Shipping company structure
- To understand the commercial operations related to Voyage
- To understand the concept of Crew Management

**Course Outcome:**

CO – 1: To understand the Organization of a shipping company

CO – 2: To be well versed with Roles of Commercial, Technical & Crewing departments

CO – 3: To understand the commercial operations related to voyage

CO – 4: To understand the Factors affecting vessel performance

CO – 5: To understand the Ship acquisition methods

CO – 6: To understand the Induction of a vessel in the fleet

CO – 7: To understand the Management of ship spares

CO – 8: To be well versed with Crew Management

CO – 9: To understand the Maritime training establishments

CO – 10: To be well versed with International Safety Management (ISM) code

**UNIT I SHIPPING COMPANY STRUCTURE**

**12**

Shipping Company Structure: Organization of a shipping company – Roles of Commercial, Technical & Crewing departments – In house vs outsourcing of Ship Management functions – Ship Registries, National vs Open Registries – Ship Classification societies

**UNIT II COMMERCIAL OPERATIONS**

**12**

Commercial Operations: Commercial operations related to voyage – Chartering – Voyage estimates – Time charter yield calculations – Bunkering operations – Factors affecting vessel performance – Post fixture Management – Lay time calculation – Demurrage, Despatch calculation

**UNIT III TECHNICAL MANAGEMENT**

**12**

Technical Management : Technical Management – Ship acquisition methods – Induction of a vessel in the fleet – Planned maintenance & emergency repairs – Dry-docking and annual / special surveys – Management of ship spares

## **UNIT IV CREW MANAGEMENT**

**12**

Crew Management : Crew Management – Manning regulations, international conventions viz. STCW, SOLAS – Crew management companies – Maritime training establishments – Maritime Training administration – Port State Control

## **UNIT V SHIP MANAGEMENT CONTRACTS**

**12**

Ship Management Contracts : Standard Ship Management contracts (BIMCO Shipman) – International Safety Management (ISM) code – ISMA code of Ship Management Practice

**TOTAL: 60h**

### **TEXT BOOKS:**

University handout

### **REFERENCE BOOKS:**

1. Malcolm Willingale, “Ship Management (Business of Shipping)”, LLP Professional Publications, 4th ,2005
2. Panayides P, “Professional Ship Management”, Ashgate Publications, 2001
3. R.Tallack , “Commercial Management in Shipping” , Nautical Institute, 2002

# **GENERIC ELECTIVE COURSES**

**15BNS151 PARADE & OLQ TRAINING – I (PRACTICAL) 0032**

**Course Objective:**

- To Practices on Parade March Past Grooming & Developing Correct attitude to become a ship board officer Aspects with daily routine schedule

Merchant navy cadets are trained in Officer Like Qualities and in Parade March Past Practices on daily basis.

Grooming & developing correct attitude of an individual to become a Ship Board officer is an integral part of Pre Sea training as per DG Shipping guidelines.

Towards this end cadets are trained in these aspects with “daily routine schedule”.

The progress of the cadets is monitored “on-going” basis and records are maintained.

Total Minimum Hours of Parade & OLQ in a Semester: 40 hours

**Total: 30h**

## 15BNS152 PROFESSIONAL PRACTICE – I 0032

### 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.

### Course Outcome:

CO – 1: To understand the commercial environment

CO – 2: To understand how to finding your qualifications fit into the professional maritime world

CO – 3: To understand the obligations in protecting the environment

CO – 4: To appropriate planning and situational awareness

CO – 5: To understand the concept of self awareness

CO – 6: To deal with some of the more personal dimensions of students' ongoing learning development

CO – 7: To understand the personality traits

CO – 8: To help some leaders choose compatible team members

CO – 9: To understand the essential communication for managing and working in a productive and efficient workplace

CO – 10: To get the confidence in their work and getting the desired results more quickly and efficiently

### 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.

**TOTAL: 30h**

**TEXT BOOKS:**

University Study Material



**Course Objective:**

- To Practices on Parade March Past, Grooming & Developing Correct attitude to become a ship board officer, Aspects with daily routine schedule

Merchant navy cadets are trained in Officer Like Qualities and in Parade March Past Practices on daily basis.

Grooming & developing correct attitude of an individual to become a Ship Board officer is an integral part of Pre Sea training as per DG Shipping guidelines.

Towards this end cadets are trained in these aspects with “daily routine schedule”.

The progress of the cadets is monitored “on-going” basis and records are maintained.

Total Minimum Hours of Parade & OLQ in a Semester: 40 HOURS

**TOTAL: 30h**

## **15BNS154 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.

### **Course Outcome:**

CO – 1: To maintain and Enhance cadets’ professional knowledge and expertise

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

CO – 3: To maintain independence, integrity and objectivity

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

CO – 5: To avoid prejudice and conflict of interest

CO – 6: To avoid assignments that would create a conflict of interest.

CO – 7: To understand the leadership in team building

CO – 8: To improve interpersonal relations and social interactions

CO – 9: To understand the time management

CO – 10: To understand Exercising conscious control over the amount of time spent on specific activities, especially to increase effectiveness, efficiency or productivity

### **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.

**TOTAL: 30h**

#### **TEXT BOOKS:**

University Study Materials

**Course Objective:**

- To Understand the Basic Definitions of Computers
- To understand MS Word for Document Typing and Excel for Calculation
- To understand MS PowerPoint for preparing Presentations

**Course Outcome:**

- CO – 1: To understand the Historical development of computers as an evolution
- CO – 2: To understand the different functional parts of a computer and their functions
- CO – 3: To understand the role and functions of DOS
- CO – 4: To be well versed with basic trouble shooting of software crashes
- CO – 5: To be well versed how to use Mail Merge in Microsoft Word
- CO – 6: To understand the various functions and Chars in Microsoft Excel
- CO – 7: To be well versed with how to use Microsoft PowerPoint for creating slides
- CO – 8: To be well versed what is called Database and basic operations in Microsoft Access
- CO – 9: To understand the various types of Network
- CO – 10: To understand the Important features of internet

**UNIT I COMPUTER FUNDAMENTALS**

**12**

Historical development of computers as an 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.

**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****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**

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

**TOTAL: 60h**

### **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, 2002
2. Mehta S , “Introduction To Computer I ,II & III”, BPB Publications, 2<sup>nd</sup> Edition, 2002

**Course Objective:**

- To identify the list of equipments
- To understand how to uses of Bridge equipments, RADAR / ARPA, GPS, Rule 5 Look, Radar Look Out, Watch keeping, Wind Waves, Log Keeping

**Course Outcome:**

CO – 1: To understand the Radar

CO – 2: To be well versed with Main Engg. Control Panel

CO – 3: To understand the use of Bridge Equipment

CO – 4: To be well versed with Entry in log book after 4 hours navigational watch

CO – 5: To understand the uses of ARPA

CO – 6: To know how to do Receiving a pilot / pilot flags / Entry in movement book

