### SEMESTER – III
(Applicable to the students admitted from the Academic year 2008 – 2009 onwards)

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
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<tr>
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<tr>
<td>MA 2211</td>
<td>Transforms And Partial Differential Equations</td>
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<td>MV 2201</td>
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<tr>
<td>MV 2205</td>
<td>Seamanship, Elementary Navigation and Survival At Sea</td>
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<tr>
<td>MV 2206</td>
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<td>MV 2202</td>
<td>Marine Electrical Machine – I</td>
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<tr>
<td>MV 2203</td>
<td>Marine Refrigeration and Air Conditioning</td>
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<td>MV 2204</td>
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<td>MV 2208</td>
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<td>MV 2209</td>
<td>Welding Techniques, Lathe and Special Machine Shop</td>
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### SEMESTER – IV
(Applicable to the students admitted from the Academic year 2008 – 2009 onwards)

<table>
<thead>
<tr>
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<th>Course Title</th>
<th>L</th>
<th>T</th>
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<td>THEORY</td>
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<tr>
<td>MV 2251</td>
<td>Applied Mathematics for Marine Engineering</td>
<td>3</td>
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<td>MV 2257</td>
<td>Strength of Materials</td>
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<td>MV 2252</td>
<td>Marine Diesel Engines – I</td>
<td>3</td>
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<tr>
<td>MV 2253</td>
<td>Marine Steam Engines</td>
<td>3</td>
<td>0</td>
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<td>MV 2254</td>
<td>Marine Electrical Machines – II</td>
<td>3</td>
<td>0</td>
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<td>MV 2255</td>
<td>Mechanics of Machines – I</td>
<td>3</td>
<td>0</td>
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<td>MV 2256</td>
<td>Marine Electronics</td>
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<td>PRACTICAL</td>
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<tr>
<td>MV 2258</td>
<td>Strength of Materials and Applied Mechanics Lab</td>
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<tr>
<td>MV 2259</td>
<td>Heat Engines and Boiler Chemistry Lab</td>
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<td>2</td>
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<tr>
<td><strong>TOTAL CREDITS</strong></td>
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<td>21</td>
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<td>8</td>
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</tbody>
</table>
OBJECTIVES
The course objective is to develop the skills of the students in the areas of Transforms and Partial Differential Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

1. FOURIER SERIES

2. FOURIER TRANSFORMS

3. PARTIAL DIFFERENTIAL EQUATIONS
Formation of partial differential equations – Lagrange’s linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients.

4. APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS
Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in cartesian coordinates.

5. Z-TRANSFORMS AND DIFFERENCE EQUATIONS

Lectures : 45  Tutorials : 15  Total : 60
TEXT BOOKS

REFERENCES


AIM
To develop the theoretical and application skills in Marine Hydraulics and Fluid Machinery.

OBJECTIVES
At the end the course the students are expected to have knowledge of
The Fluid properties and effect of various forces acting on different planes and surfaces and Pipes.
The In-viscid flow and Real Viscous flow.
The pumps and hydraulic turbines.

UNIT I  9+3
FLUID STATICS:

UNIT II  11+3
FLUID KINEMATICS:
FLUID DYNAMICS:

UNIT III  7+3
LAMINAR, TURBULENT FLOWS:

UNIT IV  9+3
PUMPS :
Rotodynamic pumps – principles of dimensional analysis – Buckinghams theorem – important dimensionless numbers applicable to fluid mechanics – centrifugal pumps – some definitions – pump output and efficiencies – effect of vane angle– cavitation – constructional details, pump characteristics, multistage 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.

TEXT BOOKS


REFERENCES

MV2205  SEAMANSHIP, ELEMENTARY NAVIGATION AND SURVIVAL AT SEA

AIM

• To develop skill and knowledge about Navigation and Operation of ship.
• To develop self confidence and stuff ness for survival at sea.

OBJECTIVES

On completion of the course the students are expected to

• Have learnt operation of various deck machinery.
(a) Navigation equipment
• Have sound knowledge of Navigation.
• Have learnt survival techniques at sea.
• Have learnt operation of life boats and life rafts.

