



C.V.Raman College of Engineering,

(An autonomous Institute affiliated to BPUT, Odisha)

2ND YEAR B.TECH. STRUCTURE WITH EFFECT FROM ACADEMIC YEAR 2016-17

3RD SEMESTER

Sl. No.	Code	Subject	Type	Teaching Scheme			Credits
				L	P	T	
S1	MR 20101	Strength of material-I	Theory – Core	3	-		3
S2	MR20102	Mechanics of Machine –I	Theory – Core	3			3
S3	MR20103	Applied Thermodynamics	Theory – Core	3	-		3
S4	MR20104	Electronics	Theory – Core	3	-	-	3
S5	MR20105	Electrical Machine	Theory – Core	3			3
S6	MR21106	Computational Mathematics-III	Theory – MD	2	-	-	2
P1	MR20307	Workshop Practical	Lab – CORE	-	3	-	2
P2	MR20308	Marine Engineering Drawing	Lab – CORE	-	3	-	2
P3	MR21309	Electronics lab	Lab – MD	-	2	-	1
P4	MR24310	Computer lab	Lab – SD	-	2	-	1
P5	MR24311	PET - I (Physical Endurance Training – I)	Lab – Physical Skill Development		5		1
P6	HS27421	Technical Writing	Lab – Communication Skills		2		1
Total:				15	17	2	25



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SEMESTER-III

REF NO: To be filled by CD office

MR 20101 : STRENGTH OF MATERIALS-I

Credits: 03

Teaching Scheme: Theory 03 Hrs/Week

Prerequisites: NIL

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: Simple Stresses and Strains & Strain Energy in Simple Stresses

U1.1 Simple Stresses and Strains: Concept of Stress and Strain and their relationship in deformable solids. Normal, shear and hydrostatic stresses and the corresponding strains. Poisson's Ratio and complementary shear stress. Relationship between three elastic constants. Uni-axial loading and deformations; Thermal Stress; Axial Stresses in composite materials.

- 8 hrs

U1.2 Strain Energy in Simple Stresses: Concept of Strain Energy; Strain Energy due to normal and Shear Stresses; Strain Energy due to impact loads; Resilience.

- 4 hrs

UNIT-II: Shearing Force and Bending Moment:

U2.1 Shearing Force and Bending Moment: Sign Convention, Relation between Intensity of Loading,
-02 hrs

U2.2 Shearing Force and Bending Moment. Graphical construction of Bending Moment & Shear Force diagrams.

- 8hrs



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UNIT-III: Thin Walled Shells, Welded Joints:

- U3.1 Thin Walled Shells :** Stresses and Strains in thin Walled Shells subjected to internal pressure; Stresses and Strains in submersibles. Strengthening of Thin Walled Shells by wire or tape winding. Effect of temperature; volumetric strain on capacity. -6 hrs
- U3.2 Welded Joints :** Strength of Welded Joints. Torsion effect on welded joint. - 3 hrs

UNIT-IV: Bending Stress:

- U4.1 Bending Stress :** Pure Bending, 2nd moment of area, Stresses due to bending. Position of Neutral axis, Radius of Curvature,
- U4.2** Combined bending and direct stress. Short Column with eccentric loading. Composite beams. Bending beyond the limit of proportionality. - 8 hrs

UNIT-V: Shear & Torsional stress:

- U5.1 Shear & Torsional stress:** Shear Stress and Shear Strain. Twisting of solid and hollow shafts, Stiffness and Strength. Power and Torque relation.
- U5.2** Shafts with linear and compound shafts, Partial hollow shafts, Calculation for Coupling bolts,
- U5.3** Torsion applied to closed coil springs, springs with axial load, Calculations for mean diameter of springs, wire diameter & number of coils. Strain Energy in torsion.
- U5.4** Plastic yielding of materials in Torsion. - 15hrs

Text Books:

- T1. Strength of Materials, Er.R. K. Rajput, S.Chand Publication, 5th revised Edition 2010

Reference Books:

- R1. Strength of Materials, G. H. Ryder, 3rd edition 2009, Macmillan.
- R2. Strength of Materials, Stephen Timoshenko, 3rd edition 2010, CBS publication.
- R3. Strength of Materials, R.K. Bansal, 3rd edition 2002, Laxmi Publisher.



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SEMESTER-III

REF NO: To be filled by CD office

MR20102 : MECHANICS OF MACHINES-I

Credits: 03

Teaching Scheme: Theory 03 Hrs/Week

Prerequisites: NIL

Objectives: To impart the knowledge of velocity and acceleration of various kinematic linkages, cam profiles for different cam followers, various parameters of gears and gear trains.

UNIT-I: Turning Moment & Flywheel:

- U1.1 Turning Moment & Flywheel :** Function of a Flywheel. Crank effort diagrams. Fluctuation of speed and energy. Effect of centrifugal tension on flywheel,
U1.2 Inertia torque and its effects on Crank Effort diagrams.

- 10 hrs

UNIT-II: Kinematics' and Link-Mechanisms:

- U2.1 Kinematics' and Link-Mechanisms :** Relative motion between bodies moving in different planes. Instantaneous center method; Rubbing velocities at pin joints.
U2.2 Graphical construction for relative velocity and acceleration in different link and sliding mechanisms. Analytical determination of velocity and acceleration. Forces in Crank and connecting rods. Inertia force on link connecting rods, Effect of friction. - 10 hrs

UNIT-III: Cams:

- U3.1 Cams:** Types of cams and followers. Specified motion of followers. Uniform acceleration and deceleration, S.H.M. and uniform velocity Graphical construction of Cam-profile.- 5 hrs
U3.2 Analytical design procedure for cams with Straight flank, Curved flank, Circular flank with various types of followers Spring force and Reaction Torque. In-line cams and off center cams.

- 5 hrs



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UNIT-IV: Spur Gearing & Toothed gearing:

U4.1 Spur Gearing : Various definition e.g. p.c.d., profile of gear teeth, module, path of contact, velocity of sliding, Interference, Gear ratio and center distance of simple and compound gear trains. - 6 hrs

U4.2 Toothed gearing : Types of gears, conditions for transmission of constant velocity ratio; methods of avoiding interference; Transmission of power by gear trains on parallel shafts; Rack and pinion, Bevel gears, Worm and Worm wheel, Spur gear Helical gears, Spiral gears; Epicyclic gear trains, Torque on gear trains, acceleration of gear trains. - 13 hrs

UNIT-V: Gyroscope:

U5.1 Gyroscope : Gyroscopic couple, Vector representation of torque and angular momentum, steady rectangular precession, vector treatment; Steady conical precession; Motion involving steady precession; Application to Ship's stabilization, reaction on gearbox bearings & other bearings . - 5 hrs

Text Books:

- T1. Mechanics of machine-I, Theory of Machine by R.K. Bansal & J.S. Bran, 5th edition, Laxmi publication.