CO – 7: To Understanding /repeating / executing pilots HELM n ENGINE orders

CO – 8: To understand how to avoid collision

60

**IDENTIFYING LIST OF EQUIPMENTS**

1. Clocks synchronise / E/R status to be manned / Terms FWE , SBE , RFA
2. Radar / ARPA
3. ECDIS
4. GPS
5. Navtex
6. GMDSS panel
7. Steering gear test /Auto pilot / NFU
8. Sound signals test
9. Nav Lights test
10. VHF test in 16 and local port channel
11. Echo sounder
12. Doppler log
13. Main eng control panel
14. Eng telegraph
15. Alarms panel / PA
16. Entry in movement book and logkeeping

**USE OF BRIDGE EQUIPMENTS**

1. Operation
2. Significance in realtime in scenario
3. Calling stations F and A

## **WATCHKEEPING**

### **Open Sea**

1. Rule 5 Look out / Radar look out / Targets on radar / Vectors true/ rel
2. Position plotting / from GPS /sight calculations / By radar / terrestrial fix
3. Effect of Beam swell / wind waves / white horses n wind direction
4. Hand over and taking over a watch
5. Entry in log book after 4 hours navigational watch

### **Restricted waters**

1. Dense traffic / position fixing frequency / position fixing aids /
2. Use of ARPA
3. Monitoring depth, soundings
4. Reporting to VRS / VTS
5. Shallow water effect ( Effect of squat , turning circle)

### **Pilotage**

1. Receiving a pilot / pilot flags / Entry in movement book
2. Master pilot info exchange / passage plan discussion
3. Understanding /repeating / executing pilots HELM n ENGINE orders
4. Position fixing under pilotage

### **Restricted Visibility**

1. Lights n sound signals in restricted visibility
2. Meaning of the term "Apparently forward of the beam"
3. Meaning of the term "Determined by rader alone, the presence of a target"
4. "Taking ALL way off"
5. Action to avoid collision inreal time scanario
6. Log keeping

## **HAND STREEING**

1. In open seas / restricted waters / under pilot (Both in Ballast and loaded conditions)
2. Steering a loaded ship ( momentum , counter rudder )
3. Steering a loaded ship or ballast ship when engines are stopped ( larger helm / frequent hardover)
4. Steering a light ship with strong winds on the bow , quarter, beam
5. Steering a light ship with strong currents on the bow , quarter ,beam

## **ACTION TO AVOID COLLISION**

1. Head on / Crossing / Overtaking / TSS / Both in clear visibility and restricted visibility
2. Vessel on port side / crossing / not taking action
3. Overtaking vessel gradually becoming a crossing vessel
4. Head on situation/ Target vessel not taking action
5. Significance of understanding the meaning of true vectors/ relative vectors
6. ( increasing their lengths to see the CPA) in a collision avoidance situation



## **CALLING MASTER**

1. Scenarios where the OOW shall call the master well in advance
2. Minimum of 5 scenarios would be simulated.

**TOTAL: 60h**

### **TEXT BOOKS:**

University Study Materials

**Course Objective:**

- To understand the Human Values
- To understand the Engineering Ethics, sense of engineering ethics
- To understand the Human Safety Responsible and Rights

**Course Outcome:**

CO – 1: To understand the Morals, Values and Ethics

CO – 2: To be well versed with the introduction to Yoga and meditation for professional excellence and stress management

CO – 3: To understand the senses of Engineering Ethics

CO – 4: To understand how to use ethical theories

CO – 5: To be well versed with codes of ethics

CO – 6: To understand a Balanced Outlook on Law

CO – 7: To understand the assessment of safety and risk

CO – 8: To understand the Intellectual Property Rights (IPR)

CO – 9: To understand the Environmental Ethics

CO – 10: To understand the Computer Ethics

**UNIT I HUMAN VALUES****6**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

**UNIT II ENGINEERING ETHICS****6**

Senses of ‘Engineering Ethics’ – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg’s theory – Gilligan’s theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

**UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION****6**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

## **UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS**

**6**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

## **UNIT V GLOBAL ISSUES**

**6**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility.

**TOTAL: 30h**

### **TEXT BOOKS:**

- 1 Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw Hill, New York (2005).
- 2 Charles E Harris, Michael S Pritchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, Thompson Learning, (2000).

### **REFERENCE BOOKS:**

1. Charles D Fleddermann, “Engineering Ethics”, Prentice Hall, New Mexico, (1999).
2. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, (2003)
3. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, (2001)
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, “Business Ethics – An Indian Perspective”, Biztantra, New Delhi, (2004)
5. David Ermann and Michele S Shauf, “Computers, Ethics and Society”, Oxford University Press, (2003)

**Course Objective:**

- To understand the concept of Managing & Managers
- To understand the Planning and Strategic management
- To understand communications and negotiations

**Course Outcome:**

CO – 1: To understand the Organization and the need for management

CO – 2: To be well versed with evolution of management theory

CO – 3: To be well versed with Planning and strategic management

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

CO – 5: To understand the Human resource management

CO – 6: To be well versed with managing organizational change and innovation

CO – 7: To be understanding the Theories of motivation

CO – 8: To understand the Types of groups, characteristics of groups, problem solving in groups, making formal groups effective

CO – 9: To understand the importance of communication

CO – 10: To be well versed with importance of Operation Management

**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 is 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.

**TOTAL: 60h**

**TEXT BOOKS:**

1. DR.A.V.Athalye, “Basic Marine Management”, Bhandarkar publications, 2002
2. C B Gupta, “Management Theory & Practice”, Sultan Chand & Sons Publications, 2013

**REFERENCE BOOKS:**

1. Stoner & Freeman, “Management”, Pearson Publication, 6<sup>th</sup> Edition, 2000
2. Drucker P, “The Practice of Management”,2001
3. Mitchell, Teerence P, “People in Organisation, an Introduction to Organisation Behaviour”, 2002  
International Edition, September 1, 1987, 2002
4. Dwivedi R.S, “Manpower Management”, Prentice-Hall of India, 1984, 2002

# **SKILL ENHANCEMENT ELECTIVE COURSES**

## 15BNS251 SHIP OPERATION TECHNOLOGY – I 4003

### Course Objective:

- To understand the name of various of ships, Safety Appeal, Apply various life-saving, Fire fighting, Deck appliances on ship operations, Life jacket, Thermal Protective Aid

### Course Outcome:

CO – 1: To understand the various parts of a Ship

CO – 2: To understand the types of brushes and their features

CO – 3: To be well versed with Classification of ships for carriage of LSA, LSA requirement for cargo ships and tankers

CO – 4: To understand the Safety, care, testing maintenance of all LSA

CO – 5: To understand the Causes and types of fire

CO – 6: To understand the International Shore Connection - Description, features, tests and mode of use

CO – 7: To understand Fibre ropes – types of material used, natural and synthetic fibres, types of lay and their advantages

CO – 8: To understand Rigging

CO – 9: To be well versed with Flags and Flag etiquettes

CO – 10: To understand Securing ropes on bitts, securing more than one rope on a single bollard

### UNIT I GENERAL

12

1. Names of various parts of a ship, Types of Merchant vessels, Names and timings of watches, Ranks of Officers, Sea terms – glossary and explanation.
2. Safety apparel – goggles, helmet, gloves, safety shoes and importance of adherence to safety procedures.
3. Look out, Compass points.
4. Ships name, port of registry and IMO number.
5. 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.
6. 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.
7. Grease – types of grease used on board ships. Composition, features and mode of use of each type of grease. Greasing schedule on board ships.
8. Cleaning of wooden decks, polishing of brass and copper.



