

## **SCHOOL OF MARITIME STUDIES**

# B.E

# **Marine Engineering**

**Curriculum and Syllabus** 

(Based on Choice Based Credit System)

Effective from the Academic year

2015 - 2016

Department of Marine Engineering
School of Maritime Studies

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#### PROGRAM EDUCATIONAL OBJECTIVES (PEO)

**PEO1:** Be well educated professionals who utilize their intellectual learning, applied technology experience, leadership skills and global awareness in successful careers, and continue to improve their skills through lifelong learning and advanced studies

**PEO2:** Effectively practice as professional engineers, managers, and leaders in the maritime and energy industries and a wide variety other fields, and as licensed engineers in the merchant marine

**PEO3:** Successfully combine fundamental engineering knowledge, core leadership skills and the practical experience gained at the Academy to turn ideas into reality for the benefit of society

**PEO4:** Be influential members of multidisciplinary teams, creatively and effectively contributing to the design, development, and objective evaluation of engineering components, systems, and products, and clearly communicating the work in an appropriate manner to their customers and colleagues

**PEO5:** Personally assume and actively encourage peers to uphold the professional, ethical, social and environmental responsibilities of their profession

#### PROGRAM OUTCOME (PO)

- **PO1:** Apply knowledge of mathematics, science and engineering in their specialization involving complex engineering problems.
- **PO2:** Analyze a problem, identify, formulate and solve engineering problems using basic fundamental Principles of mathematics and science.
- **PO3:** Design a system component or process to meet the desired needs and standards within realistic constraints such as public health and safety, social and environmental considerations.
- **PO4:** Design and conduct experiments, as well as do research, analyze and interpret data and give clear solutions.
- **PO5:** Use and learn the limitations involved in recent techniques, skills and modern engineering tools necessary for engineering practice.
- **PO6:** Assess the local and global impact of engineering solutions on individuals, organization and society and the consequent responsibilities relevant to their professional engineering practice.
- **PO7:** Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.
- **PO8:** Understand the professional and ethical responsibilities and norms of engineering practice.

- **PO9:** Work with multi-disciplinary teams, involve in team activities and accomplish a common goal.
- **PO10:** Communicate effectively with engineering community for presentation, documentation of reports adopting the design standards.
- **PO11:** Understand engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.
- **PO12:** Meet contemporary issues and create advance technologies and will be engaged to lifelong learning in the broadest scale.

#### PROGRAMME SPECIFIC OUTCOME (PSO)

- **PSO1:** To attain knowledge to carry out the watch keeping by an engineer officer on board a ship in a safely manner
- **PSO2:** To attain knowledge to maintain and operate machinery and engineering equipment fitted on board ships at many operational levels
- **PSO3:** To attain the knowledge of implementing immediate action in the event of fire or accidents occurs in the Ship

**PSO4:** To attain the knowledge of different electrical, electronic and control equipments used in the on board ship such as generator and distribution system

**PSO5:** To attain the knowledge of marine boilers, legislation, leadership and ship security

### **Board of Studies**

S.No	Name	Affiliation	Role
01.	Mr. R. Ravindran	Marine Chief Engineer Marine Consultant, Chennai	External Expert
02.	Mr. Rajan Isaac	Marine Chief Engineer Marine Consultant, Chennai	External Expert
03.	Mr. Prithvi Raja	Junior Engineer, Synergy Maritime, Chennai	Alumni Member
04.	Capt. N. Kumar	Director, School of Maritime Studies, VISTAS	Member
05.	Mr. Ajit Seshadri	Course Coordinator, BE Marine Engg, School of Maritime Studies, VISTAS	Convenor - BOS
06.	Mr. M. Rajesh	OIC, Ship In Campus, School of Maritime Studies, VISTAS	Internal Member

## VISTAS - SCHOOL OF MARITIME STUDIES B.E MARINE ENGINEERING DEGREE COURSE CURRICULUM

Total Number of Credits:190						
Category	Code	Trul Cal C	Hour / Week			G 114
		Title of the Course	Lecture	Tutorial	Practical	Credits
		SEMESTER - I				
CORE	CORE	Mathematics - I	3	0	0	3
CORE	CORE	<b>Electrical Engineering Basics</b>	2	0	0	2
CORE	CORE	<b>Engineering Drawing</b>	3	0	0	3
AECC	LANG	Technical English	3	0	0	3
AECC	AECC	Workshop Technology	3	0	0	3
AECC	AECC	<b>Engineering Mechanics</b>	4	0	0	4
AECC	AECC	Applied Mechanics Lab	0	0	2	1
DSE	DSE	Discipline Specific Elective - 1	0	0	3	1
SEC	SEC	Skill Enhancement Elective - 1	1	0	0	1
SEC	SEC	Skill Enhancement Elective - 2	0	0	6	3
TOTAL		19	0	11	24	
		SEMESTER - II				
CORE	CORE	Mechanics Of Materials	4	0	0	3
CORE	CORE	Mathematics II	3	0	0	3
CORE	CORE	Materials Science I	2	0	0	2
CORE	CORE	Marine Machinery Drawing I	3	0	0	3
AECC	AECC	Pumps and Pumping Systems I	3	0	0	3
AECC	AECC	Thermodynamics I	4	0	0	4
AECC	AECC	Hydraulics Lab	0	0	2	1
DSE	DSE	Discipline Specific Elective - 2	0	0	2	1
SEC	SEC	Skill Enhancement Elective - 3	0	0	1	1
SEC	SEC	Skill Enhancement Elective - 4	0	0	6	3
		TOTAL	19	0	11	24

		SEMESTER – III				
CORE	CORE	Electric Motors and Starters I	4	0	0	3
CORE	CORE	Electronics I	5	0	0	4
CORE	CORE	Material Science II	3	0	0	2
CORE	CORE	Marine Machine Drawing II	3	0	0	3
AECC	AECC	Deck Machinery	3	0	0	3
AECC	AECC	Thermodynamics II	4	0	0	3
AECC	AECC	Electrical Machines Lab I	0	0	2	2
AECC	AECC	Electronics I Lab	0	0	2	2
DSE	DSE	Discipline Specific Elective - 3	0	0	4	2
	TOTAL			0	8	24
		SEMESTER - IV				
CORE	CORE	<b>Electric Motors and Starters II</b>	4	0	0	3
CORE	CORE	Electronics II	5	0	0	4
CORE	CORE	Thermal Engineering	3	0	0	2
AECC	AECC	Safe Maintenance on Ships	3	0	0	2
AECC	AECC	Marine Auxiliary Machinery	4	0	0	3
AECC	AECC	Electrical Workshop-Motors/Starters	4	0	0	4
AECC	AECC	Electronics II Lab	0	0	3	2
DSE	DSE	Discipline Specific Elective - 4	0	0	2	2
SEC	SEC	Skill Enhancement Elective - 5	2	0	0	2
	TOTAL			0	5	24

		SEMESTER – V				
CORE	CORE	Marine Internal Combustion Engineering I	5	0	0	4
CORE	CORE	<b>Control Systems for Marine Machinery</b>	5	0	0	4
AECC	AECC	Marine Engineering Practice I	2	0	0	2
AECC	AECC	Marine Electrical Technology I	2	0	0	2
DSE	DSE	Discipline Specific Elective - 5	3	0	0	2
DSE	DSE	Discipline Specific Elective - 6	0	0	2	1
DSE	DSE	Discipline Specific Elective - 7	0	0	5	4
GE	GE	Generic Elective - 1	2	0	0	1
GE	GE	Generic Elective - 2	0	0	2	1
SEC	SEC	Skill Enhancement Elective - 6	0	0	2	2
	TOTAL		19	0	11	23
		SEMESTER – VI				
CORE	CORE	Marine Internal Combustion Engineering II	5	0	0	4
CORE	CORE	Ship Construction	3	0	0	3
AECC	AECC	Refrigeration, Air-Conditioning & Ventilation Systems	3	0	0	3
AECC	AECC	Marine Electrical Technology II	2	0	0	2
AECC	AECC	Naval Architecture I	3	0	0	3
AECC	AECC	Mechanics of Machines	2	0	0	2
DSE	DSE	Discipline Specific Elective - 8	0	0	1	1
DSE	DSE	Discipline Specific Elective - 9	0	0	5	2
SEC	SEC	Skill Enhancement Elective - 7	0	0	4	2
SEC	SEC	Skill Enhancement Elective - 8	0	0	2	1
	TOTAL			0	12	23

		SEMESTER - VII				
CORE	CORE	Marine Power Plant Operation	4	0	0	4
CORE	CORE	Monitoring And Protection Of Electrical Systems	3	0	0	2
CORE	CORE	Electrical Testing and Measuring Equipment	2	0	0	1
AECC	AECC	Pumps And Pumping Systems II	3	0	0	3
AECC	AECC	Marine Engineering Practice II	2	0	0	2
AECC	AECC	Naval Architecture II	3	0	0	3
AECC	AECC	Advanced Marine Workshop (MEP II)	0	0	3	3
DSE	DSE	Discipline Specific Elective - 10	0	0	2	1
GE	GE	Generic Elective - 3	0	0	3	2
SEC	SEC	Skill Enhancement Elective - 9	0	0	3	2
SEC	SEC	Skill Enhancement Elective - 10	0	0	2	2
	TOTAL		17	0	13	25
		SEMESTER - VIII				
CORE	CORE	Fire Prevention, Fire-Fighting and Life- Saving Appliances	3	0	0	3
CORE	CORE	Marine Boilers And Steam Engineering	3	0	0	2
CORE	CORE	Elementary Design Of Marine Machinery	2	0	0	2
AECC	AECC	Marine Engineering Practice III	2	0	0	2
AECC	AECC	Leadership, Team-Building And Ship Security	2	0	0	1
AECC	AECC	Engine Room Resources Management	2	0	0	2
AECC	AECC	Maritime Legislation	3	0	0	2
DSE	DSE	Discipline Specific Elective - 11	0	0	3	2
DSE	DSE	Discipline Specific Elective - 12	0	0	2	1
GE	GE	Generic Elective - 4	0	0	2	1
SEC	SEC	Skill Enhancement Elective - 11	0	0	4	3
SEC	SEC	Skill Enhancement Elective - 12	0	0	2	2
	TOTAL		17	0	13	23

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# **List of Core Courses**

CC1	Mathematics - I
CC2	<b>Electrical Engineering Basics</b>
CC3	<b>Engineering Drawing</b>
CC4	<b>Mechanics Of Materials</b>
CC5	Mathematics II
CC6	Materials Science I
CC7	Marine Machinery Drawing I
CC8	Electric Motors and Starters I
CC9	Electronics I
CC10	Material Science II
CC11	Marine Machine Drawing II
CC12	<b>Electric Motors and Starters II</b>
CC13	Electronics II
CC14	Thermal Engineering
CC15	<b>Marine Internal Combustion Engineering I</b>
CC16	<b>Control Systems for Marine Machinery</b>
CC17	<b>Marine Internal Combustion Engineering II</b>
CC18	<b>Ship Construction</b>
CC19	<b>Marine Power Plant Operation</b>
CC20	<b>Monitoring And Protection Of Electrical Systems</b>
CC21	<b>Electrical Testing and Measuring Equipment</b>
CC22	Fire Prevention, Fire-Fighting and Life-Saving Appliances
CC23	Marine Boilers And Steam Engineering
CC24	<b>Elementary Design Of Marine Machinery</b>

## **List of Ability Enhancement Compulsory Courses**

AECC1 **Technical English** AECC2 **Workshop Technology** AECC3 **Engineering Mechanics** AECC4 **Applied Mechanics Lab** AECC5 **Pumps and Pumping Systems I** AECC6 Thermodynamics I AECC7 **Hydraulics Lab** AECC8 **Deck Machinery** AECC9 Thermodynamics II AECC10 **Electrical Machines Lab I** AECC11 **Electronics I Lab** AECC12 **Safe Maintenance on Ships** AECC13 Marine Auxiliary Machinery AECC14 **Electrical Workshop-Motors/Starters** AECC15 **Electronics II Lab** AECC16 Marine Engineering Practice I AECC17 Marine Electrical Technology I AECC18 Refrigeration, Air-Conditioning & Ventilation Systems AECC19 Marine Electrical Technology II AECC20 **Naval Architecture I** AECC21 **Mechanics of Machines** AECC22 **Pumps And Pumping Systems II** AECC23 **Marine Engineering Practice II** AECC24 **Naval Architecture II** AECC25 Advanced Marine Workshop (MEP II) AECC26 **Marine Engineering Practice III** AECC27 Leadership, Team-Building And Ship Security AECC28

**Engine Room Resources Management** 

**Maritime Legislation** 

AECC29

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

DSE1 Electrical Engineering Lab - Basic

DSE2 Introduction to Shipping

DSE3 Safe Working Practices

DSE4 Advanced Marine Workshop(Deck/M/C)

DSE5 Advanced Marine Workshop (MAM I)

DSE6 Marine Environmental Pollution Control

DSE7 Seamanship Practical

DSE8 Advanced Marine Workshop (MEP I)

DSE9 Marine Hydraulic Systems

DSE10 Advanced Marine Workshop-Refrigeration And

**Airconditioning Trainer** 

DSE11 Electrical Lab II + Electrical Workshop

**DSE12** Marine Refrigeration

DSE13 Advanced Marine Workshop (Electrical)

DSE14 Energy Efficiency on Ships

DSE15 Ship Repair and Surveys Practices

DSE16 Marine Engineering Practice III-Simulator Lab

DSE17 Marine Machinery Start-Up (S-I-C)

### **List of Generic Elective Courses**

**Different Types of Ships** 

**Safe Working Practices On Board** GE2 **Welding Practices** GE3 GE4 **Marine Machine Design and Drawing Machine Shop Practices** GE5 GE6 **AutoCAD Principles and Practices GE7 Marine Functions of Systems Seamanship and Commercial Geography** GE8 **Anti-Pollution Lab (In Advanced Mar W/S)** GE9

**GE11** Control Engineering Lab

GE12 Boiler Shop

GE1

**GE13** Management of Ships

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

**SEC1** Computer Science

SEC2 Basic Workshop 1

SEC3 NSS - Paper 1

**SEC4** Strength of Materials Lab

SEC5 Basic Workshop II

SEC6 NSS - Paper II

SEC7 NSS - Paper III

SEC8 Lube Oil. Fuel Oil and Cooling Systems

SEC9 NSS - Paper IV

SEC10 Control Engineering Lab

**SEC11** Marine Automation

SEC12 NSS - Paper V

SEC13 Ship-in-Campus- Diesel Engine Lab

SEC14 Ship-in-Campus- Ship Construction

SEC15 NSS - Paper VI

SEC16 Ship-in-Campus(Pumps and Auxiliaries)

**SEC17 ship-in-Campus (Watch-Keeping)** 

SEC18 Fire-Fighting / Life-Saving Appliances Lab

SEC19 Communication Lab

**SEC20** Watch Keeping Principles and Practices

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# **CORE COURSES**

#### 15EMR001 MATHEMATICS I 3 0 0 3

#### **Course Objective:**

- To understand the arithmetic, geometry
- To impart knowledge on trigonometry and differential calculus

#### **Course Outcome:**

- **CO-1** To know the basic number systems.
- **CO-2** To do practical problems by using A.P & G.P.
- **CO-3** To remember the formulas of binomial theorem.
- **CO-4** To know about cone & the diagrams
- **CO-5** To know about the basic geometrical concepts.

#### UNIT I ARITHMETIC 08

Indices, surds, logarithms, quadratic equations, Partial fractions, arithmetical progression, geometric progression, Binomial theorem and its applications.

#### UNIT II GEOMETRY 06

Plane and coordinate geometry coordinates of a point, changing of axes, the circle and the parabola.

#### UNIT III TRIGONOMETRY 08

Simple relations between trignometrications. Compound angles, inverse trignometrical functions, trignometrical equations, relations between angles and sides of triangle. Solution of triangle, sum of a cosine curve and sine curve.

#### UNIT IV DIFFERENTIAL CALCULUS

16

Differential calculus: Differentiation of algebraic, circular, exponential, logarithmic functions of products, quotients functions, simple implicit function. Successive differentiation – intro and notation, nth order derivatives of std functions, nth order derivatives using (a) trig identities and standard functions. Leibnitz's Theorem. Macluarin's Theorem and Standard Expansions

Taylor's Theorem. Indeterminate forms and L'Hospital's Rule. Curve tracing of Cartesian and Polar Curves.

#### **UNIT V DIFFERENTIAL CALCULUS**

16

Functions of Several variables, limits and continuity. Partial derivatives – definitions, geometrical interpretation and rules of partial differentiation, Higher order partial derivatives, Homogeneous functions and Euler's Theorem, Total derivatives and Chain Rules, Implicit functions and Composite functions, Errors and Approximations, Maxima and Minima, LaGrange's multiple.

#### **TOTAL 54 HOURS**

#### **TEXT BOOKS:**

1. B.S. Grewal ,"Higher Engineering Mathematics", Khanna Publishers ,39<sup>th</sup> edition

#### **REFERENCE BOOKS:**

1. P.N. Wartikar and J.N. Wartikar,"A text book of Applied Mathematics", Volume 1 and 2,2001

#### 15EMR002 ELECTRICAL ENGINEERING BASICS 2 0 0 2

#### **Course objective:**

- To impart knowledge on electrical, electronic and control system.
- To manage operations of electrical and electronic equipment Electrical equipment,
   Generator and distribution systems.
- To learn about preparing, starting, paralleling and changing over generators.

#### **Course outcome:**

- **CO-1** To understand about basic fundamentals of electric current.
- **CO-2** To know about circuits (series & parallel), kirchoff's law & faraday's law.
- **CO-3** To understand basic fundamentals of AC circuit.
- **CO-4** To know the behaviour of AC in pure resistance, capacitance and inductive circuits.
- **CO-5** To understand about polyphase circuit.

#### UNIT I INTRODUCTION – ELECTRIC CURRENT

06

Introduction – Electric current, power, circuit elements – Ohm's law – series circuits – parallel circuits – Kirchhoff's Law – Faraday's law

#### **UNIT II AC CIRCUITS – FUNDAMENTALS**

06

AC Circuits – Fundamentals of AC- RMS value – Average value – R, RL, RLC RC circuits with numerical problems – Behaviour of AC in pure resistance, capacitance and inductive circuits.

#### **UNIT III PLOYPHASE CIRCUITS**

06

Ployphase circuits – Phase voltage, line voltage, power factor, power calculation, phase sequence – numerical problems

#### **UNIT IV BASICS OF ELECTRICAL MACHINES**

06

Basics of electrical machines-Different types of transformer connections - basic DC Machines – AC machines

#### UNIT VINSTRUMENTATION

06

Measurements and Instrumentation – MI, MC meters, Megger.

#### **TOTAL 36 hours**

#### **TEXT BOOKS:**

1. B L Theraja,"Electrical Technology" S Chand and company pvt.ltd, 2015

#### **REFERENCE BOOKS:**

1. P S Bhimbhara "Electrical Machinery", khanna publishers, 7th edition, 2005

#### 15EMR003 ENGINEERING DRAWING 3 0 0 3

#### **Course objective:**

- To do Maintenance and repair of shipboard machinery and equipments.
- To improve knowledge on machinery drawings and handbooks.

#### Course outcome:

- **CO-1** To understand essential feature of printing lettering on technical drawing.
- **CO-2** To understand the orthographic & basic dimension system.
- **CO-3** Able to know the draughtmanship skill & to draw free hand sketch on geometrical object.
- **CO-4** To understand & able to draw curves like ellipse, parabola & hyperbola.
- **CO-5** To understand & able to draw on cycloids, epicycloids & hypocycloids.

#### UNIT I INTRODUCTION TO TECHNICAL DRAWING

12

Draughtsman ship, lettering, dimensioning, types of lines and correct use of drawing instruments. Construction of geometrical figures specially showing joining of straight lines and curves. Free hand sketching

#### UNIT II CURVES USED IN ENGINEERING PRACTICE

12

Conic sections construction of ellipse, parabola and hyperbola by various methods. Drawing of spirals involutes, cycloids, epicycloids and hypocycloids, helixes.

UNIT III PROJECTIONS 10

Projection of points and lines. Projection of solids - Axis perpendicular to a plane and axis parallel to planes, axis parallel to one plane and inclined to the other, and axis inclined to both planes.

#### UNIT IV DEVELOPMENT OF SURFACES AND CURVES OF INTERSECTIONS

10

Developing the surface of prisms. Pyramids and cones and drawing the curves of intersection of cylinders to cylinders to cones, and other solids.

#### **UNIT V DEVELOPMENT OF SPRINGS AND THREADS**

10

Detailed drawings of helical springs of round and rectangular sections square thread formation in proper helical form.

#### **TOTAL 54 hours**

#### **TEXT BOOKS:**

1. K.V Natarajan, "Engineering Graphics", Dhanalakshmi publications, 16<sup>th</sup> edition, 2015

#### **REFERENCE BOOKS:**

1. Engineering Drawing, by N. H. Dubey, 2008

#### 15EMR004 MECHANICS OF MATERIALS 4003

#### **Course objective:**

- To know about maintenance and repair of shipboard machinery and equipment.
- To impart knowledge on design characteristics and selection of materials in construction of equipment.

#### **Course outcome:**

- **CO-1** To understand about stress.
- CO-2 To understand about strain.
- **CO-3** To understand about Circumferential and longitudinal stress in thin cylindrical shells.
- **CO-4** To understand about stress on Springs with axial load.
- **CO-5** To understand Strain energy due to normal, shear stresses & impact loads.

#### **UNIT I STRESS AND STRAIN**

12

Direct stress and strain. Modulus of Elasticity. Shear Stress and strain. Modulus of rigidity. Factor of Safety. Stress due to restricted expansion or contraction of single members. Hydrostatic stresses and the corresponding strains. Relationship between the three elastic constants. Thermal stress. Axial stresses in composite materials. Strength of welded joints.

UNIT II THIN SHELLS 12

Circumferential and longitudinal stress in thin cylindrical shells Course to internal pressure. Thick cylinders. Lame's Theory, Compound cylinders. Springs – Springs with axial load. Calculations for mean diameter of springs, wire diameter and number of coils. Close-coiled helical spring.

#### UNIT III CONCEPT OF STRAIN ENERGY

16

Strain energy due to normal and shear stresses. Strain energy due to impact loads. Resilience. Compound stress and strain. Stresses on an oblique section. General two-dimensional stress system. Principal planes and principal stresses. Strain on an oblique section. Determination of principal strains. Principal strain in three dimensions. Principal stresses derived from principal strains. Mohr's diagram for stress and strain. Combined bending and twisting. Equivalent bending and twisting moment. Shear, bending and torsion. Theories of failure.

#### UNIT IV BENDING OF BEAMS

16

Torsion. Combined stress. Simply supported beams. Cantilevers. Shearing Force and Bending Moment diagrams for cantilevers, simply supported beams with concentrated and uniformly distributed loads. Stress due to bending. Application of impact loads.

UNIT V DEFLECTION 16

Deflection of built-in beams and continuous beams by Integration and Macaulay's method. Moment area method of deflection coefficient. Deflection due to shear. Deflection by graphical method. Clapeyron's Three moment theorem. Applied problems. Thin curved bar. Strain energy due to bending. Castigliano's theorem, and its application to curved bars, strain energy due to twisting. Applied problems.

#### **TOTAL 72 hours**

#### **TEXT BOOKS:**

1. Ramamrutham, "Strength of Materials", DhanpatRai, 17<sup>th</sup> edition, 2011

#### **REFERENCE BOOKS:**

1. Rajput,"Strength of materials",2000

#### 15EMR005 MATHEMATICS II 3 0 0 3

#### **Course objective:**

- To able to understand integral calculus.
- To impart knowledge on ordinary differential calculus

#### Course outcome:

- **CO-1** To understand knowledge about integral calculus.
- **CO-2** To know application of integration to area under a curve, volume by revolution.
- **CO-3** To understand about moment of inertia.
- **CO-4** To know the applications to area and volume, mass of wire, lamina and a solid.
- **CO-5** To understand formation of differential equation.