References Books:

- R1. Advanced Mechanics of Machines - J. Hannah & R.C. Stephens, 8th/1978, James Munro & company.
- R2. Theory of Machines, P. L. Ballaney, 2010, Khanna Publication.
- R3. Engineering Mechanics, S. Timoshenko & D. H. Young, 4th/2012, TMH.



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SEMESTER-III

REF NO: To be filled by CD office

MR20103 : APPLIED THERMODYNAMICS

Credits: 03

Teaching Scheme: Theory 03 Hrs/Week

Prerequisites: NIL

Objectives: To understand the application of Thermodynamics in air standard cycle, gas mixture and heat transfer.

UNIT – I:

Constant Volume Cycle; Constant Pressure Cycle; Diesel Cycle; Dual Combustion Cycle; 4-Stroke & 2-Stroke Cycle; Criteria of Performance; Compression Ratio and Thermal Efficiency; Indicator Diagrams; Indicated Power; Brake Power; Friction Power; Mechanical Efficiency; Specific Fuel consumption; Energy Balance; Applied Problems. - 9 hrs

UNIT –II:

U2.1 Fuels, Combustion & Dissociation :- Definition of Fuel, combustion. Combustion Equation, Analysis of the Products of Combustion, stoichiometric combustion, Actual combustion, Excess Air, Mixture strength, Dissociation. Effect of Dissociation on I.C. Engines. - 04 hrs

U2.2 Gas Dynamics :- One Dimensional steady flow of compressible fluids, Isentropic flow, Effect of Friction, Flow through Nozzles and Diffuser. Critical condition, Mach number, Subsonic, Sonic and Supersonic Flow. Flow of steam through Nozzles and Diffusers. - 06 hrs

UNIT –III:

U3.1 Ideal cycle for compressors, work Transfer in single stage compressor, Mass and volume flow, Free Air Delivery, Effect of clearance and volumetric Efficiency in Single stage compressors, Multi-stage compression neglecting clearance and with clearance. Condition for Minimum work Input and Perfect Intercooling.

U3.2 Tandem and In-line arrangement in compressors. Rotary positive Displacement Types of compressors. Compressed air Motors. Applied Problems. - 10 hrs



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UNIT –IV:

Dalton's Law of partial pressure, Amagat's Law of partial volume, volumetric and Gravimetric Analysis of Gas Mixtures, Gibb's –Dalton Law, Mean value of a Gas constant. Equivalent Molecular weight, Density, specific volume, specific Heat and Molar Heat capacity of gas mixture. Advanced problem on Adiabatic Mixing. - 8 hrs

UNIT –V:

U5.1 Transmission of Heat :- Fourier's Law of Heat conduction. Thermal conductivity of insulating materials. Conduction through flat & cylindrical, spherical surfaces in series. Heat Transfer from fluids to fluids through walls.

U5.2 Application of Heat Transfer in Marine Heat Exchangers, like Coolers, Heaters, Condensers. Prediction of convection Heat Transfer rates. -11 hrs

U5.3 Use of Non-Dimensional Groups. Prandtl No. Nusselt No., Reynolds No., Stanton No., Grashof No, Graetz No., Natural and Forced Convection. - 06 hrs

Text Books:

- T1. Thermal Engineering by R.K.Rajput, 2nd revised 1999
- T2. Engineering Heat & Mass Transfer by Mahesh M.Rathore, 2nd edition

References Books:

- R1. Applied Thermodynamics for Engineering Technologies, T.D.Eastop & A. McConkey, 5th edition 2004, Pearson.
- R2. Basic Engineering Thermodynamics, Joel Rayner, 5th edition 2009, Pearson.
- R3. Heat and Thermodynamics, Mark W. Zemansky & Richard H. Dittman, 7th edition 2010, MC Graw Hill.
- R4. Thermodynamics: An Engineering, Cengel & Boles, 3rd edition 2002, TMH.



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SEMESTER-III

REF NO: To be filled by CD office

MR20104 : ELECTRONICS

Credits:03

Teaching Scheme: Theory 03 Hrs/Week

Prerequisites: NIL

Objectives: To familiarize the student with the principles of operation of various electron devices so that he will be able to use these devices effectively.

UNIT-I: Electron Emission, Semi Conductors & Semi Conductor & Diodes:

- U1.1 Electron Emission:** Thermionic Emission, Photoelectric emission, Electric field emission and their applications. - 3 hrs
- U1.2 Semi Conductors:** What is semiconductor, Types of Semi Conductors, Electrical characteristics, Diffusion and Drift, Mobility, Varistors Thermistors and Non Linear Resistors. - 3 hrs
- U1.3 Semi Conductor & Diodes:** Characteristics of diodes, Diode as a rectifier, Diode clamper and voltage doubler, Zener diodes, tunnel Diodes, Rectifiers & Filters LEDs. - 3 hrs
- U1.4 Transistors:** The junction transistor and its basic characteristics, the transistor as a switch. The transistor as an amplifier, - 3 hrs
- U1.5 Signal generation – operating principles, applications** - 2 hrs

UNIT-II: Transistors Regulated Power Suppliers, Oscillators & Transistor Power Amplifier:

- U2.1 Transistors:** The transistor as an amplifier, Stabilized biased circuits, Self biased and potentiometer biased, low and high frequency Response, Response of Transistor Amplifiers, Effect of negative & positive feedback in transistor amplifier, JFET & MOSFETS, BJT, UJT. - 3 hrs
- U2.2 Regulated Power Suppliers:** Series Regulators, Shunt Regulators, PNM regulators. - 3 hrs
- U2.3 Oscillators:** Requirements for Oscillations phase shift Oscillator, Wien Bridge Oscillator, Crystal



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Oscillators, and Decoupling Filters. - 3 hrs

- U2.4 Transistor Power Amplifier:** Design theory, Basic Complementary symmetry. Practical complementary push-pull amplifier, Transistor. Phase inverter Relation between Maximum Output power and load resistance and Transistor dissipation. - 3 hrs

UNIT-III: Wave Shaping and Switching, Operation Amplifier Theory & Digital Circuits:

- U3.1 Wave Shaping and Switching:** Clipping, Clamping, time base or Sweep Generator, Multivibrators & Schmitt Triggers. - 3 hrs
- U3.2 Operation Amplifier Theory :** Concept of Differential Amplifiers. Its use in DP-AMPS. Linear OP-amp circuits. - 3 hrs
- U3.3 Digital Circuits :** Logic systems and Gates. Binary and BCD codes, Boolean Algebra, Simplifications, Flip-flops; Counters; Registers and Multiplexers. - 3 hrs

