### SEMESTER I

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**Note:** * This course and syllabi are prescribed as per directions of the Director General of Shipping, Government of India.

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**TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 202**

**Electives for B.E. Marine Engineering**

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OBJECTIVES:
- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

UNIT I
9 + 3
Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one’s place, important festivals etc. – Introducing oneself, one’s family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one’s leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

UNIT II
9 + 3
Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking and answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Process descriptions (general/specific) - Definitions - Recommendations – Instructions; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association (connotation); E-materials - Interactive exercises for Grammar and Vocabulary - Reading exercises with sample telephone conversations / lectures – Picture-based activities.

UNIT III
9 + 3
Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause and effect / compare and contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

UNIT IV
9 + 3
Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations and acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.
UNIT V

Listening - Listening to different accents, Listening to Speeches/Presentations, Listening to broadcast and telecast from Radio and TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email; Writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar and Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents - Interpreting posters.

TOTAL: 60 PERIODS

OUTCOMES:
Learners should be able to
- Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- Read different genres of texts adopting various reading strategies.
- listen/view and comprehend different spoken discourses/excerpts in different accents

TEXT BOOKS:

REFERENCES:

EXTENSIVE Reading (Not for Examination)

WEBSITES:

TEACHING METHODS:
- Lectures
- Activities conducted individually, in pairs and in groups like self introduction, peer introduction, group poster making, grammar and vocabulary games, etc.
- Discussions
- Role play activities
- Short presentations
- Listening and viewing activities with follow up activities like discussion, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc.
EVALUATION PATTERN:

Internal assessment: 20%
3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Reviews
- Creative writing
- Poster making, etc.

All the four skills are to be tested with equal weightage given to each.

✔ Speaking assessment: Individual speaking activities, Pair work activities like role play, Interview, Group discussions
✔ Reading assessment: Reading passages with comprehension questions graded from simple to complex, from direct to inferential
✔ Writing assessment: Writing paragraphs, essays etc. Writing should include grammar and vocabulary.
✔ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content.

End Semester Examination: 80%

MA6152 MATHEMATICS FOR MARINE ENGINEERING – I

OBJECTIVES:

- To provide the required knowledge on fundamentals of geometry integrals and integral calculus for engineering applications.

UNIT I THREE DIMENSIONAL ANALYTICAL GEOMETRY

UNIT II DIFFERENTIAL CALCULUS
Differentiation of algebraic, circular, exponential and logarithmic functions, of products, quotient functions of a function and simple implicit functions.
Successive differentiation- intro. And notation, nth order derivatives of standard functions, nth order derivatives using (a) trig. identities and standard functions (b) partial fractions, Leibnitz theorem, Maclaurin’s Theorem, and standard expansions, Expansions using standard expansions, Taylor’s theorem, Indeterminate forms and L'Hospital's rule, Curve tracing of Cartesian and polar curves.

UNIT III FUNCTIONS OF SEVERAL VARIABLES
UNIT IV  INTEGRAL CALCULUS
Integration of standard forms by substitution and by parts. The definite integral as the limit of a sum.
Application of integration to area under curve; volume of revolution; First moment of area and the position of a centroid of an area; Work done by variable forces; mean values, Root mean square values of \( \sin x \) and \( \cos nx \). The rules of Guldinus.
Theorems of parallel and perpendicular axes. Second moments of area and moments of inertia of a rectangular and circular laminas

UNIT V  MULTIPLE INTEGRALS
Double and triple integrals – Cartesian coordinates- Region of integration and change of order of integration, Spherical polar and cylindrical coordinates Theorems of parallel and perpendicular axes. Second moments of area and moments of inertia of a rectangular and circular laminas
Applications- Area, Volume, Mass of wire, lamina and solid. Centre of Gravity of wire, lamina and solid. Moment of Inertia using multiple integrals

TOTAL: 60 PERIODS

OUTCOMES:
• The basic concepts of analytical geometry and differential and integral calculus learnt by the students will be applied to marine engineering

TEXT BOOKS:

REFERENCES:

PH6151 ENGINEERING PHYSICS – I

OBJECTIVES:
• To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I  CRYSTAL PHYSICS
Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment)- Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)
UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS
Elasticity - Hooke’s law - Relationship between three modulii of elasticity (qualitative) - stress - strain diagram – Poisson’s ratio – Factors affecting elasticity – Bending moment – Depression of a cantilever – Young’s modulus by uniform bending - I-shaped girders

UNIT III QUANTUM PHYSICS

UNIT IV ACOUSTICS AND ULTRASONICS
Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating - Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications - Sonogram

UNIT V PHOTONICS AND FIBRE OPTICS
Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors - Endoscope.

TOTAL: 45 PERIODS

OUTCOMES:
- The students will have knowledge on the basics of physics related to properties of matter, matrices, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications.

TEXT BOOKS:
1. Arumugam M. Engineering Physics. Anuradha publishers, 2010

REFERENCES:
1. Searls and Zemansky. University Physics, 2009
5. Rajagopal K. Engineering Physics. PHI, New Delhi, 2011
OBJECTIVES:
On Completion of the course the Students are expected to
• Have a thorough knowledge of Boiler Chemistry and Feed Water Treatment methods.
• Have a knowledge of various Water Hardness analysis procedures
• Have a basic concept on Nano chemistry

UNIT I WATER TECHNOLOGY
Water and it’s impurities – Impurities in water – fresh water, sea water, distilled water impurities. Purpose of water treatment in boilers, scale formation and prevention.

UNIT II BOILER CHEMISTRY
Boiler corrosion – fretting, pitting corrosion, corrosion fatigue, atoms and ions, electro chemical corrosion, hydrogen and hydroxyl ions, types and causes of corrosion and it’s control; chemical and mechanical deareation, methods of chemical deareation, dezincification, stress corrosion,

UNIT III BOILER WATER TREATMENT
Lime and Soda treatment, PH treatment, salinometer, use of litmus paper, test for partial, total alkalinity, chloride, sulphite, phosphate test, caustic soda treatment, condensate lime treatment. Desalination of water, reverse osmosis and electro dialysis, priming, foaming and control, effects of salts and gases in feed water

UNIT IV WATER HARDINESS ANALYSIS
Hardness, units of hardness, estimation of hardness by EDTA method, treatment for hardness, total dissolved solids, dissolved oxygen test, use of coagulants, typical test valves for smoke and water tube boilers.

UNIT V ENERGY SOURCES AND NANO CHEMISTRY
Introduction - Properties (Electrical, Mechanical and vibration) – carbon nano tubes -Applications in fuel cells, catalysis and use of gold nanoparticles - batteries –secondary batteries - alkaline batteries – lead acid, Ni – Cd and Li batteries, principles and applications of solar cells, fuels cells - Hydrogen and methanol.

OUTCOMES:
• The knowledge gained on various aspects of water chemistry, energy sources and nano-chemistry will provide a strong platform to understand concepts on these subjects for further learning.

TEXT BOOKS:

REFERENCES:
2. Reed’s General Engineering Knowledge for Marine Engineers by Leslie Jackson and Thomas D. Morton
OBJECTIVES:
The students should be made to:
- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

UNIT I  INTRODUCTION

UNIT II  C PROGRAMMING BASICS

UNIT III  ARRAYS AND STRINGS

UNIT IV  FUNCTIONS AND POINTERS

UNIT V  STRUCTURES AND UNIONS
Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Design C Programs for problems.
- Write and execute C programs for simple applications

TEXTBOOKS:

REFERENCES:
OBJECTIVES:
- To develop in students, graphic skills for communication of concepts, ideas and design engineering products
- To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination)
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREE HAND SKETCHING 5+9
Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 5+9
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 5+9
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+9
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+9
Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

COMPUTER AIDED DRAFTING (Demonstration Only) 3
Introduction to drafting packages and demonstration of their use.

TOTAL: 75 PERIODS

OUTCOMES:
On Completion of the course the student will be able to
- Perform free hand sketching of basic geometrical constructions and multiple views of objects.
- Do orthographic projection of lines and plane surfaces.
Draw projections and solids and development of surfaces.
Prepare isometric and perspective sections of simple solids.
Demonstrate computer aided drafting.

TEXT BOOK:

REFERENCES:

Publication of Bureau of Indian Standards:

Special points applicable to University Examinations on Engineering Graphics:
1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.

MV6101 BASICS OF MARINE ENGINEERING

OBJECTIVES
On Completion of the course the Students are expected to
- Have studied the renewable and Non-Renewable Energy Sources
- Have a good knowledge of working principle of 2 Stroke and 4 Stroke Marine IC Engines
- Have sound knowledge of Marine Refrigeration and Air- Conditioning Plant
- Have a Knowledge of Metal Forming and Joining Processes and various Power Transmission methods

UNIT I ENERGY RESOURCES AND POWER GENERATION
Renewable and Non-renewable resources – thermal, hydel, solar, wind, tidal, geothermal and nuclear – Indian energy scenario.
Power Plants - Steam, gas turbine, diesel, nuclear and hydel power plants – Layout, major components and working, Choice of the type of plant, Combined cycles, cogeneration, Importance of Energy storage, Environmental constraints of power generation using fossil fuels and nuclear energy. Steam generators - Classification, working or Cochran, Babcock Wilcox, Lamont and Benson boilers, Principles and features of modern high pressure boiler – tower type boilers. (A separate study of boiler mountings and accessories are beyond the scope of this course).

UNIT II MARINE I.C. ENGINES

UNIT III MARINE REFRIGERATION & AIR CONDITIONING
Refrigeration – application and types, Vapour compression refrigeration system – working principles and features, working fluids. Air conditioning – requirement of conditioned air, summer and winter air conditioning, layout of a typical window air conditioner, Thermostatic cooling.

UNIT IV METAL FORMING, METAL JOINING PROCESSES
Metal forming – Principles of forging – mechanical power hammers – Hot and Cold forging processes – rolling, drawing and extrusion, Metal joining processes – flexible and permanent, Principles of welding – Fundamentals of arc welding, gas welding and gas cutting, Brazing and Soldering

UNIT V POWER TRANSMISSION
Brief introduction to belt and rope drives. Simple and compound gear trains. Machine Tool Engineering - Main Components and functions of lathe, drilling, shaping, planning and milling machines. Introduction to CAD, CAM, CIM and ROBOT.

TOTAL: 45 PERIODS

OUTCOMES:
- Ability to identify the sources of renewable and nonrenewable energy towers.
- Ability to explain the working principles of 2 Stroke and 4 Stroke Marine Engines
- Ability to explain the working cycle of Refrigeration and Air-Conditioning used in marine
- Ability to explain different forming and metal forming processes.

TEXT BOOKS:

REFERENCES:
3. Leslie Jackson and Thomas D. Morton, Reed’s General Engineering Knowledge for Marine Engineers.
OBJECTIVES:
The student should be made to:

- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

LIST OF EXPERIMENTS:

1. Search, generate, manipulate data using MS office/Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions – Includes Parameter Passing
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

OUTCOMES:
At the end of the course, the student should be able to:

- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.
- Develop recursive programs.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C compiler 30 Nos.
(or)
Server with C compiler supporting 30 terminals or more.

GE6163                         PHYSICS AND CHEMISTRY LABORATORY – I
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PHYSICS LABORATORY – I
(Any FIVE Experiments)

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

LIST OF EXPERIMENTS

1. (a) Determination of Wavelength, and particle size using Laser
    (b) Determination of acceptance angle in an optical fiber.
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
3. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of Young’s modulus by Non uniform bending method
6. Determination of specific resistance of a given coil of wire – Carey Foster’s Bridge
OUTCOMES:
• The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Diode laser, lycopodium powder, glass plate, optical fiber.
2. Ultrasonic interferometer
3. Spectrometer, mercury lamp, grating
4. Lee’s Disc experimental set up
5. Traveling microscope, meter scale, knife edge, weights
6. Carey foster’s bridge set up
   (vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

CHEMISTRY LABORATORY- I
(Any FIVE Experiments)

OBJECTIVES:
• To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
• To acquaint the students with the determination of molecular weight of a polymer by vacometry

LIST OF EXPERIMENTS

1. Determination of DO content of water sample by Winkler’s method.
2. Determination of chloride content of water sample by argentometric method
3. Determination of strength of given hydrochloric acid using pH meter
4. Determination of strength of acids in a mixture using conductivity meter
5. Estimation of iron content of the water sample using spectrophotometer
   (1,10- phenanthroline / thiocyanate method)
6. Determination of molecular weight of polyvinylalcohol using Ostwald viscometer
7. Conductometric titration of strong acid vs strong base

TOTAL: 30 PERIODS

OUTCOMES:
• The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

REFERENCES:
LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Iodine flask - 30 Nos
2. pH meter - 5 Nos
3. Conductivity meter - 5 Nos
4. Spectrophotometer - 5 Nos
5. Ostwald Viscometer - 10 Nos

Common Apparatus: Pipette, Burette, conical flask, percelain tile, dropper (each 30 Nos.)

MV6111 MARINE ENGINEERING PRACTICES LABORATORY

OBJECTIVES
• To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE

Buildings:
(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:
(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:
(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:

Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE

Welding:
(a) Preparation of arc welding of butt joints, lap joints and tee joints.
(b) Gas welding practice

Basic Machining:
(a) Simple Turning and Taper turning
(b) Drilling Practice
Sheet Metal Work:
(a) Forming & Bending:
(b) Model making – Trays, funnels, cones etc.
(c) Different type of joints.

Machine assembly practice:
(a) Study of centrifugal pump
(b) Study of air conditioner

Fitting – Exercises – Preparation of square fitting and vee – fitting models

Smithy and foundry
(a) Smithy operations, upsetting, swaging, setting down and bending. Example –
   Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 18
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
5. Measurement of energy using single phase energy meter.

IV ELECTRONICS ENGINEERING PRACTICE 12
1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EOR and NOT.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 60 PERIODS

OUTCOMES:
- Ability to fabricate plumbing and carpeting components
- Ability to use welding equipments to join the structures.
- Ability to fabricate electrical and electronics circuits.

REFERENCES:
LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools: (a) Rotary Hammer 2 Nos (b) Demolition Hammer 2 Nos (c) Circular Saw 2 Nos (d) Planer 2 Nos (e) Hand Drilling Machine 2 Nos (f) Jigsaw 2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2 Nos.
5. Centre lathe 2 Nos.
6. Hearth furnace, anvil and smithy tools 2 Sets.
7. Moulding table, foundry tools 2 Sets.
8. Power Tool: Angle Grinder 2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner One each.

ELECTRICAL

1. Assorted electrical components for house wiring 15 Sets
2. Electrical measuring instruments 10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each
4. Megger (250V/500V) 1 No.
5. Power Tools: (a) Range Finder 2 Nos (b) Digital Live-wire detector 2 Nos

ELECTRONICS

1. Soldering guns 10 Nos.
2. Assorted electronic components for making circuits 50 Nos.
3. Small PCBs 10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply
OBJECTIVES:
- To help students develop listening skills for academic and professional purposes.
- To help students acquire the ability to speak effectively in English in real-life situations.
- To inculcate reading habit and to develop effective reading skills.
- To help students improve their active and passive vocabulary.
- To familiarize students with different rhetorical functions of scientific English.
- To enable students write letters and reports effectively in formal and business situations.
- To understand and use technical and engineering publications

UNIT I
Technical Vocabulary - meanings in context, sequencing words, Articles- Prepositions, intensive reading & predicting content, Reading and interpretation, extended definitions, Process description

Suggested activities:
1. Exercises on word formation using the prefix ‘self’ - Gap filling with preposition.
2. Exercises - Using sequence words.
3. Reading comprehension exercise with questions based on inference – Reading headings and predicting the content – Reading advertisements and interpretation.

UNIT II

Suggested activities:
1. Reading comprehension exercises with questions on overall content – Discussions analyzing stylistic features (creative and factual description) - Reading comprehension exercises with texts including graphic communication - Exercises in interpreting non-verbal communication.
2. Listening comprehension exercises to categorise data in tables.

UNIT III
Cause and effect expressions – Different grammatical forms of the same word - Speaking – stress and intonation, Group Discussions - Reading – Critical reading - Listening, - Writing – using connectives, report writing – types - accident, survey, breakdown of machinery, Letter to superintendent reporting the defects, damage and repair of machinery; requirement of machinery spares, logistic and repair support on arrival at the harbour; monthly report on the condition of men and machinery.

Suggested activities:
1. Exercises combining sentences using cause and effect expressions – Gap filling exercises using the appropriate tense forms – Making sentences using different grammatical forms of the same word. (Eg: object – verb / object – noun)
2. Speaking exercises involving the use of stress and intonation – Group discussions – analysis of problems and offering solutions.
3. Reading comprehension exercises with critical questions, Multiple choice question.
UNIT IV
Numerical adjectives – Oral instructions – Descriptive writing – Argumentative paragraphs – Letter of application - content, format (CV / Bio-data) - Instructions, imperative forms - Checklists, Yes/No question form – E-mail communication.