1. SEAMAN & THEIR DUTIES

Ship’s Department, General ship knowledge ad nautical terms like o’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, Mores and semaphore signalling, Sound signals.

2. 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.

3. NAVIGATION

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

4. LIFE BOATS & LIFE RAFTS


5. 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 : 60 PERIODS
TEXT BOOKS:

REFERENCE BOOKS:
AIM
To develop theoretical skill of students.

OBJECTIVES
To impart knowledge to the students about
- Metal joining processes
- Casting processes.
- Metal forming, Machining and finishing processes.

UNIT-I

UNIT-II

UNIT-III

UNIT-IV

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, turret and capstan lathes. Drilling and boring: machines- 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

TOTAL : 60 PERIODS
TEXT BOOKS


REFERENCES

AIM
To expose the students to the concepts of electrical measurements, D.C. machine, transformers and transmission system.

OBJECTIVES
To introduce the concepts about measurement practices and measuring instruments.
To impart knowledge about construction and operation of D.C. Machines in general and generators in particular.
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.

UNIT I
Principles of Measurement
Basic requirements of measuring instrument – 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, voltmeters and wattmeter. Extension of instrument range.

UNIT II
Principles of D.C. Machines and Generators

UNIT III
D.C. motors

UNIT IV
Transformers

UNIT V
Transmission systems

TUTORIAL

TOTAL: 60 PERIODS
TEXT BOOKS


REFERENCES

AIM
To develop the knowledge of students in Marine Refrigeration and Air conditioning.

OBJECTIVES
At the end of the course the students are expected to have completed the detailed study of Reciprocating Compressors, Marine refrigeration and air-conditioning plants.

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V
Basic design of Heat Exchangers: Introduction - Types - LMTD and NTU method - Double-pipe, Shell and Tube type, Condensor and Evaporator - Problems

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES
AIM
To make the students understand and practice Machine Drawing.

OBJECTIVES
To make the students practice in,

- Understanding limits, Fits and Tolerances.
- Explaining and Sketching Valves, Cocks and Plugs.
- Various parts of Marine Machinery.

UNIT I
Explanation and sketching of the following aspects:
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
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
Sketching of the following: Screw-threads, screwed fastenings, Rivets and Riveted joints keep. Cotter joints & pin joints.

UNIT IV
Machinery Component drawing:
Drawing of complete machine components in assembly (Orthographic to isometric and isometric to Orthographic) with details like couplings, Glands, Return and non-return valves, cocks & plugs, cylinder, Boiler mountings – Full bore safety valve, Blow down cock, Gauge glass, Main stop valve.

UNIT V
Marine Component Drawing:
Assembly Drawings of simple marine components in orthographic projection from Isometric view e.g. Bilge Strainer boxes, control valves, Cylinder relief valves, boiler blow down cock.

TOTAL : 90 PERIODS

TEXT BOOKS

REFERENCES
(A) FLUID MECHANICS LAB.

Buoyancy Experiment – Metacentric Height for Cargo and War ship models.
Fluid flow measurement using Pitot tube, Flow nozzle, Rotameter, Notches etc.
Cd of Venturimeter and orifice-meter.
Determination of frictional losses in pipes.

(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

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>
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<tbody>
<tr>
<td>01.</td>
<td><strong>Buoyancy Experiment</strong></td>
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</tr>
<tr>
<td></td>
<td>Cargo Ship Model</td>
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</tr>
<tr>
<td></td>
<td>War Ship Model</td>
<td>01</td>
</tr>
<tr>
<td>02.</td>
<td>Pitot tube</td>
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<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>
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<tr>
<td>04.</td>
<td>Orifice meter</td>
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<tr>
<td>05.</td>
<td>Frictional Losses in pipes</td>
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<thead>
<tr>
<th>Sl. No.</th>
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<th>Qty.</th>
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<tbody>
<tr>
<td>01.</td>
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<tr>
<td>02.</td>
<td>Multistage Centrifugal Pump</td>
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<tr>
<td>03.</td>
<td>Impulse Turbine (Pelton)</td>
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<tr>
<td>04.</td>
<td>Reaction Turbine (Francis)</td>
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<tr>
<td>05.</td>
<td>Reciprocating pump</td>
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<tr>
<td>06.</td>
<td>Submersible pump</td>
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<tr>
<td>07.</td>
<td>Jet pump</td>
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**MV 2209 WELDING TECHNIQUES, LATHE AND SPECIAL MACHINE SHOP**