#### UNIT I INTEGRAL CALCULUS 12

Integration of standard forms by substitution and by parts. The definite integral as the limit of a sum. Application of integration to area under a curve, volume by revolution. First moment of the area and the position of a centroid of an area. Work done by variable forces. Mean values. Root Mean square values of Sin nX and CosnX. The Rules of Guldinus.

#### UNIT II MOMENT OF INERTIA 16

Integral Calculus - Theories of Parallel axes and Perpendicular Axes. Second moments of area and moments of inertia of rectangular and circular laminas. Multiple integrals. Double and Triple Integrals. Regions of integration and change of order of integration. Spherical, Polar and Cylindrical co-ordinates. Applications to area and volume, mass of wire, lamina and a solid. Centre of gravity of a wire lamina and solid. Moment of Inertia using multiple integrals.

#### **UNIT III ORDINARY DIFFERENTIAL EQUATIONS**

16

Definition, order and degree. Formation of differential equation. Solution of first order, first degree equations in variables separable form, homogeneous equations, other substitutions. Equations reducible to homogeneous and exact differential equations. Linear differential equations of the first order and first degree, reducible to linear.

#### UNIT IV APPLICATIONS TO ELECTRICAL CIRCUITS AND ORTHOGONAL TRAJECTORIES

Nth order Linear Differential equations – definition and complementary function solution. Methods of obtaining the particular integral. Method of variation of parameters. Method of undetermined coefficients. Cauchy's homogeneous LDE and Legendre's equation. System of ordinary differential equations. Simultaneous equations in symmetrical form. Applications to deflection of beams, struts and columns.

#### UNIT V CALCULUS OF FINITE DIFFERENCES

12

16

Difference operators and relations between them, Algebra of finite difference operators, Newton's forward and backward interpolation formulae, Stirling's interpolation formula, Lagrange's Interpolation formula, Numerical differentiation, Numerical integration, Difference equations — definition formation and solution, Linear difference equation with constant coefficients.

#### **TOTAL 72 hours.**

#### **TEXT BOOKS:**

1. B.S GrewalKhanna, "Higher Engineering Mathematics", 39<sup>th</sup> edition, Publishers, New Delhi.,2004

#### **REFERENCE BOOKS:**

1. P.N. Wartikar, J.N. Wartikar, "A text book of Applied Mathematics" Volume 1 and 2,2000

# 15EMR006 MATERIALS SCIENCE I 2 0 0 2 Course objective: To impart knowledge on maintenance and repair of ship

- To impart knowledge on maintenance and repair of shipboard machinery and equipment.
- To know the Design characteristics and selection of materials in construction of equipment.

#### Course outcome:

- **CO-1** To know the basic metallurgy.
- CO-2 To know about the metals & the process involved.
- **CO-3** To gain knowledge about metals used in ship building.
- **CO-4** To know the properties of metals & non metals.
- **CO-5** To know the characteristics and limitations of process used for fabrication and repair.

#### UNIT I BASIC METALLURGY.

06

Metals and Processes

#### **UNIT II METALS USED IN SHIP-BUILDING**

06

Properties and uses. Non-metallic materials.

#### UNIT III HEAT TREATMENT

06

Characteristics and limitations of process used for fabrication and repair. Process heat treatment of carbon steel

#### **UNIT IV FABRICATION AND REPAIR**

08

Properties and parameters considered in the fabrication and repair of systems and components – Materials under load, vibration, self-secured joints, permanent joints, bonding plastics, adhesives and bonding, pipe work.

#### UNIT V IRON-CARBON EQUILIBRIUM DIAGRAM.

10

Non-ferrous alloys. Welding, gas-cutting

#### **TOTAL 36 hours.**

#### **TEXT BOOKS:**

1. O P Khanna," Material Science and Metallurgy ", Dhanpat Rai Publishers., 2002

#### **REFERENCE BOOKS:**

1. R S Khurmi,"Material Science", 2000

#### 15EMR007 MARINE MACHINERY DRAWING I 3 0 0 3

#### Course objective:

- To do Maintenance and repair of shipboard machinery and equipments.
- To improve knowledge on machinery drawings and handbooks.

#### **Course outcome:**

- **CO-1** To understand orthographic projection.
- **CO-2** To understand about the details of sectioning.
- **CO-3** To know about screw, threads & fasteners.
- **CO-4** To know about various types of locking arrangements of nuts.
- CO-5 To understand design characteristics of bearings & seals.

#### **UNIT I ORTHOGRAPHIC PROJECTIONS:**

16

Orthographic Projections in 1<sup>st</sup>& 3<sup>rd</sup> angle projections of simple machine components from given isometric drawings; Drawing of third view from the given two views in Orthographic Projections. Learn to put dimensions in different views Details of Sectioning: Sectioning of components at the central axis; Part Sectioning' Off-centre Sectioning and Off-set Sectioning; simple assembly drawings with sectional views.

#### UNIT II SCREW THREADS AND FASTENERS.

12

Locking and retaining devices. Riveted type fastenings. Welded connections. Standard Bolts, studs, nuts & tapped holes - Special bolts & screws e.g. tapped bolts, collar bolts and studs, pinching screws, cheese headed and round headed screws; Various types of locking arrangements of nuts.

#### **UNIT III DESIGN CHARACTERISTICS**

80

Design characteristics of bearings, seals, lubrication arrangement, ball and roller bearings.

#### UNIT IV CONVENTIONS FOR DRAWING

08

Thread formation, Nuts, Bolts & Studs – V - threads and square thread details; Metric & BSP threads; General conventions for drawing of threads in engineering drawings;

#### **UNIT V MACHINERY DRAWING**

10

Interpretation of machinery drawings. Interpretation of hydraulic and pneumatic diagrams.

#### **TOTAL 54 hours.**

#### **TEXT BOOKS:**

1. P.S. Gill., "Machine Drawing,", 2005

#### **REFERENCE BOOKS:**

1. K.V Natarajan, "Engineering Graphics", Dhanalakshmi publications, 16<sup>th</sup> edition, 2013

#### 15EMR008 ELECTRIC MOTORS AND STARTERS I 4 0 0 3

#### Course objective:

- To operate electrical, electronic, control systems, Electrical motors
- To know the starting methodologies of electrical motors.

#### Course outcome:

- **CO-1** To know the principles, constructional details and protection of DC Series, shunt and compound-wound motors and generators.
- **CO-2** To know about self Excitation, generation of back-EMF and load/voltage characteristics.
- **CO-3** To know about methods of voltage control, paralleling procedures & load sharing for DC Generators.
- **CO-4** To understand types of starters, characteristics between speed & torque, speed control of DC motors.
- CO-5 To know about theory of rotating magnetic fields in AC machines.

#### UNIT I PRINCIPLES, CONSTRUCTIONAL DETAILS

10

The principles, constructional details and protection of DC Series, shunt and compound-wound motors and generators. Self Excitation, generation of back-EMF and load/voltage characteristics. Numerical problems.

#### UNIT II METHODS OF VOLTAGE CONTROL

10

Methods of voltage control, paralleling procedures and load sharing for DC Generators. Numerical problems. Types of starters, characteristics between speed and torque, speed control of DC motors.

UNIT III AC MACHINES 10

AC Machines: Theory of rotating magnetic fields. Relation between frequency and no of poles and speed of a machine. Relation between slip, rotor emf and frequency, torque-speed characteristics. Numerical problems.

#### UNIT IV THEORY OF SYNCHRONOUS AND INDUCTION MOTORS

14

Theory of synchronous and induction motors.

#### **UNIT V CONSTRUCTIONAL DETAILS**

10

Constructional details of synchronous machines and induction motors. Coupling, load sharing and changing-over generators.)

#### **TOTAL 54 hours**

#### **TEXT BOOKS:**

1. BL Theraja ,"Electrical Technology" S. Chand, 2012

#### **REFERENCE BOOKS:**

1. P S Bhimbhara "Electrical Machinery", khanna publishers,7<sup>th</sup> edition,2005

#### 15EMR009 ELECTRONICS I 5 0 0 4

#### Course objective:

- To operate electrical, electronic and control systems.
- To know the characteristics of basic electronic circuit elements.

#### Course outcome:

- **CO-1** To understand about electron emission.
- **CO-2** To understand the application of electron emission.
- **CO-3** To understand the types of semi conductors.
- **CO-4** To understand the characteristics of semi conductors.
- **CO-5** To understand about transistors & its characteristics.

#### UNIT I ELECTRON EMISSION

12

Electron Emission- Thermionic Emission, Photoelectric emission, Electric field emission and their application.

#### **UNIT II SEMI CONDUCTORS**

24

Semi Conductors - Types of Semi Conductors, Electrical characteristics, Diffusion and Drift, Mobility. Diodes Characteristics of diodes, Diodes as a rectifier, Zener diodes, Thyristors, Varistors, Thermistors and Non Linear Resistors their function and operation. Symbols used.

UNIT III TRANSISTORS 18

Transistors - The junction transistor and its basic characteristics, The transistor as an amplifier, Full wave, half wave, Bridge Rectifiers, DIAC, TRIAC. SCR, UJT, LED. Integrated Circuits and Large Scale Integrated Circuits (LSI). IC555 based timers, audio-visual alarms. Basics of digital electronics

UNIT IV REGULATORS 24

Regulated power supplies Series Regulators, Shunt regulators. Oscillators – circuit diagram and explanation – requirements for Oscillations phase shift Oscillator Wien Bridge oscillators, Crystal Oscillators. Power Amplifiers circuit diagram and explanation. Class A, B & C amplifier,

efficiency, distribution. Design theory, Symmetry, Practical complementary push-pull amplifier. Wave Shaping and Switching -Clipping, Clamping. Operational amplifier – inverting and non inverting.

#### UNIT V FLOW CHARTS 12

Flow charts for manual and automatic control systems

#### **TOTAL 90 hours**

#### **TEXT BOOKS:**

1. V.K. Metha & Rohit, "Principle of Electronics," S.chand,10<sup>th</sup> edition,2008

#### **REFERENCE BOOKS:**

1. B L Theraja, "Electrical Technology" S.Chand and company pvt.ltd, 2013

# 15EMR010 MATERIAL SCIENCE II 3 0 0 2 Course objective:

- To do maintenance and repair of shipboard machinery and equipment.
- To know the design characteristics and selection of materials in construction of equipment.

#### **Course outcome:**

- **CO-1** To understand about vibrations.
- CO-2 To understand about failure modes caused by vibrations.
- **CO-3** To understand about the metallurgy of steel and cast Iron.
- **CO-4** To understand about properties and applications of materials used in machinery on board ships.
- **CO-5** To understand about the engineering process.

#### UNIT I VIBRATIONS 12

Vibrations. Failure modes – viz plastic deformation, fracture, fatigue, creep.

#### UNIT II TECHNOLOGY OF MATERIALS

12

Technology of materials – Metallurgy of steel and cast Iron, properties and applications of materials used in machinery on board ships

#### **UNIT III ENGINEERING PROCESSES**

10

Engineering processes used in construction and repair

#### **UNIT IV MATERIALS AND WELDING**

12

Materials and welding. Mechanical testing of materials. Destructive testing of materials

#### UNIT VTESTING OF MATERIALS

80

Non-destructive examination and testing of materials.

#### **TOTAL 54 hours**

#### **TEXT BOOKS:**

1. O.P. Khanna "Material Science and Metallurgy,", DhanpatRai Publishers, 2012

#### **REFERENCE BOOKS:**

1. R.S. Khurmi, "Material Science",2009

# 15EMR011 MARINE MACHINE DRAWING II 3 0 0 3 Course objective:

- To do maintenance and repair of shipboard machinery and equipment.
- To able to Interpret machinery drawings and handbooks.
- To know the interpretation of piping, hydraulic and pneumatic diagrams.

#### Course outcome:

- **CO-1** To understand & able to draw the assembly & dismantling of air inlet valve.
- **CO-2** To understand & able to draw assembly & dismantling of automatic valve.
- **CO-3** To understand & able to draw assembly & dismantling of starting air pilot valve.
- **CO-4** To understand & able to draw assembly & dismantling of boiler mounting full bore safety valve.
- **CO-5** To understand & able to draw assembly & dismantling of high lift safety valve.

#### **UNIT I MAIN ENGINE SYSTEM**

12

Main Engine System Air-inlet valve, Automatic valve, Starting Air Pilot valve

#### **UNIT II BOILER MOUNTINGS**

16

Boiler Mountings Boiler Blow-Down valves, Full Bore Safety valve, Plate type gauge glass, High lift Safety valve

#### **UNIT III ENGINE COMPONENTS**

16

Engine Components, Connecting rod with bearings, Rocker Arms, Starting Air valve, 4-stroke piston

#### UNIT IV MARINE COMPONENTS

12

Marine Components Ballast Chest, Bilge suction strainer, Tele-motor receiver

#### **UNIT V AUXILIARY COMPONENTS**

16

Auxiliary components, Fuel Oil Strainer, Reducing valve, Return and Non-return globe valves

#### **TOTAL 72 HOURS**

# **TEXT BOOKS**:

H.G Beck, "Reeds Engg. Drawing for marine engineers", Thomas Reed publication, 2<sup>nd</sup> edition, 1978.

# **REFERENCE BOOKS:**

1. K.V Natarajan, "Engineering Graphics", Dhanalakshmi publications, 16<sup>th</sup> edition, 2015

# 15EMR012 ELECTRIC MOTORS AND STARTERS II 4 0 0 3 COURSE OBJECTIVE:

- To operate electrical, electronic and control systems.
- To impart knowledge on Electrical motors starting methodologies.

#### Course outcome:

- **CO-1** To understand about three phase ac induction motor.
- **CO-2** To understand about three phase synchronous motor.
- **CO-3** To understand motor control & protection.
- **CO-4** To understand about speed control of motors.
- **CO-5** To understand about three phase generators.

UNIT I 10

Three phase AC induction motors, three phase synchronous motors, and effect of varying frequency and voltage of AC motors, Numerical Problems

UNIT II 10

Motor control and protection, IGBT(Insulated Gate Bipolar Transistor) motor speed control, motor speed control by Thyristors,

UNIT III 14

Three phase Generators, Three phase transformers. Transformers – theory of transformers and their onboard usage. Specifications of coolant. Distribution Systems. Numerical problems.

UNIT IV 10

Various means of starting AC machines, motor speed control, HV and LV switch gear, distribution and equipment- Coupling and breaking connection between switchboard and distribution panels.

UNIT V 10

Basics of electric propulsion systems, power distribution systems – distribution, insulation, transformer, types.

# **TOTAL 54 hours**

# **TEXT BOOKS**:

1. B L Theraja, "Electrical Technology", S Chand, 2015

# **REFERENCE BOOKS:**

1. P S Bhimbhara "Electrical Machinery", khanna publishers, 7<sup>th</sup> edition,2005

# 15EMR013 ELECTRONICS II 5 0 0 4

# Course objective:

- To gain knowledge on Operate electrical, electronic and control systems.
- To know the Sequential control circuits and associated system devices.

#### Course outcome:

- **CO-1** To understand the concept of differential amplifier.
- **CO-2** To understand about the operation amplifier theory.
- **CO-3** To gain knowledge about the converters.
- **CO-4** To understand about various sensors onboard ship.
- **CO-5** To understand about digital integrated circuits.

UNIT I 24

Operation Amplifier Theory: Concept of Differential Amplifiers. Linear OP-amp circuits. Digital Circuits: Logic System and Gates. Binary and BCD codes, Boolean algebra, Simplifications, Flipsflops; Counters; Registers and Multiplexers.

UNIT II 18

Converters: Analog to Digital (AD) and Digital to Analog (DA) converters and their use in Data-Loggers. Various Sensors used on board ship- Pressure Sensors - Temperature Sensors – Level Sensors - RPM Sensors – Photo Sensors - Water Salinometer

UNIT III 16

TTL & CMOS GATES: Digital integrated Circuits, Semi – conductor Memories-ROM, RAM and PROM. Industrial Electronics: Power rectification, Silicon Control rectifier power control, Photo-Electric Devices. Electronic Control equipment – PLC – Integrated Automation Control and Monitoring System (IACMS), Computer programmable controller, Relay circuit Unit, Digital Sequential Control devices

UNIT IV 16

Communication devices: Communication systems, Modulation and Demodulation, their

necessity and circuit explanation. AM, FM, Wireless communication, Radio Transmitters and Receivers, T-V broadcasting, Radar Communication, Pulse Communication. Practical use of VHF.

UNIT V 16

Electronic Instruments: Cathode Ray Oscilloscope, Digital Voltmeters and frequency – meters, Multimeters; Voltmeter and signal Generators, Q-Meters. Flow Chart for Automatic and other Control Systems – Depiction and understanding of flow-charts, symbols utilization, and processes involved.

# **TOTAL 90 HOURS**

# **TEXT BOOKS:**

1. V. K. Mehta "Electronics engineering", S.Chand, 2012

# **REFERENCE BOOKS:**

1. B L Theraja ,"Electrical Technology" S Chand and company pvt.ltd, 2013

# 15EMR014 THERMAL ENGINEERING

3 0 0 2

# **Course objective:**

- To manage the operation of propulsion plant machinery Plan and schedule operations, surveillance, performance assessment.
- Able to maintain safety of propulsion plant and auxiliary machinery.

#### **Course outcome:**

- **CO-1** To understand the working of air compressors.
- **CO-2** To understand the calculation of work done.
- **CO-3** To understand about the properties of steam.
- **CO-4** To solve numericals based on the properties of steam.
- **CO-5** To understand Operation principle and basic construction of and materials of steam turbine.

UNIT I 10

Air Compressors – Elementary principles and cycles of operation. Calculation of work done. Indicator diagrams. Numerical examples.

UNIT II 10

Properties of steam – Saturated steam, dry, wet. Dryness fraction. Super heated steam. Internal energy. Enthalpy. Specific volume. Steam tables. Throttling. Advantages of using steam expansively. Numerical examples.

UNIT III 10

Rankine cycle. Operation principle and basic construction of and materials of steam turbine. Impulse turbine. Reaction turbine. Elementary principles of steam turbines including simple velocity diagrams for impulse and reaction turbines. Force and work on blades. Numerical examples.

UNIT IV 10

Combustion – Solid and liquid fuels. Calorific value. Chemical equations for complete combustion. Theoretical minimum air required. Excess air. Numerical examples.

UNIT V 14

Gas dynamics. Gas nozzles and Steam nozzles. One dimensional flow of gases through varying cross-section, critical pressure ratio, convergent nozzle, convergent-divergent nozzle. Gas turbine – open cycle gas turbine-operation, principle and basic construction. Effect on thermal efficiency due to change in pressure ratio, inclusion of intercooler, reheaters and heat exchangers. construction)

# **TOTAL 54hours**

# **TEXT BOOKS**:

1. Thermal Engineering by A P. Ballaney.2012

# 15EMR015 MARINE INTERNAL COMBUSTION ENGINEERING I 5 0 0 4 Course objective:

• To operate main and auxiliary machinery and associated control systems

# Course outcome:

- **CO-1** To understand the various thermodynamic cycles that are used in IC Engines.
- **CO-2** To be able to relate the thermodynamic cycles to the actual working of the engines and solve problems based on the cycles.
- **CO-3** To be able to classify IC Engines based on various parameters.
- **CO-4** To be able to draw the Valve timing Diagram of the 4-Stroke and 2-Stroke IC Engines.
- **CO-5** To understand the various components that make up the IC Engines.

UNIT I 18

Characteristics of I.C. Engine: 4 – stroke and 2 – stroke cycles; Deviation from Ideal Condition in actual engines; Limitation in parameters, Timing Diagrams of 2-stroke and 4 – stroke engines. Comparative study of slow speed, medium speed and high speed diesel engines – suitability and requirements for various purposes mean piston speed, M.C.R. & C.S.R. ratings. Practical heat balance diagrams and thermal efficiency.

UNIT II 18

**General Description of I.C. Engines:** Marine Diesel Engine of M.A.N., Sulzer, B& W make constructional details of I.C. Engines: Principal components: Jackets and Liners, Cylinder heads. Pistons, Cross heads, Connecting rods, Bed plates, A-frames, welded construction for bed plates & frames. Tie rods.

UNIT III 18

**Scavenging systems:** Scavenging arrangements in 2 – stroke engines; air charging and exhausting in 4 – stroke engines; various types of scavenging in 2 – stroke engines; Uni – flow, loop, cross scavenging, their merits and demerits Scavenge pumps for normally aspired engines; under piston scavenging, Scavenge manifolds.

UNIT IV 18

**Supercharging arrangements:** Pulse and Constant Pressure type; their relative merits and demerits in highly rated marine propulsion engines. Air movements inside the cylinders. Turbocharger and its details. Two stage, un-cooled, radial turbochargers.

UNIT V 18

**Marine Gas Turbines:** Brief history of development. Principle of simple open-cycle gas turbine, gas turbine with regenerator, intercooler. Definition of Air Rate, Work ratio, compressor and turbine efficiencies. Basic gas turbine components. Materials of construction of the various components.

#### **TOTAL 90 hours**

# **TEXT BOOKS:**

1. Devan Aranha, "Marine Diesel Engines", Shroff Pub., 5<sup>th</sup> edition, 2010

# **REFERENCE BOOKS:**

1. Doug wood yard ,"Pounder's Marine Diesel Engines" 8<sup>th</sup> Edition, Elsevier Ltd, 2004

# 15EMR016 CONTROL SYSTEMS FOR MARINE MACHINERY Course objective:

5004

- Able to Operate electrical, electronic and control systems, Manage operation of electrical and electronic control equipment, Operation, surveillance, performance assessment.
- To maintain safety of propulsion plant and auxiliary machinery.

#### **Course outcome:**

- **CO-1** To understand about basic control engineering.
- **CO-2** To understand Fundamentals of automatic control.
- **CO-3** To understand Static and dynamic characteristics of measuring instruments.
- **CO-4** To understand Construction and operation of electrical testing and measuring equipment.
- **CO-5** To understand about transmission of signals.

UNIT I 12

Basic Control Engineering. Fundamentals of automatic control. Various types – ON/OFF control, Continuous Control, Sequential Control.

UNIT II 18

Static and dynamic characteristics of measuring instruments. Construction and operation of electrical testing and measuring equipment. Filters, regulated power supply. Transducers and Transmitters suitable for measurement of temperature, pressure, flow, level, speed, torque, vibration, and water content.

UNIT III 12

Measurement of process value. Temperature (Mechanical, Electrical), Pressure, Level (Direct and inferential methods), Flow. Transmission of signals- Transmitters, controlling elements (Pneumatic, electrical). Manipulator elements – principles, operation, application of pneumatic, electrical and hydraulic servomotors.

UNIT IV 18

Theory and characteristics of P-I-D control, and its tuning. V-I, I-V, P-I and I-P Converters. Basics of Programmable Logic Controllers. Functions and mechanism of automatic control for Main

Engines and Auxiliary Machinery. Generator distribution system, steam boiler, oil purifier, refrigeration, pumping systems, steering gear, cargo handling equipment and deck machinery.

UNIT V 12

Design features and system configuration of automatic control equipment and safety devices for the following – Main Engine, Generator and distribution system, and Steam Boiler. Features of Pneumatic and Hydraulic control equipment.

# **TOTAL 72hours**

# **TEXT BOOKS:**

1. Marine Control Practice by D A Taylor, 2<sup>nd</sup> Edition, Butterworth and Co (Publishers) Ltd., London 1987.

# **REFERENCE BOOKS:**

1. J.Majumder,Elastan A Fernandez, "Marine Control Technology", Shroff Pub. , 7<sup>th</sup> edition, 2014

# 15EMR017 MARINE INTERNAL COMBUSTION ENGINEERING II 5 0 0 4 Course objective:

• Able to operate main and auxiliary machinery and associated control systems.