## **UNIT II CLASSIFICATION OF SHIPS**

**12**

1. Classification of ships for carriage of LSA, LSA requirement for cargo ships and tankers.
2. 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
3. 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.
4. SART – Description, features, tests and mode of use.
5. EPIRB – Description, features, tests and mode of use.
6. Lifebuoy - Description, features, tests and mode of use.
7. Lifejacket - Description, features, tests and mode of use.
8. Thermal Protective Aid (TPA) Description, features, tests and mode of use.
9. Immersion Suit - Description, features, tests and mode of use.
10. Line Throwing Apparatus (LTA) Description, features, tests and mode of use.
11. Pyrotechnics - Description, features, tests and mode of use. Carriage requirements for ships as per SOLAS.
12. Safety, care, testing maintenance of all LSA.

## **UNIT III FIRE FIGHTING APPLIANCES (FFA)**

**12**

1. 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.
2. Fire hoses, hydrants and nozzles - Description, features, tests and mode of use.
3. International Shore Connection - Description, features, tests and mode of use.
4. Portable Fire extinguishers – Description of various types and their suitability for various types of fire. Operation and refilling of each type of extinguisher.
5. Fireman's Suit - Description, features, tests and mode of use, checks and maintenance.
6. Smoke Helmet and Self-contained Breathing Apparatus SCBA - Description, features, tests and mode of use, checks and maintenance.
7. Safety Lamp & Fire axe - Description, features, mode of use and maintenance.
8. Lifeline and harness - Description, features, mode of use and maintenance.
9. Safety, care, testing and maintenance of all FFA

## **UNIT IV ROPES & WIRES**

**12**

1. 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.
2. 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.
3. Rigging – explanation of running and standing rigging and the rope used in each case.
  4. Safe Working Load – Explanation of Safe Working Load and Breaking Strength of ropes, wire and chains.
  5. Size – Measuring size of various ropes, wires and chains, tools and methods used.

## **UNIT V FLAGS AND MOORING**

**16**

1. 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.
2. 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.
3. Mooring a ship alongside a wharf – Different types of ropes used for mooring.
4. Rat guards – Description and usage, Rope and chain stoppers – Mode of use.
5. Securing ropes on bitts, securing more than one rope on a single bollard.
6. Throwing the heaving line, passing the messenger line.
7. Mooring a vessel to the buoys.
8. Mooring terms, general safety precautions while mooring a vessel.

**TOTAL: 60h**

### **TEXT BOOKS:**

1. Capt. V.K.Bhandarkar, “Seamanship Primer”, Bhandarkar Publications, Eleventh Edition , 2013
2. Kemp and young, “Seamanship notes” , Butterworth Heinemann, Fifth Edition, 1993

### **REFERENCE BOOKS:**

1. Capt. S.K.Puri, “Survival in life boat and life raft”, Publisher Maritime Progress, 2011
2. A.N.Cockcroft , “Nicholl’s seamanship and nautical knowledge”, Brown Son & Ferguson Publisher, 28<sup>th</sup> Edition, 2004
3. Capt. V.K.Bhandarkar ,“Life saving appliances rules”, Bhandarkar publications, 2003 Edition
4. Capt. V.K.Bhandarkar ,“Fire fighting appliances rules”, Bhandarkar publications, 2003 Edition
5. Graham Danton, “Theory and practice of seamanship”, Publisher: Routledge., 11<sup>th</sup> Edition, 1996
6. C.H.Wright, “Survival at sea”, BROWNSON & FERGUSON, LTD. , Fifth Revised Edition, Aug 2000

**Course Objective:**

- To apply various life-saving, Fire fighting, Deck appliances on ship operations
- To use of Safety belt and safety harness, cleaning and polishing of copper and brass items on board ships

**Course Outcome:**

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

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

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

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

CO – 5: To apply rope and chain stoppers

CO – 6: To demonstrate various types of paint brushes, types of paints, painting procedures and defects

CO – 7: To be well versed with the Recognition of National flags of countries

CO – 8: To be well versed with the Recognition of flags denoting alphabets, numerals and substitutes

**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.

**TOTAL: 30h**

**TEXT BOOKS:**

1. Capt. V.K.Bhandarkar, "Seamanship Primer", Bhandarkar Publications, Eleventh Edition , 2013
2. Kemp and young, "Seamanship notes" , Butterworth Heinemann, Fifth Edition, 1993

**REFERENCE BOOKS:**

1. Capt. S.K.Puri, "Survival in life boat and life raft", Publisher Maritime Progress, 2011
2. A.N.Cockcroft , "Nicholl's seamanship and nautical knowledge", Brown Son & Ferguson Publisher, 28<sup>th</sup> Edition, 2004
3. Capt. V.K.Bhandarkar , "Life saving appliances rules", Bhandarkar publications, 2003 Edition
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5. Graham Danton, "Theory and practice of seamanship", Publisher: Routledge., 11<sup>th</sup> Edition, 1996
6. C.H.Wright, "Survival at sea", BROWNSON & FERGUSON, LTD. , Fifth Revised Edition, Aug 2000

**Course Objective:**

- The overall objective of the N.S.S. is "Service to the Community" offered while undergoing instruction in an Educational institution.
- It is sought to arouse the social conscience of students and provide them with the opportunity to work with people around the educational campus creatively and constructively and to put the Education they receive to concrete social use.
- Its motto is "NOT ME, BUT YOU"

**Course Outcome:**

CO – 1: To understand the History, Philosophy and Objectives of NSS

CO – 2: To understand the concept of regulation activities

CO – 3: To understand the Definition, profile of youth, categories of youth

CO – 4: To be well versed with Issues, challenges and opportunities for youth

CO – 5: To understand the Mapping of community stakeholders

CO – 6: To understand the Identifying methods of mobilization

CO – 7: To understand the Indian Tradition of volunteerism

CO – 8: To understand the Motivation and Constraints of volunteerism

Theory Weight - 60

**Unit – 01:** Introduction and Basic Concepts of NSS (4)

- |  |     |
|--|-----|
| a) History, philosophy, aims & objectives of NSS                                     | (1) |
| b) Emblem, flag, motto, song, badge etc.   | (1) |
| c) Organizational structure, roles and responsibilities of various NSS functionaries | (2) |
| a) Concept of regular activities, special camping, Day camps                         | (3) |
| b) Basis of adoption of villages/slums, Methodology of conducting Survey             | (2) |
| c) Financial pattern of the scheme   | (1) |
| d) Other youth prog./schemes of GOI  | (2) |
| e) Coordination with different agencies  | (2) |
| f) Maintenance of the Diary  | (1) |

**Unit – 02:** Understanding Youth (5)

- |  |     |
|--|-----|
| a) Definition, profile of youth, categories of youth | (2) |
| b) Issues, challenges and opportunities for youth    | (2) |
| c) Youth as an agent of social change                | (1) |

**Unit – 03:** Community Mobilisation (9)

- |   |     |
|---|-----|
| a) Mapping of community stakeholders                                      | (3) |
| b) Designing the message in the context of the problem and the culture of | (1) |

- the community
- c) Identifying methods of mobilisation (3)
  - d) Youth-adult partnership (2)