UNIT-IV: Converters, TTL & CMOS GATES, Industrial Electronics:

- U4.1 Converters (A-D and D-A) :** Analog to Digital and Digital to Analog Convertors and their use in Data-Loggers. - 3 hrs
- U4.2 TTL & CMOS GATES :** Digital Integrated Circuits, Semi-conductor Memories-ROM, RAM and PROM. - 3hrs
- U4.3 Industrial Electronics :** Power rectification, Silicon Control rectifier power control, Photo-Electric Devices, Invertors. - 4 hrs

UNIT-V: Communication, Electronic Instruments & Microprocessors:

- U5.1 Communication :** Modulation, Demodulation, AM/FM/PM Wireless, Radio Transmitters and Receivers, T-V Radar, Pulse Communication. - 4 hrs
- U5.2 Electronic Instruments :** Cathode Ray Oscilloscope, Digital Voltmeters and frequency-meters, Multimeters; Vacuum Tube voltmeter and signal Generators, Signal generation –operating principle – application; signal generation as used on board ship like measuring and controlling various variables including rpm, pressure, flow, temperature level, strain. - 3 hrs
- U5.3 Microprocessors :** 8085 Architecture – Programming – interfacing and Control of motors – Temperature / Speed control.



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Transistor as an amplifier, switch, oscillator, IC based timers, photo electric devices e.g. LED, LCD, 7 segment display, electron theory IC based generic (IC 555) & its application multi-vibrators, Tele communication system and service. - 2 hrs

Text Books:

T1.

References Books:

- R1. Power Electronics, P. S. Bhimbra, 3rd edition, 2005, Khanna.
- R2. Digital Principles & Applications, Malvino Leach, 6th edition, 2009, TMH.
- R3. Microprocessors & Microcomputers, Ramesh Gaonkar, 5th edition, 2009, Penram international.
- R4. Power electronics, B.R.Gupta, 3rd edition 2003, Kataria publication



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SEMESTER-III

REF NO: To be filled by CD office

MR20105 : ELECTRICAL MACHINES

Credits: 03

Teaching Scheme: Theory 03 Hrs/Week

Prerequisites: NIL

Objectives: To introduce the concept of operation and construction of DC machines and transformers.

UNIT-I: Direct current machines:

Direct current machines:

- U1.1** Principle of working, construction, winding, e.m.f. equation. Armature reaction, commutation, brush shift, compensating winding. - 2 hrs
- U1.2** D.C. generator, their characteristics, methods of excitation, parallel operation, equalizer busbar, performance equations. - 4 hrs
- U1.3** D.C. motor-their characteristics, starting and reversing, speed-torque equations, starters, speed control including electronic method of control, testing of d.c. machines for finding out losses and efficiency, braking of d.c. motor. - 4 hrs
- U1.4** D.C. and A.C. transmission and distribution-two wire and three wire d.c. system, use of balancer, a.c. transmission single phase and three phase, three wire and four wire distribution, comparison of d.c. and a.c. transmission, effect of voltage drop, copper utilization under different systems, single and double fed distributors, fuses, d.c. air circuit breaker, a.c. air and oil circuit breakers. HV & LV switchgears - 5 hrs

UNIT-II: Alternator:

- U2.1** Alternators-general arrangement of alternators, construction of salient pole and cylindrical-rotor types, types of stator windings, single and double layer windings, e.m.f. equation of an alternator, distribution and pitch factor, waveform of generated e.m.f., alternator on load, percentage regulation, internal voltage drop, production of rotating magnetic field, resultant magnetic field distribution, mathematical derivation of the rotating field condition, magnetomotive force or ampere-turn waveform distribution, reversal of direction of rotation of rotating field. - 8 hrs



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UNIT-III: Transformers:

U3.1 Transformers – principle of action, e.m.f. equation, phasor diagrams for no load and load conditions, useful and leakage flux, leakage reactance, equivalent circuits, voltage regulation, losses and efficiency, open circuit and short circuit and short circuit tests, parallel operation, three phase transformer – core and shell type transformer, current and potential transformer, auto-transformer (single phase & 3-phases). - 9 hrs

UNIT-IV: Three phase induction motor:

U4.1 Three phase induction motor – principle of operation and theory of action, slip speed, rotor to stator relationship, rotor frequency, rotor e.m.f. and current, equivalent circuit relationship between rotor IR loss and the rotor slip, torque/slip characteristics, starting torque and maximum running torque, reversing, speed control of induction motor, including IGBT (Insulated Gate Bipolar Transistor) and Thyristor controls.

U4.2 Starting of induction motor, method of starting D.O.L, Star/Delta, Auto, Testing of motor, use of circle diagram. Single phase induction motor – principle and operational characteristics, starting control, constructional details. - 15 hrs

UNIT-V: Synchronous alternator and motor:

U5.1 Armature reaction in synchronous alternator, armature reactance, prediction of voltage regulation, open circuit test, short circuit test, synchronous impedance, torque/angle characteristics, infinite busbar, synchronizing current, torque and power, hunting of phase swinging, parallel operation of alternators, a.c. generators in parallel-excitation control, throttle control, load sharing –KW and KVA,

U5.2 principle of action of three phase synchronous motor effect of varying load and excitation, methods of starting, advantages and disadvantages of synchronous motor. - 7 hrs



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Text Books:

T1. Electrical Technology, Hughes Edward, 10th/2011, Pearson.

Reference Books:

- R1. Electricity applied to Marine Engineering, W. Laws
- R2. Electrical Power, S. Uppal, 15th/2010, Khanna
- R3. Electrical Technology, Hughes Edward
- R4. Electric Motor drives, Berde
- R5. Electricity applied to Marine Engineering, W. Laws

SEMESTER-III

REF NO: To be filled by CD office

MR21106 : COMPUTATIONAL MATHEMATICS-III

Credits:02

Teaching Scheme: Theory 02 Hrs/Week

Prerequisites: NIL

Objectives: To impart the knowledge to the students, on various computational methods.

UNIT-I: Sampling Theory:

- U1.1** Population and Sample.
- U1.2** Sampling with and without replacement.
- U1.3** Random Samples, Population parameters, sample statistics, samples mean, sampling distribution of means.
- U1.4** Sample variance, mean, variance and moments for grouped data. - 4 hrs

UNIT-II: Curve Fitting, Regression and Correlation :

- U2.1** Curve fitting, the method of least squares, the least squares line, least, square line in terms of Sample variance and covariance.
- U2.2** Regression lines, regression coefficients, the least square parabola, multiple regression.
- U2.3** Standard error of estimate, linear correlation coefficient.
- U2.4** Probabilistic interpretations of regression and correlation, interpretations of regression and correlation. - 8 hrs



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UNIT-III: Digital Mathematics & Logic Circuits:

U3.1 Digital Mathematics :

Binary codes: Weighted and Non weighted Binary codes, Error detecting codes, Error correcting codes, alphanumeric codes. Basic logic gates: AND or not gates, combining logic gates, NAND, NOR, Exclusive-OR, Exclusive-NOR gates, converting gates with inverters.