# **Course outcome:**

- **CO-1** To understand Propulsive characteristics of Diesel engines.
- **CO-2** To understand Fuel atomization, Ignition quality, Fuel injectors and its detail. Ignition delay, after burning.
- **CO-3** To understand Marine Diesel Engine trunk and Crosshead types.
- **CO-4** To understand Compression pressure ratio and its effect on engines.
- **CO-5** To understand Assessment of engine power, and running adjustments to maintain performance.

# **UNIT I COMBUSTION OF FUELS**

16

Propulsive characteristics of Diesel engines including speed, output and fuel consumption. Engine lay-out and load diagrams. Fuel oil preparation systems. Combustion of Fuels in I.C. Engines: Grades of suitable fuels. Preparation of fuels for efficient combustion. Fuel atomization, Ignition quality, Fuel injectors and its detail. Ignition delay, after burning.

#### **UNIT II MARINE DIESEL ENGINE**

12

Marine Diesel Engine – trunk and Crosshead types. Compression pressure ratio and its effect on engines. Reasons for variation in compression pressure and peak pressure. Design aspects of combustion chamber. Control of NOX, SOX in Exhaust emission.

# UNIT III LUBRICATION 16

Assessment of engine power, and running adjustments to maintain performance. Operational limits of Power Plants. Lubrication systems: need for lubrication – types of Lubrication systems Lubrication systems: lubrication arrangement in diesel engines including coolers & filters, cylinder – lubrication, linear wear and preventive measures, combinations of lubricating oil its

effect and preventive measures. Improvements in lubricating oils through use of additives types of additives. Monitoring engines through lubricating oil analysis reports.

# **UNIT IV CONTROL AND ALARM SYSTEMS**

16

Control and Alarm systems associated with automatic operation of a Diesel Power Plant.UMS operation of Power Plant. Governors(Hydraulic and Electronic). Turbochargers, supercharging and scavenge system. Cooling systems: Various Cooling media used; their merits and demerits, cooling of Pistons, cylinder jackets & cylinder heads, bore cooling, Coolant conveying mechanism and systems, maintenance of coolant and cooling system.

#### UNIT V SAFETY AND PREVENTION

12

Detection, Safety and prevention: Causes and prevention of crank case explosions, and scavenge fires, safety fittings, Uptake fire, starting air-line explosion.

# **TOTAL 72 HOURS**

# **TEXT BOOKS:**

1. DevanAranha, "Marine Diesel Engines", Shroff Pub., 5<sup>th</sup> edition, 2010

# **REFERENCE BOOKS:**

1. Doug wood yard ,"Pounder's Marine Diesel Engines" 8th Edition, Elsevier Ltd, 2004

#### 15EMR018 SHIP CONSTRUCTION 3 0 0 3

# Course objective:

• To maintain seaworthiness of the ship, Control trim, stability and stress.

# **Course outcome:**

- **CO-1** To understand Common terms used in the measurement of steel ships.
- **CO-2** To understand Descriptions and sketches of structural members in ordinary types of steel ships.
- **CO-3** To understand Water-tight doors, Hatches, Rudders, Bow-thrusters, Propellors, Watertight bulkheads.
- **CO-4** To understand Ventilation arrangements for pump rooms in tankers and for cargo holds and oil fuel tanks.
- **CO-5** To understand Double-bottom and deep tank filling and pumping arrangements.

UNIT I 09

Common terms used in the measurement of steel ships – Length overall, Length between perpendiculars, breadth overall, moulded depth, draught and freeboard. Definitions of ship-building terms in general use. Descriptions and sketches of structural members in ordinary types of steel ships. Load lines, Deck Line, Freeboard, Plimsoll line.

UNIT II 12

Water-tight doors, Hatches, Rudders, Bow-thrusters, Propellors, Watertight bulkheads. Double bottoms. Anchors and cables. Descriptive treatment of the effect of liquids on stability Arrangements for the carriage of dangerous goods in bulk. Ventilation arrangements (natural and mechanical) for pump rooms in tankers and for cargo holds and oil fuel tanks.

UNIT III 12

Forepeak and after-peak tanks. Double-bottom and deep tank filling and pumping arrangements. Compartmental drainage. Leveling arrangements for damaged side compartments. Ship dimensions and form-general arrangement of general cargo ships, tankers,

bulk carriers, combination carriers, container ships, RO-RO and passenger ships. Definitions of camber, rise of floor, flare, sheer, rake, etc.

UNIT IV 09

Ship stresses- hogging and sagging, racking, panting, pounding, slamming, etc. Hull structure-Proper names for the various parts, standard steel sections used, Bow and Stern construction, Stern frame. Structural arrangements forward and aft to withstand panting and pounding, etc.

UNIT V 12

Fittings- water-tightness of the hatches, openings in oil tankers, chain lockers and attachment of cables. Bilge piping system. Ballast System. Sounding pipes and air pipes. Propellors and rudders- construction of rudders and propellers, controllable pitch propellers, stern-tube arrangement. Ship Survey Rules. Functioning of Ship Classification Societies. Surveys during construction. Periodical surveys for retention of Class, and Statutory Surveys.

# **TOTAL 54 hours.**

# **TEXT BOOKS:**

1. E A Stokoe, "Reed's Ship Construction for Marine Engineers", Volume 5,2010

# **REFERENCE BOOKS:**

1. D. J. Eyres,"Ship Construction", Elsevier Ltd, Sixth edition, 2007

#### 15EMR019 MARINE POWER PLANT OPERATION 4 0 0 4

#### **COURSE OBJECTIVE:**

To operate main and auxiliary machinery and associated control systems

#### Course outcome:

- **CO-1** To understand watch keeping procedures.
- **CO-2** To understand watch keeping routines & operations.
- **CO-3** To understand the safe working practices.
- **CO-4** To understand importance of **PPE** & emergency procedures.
- **CO-5** To understand about safe system of working.

# UNIT I WATCH-KEEPING-PROCEDURES

18

Safe Engineering Watch-Keeping-Procedures to be adopted in safe Watch-keeping. Procedures for Handing Over/Taking over a Watch. Routine work doing Watch-keeping, such as soot-blowing, cleaning of filters, pumping out of bilges through Oily Bilge Separator, routine pumping operations of fuel oil, ballast water, fire pump and cargo pumping system. Remote operation of pumping system and associated controls, purification and clarification of fuel oil, purification and clarification of lube oil.

#### **UNIT II SAFE WORKING PRACTICES**

18

Practical Knowledge – Ensure Safe Working Practices – Risk Assessment – Safety Officials – Personal Protective equipment – Work equipment- Safety Induction – Fire Precautions – Emergency procedures.

# **UNIT III PERMIT TO WORK SYSTEMS**

18

Safe movement on board ship. Safe system of working – Entering enclosed or confined spaces – Permit to work systems – Manual handling of equipment – Use of work equipment – Lifting devices – Maintenance of machinery – Hot Work-Painting hazards – Hazardous substances – Noise and vibrations.

# **UNIT IV EMERGENCY PROCEDURES**

18

Emergency procedures, such as: action to be taken in the event of fire, including fire drills, flooding of Engine room, rescue operations for injured persons, action in case of stoppage of the main engine, auxiliary engines and associated systems.

# **UNIT V MAINTENANCE OF MACHINERY**

18

Actions in the event of Main Engine auto slow-down and shut down. Main Boiler auto shut-down. Power Failure. Emergency procedure for other equipment/Installations. Emergency Steering. Black-out operations and power restoration, and propulsion Plant restart. Interpretation of functional tests on communication and control systems. Maintenance of machinery space Log Book and the significance of the readings taken.

# **TEXT BOOKS:**

1 .Marine Control Practice by D A Taylor, 2<sup>nd</sup> Edition, Butterworth and Co (Publishers) Ltd., London 1987

# **REFERENCE BOOKS:**

1. Nanda and Ghokale,"Basic Marine Engineering Knowledge" N.G Series, 4<sup>th</sup> edition, 2011.

# 15EMR020 MONITORING AND PROTECTION OF ELECTRICAL SYSTEMS 3 0 0 2 Course objective:

- Able to Maintain and repair of electrical and electronic equipment.
- To manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition.

#### **Course outcome:**

- **CO-1** To understand flow diagrams & circuits.
- **CO-2** To understand Electric and electronic symbols and interpretations of flow diagrams and circuits.
- **CO-3** To understand Trouble shooting of electrical and electronic control equipment.
- **CO-4** To understand Interpretation of circuit symbols.
- **CO-5** To understand about the protection of generators.

# **UNIT I FLOW DIAGRAMS AND CIRCUITS**

12

Electrical and simple electronic diagrams. Electric and electronic symbols and interpretations of flow diagrams and circuits. Software Version Control – Programmable Logic controllers, Microcontrollers, Digital techniques.

# **UNIT II TROUBLE SHOOTING**

09

Trouble shooting of electrical and electronic control equipment. Electrical Safety. Test equipment. Interpretation of circuit symbols. Logical six-step trouble-shooting procedure.

# **UNIT III PROTECTION MAINTENANCE**

12

Power Generation, Prime mover electrical control. Main Air Circuit breaker. Protection of generators. Safe Electrical practice: Safe watch – keeping, points to check on electrical machineries, switch gears & equipments, microprocessor control and maintenance electrical fire fighting, precautions against electric shock and related hazards.

# **UNIT IV SURVEY REQUIREMENTS**

09

Electrical distribution system. Motors. Electrical Survey requirements. Function test of electrical, electronic control equipment and safety devices.

# **UNIT V TEST AND CALIBRATION**

Calibrate and adjust transmitters and controllers. Fault-finding in Control Systems. Trouble shooting of monitoring systems- Test and calibration of sensors and transducers of monitoring systems.

# **TOTAL 54 hours.**

# **TEXT BOOKS:**

1. Eltsan Fernandez, "Marine Electrical Technology", shroff pub., 7<sup>th</sup> edition, 2014

# **REFERENCE BOOKS:**

 Marine Control Practice by D A Taylor, 2<sup>nd</sup> Edition, Butterworth and Co (Publishers) Ltd., London 1987.

# 15EMR021 ELECTRICAL TESTING AND MEASURING EQUIPMENT 2 0 0 2 Course objective:

• able to do Maintenance and repair of electrical and electronic equipment

# Course outcome:

- **CO-1** Able to identify the test equipment needed for testing IR value of electrical equipment and the important of IR value.
- **CO-2** Attains knowledge of taking IR value of electrical equipment by knowing the points for testing.
- **CO-3** Able to tell the name of equipment required for various working voltages of electrical equipment.
- **CO-4** Knows the operating principle of equipment including its parts.
- **CO-5** Knows the type of test equipment to be used on electrical equipment to check various parameters like **V** ac & dc, **current** ac & dc, **resistance** & **capacitance**.

# **UNIT I INSULATION TESTER, CONTINUITY TESTER**

08

Construction of electrical testing and measuring equipment: Insulation Tester, Continuity tester,

# UNIT II MULTI-TESTER, CLAMP METER

08

Construction of electrical testing and measuring equipment: Multi-Tester, Clamp Meter

# **UNIT III INSULATION TESTER, CONTINUITY TESTER**

08

Operation of electrical testing and measuring equipment: Insulation Tester, Continuity tester

# **UNIT IV MULTI-TESTER, CLAMP METER**

06

Operation of electrical testing and measuring equipment: Multi-Tester, Clamp Meter

# **UNIT V MEASURING EQUIPMENT**

06

Construction and operation of electrical testing and measuring equipment: Digital meters for voltage, current, speed, frequency, power factor, phase sequence, salinometer.

# **TOTAL 36 hours.**

# **TEXT BOOKS:**

1. B.L Theraja& A K Theraja, ,"Electrical Technology,"S.Chand,2012

# **REFERENCE BOOKS:**

1. P S Bhimbhara "Electrical Machinery",khanna publishers,7<sup>th</sup> edition,2005

# 15CMRE81 FIRE PREVENTION, FIRE-FIGHTING AND LIFE-SAVING APPLIANCES 3 0 0 3 Course objective:

- Able to Prevent, control and fight fires on board
- To able to operate life-saving appliances.

# Course outcome:

- **CO-1** To understand fire hazard onboard ship & fire basics.
- **CO-2** To understand control of fire onboard ship.
- **CO-3** To understand fire protection built in ship.
- **CO-4** To understand fire detection & safety system.
- **CO-5** To understand different fire fighting equipments.

# UNIT I FIRE HAZARD 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 09

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 FIREFIGHTING 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.

09

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 VOPERATION AND MAINTENANCE

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 54 hours**

# **TEXT BOOKS:**

H.D.Mcgeorge, "Marine Auxiliary Machinery", Reed Elseiver India, 2011

# 15EMR023 MARINE BOILERS AND STEAM ENGINEERING 3 0 0 2 Course objective:

• able to Operate main and auxiliary machinery and associated control systems.

# Course outcome:

- **CO-1** To understand various types of marine boilers.
- **CO-2** To understand about the mountings in boiler.
- **CO-3** To understand about the various operation of boilers.
- **CO-4** To understand about the care & maintenance of boilers.
- **CO-5** To understand Furnace arrangement for oil burning.

# UNIT I VARIOUS TYPES OF MARINE BOILERS AND BOILER MOUNTINGS

12

Cochran Boiler, Spanner Boiler, Clarkson thimble tube, waste-heat recovery calculation, Lamont exhaust gas boiler, Composite boilers, and water tube boilers – Babcock Wilcox; Foster Wheeler – D-type, Double evaporation boilers. Boiler Mountings: Safety valves – Improved High Lift, Full lift and full Bore type - procedure for setting. Gauge glass – Ordinary plate type and remote indicator- blowing of gauge glass. Automatic feed regulator, three element High & Low water level alarms, Main Steam stop valve, Retractable type Soot blower.

# **UNIT II OPERATION CARE AND MAINTENANCE OF BOILERS**

12

Pre-commissioning procedures - preparing for Survey - Hydraulic tests, steam raising and Operating procedures, Action in the event of shortage of water. Blowing down of boiler, laying up a boiler; general maintenance External and internal tube cleaning. Tube renewals, etc, Maintenance inspection and survey of boilers. Refractory: Purposes of Refractory types of Refractory and reasons for failure.

UNIT III OIL BURNING 09

Procedure of liquid fuel burning in open furnace, various types of atomizer - overhauling of FO Burner. Furnace arrangement for oil burning, Boiler control system i.e. master control, fuel control, air control & viscosity control, Introduction to Automation.

# **UNIT IV OPERATION AND MAINTENANCE**

12

Turbine drain system, turbine gland system, warming through a turbine plant, control of speed and power of propulsion, throttle valve control and nozzle control, emergency controls,

emergency operations of turbines, vibration in marine steam turbine, steam turbine losses. Lubrication of Turbines: Suitable oils and their properties, lubrication of main bearings, thrust bearings and gears. Gravity and pressure lubrication - Oil system and emergency lubrication arrangement. Breakdown and faultfinding.

UNIT V CONDENSERS 09

Types of condensers, constructional details, location & working principles, contraction and expansion allowances, leak test. Effect of Change of temperature, circulating water quantity, change of main engine power, condenser surface.

# **TOTAL 54hours**

# **TEXT BOOKS:**

1., J.H. Milton & R.M. Leach,"Marine Steam Boilers", 4<sup>TH</sup> Edition, Butter worth, London 1980

# 15EMR024 ELEMENTARY DESIGN OF MARINE MACHINERY 2 0 0 2 Course objective:

- Able to manage the operation of propulsion plant machinery, Plan and schedule operations Operation, surveillance, performance assessment.
- To maintain safety of propulsion plant and auxiliary machinery.

#### Course outcome:

- **CO-1** To understand the procedure in machine design.
- **CO-2** To understand the Concepts of design, procedure and processes.
- **CO-3** To understand the elementary design of Main propulsion Engine (Diesel Engine).
- **CO-4** To understand the elementary design of Auxiliary Diesel Generator & gas turbine.
- **CO-5** To understand the elementary design of Main propulsion Engine (Steam Turbine).

# UNIT I PROCEDURE IN MACHINE DESIGN

06

Concepts of design, procedure and processes, Design synthesis, Economic consideration in design, Feasibility, Preliminary Design alternative, Preliminary & final plans & drawings.

# **UNIT II ELEMENTARY DESIGN**

06

Elementary design considerations of following: Main propulsion Engine (Diesel Engine), Auxiliary Diesel Generator, gas turbine.

# **UNIT III ELEMENTARY DESIGN**

06

Elementary design considerations of following: Main propulsion Engine (Steam Turbine), Turbo-electric propulsion. Turbo-generator

# UNIT IV START-UP AND SHUT DOWN PROCEDURES

09

Start-up and shut down procedures for the following ships' Power plant: (i) Diesel Engine (ii) Steam turbine (iii) Main WT Boiler. Include all auxiliary machinery in each case.

# UNIT V PERFORMANCE ASSESSMENT

09

For all propulsive Plants above determine operating limits, maintain operational surveillance, carry out performance assessment, and ensure safety of operation of Main Propulsion and Auxiliary equipment.

# **TOTAL 36 hours.**

# **TEXT BOOKS:**

1. R. S. Khurmi & J.K.Gupta, "A Textbook of Machine Design",2012

# ABILITY ENHANCEMENT COMPULSORY COURSES

# 15EMR201 TECHNICAL ENGLISH 3 0 0 3

# **Course objective:**

Able to get adequate knowledge of the English Use in written and oral form.

# Course outcome:

- **CO-1** To understand Simple, Compound and Complex sentences.
- **CO-2** To understand Reading text: skimming for general information.
- **CO-3** To understand the characteristics of technical style.
- **CO-4** To understand Listening and transferring of information from text to graphic forms.
- **CO-5** To understand reading comprehension.

# **UNIT I ORAL COMMUNICATION**

80

Simple, Compound and Complex sentences – impersonal passive voice – Use of Articles – Use of Prepositions – Commonly mispronounced and wrongly spelt words – Reading text: skimming for general information.

# **UNIT II WRITTEN COMMUNICATION**

12

Introduction to the characteristics of technical style – writing definitions and descriptions – note making – Listening and transferring of information from text to graphic forms - bar charts, flow-charts.

UNIT III READING 12

Reading Comprehension - scanning for information – inferring meaning from context - Listening and guided note-taking - using notes – giving suitable headings / subheadings for paragraphs

# **UNIT IV GRAMMAR AND VOCABULARY**

12

Word formation with prefixes and suffixes – Parts of Speech – Verb patterns - adjectives, adverbs - matching words with meanings - British and American Vocabulary – Marine Vocabulary

UNIT V LISTENING 10

Extensive listening – listening for general content – listening to fill up missed text – intensive listening – listening for specific information.

# **TOTAL 54 HOURS**

# **TEXTBOOKS:**

1. Mark Ibbotson, "English for engineering", Cambridge press, 2008 edition, 2014

# **REFERENCE BOOKS:**

1. Rizvi M. Ashraf, "Effective Technical Communication, ",Rizvi M. Ashraf, Tata McGraw-Hill publishing company ltd., New Delhi.2005

# 15EMR202 WORKSHOP TECHNOLOGY 3 0 0 3

# Course objective:

- Able to Maintain and repair shipboard machinery and equipments.
- To gain appropriate basic mechanical knowledge and skills.

# **Course outcome:**

- **CO-1** To understand common workshop tools.
- **CO-2** To understand Pattern maker's tools, Smithy tools and Mouldings tools.
- **CO-3** To understand measuring tools.
- **CO-4** To understand the inspection of measuring tools.
- **CO-5** To understand about permanent joints.

# **UNIT I COMMON WORKSHOP TOOLS**

10

Description and used of different types of calipers, Straight edges, Try squares. Vices, Hammers, Chisels, Scrapers, Files, Drills, Reamers, Taps, V-Block, Face plate, Marking Blocks Carpentry Tools, Pattern maker's tools, Smithy tools and Mouldings tools

# **UNIT II MEASURING INSTRUMENTS & INSPECTION**

10

Description and use of steel rule, Vernier's Scale, Micro-meter, Dial gauge, Depth gauge, thread gauge, Feeler gauge, Wire gauge, Pattern Maker's Scale, Taper gauge, snap gauge, Plug gauge, Optical method of measurement, principles of interchangeability, limit system, uses of limit gauge.

# **UNIT IIIMETAL WORK - JOINTS**

06

Permanent joints. Riveting. Soldering. Self-secured joints.

# UNIT IV WELDING 12

Safety and Health when welding. Principles of electric Arc welding. Principles of gas welding. Welded joints and low carbon steels. Common faults in welded joints. Inspection and Non-destructive testing.

# **UNIT V MACHINE PROCESSES IN MANUFACTURE**

Plate work – marking out, thermal cutting, Mechanical cutting, Cutting forces, Stresses and power; Friction of chip on tool. Plate Forming, Bending plates. Pipe work. Manufacturing of components, gauges, deck machinery, gearing, clutches.

# **TOTAL 54 hours**

# **TEXT BOOKS:**

1. S.K Hajra Choudhry "Workshop Technology" MPP, 14<sup>th</sup> edition, 2015

# **REFERENCE BOOKS:**

1. Workshop Technology by Chapman, 2009

# 15EMR203 ENGINEERING MECHANICS 4004

# **Course objective:**

- Able to do Maintenance and repair of shipboard machinery and equipment Design characteristics.
- To know the selection of materials in construction of equipment.

#### **Course outcome:**

- **CO-1** To understand scalar & vector quantities.
- **CO-2** To understand Graphic representation of Forces.
- **CO-3** To understand Graphs and equations for displacement, speed, velocity and uniform acceleration.
- **CO-4** To understand Problems on constant force or force with linear variation.
- **CO-5** To understand Simple lifting machines.

UNIT I STATICS 16

Scalar & Vector quantities - addition/subtraction. Graphic representation of Forces - parallelogram of forces - resultant of two forces - conditions for a number of forces to be in equilibrium. Force as a vector, Triangle and polygon of forces, Resultant and equilibrium of a system of concurrent, coplanar forces. Lami's theorem. Parallel forces in a plane. General cases of forces in a plane. Couples. Method of moments. Palin trusses. Method of joints, method of sections. Method of members. Centroids, areas and volumes of composite bodies (Pappu's Theorem). Centre of Gravity - definition centre of gravity - centre of gravity of (a) suspended mass (b) mass supported at a single point - C.G. of regular shaped masses.

UNIT II DYNAMICS 16

Linear Motion. Graphs and equations for displacement, speed, velocity and uniform acceleration. Velocity as a vector. Relative velocities in one plane only. Angular motion. Equations for displacement, velocity and uniform acceleration. Kinematics of particles and rigid bodies. Impulse and momentum principle. Work and energy principle. Rectilinear motion. Curvilinear motion. Motion of projectiles. Use of D'Alembert's formula. Instantaneous centre. Problems on constant force or force with linear variation. Potential Energy. Kinetic energy. Newton's Laws of motion. Conservation of momentum. Centrifugal force and its application to

conical pendulum, unloaded governor, curved tracks and machine parts. Stress in thin rim due to centrifugal action.

# **UNIT III SIMPLE MACHINES (STATIC ANALYSIS)**

16

Simple lifting machines. Graphics of load and effort and efficiency. Linear Law. Velocity Ratio, Mechanical Advantage and Efficiency of Wheel and axle, Differential Wheel and Axle, Rope pulley blocks, differential pulley blocks, Warwick Screw, worm driven chain blocks, and single and double purchase crab winches. Virtual Work, Moment of Inertia of plane figures. Moment of inertia of material bodies.