Suggested Activities:
1. Rewriting exercises using numerical adjectives.
2. Reading comprehension exercises with analytical questions on content – Evaluation of content.
3. Listening comprehension – entering information in tabular form, intensive listening exercise and completing the steps of a process.
4. Speaking - Role play – group discussions – Activities giving oral instructions.

UNIT V
Speaking - Discussion of Problems and solutions - Creative and critical thinking – Writing an essay, Writing a proposal.

Suggested Activities:
1. Case Studies on problems and solutions
2. Brainstorming and discussion
3. Writing Critical essays
4. Writing short proposals of 2 pages for starting a project, solving problems, etc.
5. Writing advertisements.

TOTAL: 60 PERIODS

LEARNING OUTCOMES:
- Learners should be able to employ English effectively for all their communicative purposes, both formal and informal contexts.
- Learners should be able to deploy specific English (Marine Engineering) skills required for all their professional work.
- Learners should be able to write and publish their research articles in refereed journals, including the international journals.

TEXT BOOK:

REFERENCES:

EXTENSIVE READING:

NOTE:
The book listed under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.
OBJECTIVES:

- To provide the required skill to apply the concepts of ordinary differential equations, vector calculus, complex variable and laplace transformation in marine engineering problems.

UNIT I  ORDINARY DIFFERENTIAL EQUATIONS – FIRST ORDER AND APPLICATIONS  12
Definition, order and degree, formation of differential equation. Solution of first order, first degree equations in variable separable form, homogeneous equations, other substitutions, Equations reducible to homogeneous and exact differential equations. Equations reducible to exact Integration Factor, Linear differential equation of first order first degree, reducible to linear, Applications to electrical circuits and orthogonal trajectories

UNIT II  ORDINARY DIFFERENTIAL EQUATIONS – HIGHER ORDER AND APPLICATIONS  12
Higher (nth) order linear differential equations - definition and complementary solution, Methods of obtaining PI, Method of variation of parameters, Method of undetermined coefficients, Cauchy's Homogeneous LDE and Legendre’s equations, System of Ordinary Differential Equations Simultaneous equations in symmetrical form , Applications to deflection of beams, struts and columns. Applications to electrical circuits and coupled circuits

UNIT III  VECTOR CALCULUS  12

UNIT IV  ANALYTIC FUNCTIONS  12
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping : w= z+c, cz, 1/z, and bilinear transformation.

UNIT V  LAPLACE TRANSFORM  12

TOTAL: 60 PERIODS

OUTCOMES:

- The basic and fundamental knowledge gained by the students in the application of ordinary differential equations vector fields and transformations will be applied by them in the process field related to marine engineering.

TEXT BOOK:

REFERENCES:

PH6251 ENGINEERING PHYSICS – II L T P C
3 0 0 3

OBJECTIVES:
- To enrich the understanding of various types of materials and their applications in engineering and technology.

UNIT I CONDUCTING MATERIALS
9

UNIT II SEMICONDUCTING MATERIALS
9

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS
9
Superconductivity : properties – Type I and Type II superconductors – BCS theory of superconductivity (Qualitative) - High $T_c$ superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS
9

UNIT V ADVANCED ENGINEERING MATERIALS
9

TOTAL: 45 PERIODS
OUTCOMES:
- The students will have the knowledge on physics of materials and that knowledge will be used by them in different engineering and technology applications.

TEXT BOOKS:

REFERENCES:

GE6252 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING  
L T P C  
4 0 0 4

OBJECTIVES:
- To explain the basic theories used in electrical circuits and the different components and function of electrical machine
- To explain the fundamentals of semiconductor devices and applications
- To explain the principles of digital electronics
- To impart knowledge of communication

UNIT I ELECTRICAL CIRCUITS & MEASUREMENTS  

UNIT II ELECTRICAL MECHANICS  

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS  

UNIT IV DIGITAL ELECTRONICS  
Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING  

TOTAL: 60 PERIODS
OUTCOMES:
- Ability to identify the electrical components
- Explain the characteristics of electrical machines
- Ability to identity of electronics components and use of them to design circuits.

TEXT BOOKS:

REFERENCES:
UNIT V  FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS  12
Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL : 60 PERIODS

OUTCOMES:
- Ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
- Ability to analyse the forces in any structures.
- Ability to solve rigid body subjected to dynamic forces.

TEXT BOOKS:

REFERENCES:

MV6201  MARINE ENGINEERING THERMODYNAMICS  L T P C
3 0 0 3

OBJECTIVES:
- At the end of the study of this topic the students should have the knowledge on basic Thermodynamics and solve the problems on First and Second Law of Thermodynamics and Gas power cycles. Also should have the knowledge on fuel used in IC Engines and Combustion of Fuels.

UNIT I  BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS  9
Thermodynamic systems, concepts of continuum, thermodynamic properties, equilibrium, processes, cycle, work, heat, temperature, Zeroth law of thermodynamics. First law of thermodynamics – applications to closed and open systems, internal energy, specific heats, enthalpy,. – applications to steady and unsteady flow conditions.

UNIT II  BASIC CONCEPTS OF SECOND LAW OF THERMODYNAMICS  9
Thermodynamic systems, Second law of thermodynamics Statements, Reversibility, causes of irreversibility, Carnot cycle, reversed Carnot cycle, heat engines, refrigerators, and heat pumps. Clausius inequality, entropy, principles of increase in entropy, Carnot theorem, available energy, availability.
UNIT III  FLUID CYCLES
Thermo dynamic properties of pure substances, property diagram, PVT surface of water and other substances, calculation of properties, first law and second law analysis using tables and charts.

UNIT IV  GAS POWER CYCLES

UNIT V  THERMODYNAMIC RELATIONS AND COMBUSTION OF FUELS
Exact differentials, T-D diagrams, Maxwell relations, Clausius Claperon Equations, Joule-Thomson coefficients. Heat value of fuels, Combustion equations, Theoretical and excess air, Air fuel ratio and Exhaust gas analysis

OUTCOMES:
• Upon completion of this course, the students can able to apply the Thermodynamic Principles to Mechanical Engineering Application.
• Apply mathematical fundamentals to study the properties of steam, gas and gas mixtures

TEXT BOOKS

REFERENCES

GE6261  COMPUTER AIDED DRAFTING AND MODELING LABORATORY

OBJECTIVES:
• To develop skill to use software to create 2D and 3D models.

List of Exercises using software capable of Drafting and Modeling
1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc., and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.
Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

TOTAL: 45 PERIODS

OUTCOMES:
- Ability to use the software packages for drafting and modeling
- Ability to create 2D and 3D models of engineering components.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Description of Equipment</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Pentium IV computer or better hardware, with suitable graphics facility</td>
<td>30 No.</td>
</tr>
<tr>
<td>2.</td>
<td>Licensed software for Drafting and Modeling.</td>
<td>30 Licenses</td>
</tr>
<tr>
<td>3.</td>
<td>Laser Printer or Plotter to print / plot drawings</td>
<td>2 No.</td>
</tr>
</tbody>
</table>

GE6262    PHYSICS AND CHEMISTRY LABORATORY – II

L T P C
0 0 2 1

OBJECTIVES:
- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

PHYSICS LABORATORY – II
(Any FIVE Experiments)

LIST OF EXPERIMENTS
1. Determination of Young’s modulus by uniform bending method
2. Determination of band gap of a semiconductor
3. Determination of Coefficient of viscosity of a liquid – Poiseuille’s method
4. Determination of Dispersive power of a prism – Spectrometer
5. Determination of thickness of a thin wire – Air wedge method
6. Determination of Rigidity modulus – Torsion pendulum

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Traveling microscope, meter scale, Knife edge, weights
2. Band gap experimental set up
3. Burette, Capillary tube, rubber tube, stop clock, beaker and weighing balance
4. spectrometer, prism, sodium vapour lamp.
5. Air-wedge experimental set up.
6. Torsion pendulum set up.
   (vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

OUTCOMES:
- The students will have the ability to test materials by using their knowledge of applied physics principles in optics and properties of matter.
CHEMISTRY LABORATORY -II
(Any FIVE Experiments)

OBJECTIVES:
• To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

LIST OF EXPERIMENTS
1. Determination of alkalinity in water sample
2. Determination of total, temporary & permanent hardness of water by EDTA method
3. Estimation of copper content of the given solution by EDTA method
4. Estimation of iron content of the given solution using potentiometer
5. Estimation of sodium present in water using flame photometer
6. Corrosion experiment – weight loss method
7. Conductometric precipitation titration using BaCl₂ and Na₂SO₄

TOTAL : 30 PERIODS

OUTCOMES:
• The students will be conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.

REFERENCES:

• Laboratory classes on alternate weeks for Physics and Chemistry.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. Potentiometer - 5 Nos
2. Flame photo meter - 5 Nos
3. Weighing Balance - 5 Nos
4. Conductivity meter - 5 Nos

Common Apparatus : Pipette, Burette, conical flask, percelain tile, dropper (30 Nos each)
OBJECTIVES:
The Students should be made to
- Be exposed to Unix shell commands
- Be familiar with an editor on Unix
- Learn to program in Shell script
- Learn to write C programme for Unix platform

LIST OF EXPERIMENTS

1. UNIX COMMANDS
15
Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING
15
Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX
15
Dynamic Storage Allocation-Pointers-Functions-File Handling

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course the students should me able to:
- Use Shell commands
- Design of Implement Unix shell scripts
- Write and execute C programs on Unix

HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS

Hardware
- UNIX Clone Server
- 33 Nodes (thin client or PCs)
- Printer – 3 Nos.

Software
- OS – UNIX Clone (33 user license or License free Linux)
- Compiler - C

OBJECTIVES:
- On Completion of the Course The Students are expected to have the Knowledge of Metal Cutting and Joining Process Tools and equipments used in Smithy, Carpentry, Fitting, Foundry, Welding and Sheet Metal.
LIST OF EXPERIMENTS

SHEET METAL  
Fabrication of tray, cone etc. with sheet metal.  20

WELDING  
Arc Welding of butt joint, Lap joint, Tee fillet etc. Demonstration of gas welding.  20

FITTING  
Practice in chipping, filing, drilling – Making Vee, square and dove tail joints.  20

TOTAL: 60 PERIODS

OUTCOMES:
- Ability to fabricate components using sheet metal.
- Ability to handle tools used in workshop.
- Ability to use the welding process for forming.
- Ability to make joint using fitting.

REFERENCES:

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Surface plate
V Block with clamp inside caliper - 6 inch.  8 Nos
Outside caliper - 6 inch.
Spanner and Wrench
Arc Welding unit of as Welding unit - 1 No.

Hack Saw Frame - 12 inch.
Flat Rough Files - 14 inch.
Flat smooth file - 6 inch.
Flat smooth file - 12 inch.
Half Round Rough file - 12 inch.
Half Round smooth file - 12 inch.
Triangular Rough file - 12 inch.
Flat chisel - 6 inch.
Cutting pliers - 8 inch.
Nose Pliers - 8 inch.

MA6351  TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS  L T P C  3 1 0 4

OBJECTIVES:
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.
UNIT I  PARTIAL DIFFERENTIAL EQUATIONS
Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations - Lagrange’s linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II  FOURIER SERIES
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half range cosine series – Complex form of Fourier series – Parseval’s identity – Harmonic analysis.

UNIT III  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS
Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

UNIT IV  FOURIER TRANSFORMS

UNIT V  Z - TRANSFORMS AND DIFFERENCE EQUATIONS

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
- The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To develop the theoretical and application skills of students in Marine Hydraulics and Fluid Machinery.

UNIT I FLUID STATICS

UNIT II FLUID KINEMATICS AND DYNAMICS

UNIT III LAMINAR AND TURBULENT FLOWS

UNIT IV PUMPS

UNIT V HYDRAULIC TURBINES
Classification of hydraulic turbines – pelton turbines, velocity triangle – efficiencies – non dimensional numbers, working principle of the pelton wheel. francis and kaplan turbines – velocity triangles, - efficiencies of the draft tubes, hydraulic turbine characteristics.

TOTAL: 45 PERIODS

OUTCOMES:
At the end the course the students are expected to have the knowledge of
- The Fluid properties and effect of various forces acting on different planes ,surfaces and Pipes.
- The In-viscid flow and Real Viscous flow and their characteristics.
- The principles of theoretical aspect of pumps and hydraulic turbines fitted on board ships.

TEXT BOOKS:

REFERENCES:

MV6302  SEAMANSHIP, ELEMENTARY NAVIGATION AND SURVIVAL AT SEA  L  T  P  C
3  0  0  3

OBJECTIVES:
• To develop skill and knowledge about Navigation and Operation of ship.
• To develop self confidence and skillfulness for survival at sea.

UNIT I  SEAMAN & THEIR DUTIES
Ship’s Department, General ship knowledge and nautical terms like poop-deck forecastle, bridge etc. 
deck equipment: wincs, windlass, derricks cranes, gypsy, capstan, hatches and function. navigation 
lights and signals: port and starboard, forward and aft mast lights, colors and location. look out, 
precautions and bad weather, flags used on ships, flag etiquette, sound signals.

UNIT II  ROPE KNOTS AND MOORINGS
Types of knots, practice of knot formation, materials of ropes, strength, care and maintenance, use 
of mooring line, heaving line, rat guards, canvas and it’s use. anchors: their use, drooping and weighing 
anchor, cable stopper.

UNIT III  NAVIGATION
General knowledge of principal stars. Sextant, Navigation compasses, echo sounder, Gps, Glonass, 
log and uses, barometer and weather classification, G.M.T and Zonal time, wireless Navigational 
Instruments, radar satellite navigation etc.

UNIT IV  LIFE BOATS & LIFE RAFTS
Life buoy, EPRIB, SART, TPA, Construction, equipment carried, carrying capacity. Davits and their 
operation, Launching of life rafts (Inflatable type) Embarkation into lifeboat and life raft. Survival pack, 
Stowage and securing arrangement, Abandon ship: Manning of lifeboat and life raft. Muster list. Radio 

UNIT V  SURVIVAL AT SEA
Survival difficulties and factors, equipment available, duties of crew members, Initial action on 
boarding, Maintaining the craft, Practical: Knots, bends and hitches, Ropes splice, donning of life 
jackets, life boat drills. Lowering & hoisting of life boats (model).

TOTAL: 45 PERIODS
OUTCOMES:
On completion of the course the students are expected to
• Have learnt operation of various deck machinery and Navigation equipment
• Have sound knowledge of Navigation.
• Have learnt survival techniques at sea.
• Have learnt operation of life boats and life rafts.

TEXT BOOKS:

REFERENCES:

MV6303 MARINE MANUFACTURING TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:
• To develop theoretical Knowledge of students on the process of manufacture of Marine Components.

UNIT I METAL JOINING PROCESSES

UNIT II CASTING PROCESSES

UNIT III FINISHING PROCESSES

UNIT IV METAL FORMING PROCESSES
UNIT V  MACHINING PROCESSES  
Lathe: working principle, classification, specification accessories, lathe and tool holders, different operations on a lathe, methods of taper turning machining time and power required for cutting, Drilling and boring - classification, specification, cutters speed feed, machining time parts and description of parts parts-boring machines- jig borer –description, types and hole location procedures – milling - classification, principle, parts- specification milling cutters indexing, selection of milling m/c fundamentals of inches processes, milling processes and operations – CNC machines.

OUTCOMES:
At the end of the course the students are expected to have the knowledge of
- Metal joining processes
- Casting processes.
- Metal forming, Machining and finishing processes.

TEXT BOOKS:

REFERENCES:

MV6304  MARINE ELECTRICAL MACHINES – I

OBJECTIVES:
To expose the students to the Electrical equipments fitted on boards ships, the concepts of electrical measurements and electrical distribution systems.

UNIT I  PRINCIPLES OF D.C. MACHINES AND GENERATORS  
8+3

UNIT II  D.C. MOTORS  
8+3
UNIT III TRANSFORMERS 10+3

UNIT IV INSTRUMENTS AND TESTING 9+3
Basic requirements of measuring instrument-static and dynamic characteristics of measuring instruments – principles of indicating instruments – control and damping devices – moving coil and moving iron instruments and their use as voltmeters and ammeters – dynamometer type wattmeter – thermocouple type ammeter, voltimeters and wattmeter. extension of instrument range.

UNIT V DISTRIBUTION AND TRANSMISSION SYSTEMS 10+3

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
At the end of the course the students are expected to have
• The knowledge about construction and operation of D.C. Machines in general and generators in particular
• To introduce the concepts about measurement practices and measuring instruments.
• To familiarize the students with the operation and control of D.C. motors.
• To study the construction and operation of transformer.
• To study the structure and functioning of transmission and distribution.