**WELDING TECHNIQUES**
45
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**
45
Lathe – Straight turning, Step turning, under cut, taper turning, knurling and thread cutting exercises.
Shaping Machine – Making square from round rod and grooving exercises.
Exercises on milling machine.
Grinding: Exercises to the required accuracy on universal cylindrical grinder and surface grinder.
Slotting Machine: Slotting and Key-way cutting.

**TOTAL : 90 PERIODS**

**LIST OF EQUIPMENTS** *(for a batch of 30 students)*

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Name of the Equipment</th>
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<tbody>
<tr>
<td>01.</td>
<td>Light duty Lathe</td>
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<td>02.</td>
<td>Medium duty Lathe</td>
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<tr>
<td>03.</td>
<td>Heavy duty Lathe</td>
<td>04</td>
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<tr>
<td>04.</td>
<td>Shaper</td>
<td>01</td>
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<tr>
<td>05.</td>
<td>Slotter</td>
<td>01</td>
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<tr>
<td>06.</td>
<td>Planner</td>
<td>01</td>
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<tr>
<td>07.</td>
<td>Radial drilling m/c</td>
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<tr>
<td>08.</td>
<td>Surface grinder</td>
<td>01</td>
</tr>
<tr>
<td>09.</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>
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<tr>
<td>13.</td>
<td>Gear hobber</td>
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<tr>
<td>14.</td>
<td>CNC Lathe Machine</td>
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<td>15.</td>
<td>Capstan Lathe</td>
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<tr>
<td>16.</td>
<td>Cylindrical grinding m/c</td>
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<td>Power hacksaw</td>
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<td>Duplicating Lathe</td>
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15
### WELDING WORK SHOP

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<th>S.No.</th>
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<tr>
<td>01.</td>
<td>Welding Transformer Air Cooled with Fan</td>
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<tr>
<td>02.</td>
<td>Maxi – MIG 400A Welding Set</td>
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</tr>
<tr>
<td>03.</td>
<td>AOL make TIG Control Outfit</td>
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</tr>
<tr>
<td>04.</td>
<td>Welding Rectifier Throluxe – 401 MMA</td>
<td>01</td>
</tr>
<tr>
<td>05.</td>
<td>Water Cooled Torch 0150102071 400 AMPS</td>
<td>02</td>
</tr>
<tr>
<td>06.</td>
<td>Bending Machine Pipe dia ½” to 3”</td>
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<tr>
<td>07.</td>
<td>Gas welding and cutting set</td>
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### FITTING SHOP

<table>
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<th>Description of Equipment</th>
<th>Qty</th>
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<tbody>
<tr>
<td>01.</td>
<td>Power Hacksaw</td>
<td>01</td>
</tr>
<tr>
<td>02.</td>
<td>Vernier Height Gauge</td>
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</tr>
<tr>
<td>03.</td>
<td>Surface Plate with stand</td>
<td>02</td>
</tr>
<tr>
<td>04.</td>
<td>Fitting Bench Vice</td>
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<tr>
<td>05.</td>
<td>Hand tools (Different types)</td>
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SEMESTER – IV

MV 2251 APPLIED MATHEMATICS FOR MARINE ENGINEERING 3 0 0 3

UNIT – I
Testing of Hypothesis: 9+3
Sampling, distributions – Testing of Hypothesis for mean, variance, proportions and differences using normal, t, chi-square and F distributions – tests for independence of attributes and goodness of fit.

UNIT – II
Probability and Random variables. 9+3

UNIT – III Standard distributions 9+3
Binomial, poisson, geometric, negative binomial, uniform, exponential, gamma, weibull and normal distributions and their properties – functions of random variables.