# **UNIT IV SIMPLE MACHINES (DYNAMIC ANALYSIS)**

16

Law of Conservation of momentum. Centrifugal force and its application to conical pendulum, unloaded governor, curved tracks and machine parts. Stress in thin rim due to centrifugal action. Periodic motion (SHM). Acceleration of connected bodies. Effect of simple air friction on motion under effect of gravity. Kinetic energy of translation and rotation. Flywheels. Impulse forces. Governors including sleeve friction. Simple pendulum. Simple vibrations. Dynamic balancing of masses rotating in one plane. Basic dynamics of the engine mechanism. Balancing – Simple harmonic Motion).

UNIT V FRICTION 08

Coefficient of friction. Friction angle. Energy and power lost due to friction in simple bearings. Friction in belt drive, Efficiency of screw-jack (Square and Vee Thread)

#### **TOTAL 72 hours**

# **TEXT BOOKS:**

1. K.V Natarajan, "Engineering mechanics" dhanalalshmi publishers, 10<sup>th</sup> edition, 2015

#### 15EMR204 APPLIED MECHANICS LAB 0021

# **Course objective:**

- Able to do Maintenance and repair of shipboard machinery and equipment Design characteristics.
- To select materials in construction of equipment.

# Course outcome:

- **CO-1** To understand Principles of Moment.
- **CO-2** To understand the magnitude and nature of forces acting on the different members.
- **CO-3** To understand about Young's Modulus of a Loaded Beam.
- **CO-4** To understand about co-efficient of friction.
- **CO-5** To understand about uniplanar forces.

# LIST OF EXPERIMENTS

- 1. To verify the Principles of Moment with the help of (a) Bell Crank Lever & (b) Moments of Stand
- 2. To determine the magnitude and nature of forces acting on the different members of—
  (a)Wall Crank,(b)Shear Leg Apparatus,&(c)Derrick Crane.
- 3. To determine the Young's Modulus of a Loaded Beam.
- 4. To determine the co-efficient of friction between leather and metal in an inclined plane.
- 5. To prove that if a system of uniplanar forces is in equilibrium, the links respectively given in magnitude and direction taken in order form a closed polygon. If any number of forces acting at a point be such that they can be represented in magnitude, direction and sense by the sides of a closed polygon taken in order, then they shall be in equilibrium.
- 6. To find out the Mechanical Advantage, Velocity Ratio, Theoretical Effort, Efficiency, Friction, the equation giving the relation between Load and Actual Efforts, and draw graphs with load as base for(i)Efficiency (ii)Actual Effort (iii)Mechanical Advantage and (iv)Friction for the following machines
  - (a) Screw Jack;
  - (b) Worm and Worm Wheel
  - (c) Compound Wheel and Axle
  - (d) Single Purchase Crab and
  - (e) Double Purchase Crab.
- 7. To determine the value of 'g" (acceleration due to gravity) by means of
- (a) Atwood's Machine, and,
- (b) Fletcher's Trolley.
- 8. To determine the Moment of Inertia and Radius of Gyration of a Fly Wheel.

#### **TOTAL 36 hours**

#### **TEXT BOOKS:**

In-house developed Lab Manual.

# 15EMR205 PUMPS AND PUMPING SYSTEMS I 3 0 0 3

# **Course objective:**

- To able to Operate fuel, lubrication, ballast and other pumping systems and associated control systems.
- To know the Operational characteristics of pumps and piping systems, including control systems.

#### Course outcome:

- **CO-1** To understand Properties of fluid.
- **CO-2** To understand Equilibrium of floating bodies.
- **CO-3** To understand Bernoulli's equation and applications.
- **CO-4** To understand Flow rate measurement.
- **CO-5** To understand the concepts of flow through pipes.

# **UNIT I PROPERTIES OF FLUID**

14

Properties of fluid density. Compressibility. Vapor pressure. Capillarity. Cavitation phenomena. Viscosity and its measurement. Rotating viscometer. Equilibrium of floating bodies. Variation of fluid pressure with depth. Total force due to liquid pressure on immersed plane surfaces, horizontal or vertical. Centre of pressure on a rectangular vertical plane surface or triangular plane surface, both with one edge parallel to the liquid surface.

# UNIT II BERNOULLI'S EQUATION AND APPLICATIONS

16

Bernoulli's equation and applications. Venturi-meter. Euler's formula. Bernoulli's formula. Energy equations and applications. Flow rate measurement – Venturimeter, Orifice meter, Pitot tube. Coefficients of velocity, contraction of area, and discharge.

# **UNIT III FLOW THROUGH PIPES**

80

Full- bore flow of liquids under a constant head. Flow through an orifice. Flow through pipes. Flow through concentric pipes. Flow through parallel plates. Coefficients of velocity, contraction of area and discharge.

UNIT IV IMPACT OF JETS 08

Impact of jets – force exerted by a jet on flat and curved plates and at pipe bends. Surge pressure and control. Blade diagrams for a centrifugal pump.

# UNIT V FLUID FLOW AND CHARACTERISTICS

08

Fluid flow and characteristics of major ship's pumping systems. Description of all fluid systems on board. Operation and material construction of devices/equipment in the system.

# **TOTAL 54 hours**

# **TEXT BOOKS:**

1.R. K Bansal,"Fluid Mechanics", Lakshmi publicaions, 9th edition, 2009

# **REFERENCE BOOKS:**

1.JagdishLal," Hydraulic Machines ",2010

## 15EMR206 THERMODYNAMICS I 4 0 0 4

## **Course objective:**

- Able to Manage the operation of propulsion plant machinery Plan and schedule operations.
- Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery.

#### **Course outcome:**

- **CO-1** To understand about the basic thermodynamic defenitions.
- **CO-2** To understand Problems involving changes of phase and not more than three substances.
- **CO-3** To understand First law of thermodynamics and its application to various processes.
- **CO-4** To understand Relationship between pressure, temperature and volume.
- **CO-5** To understand Statements of the Second Law of Thermodynamics.

## **UNIT I THERMODYNAMIC DEFINITIONS**

10

Heat, Work, Energy, System, Boundary, Control, Volume. Working substance, phase properties, Phase diagrams. Point function, Path function, Reversible and irreversible process; P-V Diagram of work transfer in reversible processes; Closed system and Open System; Steady flow process and Non-flow process - Specific heat capacity – specific enthalpy of evaporation and fusion. Problems involving changes of phase and not more than three substances. Linear, superficial and volumetric expansion due to temperature changes. Co-efficient and the relationships between them.

## **UNIT II FIRST LAW OF THERMODYNAMICS**

10

First law of thermodynamics and its application to various processes; Steady- Flow Energy Equation; Non-Flow Energy Equation; Applied Problems. Boyles and Charles law for perfect gases. Characteristics equation. Constant R and its use in simple problems. Isothermal, adiabatic and polytropic process. Relationship between pressure, temperature and volume. Work done, change in internal energy.

#### UNIT III SECOND LAW OF THERMODYNAMICS

12

Statements of the Second Law of Thermodynamics. Carnot's cycle, Thermodynamic Reversibility. Carnot's principle, Carnot's cycle for a gas, deductions from Carnot's cycle. Thermodynamic temperature scale. Steam and Gas processes on T-S and H-S charts, Entropy and irreversibility. Applied problems.

#### UNIT IV PROPERTIES OF MIXTURE OF GASES AND GAS VAPORS

Dalton's Law of partial pressure, Amagat's Law of partial volume, volumetric and Gravimetric Analysis of Gas mixtures, Gibb's Law – Dalton's Law, Mean value of a Gas constant. Equivalent Molecular weight, Density, specific volume, specific Heat and molar heat capacity of a gas mixture.

#### UNIT V COMPRESSORS AND IC ENGINES

14

14

Reciprocating Air compressors: Elementary principles and cycles of operation. Calculation of work done, indicator diagrams. IC engines: Elementary principles and cycle of operation, actual indicator diagrams, mean effective pressure, work done, power developed, indicated and brake thermal efficiency, mechanical efficiency, overall efficiency, fuel consumption and heat balance.

#### **TOTAL 60 hours**

## **TEXT BOOKS:**

1. P.L. Ballaney, "Thermal engineering", khanna publication, 2005

## **REFERENCE BOOKS:**

1. Nag,"Engineering Thermodynamics ",2012

#### 15EMR207 HYDRAULICS LAB 0 0 2 1

## **Course objective:**

- To able to understand Operational fuel, lubrication, ballast and other pumping systems and associated control systems.
- To understand the Operational characteristics of pumps and piping systems, including control systems.

#### Course outcome:

- **CO-1** To understand about venturimeter.
- **CO-2** To understand about pelton wheel.
- **CO-3** To understand about co-efficient of velocity of contraction.
- **CO-4** To understand about co-efficient of discharge of water through orifice/s.
- **CO-5** To understand about the friction co-efficient for the flow of water through a pipe.

## **FLUID MECHANICS EXPERIMENTS**

- 1. To determine the meter constant of the venturimeter
- 2. To determine the efficiency of a Pelton wheel
- 3. To determine the co-efficient of velocity of contraction and co-efficient of discharge of water through orifice/s.
- 4. To determine the friction co-efficient for the flow of water through a pipe.

## **TEXT BOOK:**

In-house developed Work Manual

#### 15EMR208 DECK MACHINERY 3 0 0 3

## Course objective:

 To able to Operate main and auxiliary machinery and associated control systems, Deck machinery.

#### **Course outcome:**

- **CO-1** To understand construction & working of windlass & mooring winches.
- **CO-2** To understand bow thruster system & controls.
- **CO-3** To understand types of cargo cranes (electro hydraulic & total hydraulic).
- **CO-4** To understand various crane movement & safety.
- **CO-5** To understand various hydraulic systems.

#### PRINCIPLES AND OPERATION OF THE FOLLOWING TYPES OF DECK MACHINERY:

## **UNIT I WINDLASS AND MOORING WINCHES**

80

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 CIRCUIT**

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 06

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

UNIT V STEERING GEAR 16

Steering Gear **4**ram 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 54 hours**

## **TEXT BOOKS:**

1. H.D McGeorge,"Marine AuxillaryMachinary", Reed Elsevier India, 2011

## **REFERENCE BOOKS:**

Leslie Jackson and W Embleton,"Reed's General Engineering Knowledge" Volume
 VIII,2010

#### 15EMR209 THERMODYNAMICS II 4 0 0 3

## **Course objective:**

- To able to Manage the operation of propulsion plant machinery Plan and schedule operations, surveillance, performance assessment.
- To maintain safety of propulsion plant and auxiliary machinery.

#### **Course outcome:**

- **CO-1** To understand Steam and Two Phase System.
- **CO-2** To understand Non flow processes with Steam.
- **CO-3** To understand Steam Cycle: Carnot's cycle for steam and ideal efficiency.
- **CO-4** To understand Reheating and Regenerative Feed Heating and their effect on Thermal Efficiency.
- **CO-5** To understand Boilers and Evaporators.

## UNIT I INTRODUCTION 12

Steam and Two Phase System: Phase; Equation of Steam; Temperature- Pressure Diagrams; Triple Point; Specific Enthalpy and Entropy Diagrams; Use of Steam table and Steam Charts; Pressure volume and Enthalpy and Entropy Diagrams Internal energy vapours Super critical vapours, Non flow processes with Steam; Applied Problems.

## UNIT II STEAM CYCLE 08

Steam Cycle: Carnot's cycle for steam and ideal efficiency. Rankine cycle with dry saturated steam and superheated steam. Feed Pump work. Rankine Efficiency, cycle efficiency, Isentropic Efficiency, work ratio, Reheating and Regenerative Feed Heating and their effect on Thermal Efficiency. Applied problems.

#### **UNIT III BOILERS AND EVAPORATORS**

10

Boilers and Evaporators: Boilers and Calculations; Boiler Thermal Efficiency and Equivalent Evaporation of a Boiler; Basic calculations on the effect of Condenser Leakage and Impure feed, dissolved solids and scale in Boilers; Density of water and its control in Boilers & Evaporators. Applied Problems.

UNIT IV STEAM TURBINES 12

Steam Turbines: General Principles of impulse and Reaction Turbines – Velocity Diagrams for simple impulse and impulse – Reaction Turbine. Compounding of impulse Turbine-Pressure and velocity compounding. Force on blades, work done by Blades, Axial Trust, Blade or Diagram Efficiency. Effect of Friction on blades, Applied Problems.

UNIT V STEAM ENGINES 12

Steam Engines: Modified Rankine cycle for steam engines, Hypothetical Indicator Diagram. Mean Effective pressure and work transfer, Diagram factor. Indicated power, specific steam consumption. Indicated Thermal Efficiency. Efficiency ratio, Engine Efficiency, Energy Balance, Applied Problems.

## **TOTAL 54 HOURS**

#### **TEXT BOOKS:**

1. P.L. Ballaney,"Thermal engineering",khanna publication,2005

## 15EMR210 ELECTRICAL MACHINES LAB I 0 0 2 2

## **Course objective:**

 Able to operate electrical, electronic and control systems, Electrical motors including starting methodologies.

#### **Course outcome:**

- **CO-1** To understand about the continuity test.
- **CO-2** To understand about speed controls of motor.
- **CO-3** To understand about starters.
- **CO-4** To understand about constant current & voltage.
- **CO-5** To understand about wattmeter.

## LIST OF EXPERIMENTS

1.	Testing of continuity, insulation and grouping of coils of AC and DC Motors.	04
2.	Speed control of DC motors by armature and field control.	04
3.	Connecting a three phase Induction Motor with DOL starter and measurement of power and speed.	04
4.	Study of constant current and voltage source and current source.	04
5.	Measurement single phase power using wattmeter.	04
6.	Wiring of TPN switch, fuse units for circuits of three phase four wire system load.	04
7.	Energy measurement by single phase Energy meter.	04
8.	Load test on DC shunt generator.	04
9.	Study of single phase and three phase transformers.	02
10.	Open circuit characteristics of DC generator.	02

## **TOTAL 36 HRS**

## **TEXT BOOK**S:

In-House developed Lab Manual

## 15EMR211 ELECTRONICS I LAB 0 0 2 2

## **Course objective:**

• Able to Operate electrical, electronic and control systems, Flowchart for automatic and control systems.

## **Course outcome:**

- **CO-1** To understand about half & full wave rectifiers.
- **CO-2** To understand characteristics of semiconductor diode.
- **CO-3** To understand characteristics of zener diode.
- **CO-4** To understand Characteristics of Thermistor.
- **CO-5** To understand Characteristics of LED.

## LIST OF EXPERIMENTS

1.	Study of half wave and full wave rectification circuit without and with filter	04
2.	Characteristics of Semi conductor diode	04
3.	Volt – ampere characteristics of Zener diode.	04
4.	Characteristics of Thermistor.	04
5.	Characteristics of LED.	04
6.	Characteristics of Field Effect Transistor.	04
7.	Characteristics of SCR.	04
8.	Characteristics of TRIAC.	04
9.	Speed Control of DC motor using SCR.	04

## **TOTAL 36 hours**

## **TEXT BOOKS:**

In-house developed Lab Manual

# 15CMRE45 SAFE MAINTENANCE ON SHIPS 3 0 0 2 Course objective:

- able to Maintenance and repair of shipboard machinery and equipment Safety measures to be taken for repair and maintenance.
- To do the safe isolation of shipboard machinery and equipment required before personnel are permitted to work on such machinery or equipment.

#### Course outcome:

- **CO-1** To understand about risk assessment.
- **CO-2** To understand General safety and cleanliness on board.
- **CO-3** To understand about the usage of Personal protective equipment.
- **CO-4** To understand the standard communication system onboard.
- **CO-5** To understand the risks of working aloft & outboard.

UNIT I 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 16

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 16

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 16

Maintenance – Introduction – General – Floor plates 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 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 72hours**

#### **TEXT BOOKS:**

Code of Safe Practices for Merchant Seamen – Consolidated Edition 2010

# 15EMR213 MARINE AUXILIARY MACHINERY 4 0 0 3

## Course objective:

- able to operate main and auxiliary machinery and associated control systems Shafting installations, including propeller.
- able to operate able to operate other auxiliaries, including various pumps, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, air-conditioning and ventilation systems etc.

#### Course outcome:

- **CO-1** To understand Propulsion transmission systems.
- **CO-2** To understand Types of propellers and features.
- **CO-3** To understand Heat Exchangers.
- **CO-4** To understand Fouling of tubes.
- **CO-5** To understand principles, operation, types of Steering Gear.

UNIT I 16

Propulsion transmission systems including thrust and shaft bearings and stern-tubes.(oil-filled and water-lubricated lignum-vitae, and Thordon types. Types of propellers and features – fixed pitch, CPP. Materials of construction. Cavitation.

UNIT II 16

Heat Exchangers: Tubular and plate type, reasons of corrosion, leakages – erosion tube removal, plugging, pressure testing. Materials used. Fouling of tubes – plates. Renewal of sacrificial anodes Filters: Strainers and filters, types of marine filters, auto cleaner and duplex filters, Static filters. Priming and core maintenance of filters.

UNIT III 16

Steering Gear, Stabilizers, Bow Thrusters – principles, operation, types, materials of construction, hydraulic power pumps and control systems for above.

UNIT IV 12

Air Compressors – System principles, materials of construction, operation, the compression process, inter and after coolers. Air Bottles – Construction and mountings.

UNIT V 12

Evaporators and distillers- Principles, Operation, materials of construction. Flash evaporators, Multiple-effect evaporation. Construction, characteristics and operation of Fresh Water Generators.

## **TOTAL 72 hours.**

## **TEXT BOOKS**:

1.H.D McGeorge,"Marine Auxiliary Machinery", Reed Elsevier India, 2011

## **REFERENCE BOOKS:**

1. Leslie Jackson and W Embleton, "Reed's General Engineering Knowledge" Volume VIII,2010

# 15EMR214 ELECTRICAL WORKSHOP – MOTORS/STARTERS 4 0 0 4 Course objective:

 Able to operate electrical, electronic and control systems Electrical motors including starting methodologies.

#### **Course outcome:**

- **CO-1** To study about squirrel cage induction motor.
- **CO-2** To study about wound rotor induction motor.
- **CO-3** To study about capacitor start induction motor.
- **CO-4** To study about capacitor start / capacitor run induction motor.
- **CO-5** To understand Stator armature winding of 3ph squirrel cage type induction motor.

#### **Exercises**

- 1. Dismantling and study of AC motor 3 ph induction type squirrel cage type.
- 2. Dismantling and study of AC motor 3 ph induction type wound rotor type.
- 3. Dismantling and study of AC motor 1 ph induction type capacitor start type
- 4. Dismantling and study of AC motor 1 ph induction type capacitor start/capacitor run
- 5. Type
- 6. Stator armature winding of 3ph squirrel cage type induction motor
- 7. Single-phase AC motor starter wiring connections
- 8. Direct-on-line starter for 3ph AC motor wiring connections
- 9. Star-Delta Starter for 3ph AC motor
- 10. Auto-transformer starter for 3ph induction motor
- 11. Transformer winding 1 phase
- 12. Transformer winding 3 phase
- 13. Soft starting 3 ph induction motor

## **TEXT BOOKS:**

In-house developed Lab Manual

#### 15EMR215 ELECTRONICS II LAB 0 0 3 2

## **Course objective:**

 Able to Operate electrical, electronic and control systems Sequential control circuits and associated system devices.

#### Course outcome:

- CO-1 To understand about push pull amplifier.
- **CO-2** To understand Integrator and Differentiator.
- **CO-3** To understand Inverting and Non inverting amplifier.
- **CO-4** To understand Logic Gates truth tables.
- **CO-5** To understand multiplexers & de multiplexers.

## **LIST OF EXPERIMENTS:**

- 1. Push Pull Amplifier.
- 2. Study of Integrator and Differentiator
- 3. Study of Inverting and Non inverting amplifier
- 4. Verification of Logic Gates truth tables
- 5. Study of multiplexers & de multiplexers
- 6. Study of Analog to Digital converter.
- 7. Study of Digital to Analog Converter.
- 8. Study of 555 Timer

## **TOTAL 36 hours**

## **TEXT BOOKS:**

In-house developed Lab Manual

#### 15EMR216 MARINE ENGINEERING PRACTICE I 2 0 0 2

## **Course objective:**

 Able to use hand tools, machine tools and measuring instruments for fabrication and repair on board.

#### Course outcome:

- **CO-1** To be aware of different types of material.
- **CO-2** To understand the properties of material.
- **CO-3** To understand the choice of material for main engine.
- **CO-4** To understand the choice & application of materials for steam turbines & gas turbines.
- **CO-5** To understand the safe working practice of power tools & hand tools.

UNIT I 12

Characteristics and limitations of materials used in construction and repair of ships and equipment. – Steel – mild steel, carbon steel, cast iron, wrought iron, aluminium and aluminium alloys, copper, tin, plastics, composites.

UNIT II 16

Design characteristics and selection of materials in the construction of equipment – Main engine cylinder liners, pistons, crankshafts, bearings. Material for boilers, super-heaters, steam turbines casing, blades, rotor etc. Gas turbine casings, rotors, blades, combustion chambers etc.

UNIT III 16

Safety measures to be taken to ensure a safe working environment, and for use of hand tools, powered hand tools, machine tools (Centre Lathe, Soldering, Thermal cutting, Inspection, safety and health when carrying out above operations — using appropriate specialized tools(for overhaul of particular machinery items) and precision measuring instruments (micrometers, liner gauges, tachometers, feeler gauges, UTG).

UNIT IV 16

The process of welded repair and construction. Advantages and disadvantages. Types of welds. Defects in welds. Destructive and Non-destructive testing of welds. (tests carried out on a typical welded seam of a water tube boiler drum).

UNIT V 12

Use of various types of sealants and packings for various applications on board- Superheated Steam, Sea water, Fresh water, Lub oil, Refrigerant lines, chemicals.

#### **TOTAL 72 hours.**

#### **TEXT BOOKS:**

1. H.D Mc George, "Marine Auxiliary Machinery", Reed Elsevier India, 2011

## **REFERENCE BOOKS:**

1. Devan Aranha, "Marine Diesel Engines", Shroff Pub., 5<sup>th</sup> edition, 2010

# 15EMR217 MARINE ELECTRICAL TECHNOLOGY I 2 0 0 2 Course objective:

• able to Manage operation of electrical and electronic control equipment Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery, Maintenance and repair of electrical and electronic equipment.

#### Course outcome:

- **CO-1** To understand Starting, parallel operation and changing of alternators.
- **CO-2** To understand Maintenance required on Alternators and motors and paralleling equipment.
- CO-3 To understand Emergency Generator & Different Starting methods including auto-start.
- **CO-4** To understand Emergency batteries construction and its different types.
- **CO-5** To understand Safety devices on emergency switch board.

UNIT I 06

Starting, parallel operation and changing of alternators. Synchronizing methods – scope and lamp. Load sharing. Parallel operation of Diesel Generator and Shaft Generator. Maintenance required on Alternators and motors and paralleling equipment.

UNIT II 09

Purpose of emergency power supply. Emergency Generator & Different Starting methods including auto-start. Emergency batteries construction and its different types (Lead acid and alkaline battery) & duties. Location of emergency power. Maintenance required on all the above equipment.

UNIT III 09

Alternative Source of Power: Safety devices on emergency switch board – Interconnection between the MSB and emergency switch board. Shore Supply – Specifications as per Voltage / Frequency, precautions while taking shore supply. List the essential services supplied with electrical power. Describe the maintenance routine of all the above equipment, including circuit breakers.

UNIT IV 06

Switchboard construction – Main and Emergency – different switchgear & protective devices, Grounded and insulated neutral systems, precautions adopted in High Voltage Distribution system. Transformers. Cables & temperature classification. Describe the maintenance routine of all the above equipment, including circuit breakers.

UNIT V 06

Motor & Control Equipments: Types of marine motors, types of enclosures, protective devices on motors explain how excitation of a motor is produced and supplied. Describe how a generator is cooled and why heaters are fitted. Describe the maintenance required on these items.