TEXT BOOKS:

REFERENCES:

MV6305 MARINE REFRIGERATION AND AIR CONDITIONING L T P C
3 1 0 4

OBJECTIVES
• To develop the knowledge of students in Marine Refrigeration and Air conditioning.
UNIT I  **RECIROCATING COMPRESSORS**  9+3
Ideal cycle for compressors work transfer in a single stage compressors – mass flow – volume flow – free air delivery – effect of clearance and volumetric efficiency in single stage compressors. multi stage compression neglecting clearance volume. condition for minimum work input and perfect inter cooling. tandem in line arrangements in compressors. air motors.

UNIT II  **BASIC REFRIGERATION AND AIR CONDITIONING**  9+3

UNIT III  **MARINE REFRIGERATING PLANTS**  9+3

UNIT IV  **MARINE AIR CONDITIONING**  9+3
Principles of air conditioning – Psychrometric properties of air – comfort conditions – control of humidity – airflow and air conditioning capacity – calculation for ships plants.

UNIT V  **BASIC DESIGN OF HEAT EXCHANGERS**  9+3
Introduction - types - LMTD and NTU method - double-pipe, shell and tube type, condenser and evaporator – problems

**TOTAL (L:45+T:15): 60 Periods**

**OUTCOMES:**
At the end of the course the students are expected to have the knowledge on
- The performance of Reciprocating Compressors,
- The theoretical aspects of Marine refrigeration and air-conditioning
- The method of economical and efficient design of Heat Exchangers for Air conditioning and refrigeration plants.

**TEXT BOOKS:**

**REFERENCES:**
OBJECTIVES
• To make the students understand and practice Machine Drawing.

UNIT I EXPLANATION AND SKETCHING 3+12
Dimensioning conventions of shafts, arcs, angles, holes, tapers, welded joints, threads and pipes conventional representation of metals and materials. sectioning conventions, removed sections and revolved sections, parts not usually sectioned, conventions of gears

UNIT II LIMITS, FITS AND TOLERANCES 3+12
Limits and tolerances, Surface Finish, Type of fits – description, hole basis system and shaft basis system, calculations involving minimum and maximum clearances for given combination of tolerance grades- simple problems, geometric tolerances

UNIT III RIVETS AND JOINTS 3+12
Sketching screw-threads, screwed fastenings, rivets and riveted joints keep. cotter joints & pin joints.

UNIT IV MARINE MACHINERY PARTS 3+12
Drawing of machine components in assembly - details like couplings, glands, non-return valves, cocks & plugs, cylinder, connecting rod & bearings. boiler mountings – full bore safety valve, gauge glass, main stop valve.

UNIT V MARINE COMPONENT 3+12
Assembly drawings of simple marine components - bilge strainer boxes, control valves, cylinder relief valves, boiler blow down cock.

TOTAL : 75 PERIODS

OUTCOMES:
At the end of the course the students would have learnt
• The Method of sketching to Explain the Limits, Fits and Tolerances arcs etc., with respect to the Marine Machinery.
• To Sketch Valves, Cocks and Plugs.
• To draw Various parts of Marine Machinery and the general Marine components

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To impart skill and knowledge on Fluid Mechanics and Fluid Machinery operation

(A) FLUID MECHANICS LAB

(B) FLUID MACHINERY LAB
Centrifugal pumps- Performance characteristics of a constant speed pump, specific speed. Performance characteristics of multistage pump. Characteristics of Impulse and Reaction Turbine Specific speed and unit quantities. Positive displacement pumps. Performance characteristics of a deep well pump, Jet pump

TOTAL : 45 PERIODS

OUTCOMES
After completion of the Laboratory Experiments the students would have the skill to
- Understand the flow behavior of fluids
- Calculate the frictional losses and Cd of fluids when it passes through various obstructions
- Calculate the performance characteristics of hydraulic pumps and turbines.

REFERENCES
1. Laboratory Manuals

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of the Equipment</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Buoyancy Experiment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cargo Ship Model</td>
<td>01</td>
</tr>
<tr>
<td></td>
<td>War Ship Model</td>
<td>01</td>
</tr>
<tr>
<td>02</td>
<td>Pitot tube</td>
<td>01</td>
</tr>
<tr>
<td></td>
<td>Flow nozzle</td>
<td>01</td>
</tr>
<tr>
<td></td>
<td>Rotameter</td>
<td>02</td>
</tr>
<tr>
<td></td>
<td>Notches</td>
<td>02</td>
</tr>
<tr>
<td>03</td>
<td>Venturimeter</td>
<td>02</td>
</tr>
<tr>
<td>04</td>
<td>Orifice meter</td>
<td>01</td>
</tr>
<tr>
<td>05</td>
<td>Frictional Losses in pipes</td>
<td>01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of the Equipment</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Centrifugal pump</td>
<td>01</td>
</tr>
<tr>
<td>02</td>
<td>Multistage Centrifugal Pump</td>
<td>01</td>
</tr>
<tr>
<td>03</td>
<td>Impulse Turbine (Pelton)</td>
<td>01</td>
</tr>
<tr>
<td>04</td>
<td>Reaction Turbine (Francis)</td>
<td>01</td>
</tr>
<tr>
<td>05</td>
<td>Reciprocating pump</td>
<td>01</td>
</tr>
<tr>
<td>06</td>
<td>Submersible pump</td>
<td>01</td>
</tr>
<tr>
<td>07</td>
<td>Jet pump</td>
<td>01</td>
</tr>
</tbody>
</table>
OBJECTIVES

- To develop skill of the students in welding and machining techniques

WELDING TECHNIQUES

WELDING - Exercises in Electric Arc welding and Gas welding Advanced Techniques.
HAND TOOLS - Hand tools, sharpening, Powered hand tools, Measurements etc. Exercise involving above.
SHEET METAL WORKING - Simple Exercise.
PIPE WORK - Experiments involving thin pipes, Joining, bending, welding and inspection.

LATHE & SPECIAL M/C SHOP

Lathe – Straight turning, Step turning, under cut, taper turning, knurling and thread cutting exercises.

TOTAL : 90 PERIODS

OUTCOMES

At the end of this work shop training the students would have the skill
- To carry out repair of Ship machinery and components by welding
- To do any kind of sheet metal works
- To make machine components using Lathes and Special machines such as milling, grinding and slotting machine.

REFERENCES:
1. Youssef, “Machining Technology”, 1st Vol.,Taylor & Francis, Indian Reprint 2012(Yesdee Publishing Pvt. Ltd.)

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Equipment</th>
<th>Qty.</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Light duty Lathe</td>
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</tr>
<tr>
<td>2</td>
<td>Medium duty Lathe</td>
<td>03</td>
</tr>
<tr>
<td>3</td>
<td>Heavy duty Lathe</td>
<td>04</td>
</tr>
<tr>
<td>4</td>
<td>Shaper</td>
<td>01</td>
</tr>
<tr>
<td>5</td>
<td>Slotter</td>
<td>01</td>
</tr>
<tr>
<td>6</td>
<td>Planner</td>
<td>01</td>
</tr>
<tr>
<td>7</td>
<td>Radial drilling m/c</td>
<td>01</td>
</tr>
<tr>
<td>8</td>
<td>Surface grinder</td>
<td>01</td>
</tr>
<tr>
<td>9</td>
<td>Pedestal grinder</td>
<td>01</td>
</tr>
<tr>
<td>10</td>
<td>Vertical milling m/c</td>
<td>01</td>
</tr>
<tr>
<td>11</td>
<td>Universal milling m/c</td>
<td>03</td>
</tr>
<tr>
<td>12</td>
<td>Tool &amp; cutter grinder</td>
<td>01</td>
</tr>
<tr>
<td>13</td>
<td>Gear hobber</td>
<td>01</td>
</tr>
<tr>
<td>14</td>
<td>CNC Lathe Machine</td>
<td>01</td>
</tr>
<tr>
<td>15</td>
<td>Capstan Lathe</td>
<td>01</td>
</tr>
</tbody>
</table>
16. Cylindrical grinding m/c 01
17. Power hacksaw 01
18. Duplicating Lathe 01

WELDING WORK SHOP

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Equipment</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Welding Transformer Air Cooled with Fan</td>
<td>04</td>
</tr>
<tr>
<td>2.</td>
<td>Maxi – MIG 400A Welding Set</td>
<td>01</td>
</tr>
<tr>
<td>3.</td>
<td>AOL make TIG Control Outfit</td>
<td>01</td>
</tr>
<tr>
<td>4.</td>
<td>Welding Rectifier Throluxe – 401 MMA</td>
<td>01</td>
</tr>
<tr>
<td>5.</td>
<td>Water Cooled Torch 0150102071 400 AMPS</td>
<td>02</td>
</tr>
<tr>
<td>6.</td>
<td>Bending Machine Pipe dia ½” to 3”</td>
<td>01</td>
</tr>
<tr>
<td>7.</td>
<td>Gas welding and cutting set</td>
<td>02</td>
</tr>
</tbody>
</table>

FITTING SHOP

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Equipment</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Power Hacksaw</td>
<td>01</td>
</tr>
<tr>
<td>2.</td>
<td>Vernier Height Gauge</td>
<td>02</td>
</tr>
<tr>
<td>3.</td>
<td>Surface Plate with stand</td>
<td>02</td>
</tr>
<tr>
<td>4.</td>
<td>Fitting Bench Vice</td>
<td>40</td>
</tr>
<tr>
<td>5.</td>
<td>Hand tools (Different types)</td>
<td>-</td>
</tr>
</tbody>
</table>

TOTAL : 90 PERIODS

MA6465 APPLIED MATHEMATICS FOR MARINE ENGINEERING

OBJECTIVES:
- To provide the required skill to apply the statistical and numerical tools in Marine engineering problems.

UNIT I BASIC STATISTICS
Measures of Central Tendency: Mean - Calculation of mean, Measure of Dispersion: Mean deviation - Standard deviation – Variance - calculation of Standard deviation of single group and two groups – Moments.

UNIT II PROBABILITY AND RANDOM VARIABLES

UNIT III STANDARD DISTRIBUTIONS
Binomial, Poisson, Normal, Geometric, Negative binomial, Uniform, Exponential, Gamma distributions and their properties.
UNIT IV TESTING OF HYPOTHESIS 9+3
Sampling distributions - Estimation of parameters - Statistical hypothesis - Tests based on Normal, t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT V NUMERICAL METHODS 9+3
Interpolation for equal and unequal integrals: Lagrange’s methods – Newton’s forward and backward different formulae - Divided difference method.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
- To acquaint the students with fundamental knowledge of the concepts from Statistics and Probability.
- To introduce standard distributions which can describe real life phenomenon.
- To introduce the notion of sampling techniques and numerical used in Marine engineering problems.

TEXT BOOKS:

REFERENCES:

MV6401 MECHANICS OF SOLIDS L T P C 3 1 0 4
OBJECTIVES:
- To impart knowledge to the students about the Strength of Materials.

UNIT I CONCEPT OF STRESS 8+3

UNIT II STRESSES IN BEAMS 9+3
Stresses in beams – neutral axis- theory of simple bending- bending stresses in rectangular, I-sections and circular section beams. bending stresses in composite section beams. strain energy due to bending. shear stresses in beams – rectangular, I-sections and circular sections. stress
components on a general plane and oblique plane - principal stresses and principal Planes, Maximum shear stresses and their planes- Mohr’s Diagram for stress & strain.

UNIT III  BENDING MOMENT  10+3
Bending moment-shear force, BMD and SFD for statically determinate beams-cantilever simply supported--overhanging beams- with or without applied moments, point of contra flexure. Statically indeterminate beams-BMD and SFD for fixed beams, propped cantilever beams and continuous beams-clapeyron’s theorem of three moments.

UNIT IV  SLOPE, DEFLECTION AND TORSION  9+3
Slope and deflection of Cantilever, overhanging and simply supported beams – Double integration method – Macalay’s Method - Moment area method- problems with various types of 14+load with or without applied moments and varying flexural rigidity (EI). Deflection due to shear, Deflection by graphical method.
Torsion of solid and hollow circular shafts – power transmitted by shafts – compound shafts - shafts subjected to both twisting and bending moment. torsion applied to closely coiled springs, plastic yielding of materials in torsion. torsion of shaft fitted with liner. combined bending & twisting, equivalent bending & twisting moments, shear, bending & torsion, theories of failure- open coil and closed coil helical springs.

UNIT V  COLUMNS, STRUTS, CYLINDERS AND PRESSURE VESSELS  9+3
Columns and struts - long and short columns- Euler’s formula for long column – equivalent length – slenderness ratio - Eccentric loaded long and short columns - Rankine Gordon formula, use of Strut formulae. thin cylinders and thin spherical shells under internal pressure-change in volume due to internal pressure. thick cylinders – simple treatment of thick cylindrical walled pressure vessels. lame’s theory, compound cylinders. thin curved bar, strain energy due to bending, castigliano’s theorem & its application to curved bar, strain energy due to twisting, applied problems.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
On completion of this course the students would have learnt
• The methods of determining various stresses and strains in simple and composite members under external load, strength of simple connections and strain energy stored in members.
• The concept of principal stresses and maximum shear stresses.
• To design beams which can resist bending and shearing stresses T
• To calculate the Shear force and Bending moment for the various types of statically determinate and indeterminate beams and the method of drawing the SFD and BMD.
• To calculate the deflections caused by the application of loads and design of solid, hollow shafts, open coiled and closed coiled helical springs based on shear and bending.

TEXT BOOKS:

REFERENCES:
OBJECTIVES

- To Teach students so as to have the basic knowledge in Marine Diesel Engines

UNIT I PERFORMANCE 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 GENERAL DESCRIPTION OF MARINE DIESEL ENGINE
Constructional Details of I.C. engines and marine diesel engines: components: jackets and liners, cylinder heads and fittings, pistons, cross heads, connecting rods, crank shaft, bearings, bed plates, aframes, welded construction for bedplates & frames and tie rods etc.

COOLING OF I.C. ENGINES:
Various cooling media, their merits and demerits, cooling of pistons, cylinder jackets & cylinder heads, bore cooling, coolant conveying mechanism and systems, maintenance of coolant and cooling system, cooling water: testing and treatment.

UNIT III SCAVENGING SYSTEM
Scavenging arrangements in 2-stroke engines; air charging and exhausting in 4-stroke engines; various types of scavenging in 2-stroke engines; uniflow, loop and cross flow scavenging, their merits and demerits, scavenge pumps for normally aspirated engines, under piston scavenging, scavenge manifolds.

SUPERCHARGING ARRANGEMENTS
Pulse and constant pressure type; merits and demerits in highly rated marine propulsion engines. air movements inside the cylinders. turbocharger and its details.

UNIT IV FUEL TECHNOLOGY:

UNIT V MARINE LUBRICATING OIL:

SELECTION OF LUBRICANTS

TOTAL: 45 PERIODS
OUTCOMES:
On completion of the course the students are expected to have knowledge
- On Various types of Marine Diesel Engines.
- Of Various systems used in Marine Diesel Engine plants.
- On the theoretical aspect of Scavenging and super charging system.
- Of qualities and behavior of various types of fuel Oil and Lubricating Oil used in Marine Diesel Engines.

TEXT BOOKS:

REFERENCES:

MV6403 MARINE STEAM ENGINES L T P C
3 0 0 3

OBJECTIVES:
- To develop the knowledge of students in Marine Steam Engines and Turbines and Applied Thermodynamics.

UNIT I STEAM AND VAPOUR POWER CYCLES

UNIT II MARINE STEAM ENGINE
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. energy balance – compound steam engines.

UNIT III STEAM NOZZLES
General flow analysis. velocity at exit. critical pressure ratio and maximum mass flow. convergent and convergent-divergent nozzles – isentropic flow –effect of friction. nozzle area at the throat and exit. problems of steam flow through nozzles.
UNIT IV  MARINE STREAM TURBINE PLANTS

UNIT V  BASIC PRINCIPLE OF HEAT TRANSFER

OUTCOMES:
At the end the course the students should have
• Completed the detailed study of steam cycles, steam engines, steam nozzle and Turbines
• The knowledge to calculate the efficiencies of Steam Turbine plant
• Learnt about basics of heat transfer.

TEXT BOOKS:

REFERENCES:

MV6404  MARINE ELECTRICAL MACHINES – II

OBJECTIVES:
• To expose the students to the concepts about Electricity production, measurements, cable faults and AC Machines used in Marine engineering.

UNIT I  ELECTRICAL MEASUREMENTS AND CONTROL SYSTEM
Induction type energy meters-megger (Basic construction & principles of operation only).– Single phase and three phase wattmeter for power measurement – Measurement of energy, speed, frequency and phase difference – Measurement of resistance, inductance and capacitance by Bridge method – Magnetic measurement. Location of cable faults – transducers and its application in the measurement of pressure, flow, temperature, Torque, Humidity, Water content etc – simple electronic measuring devices – CRO, IC tester, Signal generator, Timers, Multi Tester, Clamp meter-Principle of operation and Application of Automatic control system-PID controller etc.
UNIT II  ALTERNATORS
Alternators – general arrangement – construction of salient pole and cylindrical rotor types – types of stator windings – e.m.f equation – distribution and pitch factor – waveform of e.m.f. generated – rotating magnetic field – armature reaction – voltage regulation – load characteristics – open circuit and short circuit tests – e.m.f and m.m.f. methods – parallel operation of alternators – KW and KVA sharing – Brushless alternator – static excitation system.