UNIT – IV Curve fitting and Interpolation 9+3

UNIT – V Numerical solutions of ODE and PDE 9+3
Taylor series – Euler and modified Euler – Rungekulta methods – finite difference methods for second order differential equation, finite difference solutions for one dimensional heat equations (both implicit & explicit) one dimensional wave equation and two dimensional Laplace and Poisson equations.

TOTAL :60 PERIODS

TEXT BOOK

REFERENCE BOOK
AIM

To impart knowledge to the students about the Strength of Materials.

OBJECTIVES

To make the student learner, able to determine various stresses and strains in simple and composite members under external load, strength of simple connections and strain energy stored in members.
To make the student learner able to design beams which can resist bending and shearing stresses and to teach the concept of principal stresses and maximum shear stresses.
To teach the students 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 make the student learner able 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.

UNIT I


UNIT II

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. 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.

UNIT III

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-theorem of three moments.

UNIT IV

Slope and deflection of Cantilever, overhanging and simply supported beams - Double integration method - Moment area method- problems with various types of load with or without applied moments and varying flexural rigidity (EI). Torsion of solid and hollow circular shafts – power transmitted by shafts – compound shafts - shafts subjected to both twisting and bending moment - Open coil and closed coil helical springs.
UNIT V

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

TOTAL : 60 PERIODS

TEXT BOOKS


REFERENCES

AIM
To develop knowledge in Marine Diesel Engines, the students will be taught in detail.

OBJECTIVES
On completion of the course the students are expected to have knowledge of
Various types of Marine Diesel Engines.
The Various systems used in Marine Diesel Engine plants.
The Scavenging and super charging system.
The qualities and behavior of various types of fuel Oil and Lubricating Oil used 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, A-frames, 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; Uni-flow, 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
Compression pressure ratio and its effect on engines. Reasons for variation in compression pressure and peak pressure. Design aspects of combustion chamber. Control of NOX, SOX in Exhaust emission.
UNIT V


TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES
AIM
To develop the knowledge of students in Marine Heat Engines and Applied Thermodynamics.

OBJECTIVES
At the end the course the students are expected to have
Completed the detailed study of steam cycles, steam engines, steam nozzle and steam turbines.
Learnt about basic heat transfer.

UNIT I

7+3

UNIT II

11+3

UNIT III

7+3

UNIT IV

11+3

UNIT V

9+3

TUTORIAL 15
TOTAL : 60 PERIODS
TEXT BOOKS

REFERENCES
AIM
To expose the students to the concepts about energy meters, cable faults and AC Machines used in Marine engineering.

OBJECTIVES
To impart knowledge about
Energy meters, power measurement and cable faults.
Alternators – their construction and operation.
Principles of operation of synchronous motors.
Construction and operation of induction machines.
Speed control and trouble shooting in induction machines.

UNIT I
Electrical Measurements
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 etc – simple electronic measuring devices – CRO, IC tester, Signal generator, Timers 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

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES
AIM

To make the students gain knowledge in the fundamentals of Mechanics of Machines, synthesis of various Mechanisms, CAM profiles, theory of gearing, governors, gyroscopic effects.

OBJECTIVES

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.
Cam profiles for different cam followers.
Various parameters of gears and gear trains.
Gyroscopic effect on aeroplanes, ships, two and four wheelers.

UNIT I  MECHANISMS  12+3
Introduction – science of mechanisms – terms and definitions – planar, spherical and spatial mechanisms, mobility classification of mechanisms (indexing mechanism, reciprocating mechanisms, etc.,) straight line generators – kinematic inversion – slider crank chain inversions – four bar chain inversions – Grashoff’s law – mechanical advantage.

Determination of velocities and acceleration in mechanisms – relative motion method (graphical) for mechanisms having turning, sliding and rolling pair – Coriolis acceleration – analysis using vector mathematics for a four bar mechanism - analysis using complex numbers and loop closure equations for slider crank mechanism, inverted slider crank mechanism – four bar mechanism.

UNIT II SYNTHESIS OF MECHANISMS  8+3
Classification of kinematics synthesis problems – Tchebycheff spacing – two points synthesis – slider crank mechanism – three position synthesis – four bar mechanism and slider crank mechanism – Freudenstein method – analytical and graphical design – four bar linkage for body guidance – design of four bar linkage as a path generator.