#### **TOTAL 36hours.**

#### **TEXT BOOKS:**

- 1. Eltsan Fernandez, "Marine Electrical Technology", shroff pub., 7<sup>th</sup> edition, 2014 **REFERENCE BOOKS:** 
  - Marine Control Practice by D A Taylor, 2<sup>nd</sup> Edition, Butterworth and Co (Publishers) Ltd., London, 2012

#### 15EMR218 REFRIGERATION, AIR-CONDITIONING & VENTILATION SYSTEMS 3 0 0 3

## **Course objective:**

Able to operate main and auxiliary machinery and associated control systems.

#### Course outcome:

- **CO-1** To understand basic refrigeration concepts.
- **CO-2** To understand refrigeration system components.
- **CO-3** To understand operation, maintenance & troubleshooting of refrigeration plant.
- **CO-4** To understand temperature monitoring system & automatic operation.
- **CO-5** To understand basic air conditioning principles & concepts.

## UNIT I INTRODUCTION 12

Marine refrigeration Cycle. Principles of refrigeration. Circuit diagrams and components of Vapor Compression Refrigeration System. Construction and materials used for the various components. Cargo refrigeration system and Domestic Refrigeration System (Brine and Direct Cooling). Construction of cold rooms. Refrigeration: Design and construction of various components of refrigeration plants i.e. compressor, condenser, evaporator, expansion valves, and control and safety equipments.

## **UNIT II OPERATION OF REFRIGERATION SYSTEMS**

09

Operation of refrigeration Systems (Cargo and Domestic). Automatic Operation. Normal operating parameters. Abnormal operation, fault detection and remedial measures. Reefer Container plant operation. Data loggers and temp monitoring systems. Defrosting systems. Operation and maintenance of refrigeration plants, control of temperature in different chambers, changing of refrigerant/Oil, purging of air, defrosting methods,

#### **UNIT III AIR CONDITIONING**

12

Introduction to Air Conditioning. Psychrometric principles. Why imperative on tankers. Circuit diagrams and components of Air Conditioning System. Construction and materials used for the various components. Air conditioning: necessity on board ships, different systems, control of rooms, air change requirements, design considerations, maintenance.

## UNIT IV OPERATION OF AIR CONDITIONING SYSTEMS

12

Operation of Air Conditioning Systems. Cabin cooling, Cabin heating and humidity control. Automatic Operation. Normal operating parameters. Recirculation options and duct layouts. Abnormal operation, fault detection and remedial measures.

UNIT V VENTILATION 09

Ventilation of cargo holds (natural and forced), Accommodation and Engine Rooms. Types of blowers used. Emergency shut-off in case of fire. Ventilation: Ventilation of engine room, pump room, CO2 and battery rooms, air change requirements, design considerations, maintenance.

#### TOTAL 54hours.

#### **TEXT BOOKS:**

1. Leslie Jackson and W Embleton,"Reed's General Engineering Knowledge"' Volume VIII ,2010

#### **REFERENCE BOOKS:**

1. Nanda and Ghokale," Basic Marine Engineering Knowledge" N.G Series, 4<sup>th</sup> edition, 2011.

#### 15EMR219 MARINE ELECTRICAL TECHNOLOGY II 2 0 0 2

## **Course objective:**

• Able to do Maintenance and repair of electrical and electronic equipment.

#### **Course outcome:**

- **CO-1** To understand Marine electrical equipment.
- **CO-2** To understand Alarm system (types, supply) on board.
- **CO-3** To understand Maintenance of electrical systems, fault finding & repair.
- **CO-4** To understand Detection of faults on electrical circuits
- **CO-5** To understand Special electrical practice.

UNIT I INTRODUCTION 06

Miscellaneous Marine electrical equipment Alarm System: Alarm system (types, supply) on board- watertight doors, bow-doors, oxygen analyzer, High & low level alarms, navigational lights, emergency radio operation, main engine telegraph, steering gears, Electrical Deck Cranes.

UNIT II MAINTENANCE 09

Maintenance of electrical systems, fault finding & repair: Type of faults & indications on Generator, motor & distribution systems, different testing equipments& meters (multimeter / megger, clampmeter, etc) Salvaging a motor. Detection of faults on electrical circuits – Indications & corrective arrangements, necessary precautions & care while fault finding and repair, preventive maintenance, periodic surveys, spares requirement.

## UNIT III SAFE WORKING PRACTICES

09

Mandatory requirements for electrical installations. Ship's lighting. Safe working practices. Electrical protective devices. Specification and installation of cables for various shipboard uses. Special electrical practice: Rules and regulations & operation of electro-hydraulic & electrical steering gear, Diesel-electric and turbo electric propulsion system.

## **UNIT IV ELECTRICAL SYSTEMS**

06

Electrical systems for operation in flammable areas. . Special electrical practice for oil, gas and chemical tankers (Tanker classification, Dangerous spaces, Hazardous zones, Temperature

class), flame proof Ex 'd' and intrinsic safety Ex 'i' Ex 'e', and Ex 'n' equipments and their applications in zones, maintenance of Ex-protected apparatus.

#### UNIT V MAINTENANCE 06

Safe Electrical practice: Safe watch – keeping, points to check on electrical machineries, switch gears & equipments, microprocessor control and maintenance – electrical fire fighting, precautions against electric shock and related hazards.

#### **TOTAL 36 hours**

## **TEXT BOOKS:**

1. ElsanFernandez, "Marine Electrical Technology," Shroff Pub., 7<sup>th</sup> edition, 2014

#### **REFERENCE BOOKS:**

1. B L Theraja ,"Electrical Technology" S Chand and company pvt.ltd, 2013

#### 15EMR220 NAVAL ARCHITECTURE I 3 0 0 3

## **Course objective:**

Able to Maintain seaworthiness of the ship Working knowledge and application of stability,
 trim and stress tables, diagrams and stress-calculating.

#### Course outcome:

- **CO-1** To understand Principal terms used in Naval Architecture.
- **CO-2** To understand Hydrostatic calculations.
- **CO-3** To understand specific terms in naval architecture.
- **CO-4** To understand effect of addition and removal of masses.
- **CO-5** To understand Simpson's rules, application to area and volume.

UNIT I 12

Principal terms used in Naval Architecture – Geometry of ships.

Hydrostatic calculations: Ship lines, displacement calculation, first and second moment of area.

UNIT II 12

Tons per Cm. Immersion, Co-efficient of forms, wetted surface area, similar figures, centre of gravity, effect addition and removal of masses.

UNIT III 09

Simpson's rules, application to area and volume, Trapezoidal rule, mean and mid-ordinate rule, Tchebycheff's rule and their applications.

UNIT IV 12

Transverse stability of ships- statical stability at small angles of heel, calculation of BM, metacentric height- inclining experiment- free surface effect —

UNIT V 09

Transverse stability at large angles of heel – curves of statical stability- dynamical stability.

## **TOTAL 54 hours**

## **TEXT BOOKS:**

- 1. E.A. Stokoe,"Reeds Naval Architecture for Marine Engineers", Volume V,2013 **REFERENCE BOOKS:**
- 1. D. J. Eyres,"Ship Construction", Elsevier Ltd, Sixth edition, 2007

#### 15EMR221 MECHANICS OF MACHINES 2002

## **Course objective:**

• Able to do Maintenance and repair of shipboard machinery and equipment.

#### Course outcome:

- **CO-1** To understand Relative motion between bodies moving in different planes.
- **CO-2** To understand Analytical determination of velocity and acceleration.
- **CO-3** To understand Function of a flywheel.
- **CO-4** To understand Effect of centrifugal tension on flywheel.
- **CO-5** To understand Flat belts and effect of centrifugal tension.

#### **UNIT I KINEMATICS AND LINK MECHANICS:**

06

Relative motion between bodies moving in different planes. Instantaneous center method; Rubbing velocities at pin joints. Graphical construction for relative and acceleration in different link and sliding mechanisms. Analytical determination of velocity and acceleration. Forces in Crank and connecting rods. Inertia force on link connecting rods etc. effect of friction.

#### **UNIT II TURNING MOMENT & FLYWHEEL:**

06

Function of a flywheel. Crank effort diagram. Fluctuation of speed and energy. Effect of centrifugal tension on flywheel, Inertia torque and its effect on Crank Effort Diagrams.

#### **UNIT III BELTS AND CHAINS:**

09

Flat belts and effect of centrifugal tension. Initial Belt tension & conditions for maximum power transmission. Roller & inverted tooth chains. Gears: Spur Gears – Various definitions – P.C.D., module, Interference, Gear ratio and center distance of simple and compound gear trains. Fundamental Law. Tooth profiles – proportions. Bevel and Worm Gears. Plain and epicyclic gear trains.

#### **UNIT IV BALANCING:**

06

Balancing of masses rotating in one or different planes, dynamic forces at bearings; Primary and secondary balance of multi-cylinder in-line engines and configurations. Balancing Machines.

Gyroscope: Gyroscopic couple, vector representation of torque and angular momentum, steady rectangular precession; vector treatment; steady conical precession; Motion involving steady procession; Application to ship's stabilization.

UNIT V VIBRATION: 09

Free Harmonic vibrations, linear motion of an elastic system, and Angular motion of an elastic system. Differential equation of motion. Single and two degrees of freedom. Torsional vibrations: Single rotor system, rotor at end and rotor in the middle. Effect of inertia of shaft, two rotor system, rotors at both ends and rotors at one end. Three rotor and multi rotor system. Torsionally equivalent shafts, geared system – whirling. Forced vibrations: Forced linear and angular vibrations, periodic force transmitted to support, periodic movement of the support. Damping

## **TOTAL 36hours**

#### **TEXT BOOKS:**

1. Ballaney, "Theory of Machines", 2010

#### 15EMR222 PUMPS AND PUMPING SYSTEMS – II 3 0 0 3

## **Course objective:**

 Able to operate fuel, lubrication, ballast and other pumping systems and associated control systems, Manage fuel, lubrication and ballast operations.

#### Course outcome:

- **CO-1** To be able to draw the typical bilge pumping arrangement in the Engine room showing the various components.
- **CO-2** To be able to draw the typical sludge pumping arrangement in the Engine room showing the various components.
- **CO-3** To be able to draw the Ballasting and De-ballasting pipeline arrangement in a typical tanker ship.
- **CO-4** To be able to explain the IG system on an Oil tanker with emphasis on how it protects the cargo space.
- **CO-5** To be able to draw the typical cargo pumping arrangement in a tanker ship.

#### UNIT I OPERATION OF PUMPING SYSTEMS

09

Operation of pumping systems-Routine pumping operations – Operation of bilge, ballast and cargo operating systems

UNIT II MARPOL 06

Oily Water separator – prevention of pollution – principles, construction and operation – requirements of MARPOL

#### **UNIT III DIMENSIONAL ANALYSIS**

06

Dimensional Analysis & dynamically similarity: Use of dimension for finding conversion factors: Dimensions equation: Methods of finding dimensional groups; Geometrical and dynamical similarity, General principle; dynamically similarity problems

#### **UNIT IV CHEMICAL PROPERTIES**

06

Physical and chemical properties of fuels and lubricants – Production of oils from crude oilproperties and characteristics of fuels and lubricants

## **UNIT V TESTING OF FUEL OIL**

Shore side and shipboard sampling and testing of fuel oil – interpretation of test results – contaminants including microbial infection – treatment of fuels and lubricants including storage, centrifuging, blending, pretreatment and handling

## **TOTAL 36 hours**

## **TEXT BOOKS:**

1. H.D McGeorge, "Marine Auxiliary Machinary", Elsevier India, 2011

## **REFERENCE BOOKS:**

1. DevanAranha, "Marine Diesel Engines", Shroff Pub., 5<sup>th</sup> edition, 2010

#### 15EMR223 MARINE ENGINEERING PRACTICE II 2 0 0 2

## **Course objective:**

• able to Maintain and repair of shipboard machinery and equipment.

#### Course outcome:

- **CO-1** To be aware of principles of clarifier & purifier.
- **CO-2** To be aware of purifier parts, assembly / disassembly procedures.
- **CO-3** To get working knowledge of purification piping layout, gravity disc selection & desludging procedure.
- **CO-4** To understand the sequence of operation of purifier.
- **CO-5** To be aware of rules & regulation of automation on slips.

#### UNIT I PURIFIERS AND CLARIFIERS.

06

Construction and characteristics of Separators – Purifiers and Clarifiers.

#### UNIT II FUEL OIL PREPARATION AND TREATMENT

06

Fuel Oil preparation and treatment – Operation and principles and materials of construction of purifiers and clarifiers.

### **UNIT III SAFE WORKING PRACTICES**

06

Change-over of Remote/Automatic to Local Control for ALL Main and auxiliary Systems. Safe Working Practices in carrying out hot work and welding.

### **UNIT IV OVERHAULINGPROCEDURES**

09

Procedures to be followed when handling heavy machinery parts, and overhauling of engines. Man-entry and hot work in enclosed compartments. Safe and efficient operation and maintenance of Marine Diesel Engines. Crankcase inspection, Depth gauge and crankshaft deflections.

#### **UNIT V MAINTENANCE AND REPAIR**

09

Maintenance and repair such as dismantling, adjustment and reassembling of machinery and equipment. Preparation for work on machinery. General maintenance procedures for centrifugal pumps, screw and gear pumps, valves, air compressors and heat exchangers.

## **TOTAL 36 hours.**

## **TEXT BOOKS**:

1. The Running and maintenance of Marine Machinery (Institute of Marine Engineers, London.), 2009

## **REFERENCE BOOKS:**

1. Nanda and Ghokale, "Basic Marine Engineering Knowledge" N.G Series, 4<sup>th</sup> edition, 2011.

#### 15EMR224 NAVAL ARCHITECTURE II 3 0 0 3

## **Course objective:**

• able to Maintain seaworthiness of the ship, Control trim, stability and stress.

#### Course outcome:

- **CO-1** To understand Curves of buoyancy and weight, curves of load, shearing force and bending moments.
- **CO-2** To understand Longitudinal strength, moment of inertia of section & section modulus.
- **CO-3** To understand Trim because of filling / flooding several tanks with different densities.
- **CO-4** To understand method for determination of floodable lengths.
- **CO-5** To understand relation between powers & relation between pressure and speed.

#### UNIT I LONGITUDINAL STABILITY AND TRIM:STRENGTH OF SHIPS

12

Curves of buoyancy and weight, curves of load, shearing force and bending moments, alternate methods, standard conditions, balancing ship on wave, approximation for max. Shearing force and bending moment, method of estimating B.M. & Deflection. Longitudinal strength, moment of inertia of section, section modulus. MCT1, change of L.C.B. with change of trim, change of trim due to adding and deducting weights, change in draft – associated numerical

UNIT II TRIM 09

Trim because of filling / flooding several tanks with different densities, alteration of draft due to change in density, flooding calculations, floodable length curves, **Trim:** M.O.T. method for determination of floodable lengths, factors of sub division, loss of stability due to grounding, docking stability, pressure on chocks.

UNIT III PROPULSION 12

Definitions, apparent and real ships wake, thrust, relation between powers, relation between pressure and speed, Resistance and powering - Froude's law- frictional resistance-residuary resistance- calculation of naked power-various efficiencies-calculation of effective power-admiralty coefficient —applied problems

UNIT IV RUDDER THEORY 09

Action of the rudder in turning a ship, force on rudder, torque on stock, calculation of force torque on non-rectangular rudder, angle of heel due to force torque on rudder, angle of heel when turning. Types of rudder, model experiments and turning trials; area and shape of rudder, stern rudders bow rudders.

UNIT V PROPELLER 12

Blade element theory, law of similitude and model tests with propellers, measurement of pitch, cavitations. Propeller types, fixed pitch and variable pitch. Propeller types- Ring propeller, Kort nozzles, Voith Schneider propeller - propulsion tests, Geometry and geometrical properties of screw propellers, ship model correlation ship trials. Motion of ship on waves-theory of waves, Trochoidal waves, relationship between line of orbit centers and the undistributed surface, Sinusoidal waves. Rolling in unresisting media, rolling in resisting media, practical aspects of rolling, anti-rolling devices.

#### **TOTAL 54 hours**

#### **TEXT BOOKS:**

1. E.A. Stokoe, "Reeds Naval Architecture for Marine Engineers Volume V," 2013

#### **REFERENCE BOOKS:**

1. D. J. Eyres, "Ship Construction", Elsevier Ltd, Sixth edition, 2007

# 15EMR225 ADVANCED MARINE WORKSHOP (MEP II) 0 0 3 3 Course objective:

• To Maintenance and repair of shipboard machinery and equipment (Table A – III/1).

#### Course outcome:

- **CO-1** To understand fuel oil separator- purifier.
- **CO-2** To understand fuel oil separator- clarifier.
- **CO-3** To understand purification system for Fuel Oil using a Purifier-Clarifier.
- **CO-4** To understand procedures to be followed when doing hot work, gas cutting, arc welding.
- **CO-5** To understand procedures to be followed for moving heavy machinery in engine room & working aloft.

## **LIST OF JOBS/EXPERIMENTS**

- 1. Construction and characteristics of A Fuel Oil Separator Purifier Opening up, identification of parts, inspection for damage and reassembly. Start up after re-assembly.
- 2. Construction and characteristics of A Fuel Oil Separator Clarifier Opening up, identification of parts, inspection for damage and reassembly. Start up after re-assembly.
- 3. Setting up purification system for Fuel Oil using a Purifier-Clarifier combination in series.
- 4. Draw up check lists for procedures to be followed when doing hot work, gas cutting, arc welding.
- 5. Draw up check lists for procedures to be followed when (i) moving heavy machinery items within the Engine Room (ii) working aloft in Machinery Spaces..
- 6. Draw up check lists for procedures to be followed when the Main Engine is to be opened up for overhaul.
- 7. Draw up check lists for procedures to be followed when Crankshaft deflections of the Main Engine are to be taken. List the precautions and tabulate the results.
- 8. Draw up check lists for procedures to be followed when Main Bearing clearances of the Main Engine are to be taken. List the precautions and tabulate the results.
- 9. Draw up check lists for procedures to be followed when the running gear of an Auxiliary Engine is to be checked. Set the valve tappets of a 4-stroke Auxiliary Engine. List the precautions and tabulate the results.

## TOTAL 144 hours.

## **TEXT BOOKS:**

In-house developed Lab Manual

# 15EMR226 MARINE ENGINEERING PRACTICE III 2 0 0 2 Course objective:

- Able to manage safe and effective maintenance and repair procedures.
- To Detect and identify the cause of machinery malfunctions and correct faults Ensure safe working practices.

#### **Course outcome:**

- **CO-1** To understand Detection and identification of the cause of machinery malfunctions and correct faults .
- **CO-2** To understand destructive and non-destructive testing.
- **CO-3** To understand Unplanned or break-down maintenance.
- **CO-4** To understand inspection and adjustment of all relevant equipment.
- **CO-5** To understand Theoretical knowledge of Marine Engineering Practice

#### UNIT I DETECTION OF MACHINERY MALFUNCTIONS

09

Detect and identify the cause of machinery malfunctions and correct faults – practical knowledge- Detection of machinery malfunctions, localization of faults – actions to prevent damage – destructive and non-destructive testing

## UNIT II MAINTENANCE - INSPECTION

09

Unplanned or break-down maintenance – inspection and adjustment of all relevant equipment.- Risk assessment and evaluation before commencement of maintenance activity.

## UNIT III MARINE ENGINEERING PRACTICE

12

Theoretical knowledge of Marine Engineering Practice and Maintenance of Machinery. Methods of dealing with wear and tear of machinery, both electrical and mechanical. Alignment of machinery components. Correction of defects. Temporary and permanent repairs in the event of breakdown. Manageable breakdowns and Emergency Repairs.

UNIT IV SURVEYS 12

Management and conduct of ship maintenance by Planned Maintenance and Preventive Maintenance. Theory of condition monitoring and its application on board ships. Principles of Tribology and its practice. Statutory Certification of ships and Class verification. Surveys for maintenance and renewal of Class, and Statutory Certificates.

### **UNIT VSAFE WORKING PRACTICES**

Safe Working Practices. Planning for Dry-docking and major repairs. Planning and execution of safe maintenance activity and repair procedures taking into account technical, legislative, safety procedural specifications, appropriate plan, specification of materials and equipment available for maintenance and repairs. Trials and restoration of the Plant after repairs.

### **TOTAL 54 hours.**

### **TEXT BOOKS:**

The Running and Maintenance of Marine Machinery – Institute of Marine Engineers, London. 2009

# 15EMR227 LEADERSHIP, TEAM-BUILDING AND SHIP SECURITY 2 0 0 1 Course objective: ]

- Able to gain Application of leadership and team working skills, Maintain the conditions set forth in a ship security plan.
- To recognize the security risks and threats.
- To undertake regular security inspections of the ship and proper usage of security equipment.

### Course outcome:

- CO-1 To understand Knowledge of shipboard Personnel management.
- **CO-2** To understand training of shipboard personnal.
- **CO-3** To understand Human resource management.
- **CO-4** To understand Training ,development & Negotiation skills.
- **CO-5** To understand Ability to apply task and workload management.

### UNIT I PERSONNEL MANAGEMENT

06

Knowledge of shipboard Personnel management and training – Engineer and Manager.

### **UNIT II RESOURCE MANAGEMENT**

06

Human resource management -Training and development - Negotiation skills

### **UNIT III WORKLOAD MANAGEMENT**

06

Ability to apply task and workload management. Communication, Team-building, Planning and co-ordination, Personal assignments, Time and resource constraints, Prioritization.

### **UNIT IV MANAGEMENT PROCESSES**

09

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

### 09

### **UNIT V WORKING KNOWLEDGE**

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 36 hours**

### **TEXT BOOKS:**

1.Capt. Dhanraj Gupta, "Commercial Geography Ship Operation and Management", Mastermind Ventires, 2<sup>nd</sup> edition, 2008

### 15EMR228 ENGINE ROOM RESOURCES MANAGEMENT 2 0 0 2

### **Course objective:**

• Able to maintain a safe Engineering watch, Use internal communication systems.

### Course outcome:

- **CO-1** To be well versed in utilizing available resources in engine room.
- **CO-2** To know about the quality and safety conventions.
- **CO-3** To be well versed in allocating the resources.
- **CO-4** To know about multi cultural environment.
- **CO-5** To understand the concept of prioritization.

### UNIT I INTRODUCTION 06

Introduction to Resources Management, Related Conventions(ISM Code), Quality, safety and environmental Management systems.

### **UNIT II RESOURCE MANAGEMENT**

09

Engine Room Resource management. Effective corrections, allocation of resources. Time and resource constraints. Personnel relationships on board. Working in a multi-cultural environment.

### **UNIT III PRIORITIZATION OF RESOURCES**

06

Knowledge and ability to apply effective Resource Management. Allocation, assignment and prioritization of resources.

### **UNIT IV COMMUNICATION**

06

Effective communication on board and ashore. Application to task, workload management and decision making. Decisions taken should reflect consideration of team experience.

### **UNIT V MAINTENANCE**

09

Development and implementation of Project plans. Overview of standard operating procedures

for typical Engine Room running and maintenance operations. Project planning and control with emphasis on Maintenance Management.

### **TOTAL 36 hours**

### **TEXT BOOKS:**

1. Nanda and Ghokale, "Basic Marine Engineering Knowledge" N.G Series, 4<sup>th</sup> edition, 2011.

### **15EMR229** MARITIME LEGISLATION

3002

### Course objective:

• Able to monitor compliance with legislative requirements.

### Course outcome:

- **CO-1** To understand Knowledge of relevant International Maritime Law embodied in international agreements.
- **CO-2** To understand Requirements and responsibilities under the SOLAS 1974, Load Lines Convention 1966, and STCW Convention 1978.
- **CO-3** To understand International Health Regulations.
- CO-4 To understand the practical applications of medical guides
- **CO-5** To understand International Labor Organization

### UNITI MARITIME LAW 12

Knowledge of relevant International Maritime Law embodied in international agreements and applicable conventions. Requirements and responsibilities under the Safety of Life at Sea Convention 1974, Load Lines Convention 1966, and Standards of Training, Certification and Watch-Keeping Convention 1978. Brief description of SOLAS 1974. Obligation to carry out surveys and maintain validity of certificates, maintain records. Obligations and rights of the master.