- 3 hrs

U3.2 Logic Circuits : Sum-of-Products Boolean expressions, Product-of-Sums Boolean expressions, use of De Morgan's Theorems, use of NAND logic, USE OF NOR logic Numerical Analysis.

- 5 hrs

UNIT-IV: The Calculus of Finite Differences :

U4.1 Differences of a function, Fundamental operators of the calculus of Finite Differences, Algebra of Finite Difference operators, Fundamental equations satisfied by Finite Difference operators,

U4.2 Difference tables, Derivative of a tabulated function, Integral of a tabulated function, Summation formula, Difference equation with constant coefficients,

U4.3 Applications to oscillations of a chain of particles connected by strings and an electrical line with discontinuous leaks,

U4.4 Interpolation formulae, Newton's divided difference formula, Lagrange Interpolation formula, Forward and backward Gregory-Newton interpolation formulae,

U4.5 Stirling interpolation formula. Numerical integration by various methods (Trapezoidal Rule, Simpson's Rule etc.), Linear difference equation with constant coefficients. - 10 hrs

UNIT-V: Computing:

U5.1 Design of efficient algorithms for problems like-factorial of a positive integer, Fibonacci Sequence generation, Sin x, cos x, ex series summation Linear search problem.

U5.2 Bubble sort Problem, Merging Problem, Calculation of computational complexity.

- 6 hrs

Text Books:

T1. GREWAL, B. S. Higher Engineering Mathematics, 38th Edition, Khanna Publishers, Delhi, 2004.



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References Books:

- R1.** Numerical Methods for Engineering & Scientific Computation – by Jain , M. K. Iyanger, S. R. K. Jain, 6th edition, New Age publisher.
- R2.** Numerical Methods for Engineers – By Chapra S. C., Canale R. P. 4th edition, TMH publisher.

SEMESTER-III

REF NO: To be filled by CD office

MR20307 : WORKSHOP PRACTICAL

Credits: 02

Lab/ Sessional- 03 hrs/ week

Study of Workshop layout;

Steam & Exhaust Line Tracing;

Feed & condensate Line Tracing for the Steam Engine Plant;

Cooling Water & Fuel Line Tracing for the Steam Engine Plant;

Smoke tube Boiler Familiarisation;

Globe Valve Overhauling;

Sluice Valve Overhauling;

Non-return Globe Valve Overhauling;

2 Way/ 3 Way Cock Overhauling;

Shaft Key Making

Thread cutting by Taps & Die;

Thread cutting by Lathe Machine.

Other important “jobs” that may be introduced as per current trend, to keep student abreast with latest.



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SEMESTER-III

REF NO: To be filled by CD office

MR20308 : MARINE ENGINEERING DRAWING

Credits: 02

Lab/ Sessional- 03 hrs/ week

Machinery Components Drawing : Drawing of complete machine components in assembly (Orthographic to Orthographic and isometric to Orthographic) with details like couplings, Glands, Return and non-return valves, cocks & plus, interpretation of machinery drawings and handbooks marine engineering drawing and design. The interpretation of piping, hydraulic and pneumatic diagrams.

- 27 hrs

Marine Machinery Components & assembly drawings : Assembly Drawings of marine components in Orthographic projection from Isometric views e.g, Bilge Suction Strainer Boxes, Ship's Side Discharge Valve Chest, Cylinder Relief Valve, Control Valve, Oil Fuel Strainer, Parallel Slide Stop Valve , Ballast Chest for Oil or Water , Feed Check Valve, Gear Pump , Control Valves, Boiler Blow-down valves, Diesel Engines' Rocker arms, cylinder liner, connecting rod with bearings, Full bore Boiler safety valve, Hydraulic Exhaust Valve . (Minimum of 9 drawings to be completed in the class. Remaining drawings to be given as home assignment)

Sample list drawings para 17 DGS Annex-II Air Inlet Valve, Automatic Valve

- 27 hrs

REFERENCES:

1. MacGIBBON'S Pictorial Drawing Book for Marine Engineers H. Barr & J.G. Holburn
2. Reed's Engineering Drawing for Marine Engineers - Volume II H. G. Beck



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SEMESTER-III

REF NO: To be filled by CD office

MR21309 : ELECTRONICS LABORATORY

Credits: 01

Lab/ Sessional- 02 hrs/ week

- To study the characteristics of Thermistor.
- To study the volt-ampere characteristic of Field Effect Transistor.
- To study the characteristics of Silicon Controlled Rectifier.
- To study the Transistor Bias stability.
- To study the Transistor Feed Back Amplifier.
- To study the Integrated Circuit operational Amplifier.
- To study the Integrating, Differentiating Clamping and Clipping Circuit.
- To study the Logic Training Board.
- To study the Speed control of a D.C. motor by Thyristor.
- Assembling electronic components as per given circuit on Circuit Board.
- Study electronic PID controller.
- Study PCB of High Temperature alarm system .
- Study PCB of High Level alarm system.
- Study PCB for other alarm systems like heat, smoke, pressure, rpm.
- Study of IC & LSIC



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SEMESTER-III

REF NO: To be filled by CD office

MR24310 : COMPUTER LABORATORY

Credits: 01

Lab/ Sessional- 02 hrs/ week.

1. UNIX COMMANDS

Study of Unix OS – Basic Shell Commands – Unix Editor

2. SHELL PROGRAMING

Simple Shell program – Conditional Statements – Testing and Loops

3. C PROGRAMMING ON UNIX

Dynamic Storage Allocation – Pointers – Functions – File Handling

4. MATLAB

- a) Generation of periodic, exponential, sinusoidal , damped sinusoidal, step and impulse .
- b) Ramp signal using MATLAB in both discrete and analog form .
- c) Evaluation of convolution integral, Discrete Fourier transform for periodic and non periodic .
- d) Signals and simulation of difference equations using MATLAB .
- e) Cascade connection of second order system using MATLAB .
- f) Determination of Laplace Transform and inverse Laplace transform using MATLAB .
- g) Programs to implement structure union and function .