**Unit – 04:** Volunteerism and Shramdan (7)

- a) Indian Tradition of volunteerism (1)
- b) Needs & importance of volunteerism (2)
- c) Motivation and Constraints of volunteerism (2)
- d) Shramdan as a part of volunteerism (2)

**TOTAL: 35h**

**Course Objective:**

- To Anchors and Anchoring Procedures,
- To Apply various life-saving, Life Saving Appliance and Survival at sea, Fire fighting Deck appliances on ship operations

**Course Outcome:**

CO – 1: To understand the types of anchors

CO – 2: To be well versed with different parts of anchors

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

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

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

CO – 6: To be well versed with Procedures for fighting coal fires, paint fires

CO – 7: To understand the Description of parts of derrick

CO – 8: To understand the Slings – types of slings. Precautions during use. Care and maintenance

CO – 9: To understand the Different types of speed logs

CO – 10: To understand the Windlass - Brief description and its operation

**UNIT I ANCHORS AND ANCHORING PROCEDURES**

**12**

1. Description of different types of anchors.
2. Description of different parts of an anchor. Description of markings on an anchor.
3. Description of anchor cables, joining shackles and lug less shackle.
4. Markings of the anchor cables. Reading off and reporting the length of the cable paid out.
5. 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.
6. Anchoring procedure – basic, running moor, standing moor, open moor.
7. Reporting of cable paid out, cable scope, cable direction and when a vessel is brought up.
8. Indications that vessel is dragging anchor.
9. Actions when vessel dragging anchor.
10. Fouled hawse or anchor – description and remedial measures.
11. Procedure for hanging off the anchor, opening and restoring a lugless shackle during changing an intermediate length of cable, slipping the cable.
12. Measurement of size of studded cable link, joining shackle.
13. Knowledge of common damages of an anchor cable.

1. Outline knowledge of SOLAS 74 and requirements as per SOLAS for LSA
2. Boat drills and musters – Description and frequency as per SOLAS.
3. Procedures to be followed before and after abandoning a ship.
4. Managing survival craft and personnel in the craft.
5. Survival techniques in survival craft.
6. Basic knowledge of Search and rescue by ships / Helicopters.

**UNIT III FIRE PREVENTION AND FIRE FIGHTING****12**

1. Outline knowledge of SOLAS 74 requirements for FFA
2. Fire drills and musters – Description and frequency as per SOLAS
3. Causes of fire in tankers during various operations carried out on tankers and their preventive methods.
4. Procedures for fighting coal fires, paint fires.

**UNIT IV DERRICKS AND CRANES / CARGO APPLIANCES****12**

1. Description of parts of derrick.
2. 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.
3. Swinging derricks and powered (‘steam’) guys.
4. Yo-yo gear – description and working principle.
5. Heavy lift derricks – Jumbo, Stulcken derricks – Description and operation.
6. Precautions during hoisting, lowering and securing of derricks.
7. Check, test and maintenance of derricks.
8. Calculations of the Stresses in various parts of derrick rig.
9. Calculations of the tension of various ropes and wires of a purchase.
10. Description of parts of a crane. Description of various types of cranes.
11. Principle of operation, precautions while handling cranes and routine maintenance.
12. 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.
13. 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.
14. Shackles – types of shackles, Areas of usage for lugged and lugless shackles. Marking on shackles, Difference between tested and untested shackles. Care and maintenance.
15. Cargo hooks – various types of cargo hooks. Marking on hooks.
16. Turnbuckles – types of turnbuckles. Modes of use. Care and maintenance.
17. Slings – types of slings. Precautions during use. Care and maintenance.



1. Hand lead line and deep sea lead line – Description and method of taking a cast.
2. Sounding rod/tape and ullage tape – Description and mode of use. Difference between sounding and ullage.
3. UTI (Ullage/Temperature/Interface) tapes – Description and mode of use.
4. 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.
5. Bridge / Engine room telegraph – Brief description and its operation.
6. Windlass - Brief description and its operation.
7. Cargo winches - Brief description and its operation.
8. Rigging – rigging a stage, name of parts and mode of use. Bosun chair – description and mode of use.
9. 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.

**TOTAL: 60h**

**TEXT BOOKS:**

1. Capt. V.K.Bhandarkar, “Seamanship Primer”, Bhandarkar Publications, Eleventh Edition , 2013
2. Kemp and young, “Seamanship notes” , Butterworth Heinemann, Fifth Edition, 1993

**REFERENCE BOOKS:**

1. Capt. S.K.Puri, “Survival in life boat and life raft”, Publisher Maritime Progress, 2011
2. A.N.Cockcroft , “Nicholl’s seamanship and nautical knowledge”, Brown Son & Ferguson Publisher, 28<sup>th</sup> Edition, 2004
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4. Capt. V.K.Bhandarkar ,“Fire fighting appliances rules”, Bhandarkar publications, 2003 Edition
5. Graham Danton, “Theory and practice of seamanship”, Publisher: Routledge., 11<sup>th</sup> Edition, 1996
6. C.H.Wright, “Survival at sea”, BROWNSON & FERGUSON, LTD. , Fifth Revised Edition, Aug 2000

## 15BNS255 SHIP OPERATION TECHNOLOGY – II PRACTICAL 0 0 2 2

### Course Objective:

- To apply various life-saving, Rigging Stages, Handling of Life Boats, Hoisting a Life Boat, Fire fighting, Deck appliances on ship operations

### Course Outcome:

CO – 1: To understand the Rigging stages, Precautions when using stages

CO – 2: To be well versed with the parts of an anchor

CO – 3: To learn how to Rigging, Climbing of a Jacob’s ladder and a Pilot Ladder

CO – 4: To Identify various types of tackles and purchases

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

CO – 6: To Explain the following terms with respect to anchor work – cable, link swivel, joining shackle, shackle as a term of length, bitter end

CO – 7: To Handling of lifeboat under oars – Coming alongside, getting away from the ship and picking up a man overboard

CO – 8: To reporting of scope and direction of an anchor cable

### 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

**TOTAL: 30h**

**TEXT BOOKS:**

1. Capt. V.K.Bhandarkar, "Seamanship Primer", Bhandarkar Publications, Eleventh Edition , 2013
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**REFERENCE BOOKS:**

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- The overall objective of the N.S.S. is "Service to the Community" offered while undergoing instruction in an Educational institution.
- It is sought to arouse the social conscience of students and provide them with the opportunity to work with people around the educational campus creatively and constructively and to put the Education they receive to concrete social use.
- Its motto is "NOT ME, BUT YOU"

**Course Outcome:**

CO – 1: To understand the meaning and types of leadership

CO – 2: To understand the importance and role of youth leadership

CO – 3: To understand the definition and importance of life competencies

CO – 4: To be well versed with Problem-solving and decision-making

CO – 5: To understand the Indian history and culture

CO – 6: To understand the Role of youth in Nation building

CO – 7: To understand National Youth Policy

CO – 8: To be well versed with Indian history and culture

Theory Weight - 60

Practical/Project Work - 40

**Unit – 01:** Importance and Role of Youth Leadership (6)

- a) Meaning and types of leadership (2)
- b) Qualities of good leaders; traits of leadership (2)
- c) Importance and role of youth leadership (2)