UNIT III  SYNCHRONOUS MOTORS

UNIT IV  INDUCTION MACHINES

UNIT V  CONTROL OF INDUCTION MACHINES

OUTCOMES:
After completing the course the students should have the knowledge of
- The procedure for producing electricity on board ships through alternators and associated controls
- To measure the power method of finding cable faults.
- Design features of Alternators – their construction and operation.
- Principles of operation and construction details of synchronous motors, induction machines
- Speed control and trouble shooting in induction machines.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To impart knowledge on the properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various Marine Engineering applications.

UNIT I FUNDAMENTALS OF METALLURGY


UNIT II HEAT TREATMENT


UNIT III MECHANICAL PROPERTIES AND TESTING

Mechanism of plastic deformation, slip and twinning – Types of fracture – Failure modes - Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Impact test - Izod and Charpy, Fatigue and creep tests, fracture toughness tests..

UNIT IV MATERIAL PROCESSING

Properties and applications of materials used in machinery on board ships. Engineering processes used in construction and repair. Design characteristics and selection of materials in construction of equipment – Welding ,Gas cutting methods.

UNIT V TESTING OF JOINTS

Materials under load, self-secured joints, permanent joints, bonding plastics, adhesives and bonding. Vibration tests. Destructive and non-destructive testing of materials – different methods

OUTCOMES:

At the end of the course the students are capable of knowing

- Properties of metals and non metals and uses
- Various heat treatment processes
- Metal Processing methods
- Testing of joints using destructive and non destructive methods

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES:
   (Yesdee Publishings Pvt. Ltd.)

MV6406 MARINE ELECTRONICS

OBJECTIVES:
- To make the students understand the Marine Electronics and its applications.

UNIT I OPERATION AMPLIFIER THEORY 9
Concept of Differential Amplifiers – its use in DP AMPS, Linear OP amp circuits.

UNIT II DIGITAL CIRCUITS 11

ITL & CMOS GATES:
Digital integrated circuits – Semi conductor memories – ROM – RAM and PROM.

UNIT III CONVERTERS; (A-D AND D-A): 10
Analog to Digital and Digital to Analog Converters and their use in Data – Loggers.

ELECTRONIC INSTRUMENTS

UNIT IV INDUSTRIAL ELECTRONICS 8
Power rectification – silicon control rectifier power control-Filters ,RPS –Photoelectric devices – invertors. Satellite communication as applicable to GMDSS,GPS, Inmarsat.

UNIT V MICROPROCESSORS 7
8085 Architecture – Programming – interfacing and Control of motors – Temperature/Speed control – Basics and Control mechanism of PLC.

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course the students are expected to have learnt
- Amplifier Theory, Digital Circuits, Logic systems and Gates.
- Analog and Digital Converters and their applications
- Electronic Instruments and Micro Processors.
**TEXT BOOKS:**

**REFERENCES:**

**MV6411 STRENGTH OF MATERIALS AND APPLIED MECHANICS LABORATORY**

**OBJECTIVES:**
- To impart skill to the students to understand and conduct the experiments to test materials in the Strength of materials and applied mechanics Laboratory

**STRENGTH OF MATERIALS LAB**
- Tension Test on M.S. Rod.
- Compression test – Bricks, concrete cubes.
- Deflection Test - Bench type verification of Maxwell theorem.
- Tension test on thin wire.
- Hardness test on various machines.
- Tests on wood - Tension, compression, bending, impact in work testing machine.
- Tests on springs - Tension, compression.

**APPLIED MECHANICS LAB**
- Impact test.
- Double shear Test in U.T.M.
- Load measurement using load indicator, load coils.
- Fatigue test.
- Strain measurement using Rosette strain gauge.

**REFERENCES**
1. Laboratory Manuals

**TOTAL : 60 PERIODS**

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Name of the Equipment</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>UTM (Universal Testing Machine)</td>
<td>01</td>
</tr>
<tr>
<td>2.</td>
<td>Compression Testing Machine</td>
<td>01</td>
</tr>
<tr>
<td>3.</td>
<td>Deflection Testing Rig</td>
<td>01</td>
</tr>
<tr>
<td>5.</td>
<td>Spring Testing Machines – Tension, Compression</td>
<td>01</td>
</tr>
<tr>
<td>6.</td>
<td>Impact Testing Machines – (Izod, Charpy)</td>
<td>01</td>
</tr>
<tr>
<td>Sl.No</td>
<td>Name of the Equipment</td>
<td>Qty.</td>
</tr>
<tr>
<td>-------</td>
<td>----------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>1.</td>
<td>Crucible furnace</td>
<td>01</td>
</tr>
<tr>
<td>2.</td>
<td>Sand Strength Testing Machine</td>
<td>01</td>
</tr>
<tr>
<td>3.</td>
<td>Permeability</td>
<td>01</td>
</tr>
<tr>
<td>4.</td>
<td>Shear Strength Testing Machine</td>
<td>01</td>
</tr>
<tr>
<td>5.</td>
<td>Compression Strength Testing Machine</td>
<td>01</td>
</tr>
<tr>
<td>6.</td>
<td>Transfer Strength Testing Machine</td>
<td>01</td>
</tr>
</tbody>
</table>

**TOTAL : 60 PERIODS**

**OUTCOMES:**
At the end of this laboratory course the students are expected to have acquired the skill
- To operate the various testing machines.
- To carry out various tests on materials
- To choose the best materials for a particular use, based on the test results

**MV6412 HEAT ENGINES LAB AND BOILER CHEMISTRY LABORATORY**

**OBJECTIVES:**
- To impart skills to students to demonstrate the ability to carry out the different tests to understand the performance characteristics of heat engines and also to perform the tests on boiler feed water

**HEAT ENGINES LAB**
- Flue gas analysis by Orsat apparatus.
- Study and performance characteristics of steam turbine.
- Dryness fraction of steam using calorimeters.
- Performance characteristics of a constant speed air blower.
- Verification of fan laws and static efficiency of air blower.
- Test on Reciprocating compressor.
- C.O.P. of a Refrigeration plant.
- Performance test on A/C plant.
- Testing of fuels - calorific value, proximate analysis
- Testing of fuels - Ultimate analysis, octane number, cetane number.
- Testing of lubricants - flash point, fire point, pour point.
- Testing of lubricants - Viscosity index, corrosion stability, carbon residue.
- Testing of lubricants - Mechanical stability, ash content.
- Wind Tunnel - Drag and lift measurements.
- Performance test on IC Engine as per BIS specifications.

**BOILER CHEMISTRY LAB**
- To determine hardness content of the sample of boiler water in P.P.M. in terms of CaCO3.
- To determine Chloride Content of the sample of water in P.P.M. in terms of CaCO3.
- To determine Alkalinity due to Phenolphthaline, total Alk. and Caustic Alk. Of the sample of water (in P.P.M).
- To determine Phosphate Content of the sample of water.
- To determine dissolved Oxygen content of the sample of water.
- To determine sulphate content of given sample of water.
- To determine Ph-value of the given sample of water.
- Boiler trial.
- Water Testing - Dissolved oxygen, total-dissolved solids, turbidity.
- Water Analysis (Fresh and sea water) - Chloride, sulphate, hardness.
Sludges and scale deposit - Silica, volatile and non-volatile suspended matter.

TOTAL : 60 PERIODS

OUTCOMES
At the end of the course the students are expected to have acquired the skill
- To perform various tests on the heat engines
- To Analyse the results to understand the performance characteristics of engines
- To Perform Boiler water tests, Sea water and fresh water tests
- To Choose the best water, oils, fuels and lubricants based on the test results.

REFERENCES:
1. Laboratory Manuals

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS
HEAT ENGINES LAB

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Name of the Equipment</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Orsat Apparatus</td>
<td>02 nos</td>
</tr>
<tr>
<td>2.</td>
<td>Steam Turbine</td>
<td>01</td>
</tr>
<tr>
<td>3.</td>
<td>Steam Calorimeter</td>
<td>01</td>
</tr>
<tr>
<td>4.</td>
<td>Air Blower</td>
<td>01</td>
</tr>
<tr>
<td>5.</td>
<td>Air Compressor</td>
<td>02 nos</td>
</tr>
<tr>
<td>6.</td>
<td>Vapour Compression Refrigeration test rig</td>
<td>01</td>
</tr>
<tr>
<td>7.</td>
<td>Vapour compression Air Conditioning test rig</td>
<td>01</td>
</tr>
<tr>
<td>8.</td>
<td>Bomb calorimeter and Junker’s calorimeter</td>
<td>01</td>
</tr>
<tr>
<td>9.</td>
<td>Crucible Metener Burner, Electric Benser Hot air oven</td>
<td>01</td>
</tr>
<tr>
<td>10.</td>
<td>Flash &amp; Fire point – closed cup apparatus</td>
<td>01</td>
</tr>
<tr>
<td></td>
<td>Redwood’s Viscometer</td>
<td>01</td>
</tr>
<tr>
<td></td>
<td>Say bolt’s Viscometer</td>
<td>01</td>
</tr>
<tr>
<td>11.</td>
<td>Carbon residue apparatus</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Wind Tunnel</td>
<td>01</td>
</tr>
</tbody>
</table>

FUELS AND LUBRICATION OIL TESTING EQUIPMENTS

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Name of the Equipment</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Redwood Viscometer</td>
<td>01</td>
</tr>
<tr>
<td>2.</td>
<td>Saybolt’s Viscometer</td>
<td>01</td>
</tr>
<tr>
<td>3.</td>
<td>Abel’s flash point and fire point apparatus</td>
<td>01</td>
</tr>
<tr>
<td>4.</td>
<td>Closed cup apparatus (Pensky)</td>
<td>01</td>
</tr>
<tr>
<td>5.</td>
<td>Bomb Calorimeter with Beckman (Digital)</td>
<td>01</td>
</tr>
<tr>
<td>6.</td>
<td>Junker’s Gas Calorimeter</td>
<td>01</td>
</tr>
</tbody>
</table>

BOILER CHEMISTRY LAB

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Name of the Equipment</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Burette, Pipette, Beaker, Conical Flask, Bunsen Burner</td>
<td>01 each</td>
</tr>
<tr>
<td>2.</td>
<td>Burette, Pipette, Conical Flask, STD Flask 100ml</td>
<td>01 each</td>
</tr>
<tr>
<td>3.</td>
<td>Burette, Pipette, Conical Flask, STD Flask</td>
<td>01 each</td>
</tr>
<tr>
<td>4.</td>
<td>Burette, Pipette, Conical Flask.</td>
<td>01 each</td>
</tr>
</tbody>
</table>
### THERMAL ENGINEERING

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Name of the Equipment</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Internal Combustion Engines Section</td>
<td>01</td>
</tr>
<tr>
<td>2.</td>
<td>Fuel and Lubrication Oil Testing Equipments</td>
<td>01</td>
</tr>
<tr>
<td>3.</td>
<td>Heat Transfer Equipments</td>
<td>01</td>
</tr>
<tr>
<td>4.</td>
<td>Steam Lab. Equipments</td>
<td>01</td>
</tr>
<tr>
<td>5.</td>
<td>Refrigeration and Air Conditioning Equipments</td>
<td>01 set</td>
</tr>
<tr>
<td>6.</td>
<td>Automobile Components</td>
<td>01</td>
</tr>
<tr>
<td>7.</td>
<td>Engine Research Centre</td>
<td>01</td>
</tr>
<tr>
<td>8.</td>
<td>Computers with UPS</td>
<td>01</td>
</tr>
<tr>
<td>9.</td>
<td>Miscellaneous Equipments</td>
<td>01</td>
</tr>
</tbody>
</table>

### INTERNAL COMBUSTION ENGINES SECTION

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Name of the Equipment</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Multi Cylinder Petrol Engine</td>
<td>01</td>
</tr>
<tr>
<td>2.</td>
<td>Twin Cylinder Diesel Engine</td>
<td>01</td>
</tr>
<tr>
<td>3.</td>
<td>Kirloskar Diesel Engine</td>
<td>01</td>
</tr>
<tr>
<td>4.</td>
<td>Greaves Cotton diesel engine</td>
<td>01</td>
</tr>
<tr>
<td>5.</td>
<td>Two Stroke Petrol Engine</td>
<td>03 nos</td>
</tr>
<tr>
<td>6.</td>
<td>Two Stroke Diesel Engine Model</td>
<td>01</td>
</tr>
<tr>
<td>7.</td>
<td>Four Stroke Petrol Engine</td>
<td>01</td>
</tr>
<tr>
<td>8.</td>
<td>Four Stroke Diesel Engine Model</td>
<td>01</td>
</tr>
<tr>
<td>9.</td>
<td>Two Stroke Petrol Engine Model</td>
<td>01</td>
</tr>
<tr>
<td>10.</td>
<td>Multi Cylinder Petrol Engine</td>
<td>01</td>
</tr>
<tr>
<td>11.</td>
<td>Four Stroke Single Cylinder Diesel Engine (Anil)</td>
<td>01</td>
</tr>
<tr>
<td>12.</td>
<td>MK-12 Petrol Start Kerosene run Engine</td>
<td>01</td>
</tr>
<tr>
<td>13.</td>
<td>Battery charger</td>
<td>01</td>
</tr>
</tbody>
</table>

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**OBJECTIVES:**

- To impart Knowledge on Ship’s Auxiliary Machines.

**UNIT I ENGINE ROOM LAYOUT, PIPING SYSTEMS AND FITTINGS**

Layout of main and auxiliary machinery in Engine Rooms in different ships. Steam and condensate system, water hammering in pipes, Expansion joints in pipelines, Bilge – ballast, fuel oil bunkering and transfer system, bunkering procedure, precautions taken, fuel oil service system to main and auxiliary engines, lubricating oil and Engine cooling system to main and auxiliary engines, central cooling and
central priming systems, control and service air system, domestic fresh water and sea water (Hydrophore) service system, drinking water system, fire main system.

UNIT II VALVES, COCKS, PACKING, JOINTS, FILTERS AND STAINERS 9
Straight way cocks, right angled cock, ‘T’ cock, spherical cock, Boiler gauge glass cock (cylindrical cock). Globe valves, SDNR valve, swing check valve (storm valve), gate valves, butterfly valves, relief valves, quick closing valves, pressure reducing valves, control valves, change over valve chests, fuel oil transfer chest, valve actuators, steam traps.
Packings, Insulation of materials, Types, Various applications. Seals – purpose of bearing seal, description and application of non rubbing seals and rubbing seals, simple felt seal, seals suitable for various peripheral speeds, V-ring seals, Lip seals.
Filtration, filter elements basket strainers, duplex strainers, edge type strainers, auto-kleen strainers, back flushing strainers, magnetic filter, rotary filters, fine filters.

UNIT III PUMPS 8
Types of pumps for various requirements – their characteristics, performance and application in ships – centrifugal pumps – gear pumps – screw pumps and reciprocating pumps – care and maintenance of pumps, operation of all pumping systems on board such as bilge, ballast and cargo pumping operations.

UNIT IV HEAT EXCHANGERS, EVAPORATORS AND DISTILLERS 9
Principle of surface heat transfer – description, contact heat transfer, construction of shell and tube type – flat plate type, single and double pass – lubricating oil coolers, fuel oil heaters, fresh water coolers, compressed air coolers, Main Engine charge air cooler, Fresh water heaters, steam condensers, evaporators and condensers in refrigeration system – materials used in all the above heat exchangers, expansion allowance – temperature controls effect of air in the system – maintenance.
Distillation of water, distilling equipment, problem of scale formation and method of controlling, methods of distillation, single effect and double effect shell type evaporator, low pressure vacuum type evaporator, flash evaporators, multiple effect evaporators-construction and operation salt water leaks and detection, reverse osmosis desalination plant, membranes, drinking water and treatment.

UNIT V STEERING SYSTEM 10

OUTCOMES:
On completion of the course the students will acquire knowledge of
• Ship’s Engine Room Layout, Piping systems and fittings.
• Various types of Pumps and its applications.
• Construction details of Heat exchangers, Evaporators
• Fresh water Generators
• Ship’s steering systems.

TOTAL: 45 PERIODS
TEXT BOOKS:

REFERENCE:

MV6502 MARINE DIESEL ENGINES – II

OBJECTIVES:
• To make the students learn the concept and working of Marine Diesel Engines.