5. OPERATING SYSTEM presently in use in the Industry. Modern Engineering programming language.



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4TH SEMESTER

Sl. No.	Code	Subject	Type	Teaching Scheme			Credits
				L	P	T	
S1	MR20112	Ship Structure & Construction	Theory – Core	3	0	-	3
S2	MR20113	Marine Boiler & Steam Engineering	Theory – Core	3	0		3
S3	MR20114	Workshop Technology	Theory – Core	3	0		3
S4	MR20115	Marine Heat Engineering & A/C	Theory – Core	3	0		3
S5	MR20116	Strength of Material-II	Theory – Core	3	0		3
S6	MR21117	Mechanics of Machines-II	Theory – MD	3	0		3
P1	MR20318	Elementary Navigation & Seamanship	Lab – CORE	-	2	-	1
P2	MR21319	Heat & Boiler chemical Laboratory	Lab – MD	-	2	-	1
P3	MR24320	Workshop Practical	Lab – SD	-	4	-	3
P4	MR24321	PET - II (Physical Endurance Training – II)	Lab – Physical Skill Development	-	5	-	1
P5	HS27420	General Seminar	Lab – Communication Skills		2		1
Total:				17	15	1	25



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SEMESTER-IV

REF NO: To be filled by CD office

MR20112: SHIP STRUCTURE & CONSTRUCTION

Credits:04

Teaching Scheme: Theory 03 Hrs/Week

Prerequisites: NIL

Objectives: To impart the knowledge on construction of ships and ships terms and stresses in ships, primary and secondary girders used in ships.

UNIT-I: Ships Terms, Stresses in ship's structure, Sections and materials use & Bottom & Side Framing

- U1.1 Ships Terms :** Various terms used in ship Construction with reference to Ship's parameter e.g. L.B.P., LOA, Moulded Depth, Moulded draught, Freeboard, rise of floor, flare, shear, rake and other similar terms, General Classification of Ships - 3 hrs
- U1.2 Stresses in ship's structure :** Bending, Shear, Hogging, Sagging, Racking, Pounding, Painting, and Strength members to counteract the same. - 2 hrs
- U1.3 Sections and materials use :** Type of section like Angles, Bulb Plates, Flanged beams used in ship construction. Welding techniques and machines for ships building process. Testing of welds. Fabricated components. - 6 hrs
- U1.4 Bottom & Side Framing :** Double bottoms, Water tight floors, Solid and bracket floors, Longitudinal framing keels, side framing like Tankside brackets, Beam Knee, Web frame. - 5 hrs

Unit-II: Shell & Decks, Bulk heads & Deep Tanks

- U2.1 Shell & Decks :** Plating systems for shells, Deck plating & Deck girders, discontinuities like hatches and other openings, supporting & closing arrangements, mid-ship Section of ships. - 5 hrs
- U2.2 Bulk heads & Deep Tanks :** Water tight bulkheads, Arrangements of plating and stiffeners. Water tight sliding doors, Water tight openings through bulkheads for electric cables pipes and shafting. Deep tank for oil fuel or oil cargo corrugated bulk heads. - 8 hrs

UNIT-III: Fore-End Arrangements & After-End-Arrangements:

- U3.1 Fore-End Arrangements :** Stem construction, arrangements to resist panting, panting stringers, Forepeak – Collision bulk heads, Bulbous bows. Anchor and cable arrangements. Chain locker - 5 hrs
- U3.2 After-End-Arrangements :** Types of Sterns, Stern frame and rudder. Types of rudder. Supporting of rudder, Locking pintle, Bearing pintle, Pallister bearing, Shaft tunnel, Tunnel bearings. Aft peak tank - 6 hrs



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UNIT-IV: Load line and Tonnage:

U4.1 Load line and Tonnage

Definition of freeboard and various assigning conditions, List of closing appliances, Loadline Surveys, Tonnage regulations, calculation as per latest convention, details of markings permanently carved. Plimsol line - 3 hrs

UNIT-V: Shipyard Practice, Ship Types & Offshore Technology:

U5.1 Shipyard Practice

Layout of a Shipyard, Mould loft, fabrication of assembly, subassembly, units in construction, role of Surveyors in construction of Ship; Keel laying, Launching, Sea trial. Use of computers in ship design with cost implication. Ventilation arrangement for pump room in tankers and for holds and oil fuel tanks, Bridge team B/T, Plimsol line, Free Surface liquid on stability, Bilge piping system, Ballast piping, Sounding piping, Air piping. - 5 hrs

U5.2 Ship Types

Tankers, bulk carriers, container ships, car carriers, LNG, LPG and chemical carriers, Lash ships, Passenger ships, Dredger, Tugs – constructional details and requirements. - 4 hrs

U5.3 Offshore Technology

Drilling Ships and Platforms, Supply/Support Vessels-types and constructions, Dynamic Positioning, Deep Sea diving system, fire fighting arrangement, Cable laying vessels.

- 2 hrs

Text Books:

- T1. Ship Construction Reed's Vol-5, E.A.Stroke, 5th /2010, adlard coles Nautical.
- T2. Merchant Ship Construction, D.A. Taylor, 4th/1998, Imarest.

Reference Books:

- R1. Ship Construction, Munro & Smith, 1st /2003, IMarEST.
- R2. Ship Construction, D. J. Eyyres , 4th /1994, Butter Worth
- R3. Merchant Ship Construction, H.J. Pursey, 6th /2007, Elsevier.
- R4. Principles of Naval Architecture, SNAME Publication.



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SEMESTER-IV

REF NO: To be filled by CD office

MR20113: MARINE BOILER & STEAM ENGINEERING

Credits:03

Teaching Scheme: Theory 03 Hrs/Week

Prerequisites: NIL

OBJECTIVES:-

- To impart the knowledge of Boiler & Boiler Mountings,
- Steam turbines and steam engines to the students.
- Operation , care & Maintenance of both above

UNIT-I:

MARINE BOILERS

Smoke Tube Boilers : 05Hrs

U 1.1 General Considerations governing the design of Boilers,

Tests on boiler : Destructive and Non destructive tests on plates, rivets, welded seams, classification societies requirements for boilers construction, Hydraulic tests

U 1.2 Types of marine boilers, comparison of smoke tube and water tube boilers; Various types in marine use, Principal dimensions and staying of flat surface of multitubular cylindrical Boilers. Vertical Auxiliary Boilers.

Water Tube Boilers : 07Hrs

U 1.3 General description with sketches of principal types of boilers in marine use,

U 1.4 Superheater, Economizer, Air pre-heater & Steam pre-heater; Circulation and use of Unheated Down comers in highly rated boilers;

U 1.5 Superheat temperature control, Attemperators and De-superheaters.



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Waste heat Boilers :

02Hrs

U 1.6 Waste heat recovery calculation, exhaust gas boiler. Scotch composite Boiler, Cochran exhaust gas and composite boiler, Spanner marine exhaust gas and Composite boiler. Forced Water Circulation boiler, Double evaporation Boilers.