UNIT III CAMS  7+3

UNIT IV 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, non standard spur gears – extended centre distance system – long and short addendum system – epicyclic gear trains – inversions of epicyclic gear trains, specified ratio and torque calculations, automobile differential, Wilson four speed automobile gear box.
UNIT V
CONTROL MECHANISMS

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, gyroscopic effects in grinding machines.

TOTAL : 60 PERIODS

TEXT BOOKS


REFERENCES

AIM
To make the students understand the Marine Electronics and its applications.

OBJECTIVE
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.

UNIT I
9+3

UNIT II
11+3
ITL & CMOS GATES: Digital integrated circuits – Semi conductor memories – ROM – RAM and PROM.

UNIT III
10+3
Converters; (A-D and D- A): Analog to Digital and Digital to Analog Converters and their use in Data – Loggers.

UNIT IV
8+3

UNIT V
7+3

TUTORIAL 15
TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES
5. R.S. Sedha, “Electronic Devices”.

28
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.

TOTAL : 75 PERIODS

LIST OF EQUIPMENTS

(for a batch of 30 students)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of the Equipment</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>01.</td>
<td>UTM (Universal Testing Machine)</td>
<td>01</td>
</tr>
<tr>
<td>02.</td>
<td>Compression Testing Machine</td>
<td>01</td>
</tr>
<tr>
<td>03.</td>
<td>Deflection Testing Rig</td>
<td>01</td>
</tr>
<tr>
<td>04.</td>
<td>Hardness – Vickers, Brinell, Rockwell, Testing Machines</td>
<td>01</td>
</tr>
<tr>
<td>05.</td>
<td>Spring Testing Machines – Tension, Compression</td>
<td>01</td>
</tr>
<tr>
<td>06.</td>
<td>Impact Testing Machines – (Izod, Charpy)</td>
<td>01</td>
</tr>
<tr>
<td>07.</td>
<td>Load Cells</td>
<td>01</td>
</tr>
<tr>
<td>08.</td>
<td>Fatigue Testing Machine</td>
<td>01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description of Equipment</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>01.</td>
<td>Crucible furnace</td>
<td>01</td>
</tr>
<tr>
<td>02.</td>
<td>Sand Strength Testing Machine</td>
<td>01</td>
</tr>
<tr>
<td>03.</td>
<td>Permeability</td>
<td>01</td>
</tr>
<tr>
<td>04.</td>
<td>Shear Strength Testing Machine</td>
<td>01</td>
</tr>
<tr>
<td>05.</td>
<td>Compression Strength Testing Machine</td>
<td>01</td>
</tr>
<tr>
<td>06.</td>
<td>Transfer Strength Testing Machine</td>
<td>01</td>
</tr>
</tbody>
</table>
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 LABORATORY

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 : 75 PERIODS
LIST OF EQUIPMENTS
(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>01.</td>
<td>Orsat Apparatus</td>
<td>02 nos</td>
</tr>
<tr>
<td>02.</td>
<td>Steam Turbine</td>
<td>01</td>
</tr>
<tr>
<td>03.</td>
<td>Steam Calorimeter</td>
<td>01</td>
</tr>
<tr>
<td>04.</td>
<td>Air Blower</td>
<td>01</td>
</tr>
<tr>
<td>05.</td>
<td>Air Compressor</td>
<td>02 nos</td>
</tr>
<tr>
<td>06.</td>
<td>Vapour Compression Refrigeration test rig</td>
<td>01</td>
</tr>
<tr>
<td>07.</td>
<td>Vapour compression Air Conditioning test rig</td>
<td>01</td>
</tr>
<tr>
<td>08.</td>
<td>Bomb calorimeter and Junker’s calorimeter</td>
<td>01</td>
</tr>
<tr>
<td>09.</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>01.</td>
<td>Redwood Viscometer</td>
<td>01</td>
</tr>
<tr>
<td>02.</td>
<td>Saybolt’s Viscometer</td>
<td>01</td>
</tr>
<tr>
<td>03.</td>
<td>Abel’s flash point and fire point apparatus</td>
<td>01</td>
</tr>
<tr>
<td>04.</td>
<td>Closed cup apparatus (Pensky)</td>
<td>01</td>
</tr>
<tr>
<td>05.</td>
<td>Bomb Calorimeter with Beckman (Digital)</td>
<td>01</td>
</tr>
<tr>
<td>06.</td>
<td>Junker’s Gas Calorimeter</td>
<td>01</td>
</tr>
</tbody>
</table>