### **UNIT II HEALTH REGULATIONS**

09

International Health Regulations. Understand the practical applications of medical guides; understand process of Radio medical advice; demonstrate knowledge of actions to be taken in case of accidents or illnesses that are likely to occur on board ships. WHO's International Health Regulations 2005(IHR). International Medical Guide for ships (IMGS). IMO's Medical First-Aid Guide. WHO's guidelines for drinking water quality.

### UNIT III REGULATIONS 12

Treaties, conventions, Protocols, Rules and regulations: International Maritime Organization, List of IMO Conventions. Introduction to International Labor Organization (ILO), World Health Organization. Authorities, Regulations and responsibilities under International Instruments affecting the Safety of Ships, Passengers, Crew or Cargo: United Nations Law of the Sea

(UNCLOS). ILO's International Maritime Labor Convention 2006 (MLC2006). Convention on the International Regulations for Preventing Collisions at Sea (COLREG) 1972International Convention on Salvage 1989; Lloyd's Standard Form of Salvage Agreement (LOF2000) Convention on the Limitation of Liability of Maritime Claims 1976. International Convention for the Unification of Certain Rules of Law relating to Bills of Lading (Hague-Visby Rules).

### **UNIT IV SURVEYS CERTIFICATION**

09

Surveys and Audits, certification and their validity. Classification Societies-Role of Classification Societies. International Association of Classification Societies. Certificates and other documents that are required to be on board ships by International Conventions, how they may be obtained, and period of their legal validity — 1.List of Certificates and documents as per SOLAS Annex I 2. Additional Certificates and documents required on board ships.

### **UNIT V MARITIME ADMINISTRATION**

12

ISM Code and its requirements – Safety Management System, Documentation and Certification. National Legislation – Merchant Shipping Act 1958: Role of Maritime Administration (Directorate General of Shipping) and its functions; DGS Rules and MS Notices; Flag State Requirements; Statutory Surveys and Certification; Port State Control. Charter Parties. Marine Insurance, General Average, and P&I Clubs.

### **TOTAL 54 hours.**

### **TEXT BOOKS:**

 Capt. Dhanraj Gupta, "Commercial Geography Ship Operation and Management", Mastermind Ventires, 2<sup>nd</sup> edition, 2008

# DISCIPLINE SPECIFIC ELECTIVE COURSES

### 15EMR101 ELECTRICAL ENGINEERING LAB - BASIC 0 0 3 1

### **Course objective:**

• Able to operate electrical, electronic and control system Manage operations of electrical and electronic equipment Operation, surveillance.

### Course outcome:

- **CO-1** To understand Measurement of resistance using battery, voltmeter and ammeter.
- **CO-2** To understand Measurement of voltage using voltmeter description of voltmeter.
- **CO-3** To understand Measurement of current using ammeter description of ammeter.
- **CO-4** To understand Measurement of power in a DC circuit .
- **CO-5** To understand Measurement of power in an AC circuit, and calculation of power factor.

### LIST OF EXPERIMENTS TO BE CARRIED OUT

1. Measurement of resistance using battery, voltmeter and ammeter	08
2. Measurement of voltage using voltmeter – description of voltmeter	08
3. Measurement of current using ammeter – description of ammeter	08
4. Measurement of power in a DC circuit	08
5. Measurement of power in an AC circuit, and calculation of power factor	08
6. Study of parallel operation of DC Generators	04
7. Study of parallel operation of AC Generators	04
8. Applications of HV equipment and advantages of HV	04
9. Battery charging circuit.	02

### **TOTAL 54 hours**

### **TEXT BOOKS:**

In-house Laboratory Manual

### **REFERENCE BOOKS:**

P S Bhimbhara "Electrical Machinery",khanna publishers,7<sup>th</sup> edition,2005

### 15EMR102 INTRODUCTION TO SHIPPING

### **Course objective:**

 Able to understand the basics of shipping, the mechanism of trade- exports from and imports into a country, cargoes moved from port to port.

3002

• To understand the types of cargoes, the ships employed and in general the routes used for the ships.

### Course outcome:

- **CO-1** To understand basics of international trade.
- **CO-2** To understand domestic & foreign trade.
- **CO-3** To understand major shipping routes.
- **CO-4** To understand major ports of the world.
- **CO-5** To understand types of ships.

### UNIT I INTRODUCTION 04

Introduction – Shipping – Trade – Domestic and Foreign – Basics of International Trade

### UNIT II SHIPPING ROUTES 05

Major Shipping Routes – Ports – Types- Major Ports of the World

### UNIT III TYPES OF SHIPS 05

Types of Ships- Cargo Ships- Bulk Carriers- Tankers- Container Ships – Cruise Vessels

### UNIT IV WORLD BODIES 05

Role of World Bodies- IMF - World Bank - WTO- UN - Others

### **UNIT V SHIPBOARD ORGANIZATION**

05

Role of Shipboard Organization - Tasks associated in movement of ships from port to port and others-Nautical and Engine Departments- Duties to be carried out – Progression of career

### **TOTAL 24 hours**

### **TEXT BOOKS:**

1. Learning Guide by Board of Examinations for Seafarers Trust 1<sup>st</sup> Edition, 2008

### **Course objective:**

• able to do Maintenance and repair of shipboard machinery and equipment Safety measures to be taken for repair and maintenance.

### Course outcome:

- **CO-1** To understand General shipboard safety procedures.
- **CO-2** To understand Procedures for isolating, and safety checks prior to overhaul of machineries.

# LIST OF EXPERIMENTS (ADVANCED MARINE WORKSHOP)

Safety measures to be taken for repair and maintenance of the following marine machinery:

- 1. General shipboard safety procedures Working aloft, working in restricted areas, enclosed spaces, hazardous spaces, handling heavy equipment, use of safety harness, tool-kit belts, communications (10)
- 2. Procedures for isolating, and safety checks prior to overhaul of: (i) an Air Compressor (ii) an Air-Conditioning Compressor (iii) a Fridge Compressor(iv) a Centrifugal Pump (v) A Reciprocating pump (vi) a Screw displacement pump (vii) a Gear Pump (viii) a Vane type pump (ix) an air cooler (x) Main Engine Scavenge spaces inspection (xi) Main Engine Crankcase inspection (xii) Dismantling any Main Engine Part (xiii)Aux Engine Crankcase inspection (xiv) Dismantling any Aux Engine part (xv)Inspection of Boiler furnace (xvi) Inspection of a Fuel Oil tank (xvii) Overhaul of hydraulic equipment (xviii) Inspection of Main Air Receiver (xix) Overhaul of FO Separator (xx) Main Switch Board (20 items@4h each = 80h).

### **TOTAL 90 Hours**

### **TEXT BOOKS:**

In-house developed Work Manual

### **REFERENCE BOOKS:**

1. Code of Safe Working Practices for Merchant Seamen, 2010

# 15EMR104 ADVANCED MARINE WORKSHOP (DECK M/C) 0 0 4 2 Course objective:

 Able to operate main and auxiliary machinery, associated control systems and Deck machinery.

### Course outcome:

- **CO-1** To understand Windlass and Mooring Winches.
- **CO-2** To understand Circuit diagrams of hydraulic systems.
- **CO-3** To understand Cranes Electro-hydraulic and totally hydraulic systems.
- **CO-4** To understand the safety features installed on Cranes.
- **CO-5** To understand Hydraulic and Mechanical hatch-cover operation.

### **OPERATE/OVERHAUL THE FOLLOWING DECK M/C:**

### **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.

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**

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 12

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

### UNIT V STEERING GEAR 12

Steering Gear - 4 ram 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.

### UNIT VI BOW-THRUSTER 12

Bow-Thruster Systems and their Remote Control.

### **TOTAL 72 hours**

### **TEXT BOOKS:**

In-house developed Lab Manual

# 15EMR105 ADVANCED MARINE WORKSHOP (MAM I) 0 0 2 2 Course objective:

• able to operate main and auxiliary machinery and associated control systems Shafting installations, including propeller and other auxiliaries.

### Course outcome:

- **CO-1** To understand Inspection of propulsion transmission systems.
- **CO-2** To understand Types of propellers and features.
- CO-3 To understand Heat Exchangers.
- **CO-4** To understand filters.
- **CO-5** To understand Steering Gear, Stabilizers & Bow Thrusters.

### LIST OF EXPERIMENTS

- 1. Inspection of propulsion transmission systems including thrust and shaft bearings and stern-tubes. (Oil-filled and water-lubricated lignum-vitae, and Thordon types).
- 2. Types of propellers and features fixed pitch, CPP. Materials of construction. Cavitation.
- 3. Heat Exchangers: Tubular and plate type, reasons of corrosion, leakages erosion tube removal, plugging, pressure testing. Materials used. Fouling of tubes plates. Renewal of sacrificial anodes
- 4. Filters: Strainers and filters, types of marine filters, auto cleaner and duplex filters, Static filters. Priming and core maintenance of filters.
- 5. Steering Gear, Stabilizers, Bow Thrusters principles, operation, types, materials of construction, hydraulic power pumps and control systems for above.
- 6. Air Compressors Opening up and overhaul of cylinder heads, valves, inter and after coolers.
- 7. Air Compressors Safe start-up, operation, shut-down, and charging of Air Bottles
- 8. Air Bottles inspection and overhaul of mountings and inspection Air of Bottles.
- 9. Construction, characteristics and operation of Fresh Water Generators(Vacuum distillation).

### **TOTAL 54 hours**

### **TEXT BOOKS:**

In-house developed Workshop Manual

# 15EMR106 MARINE ENVIRONMENTAL POLLUTION CONTROL 3 0 0 2 Course objective:

• Able to ensure compliance with pollution prevention requirements.

### Course outcome:

- **CO-1** To understand marine environmental pollution & its impact.
- **CO-2** To understand precaution for oil transfer.
- **CO-3** To understand operation of pollution prevention equipments.
- **CO-4** To understand MARPOL requirements & documentation.
- **CO-5** To understand various convention (ballast water management).

UNIT I 09

Marine environment – Marine environmental awareness. Marine ecology, seas and coastal areas. Ship's discharges to the sea and their environmental impact.

UNIT II 12

Precautions 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.

UNIT III 12

MARPOL 73/78-Alll Annexes, equipment requirements and their documentation, including necessary Record Books. Ballast Water Management Convention 2004. Anti-Fouling Convention 2001. Oil Pollution Act 1990.

UNIT IV 12

Responsibilities under the relevant requirements of the international Convention for the prevention of Pollution from Ships – Annex I, Annex II, Annex III, Annex IV, Annex V, Annex VI. Ballast Water Management Convention 2004. Anti-Fouling Convention 2001. Oil Pollution Act 1990.

UNIT V 09

Environmental impact of accidental and operational discharges. Emissions to air from ships. Other pollutants. Proactive measures to control pollution and maintain the environment. Emergency situations-action to be taken to protect and safeguard the environment.

### TOTAL: 54 hours.

### **TEXT BOOKS:**

1. VikramGokhale, N.Nanda,"Ship's Safety And Environmental Protection", N.G Series, 4<sup>th</sup> edition, 2011.

### **REFERENCE BOOKS:**

1. Nanda and Ghokale, "Basic Marine Engineering Knowledge" N.G Series, 4<sup>th</sup> edition, 2011

# 15EMR107 SEAMANSHIP PRACTICAL 0 0 2 1 Course objective:

• Able to understand semen duties, ship departments, signals, lights etc.

### Course outcome:

- **CO-1** To understand seamen & their duties.
- **CO-2** To understand general ship knowledge.
- CO-3 To understand nautical terms.
- **CO-4** To understand navigational lights.
- **CO-5** To understand signals.

### **LAB EXPERIMENTS**

- Seamen & their duties
- Ship's departments
- General ship knowledge
- Nautical terms like poop-deck, Forecastle, bridge etc.
- Navigational lights
- Signals
- Port & starboard, forward and aft mast lights, Colors and location
- Ropes and wires
- Mooring
- Types of knots.
- Anchors, their use, dropping and weighing anchor
- Cable stopper
- General knowledge of principles of navigation
- Compasses
- Echo sounder.

# 15EMR108 ADVANCED MARINE WORKSHOP (MEP I) 0 0 5 4 Course objective:

 Able to use hand tools, machine tools and measuring instruments for fabrication and repair on board.

### Course outcome:

- **CO-1** To understand about dismantling of main engine cylinder liner.
- **CO-2** To understand about material for boilers.
- **CO-3** To understand about material for gas turbines.
- **CO-4** To understand safety measures taken while using power tools & machine tools.
- **CO-5** To understand the process of welded repair and construction.

JOB I 24

Dismantle Main engine cylinder liners, pistons, crankshafts, bearings.

JOB 2 24

Material for boilers, super-heaters, steam turbines casing, blades, rotor etc. Gas turbine casings, rotors, blades, combustion chambers etc.

JOB 3 24

Safety measures to be taken to ensure a safe working environment, and for use of hand tools, powered hand tools, machine tools (Centre Lathe, Soldering, Thermal cutting,

JOB 4 24

The process of welded repair and construction. Advantages and disadvantages. Types of welds. Defects in welds. Destructive and Non-destructive testing of welds. (Tests carried out on a sample of a typical welded seam of a water tube boiler drum.)

JOB 5 24

Use of various types of sealants and packings for various applications on board- Superheated Steam, Sea water, Fresh water, Lub oil, Refrigerant lines, chemicals.

Job 6 24

Inspection, safety and health when carrying out above operations — using appropriate specialized tools(for overhaul of particular machinery items) and precision measuring instruments (micrometers, liner gauges, tachometers, feeler gauges, UTG).

**TOTAL 144 hours.** 

# 15EMR109 MARINE HYDRAULIC SYSTEMS 5 0 0 4 Course objective:

 Able to understand the importance of various aspects of Marine Hydraulic Systems prevalent on board ships, with specific reference to main, auxiliary hydraulic systems, rotary and liners drives, control, operational, safety and emergency operation of all hydraulic systems.

### Course outcome:

- **CO-1** To understand Introduction to Marine Hydraulic systems.
- **CO-2** To understand the usage of marine hydraulic systems.
- **CO-3** To understand Marine hydraulics for application of rotary and linear motion drives on winches.
- **CO-4** To understand Marine hydraulics for application of rotary and linear motion drives on windlass.
- **CO-5** To understand Marine hydraulics for application for deck cranes & hatch covers of cargo ships.

UNIT I INTRODUCTION TO MARINE HYDRAULIC SYSTEMS Introduction to Marine Hydraulic systems- and their usage for steering gear, deck machinery etc	04
UNIT II MAIN HYDRAULICS SYSTEMS  Marine hydraulics for application of rotary and linear motion drives on winches and windlass.	05
UNIT III DECK MACHINERIES  Marine hydraulics for application for deck cranes, hatch covers and grabs for cargo ships	05
UNIT IV STEERING GEARS  Marine hydraulics for application for use on ship's steering gears with all safety features.	05
UNIT V SAFETY AND EMERGENCY OPERATION Operational, safety and emergency operation of all hydraulic systems.	05

### **TOTAL 24 hours**

# 15EMR110 ADVANCED MARINE WORKSHOP – REFRIGERATION AND AIRCONDITIONING TRAINER 0 0 1 1 Course objective:

• Able to operate main and auxiliary machinery and associated control systems.

### Course outcome:

- **CO-1** To understand the circuit of refrigeration system.
- **CO-2** To understand the circuit of air conditioning system.

### LIST OF EXPERIMENTS

- 1. Familiarization of the circuit and components of a Refrigeration system, including its automatic temperature control
- 2. Familiarization of the circuit and components of an Air Conditioning System, including itsautomatic temperature control

09

### **TOTAL 18 hours**

### **TEXT BOOKS:**

In-house developed Lab Manual

## 15EMR111 ELECTRICAL LAB II + ELECTRICAL WORKSHOP 0 0 5 2 Course objective:

• able to Maintenance and repair of electrical and electronic equipment.

### **Course outcome:**

- **CO-1** To understand the alarm system onboard.
- **CO-2** To understand the fault & repair on generators & motors.
- **CO-3** To understand about distribution systems.
- **CO-4** To understand about testing equipments.
- **CO-5** To understand about electrical protective devices.

### LIST OF EXPERIMENTS

Alarm system (types, supply) on board for-

- 1. Watertight doors,
- 2. Bow-doors,
- 3. Oxygen analyzer,
- 4. High & low level alarms,
- 5. Navigational lights,
- 6. Main engine telegraph
- 7. Steering gears
- 8. Electrical Deck Cranes.

### **FAULT FINDING & REPAIR:**

Type of faults & indications on:

- 9. Generator
- 10. Motor
- 11. Distribution systems, different testing equipments& meters (multimeter / megger, clamp meter, etc)
- 12. Detection of faults on electrical circuits Indications & corrective arrangements, necessary precautions & care while fault finding and repair, preventive maintenance, periodic surveys, spares requirement.
- 13. Salvaging a motor.
- 14. Mandatory requirements for electrical installations. Electrical protective devices.

Specification and installation of cables for various shipboard uses.

### ELECTRICAL SYSTEMS FOR OPERATION IN FLAMMABLE AREAS.

- 15. Special electrical practice for oil, gas and chemical tankers (Tanker classification, Dangerous spaces, Hazardous zones, Temperature class), flame proof Ex 'd' and intrinsic safety Ex 'i' Ex 'e', and Ex 'n' equipments
- 16. Their applications in zones; maintenance of Ex-protected apparatus.

### SAFE ELECTRICAL PRACTICE:

Safe watch – keeping, points to check on:

- 17. Electrical machinery Switch gears & equipment
- 18. Electrical fire fighting, precautions against electric shock and related hazards.

### **TOTAL 108hours**

### **TEXT BOOKS:**

1. J.Majumder, Elastan A Fernandez, "Marine Control Technology", Shroff Pub. ,  $7^{\text{th}}$  edition, 2014

### 15EMR112 MARINE REFRIGERATION 2001

### **Course objective:**

- Able to understand the importance of various aspects of Marine Refrigeration Systems prevalent on board ships, with specific reference to main, auxiliary Refrigeration systems, cargo and other reefer systems.
- To understand Control, operational, safety and emergency operation of all Marine Refrigeration systems.

### Course outcome:

- **CO-1** To understand Marine Refrigeration systems used for Reefer cargoes carried on ships.
- CO-2 To understand Reefer ship's systems used for cargoes and gas carriage on gas
- **CO-3** To understand about Reefer containers.
- **CO-4** To understand Assessment of heat leakage and insulation of reefer plant.
- **CO-5** To understand procedures for Reefer cargo survey.

### UNIT I INTRODUCTION TO MARINE REFRIGERATION

04

Introduction to Marine Refrigeration systems used for Reefer cargoes carried on ships.

### **UNIT II REEFER SHIP'S SYSTEMS**

05

Reefer ship's systems used for cargoes and gas carriage on gas- carriers and others.

### **UNIT III REEFER CONTAINERS**

05

Reefer containers - 20 and 40 TEUs self contained reefer systems for different types of cargoes

### **UNIT IV REEFER PLANT**

05

Assessment of heat leakage and insulation of reefer plant and procedures for Reefer cargo survey

### **UNIT V REEFER PLANT**

05

Reefer cargo mock tests. Surveys and inspections and Adequacy of cooling

### **TOTAL 24 hours**

# 15EMR113 ADVANCED MARINE WORKSHOP (ELECTRICAL) 0 0 2 1 Course objective:

• Able to Maintenance and repair of electrical and electronic equipment.

### Course outcome:

- **CO-1** To understand about insulation tester.
- CO-2 To understand about continuity tester.
- CO-3 To understand use of multi tester.
- **CO-4** To understand use of clamp meter.
- **CO-5** To understand about analog & digital voltmeters.

### LIST OF JOBS/EXPERIMENTS

- 1. Opening up, study and use of: Insulation tester. Safety precautions to be observed.
- 2. Opening up, study and use of: Continuity tester. Safety precautions to be observed.
- 3. Opening up, study and use of: Multi-tester. Safety precautions to be observed.
- 4. Opening up, study and use of: Clamp meter. Safety precautions to be observed.
- 5. Opening up, study and use of: Analog and digital voltmeters. Safety precautions to be observed.
- 6. Opening up, study and use of: Analog and digital ammeters. Safety precautions to be observed.
- 7. Opening up, study and use of: Analog and digital tachometers. Safety precautions to be observed.
- 8. Opening up, study and use of: Analog and digital frequency meters. Safety precautions to be observed.
- 9. Opening up, study and use of: Analog and digital Power factor meters. Safety precautions to be observed.

### **TOTAL 54 hours**

### **TEXT BOOKS:**

In-house developed Lab Manual

### 15EMR114 ENERGY EFFICIENCY ON SHIPS 0 0 2 1

### **Course objective:**

- Able to understand the importance of Energy Efficiency and ships and Ship Energy Efficiency Management plan aspects of Ships.
- To know about EPT, EEDI and IHSF Statistics code system for coding of cargo vessel etc.

### Course outcome:

- **CO-1** To understand Energy Efficiency on Ships.
- **CO-2** To understand Ship Energy Efficiency Management Plan.
- **CO-3** To understand Energy Efficiency Design Index.
- **CO-4** To understand Energy Efficiency Operational Index.
- **CO-5** To understand Assessment of IHSF Statistics code system for coding of cargo vessel.

### **UNIT I INTRODUCTION TO ENERGY EFFICIENCY ON SHIPS**

04

Introduction to Energy Efficiency on Ships and its development and overview

### **UNIT II CONCEPTS – EEDI AND SEEMP**

05

Concepts - EEDI- Energy Efficiency Design Index, SEEMP- Ship Energy Efficiency Management Plan

### **UNIT III CONCEPTS – EEOI - - ENERGY EFFICIENCY OPERATIONAL INDEX**

05

Concepts - EEOI- Energy Efficiency Operational Index for both new and old cargo ships.

### **UNIT IV IHSF STATISTICS CODE SYSTEM**

05

Assessment of IHSF Statistics code system for coding of cargo vessel and other types of vessels.

### **UNIT V EPT- ELECTRIC POWER TABLE**

05

Validation of EPT- Electric Power Table in relevance to EEDI- Energy Efficiency Design Index on tankers and other vessels.

### **TOTAL 24 hours**

### 15EMR115 SHIP REPAIR AND SURVEYS PRACTICES 0 0 2 1

### **Course objective:**

 Able to understand the importance of Ship Repair and Surveys Practices and Management plan aspects of Ships and others. The costs and expenses of routine repairs and breakdown expenses and consequences etc.

### Course outcome:

- **CO-1** To understand ship surveys.
- CO-2 To understand checklists & documentation for the survey.
- **CO-3** To understand types of ship survey.
- **CO-4** To understand annual surveys.
- **CO-5** To understand about hull, load line surveys.

### UNIT I INTRODUCTION TO SHIP SURVEYS, INSPECTIONS

04

Introduction to Ship Surveys, Inspections, Survey procedures and Certifications and Compliance. Keeping in readiness the items for Surveys, check lists used and other needed documentation.

### **UNIT II TYPES OF SHIP SURVEYS**

05

Concepts on types of Ship Surveys carried out in the course of ship surveys – Periodical Ship Surveys commencing from 1<sup>st</sup> Special and others to follow done every 4 yearly

### **UNIT III TYPES OF ANNUAL SURVEYS**

05

Concepts on Annual Surveys - Hull, Load Line, SEQ-Safety Equipment, Life Saving Appliance Items, Radio, Dry Dock, Cargo-Gear, Machineries,

### **UNIT IV CLASSIFICATION OF SURVEYS**

05

Concepts on International Conventions, Classification of Surveys, Compliance of Surveys, Recommendation and Conditions of Class,

### **UNIT V CONDITIONS OF CLASS AND SURVEYS**

05

Concepts on Classification of Surveys, Conditions of class and Inspections on Repairs and measurements of data records, check lists of surveys etc..