**Unit – 02:** Life Competencies (11)

- a) Definition and importance of life competencies (2)
- b) Communication (3)
- c) Inter Personal (3)
- d) Problem-solving and decision-making (3)

**Unit – 03:** Social Harmony and National Integration (9)

- a) Indian history and culture (2)
- b) Role of youth in peace-building and conflict resolution (5)
- c) Role of youth in Nation building (2)

**Unit – 04:** Youth Development Programmes in India (9)

- a) National Youth Policy (3)

- b) Youth development programmes at the National Level, State Level and voluntary sector (4)
- c) Youth-focussed and Youth-led organizations (2)

Project work/Practical

Conducting surveys on special theme and preparing a report thereof

40 Marks

**TOTAL: 35h**

**Course Objective:**

- To understand the Introduction to Programming Language
- To understand the concepts of OOPS
- To understand the concepts of C++, Exception Handling

**Course Outcome:**

CO – 1: To understand the introduction of OOPS

CO – 2: To be well versed with History of C and C++

CO – 3: To understand the Classes & Object with C++

CO – 4: To be well versed with the Rules of Overloading Operators

CO – 5: To understand the Inheritance

CO – 6: To understand the Virtual Functions

CO – 7: To understand how to use files in C++

CO – 8: To be well versed in Command Line Arguments in C++

CO – 9: To understand the Exception Handling

CO – 10: To be well versed with All Exception Handlers Throwing an exception from handler Uncaught Exception

**UNIT I INTRODUCTION****10**

Introduction of OOPS, Procedural Vs Object Oriented Programming Classes, Object, Data Abstraction, Encapsulation, Inheritance, Polymorphism, Dynamic Binding, Message Passing, Object Oriented Languages, Basics of C++ - History of C & C++, V C++ C++ Program Structure, Application of C++ Structure & Class Compiling & Linking- C++ Expression, C++ Tokens, Keywords, Identifiers & Constants, Basic Data Types, User-Defined Data Types, Symbolic Constant, Type Compatibility, Reference Variables, Operator in C++, Scope Resolution Operator, Member De-referencing Operators, Memory Management Operators, Manipulators, Type Cast Operator, Functions In C++, Main Function, Function Prototyping, Call by Reference, Call by Address, Call by Value, Return by Reference, Inline Function, Default Arguments, Const Arguments, Function Overloading, Friend Function

**UNIT II CLASSES & OBJECTS, CONSTRUCTOR & DESTRUCTOR****15**

Classes & Object - C++ Program with class Defining Member Functions, Making an Outside Function Inline, Nesting of Member Functions, Private Member Functions Arrays within a Class- Memory Allocation for Objects Static Data Members, Static Member Functions, Arrays of Objects Object as Function Arguments, Friendly Functions, Returning Objects, Const member functions, Pointer to

Members, Local Classes Constructor & Destructor- Parameterized Constructor Multiple Constructor in a Class, Constructors with Default Arguments, Dynamic Initialization of Objects, Copy Constructor, Dynamic Constructor, Const Object, Destructor Operator Overloading & Type Conversion- Defining operator Overloading Unary Operator Overloading Binary Operator, Overloading Binary Operator Using Friends, Manipulating of String Using Operators, Type Conversion, Rules for Overloading Operators

### **UNIT III INHERITANCE, POINTERS, VIRTUAL FUNCTION & POLYMORPHISM 10**

Inheritance - Defining Derived Classes, Single Inheritance, Making a Private Member Inheritable, Multilevel Inheritance, Hierarchical Inheritance, Multiple Inheritance, Hybrid Inheritance, Virtual Base Classes, Abstract Classes, Constructor in Derived Classes, Nesting of Classes, Pointer, Virtual Function & Polymorphism, Introduction, Pointer to Object, Pointer to Derived Class, Virtual Function, Pure Virtual Function, C++ I/O System Basics- C++ Streams, C++ Stream Classes, Unformatted I/O Operation, Formatted I/O Operation, Managing Output with Manipulators

### **UNIT IV FILES, TEMPLATES, GENERIC FUNCTION 15**

Working with Files – Introduction, Classes for File Stream Operation, Opening & Closing Files, Detection of End of File, More about Open( ): File modes, File pointer & manipulator, Sequential Input & output Operation, Updating a File : Random Access, Command Line Arguments, Template- Generic Function, A function with Two Generic Data Types, Explicitly Overloading a Generic Function, Overloading a Function Template, Using Standard Parameter with Template, Functions, Generic Function Restriction, Applying Generic Function : Generic Sort, Generic Classes, An Example with Two Generic Data Types, Using Non-Type Arguments with Generic Class, Using Default Arguments With Template Classes, Explicit Class, Specification

### **UNIT V EXCEPTION HANDLING 10**

Exception handling - Exception Handling Fundamentals, The try Block, the catch Exception Handler The throw Statements, The try/throw/catch sequence Exception Specification Unexpected Exception Catch – All Exception Handlers Throwing an exception from handler Uncaught Exception

**TOTAL: 60h**

#### **TEXT BOOKS:**

1. E. Balagurusamy, “Object Oriented Programming with C++ “, Tata McGraw-Hill Education, 2008.
2. Herbert Schildt , “C++: The Complete Reference”, Tata McGraw-Hill Education, 2008.

#### **REFERENC BOOKS:**

1. Yeshwant Kanetkar, “ Let us C++”, BPB Publications, 2000

**Course Objective:**

- To Understand Ship Maneuvering
- To Understand Maintenance on Ships and Dry Docking
- To Understand Pollution Prevention and Damage Control

**Course Outcome:**

CO – 1: To understand the Motion of a Vessel at Sea

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

CO – 3: To be well versed with the Inspection and maintenance of ship and equipment

CO – 4: To understand the Planned Maintenance System

CO – 5: To be well versed with the Maintenance of crew accommodation

CO – 6: To understand how to Rescue of persons from sea or from a vessel in distress

CO – 7: To be well versed with the Treatment and disposal of oily residues

CO – 8: To be well versed with Mental Gymnastics & Creative Problem solving

**UNIT I SHIP MANOEUVERING**

**12**

1. Motion of a vessel at sea – rolling, pitching, heaving, panting, pounding and corkscrewing.
2. Motion of a vessel at anchor or alongside a berth – heeling, listing, surging, yawing and heaving.
3. Effect of rudder – Turning circles. Effect of vessel size, load or ballast condition on rate of turn and vessel response to helm.
4. Effect of propeller – transverse thrust, other hydrodynamic effects.
5. Manoeuvring characteristics of a vessel, changes due to wind, current, tides, sea, swell in load or ballast condition of the vessel.
6. Crash stop distance. Cruising range.
7. Shallow water – definition of shallow water, shallow water effects.
8. Interaction between vessels in a narrow channel and in shallow water.
9. Mooring procedures and patterns. Berthing and unberthing operations.
10. Man overboard – Williamson’s turn and other maneuvers for recovery of victim.

**UNIT II MAINTENANCE**

**12**

1. Inspection and maintenance of ship and equipment:
2. 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.
3. Planned Maintenance System:



4. 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.
5. Maintenance of crew accommodation:
6. Methods of port control. Fumigation of holds and living spaces. Safe guards in applying various methods.