UNIT II:

05Hrs

Boiler Mountings:

U 2.1 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 valves, Retractable type Soot blower.

U 2.2 Oil burning Process & Burners : 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.

UNIT- III:

Operation, Care & Maintenance

04Hrs

U 3.1 Refractory : Purposes of refractory, types of refractory and reasons for failure.

U 3.2 Operation, Care & Maintenance : Pre-commissioning procedures, steam raising and Operating procedures, Action in the event of shortage of water. Blowing down of boiler, Laying up a boiler; general maintenance, External and internal tube cleaning. Tube renewals, maintenance, inspection and survey of boilers.



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MARINE STEAM ENGINEERING

UNIT – IV:

- U 4.1 Layout of Plant :** General layout of plant & description of a modern geared steam turbine installation including auxiliaries in modern use. - 2 hrs
- U 4.2 Steam engines :** Multiple expansion marine reciprocating engines & steam turbines. Description of different types of steam turbines. - 2 hrs
- U 4.3 Constructional details :** Types of blades, method of fixing, solid built-up & drum rotor for impulse and reaction turbines, castings for HP and LP impulse and reaction turbines, diaphragms, nozzles, glands, carbon glands, labyrinth packing glands, main bearings and thrust bearings. - 6 hrs
- U 4.4 Reduction gears :** Reduction ratio, type of gear teeth, gear construction – various arrangement of marine gearing, gear defects, flexible coupling, quill shaft. - 3 hrs
- U 4.5 Lubrication of Turbines :** Suitable oils and their properties, lubrication of main bearings, thrust bearings and gears. Gravity and pressure lubrication – oil system and emergency lubrication arrangement. - 2 hrs
- U 4.6 Condensers :** Shapes and types of condensers, constructional details, location & method of securing, working principles, contraction and expansion allowances, leak test. Effect – change of temperature, circulating water quantity, change of main engine power, condenser surface. - 4 hrs



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UNIT-V:

U 5.1 Selection of materials : Materials used in various components like blades, rotors, castings, sealing glands, gears & their justification. -2 hrs

U 5.2 Operation and maintenance : Turbine drain system, turbine gland steam, 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 fault finding. - 8 hrs

U 5.3 Alignment checking : By bridge gauge and poker gauge, allowances for expansion, sliding foot, thrust bearing static and dynamic balancing. -2 hrs

Text Books:

- T1. Marine Boilers, G. T. H. Flanagan, 1st /2009, Elsevier.
- T2. Steam Turbine Theory & Practice, J. Kearton, 1964, Sir Issac Pitman & Sons.

References Books:

- R1. Marine Steam Boilers, J. H. Milton.
- R2. Running & Maintenance of Marine Machinery, I. M. E Publication.
- R3. Boiler Plant Instrumentation, Kent Gunn.
- R4. Boiler Control System, David Lindsley.



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SEMESTER-IV

REF NO: To be filled by CD office

MR20114:WORKSHOP TECHNOLOGY

Credits: 03

Teaching Scheme: Theory 03 Hrs/Week

Prerequisites: NIL

Objectives:- To impart knowledge to the students about, Common Workshop Tools, Measuring Techniques, Overhauling of various types of valves and Machine and Machine process tools.

UNIT-I: Common workshop Tools & Metal cutting Machines:

- U1.1 Common workshop Tools :** Description and uses of different types of Calipers, Straight edges, Try squares, Vices, Hammers, Chisels, Scrapers, Files, Drills, Reamers, Tapes, V-Blocks, Face plate, Marking blocks, Carpentry tools, pattern maker's tools, Smithy tools and Moulding tools. Application of hand tools as chisel, file and saw. - 6 hrs
- U1.2 Metal cutting Machines :** Kinematic analysis, specification, operation and inspection of the more important types of metal cutting machine tool including Centre lathes, Capstan and turret lathes, Automatic lathes, drilling and boring machines. Shaping slotting and planing machines, Milling and broaching machines. - 10 hrs

UNIT-II: Machine Process & Machine Tools & Abrasive process:

- U2.1 Machine Process & Machine Tools :** The geometry of cutting processes, Chip formation, Cutting forces, Stresses and power; Friction of chip on tool. Generation and dissipation of heat in cutting. Standard nomenclature for cutting tools. Cutting speeds and feeds, estimation of machining time. The fundamental Cutting process, geometrical control of the cutting edge Turning, Screw cutting and taper turning processes on Centre lathe. - 5 hrs
- U2.2 Abrasive process :** Grinding, honing and lapping by hand and machines. Shears and punches. Wood working machines. Principles of jigs and fixtures Standardization. - 5 hrs



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UNIT-III: Measuring Instruments & Inspection:

U3.1 Measuring Instruments & Inspection : Description and use of steel rule, Vernier's scale, Micro-meter, Dial gauge, Depth gauge, thread gauge, Feeler gauge, Wire gauge, pattern maker's scale, Taper gauge, snap gauge, Plug gauge, Optical methods of measurement, Principles of interchangeability, limit system, Use of limit gauge. - 6 hrs

UNIT-IV: Fitting and Overhauling & Safety Measures:

U4.1 Fitting and Overhauling : Types of packing and jointing materials and their uses, Design considerations and construction of various types of valves and cocks, Reducing valves for steam and air. Bedding of bearings, marking of engine parts for fitting, machining operations fitting of keys, cotters, Pipe work. - 8 hrs

U4.2 Safety Measures : Sources of danger and methods of protection. Types of guards and safety devices, Factory Act regulations. -4 hrs

UNIT-V: Welding:

U5.1 Welding: Welding Equipment & Applications, Electric welding (A.C & D.C.) spot welding. Gas welding. Soldering & Brazing. Different welding & Electrodes, Solders & Brazing Fluxes. Defects in welding
Safe working practices – Personal Protection Equipment - 10 hrs

Text Books:

- T1. Hazra & Choudhury Vol-I, 14th edition, Media Promoters Publishers Pvt. Ltd.
- T2. Hazra & Choudhury Vol-II, 12th edition, Media Promoters Publishers Pvt. Ltd.

REFERENCES :

- R1. Workshop Technology – Kurmi, S.Chand publication, 2009 edition.
- R2. Workshop Technology – W.A.J. Chapman (Vol I & II), 2010 edition, CBS editor.
- R3. H.M.T Production Technology – TATA McGraw Hill, New Delhi, 30th edition 2010.