BOILER CHEMISTRY LAB

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description of Equipment</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>01.</td>
<td>Burette, Pipette, Beaker, Conical Flask, Bunsen Burner</td>
<td>1 each</td>
</tr>
<tr>
<td>02.</td>
<td>Burette, Pipette, Conical Flask, STD Flask 100ml</td>
<td>1 each</td>
</tr>
<tr>
<td>03.</td>
<td>Burette, Pipette, Conical Flask, STD Flask</td>
<td>1 each</td>
</tr>
<tr>
<td>04.</td>
<td>Burette, Pipette, Conical Flask.</td>
<td>1 each</td>
</tr>
<tr>
<td>05.</td>
<td>Do Bottle, Burette, Pipette, Conical Flask.</td>
<td>1 each</td>
</tr>
<tr>
<td>06.</td>
<td>Wephlo turbidity meter, STD Flask Pipette.</td>
<td>1 each</td>
</tr>
<tr>
<td>07.</td>
<td>PH meter, Buffer tablets, beaker.</td>
<td>1 each</td>
</tr>
<tr>
<td>08.</td>
<td>Petridish, Hot air Oven, Weighing Balance</td>
<td>1 each</td>
</tr>
<tr>
<td>09.</td>
<td>Water Analysis kit.</td>
<td>1 no.</td>
</tr>
<tr>
<td>10.</td>
<td>Meker Burner, Silica, Crucible, Electric Bunsen, Petridish Hot air Oven</td>
<td>1 each</td>
</tr>
<tr>
<td>11.</td>
<td>Burette, Pipette, Conical Flask, turbidity meter, Bunsen Burner, Beaker, STD Flask.</td>
<td>1 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>01</td>
<td>Internal Combustion Engines Section</td>
<td>01</td>
</tr>
<tr>
<td>02</td>
<td>Fuel and Lubrication Oil Testing Equipments</td>
<td>01</td>
</tr>
<tr>
<td>03</td>
<td>Heat Transfer Equipments</td>
<td>01</td>
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<tr>
<td>04</td>
<td>Steam Lab. Equipments</td>
<td>01</td>
</tr>
<tr>
<td>05</td>
<td>Refrigeration and Air Conditioning Equipments</td>
<td>01 set</td>
</tr>
<tr>
<td>06</td>
<td>Automobile Components</td>
<td>01</td>
</tr>
<tr>
<td>07</td>
<td>Engine Research Centre</td>
<td>01</td>
</tr>
<tr>
<td>08</td>
<td>Computers with UPS</td>
<td>01</td>
</tr>
<tr>
<td>09</td>
<td>Miscellaneous Equipments</td>
<td>01</td>
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</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>01</td>
<td>Multi Cylinder Petrol Engine</td>
<td>01</td>
</tr>
<tr>
<td>02</td>
<td>Twin Cylinder Diesel Engine</td>
<td>01</td>
</tr>
<tr>
<td>03</td>
<td>Kirloskar Diesel Engine</td>
<td>01</td>
</tr>
<tr>
<td>04</td>
<td>Greaves Cotton diesel engine</td>
<td>01</td>
</tr>
<tr>
<td>05</td>
<td>Two Stroke Petrol Engine</td>
<td>03 nos</td>
</tr>
<tr>
<td>06</td>
<td>Two Stroke Diesel Engine Model</td>
<td>01</td>
</tr>
<tr>
<td>07</td>
<td>Four Stroke Petrol Engine</td>
<td>01</td>
</tr>
<tr>
<td>08</td>
<td>Four Stroke Diesel Engine Model</td>
<td>01</td>
</tr>
<tr>
<td>09</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>
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</tbody>
</table>