UNIT I FUEL PUMPS AND METERING DEVICES

UNIT II MANOUVERING SYSTEMS, INDICATOR DIAGRAMS AND POWER CALCULATIONS
Starting and reversing systems of different Marine diesel engines with safety provisions Including Main Engine auto slowdown and shutdown. Restoration of operations. Constructional details of indicator instrument, significance of diagram, theoretical knowledge of power calculations, fault detection, simple draw cards and out of phase diagrams, power balancing, performance characteristic curves, test bed and sea trials of diesel engines.

UNIT III MEDIUM SPEED ENGINES
Different types of medium speed marine diesel engines, couplings and reduction gear used in conjunction with medium speed engine, development in exhaust valve design, V type engine details, crankcase inspection., Depth gauge and crankshaft defelections

UNIT IV FORCES AND STRESSES
Balancing, overloading, different types of vibration & its effects, forces and stresses acting on various components of I.C. Engine parts.

UNIT V TYPE OF ENGINES

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course the students will have knowledge of
• Marine fuel injection pumps and its applications.
• Manouvering systems of various marine diesel engines.
• Forces and stresses in slow speed and medium speed engines.
• Construction and operation of various Marine slow speed engines.
TEXT BOOKS:

REFERENCES:

MV6503 STABILITY OF SHIPS

OBJECTIVES:
To impart the Knowledge on the Basic Hydrostatics and Stability Calculations of Ships

UNIT I HYDROSTATICS
Density, relative density, pressure exerted by a liquid on an immersed plane, centre of pressure, load on immersed plane, load diagram, shearing forces on bulk head stiffeners – problems.

UNIT II GEOMETRY AND SHIP FORM CALCULATION
Archimedes principle, Laws of floatation, displacement, tonne per cm immersion. Coefficients of form, wetted surface area, similar figures, shearing force and bending moment – problems.

UNIT III CALCULATION OF AREA, VOLUME, FIRST AND SECOND MOMENTS
Simpson’s first rule and second rule, application to area and volume, use of intermediate ordinate rule, trapezoidal rule, mean and mid – ordinate rule, application of 5 + 8 – 1 Rule for area, application of simpson rule to first and second moments of area – Centre of gravity, effect of addition of mass, effect of movement of mass, effect of suspended mass – problems.

UNIT IV TRANSVERSE, STABILITY AND HEEL
Static stability at small angles of heel, calculation of BM and meta centric height, meta centric diagram, inclining experiment, free surface effect, stability at large angles of heel, curves of static stability, dynamic stability, angle of loll, stability of a wall sided ship – inclining experiment, problems. IMO recommendations concerning ship stability.

UNIT V LONGITUDINAL STABILITY
Longitudinal BM – MCT1 cm – Change of trim, change of LCB with change of trim, alteration of trim by adding or removing weights, mean draft, change in mean and end draft due to density and bilging – flooding calculation – floodable length – factor of sub division – loss of stability due to grounding – problems. Knowledge of Trim and stress tables

TOTAL (L:45+T:15): 60 PERIODS
OUTCOMES:
At the End of the Course the Students would have acquired the knowledge of
- Basic hydrostatics, Geometry of Ships
- Calculations of Ship Forms and various coefficients,
- Calculating the Area of wetted Surface, Volume etc., and Usage of Simpson rule
- Transverse and Longitudinal Stability and Heel etc.,

TEXT BOOKS:

REFERENCES:
UNIT IV  FREE BOARD AND TONNAGE

UNIT V  OFFSHORE TECHNOLOGY

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course the students are expected to have learnt,
- Ships terms and stresses in ships.
- Primary and Secondary girders used in ships.
- Fore-end and After-end arrangements.
- Free board and Tonnage of ships
- Off shore Technology

TEXT BOOKS:

REFERENCES:

MV6505 MECHANICS OF MARINE MACHINES L T P C
3 1 0 4

OBJECTIVES:
To impart theoretical knowledge about mechanism of machinery, balancing and Vibration of machines and associated system components and equipment,

UNIT I  MECHANISMS
Introduction – science of mechanisms – terms and definitions kinematic inversion – slider crank chain inversions – four bar chain inversions – Grashoff’s law– Determination of velocities and acceleration in mechanisms – relative motion method (graphical) for mechanisms having turning, sliding and rolling pair – Coriolis acceleration
FORCE ANALYSIS OF MECHANISMS: Static, Inertia and combined force analysis – graphical and analytical method – slider crank mechanism and four bar mechanism, turning moment diagram and flywheel – applications in engine, punching presses.

UNIT II THEORY OF GEARING 9+3
Classification of gears, law of gearing, nomenclature – involutes as a gear tooth profile – lay out of an involute gear, producing gear tooth – interference and undercutting – minimum number of teeth to avoid interference, contact ratio, internal gears – cycloid tooth profiles – comparison of involutes and cycloidal tooth forms, Backlash of Marine Gearing. Self Shift Synchronous Gears

UNIT III CONTROL MECHANISMS 9+3
Governors – gravity controlled and spring controlled – governor characteristics – governor effort and power - Gyroscopes – gyroscopic forces and couple – forces on bearing due to gyroscopic action – gyroscopic effects on the movement of air planes and ships, stability of two wheel drive and four wheel drive

UNIT IV BALANCING 9+3

UNIT V VIBRATION 9+3
Periodic motion – non harmonic periodic motion – undamped free vibration – linear and torsion solution – natural frequency of single degree freedom system — Free vibrations with viscous damping of single degree freedom system and solution – logarithmic decrement.

Forced vibration of single degree freedom system with damping – reciprocating and rotating unbalance – vibration isolation and transmissibility
System with two degrees of freedom – shaft with two rotors, system with many degrees of freedom – three rotor system – geared system- torsional vibration of major components in Ships - problems.

TOTAL: 60 PERIODS

OUTCOMES:
At the completion of the course the students are expected to have Knowledge of,
- Velocity and acceleration of various kinematic linkages
- Four bar and slider crank mechanisms using analytical and graphical methods.
- Force analysis of Mechanisms and turning moment diagrams and flywheel.
- Various parameters of gears and gear trains.
- Governors and gyroscopes.
- Concept of balancing.
- Free and Forced Vibration of Single degree of freedom systems. Two and Multi Degree Freedom Systems.

TEXT BOOKS:
REFERENCES:

MV6506 MARINE BOILERS AND STEAM ENGINEERING

OBJECTIVES:

• To provide knowledge to the students about Marine Boilers and Steam Engines.

UNIT I MARINE BOILERS & BOILER MOUNTINGS

Safety Valves – Improved High Lift, Full lift and full Bore type:
Gauge glass – Ordinary plate type and remote Indicator; Automatic feed regulator, three element High & Low water level alarms, Main Steam stop valve, Retractable type Soot blower etc.

UNIT II OPERATION & MAINTENANCE OF BOILERS
Pre-commissioning procedures, Hydraulic tests, steam raising and Operating procedures, Action in the event of shortage of water. Regular boiler water tests on board. 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. Oil burning: Procedure of Liquid fuel burning in open furnace, Various types of atomizer, Furnace arrangement for oil burning, Boiler Control System i.e. master control, fuel control, air control and viscosity control, Introduction to Automation.

UNIT III MARINE STEAM PLANTS
Steam engines - History of multiple expansion marine reciprocating engines &steam turbines. Description of different types of steam turbines. Layout of plant - General layout of plant & description of a modern geared steam turbine installation including auxiliaries in modern use, open and closed feed system.
Condensers - 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.

UNIT IV LUBRICATION
Suitable oils and their properties, lubrication of main bearings, thrust bearings and gears. Gravity and pressure lubrication-oil system and emergency lubrication arrangement.
UNIT V OPERATIONS AND MAINTENANCE OF TURBINES
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 operation of turbines, vibration in marine steam turbine, steam turbine losses. Breakdown and faultfinding. Selection of materials: Materials used in various components like blades, rotors, casings, sealing glands, gears etc & their justification.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course the students are expected to have learnt,
- Waste heat boilers and boiler mountings.
- Operation and Maintenance of boilers.
- Construction of steam turbines and steam engines.
- The various Method of Lubrication of turbines
- The operation and maintenance of steam turbines.

TEXT BOOKS:

REFERENCES:

MV6511 COMPUTER AIDED MARINE ENGINEERING DESIGN AND ANALYSIS LABORATORY

OBJECTIVES:
To impart practical knowledge to the students about Computer Aided Design and Drawing of Marine Machine Elements

UNIT I ENGINEERING DESIGN AND COMPUTER AIDED DESIGN 6+9
The design process, concept, analysis, feasibility, Selection of materials and manufacturing considerations in design, Design with reference to repairs and reconditioning, specifically for working out at sea with its restrictions and limitations. Role of computers - Computer Aided Engineering - Computer Aided Design - Design for Manufacturability – Computer Aided Manufacturing - Benefits of CAD.

UNIT II COMPUTER AIDED DESIGN AND FINITE ELEMENT ANALYSIS 6+9
Creation of Graphic Primitives - Graphical input techniques - Display transformation in 2-D and 3-D – Viewing transformation - Clipping - hidden line elimination – Mathematical formulation for graphics - Curve generation techniques - Geometric Modeling – Wire frame, Surface and Solid models - CSG and B-REP Techniques - Features of Solid Modeling Packages - Parametric and features - Interfaces to drafting, Design Analysis - Exposure to FEA packages.
UNIT III TYPES OF LOADING AND DESIGN CRITERIA 6+9
static loads, impact loads, repeated loads, variable and cyclic loads, combined and reversible loads.
Stress concentration and design factors, fatigue strength, modes of failure, design stresses, factor of safety, theories of failure, wear, corrosion, design criteria, S-N curve Goodman and Soderberg equations.

UNIT IV JOINTS, SHAFTS AND COUPLINGS 6+9
Design of cotter joints, knuckle joints, bolted joints, welded joints, riveted joints. Design of shafts and couplings – Drafting using CAD packages

UNIT V BELTS, FRICTION CLUTCHES AND BRAKES 6+9
Design of Belt drives and hoists (Wire ropes), Multiple plate clutches, cone clutch, centrifugal clutch block brakes, internally expanding shoe brakes, external band brakes, differential band brakes - Solid modelling using CAD packages.

TOTAL: 75 PERIODS

OUTCOMES:
At the end of the course the students are expected to have skill in
• Design concept, selection of materials and manufacturing considerations while designing.
• Computer Aided Design concepts and applications
• Design and Drawing of Fasteners and connection and Power transmission elements.
• Design and Drawing of Friction clutches and Brakes.

TEXT BOOKS:

REFERENCES:

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description of Equipment</th>
<th>Quantity Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Desktop computers with following configuration CPU (High End), Main Memory (1GB), HDD 80 GB and above, High Resolution SVGA Graphics interface, 17” or 19” Monitor, Ethernet Card</td>
<td>40 Nos.</td>
</tr>
<tr>
<td>02</td>
<td>Licensed Operating System</td>
<td>Adequate</td>
</tr>
<tr>
<td>03</td>
<td>Licensed Application Software with 20 and above seats Softwares like AutoCAD, ProEngineer, CATIA etc.,</td>
<td>20 seats &amp; above</td>
</tr>
<tr>
<td>04</td>
<td>A4/A3 Printer</td>
<td>1 No.</td>
</tr>
<tr>
<td>05</td>
<td>7.5/10 KVA online UPS</td>
<td>1 unit</td>
</tr>
</tbody>
</table>
OBJECTIVES:
To impart Practical knowledge in operation and maintenance of Electrical Machines and electronic equipments

(A) ELECTRICAL ENGG. LABORATORY
Load Test on D.C. Shunt Motor
Load Test on D.C.Series Motor
O.C.C. & load characteristic of self/separately excited D.C. Generator.
Parallel operation of D.C.Shunt Generator
Speed control of D.C.Shunt Motor.
Parallel operation of single-phase transformers.
To connect similar single-phase transformers in the following ways.
Load Test on Squirrel cage induction motor
Load Test on Slip ring induction motor
Pole changing motor for various speeds.
Synchronization of 3-phase alternator.
Trouble shooting in Electric Motors and Transformers.
Exercises in Power Wiring and earthing.

(B) ELECTRONICS / MICROPROCESSOR LABORATORY
To study the volt-ampere characteristics of a high current semi conductor diode.
To study the volt-ampere characteristics of a diode and Zener diode.
To study the half wave and full wave rectification circuit without and with filter circuit.
To study the volt-ampere characteristics of a Transistor.
To study the volt-ampere characteristics of Field Effect Transistor.
To study the characteristics of Silicon Control Rectifier.
To study the Transistor Feed Back Amplifier.
To study the Integrated Circuit operational amplifier.
To study the logic training board.
To study the speed control of D.C. motor using Thyristor.
Arithmetic operations using 8085
Logical operations using 8085
Array operations using 8085
Speed & Direction Control of Stepper motor using 8085.

OUTCOMES
On completion of this laboratory course the students would have acquired the skill in
- Conducting all types of tests on the Shunt and Series Motors,
- Load tests on the Transformers , parallel operation of single phase Transformers
- Synchronizing three phase Alternators
- understanding the volt-ampere characteristics of Semiconductors, Diodes, Transistors, Field Effect transistor
- Operation of Operational Amplifier, Thyrister
- Using the 8085 Micro processor

REFERENCES
1. Lab Manuals
LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

ELECTRICAL ENGINEERING LAB

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Name of the Equipment</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>D. C. Motor Generator Set</td>
<td>02</td>
</tr>
<tr>
<td>02</td>
<td>D.C. Compound Motor</td>
<td>04</td>
</tr>
<tr>
<td>03</td>
<td>Single Phase Transformer</td>
<td>04</td>
</tr>
<tr>
<td>04</td>
<td>Three Phase Squirrel cage and Slip ring Induction Motor</td>
<td>02</td>
</tr>
<tr>
<td>05</td>
<td>Single Phase Induction Motor</td>
<td>02</td>
</tr>
<tr>
<td>06</td>
<td>Three Phase Alternator Set</td>
<td>02</td>
</tr>
<tr>
<td>07</td>
<td>Ammeter A.C and D.C</td>
<td>20</td>
</tr>
<tr>
<td>08</td>
<td>Voltmeters A.C and D.C</td>
<td>20</td>
</tr>
<tr>
<td>09</td>
<td>Watt meters LPF and UPF</td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td>Resistors &amp; Breadboards</td>
<td>1 set</td>
</tr>
</tbody>
</table>

ELECTRONICS AND MICROPROCESSOR LAB

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Name of the Equipment</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Cathode Ray Oscilloscopes</td>
<td>04</td>
</tr>
<tr>
<td>02</td>
<td>Dual Regulated power supplies</td>
<td>06</td>
</tr>
<tr>
<td>03</td>
<td>A.C. Signal Generators</td>
<td>04</td>
</tr>
<tr>
<td>04</td>
<td>8085 Microprocessor Trainer kits</td>
<td>10</td>
</tr>
<tr>
<td>05</td>
<td>Voltmeters D.C</td>
<td>10</td>
</tr>
<tr>
<td>06</td>
<td>Ammeters D.C.</td>
<td>10</td>
</tr>
<tr>
<td>07</td>
<td>Resistors, Capacitors, Diodes</td>
<td>1 Set</td>
</tr>
<tr>
<td>08</td>
<td>Transistors (BJT, JFET), SCR, Logic Gates</td>
<td>1 Set</td>
</tr>
<tr>
<td>09</td>
<td>Stepper Motor, Interface Card and Power Supply</td>
<td>01</td>
</tr>
<tr>
<td>10</td>
<td>Breadboards, Probes</td>
<td>1 Set</td>
</tr>
</tbody>
</table>

MV6513 MEASUREMENTS, INSTRUMENTATION AND REFRIGERATION LABORATORY

OBJECTIVES:
To impart knowledge on the use of Measuring Techniques, Measuring equipments and Instruments and the Operation of Refrigeration plant

(A) MEASUREMENTS LABORATORY

Use of precision measuring instruments like micrometer, vernier, height and depth gauges, surface plate, etc.
Checking dimensions of a part using slip gauge.
Use of sine bar for measuring angles and tapers.
Measurement of tooth thickness by gear tooth vernier.
Calibration of dial gauge.
Taper and bore measurement using spheres.
Fundamental dimension of a gear using contour projector.
Testing squareness of a try square using slip gauges.
Checking straightness of a surface plate using autocollimator.
Measurement of angles between centre lines of holes drilled radially on a shaft.
Measurements of thread parameters using floating carriage micrometer.
Use of pneumatic comparator and mechanical comparator.
(B) INSTRUMENTATION LABORATORY
Pressure measuring devices-pressure and vacuum gauge calibration.
Temperature measuring devices like Platinum resistance thermometer, thermocouple, radiation pyrometer, etc.
Flow measuring devices like orifice meter, rotameter, etc.
Speed measuring devices like tachometer, stroboscope, etc.
Force measuring devices, load cells and proving rings.
Torque measuring devices
Power measurement using rope, prony brake, mechanical, hydraulic and electrical dynamometers.
Study and use of strain, displacement devices-strain gauge indicator, LVDT.
Study and use of velocity and acceleration-accelerometer.
Study and use of vibration devices-vibrometer.