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SEMESTER-IV

REF NO: To be filled by CD office

MR20115: MARINE HEAT ENGINE & AIR-CONDITIONING

Credits: 03

Teaching Scheme: Theory 03 Hrs/Week

Prerequisites: NIL

Objectives: To impart the knowledge on Steam turbines, power plants and nozzles and basic principles of marine refrigeration

UNIT –I:

- U1.1 Vapour Power cycles :** Carnot's cycle, Rankine Cycle, Modified Rankine Cycle, superheat cycle, reheat cycle, regenerative cycle, Binary vapour cycle and its effect on Thermal Efficiency, Steam machinery plants, combined steam & gas plant. - 10 hrs
- U1.2** Modified Rankine cycle for steam Engines, Hypothetical Indicator Diagram. Mean Effective pressure and work transfer, Diagram Factor. Indicated power, Specific steam consumption. Indicated Thermal Efficiency. Efficiency Ratio, Engine Efficiency, Energy *Balance*, Compound steam Engines, Missing quantity prob. Applied lems. - 5 hrs
- U1.3 Boiler Calculations;** Boiler Thermal Efficiency and Equivalent Evaporation of a Boiler; Basic Calculations on the effect of Condenser Leakage and Impure Feed, dissolved solids and scale in Boilers; Density of water and its control in Boilers & Evaporators. Basic calculations on performance of single-effect, multi-effect and Flash-type Evaporators; Applied Problems. Heat balance chart. - 3 hrs

UNIT-II:

- U2.1 Gas Turbine Plants:** Constant volume or Explosion cycle Gas Turbine plant, constant pressure cycle or Joule – Brayton cycle Gas turbine plant simple C-B-T cycle, condition for maximum work output and thermal efficiency in simple cycle. Methods of improvement of Thermal Efficiency and work ratio of Gas Turbine plants. C-B-T-H cycle, complex cycles, closed cycle operation of Gas turbine plants, their merits and demerits. - 10 hr

UNIT-III:

- U3.1 Axial Flow Compressor:** Principle of centrifugal compression and pressure rise in centrifugal compressor, change in Angular Momentum. Pre-whirl and pre-whirl vanes. Mach number at inlet to a centrifugal compressor, slip and slip factor, multi-stage centrifugal compressor. - 6 hrs



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UNIT-IV:

- U4.1 Refrigeration:-** Reversed Carnot cycle, Vapour compression cycles, Refrigerating Effect, Co-efficient of performance, cooling capacity, rating of a Refrigerating Plant, Methods of improving C.O.P. Use of Vapour Tables, Applied Problems. - 8hrs
- U4.2 Multi Refrigeration System:** Typical marine Refrigerating plants with multiple compression and Evaporator system. - 6 hrs

UNIT – V:

- U5.1 Air Conditioning System:** Air and Water vapour mixture, Specific Humidity, Relative Humidity, Dew point, unsaturated and saturated Air. Study of psychrometric chart, numerical based on psychrometry Principle of Air conditioning, psychrometric properties of air comfort conditions, control of humidity - 6 hrs

Text Books:

- T1. Thermal Engineering by R.K.Rajput, 2nd revised edition 1999.
T2. A Text book of Refrigeration & Air Conditioning by R.S.Khurmi & J.K.Gupta, 5th Edition.
T3. Steam & Gas Turbine by R.Yadav, 6th Edition.

References Books:

- R1. Heat engine, P. L. Ballaney
R2. Thermodynamics applied to Heat engines, E. H. Lewitt
R3. Applied Thermodynamics for Engineering Technologists, T.D.Eastop & A. McConkey, 5th /2004, Pearson.
R4. Applied Thermodynamics, J. B. O. Sneed & S. V. Karr.
R5. Tanker Safety Guide Liquefied Gas, International Chamber of Shipping



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SEMESTER-IV

REF NO: To be filled by CD office

MR20116: STRENGTH OF MATERIAL-II

Credits: 03

Teaching Scheme: Theory 03 Hrs/Week

Prerequisites: NIL

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: Compound Stress and Strain:

- U1.1 Compound Stress and Strain :** Stresses on an Oblique section, General two dimensional stress system, Materials subjected to Direct & Shear Stresses, Principal plane & Principal Stresses. Strain on an oblique section.
- U1.2** Determination of principal strains. Principal strains in 3-dimensions. Principal Stresses determined from Principal Strains.
- U1.3** Mohr's Diagrams for Stress, Stress and Strain Rosette. Combined bending and Twisting, Equivalent bending moment and Torsion, shear, bending and torsion, Theories of failure.

- 10 hrs

UNIT-II: Deflection of Beams:

- U2.1 Deflection of Beams :** Strain energy due to bending. Application of impact loading. Deflection by integration,
- U2.2** Macaulay's Method.
- U2.3** Moment area Methods of deflection co-efficients. Deflection due to shear, Deflection by graphical method. Applied problems.

- 10 hrs



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UNIT-III: Built-in and continuous beams:

- U3.1 Built-in and continuous beams :** Moment-area method, built-in beam with central concentrated load, built-in beam with uniformly distributed load, with load not at center, Macaulay's method,
U3.2 Continuous beam, Clapeyron's three moment theorem. Applied problems.
- 10 hrs

UNIT-IV: Thin Curved bar:

- U4.1 Thin Curved bar :** Strain energy due to bending Castigliano's theorem, and its application to curved bars, strain energy due to twisting. Applied problems. - 8 hrs
- U4.2 Thick Cylinders :** Thick cylinders, Lamé's theory, compound cylinders, solid shaft subjected to radial pressure, shrinkage allowance & application. Applied problems. - 7 hrs

UNIT-V: Struts:

- U5.1 Struts :** Euler's theory and Euler's buckling load. Struts with both ends pin joined, both ends fixed, one end fixed and one end free, one end hinged. Pin joined strut with eccentric load, Rankine-Gordon Formula. Applied problems. - 9 hrs

Text Books:

- T1. Strength of Materials by Er. R.K.Rajput, S.Chand Publication, 5th revised edition 2010.

References Books:

- R1. Strength of Materials, G. H. Ryder.
R2. Strength of Materials, Stephen Timoshenko.



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SEMESTER-IV

REF NO: To be filled by CD office

MR21117:MECHANICS OF MACHINES-II

Credits:03

Teaching Scheme: Theory 03 Hrs/Week

Prerequisites: NIL

OBJECTIVE: To impart the knowledge to the student on Balancing, Vibrations : Torsional, forced and transverse.