**Contingency plans for response to emergencies:**

1. List the Contents of muster list, State that the duties are assigned to remote control operations.
2. Describe the divisions of the crew into a command team, emergency team, back-up team and engine room team.
3. Measures which should be taken in emergencies for the protection and safety of the ship, passengers and crew
4. Actions to be taken on stranding. Initial damage, assessment and control, sounding of compartments, sounding depths all round the ship using hand-lead.
5. 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
6. Precautions for the protection and safety of passengers in emergency situations :
7. Means of limiting damage and salvaging the ship following a fire or explosion: Cooling of compartment boundaries, inspection for damage
8. **Use of emergency steering:** Arrangement of emergency steering.
9. **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.
10. **Respond to distress signal at sea:**
11. 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.
12. 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**

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

**UNIT IV POLLUTION PREVENTION and DAMAGE CONTROL**

**12**

1. Preparation to be observed to prevent pollution in port and high seas.
2. 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.
3. Oil record book.

4. Damage control – Action to be taken following collision and grounding.
5. Management of ships in heavy weather – use of oil.
6. Basic overview on towing and being towed.

**UNIT V Course module on RPSL vide DGS order no 6 of 2006**

**12**

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

**SMCP**

1. Use and understand the IMO Standard Marine Communication Phrases (SMCP)

**Safety Committee Meeting:**

2. Importance of personnel health and hygiene on board ship;
3. 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

1. Introduction to the Industry
2. Behavioural patterns & Attitudes with due cognizance to implementation of legislation eg. ISM Code/ISPS/PSC
3. Communication and the Art of listening
4. Prioritization, Time Management & Planning
5. Mental Gymnastics & Creative Problem solving
6. Anger/Violence Prevention/Aggression Control & Conflict Management
7. Management of Stress, Distress situations, Accidents proneness.
8. Emotional Management, Management of Depression / Fear / Fatigue / Revenge v/s Forgiveness, Coping with anxiety of being away from home.
9. Use of Drugs & Alcohol. Sexual health
10. Team Bonding

**Security Training for Seafarers:**

1. Security training for seafarers with designated Security Duties as per Section A - VI/6 (para 4, 5,& 6) of STCW 2010
2. Content of the topic as DGS circular 5 of 2011

**TOTAL: 60h**

**TEXT BOOKS:**

1. Capt. V.K.Bhandarkar, “Seamanship Primer”, Bhandarkar Publications, Eleventh Edition , 2013
2. Kemp and young, “Seamanship notes” , Butterworth Heinemann, Fifth Edition, 1993

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2. A.N.Cockcroft , “Nicholl’s seamanship and nautical knowledge”, Brown Son & Ferguson Publisher, 28<sup>th</sup> Edition, 2004
3. Capt. V.K.Bhandarkar ,“Life saving appliances rules”, Bhandarkar publications, 2003 Edition
4. Capt. V.K.Bhandarkar ,“Fire fighting appliances rules”, Bhandarkar publications, 2003 Edition
5. Graham Danton, “Theory and practice of seamanship”, Publisher: Routledge., 11<sup>th</sup> Edition, 1996
6. C.H.Wright, “Survival at sea”, BROWNSON & FERGUSON, LTD. , Fifth Revised Edition, Aug 2000

**Course Objective:**

- To practical Oriented on Maintenance of Ships, Cargo gear used, Measuring freeboards and drafts
- To understands Safe working Load
- To understands Rigging

**Course Outcome:**

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

CO – 2: To be well versed with the construction of cement box to arrest leaks

CO – 3: To understand how to change canvass cover in lifebuoy

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

CO – 5: To understand the measuring sounding and ullage of tanks

CO – 6: To understand how to measure freeboards and drafts

CO – 7: To demonstrate ability in rope climbing

CO – 8: To demonstrate ability to climb ship's mast

**List of Experiments**

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.

**30**

**TOTAL: 30h**

**TEXT BOOKS:**

1. Capt. V.K.Bhandarkar, “Seamanship Primer”, Bhandarkar Publications, Eleventh Edition , 2013
2. Kemp and young, “Seamanship notes” , Butterworth Heinemann, Fifth Edition, 1993

**REFERENCE BOOKS:**

1. Capt. S.K.Puri, “Survival in life boat and life raft”, Publisher Maritime Progress, 2011
2. A.N.Cockcroft , “Nicholl’s seamanship and nautical knowledge”, Brown Son & Ferguson Publisher, 28<sup>th</sup> Edition, 2004
3. Capt. V.K.Bhandarkar ,“Life saving appliances rules”, Bhandarkar publications, 2003 Edition
4. Capt. V.K.Bhandarkar ,“Fire fighting appliances rules”, Bhandarkar publications, 2003 Edition
5. Graham Danton, “Theory and practice of seamanship”, Publisher: Routledge., 11<sup>th</sup> Edition, 1996
6. C.H.Wright, “Survival at sea”, BROWNSON & FERGUSON, LTD. , Fifth Revised Edition, Aug 2000

## 15BNS260 NSS – III 2001

### Course Objective:

- The overall objective of the N.S.S. is "Service to the Community" offered while undergoing instruction in an Educational institution.
- It is sought to arouse the social conscience of students and provide them with the opportunity to work with people around the educational campus creatively and constructively and to put the Education they receive to concrete social use.
- Its motto is "NOT ME, BUT YOU"

### Course Outcome:

CO – 1: To understand the basic features of Constitution of India

CO – 2: To understand the fundamental rights and duties

CO – 3: To understand the Family and Society

CO – 4: To understand the Human Values

CO – 5: To be well versed with definition, needs and scope of health education

CO – 6: To understand the National Health Programme

CO – 7: To understand the Healthy Lifestyles

CO – 8: To understand the HIV AIDS, Drugs and Substance abuse

CO – 9: History, philosophy and concept of Yoga

CO – 10: Myths and misconceptions about yoga

Theory Weight - 60

Practical/Project Work - 40 No. of Lectures (35)

#### **Unit – 01:** Citizenship (7)

- a) Basic Features of Constitution of India (2)
- b) Fundamental Rights and Duties (2)
- c) Human Rights (1)
- d) Consumer awareness and legal rights of the consumer (1)
- e) RTI (1)

#### **Unit – 02:** Family and Society (6)

- a) Concept of family, community, (PRIs and other community-based organizations) and society (2)
- b) Growing up in the family – dynamics and impact (1)
- c) Human values (1)
- d) Gender justice (2)

**Unit – 03:** Health, Hygiene & Sanitation (7)

- a) Definition, needs and scope of health education (1)
- b) Food and Nutrition (1)
- c) Safe drinking water, water borne diseases and sanitation (Swachh Bharat Abhiyam) (2)
- d) National Health Programme (2)
- e) Reproductive health (1)

**Unit – 04:** Youth Health (6)

- a) Healthy Lifestyles (1)
- b) HIV AIDS, Drugs and Substance abuse (2)
- c) Home Nursing (1)
- d) First Aid (2)

**Unit – 05:** Youth and Yoga (9)

- a) History, philosophy and concept of Yoga (2)
- b) Myths and misconceptions about yoga (1)
- c) Different Yoga traditions and their impacts (2)
- d) Yoga and Preventive, promotive, and curative method (2)
- e) Yoga as a tool for healthy lifestyle (2)

**TOTAL: 35h**

**Course Objective:**

- To understand basic principles of mechanical drawing
- To understand Orthographic Projection, Solid Isometric Projections, Simple assembly drawing

**Course Outcome:**

CO – 1: To understand the mechanical drawing instruments and their uses

CO – 2: To understand the types of lines and dimensioning Loci of point

CO – 3: To understand Orthographic projection, projection of points, straight lines, planes.