(C) REFRIGERATION LABORATORY
1. Watch keeping: Parameters to be monitored during running of refrigeration unit.
2. Various cut-outs, viz, pressure, temperature
3. Determination of actual COP, theoretical COP and Carnot COP.

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the experiments in this laboratory course the students are expected to have the knowledge and skills in
- using the Different types of measuring equipments instruments
- Method of measurements using the instruments
- Power measurement using rope, prony brake, mechanical, hydraulic and electrical dynamometers.
- Measurement of Vibrations of Machines
- Operation and watch keeping duties of Refrigeration plant

REFERENCES:
1. Lab manuals

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS
MEASUREMENT LABORATORY

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Name of the Equipment</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Slip Gauge and Dial gauge</td>
<td>6 set</td>
</tr>
<tr>
<td>02</td>
<td>Sine Bar</td>
<td>2 nos</td>
</tr>
<tr>
<td>03</td>
<td>Four sphere &amp; Two sphere height gauge</td>
<td>2 nos</td>
</tr>
<tr>
<td>04</td>
<td>Bore Dial gauge</td>
<td>1</td>
</tr>
<tr>
<td>05</td>
<td>Sphere</td>
<td>2</td>
</tr>
<tr>
<td>06</td>
<td>Vernier caliper</td>
<td>12</td>
</tr>
<tr>
<td>07</td>
<td>Profile projector</td>
<td>1</td>
</tr>
<tr>
<td>08</td>
<td>Tri-square</td>
<td>2</td>
</tr>
<tr>
<td>09</td>
<td>Bevel protractor</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>Floating carriage Micrometer</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>Pneumatic comparator</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Optical flat interferometer</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>Gear tester</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>Auto collimator</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>Tool Maker’s Microscope</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>Surface test 301</td>
<td>1</td>
</tr>
</tbody>
</table>
## INSTRUMENTATION LABORATORY

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Name of the Equipment</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>1. Dead weight type pressure gauge 0-2kgf/cm²</td>
<td>1</td>
</tr>
<tr>
<td>02</td>
<td>2. Bourdon type Pressure gauge 0-400kgf/cm²</td>
<td>1</td>
</tr>
<tr>
<td>03</td>
<td>Vacuum pressure gauge – McLeod gauge.</td>
<td>1</td>
</tr>
<tr>
<td>04</td>
<td>Thermocouple</td>
<td>4</td>
</tr>
<tr>
<td>05</td>
<td>Resistance Temperature Detector</td>
<td>2</td>
</tr>
<tr>
<td>06</td>
<td>Proving ring mechanical type</td>
<td>2</td>
</tr>
<tr>
<td>07</td>
<td>Speed stroboscope</td>
<td>1</td>
</tr>
<tr>
<td>08</td>
<td>Strain gauge</td>
<td>4</td>
</tr>
<tr>
<td>09</td>
<td>Linear Variable differential transformer 20mm</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>Static torque meters</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>Piezoelectric sensor analog</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Piezoelectric Crystal Sensor</td>
<td>2</td>
</tr>
<tr>
<td>13</td>
<td>Orifice meter, Venturimeter, Rotameter</td>
<td>3</td>
</tr>
</tbody>
</table>

## MARINE AC & REFRIGERATION LABORATORY

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Name of the Equipment</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Marine Refrigeration Plant (10 ton capacity)</td>
<td>01</td>
</tr>
<tr>
<td>02</td>
<td>Marine Air Conditioning Plant (10 ton capacity)</td>
<td>01</td>
</tr>
<tr>
<td>03</td>
<td>Vapour compression and Vapour Absorption refrigeration test RIG</td>
<td>01 each</td>
</tr>
</tbody>
</table>

## MV6611 MARINE WORKSHOP PRACTICAL AND AFLOAT TRAINING

**OBJECTIVES:**

To impart knowledge, skill and to train the students to be able to perform as Engineer officer on board ships

The students are required to undergo Marine Workshop Training in DG Shipping approved Marine Engineering Workshop for a duration of 6 months. The training should be as per the Merchant Shipping (Standard of Training Certification and Watch keeping for Seafarers) Rule 1998.

Competency on - use of hand tools used for marine equipments for dismantling, maintenance, repair and reassembly of shipboard equipments.

100 hrs.

Competency on - use of hand tools used for electrical and electronic equipments, measuring and test equipment’s for locating and repairing faults and malfunctions.

100 hrs.

Competency on - Operation of Main and Auxillary machinery and associated control systems.

30 hrs.

Competency on - Operating pumping systems & associated control systems.

90 hrs.
Competency on - Operating alternators, generators & control systems. 100 hrs.

Competency on - Maintaining alternators, generators and Control systems. 20 hrs.

Competency on - Maintaining Marine Engineering system including control systems (overhauling and maintenance of Marine Diesel Engines, air compressors, heat exchangers, oil separators etc.) 700 hrs.

Competency on - Controlling and fighting fire onboard. 6 hrs.

Competency on - Operation of life saving appliances. 6 hrs.

Total hrs. of Training: 1152 hrs.

The competency of the students are evaluated by the Marine Engineering Workshop and a report is sent to the college. During the training the students have to maintain a work dairy. After completion of this training the students will be examined as follows:

a) Assessment on work diary (Internal) 200 Marks.

b) *(i) Written test for 1 hour. 10 questions 10 X 10 = 100 Marks
   (ii) Viva voce 200 Marks

Total 500 Marks

* Valuation by both Internal and External Examiners.

OUTCOMES:
On completion of the work shop training the students are expected to have acquired the sufficient knowledge

- In operation, maintenance, repair and refit of Marine machines viz. main engine, auxiliary engines,
- In operation, maintenance, repair and refit of Auxiliaries such as Compressors, Pumps, Steering gear, distillation plant, incinerator, sewage treatment plant etc.,
- In using hand tools, electrical and electronic equipments,
- In using Measuring and Testing Equipments for locating faults, malfunctions
- In repairing faults and malfunctions
- In operation, maintenance, repair and refit of Marine Electrical machines such as Alternators, Generators, Motors, Stabilizers
- Overhauling and maintenance of heat exchangers, oil separators, filters etc
- Of Fire fighting and Life saving Methods
- On maintenance of systems and controls

REFERENCES:
1. Original Equipment Manufacturers Manuals For On Board Equipments
4. Youssef, “Machining Technology”, 1st Vol., Taylor & Francis, Indian Reprint 2012 (Yesdee Publishings Pvt. Ltd.)

**MV6701 MARINE SYSTEMS AND MACHINERY DESIGN**

<table>
<thead>
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<th>T</th>
<th>P</th>
<th>C</th>
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<td>4</td>
</tr>
</tbody>
</table>

**OBJECTIVES:**
- To impart training and knowledge to the students about Marine Machinery system and Design.

**UNIT I**

**SLIDING AND ROLLING CONTACT BEARINGS** 11+3

- Rolling bearing - Load ratings, types of radial ball bearings, selection of bearings, lubrication of ball and roller bearings, methods of failure.

**UNIT II**

**SPUR, HELICAL BEVEL AND WORM GEARS** 9+3

- Basic design principles of spur gears, helical gears, dynamic tooth loads, design for strength and wear. Lewis and Buckingham equations.
- Basic design principles of bevel gears and worm gears, Lewis formula, thermal rating of worm gears.

**UNIT III**

**IC ENGINE PARTS** 7+3

- Piston, connecting rod with bearings, crankshaft, flywheel and rocker arms.

**UNIT IV**

**VALVES & LIFTING DEVICES** 7+3

- Valves, safety valves and reducing valves - crane hooks, lifting chains, chain blocks, E.O.T. Crane.
UNIT V  DESIGN CRITERIA FOR MARINE SYSTEMS  11+3

TOTAL: 60 PERIODS

OUTCOMES:
At the completion of the course the students are expected to have knowledge in,
- Using Different types of Bearings.
- Design of IC Engine parts and gears.
- Design of Marine Machinery systems.

TEXT BOOKS:

REFERENCES:

MV6702  MARINE ELECTRICAL TECHNOLOGY  L T P C  3 0 0 3

OBJECTIVES:
To develop skills of students in Marine Electrical Technology. The students will be imparted training in handling various electrical instruments to find out faults on various electrical equipments onboard ships and rectify such faults.

UNIT I  POWER DISTRIBUTION AND REGULATIONS  9

UNIT II INSTRUMENTATION AND SWITCHGEAR

UNIT III CABLES AND LIGHTING SYSTEMS

UNIT IV PROPULSION AND STEERING SYSTEMS
UNIT V  AUXILLARIES AND MAINTENANCE


TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course the students are expected to have the knowledge of
- Different Types of Electrical distribution Systems
- Regulations observed onboard ships regarding electrical equipments
- Different types of electrical Instruments and Switch Gear used on board Ship
- using electrical instruments, to find out and rectify various kinds of faults onboard ships.
- Specification of cables and Type of Lighting systems fitted on board
- Steering systems
- maintenance of electrical equipments, instruments, system components etc.,

TEXT BOOKS:

REFERENCES:

MV6703  MARINE VEHICLES PERFORMANCE  L  T  P  C
2  2  0  4

OBJECTIVES:
To impart Knowledge to students about Marine Vehicle Performance while sailing

UNIT I  RESISTANCE
Types of resistance, frictional, residuary and total resistance, air, appendage, wave making, eddy and form resistances, model testing, propeller tests in open water, admiralty coefficient, fuel coefficient and consumption, sea trials – Problems.
UNIT II PROPELLER THEORY 12
Types of propellers, apparent slip, real slip, wake, thrust, relation between powers and relation between mean problem and speed, measurement of pitch, cavitations, built and solid propellers, interaction between the ship and propeller, hull efficiency over all propulsive efficiency – problems.

UNIT III RUDDER THEORY 10
Types of rudders, model experiments and turning trials, area and shape of rudder, position of rudder, bow rudders vs stern rudder, forces on rudder, torque on stock, angle of heel, due to force on rudder and angle of heel when turning – problems.

UNIT IV WAVE THEORY 12
Theory of waves, trochoidal waves, relationship between line of orbit centres and the undisturbed surface, sinusoidal wave, Irregular wave pattern, wave spectra, wave amplitudes, rolling in unresisting media, rolling in resisting media, practical aspects of rolling, Anti rolling devices, forces caused by rolling, pitching, heaving and yawing.

UNIT V SHIP VIBRATION & NOISE 12
Hull vibration, Engine vibration, vibration of shafting system, engine noise reduction.

TOTAL : 60 PERIODS

OUTCOMES:
On Completion of Course the Students are expected to have knowledge about,
- Ships Model Tests and Sea Trials.
- Various types of Propellers and Rudders
- Wave motions and the Ships Vibrations

TEXT BOOKS:

REFERENCES:

MV6704 MARINE AUXILIARY MACHINERY – II

OBJECTIVES:
To impart knowledge on the Working Principle of Marine Auxiliary Machineries

UNIT I OPERATION & MAINTENANCE 9
Prevention of oil, garbage, sewage, air pollution and IMO requirement as per MARPOL act. Operation, construction, maintenance of oil water separator both manual and automatic versions. Construction, operation, maintenance of incinerator and the of sewage plant.
UNIT II  THEORY OF OIL PURIFICATION /AIR COMPRESSOR  9
Construction, operation, maintenance of fuel oil and lub oil purifiers, clarifiers together with self de sludge operation. Theory of air compression and uses of compressed air on board. Construction, operation, maintenance of main air compress and emergency air compressors. Types of bow thrusters, operation, maintenance of the same and Deck machinery, operation, maintenance of cargo winches, windless mooring winches.

UNIT III  METHODS OF SHAFT ALIGNMENT  9
Construction, operation, maintenance of - thrust block. - intermediate shaft. Construction, operation, maintenance stern tube and stern tube bearing both water cooled and oil cooled together with sealing glands .Stresses in shafting, i.e. intermediate shaft, thrust shaft and screw shaft.

UNIT IV  DRY DOCKING  9
Preparation and procedure to dry docking vessel. Maintenance of hull, underwater fittings and machine maintenance and repairs during dry dock Removal and maintenance of rudder and propeller. Removal and maintenance of tail shaft and stern tube bearing.

UNIT V MAINTAINENCE AND REPAIR AT MANAGEMENT LEVEL, LEADERSHIP AND MANAGERIAL SKILLS  9
A) Theory of marine eng. Practice and maintenance of machinery, dealing with wear and tear, both electrical and mechanical., Alignment of components, temporary and permanent repairs. Detection of machinery malfunction and action to prevent damage.
B) Planned maintenance, preventive maintenance, condition monitoring, Principles of tribology, dry docking, risk assessment, trials and safe working practices.

TOTAL: 45 PERIODS

OUTCOMES:
At The end of the course the students are expected to have the knowledge on
- The Construction, operation, maintenance of incinerator and sewage plant.
- The Construction, operation, maintenance of Oily water Separator and Purifiers
- The Construction operation, maintenance of sewage plant.
- Alignment of shafting system
- Dry docking of ships
- Maintenance and repair of Equipments, Machinery fitted in ships

TEXT BOOKS:

REFERENCES:
4. “Pumping and Piping Diagram”, IME publication
MV6705  SHIP’S FIRE PREVENTION AND CONTROL  L  T  P  C  3  0  0  3

OBJECTIVES:
To provide knowledge an understanding of advanced Fire Prevention and Control to the students.

UNIT I  FIRE PROTECTION BUILT IN SHIPS  9
SOLAS convention, requirements in respect of materials of construction and design of ships, (class A, B, type BHDS), fire detection and extinction systems, fire test, escape means, electrical installations, ventilation system and venting system for tankers. Statutory requirements for fire fighting systems and equipments on different vessels, fire doors & fire zones.

UNIT II  DETECTION AND SAFETY SYSTEMS  9
Fire safety precautions on cargo ships, tankers and passenger ships during working. Types of detectors, selection of fire detectors and alarm systems and their operational limits. Commissioning and periodic testing of sensors and detection system. Description of various systems fitted on ships.

UNIT III  FIRE FIGHTING EQUIPMENT  9
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. Advantages of various fire extinguishing agents including vaporizing fluids and their suitability for ship’s use. control of class A, C & class D fires, Combustion products & their effects on life safety.

UNIT IV  FIRE CONTROL  9
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. First aid, fire organization on ships, shipboard organization for fire and emergencies. Combustion products and their effects on life safety, fire signal and muster. Fire drill. Leadership and duties, Fire control plan, human behaviour.

UNIT V  SAFETY MEASURES  9
Special safety measures for preventing, fighting fire in tankers, chemical carriers, oil rigs, supply vessels, and fire fighting ships - Safe working practice with respect to fire on board ships and first aid for hazards arising from fire in ships.

TOTAL:45 PERIODS

OUTCOMES:
At the end of the course the students will have learnt about,

- Fire protection, Detection and Safety systems in ships.
- Construction, Operation and Maintenance of Fixed and portable Fire Extinguishers in ships.
- Fire prevention and control in oil tankers, LPG / LNG carriers, Chemical tankers, oil rigs, supply vessels
- Operation of Fire fighting ships

TEXT BOOKS:
2. Victory, “Fire Fighting Equipment And Its Use In Ships”, Marine Engineering Practice, Vol 1, Part 05, IMarEST, London
REFERENCES:

MV6711 FIRE FIGHTING, CONTROLS AND SIMULATOR LABORATORY

OBJECTIVES:
To impart Practical knowledge of fire fighting, control systems on board. To train the students in simulator so as to have knowledge of correct operation of Engines, machinery, Equipments fitted on board ships.

MARINE ENGINEERING FIRE FIGHTING LABORATORY

1. Fire hazard aboard ships – inflammability, fire extinguishing use. Control of class A, B & C fires.
2. Fire protection built in ships, extinction systems, and escape means.
3. System for tankers, statutory requirements for fire fighting systems and equipments on different vessels.
4. Fire fighting equipment: fire pumps, hydrants and hoses, couplings, nozzles and International shore connection, Construction, Operation and merits of different types of portable extinguishers.
5. Non-portable and fixed fire extinguishers, installation for ships. Properties of chemical used, bulk carbon-di-oxide, and inert gas systems.
6. Firemen outfit its use and care, maintenance, testing and recharging of appliances, preparation, and fire appliance survey.
7. Fire Control: Action required and practical techniques adopted for extinguishing fires in accommodation, machinery spaces, boiler rooms, Cargo holds, galley etc.,
8. Fire fighting in port and dry dock. Procedure for re-entry after putting off fire, rescue operations from affected compartments.
10. Fire drill.