Course Details:

UNIT 1:

- U1.1 Dynamics of Rotation :** Dynamics of rotation particle and rotating bodies, velocity and acceleration in terms of path variables, cylindrical co-ordinates forces acting on a body having known motion; Torque equation; Work done by application of torque; Kinetic energy of rotation. Total Kinetic energy of a rolling wheel. - 4 hrs
- U1.2** Balancing of masses rotating in different planes, dynamic forces at bearings; Primary and secondary balance of multi-cylinder in-line Engines and Configurations. Primary and secondary balance of multi-cylinder V - type Engines and Configurations. - 8 hrs
- U1.3 Vibration :**Free Harmonic Vibrations, Linear motion of an elastic system, Angular motion of an elastic system. Differential equation of motion. Free Vibration of springs in series and parallel. Simple and Compound pendulums. Single and two degrees of freedom. - 8 hrs

UNIT 2:

- U2.1. Torsional vibrations :** Single rotor system, rotor at end and rotor in the middle. Effect of inertia of Shaft, Two rotor system, rotors at both ends and rotors at one end. Three rotor and multirotor system. Torsionally equivalent shafts, Geared system. - 5 hrs
- U2.2. Forced Vibrations :** Forced Linear and angular Vibrations, Periodic force transmitted to support, Periodic movement of the support. - 5 hrs

Unit 3: Transverse vibrations of beams, Damped Vibrations



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U3.1. Transverse vibrations of beams : Single Concentrated load, effect of the mass of the beam, Energy method-several concentrated Loads uniformly distributed load, Dunkerley's empirical method for several Concentrated loads. - 6 hrs

U3.2. Whirling of shafts-Whirling of shafts, critical speed, effect of slope of the disc, effect of end thrust. - 5 hrs

UNIT 4:

U4.1. Damped Vibrations : Idea of Viscous and Coulomb damping, Linear and angular vibrations with Viscous damping, Forced damped linear and angular Vibrations, Periodic movement of support. - 5 hrs

UNIT 5:

U5.1. Forced Damped Vibration : Differential equation of motion, amplitude, frequency & their applications. - 8 hrs

Text Books:

T1. Theory of Machines by R.S. Khurmi & J.K.Gupta, S.Chand publication, 1st multi color revised & updated edition 2005.

REFERENCES :

- R1. Advanced Mechanics of Machines, J. Hannah & R.C. Stephens, 8th/1978, James Munro & company
- R2. Theory of Machines, P. L. Ballaney, 2010, Khanna.
- R3. Theory of Machines, R.K. Bansal, R. S.S. Bran, 5th edition, Laxmi publication
- R4. Engineering Mechanics, S. Timoshenko & D. H. Young, 4th /2012, TMH.

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MR20318: ELEMENTARY NAVIGATION & SEAMANSHIP

Credit: 01

Lab/ Sessional- 02 hrs/ Week

- **Seamen & their duties :** Ship's Department, General ship knowledge and nautical terms like Poop-Deck, Forecastle, Bridge. - 2 hrs

- **Navigational Lights and Signals :** Port and Starboard, forward and aft mast lights, Colours and Location. Look out, Precautions and Bad weather, Flags used on ships, Flag etiquette, Morse and Semaphore signaling, Sound signals. - 4 hrs

- **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 its use. - 2 hrs

- **Anchors :** Their use, Dropping and Weighing anchor, Cable stopper. - 2 hrs

- **Navigation :** General knowledge of principal Stars. Sextant, Navigation Compasses, Echo Sounder, Log and uses, barometer and weather classification, G.M.T. and Zonal time, wireless Navigational Instruments, radar satellite-Navigation. - 6 hrs

- **Life boats & Life rafts :** 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. Rescue boat, immersion suit, Thermal Protective Aid - 8 hrs

- **Abandon Ship :** Manning of lifeboat and life raft. Muster list, Radio and Alarm signals, Distress signal (S.O.S.). Distress Calls time and Radio frequency. Pyro-techniques. - 8 hrs



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- **Survival at Sea :** Survival difficulties and factors, equipment available, Duties of crew members, Initial action on boarding, Maintaining the craft. - 4 hrs
- **Introduction of :**
MARPOL Convention and its annexes, Regulatory Control towards environmental pollution at sea. Familiarisation with SOLAS, STCW conventions , ISPS code and other maritime codes & conventions, ill effects of cargo on human and environment. - 8 hrs

- Knots, bends and hitches, Ropes splice, Donning of Life jackets, Life boat drills. Lowering & hoisting of Life boats (model). - 8 hrs
- Rescue: Method of Helicopter rescue, evaporation
- Method of helicopter rescue, evacuation - 2 hrs



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SEMESTER-IV

REF NO: To be filled by CD office

MR21319: HEAT & BOILER CHEMICAL LABORATORY

Credit: 01

Lab/ Sessional- 02 hrs/ Week

BOILER CHEMISTRY

1. To determine hardness content of the sample of boiler water in P.P.M. in terms of CaCO_3
2. To determine Chloride Content of the sample of water in P.P.M. in terms of CaCO_3
3. To determine Alkalinity due to Phenolphthaline, total Alkalinity and Caustic Alkalinity of the sample of water (in P.P.M)
4. To determine Phosphate Content of the sample of water
5. To determine dissolved Oxygen content of the sample of water.
6. To determine sulphate content of given sample of water
7. To determine Ph-value of the given sample of water.
8. To determine total-dissolved solids, turbidity of a sample of water.
9. To determine Hydrazine content of boiler water .
10. Study sludges and scale deposit – Silica, volatile and non-volatile suspended matter.
11. Boiler water tests and kits as found in latest types of ships

FUEL & LUBRICANT CHEMISTRY

1. To determine Absolute Viscosity and Kinematic Viscosity of Heavy oil, Diesel oil, Fresh Lubricating Oil & Used Lubricating oil by Red Wood Viscometer.
2. To determine the Flash Point of a given sample of Fuel & Lubricating oil.
3. To determine water content of used Lubricating oil .
4. Conduct spot test for L.O and analyse result .
5. To determine the percentage of CO_2 , CO and Oxygen in the flue gases.
6. To determine the Calorific value of the fuel with the help of a Bomb Calorimeter .



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HEAT TRANSFER EXPERIMENTS

1. To determine the Thermal Conductivity of good conductors.
2. To determine the Thermal Conductivity of Insulating materials.
3. Heat transfer Through Fins or extended surface.
4. Heat Transfer through Forced Convection.

Industrial Chemistry; fundamental; acidity /alkalinity, corrosion



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SEMESTER-III

REF NO: To be filled by CD office

MR20307 : WORKSHOP PRACTICAL

Credits: 02

Lab/ Sessional- 03 hrs/ week

Study of Workshop layout;

Steam & Exhaust Line Tracing;

Feed & condensate Line Tracing for the Steam Engine Plant;

Cooling Water & Fuel Line Tracing for the Steam Engine Plant;

Smoke tube Boiler Familiarisation;

Globe Valve Overhauling;

Sluice Valve Overhauling;

Non-return Globe Valve Overhauling;

2 Way/ 3 Way Cock Overhauling;

Shaft Key Making

Thread cutting by Taps & Die;

Thread cutting by Lathe Machine.

Other important “jobs” that may be introduced as per current trend, to keep student abreast with latest.