CO – 4: To understand Solids Isometric Projection.

CO – 5: To understand Concept of Form and shape, plan Elevation and End views of object.

CO – 6: To understand Contours, change of sections, hidden (Internal) construction, dotted lines etc.

CO – 7: To understand Discussion on ship's plans.

CO – 8: To understand Isometric views, cut/cross section.

CO – 9: To understand Simple assembly drawings.

CO – 10: To be well versed with Engineering drawing by free and sketching.

**List of Experiments**

**30**

**MECHANICAL DRAWING:**

1. Brief description of drawing papers, pencils.
2. Instruments and their use.
3. Types of lines and dimensioning Loci of point,
4. Orthographic projection, projection of points, straight lines, planes.
5. Solids Isometric Projection.
6. Concept of Form and shape, plan Elevation and End views of object.
7. Contours, change of sections, hidden (Internal) construction, dotted lines etc.
8. Discussion on ship's plans.
9. Isometric views, cut/cross section.
10. Simple assembly drawings.
11. Engineering drawing by free and sketching.

**TOTAL: 30h**

**TEXT BOOKS:**

University Study material



**15BNS262 BRIDGE RESOURCE MANAGEMENT (PRACTICAL) 0 0 4 2****Course Objective:**

- To understand Review of Basic Principles
- To understand Standard Manoeuvres, Planning and Authority

No	Training area	Hours	
		Lecture	Simulator
1	Review of basic principles	1.0	–
2	Familiarization with the bridge	1.0	2.0
3	Standard manoeuvres	1.0	2.0
4	Wind and current effects	1.0	2.0
5	Attitude	1.0	-
6	Cultural awareness	1.0	-
7	Briefing and debriefing	1.0	-
8	Challenge and response	1.0	-
9	Shallow-water effects	1.0	3.0
10	Bank, channel and interaction effects	1.0	3.0
11	Planning	1.0	-
12	Authority	1.0	-
13	Management on the bridge	1.0	-
14	Workload and stress	1.0	-
15	Anchoring and single-buoy mooring	1.0	3.0
16	Human factor in error	1.0	-
17	Decision making	1.0	-
18	Crisis management	1.0	-
19	Planning and carrying out a voyage in normal and emergency situations	1.0	6.0
		19	21

Tot al	4 0
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**TOTAL: 40h****TEXT BOOKS:**

1. BRIDGE TEAM MANAGEMENT (practical guide)
2. BRIDGE PROCEDURES GUIDE
3. Model Course 1.22

**15BNS263 NSS – IV 2001**

**Course Objective:**

- The overall objective of the N.S.S. is "Service to the Community" offered while undergoing instruction in an Educational institution.
- It is sought to arouse the social conscience of students and provide them with the opportunity to work with people around the educational campus creatively and constructively and to put the Education they receive to concrete social use.
- Its motto is "NOT ME, BUT YOU"

**Course Outcome:**

CO – 1: To be well versed with Environment conservation, enrichment and sustainability

CO – 2: To understand the Climate Change

CO – 3: To understand the Waste Management

CO – 4: To understand the Natural resource management

CO – 5: To understand the Introduction to Disaster Management, classification of disasters

CO – 6: To understand the Role of youth in Disaster Management

CO – 7: To understand the Project planning

CO – 8: To understand the Project Cycle Management

Theory Weight - 60

Practical/Project Work - 40

No. of Lectures (35)

**Unit – 01: Environment Issues (11)**

- a) Environment conservation, enrichment and Sustainability (2)
- b) Climate change (2)
- c) Waste management (2)
- d) Natural resource management (5)  
(Rain water harvesting, energy conservation, waste land development, soil conservations and afforestation)

**Unit – 02: Disaster Management (7)**

- a) Introduction to Disaster Management, classification of disasters (4)
- b) Role of youth in Disaster Management (3)

**Unit – 03:** Project Cycle Management (10)

- a) Project planning (2)
- b) Project implementation (3)
- c) Project monitoring (2)
- d) Project evaluation: impact assessment (3)

**Unit – 04:** Documentation and Reporting (7)

- a) Collection and analysis of data (3)
- b) Preparation of documentation / reports (2)
- c) Dissemination of documents / reports (2)

**TOTAL: 35h**

**Course Objective:**

- To understand the concept of Machine Workshop
- To understand the basic electrical workshop, Danger of loose or improper connection

**Course Outcome:**

CO – 1: To 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.

CO – 2: To understand the Special practice to be given on use of a sledgehammer

CO – 3: To be well versed with Precautions when using electrical appliances; fuses and circuit breakers and their uses

CO – 4: To understand the Use of insulated hand tools, insulation tape, insulated footwear

CO – 5: To understand the Types and specifications of electrical wire when making indents for purchase

CO – 6: To understand the Use of insulated hand tools, insulation tape, insulated footwear

CO – 7: To be well versed with Danger of wet surfaces; proper connections (line, neuter and earth) in various joints.

CO – 8: To understand the Fuses, earthings, tube & other light fittings, etc – practice training

**UNIT – I MACHINE WORKSHOP**

**15**

1. 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.
2. Special practice to be given on use of a sledgehammer.
3. Types of nuts and bolts, studs: methods of freeing rusted nuts and bolts; proper use of the grinding machine, drilling machine (portable and mounted)
4. Use of coolants such as water, oil, etc., during drilling.
5. Use of measuring devices – feeler gauges, calipers, screw gauge, etc.
6. Overhauling of gate valves, butterfly valves and hydrants.
7. The importance of lubricating oil and grease in reducing friction in machines.
8. Cutting filing, preparation of level surfaces on metals.
9. Drilling, tapping, reamer operation.
10. Shaping, drilling, grinding operation.
11. Edge preparation on steel objects for welding
12. Welding of simple joints.
13. Removal & fittings of ball; bearing
14. Cutting & planning, Dove tail joints.

## **UNIT II BASIC ELECTRICAL WORKSHOP**

**15**

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

**TOTAL: 30h**

### **TEXT BOOKS:**

University Study Material

**Course Objective:**

- To understand how to take the precautions, understand the environmental impact of accidental oil discharges, Follow-up with preventive measures to avoid recurrence of the event.
- To show complete documentation of the drill

**Job 1**

**15**

Precautions to be taken during bunkering, loading discharging oil cargo, tank cleaning, pumping out bilges, and knowledge of construction and operation of oil pollution prevention equipment in Engine room, and on various types of ships. Demonstrate use of Check Lists. Equipment to be made ready and proficiency in its use to be demonstrated.(200 ltr Drum, Sawdust, Scoop, Buckets, Mops, Wilden Pump with suction and discharge hoses. All Reports to be recorded.

**Job 2**

**15**

Make a dummy assessment of the environmental impact of accidental oil discharges. Carry out mock drill on various actions to be taken in such an event, assuming the vessel is on the US Coast. Follow-up with preventive measures to avoid recurrence of the event. Show complete documentation of the drill.