OUTCOMES:
On completion of this laboratory course the students are expected to have skills in
- Operating Different types of fixed and portable type of fire extinguishers
- Fighting different types of fire on board ships
- Refilling all types of fire extinguishers
- operating different types of fire fighting equipments Viz. fire pumps, hydrants and hoses, couplings, nozzles and International shore connection,
- First aid
- Operating Hydraulic and Pneumatic control equipment, systems and components
- Starting, Operating, watch keeping, Keeping the machinery with in the operating parameters by controlling the system components and equipments, corrective action during fault, malfunction, and stopping of all machinery and Engines.
REFERENCES:
1. Laboratory Manual

PNEUMATIC & HYDRAULIC CONTROL LAB
1. Symbols of Hydraulics
2. Hydraulic Power Pack
3. Double acting Cylinder Operation 4/3 Direct Control valve
4. Pilot operated check valve.
5. Speed control of cylinder with throttle valve.
6. To study the cracking pressure pilot operated check valve.
8. Meter - Out-Circuit
9. Bleed of Circuit
10. Direct operated relief valve.
11. Hydraulic motor operation.
12. Speed variation of hydraulic motor.
13. Sequence Circuit.
16. Quick exhaust Valve.
17. Time Delay circuit.
18. Impulse operation of single acting cylinder
19. Impulse operation of double acting cylinder
20. Pressure switch operation pneumatic system
21. Series connection of electro pneumatic Contacts
22. Parallel connection of electro pneumatic Contacts

REFERENCES:
1. Laboratory manual
2. Shanmuga Sundram, “Hydraulics and Pneumatics Controls”, S. Chand group, 2010

SIMULATOR LAB. EXPERIMENTS
1. Description of basic engine functions and their simulation.
3. Engine operation from Remote stations – i.e. engine control room and Navigation Bridge.
5. Electronic logic circuits in remote control stations.
7. Study and adjustments of Logic circuits for remote control operation of main engine and troubleshooting.

TOTAL: 60 PERIODS

REFERENCES:
1. Laboratory Manual
2. Original Equipment (Simulator) Manufacturers manual
## LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

### MARINE FIRE FIGHTING LABORATORY

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Description of Equipment</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Fixed CO2 fire fighting system</td>
<td>01</td>
</tr>
<tr>
<td>02</td>
<td>Smoke Detection Unit</td>
<td>01</td>
</tr>
<tr>
<td>03</td>
<td>Fire main system</td>
<td>01</td>
</tr>
<tr>
<td>04</td>
<td>Fire call point &amp; Gong Bell</td>
<td>01</td>
</tr>
<tr>
<td>05</td>
<td>Portable extinguishers (Water, CO2, dry powder, mechanical type extinguishers)</td>
<td>01</td>
</tr>
<tr>
<td>06</td>
<td>Non-Portable Extinguisher – Mechanical Extinguisher</td>
<td>01</td>
</tr>
<tr>
<td>07</td>
<td>Smoke &amp; Heat detectors</td>
<td>01</td>
</tr>
<tr>
<td>08</td>
<td>C.A.B.A</td>
<td>01</td>
</tr>
<tr>
<td>09</td>
<td>Bellow type foot pump</td>
<td>01</td>
</tr>
<tr>
<td>10</td>
<td>First aid kit and stretcher</td>
<td>01</td>
</tr>
</tbody>
</table>

### MARINE CONTROLS LABORATORY

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Description of Equipment</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Transparent Hydraulic Trainer</td>
<td>01</td>
</tr>
<tr>
<td>02</td>
<td>Transparent Pneumatic Trainer</td>
<td>01</td>
</tr>
<tr>
<td>03</td>
<td>Electro Hydraulic and Pneumatic Trainer</td>
<td>01</td>
</tr>
<tr>
<td>04</td>
<td>PID Trainer – Hydraulic</td>
<td>01</td>
</tr>
<tr>
<td>05</td>
<td>PID Trainer – Pneumatic</td>
<td>01</td>
</tr>
<tr>
<td>06</td>
<td>PC Interface</td>
<td>01</td>
</tr>
<tr>
<td>07</td>
<td>Air Compressor Suitable for above system</td>
<td>01</td>
</tr>
</tbody>
</table>

### MARINE SIMULATOR LABORATORY

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Description of Equipment</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Engine Room Simulation Master Panel</td>
<td>01</td>
</tr>
<tr>
<td>02</td>
<td>Engine Room Simulation Trainee Panels</td>
<td>04</td>
</tr>
</tbody>
</table>

### MV6712 MARINE PROPULSION AND AUXILIARY MACHINERY

#### OBJECTIVES:
To impart knowledge about the overhauling of equipments associated with Main Engines, Auxiliary engines and auxiliary machines

#### MAIN ENGINE
- Study of Lubricating oil cooler
- Study of Jacket water cooler
- Study of Scavenge Air cooler
- Study of crank case inspection and bearing clearances
- Fuel injection valve and pump
- Starting air valve
- Cylinder relief valve and indicator cock
AUXILIARY ENGINE
Study of Turbo charger
Study of Cylinder Head and fittings
Study of Fuel Injection pump

AUXILIARY MACHINES
Study of Lubricating oil screw pump
Study of S.W. Centrifugal pump
Reciprocating Bilge pump
Study of Boiler safety valve and water level gauge glass
Study of 2 RAM hydraulic steering gear
Study of various types of values, filters, oil separators, Incinerator, Heat Exchange etc.
Study of boilers, cargo oil pump, F.W. Generator.

TOTAL : 60 PERIODS

OUTCOMES:
At the end of the laboratory course the students would have the ability to
  • To open, clean, repair and refit all the equipments associated with Main Engines, Auxiliary engines and auxiliary machines

REFERENCES

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS
MARINE PROPULSION LABORATORY

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Description of Equipment</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Fuel Oil Separator</td>
<td>01</td>
</tr>
<tr>
<td>02</td>
<td>Lub Oil Separator</td>
<td>01</td>
</tr>
<tr>
<td>03</td>
<td>Bilge Pump</td>
<td>01</td>
</tr>
<tr>
<td>04</td>
<td>Ballast Pump 130 cu.m/hr</td>
<td>01</td>
</tr>
<tr>
<td>05</td>
<td>Main Engine Sea Water Pump</td>
<td>01</td>
</tr>
<tr>
<td>06</td>
<td>Sludge Pump</td>
<td>01</td>
</tr>
<tr>
<td>07</td>
<td>Fuel Oil Transfer Pump</td>
<td>01</td>
</tr>
<tr>
<td>08</td>
<td>Ballast Pump 65 cu.m./hr</td>
<td>01</td>
</tr>
<tr>
<td>09</td>
<td>Lub Oil Filter</td>
<td>01</td>
</tr>
<tr>
<td>10</td>
<td>Fuel Oil Filter</td>
<td>01</td>
</tr>
<tr>
<td>11</td>
<td>Lub Oil Cooler</td>
<td>01</td>
</tr>
<tr>
<td>12</td>
<td>Sea Water Cooler</td>
<td>01</td>
</tr>
<tr>
<td>13</td>
<td>Main Engine</td>
<td>01</td>
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<tr>
<td>14</td>
<td>Air Compressor with bottle</td>
<td>01</td>
</tr>
<tr>
<td>15</td>
<td>Main Engine Lub Oil Pump</td>
<td>01</td>
</tr>
<tr>
<td>16</td>
<td>Portable Compressor</td>
<td>01</td>
</tr>
<tr>
<td>17</td>
<td>Diesel Generator 300 KW / 100 KW</td>
<td>01</td>
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</table>
### MARINE AUXILIARY MACHINERY LABORATORY

<table>
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<th>Description of Equipment</th>
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<tbody>
<tr>
<td>01</td>
<td>Air Compressor</td>
<td>01</td>
</tr>
<tr>
<td>02</td>
<td>Heat Exchanger</td>
<td>01</td>
</tr>
<tr>
<td>03</td>
<td>Incinerator</td>
<td>01</td>
</tr>
<tr>
<td>04</td>
<td>Oily Water Separator</td>
<td>01</td>
</tr>
<tr>
<td>05</td>
<td>Steering Gear</td>
<td>01</td>
</tr>
<tr>
<td>06</td>
<td>Cargo Turbine Oil Pump</td>
<td>01</td>
</tr>
<tr>
<td>07</td>
<td>Cargo Winch</td>
<td>01</td>
</tr>
<tr>
<td>08</td>
<td>Governor</td>
<td>01</td>
</tr>
<tr>
<td>09</td>
<td>Thermostat</td>
<td>01</td>
</tr>
<tr>
<td>10</td>
<td>Crankshaft</td>
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</tr>
</tbody>
</table>

### MARINE DISMANTLING AND ASSEMBLING LABORATORY

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<th>Description of Equipment</th>
<th>Qty</th>
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<tbody>
<tr>
<td>01</td>
<td>Heleshaw Pump</td>
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</tr>
<tr>
<td>02</td>
<td>Piston Pump</td>
<td>01</td>
</tr>
<tr>
<td>03</td>
<td>Centrifugal Pump</td>
<td>01</td>
</tr>
<tr>
<td>04</td>
<td>Gear Pump</td>
<td>01</td>
</tr>
<tr>
<td>05</td>
<td>Fire &amp; G.S Pump</td>
<td>01</td>
</tr>
<tr>
<td>06</td>
<td>Screw Displacement pump</td>
<td>01</td>
</tr>
<tr>
<td>07</td>
<td>Sewage Treatment Plant</td>
<td>01</td>
</tr>
<tr>
<td>08</td>
<td>Cargo Oil Pump</td>
<td>01</td>
</tr>
<tr>
<td>09</td>
<td>Different types of valves (quick closing valve,</td>
<td>01</td>
</tr>
<tr>
<td></td>
<td>non-return valve, butterfly valve)</td>
<td>Each</td>
</tr>
<tr>
<td>10</td>
<td>Water gauge glass</td>
<td>01</td>
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</tbody>
</table>

### MARINE BOILER WORKSHOP

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Description of Equipment</th>
<th>Qty</th>
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</thead>
<tbody>
<tr>
<td>01</td>
<td>Auxillary Water Tube Boiler</td>
<td>01</td>
</tr>
<tr>
<td>02</td>
<td>Fresh Water Generator</td>
<td>01</td>
</tr>
</tbody>
</table>

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**GE6674 COMMUNICATION AND SOFT SKILLS- LABORATORY BASED**

**OBJECTIVES:**

To enable learners to,
- Develop their communicative competence in English with specific reference to speaking and listening
- Enhance their ability to communicate effectively in interviews.
- Strengthen their prospects of success in competitive examinations.

**UNIT I LISTENING AND SPEAKING SKILLS**

Conversational skills (formal and informal)- group discussion- making effective presentations using computers, listening/watching interviews conversations, documentaries. Listening to lectures, discussions from TV/ Radio/ Podcast.
UNIT II  READING AND WRITING SKILLS  12
Reading different genres of tests ranging from newspapers to creative writing. Writing job applications- cover letter- resume- emails- letters- memos- reports. Writing abstracts- summaries- interpreting visual texts.

UNIT III  ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS AND PLACEMENTS  12
International English Language Testing System (IELTS) - Test of English as a Foreign Language (TOEFL) - Civil Service(Language related)- Verbal Ability.

UNIT IV  INTERVIEW SKILLS  12
Different types of Interview format- answering questions- offering information- mock interviews-body language(paralinguistic features)- articulation of sounds- intonation.

UNIT V  SOFT SKILLS  12
Motivation- emotional intelligence- Multiple intelligences- emotional intelligence- managing changes-time management-stress management-leadership straits-team work- career planning - intercultural communication- creative and critical thinking

TOTAL: 60 PERIODS

Teaching Methods:
1. To be totally learner-centric with minimum teacher intervention as the course revolves around practice.
2. Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.
3. Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.
4. GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.
5. Learners are to be assigned to read/write/listen/view materials outside the classroom as well for graining proficiency and better participation in the class.

Lab Infrastructure:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Description of Equipment (minimum configuration)</th>
<th>Qty Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Server</td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td>• PIV System</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 1 GB RAM / 40 GB HDD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• OS: Win 2000 server</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Audio card with headphones</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• JRE 1.3</td>
<td></td>
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<tr>
<td>2</td>
<td>Client Systems</td>
<td>60 Nos.</td>
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<tr>
<td></td>
<td>• PIII or above</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 256 or 512 MB RAM / 40 GB HDD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• OS: Win 2000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Audio card with headphones</td>
<td></td>
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<tr>
<td></td>
<td>• JRE 1.3</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Handicam</td>
<td>1 No.</td>
</tr>
<tr>
<td>4</td>
<td>Television 46&quot;</td>
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</tr>
<tr>
<td>5</td>
<td>Collar mike</td>
<td>1 No.</td>
</tr>
<tr>
<td>6</td>
<td>Cordless mike</td>
<td>1 No.</td>
</tr>
<tr>
<td>7</td>
<td>Audio Mixer</td>
<td>1 No.</td>
</tr>
<tr>
<td>8</td>
<td>DVD recorder/player</td>
<td>1 No.</td>
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Evaluation:
Internal: 20 marks
Record maintenance: Students should write a report on a regular basis on the activities conducted, focusing on the details such as the description of the activity, ideas emerged, learning outcomes and so on. At the end of the semester records can be evaluated out of 20 marks.

External: 80 marks
Online Test - 35 marks
Interview - 15 marks
Presentation - 15 marks
Group Discussion - 15 marks

Note on Internal and External Evaluation:
1. Interview – mock interview can be conducted on one-on-one basis.
2. Speaking – example for role play:
   a. Marketing engineer convincing a customer to buy his product.
   b. Telephonic conversation- fixing an official appointment / placing an order / enquiring and so on.
3. Presentation – should be extempore on simple topics.
4. Discussion – topics of different kinds; general topics, and case studies.

OUTCOMES:
At the end of the course, learners should be able to
• Take international examination such as IELTS and TOEFL
• Make presentations and Participate in Group Discussions.
• Successfully answer questions in interviews.

REFERENCES:
2. Graded Examinations in Spoken English and Spoken English for Work downloadable materials from Trinity College, London.
4. Interactive Multimedia Programs on Managing Time and Stress.

Web Sources:
http://www.slideshare.net/rohitjsh/presentation-on-group-discussion
http://www.washington.edu/doit/TeamN/present_tips.html
http://www.oxforddictionaries.com/words/writing-job-applications
http://www.kent.ac.uk/careers/cv/coveringletters.htm
http://www.mindtools.com/pages/article/newCDV_34.htm
OBJECTIVES:
To impart knowledge about the importance of keeping the environment, ecosystems without any kind of pollution and effective use of natural resources.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY
Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers - Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation. Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION
Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry- Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry; - Mitigation procedures- Control of particulate and gaseous emission, Control of SO_2, NO_x, CO and HC) (b) Water pollution: Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies – Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins –Biochemical degradation of pollutants, Bioconversion of pollutants.
Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT
From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization-

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

OUTCOMES:
At the end of the course the students would have learnt about,
- Environment and its eco systems
- Types of pollution and the method of controlling the pollution
- Planning and methods of preserving the natural resources
- Health and the effect of environment on the health of humans
- Methods of disposal of different kind of wastes

TEXT BOOKS:

REFERENCES:

MV6801 SHIP OPERATIONAL MANAGEMENT AND IMO REQUIREMENTS

OBJECTIVES:
- To teach the students about management of ships and impart knowledge on statutory regulations.

UNIT I STRUCTURE OF A SHIPPING COMPANY
Structure of a shipping company and functioning of its various departments, ownership of vessels, registration of ships, flags of convenience, IMO identification number.. Maritime Declarations of Health and the requirements of the International Health Regulations.

UNIT II COMMERCIAL SHIPPING PRACTICE
Planning sailing schedules and voyage estimates, liner and tramp shipping services, conference systems, chartering and charter parties, ship’s papers for arrival and departure, port procedures, role of agents, theory of freight rates, bills of lading, cargo surveys and note of protests, International labour organization (ILO) and Maritime Labour Convention, 2006, COLREG 1972

UNIT III MARINE INSURANCE
Underwriting and loss adjusting principles applied to Marine cargo insurance, hull / machinery policy, particular average, general average, P & I Clubs – making claims.

UNIT IV STATUTORY REGULATIONS
IMO Conventions, legislations, MARPOL acts and conventions, annexes I to VI, SOLAS 1974 and amendments, main objectives, overview of all chapters and articles with an emphasis on ISM and ISPS codes, Maritime security policy, security responsibilities, vessel security assessment, security equipment, threat identification, vessel security actions and security administration, Load Lines Convention 1966, Tonnage Convention 1969.
Responsibilities under International Instruments Affecting the Safety of the Ships, Passengers, Crew or Cargo, Ballast Water Management

UNIT V STCW
International convention on STCW for seafarers 1978 with 1995 amendments, an overview of all sections, manning of ships, engagement and discharge of ship’s crew, ship’s articles, Merchant shipping act, Role of Maritime administration (DGS) and its functions: DGS Rules and MS Notices Port state control, PSC mandatory certificate check list, grounds for PSC inspection criteria for detention. Emergency Preparedness, drills and excercises, ERM (engine room resource management)

OUTCOMES:
At the end of the course the students would have learnt about,
- Structure and functioning of a shipping company.
- Planning and estimating of a voyage besides executing the same.
- Marine Insurance as applicable to ship, cargo and crew.
- Statutory regulations applicable to shipping industry.
- Manning of ships, STCW and Port state control.
- Security Training with designated Security Duties as per STCW 2010

TEXT BOOKS:

REFERENCES:
2. SOLAS – 1974 - International Maritime Organisation Publications
4. STCW -1978/95 - International Maritime Organisation Publications

MV6802 MARINE CONTROL ENGINEERING AND AUTOMATION L T P C
3 0 0 3

OBJECTIVES:
• To provide knowledge about Automation and Controls fitted in ships.