### **TOTAL 24 hours**

# 15EMR116 MARINE ENGINEERING PRACTICE III - SIMULATOR LAB 0 0 3 2 Course objective:

• Able to manage safe and effective maintenance and repair procedures, Detect and identify the cause of machinery malfunctions and correct faults, Ensure safe working practices.

### Course outcome:

- **CO-1** To understand Plant arrangements on Simulator Panels.
- **CO-2** To understand Instrumentation and Control System for Main and Auxiliary Machineries.
- **CO-3** To understand Procedures for Pumps and Pumping Systems.
- **CO-4** To understand Procedures for Air Compressors, Purifiers, Hydrophore System.
- **CO-5** To understand Procedures for Diesel operated aux. engines.

### **ENGINE SIMULATOR LAB EXPERIMENTS**

- 1. Familiarization with Plant arrangements on Simulator Panels.
- 2. Familiarization with Instrumentation and Control System for Main and Auxiliary Machineries.
- 3. Familiarization with Operational Procedures for Pumps and Pumping Systems.
- 4. Familiarization with Operational Procedures for Air Compressors, Purifiers, Hydrophore System.
- 5. Familiarization with Operational Procedures for Diesel operated aux. engines.
- 6. Familiarization with Operational Procedures for Steam driven Turbine Generator.
- 7. Familiarization with Operational Procedures for Aux. Boiler& Exhaust Boiler.
- 8. Familiarization with Operational Procedures for Main Propulsion Diesel Engine.
- 9. Familiarization with Operational Procedures for Inert Gas and COPT system.
- 10. Familiarization with Operational Procedures for Incinerator plant OWS.

### **TOTAL 54 hours**

### **TEXT BOOKS:**

In-house developed Lab Manual.

### 15EMR117 MARINE MACHINERY START-UP(S-I-C) 0 0 2 1

### **Course objective:**

able to manage the operation of propulsion plant machinery Plan and schedule operations
 Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery.

### Course outcome:

- **CO-1** To understand bilge pumping system.
- **CO-2** To understand ballast pumping system.
- **CO-3** To understand steam and condensate line.
- CO-4 To understand Feed water line.
- **CO-5** To understand cooling water line.

### LIST OF JOBS/EXPERIMENTS

- 1. Sketch the layout of bilge pumping system
- 2. Sketch the layout of ballast pumping system
- 3. Sketch the layout of steam and condensate line
- 4. Sketch the layout of Feed water line
- 5. Sketch the layout of cooling water line
- 6. Sketch the layout of cargo oil pumping system in oil tankers
- 7. Sketch the layout of fuel oil line.

### **TOTAL 36 hours.**

### **TEXT BOOKS:**

1. In-house developed Lab Manual.

# GENERIC ELECTIVE COURSES

15EMR151	DIFFERENT TYPES OF SHIPS	2001

### **Course objective:**

 Able to understand the different types of ships, with clear distinction on cargoes as states of mattersolids, liquids, and gases as found in raw, semi-processed and processed form in the categories of cargoes and passenger carriage on ships.

### **Course outcome:**

- **CO-1** To understand about shipping trade.
- **CO-2** To understand basics of international trade.
- **CO-3** To understand different types of ships.
- **CO-4** To understand different type of cargo ships.
- **CO-5** To understand different type of tanker ships.

UNIT I INTRODUCTION Introduction – Shipping – Trade – Domestic and Foreign – Basics of International Trade	04
UNIT II CARGO AND PASSENGER SHIPS  Different types of Ships – Cargo Ships - Bulk Carriers- Tankers- Container Ships – Cruise Vessels	05
UNIT IIICARGO SHIPS Cargo Ships – RO-RO Ships, Car Carriers - different types of tankers,	05
UNIT IV LIQUID CARGO SHIPS Tankers- Petroleum- Crude, Product, Chemical, Other liquids- vegetable oils, acids, alkakis,	05
UNIT V OFFSHORE OIL AND GAS VESSELS  Different types of Oil and Gas Field - Off Shore Vessels, Survey Vessels.	05

### **TOTAL 24 hours**

### **TEXT BOOKS:**

Learning Guide by Board of Examinations for Seafarers Trust  $\mathbf{1}^{\text{st}}$  Edition, 2008

# 15EMR152 SAFE WORKING PRACTICES ON BOARD 2 0 0 1 Course objective:

• Able to understand the importance of safe work practices on board ships. Also the safety measures taken prior, during and after the repair and other works are carried out.

### Course outcome:

- **CO-1** To understand Safe Working Practices on Board.
- **CO-2** To understand working in restricted areas & enclosed spaces.
- **CO-3** To understand Safety principles and practices.
- **CO-4** To understand Working in aloft areas, hazardous spaces and confined areas.
- **CO-5** To understand Safety procedures for isolation.

### UNIT I INTRODUCTION 04

Introduction – Safe Working Practices on Board- working in restricted areas, enclosed spaces,

### UNIT II SAFE WORK PRACTICES

05

Safety principles and practices- Working in aloft areas, hazardous spaces and confined areas

### **UNIT III ISOLATION OF MACHINES**

05

Safety procedures for isolation, carrying out safety checks for maintenance work in Engine Room

### **UNIT IV DOCUMENTATION PROCEDURES**

05

Documentation of work permits, check lists for various works on machinery maintenance, others

### **UNIT V REPORTING PROCEDURES**

05

Procedures of taking work data and permits for undertaking work, check lists for carrying out various works for carrying out machinery maintenance, dimensions and drawings and others

### **TOTAL 24 hours**

### 15EMR153 WELDING PRACTICES 2001

### **Course objective:**

• Able to understand the importance of welding practices on board ships. Also the safety measures taken prior, during and after the repair and welding and other works are carried out.

### **Course outcome:**

- **CO-1** To understand Safe Welding on Board.
- **CO-2** To understand welding principles and practices.
- **CO-3** To understand Different types of welding.
- **CO-4** To understand about forge welding.
- **CO-5** To understand about electric welding.

UNIT I INTRODUCTION Introduction – Safe Welding on Board- Electric Arc and Gas welding principles and practices	04
UNIT II DIFFERENT TYPES OF WELDING Different types of welding- Pressure welding and non-pressure welding practices, forge welding	05
UNIT III WELDING- WORK PROCEDURES  Electric Welding- Work procedures- Common defects in Welding practices – on surface, internal	05
UNIT IV GAS WELDING PRACTICES  Differentiation of welding, brazing and soldering practices, Gas welding practices on cutting, Etc.	05
UNIT V TESTING PROCEDURES ON WORK COMPLETION Differentiation of welding, brazing and soldering practices, Gas welding practices on cutting, Etc.	05

### **TOTAL 24 hours**

### **TEXT BOOKS:**

1. S.K Hajra Choudhry, "Workshop Technology "MPP, 14<sup>th</sup> edition, 2013

### 15EMR154 MARINE MACHINE DESIGN AND DRAWING 2001

### **Course objective:**

Able to understand the importance of marine machine design and drawing practices on board ships.
 Also the techniques of interpretation of machinery drawings and their importance for the upkeep of machinery etc.

### Course outcome:

- **CO-1** To understand Basics of Marine Machine Design and Drawing.
- **CO-2** To understand Function purpose of machine & parts.
- CO-3 To understand Procedure in Machine Design.
- **CO-4** To understand Elements of design, procedure and processes.
- **CO-5** To understand elements of design synthesis.

### UNIT I INTRODUCTION TO MARINE DRAWING ASPECTS.

04

Introduction – Basics of Marine Machine Design and Drawing, and Function purpose of machine, parts

### **UNIT II MACHINE DESIGN CONCEPTS**

05

Procedure in Machine Design – Elements of design, procedure and processes, devices in a system

### **UNIT III ELEMENTS OF DESIGN SYNTHESIS**

05

Design synthesis, applying preliminary design principles, and practices with safety factors Preliminary & final plans & drawings.

### **UNIT IV MATERIAL SPECIFICATION**

05

Practices on forming preliminary & final plans, drawings made with machine, strength, safety consideration and material specification etc.

### UNIT V FORMULATION OF FINAL PLANS

05

Practices on Machine design, theory principles with calculations of working stres / strain and the strength of the members etc. forming preliminary & final plans,

### **TOTAL 24 hours**

### **TEXT BOOKS:**

1. K.V Natarajan,"Engineering Graphics", Dhanalakshmi publications, 16<sup>th</sup> edition, 2013

### 15EMR155 MACHINE SHOP PRACTICES 2001

### Course objective:

• Able to understand the importance of Machine Shop Practices with all types of practices on board ships. Also the techniques of polishing and finishing job to specific standards.

### Course outcome:

- **CO-1** To understand Basics of Machine Shop Practices.
- **CO-2** To understand Procedure in other machining practices.
- **CO-3** To understand Special machines applied for on board work.
- CO-4 To understand Advanced Machining practices applied for hull, and docking surveys
- **CO-5** To understand Procedure in machining practices for on board repairs of components.

# UNIT II MACHINING PRACTICES Procedure in other machining practices - Milling, broaching, taper turning done on machines UNIT III MACHINING PRACTICES Procedure in other machining practices - Milling, broaching, taper turning done on machines UNIT III MACHINING PRACTICES- ENGINE ASSEMBLIES Procedure in machining practices for on board repairs of components- large component- Exh. V/v. UNIT IV SPECIAL MACHINING PRACTICES Special machines applied for on board work using principles of jigs and fixtures, honing, lapping UNIT V ADVANCED MACHINING PRACTICES Advanced Machining practices applied for hull, and docking surveys and conforming to Class

### **TOTAL 24 hours**

Standards and specification.

## 15EMR156 AUTOCAD PRINCIPLES AND PRACTICES 2 0 0 1 Course objective:

 Able to understand the importance of AutoCAD principles and practices as used primarily for designing, adapting designs, and with drawing skills.

### **Course outcome:**

- CO-1 To understand Introduction to AutoCAD.
- **CO-2** To understand Introduction to AutoCAD interface.
- **CO-3** To understand the basics of drawing commands.
- **CO-4** To understand erase command & mirror command.
- **CO-5** To understand the various commands of autocad.

### UNIT I INTRODUCTION TO AUTOCAD

04

Introduction to AutoCAD, AutoCAD interface, Draw Commands, Line Commands, Polygon Commands, Rectangle Commands

### **UNIT II DRAWING COMMANDS**

05

Circle commands, Ellipse Commands, Toolbar Modifications, Erase Command, Copy Command, Mirror Command

### **UNIT III VARIED COMMANDS**

05

Offset commands, Extent command, Array Command, Scale command, Move Command

### **UNIT IV COMMAND ORDERS**

05

Rotate command, Trim command, Chamfer command, Fillet command, Coordinate Entry, Osnap, QNew, Open, Save, Exit commands, Layers, Dimensioning, and Zoom.

### UNIT V ASSESSMENT AND RECAPITULATION

05

Command orders, assessments of drawing and adaptable designing as per changes effected.

### **TOTAL 24 hours**

#### 15EMR157 MARINE FUNCTIONS OF SYSTEMS 2001

#### **Course objective:**

 Able to understand the importance of various Marine functions available on board ships, with specific reference to operational, safety and emergency requirements.

#### Course outcome:

- **CO-1** To understand Sea water cooling & bilge system.
- **CO-2** To understand, ballast, fuel process & steam system.
- CO-3 To understand Details of service systems
- **CO-4** To understand Sea water cooling/low-temperature water pumps and pipelines.
- **CO-5** To understand ballast & bilge pumping system.

#### UNIT I INTRODUCTION TO MARINE FUNCTIONS

04

Different types of service systems – Sea water cooling, bilge, ballast, fuel process, steam, others

#### **UNIT II SEAWATER COOLING SYSTEMS**

05

Details of service systems- Sea water cooling/ low- temperature water pumps and pipelines.

#### **UNIT III BILGE, BALLAST SYSTEMS**

05

Details of service systems- Ballast water, bilge pumps, pumping systems and pipelines.

#### UNIT IV FUEL OIL SYSTEMS

05

Details of service systems- Fuel oil- bunkering, clean-up process, for use systems and pipelines.

#### **UNIT V MARINE FUNCTIONS CONCEPTS**

05

Consolidation and simulation of various marine functions for on board application, with contingency and emergency situations.

#### **TOTAL 24 hours**

# 15EMR158 SEAMANSHIP AND COMMERCIAL GEOGRAPHY 2001 Course objective:

Able to understand semen duties, mooring practice, anchors etc.

#### **Course outcome:**

- **CO-1** To understand about the duties of seaman.
- CO-2 To understand about nautical terms.
- **CO-3** To understand about ropes & knots.
- **CO-4** To understand about mooring.
- **CO-5** To understand about anchors.

UNIT I 06

Seamen & their duties: Ship's department, general ship knowledge and nautical terms like poop-deck, forecastle, bridge etc. navigational lights and signals: Port & starboard, forward and aft mast lights, colors and location.

UNIT II 09

Rope Knots and Mooring: Types of knots. Practice of knot formation.

UNIT III 06

**Anchors:** Their use, dropping and weighing anchor, cable stopper. Navigation: General knowledge of principles of navigation compasses, echo sounder.

UNIT IV 09

World Transport – Ports – Types, Characteristics and establishment issues – Major ports of the world – Government Policy.

UNIT V 06

Economics of Sea Transport – Major Shipping Routes – Weather Routing – Fishing Zones – Off shore Oil and Power Installations.

#### **TOTAL 36 hours.**

#### **TEXT BOOKS:**

1. Capt. Dhanraj Gupta, "Commercial Geography Ship Operation and Management", Mastermind Ventires, 2<sup>nd</sup> edition, 2008.

15EMR159 ANTI-POLLUTION LAB (IN ADVANCED MAR W/S) 0 0 2 1

**Course objective:** 

able to ensure compliance with pollution prevention requirements.

**Course outcome:** 

**CO-1** To understand about the operation carried during bunkering, loading & tank cleaning.

**CO-2** To understand sopep equipments.

**CO-3** To understand the environmental impact of accidental oil discharge.

**CO-4** To understand preventive measure to avoid oil spills.

JOB 1 12

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 12

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 24 hours.** 

**REFERENCE BOOKS:** 

MARPOL with latest Amendments

#### 15EMR160 E/R SIMULATOR PRACTICES 2001

#### **Course objective:**

• Able to understand the importance of various aspects of E/R Simulator System and other prevalent systems on board ships, with specific reference to main, auxiliary, cargo machinery safety and operation of all systems.

#### **Course outcome:**

- **CO-1** To understand Introduction to E/R simulator system.
- CO-2 To understand operation control of main engine, aux. engine and others.
- **CO-3** To understand objectives of engine room.
- **CO-4** To understand manning procedures of engine room.
- **CO-5** To understand functions of monitoring panels.

UNIT I INTRODUCTION TO E/R SIMULATOR SYSTEM Introduction to E/R simulator system, operation control of main engine, aux. engine and others.	04
UNIT II OBJECTIVES AND MANNING OF ENGINE ROOM Objectives E/R simulator system- with modern engine plant fully automated on reduced manning	05
UNIT III MONITORING PANELS E/R simulator system associated with demonstrations of functions on control, monitoring panels	05
UNIT IV E/R SIMULATOR SYSTEM E/R simulator system training for operational, watch keeping and troubleshooting functions,	05
UNIT V STANDBY, SAFETY AND EMERGENCY OPERATION Operational, conditions of standby systems, operation of all simulator systems.	05
UNIT V SAFETY AND EMERGENCY OPERATION  Operational, safety and emergency operation of all simulator systems.	05

#### **TOTAL 24 hours.**

#### 15EMR161 CONTROL ENGINEERING LAB 0032

#### **Course objective:**

• Able to Maintenance and repair of electrical and electronic equipment, Manage troubleshooting, restoration of electrical and electronic control equipment to operating condition.

#### Course outcome:

- **CO-1** able to operate & explain the control process of the fluids viscosity.
- **CO-2** To Understand the configuration of various parameters to achieve required viscosity- air pressure, PI control, steam or electrical heater.
- **CO-3** To Learn the configuration required for measuring flow control of fluids temperature, pressure, differential pressure.
- **CO-4** To operate oil mist detector understands the importance.
- **CO-5** Able to set the set point to reach the output using PID controller.

#### **CONTROL LAB EXPERIMENTS**

- 1. Operation of an Automatic Viscosity Controller, and maintaining a specific viscosity of a given fuel.
- 2. Operation of an Automatic Flow Controller and measuring the flow in a given pipe.
- 3. Operation and utility of a 3-term (P + I + D) Controller.
- 4. To study the functioning of an Oil mist detector, and check the alarm when the pre-set value is exceeded.
- 5. Study the operation of a Fire Detection Unit(Ionization chamber type detector).
- 6. CNC and VMC Machines.
- 7. Microprocessor controlled DC machines.
- 8. Microprocessor controlled AC machines.
- 9. SCADA Supervisory Control and Data Acquisition.

#### **TOTAL 54 hours**

#### **TEXT BOOKS:**

In-house developed Lab Manual.

#### 15EMR162 BOILER SHOP 0 0 2 1

#### **Course objective:**

Able to operate main and auxiliary machinery and associated control systems.

#### Course outcome:

- **CO-1** To understand inspection of boiler mountings.
- CO-2 To understand safety valve overhauling.
- CO-3 To understand plate type gauge glass overhauling.
- **CO-4** To understand main steam stop valve overhauling.
- **CO-5** To understand the overhauling of soot blower.

#### LIST OF JOBS/EXPERIMENTS.

- 1. External inspection and description of Boiler and all its mountings.
- 2. Safety valve to open up, overhaul and box up, relevant clearances being measured and recorded.
- 3. Plate type Gauge Glass to be opened up, overhauled, all valves and cocks overhauled and all parts fitted back with new joints and packing.
- 4. Main Steam stop valve to be opened up, all parts checked for soundness. Valve to be ground on its seat. All parts to be cleaned and reassembled with new joints and packing, and relevant clearances measured and recorded.
- 5. Soot Blower to be opened up, overhauled, working checked, and boxed up with new joints and packing.
- 6. Furnace to be opened up cleaned. Condition of burner, air-register to check and report on.

  Condition of refractory to be determined. A sample area of refractory to be repaired.
- 7. Blowing down the boiler, draining, opening the manhole doors and cleaning of the boiler.

  Boxing up with new jointing.
- 8. Preparing to present the Boiler for Annual Survey.
  - 9. After survey closing up the boiler, raising steam, floating and securing of the safety valves.

#### **TOTAL 36 hours**

#### **TEXT BOOKS:**

**1.** J.H. Milton & R.M. Leach, "Marine Steam Boilers",  $4^{TH}$  Edition , Butter worth, London 1980.,2010

#### 15EMR163 MANAGEMENT OF SHIPS 2001

#### **Course objective:**

Able to understand the management policies onboard & about owners & managers.

#### Course outcome:

- **CO-1** To understand Concepts on Managing of ships.
- **CO-2** To understand about the sea passage routes.
- **CO-3** To understand Elements on Ship Management Principles and Practices.
- CO-4 To understand principles on manning of ships.
- **CO-5** To understand Concepts on Ship Owners, Ship Manager ,ships on time and voyage charter.

#### **UNIT I INTRODUCTION TO MANAGEMENT OF SHIPS**

04

Concepts on Managing of ships, daily, regular running expenses- DRE, Average Annual Cost AAC. Different types of ships- cargoes, sea- passage-routes, cost of bunkers, crewing costs, bunkers etc.

#### **UNIT II SHIP MANAGEMENT PRINCIPLES**

05

Elements on Ship Management Principles and Practices with concepts and principles on manning of ships, and engagement and discharge of ship's crew, and safe manning certificate etc.

#### **UNIT III OWNERS AND MANAGERS**

05

Concepts on Ship Owners, Ship Manager and ships on time and voyage charter. On Hire and off Hire surveys. Notice of Readiness - NOR. Time delays, Demurrage charges on Charter, others

#### UNIT IV RETURN OF INCOME, LIFE CYCLE COST

05

Concepts on elements - Return of income, Life Cycle cost, wastage of resources, increase pollution effects, risk to marine safety, periodical survey with up keep afforded for maintaining ship.

#### **UNIT V OPERATIONAL AND MANAGEMENT FUNCTIONS**

05

Concepts on principles and practices on Operational and Management functions

#### **TOTAL 24 hours**

#### **TEXT BOOKS:**

 Capt. Dhanraj Gupta, "Commercial Geography Ship Operation and Management", Mastermind Ventires, 2<sup>nd</sup> edition, 2008

# SKILL ENHANCEMENT ELECTIVE COURSES

15EMR251 COMPUTER SCIENCE 1001

#### Course objective:

• Able to Use Computer Applications (PMS, E Learning, LAN network)etc, Internet and Shipboard Applications.

#### **Course outcome:**

- **CO-1** To understand the evolution of information processing.
- **CO-2** To understand about motherboard structure.
- **CO-3** To understand about machine language.
- **CO-4** To understand fourth generation languages.
- **CO-5** To understand concept & functions of operating system.

UNIT I INTRODUCTION 04

Information – need for information – evolution of information processing – elements of computer processing systems. Classification of Computers based on size, design and purpose – Hardware: CPU- components RAM ROM – Motherboard structure - Storage devices. Personal Computer Software – systems and applications – word processing packages – Spread sheet packages MS office. MS Word – MS EXCEL – MS Power Point

#### **UNIT IIPROGRAMMING LANGUAGES**

02

Machine language – assembly languages, high level languages – fourth generation languages

#### **UNIT III OPERATING SYSTEMS**

04

Concept and functions of operating systems – batch processing – multi programming – real time – time sharing distributed systems- familiarity with common operating systems.DOS: Functions of DOS, structure booting – internal and external commands

UNIT IV INTERNET 04

Internet topology – how internet works – email - www (World Wide Web) - web sites – LAN - search engines.

#### **UNIT V SHIPBOARD APPLICATIONS**

04

Alarms – data storage – inventory control - use of spread sheets for voyage planning – maintenance schedules – PMS - simulation – artificial Intelligence

#### **TOTAL 18 hours**

#### **TEXT BOOKS:**

1. Alexis Leon & Mathews Leon ,"Fundamentals of Information Technology ",Vijay Nicole Imprints Pvt. Ltd, second edition, 2014

#### **REFERENCE BOOKS:**

1. Principles Of Information systems by George Reyholds, 2013

#### 15EMR252 BASIC WORKSHOP 1 0 0 6 3

#### Course objective:

- Able to gain appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair.
- To ensure a safe working environment and for using hand tools, machine tools and measuring instruments.