**TOTAL: 30h**

**TEXT BOOKS:**

University Study materials

**REFERENCE BOOKS:**

MARPOL with latest Amendments

**Course Objective:**

- The overall objective of the N.S.S. is "Service to the Community" offered while undergoing instruction in an Educational institution.
- It is sought to arouse the social conscience of students and provide them with the opportunity to work with people around the educational campus creatively and constructively and to put the Education they receive to concrete social use.
- Its motto is "NOT ME, BUT YOU"

**Course Outcome:**

CO – 1: To understand Vocational Skill Development

CO – 2: To understand the Qualities of good entrepreneur

CO – 3: To be well versed with Steps/ways in opening an enterprise

CO – 4: To understand the Sociological and Psychological Factors influencing Youth Crime

CO – 5: To understand the Peer Mentoring in preventing crimes

CO – 6: To understand the Awareness about Anti-Ragging

CO – 7: To understand the Cyber Crime and its Prevention

CO – 8: To understand Juvenile Justice

**Theory Weight - 60**

**Practical/Project Work - 40**

**No. of Lectures (35)**

**Unit – 01: Vocational Skill Development (20)**

This unit will aim to enhance the employment potential of the NSS volunteers or, alternately, to help them to set up small business enterprises. For this purpose, a list of 12 to 15 vocational skills will be drawn up, based on the load conditions and opportunities. Each volunteer will have the option to select two skill-areas out of this list – one such skill in each semester. The education institution (or the university) will make arrangements for developing these skills in collaboration with established agencies that possess the necessary expertise in the relational vocational skills.

**Unit – 02: Entrepreneurship Development (8)**

a) Definition & Meaning (1)

b) Qualities of good entrepreneur (2)

- c) Steps/ways in opening an enterprise (3)
- d) Role of financial and support service institutions (2)

**Unit – 03: Youth and Crime (7)**

- a) Sociological and Psychological Factors influencing Youth Crime (2)
- b) Peer Mentoring in preventing crimes (1)
- c) Awareness about Anti-Ragging (1)
- d) Cyber Crime and its Prevention (2)
- e) Juvenile Justice (1)

**Project work/Practical**

**40 Marks**

**TOTAL: 35h**

**TEXT BOOKS:**

NOT APPLICABLE



## **15BNS267 MARINE ENGINEERING & CONTROL SYSTEMS - III PRACTICAL 0032**

### **Course Objective:**

- To familiar with basic operations, familiarity with parts of Internal combustion engine, assembly of engine components, simple turning operations on lathe machine

### **Course Outcome:**

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

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

CO – 3: To assembly of certain engine components.

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

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

CO – 6: To be well versed with Simple turning operations on lathe machine.

CO – 7: To be well versed with Use of instruments like portable Oxygen analyzer, explosimeter, Draeger apparatus.

CO – 8: Basic theory and practical experience of gas cutting, gas welding and electric arc welding.

CO – 9: Gas heating to free rusted nuts and bolts.

CO – 10: The proper precautions to be taken during each of these processes

### **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.

**TOTAL: 60h**

### **TEXT BOOKS:**

1. University Study Materials

**Course Objective:**

- To understand the Knowledge of shipboard Personnel management and training
- To understand the Human resource management
- To understand Knowledge and ability to apply decision-making techniques

**Course Outcome:**

- CO – 1: To understand the knowledge of Shipboard Personnel Management and Training
- CO – 2: To differentiate Engineer and Manager
- CO – 3: To understand Human Resource Management
- CO – 4: To understand the stages of negotiation skills
- CO – 5: To be well versed with Knowledge and ability to apply decision-making techniques
- CO – 6: To understand the Management processes and functions.Situation and Risk Assessment
- CO – 7: To be well versed with Select Course of Action
- CO – 8: To understand the working knowledge of Maritime Security
- CO – 9: To understand the Drills and exercises under IMO Codes and Circulars
- CO – 10: To be well versed with need for testing, calibrating and maintaining security systems and equipment

**UNIT I SHIPBOARD PERSONNEL MANAGEMENT** 12  
Knowledge of shipboard Personnel management and training – Engineer and Manager.

**UNIT II HUMAN RESOURCE MANAGEMENT** 12  
Human resource management -Training and development - Negotiation skills

**UNIT III WORKLOAD MANAGEMENT** 12  
Ability to apply task and workload management, Communication, Team-building, Planning and co-ordination, Personal assignments, Time and resource constraints, Prioritization.

**UNIT IV DESIGN MAKING TECHNIQUES** 12  
Knowledge and ability to apply decision-making techniques – Management processes and functions.Situation and Risk Assessment. Identify and generate options. Select course of action. Evaluate effectiveness

**UNIT V WORKING KNOWLEDGE OF MARITIME SECURITY** 12  
Security-Working knowledge of maritime security terms and definitions, maritime security levels. Drills and exercises under IMO Codes and Circulars. Techniques for monitoring restricted areas on board.

General knowledge of various types of security equipment and systems, including their limitations; need for testing, calibrating and maintaining security systems and equipment.

**TOTAL: 60h**

**TEXT BOOKS:**

1. Jagmeet Makkar, "Principles of Ship Management", Vijaya Publications, 2013
2. Capt Subramaniam, "Principles of Ship Management", Vijaya Publications, 2013
3. University Handout

**Course Objective:**

- The overall objective of the N.S.S. is "Service to the Community" offered while undergoing instruction in an Educational institution.
- It is sought to arouse the social conscience of students and provide them with the opportunity to work with people around the educational campus creatively and constructively and to put the Education they receive to concrete social use.
- Its motto is "NOT ME, BUT YOU"

**Course Outcome:**

CO – 1: To understand the Vocational Skill Development

CO – 2: To understand the Civil defense services

CO – 3: To understand the Needs for self defense training

CO – 4: To be well versed with Writing a Project Proposal for Resource Mobilisation

CO – 5: To understand the establishment of SFUs

CO – 6: To understand the Positive Thinking

CO – 7: Self Confidence and Self Esteem

CO – 8: Setting Life Goals and working to achieve them

Theory Weight - 60

Practical/Project Work - 40

No. of Lectures (35)

**Unit – 01: Vocational Skill Development (20)**

This unit will aim to enhance the employment potential of the NSS volunteers or, alternately, to help them to set up small business enterprises. For this purpose, a list of 12 to 15 vocational skills will be drawn up, based on the load conditions and opportunities. Each volunteer will have the option to select two skill-areas out of this list – one such skill in each semester. The education institution (or the university) will make arrangements for developing these skills in collaboration with established agencies that possess the necessary expertise in the relational vocational skills.

**Unit – 02: Civil / Self Defense (5)**

- a) Civil defense services, aims and Objectives of civil defense (2)
- b) Needs for Self defense training (3)

**Unit – 03: Resource Mobilisation (3)**

- a) Writing a Project Proposal (2)

b) Establishment of SFUs (1)

**Unit – 04: Additional Life Skills (7)**

a) Positive Thinking (1)

b) Self Confidence and Self Esteem (2)

c) Setting Life Goals and working to achieve them (2)

d) Management of Stress including Time Management (2)

Project work/Practical

40 Marks

**Total: 35h**