UNIT I CONTROL SYSTEM
Introduction to control terms, Block diagrams for control systems, open loop and closed feedback control, comparison of closed and open loop, feed forward control. Feed forward modification. ON-OFF control, sequential control, Proportional plus integral plus derivative controls. Use of various control modes, Mathematical Model: Developing Mathematical Models for Mechanical, Hydraulic, Pneumatic, Thermal, Electrical and Electro mechanical Systems

UNIT II GRAPHICAL REPRESENTATION OF SIGNALS
Inputs of step, Ramp, Sinusoid, Pulse and Impulse, Exponential Function etc Error Detector, Controller output elements. Dynamics of a simple servomechanism for Angular position Control: Torque Proportional to error, Different responses of servomechanism.

UNIT III PROCESS CONTROL SYSTEMS

UNIT IV TRANSMISSION

UNIT V APPLICATION OF CONTROLS ON SHIPS
Marine Boiler - Automatic Combustion control, Air - Fuel ratio control, feed water control single, two and three-element type, steam pressure control, fuel oil temperature control, Control in Main Machinery units for temperature of lubricating oil, jacket cooling water, fuel valve cooling water, piston cooling water and scavenge air, fuel oil viscosity control. Bridge control of main machinery, Instruments for UMS classification.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course the students would have learnt,
• Basics of Control systems.
• Graphical representation of signals.
• Electrical, Electronics, Pneumatic and Hydraulic control systems.
• Design aspects of control systems on board ships.

TEXT BOOKS:

REFERENCES:

MV6803 SAFETY PRECAUTIONS AND WATCH KEEPING L T P C
3 0 0 3

OBJECTIVES:
To impart knowledge to the students in Watch-keeping of Engine Room in various types of ships and to prepare for Class IV MOT Examinations

UNIT I SAFE WATCH KEEPING
Definition of watch, operating principles, requirements of watch keeping, requirements of certification, duties of engine officers – operation of engine room in general, log book writing – watch keeping under way – watch keeping at port – at unsheltered anchorage, fitness for duty, preparation of Diesel Engines for a long voyage – bad weather precautions, safe working practices – during overhauling at port, and during bad weather, change over from diesel oil to heavy oil and vice versa.
Trouble shooting during watch keeping: Emergency measures taken in case of –flooding of engine room, engine room bilge fire, general fire, Incase of any system failure or breakage of pipe lines, etc.

UNIT II TROUBLE SHOOTING IN AUXILIARY MACHINERIES
Malfunctioning, partial or total failure of auxiliary machineries – such as, auxiliary engines, purifiers, heat exchangers, air compressors, reefer and air conditioning compressors and systems, boilers and accessories, fresh water generators, hydrophore tanks and systems, all pumps & systems. Repairs and maintenance of propeller, rudder, drydocking methods, drydocking inspection and repair works.

UNIT III TROUBLE SHOOTING IN MAIN ENGINE
Trouble shooting related to various types of marine diesel engines and condition monitoring – causes, effects, remedies and prevention of engine not turning on Air and Fuel, knocking at TDC and BDC, black smoke in funnel, poor compression and combustion, early or advanced injection, turbocharger surging, scavenge fire, Air starting line explosion, crank case explosion, exhaust uptake fire, failure of bottom end bolts.

UNIT IV MAINTENANCE OF ENGINE COMPONENTS
Checking of holding down bolts, resin chocking – Tie-rods tensioning, checking and tightening of 2-stroke and 4-stroke bottom end bolts. Inspection and maintenance of crankshaft and cam shaft, dismantle inspection and reassemblage of main bearings, cross head bearings & bottom end bearings, connecting rod, piston and piston
assembly, stuffing box, cylinder head and all mountings, governor and over speed trip – checking of all clearances, adjustments, effect of improper clearances, prevention and rectification. Cylinder liner and cylinder lubrication, thrust bearing, running gears inspection, engine alignment, chains drive adjustment and tensioning.

UNIT V TROUBLE SHOOTING AND MAINTENANCE OF ELECTRICAL MACHINERIES

Circuit testing, shore supply arrangement, maintenance of circuit breakers, transformers, electrical motors, navigational lights, batteries, starters, electrical equipments, maintenance of switchboard. Maintenance of electrical equipments in oil tankers, LNG / LPG carriers.

OUTCOMES:
At the end of the course the students are expected to have learnt,

- STCW standards of training, requirements of officers and ratings.
- Watch-keeping in various ships.
- Prevention, rectification and maintenance with respect to trouble shooting of machineries in the Engine Room.

TEXT BOOKS:

REFERENCES:
1. IME Manuals and Ship’s Marine Manuals.
4. Manual De Maintenance & operation MAN type K.270 120E DMR.

MV6811 PROJECT WORK, TECHNICAL PAPER AND VIVA VOCE

OBJECTIVES:
To develop knowledge and skill in designing and fabricating a complete Engineering systems/machines /equipment and do experiments. To enhance the ability of students to analyse and conclude from the experimental data obtained

DETAILS
• It is mandatory on the part of the students to do a project and submit a report containing not more than 100 pages. A project should be undertaken by not exceeding 4 students in a batch.
• The project can be of working model, PC based training module and theoretical design and analysis. This will be evaluated by both Internal and External Examiners.
• The projects will be done in the eighth semester and will be reviewed three times by project guide and HOD. The internal mark of 100, for this will be allotted by the guide.
• The thesis work will be evaluated by both Internal and External Examiners for a maximum of 100 Marks.

OUTCOMES:
On completion of the project work, the students would have the ability to
1. Design and fabricate any machinery/equipment/components
2. Conduct experiments
3. Provide alternative solutions to the malfunctioning/faulty equipments.

REFERENCES:
Books and Manuals on Design, fabrication, control which are relevant for the topic chosen.

MV6812 COMPREHENSION

OBJECTIVES:
To enhance the knowledge on the subjects relevant to the functioning of Engineer Officer on board ship

SYLLABUS: Diesel Engines, Marine Auxiliary machineries, controls, Naval Architecture and Marine electrical machineries.
After completion of 4 years training, the Marine Engineering students will be tested on the Marine Engineering knowledge acquired by way of comprehension test. Valuation is done by both Internal and External Examiners for 100 Marks.

OUTCOMES:
At the end of the course the students are expected to have knowledge and skills required to perform the duties of engineer officer on board ships.

REFERENCES:
All text books, reference books, Manuals, operating instructions, journals, failure reports etc., which are relevant for watch keeping, ships operation, maintenance, repair and refitting

MV6001 ADVANCED MARINE HEAT ENGINES

OBJECTIVES:
To impart the knowledge of Latest Designed Marine Heat Engines

UNIT I COMPLEX HEAT ENGINE PLANTS
UNIT II  COMBUSTION AND FLAME STABILISATION  9
Combustion of liquid fuels, atomisation, mixing, combustion curve and different methods of flame stabilisation, design and combustion chamber. Spray of fuel. Pre-mixing of gaseous fuels for combustion. Stability of the flame. introduction of simulation of engine

UNIT III  TURBO BLOWERS AND TURBO COMPRESSORS  9

UNIT IV  HEAT EXCHANGER  9
Types – construction – design – applications.

UNIT V  RECENT TRENDS  9
Diesel Engines using LNG vapour camless intelligent Engines, CRDI, NOX and SOX control by various types – Exhaust gas recirculation – water injection selective cat reduction – Emission variable injection timing.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course the students are expected to have the
- Knowledge on the co-generation plant engines
- Design Concept of Turbo blowers and compressors
- Design Concept of Heat Exchangers
- Recent trends in the design changes of IC Engines and Propulsion engines

TEXT BOOKS:
2. Gorla, “Turbomachinery” 1st Ed. Taylor & Francis, First Indian reprint 2011 (Yesdee Publishing)

REFERENCES:

MV6002  SHIP SAFETY AND ENVIRONMENTAL PROTECTION  L T P C
3 0 0 3

OBJECTIVES:
To ensure awareness regarding Environmental Protection at Sea and to impart aspect of commitment.
UNIT I  OIL POLLUTION PREVENTION  9
Pollution of the Marine environment while bunkering, loading/discharging oil cargo – tank cleaning – pumping out bilges etc., - knowledge of construction and operation of oil pollution prevention equipment in engine room and on tankers.

UNIT II  LEGISLATIONS  9
MARPOL 73/78 and other country legislations like OPA-90 MARPOL equipment – Knowledge of Codes of Safety Working practices as published – Knowledge of type of information issued by D.G. Shipping with regard to safety at sea & safe working practices.

UNIT III  SURVIVAL TECHNIQUES AND LIFE SAVING APPLIANCES ON SHIP  9

UNIT IV  RULES & REGULATIONS  9
Knowledge of the appropriate statutes of concern to marine engineer officers: The administrative duties of a Chief Engineer – the organisation and training of staff for both normal and emergency duties. The various statutory certificates and documents to be carried onboard ships by all ships: Dangerous goods codes– Carrying more than 2000 tonnes of oil – Chemical tankers and Gas carriers.

UNIT V  PERSONNEL MANAGEMENT  9
Organisation of Staff: Manning arrangements – Analysis of work – Allocation of staff – Organisation of safety and emergencies, staff duties, maintenances, Ship’s records, communication on the ship, meeting techniques.

OUTCOMES:
• Learn precautions required for oil tanker operations.
• Learn about MARPOL 73/78 requirements and Safe Working Practices.
• Learn Life Saving and Survival at Sea techniques.
• Learn about IMO, its conventions and statutory certificates of ships.
• To understand Personnel Management, Training and Emergency drills of ships

TEXT BOOK:
1. STCW – 1995 Hand Book

REFERENCES:
STERLING BOOK HOUSE, MUMBAI, 1997.


MV6003 DOUBLE HULL TANKERS

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OBJECTIVES:
- To impart knowledge on the design features and utility of Double Hull Tankers

UNIT I INTRODUCTION
Origin of double hull ships, their usefulness and superiority over conventional single skin ships, use of double hull tank ships for transport of different types of commodities, prevention of oil-spill and pollution of sea, IMO requirements, schedule for phasing out single hull tank vessels of different sizes.

UNIT II DESIGN
Main dimension, hull-weight estimate, double hull requirements, minimum depth of double bottom tank, wing tank width, clearance for inspection etc. maximum cargo tank size, capacity, effect of free surface, damage stability, hydrostatically balanced loading, sloshing loads, its elimination or minimization.

UNIT III STRUCTURAL ANALYSIS
Non-uniform and uniform stress distribution, unidirectional (longitudinal) structural members, elimination of transverse structural members (except transverse bulkheads), minimization of structural discontinuities and stress concentration zones, use of steel of higher strength, resistance to grounding and collision, classification society requirements, access to inside and bottom spaces.

UNIT IV CARGO HANDLING SYSTEM
Use of submerged pumps, ordinary pumps of new independent pumps, cargo transfer system, assurance of quality of cargo oil, complete elimination of risk of admixture of different grades of oil, concealed pipelines, easy maintenance, inspection and cleaning, elimination of explosion risks.

UNIT V ECONOMICAL OPERATIONS
Economical aspects, fast loading discharging or oil cargo, quicker cleaning, ballasting and de-ballasting, larger number of trips per year.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course the students are expected to have the knowledge on the
- Advantages and superiority of double hull tankers
- Design Consideration and Storage of Oil Space
- Structural design of double hull and oil handling devices
- Economic Aspect of Double Hull tankers

TEXT BOOKS:
1. Indian Register of Shipping Notes on Design of Double Hull Tankers
2. Lloyd Register of Shipping Notes on Design of Double Hull Tankers
OBJECTIVES:
• To sensitize the Engineering students to various aspects of Human Rights.

UNIT I

UNIT II

UNIT III
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV
Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V

OUTCOME:
• Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

OBJECTIVES:
To impart knowledge to the students about special duty ships operation and classification society regulations.

UNIT I
INTRODUCTION
Need for special duty vessels with reference to development of trade and necessities of the trade. Operation of Bulk carriers – Bulk Grain and ore etc., - Banana carriers – Coal Carriers – Forest Products carriers – Timber carriers – Container vessels.

UNIT II
OIL TANKER CARGO OPERATIONS
precautions to prevent ignition due to static electricity cargo operations when not secured alongside – procedure if oil spill occurs – oil record books.

UNIT III OIL TANKERS ROUTINE OPERATIONS

Inert Gas system – principle – components of system, plant and distribution system – uses of inert gas during tanker operating cycle.


UNIT IV INTRINSICALLY DANGEROUS CARGOS


UNIT V RULES AND REGULATIONS

Classification societies for hull, equipment and machineries of Cargo ships and oil tankers – requirements of various types of surveys and certification of Merchant Ships.

TOTAL: 45 PERIODS

OUTCOMES:
After the completion of the course the students will have learnt
- History of trade of special duty vessels.
- Cargo Operations of Oil tankers.
- Cargo Operations of Chemical tankers, LPG / LNG vessels.
- About rules of classification societies for Cargo Ships and Tankers.

TEXT BOOKS:

REFERENCES:

MV6005 SHIP RECYCLING

OBJECTIVES:
- To impart knowledge on the Ship Recycling
UNIT I  SHIP BREAKING METHODS
Introduction on ship breaking, ‘Afloat method’, Dry dock method, type of components to be removed. Towing – Beaching – Preparation of diagram combustible and non-combustible - re usable materials and components, recovering metals, which are mixed with non-metal – metal cutting and scraping.

UNIT II  SHIP BREAKING SAFE PRACTICES

UNIT III  SHIP RECYCLING DOWNSTREAM

UNIT IV  REGULATION ON RECYCLING

UNIT V  SHIP BREAKING INDUSTRY

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course the students are expected to have the knowledge on the
- Method of preparation and breaking of the Ships
- Hazards involved in while breaking the ships Method of controlling the same
- Types of Recycling and designing the ships Regulations in force for Recycling
- Ship Breaking Yards in INDIA

TEXT BOOKS:
2. IMO Guidelines on ship recycling

MV6006  MARINE CORROSION AND PREVENTION

OBJECTIVES:
- To impart knowledge on the Type of corrosion and how this is being controlled in marine environment

UNIT I  INTRODUCTION

UNIT II  HULL PLATE PREPARATION

UNIT III MODERN PAINT TYPES

UNIT IV CORROSION IN BOILER
Atoms & Ions, Ph value electrochemical corrosion, Direct chemical attack – Electro chemical attack – reason – remedial measures. Effect of salts & Grease in feed water. Effect of corrosion while boiler not in service – preservation to avoid corrosion.

CORROSION IN MARINE DIESEL ENGINES:

UNIT V CORROSION AND ITS PREVENTION

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course the students are expected to have the knowledge on the

• Causes of corrosion
• Method of prevention during operation and during construction
• Anti-corrosive paints
• Corrosion in BOILERS and IC ENGINES

TEXT BOOKS:
1. Lavery, H.I., "Shipboard operations" Institute of Marine Engineers Publication

REFERENCES:

GE6083 DISASTER MANAGEMENT

OBJECTIVES:
• To provide students an exposure to disasters, their significance and types.
• To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
• To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
• To enhance awareness of institutional processes in the country and
• To develop rudimentary ability to respond to their surroundings with potential
disaster response in areas where they live, with due sensitivity

UNIT I  INTRODUCTION TO DISASTERS  9
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters –
Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social,
economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste,
class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics,
complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II  APPROACHES TO DISASTER RISK REDUCTION (DRR)  9
Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based
DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj
Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional
Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III  INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT  9
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams,
embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios
in the context of India - Relevance of indigenous knowledge, appropriate technology and local
resources.

UNIT IV  DISASTER RISK MANAGEMENT IN INDIA  9
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation,
Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and
Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and
legislation – Role of GIS and Information Technology Components in Preparedness, Risk
Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V  DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD
WORKS  9
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and
Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge
Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man
Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field
works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to
• Differentiate the types of disasters, causes and their impact on environment and society
• Assess vulnerability and various methods of risk reduction measures as well as mitigation.
• Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster
damage assessment and management.

TEXTBOOK:
13: 978-9380386423

REFERENCES
1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005