#### **Course outcome:**

- CO-1 To make a hexagon block from a round bar by chipping and filing
- **CO-2** To make a Male-Female V- fitting.
- **CO-3** To make a T-Fitting.
- **CO-4** To make a dove tail fitting
- **CO-5** To make a Square fitting

#### LIST OF EXPERIMENTS

#### **FITTING**

1. To make a hexagon block from a round bar by chipping and filing	20
2. To make a Male-Female V- fitting.	20
3. To make a T-Fitting.	20
4. To make a dove tail fitting	20
5. To make a Square fitting	20
6. To make a H fitting.	20
7. To make outside calipers of given dimensions.	24

#### **TOTAL 144 hours**

#### **TEXT BOOKS:**

1. In house Manual as per TAR Book

#### 15EMR253 NSS - PAPER 1 2 0 0 1

#### **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

ONLI - OT: INTRODUCTION	DN AND BASIC CONCEPTS OF NSS	04
History, philosophy, a	aims & objectives of NSS	01
Emblem, flag, motto,	song, badge etc.	01
Organizational struct	ure, roles and responsibilities of various NSS functionaries	02
UNIT – 02: NSS PROGRA	MMES AND ACTIVITIES	10
Concept of regular ac	tivities, special camping, Day camps	03
Basis of adoption of v	rillages/slums, Methodology of conducting Survey	02
Financial pattern of t	he scheme	01
Other youth prog./sc	hemes of GOI	02
Coordination with dif	ferent agencies	02
Maintenance of the D	Diary	01
UNIT – 03: UNDERSTANI	DING YOUTH	05
Definition, profile of	youth, categories of youth	02
Issues, challenges and	d opportunities for youth	02
Youth as an agent of	social change	01
UNIT – 04: COMMUNITY	MOBILISATION	09
SEEC-	4	

Mapping of community stakeholders	03
Designing the message in the context of the problem and the culture of the	
community	01
Identifying methods of mobilisation	03
Youth-adult partnership	02
UNIT – 05: VOLUNTEERISM AND SHRAMDAN	07
Indian Tradition of volunteerism	01
Needs & importance of volunteerism	02
Motivation and Constraints of volunteerism	02
Shramdan as a part of volunteerism	02

#### **TOTAL 35 hours**

# 15EMR254 STRENGTH OF MATERIALS LAB 0 0 1 1 Course OBJECTIVE:

- Able to do Maintenance and repair of shipboard machinery and equipment Design characteristics.
- To know about the Selection of materials in construction of equipment.

#### **Course outcome:**

- **CO-1** To understand Rockwell hardness test.
- **CO-2** To understand Brinell hardness test.
- **CO-3** To understand Universal testing machine stress strain curve.
- **CO-4** To understand Torsion test on mild steel rod.
- **CO-5** To understand Impact test Izod and Charpy test.

#### LIST OF EXPERIMENTS

1.	Rockwell hard	06
2.	Brinell hardness test	06
3.	Universal testing machine – stress – strain curve	06
4.	Torsion test on mild steel rod	06
5.	Impact test – Izod and Charpy test	06
6.	Compression test on a coil spring	06

#### **TOTAL 36 hours**

#### **TEXT BOOKS:**

In-house developed Lab Manual.

#### 15EMR255 BASIC WORKSHOP II 0 0 6 3

#### Course objective:

- Able to appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board.
- To know about the Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools measuring instruments.

#### **Course outcome:**

- **CO-1** To understand about grinding tools.
- **CO-2** To understand the procedure for Grinding of cutting tools & welded joints.
- **CO-3** To understand technique involved in lathe work.
- **CO-4** To understand about shapping.
- **CO-5** To understand about drilling.

UNIT I GRINDING 24

Grinding tools familiarization - Checking of angles with tool angle gauge - Grinding of cutting tools -Grinding of welded joints

UNIT II LATHE WORK 32

Straight Turning - Step Turning - Taper Turning - Thread cutting on Lathe

#### UNIT III SHAPING AND DRILLING

32

Familiarization of shaping machine - Tools employed in shaping - Shaping a specimen - Machine Drilling - Hand Tapping of threads

#### UNIT IV WELDING (ARC WELDING)

32

Bead building - Closed Butt joint - Square Butt Joint - Single Vee Butt Joint - Single Bevel Butt Joint - T Joint - Lap Joint - Outside corner joint - Fillet joint (Flat) - Horizontal Butt Joint - Horizontal Filet joint - Vertical Butt Joint - Vertical Fillet joint

UNIT V WELDING 24

#### **Gas Welding**

Butt joint Fillet joint - Vertical up Fillet

#### **Gas Cutting**

Round cutting

Beveling

#### **TOTAL 144 hours**

#### **TEXT BOOKS:**

1. S.K Hajra Choudhry" Workshop Technology "MPP, 14<sup>th</sup> edition, 2013

### 15EMR256 NSS – PAPER II 2 0 0 1 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"

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

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

#### **Course Outcome:**

CO – 3: To understand the o	definition and importance of life competencies	
CO – 4: To be well versed w	ith Problem-solving and decision-making	
CO – 5: To understand the I	ndian history and culture	
UNIT – 01: IMPORTANCE	AND ROLE OF YOUTH LEADERSHIP	06
Meaning and types of	leadership	02
Qualities of good lead	lers; traits of leadership	02
Importance and role of	of youth leadership	02
UNIT – 02: LIFE COMPETE	ENCIES	11
Definition and import	ance of life competencies	02
Communication		03
Inter Personal		03
Problem-solving and o	decision-making	03
UNIT – 03: SOCIAL HARM	IONY AND NATIONAL INTEGRATION	09
Indian history and cul	ture	02
Role of youth in peace	e-building and conflict resolution	05
Role of youth in Natio	n building	02
UNIT – 04: YOUTH DEVEL	OPMENT PROGRAMMES IN INDIA	09
National Youth Policy		03
Youth development p	rogrammes at the National Level, State Level a	and
voluntary sector		04
SEEC-	8	

#### PROJECT WORK/PRACTICAL:

Conducting surveys on special theme and preparing a report there of 40 Marks

**TOTAL 35 hours** 

#### 15EMR257 NSS - PAPER 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

UNIT – 01: CITIZENSHIP		07
Basic Features of Constitution of India		02
Fundamental Rights and Duties		02
Human Rights		01
Consumer awareness and legal rights of	of the consumer	01
RTI		01
UNIT – 02: FAMILY AND SOCIETY		06
Concept of family, community, (PRIs	and other community-based organizations)	
and society		02
Growing up in the family – dynamics a	nd impact	01
Human values		01
Gender justice		02
UNIT – 03: HEALTH, HYGIENE & SANITATI	ON	07
Definition, needs and scope of health e	education	01
Food and Nutrition		01
Safe drinking water, water borne disea	ses and sanitation (Swachh Bharat Abhiyam)	02
SEEC-	10	

National Health Programme	02
Reproductive health	01
UNIT – 04: YOUTH HEALTH	06
Healthy Lifestyles	01
HIV AIDS, Drugs and Substance abuse	02
Home Nursing	01
First Aid	02
UNIT – 05: YOUTH AND YOGA	09
History, philosophy and concept of Yoga	02
Myths and misconceptions about yoga	01
Different Yoga traditions and their impacts	02
Yoga and Preventive, promotive, and curative method	02
Yoga as a tool for healthy lifestyle	02
PROJECT WORK/PRACTICAL	
Preparation of research project report	40 Marks
TOTAL 35 hours	

# 15EMR258 LUBE OIL, FUEL OIL, AND COOLING SYSTEMS 2 0 0 2 Course objective:

- Able to operate main and auxiliary machinery and associated control systems Fluid flow
- To know the characteristics of lubricating oil, fuel oil and cooling systems.

#### Course outcome:

- **CO-1** To understand about engine room layout.
- **CO-2** To understand about the layout of various type of ships.
- **CO-3** To understand the layout of lube oil pipeline system.
- **CO-4** To understand Main circulation system and Continuous by-pass purification system.
- **CO-5** To understand the layout of fuel oil pipeline system.

UNIT I 12

Engine Room Layout: Lay-out of Main and Auxiliary machinery in engine rooms in different ships – bulk carriers, tankers, RO-RO, Passenger vessels.

UNIT II 12

Lay-out of piping arrangement for Main Lube Oil system. Main circulation system and Continuous by-pass purification system. Components of the system – Filters, Coolers

UNIT III 09

Lay-out of piping arrangement for Main Engine Fuel Oil system. Components of the system – Filters, heaters, flow meters, quick closing valves, drain and collection arrangements.

UNIT IV 12

Lay-out of piping arrangement for Fuel Oil Bunkers and Transfer system. Components of the system – Filters, heaters, sampling arrangement. Bunker precautions and Procedure.

UNIT V 09

Lay-out of piping arrangement for Main Jacket Cooling Water System. Components of the system – Filters, Coolers, Valves, Temperature Control valves, Thermostatic valves for temperature control.

#### **TOTAL 54 hours**

#### **TEXT BOOKS:**

1. Paul A Russel, Thomas D Morton, Leslic Jackson, Anthony S Prince, "Reed's Motor Engineering Knowledge", Thomas Reed Publication, 3<sup>rd</sup> Edition, 2014

#### **REFERENCE BOOKS:**

1. H.D McGeorge,"Marine Auxiliary Machinery", Reed Elsevier India, 2011

#### 15EMR259 NSS - PAPER 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:**

${\sf CO-1}$ : 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	
Unit – 01: Environment Issues	11
Environment conservation, enrichment and Sustainability	02
Climate change	02
Waste management 0	02
Natural resource management (Rain water harvesting, energy conservation,	
waste land development, soil conservations and afforestation	05
Unit – 02: Disaster Management	07
Introduction to Disaster Management, classification of disasters	04
Role of youth in Disaster Management	03
Unit – 03: Project Cycle Management	10
Project planning C	02
Project implementation C	03
Project monitoring C	02
SEEC- 13	

Project evaluation: impact assessment	03
Unit – 04: Documentation and Reporting	07
Collection and analysis of data	03
Preparation of documentation / reports	02
Dissemination of documents / reports	02
PROJECT WORK / PRACTICAL Workshops/seminars on personality development and improvement	<b>40 Marks</b> ent of communication skills

#### 15EMR260 CONTROL ENGINEERING LAB 0022

#### **Course objective:**

- able to operate electrical, electronic and control systems, Manage operation of electrical and electronic control equipment, Operation, surveillance, performance assessment.
- To maintain safety of propulsion plant and auxiliary machinery.

#### **Course outcome:**

- **CO-1** Is able to operate & explain the control process of the fluids viscosity.
- **CO-2** Understand the configuration of various parameters to achieve required viscosity- air pressure, PI control, steam or electrical heater.
- **CO-3** Learns the configuration required for measuring flow control of fluids temperature, pressure, differential pressure.
- **CO-4** In position to operate oil mist detector understands the importance.
- **CO-5** Able to set the set point to reach the output using PID controller.

#### CONTROL ENGINEERING LAB EXPERIMENTS

- 1. Operation of automatic viscosity controller and maintaining a specific viscosity of a given fuel.
- 2. Operation of an automatic flow controller and measuring the flow from in a given pipe.
- 3. Operation and utility of a 3 term (P + I + D) Pneumatic controller.
- 4. To study the functioning of a mist detector and checking the alarm when the pre-set value is exceeded.
- 5. Study the operation of fire detection unit using lionization chamber type detector.
- 6. CNC & VMC machines, microprocessor controlled DC & AC machines, SCADA.

#### **TOTAL 36 hours**

#### **TEXT BOOKS:**

In-house developed Lab Manual.

#### 15EMR261 MARINE AUTOMATION 2002

Course Objective: At the end of the course, the cadet should be

 Able to understand the importance of various aspects of Marine Automation prevalent on board ships, with specific reference to main, auxiliary control, operational, safety and emergency operation.

#### **Course outcome:**

- **CO-1** To understand the marine automation applied for the machineries.
- **CO-2** To understand marine automation control & process system.
- **CO-3** To understand the parameters maintained in the automatic function.
- **CO-4** To know about unmanned machinery spaces.
- **CO-5** To understand the safety operation onboard.

# UNIT II MARINE AUTOMATION UNIT II MARINE AUTOMATION Marine Automation – control and process systems- pneumatics, electronics, hydraulics, UNIT III FUNCTIONAL PARAMETERS Parameters maintained in automatic function - pressure, temperature, liquid levels, others UNIT IV UMS- E-O CLASS OF VESSELS Concepts on UMS- E-O Class of vessels, with bridge control and reduced manning on ships. UNIT V SAFETY AND EMERGENCY OPERATION Concepts on main, auxiliary control, operational, safety and emergency operation.

#### **TOTAL 24 hours**

#### 15EMR262 NSS - PAPER V 2001

#### **Course Objective:**

- The overall objective of the N.S.S. is "Service to the Community" offered while undergoing instruction in an Educational institution.
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- 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

#### **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		08
Definition & Meaning	g	01
Qualities of good ent	repreneur	02
Steps/ways in openir	ng an enterprise	03
Role of financial and	support service institutions	02
SEEC-	17	

UNIT – 03: YOUTH AND CRIME	07
Sociological and Psychological Factors influencing Youth Crime	02
Peer Mentoring in preventing crimes	01
Awareness about Anti-Ragging	01
Cyber Crime and its Prevention	02
Juvenile Justice	01
DDOLECT MODY /DDACTICAL	40 Maula
PROJECT WORK/PRACTICAL	40 Marks
TOTAL 35 hours	

# 15EMR263 SHIP-IN-CAMPUS – DIESEL ENGINE LAB 0 0 4 2 Course objective:

• Able to operate main and auxiliary machinery and associated control systems.

#### Course outcome:

- **CO-1** To understand about repair & maintenance of main engine.
- **CO-2** To understand about repair & maintenance of auxiliary engine.

#### LIST OF EXPERIMENTS

#### REPAIR AND MAINTENANCE OF MAIN PROPULSION ENGINES

- 1. Procedure for dismantling and assembling of main engine unit, including all cylinder head mountings.
- 2. Inspect condition, wear, clearances etc. of Piston, Piston rings, Cylinder head, Cylinder liner, air starting valve, fuel injectors, relief valve, and exhaust valve. Prepare decarbonizing report.
- 3. Procedure for dismantling and assembling Main Engine bearing (a)Main bearings (b)Crosshead bearings (c)Bottom End bearings .
- 4. Inspect above bearings, check clearances, drops, and criteria for rejection of a white metalled bearing.
- 5. Crankshaft deflection, purpose, procedure tabulation and interpretation of results.
- 6. Causes of crankshaft misalignment.

#### REPAIR AND MAINTENANCE OF AUXILIARY ENGINES.

- 1. Procedure for dismantling and assembling auxiliary engine for (a) complete over haul (b) top overhaul.
- 2. Inspect cylinder head, piston, piston rings liner bottom end bearings, fuel injector, inlet, exhaust valves, air starting valve distributor take clearances, measure wear down, and prepare a report.
- 3. Carry out crank case inspection tappet clearance, fuel valve priming.
- 4. Crank shaft deflections.
- 5. Generator maintenance routines /schedules.
- 6. Check fuel pump timing.
- 7. Starting procedure.
- 8. Check working of safety cut outs
- 9. Safe working procedure for various operations.

#### **TOTAL 72 hours**

# 15EMR264 SHIP-IN-CAMPUS – SHIP CONSTRUCTION 0 0 2 1 Course objective:

• Able to maintain seaworthiness of the ship.

#### Course outcome:

- **CO-1** To understand about the vertical portion of ship's hull.
- **CO-2** To understand about the curved portion of stern of ship's hull.
- **CO-3** To understand about the layout of machinery spaces.
- **CO-4** To understand about the steering gear.
- **CO-5** To understand about the construction of rudder.

#### **LIST OF JOBS**

#### TO STUDY AND REPORT ON THE CONSTRUCTION OF THE FOLLOWING:

Ship's hull – vertical portion – plating and welds
 Ship's hull – curved portion of stern – plating and welds
 Machinery Room lay-out
 Steering Compartment and Main Steering Gear
 Rudder construction
 Stern-tube and Propeller
 Stern-tube and Propeller

#### **TOTAL 36 hours**

#### **TEXT BOOKS:**

1. E A Stokoe, "Reed's Ship Construction for Marine Engineers", Volume 5,

#### **REFERENCE BOOKS:**

1. D. J. Eyres, "Ship Construction", Elsevier Ltd, Sixth edition, 2007

#### 15EMR265 NSS - PAPER VI 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 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

#### **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 Civil defense services, aims and Objectives of civil defense Needs for Self defense training 03

UNIT – 03: RESOURCE MOBILISATION	03
Writing a Project Proposal	02
Establishment of SFUs	01
UNIT – 04: ADDITIONAL LIFE SKILLS	07
Positive Thinking	01
Self Confidence and Self Esteem	02
Setting Life Goals and working to achieve them	02
Management of Stress including Time Management	02
PROJECT WORK/PRACTICAL	40 Marks
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**TOTAL 35 hours** 

# 15EMR266 SHIP-IN-CAMPUS (PUMPS AND AUXILIARIES) 0 0 3 2 COURSE OBJECTIVE:

• Able to operate fuel, lubrication, ballast and other pumping systems and associated control systems Manage fuel, lubrication and ballast operations.

#### Course outcome:

- **CO-1** To understand about starting of a pump.
- **CO-2** To understand Safety precaution before starting maintenance work on a pump.
- **CO-3** To understand about centrifugal pump.
- **CO-4** To understand about reciprocating pump.
- **CO-5** To understand about screw pump.

#### LIST OF EXPERIMENTS

- 1. Precautions to be taken before starting a pump.
- 2. Safety precaution before starting maintenance work on a pump
- 3. Centrifugal Pump Casting impeller- wear rings- shaft bearings- gland seal- air pump & float chamber mechanical seal. Various types of impellers. Dismantle & reassemble centrifugal pumps: Identify all parts Check for wear wastage of casing, pitting, trueness of shaft, condition of bearings, seals, wear rings alignment of pump and motor.
- 4. Reciprocating pump: Cylinders, piston/ bucket rings, valves, glands, relief valve. Dismantle & reassemble pump. Measure cylinder liner wear, ring gaps, overhaul valve/ seats. Various links, bushes relief valve gland packing etc.
- 5. Screw Pump: Dismantle & reassemble screw pump: Rotors / Gears seals- bearings- relief valve, pump body. Examine for wear and damages, check clearances and back lashes. Repair/ adjust seals.
- Gear Pump: Dismantle & reassemble screw pump: Rotors / Gears seals- bearings- relief valve, pump body. Examine for wear and damage, check clearances and back lashes. Repair/ adjust seals.
- 7. Trials after overhauling. Data to be checked (all the above types of pumps.)
- 8. Learn starting and stopping of Engine Room Bilge pump and Oily Water Separator
- 9. Learn starting and stopping of cargo oil pumps and Stripping pumps on tankers.

#### **TOTAL 90 hours**

#### **TEXT BOOKS:**

In-house developed Lab Manual

#### 15EMR267 SHIP-IN-CAMPUS (WATCH-KEEPING) 0 0 2 2

#### **Course objective:**

• Able to maintain safe engineering watch Operate main and auxiliary machinery and associated control systems.

#### Course outcome:

- **CO-1** To understand Procedures for Handing Over/Taking over a Watch.
- **CO-2** To understand routine work on watch keeping.
- **CO-3** To understand Purification and clarification of fuel oil.
- CO-4 To understand Safe Working Practices & Risk Assessment.
- **CO-5** To understand about personal protective equipment.

#### LIST OF JOBS/EXPERIMENTS

- 1. Procedures for Handing Over/Taking over a Watch
- 2. Routine work doing Watch-keeping, such as soot-blowing, cleaning of filters, pumping out of bilges through Oily Bilge Separator, routine pumping operations of fuel oil, ballast water, fire pump and cargo pumping system.
- 3. Purification and clarification of fuel oil, purification and clarification of lube oil
- 4. Ensure Safe Working Practices Risk Assessment Safety Officials
- 5. Personal Protective equipment Work equipment- Safety Induction
- 6. Fire Precautions Emergency procedures.
- 7. Safe movement on board ship. Safe system of working Entering enclosed or confined spaces –Permit to work systems
- 8. Manual handling of equipment Use of work equipment Lifting devices
- 9. Hot Work-Painting hazards Hazardous substances Noise and vibrations.
- 10. Emergency procedures, such as action to be taken in the event of fire, including fire drills
- 11. Emergency procedures, such as action to be taken in the event of flooding of Engine room, including drills
- 12. Rescue operations for injured persons
- 13. Emergency action in case of stoppage of the Main Engine, Auxiliary Engines, and/or associated systems.
- 14. Emergency action in case of auto shutdown of the Main Boiler, and/or associated systems
- 15. Procedures for Emergency Steering
- 16. Power Black-out, restoration of power and sequence restarting of various machinery
- 17. Interpretation of functional tests on communication and Control Systems
- 18. Maintaining Engine Room Log Book and significance of the readings entered there-in.

#### **TOTAL 120 hours**

#### **TEXT BOOKS:**

The Running and maintenance of Marine Machinery (Institute of Marine Engineers, London)
 SEEC-

# 15EMR268 FIRE-FIGHTING/LIFE-SAVING APLLIANCES LAB 0 0 4 3 Course objective:

• Able to Prevent, control and fight fires on board, Operate life-saving appliances.

#### Course outcome:

- **CO-1** To understand fire hazard onboard ship & fire basics.
- **CO-2** To understand control of fire onboard ship.
- **CO-3** To understand fire protection built in ship.
- **CO-4** To understand fire detection & safety system.
- **CO-5** To understand different fire fighting equipments.

#### LIST OF EXPERIMENTS (FIRE-FIGHTING)

Testing and operation of:

- 1. Jet type water nozzle/.spray type water nozzle
- 2. Combined spray/jet nozzle
- 3. Fog nozzle.
- 4. Fire hoses operation and maintenance uncoiling for use, operation, cleaning with FW after use, draining and recoiling and stowing on drum. Instantaneous coupling on fire lines.
- 5. Soda acid type extinguisher operation, cleaning and recharging
- 6. Foam type extinguisher operation, cleaning and recharging.
- 7. Dry powder operation, cleaning and recharging.
- 8. Operation use and functions of breathing apparatus: (a)Self-contained type (b) Bellow Type
  - 9. Use of fireman's outfit.

#### LIST OF EXPERIMENTS(LIFE-SAVING)

- 1. Study of working of FRP lifeboat
- 2. Study of construction of FRP life-boat, and list of equipment on board
- 3. Maintenance of equipment in life-boat and Rules regarding checking them, renewal of provisions.
- 4. Features, use and maintenance of life jackets.
- 5. Construction and operational details of the life raft giving importance to manual and hydrostatic release devices.

- 6. Construction and operation of gravity davits for life-boat
- 7. Maintenance routines required on gravity davits
- 8. Function, location, construction and maintenance of EEBDs in Engine Rooms and Pump Rooms
- 9. Neil Robertson stretcher its use, and maintenance.

#### **TOTAL 108 hours**.

#### **TEXT BOOKS:**

In-House Prepared Lab Manual.

#### 15EMR269 COMMUNICATION LAB 0 0 2 2

#### **Course objective:**

• able to maintain a safe Engineering watch, Use internal communication systems

WILL BE CARRIED OUT IN THE CLASSROOMS ALONG WITH THE THEORY PORTIONS UNDER 15CMRE87

# 15EMR270 WATCH KEEPING PRINCIPLES AND PRACTICES 0 0 2 2 COURSE OBJECTIVE:

 To understand the importance of Watch Keeping Principles and Practices aspects of Ships and others. The concepts on watch keeping at different situations and data, record and check lists maintained etc.

#### **Course Outcome:**

- CO 1: To understand the elements of watch keeping principles and practices
- CO 2: To understand the concepts on watch keeping at different situations
- CO 3: To understand emergency response plans

#### UNIT I INTRODUCTION TO WATCH KEEPING

04

Elements on Watch Keeping Principles and Practices with concepts on purpose on how and why it is carried out, carrying out a watch with taking over and handing over of regular watches,

#### UNIT II WATCH KEEPING IN PORT, ANCHORAGE

05

Concepts on watch keeping at different situations- in port, anchorage, during maneuvering, sailing at sea, bunkering, dry dock and repairs and survey procedures etc.

#### **UNIT III WATCH KEEPING AT SEA AND PORTS**

05

Watch keeping at different situations- in port, anchorage, during maneuvering, sailing at sea, bunkering, dry dock and repairs and survey procedures etc.

#### **UNIT IVEMERGENCY RESPONSE PLANS**

05

Watch keeping at different situations of ERP- Emergency Response Plans – Oil Pollution, check lists and use of safety, emergency and standby equipments,

#### UNIT V WATCHKEEPING FFAAND LSA DRILLS

05

Watch keeping at Safety ERP- Emergency Response Plans – Fire Fighting, Life Saving, Plans and other emergency drills, equipments,

#### TOTAL 24 hours.