3rd Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMEE4-301	Strength of Materials- I	3	1	0	40	60	100	4
BMEE4-302	Theory of Machines-I	3	1	0	40	60	100	4
BMEE4-303	Machine Drawing	1	0	4	40	60	100	3
BMEE4-304	Applied Thermodynamics -I	3	1	0	40	60	100	4
BMEE4-305	Workshop Technology	3	1	0	40	60	100	4
BMEE4-306	Engineering Materials & Metallurgy	3	0	0	40	60	100	3
BMEE4-307	Engineering Materials & Metallurgy Lab.	0	0	2	60	40	100	1
BMEE4-308	Strength of Materials Lab.	0	0	2	60	40	100	1
BMEE4-309	Applied Thermodynamics Lab.	0	0	2	60	40	100	1
BMEE4-310	Training-I#	0	0	4	60	40	100	2
Total		**16**	**4**	**10**	**500**	**500**	**1000**	**27**

#Training will be imparted in the Institution at the end of 2nd semester for Four (04) weeks duration (Minimum 36 hours per week). Industrial tour will also form part of this training.

4th Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMEE4-411	Strength of Materials- II	3	1	0	40	60	100	4
BMEE4-412	Theory of Machines-II	3	1	0	40	60	100	4
BMEE4-413	Fluid Mechanics	3	0	0	40	60	100	3
BMEE4-414	Applied Thermodynamics - II	3	1	0	40	60	100	4
BMEE4-415	Basic Ship structure & Design-I	3	0	0	40	60	100	3
BMEE4-416	Fluid Mechanics Lab.	0	0	2	60	40	100	1
BMEE4-417	Workshop Technology Lab.	0	0	2	60	40	100	1
BMEE4-418	Theory of Machines Lab.	0	0	2	60	40	100	1
Total		**15**	**3**	**6**	**380**	**420**	**800**	**21**

5th Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMEE4-519	Marine Auxiliary Machine	3	1	0	40	60	100	4
BMEE4-520	Ship Construction	3	1	0	40	60	100	4
BMEE4-521	Electrical Machines	3	1	0	40	60	100	4
BMEE4-522	Mechanics of Machines-I	3	1	0	40	60	100	4
BMEE4-523	Electronics	3	1	0	40	60	100	4
BMEE4-524	Workshop Practical (Marine)	0	0	2	60	40	100	1
BMEE4-525	Electrical Engg., Electronics & Microprocessor Lab.	0	0	2	60	40	100	1
BMEE4-526	Electrical Machine Lab.	0	0	2	60	40	100	1
BMEE4-527	Computer Aided Marine Engineering Design and Analysis Lab.	0	0	2	60	40	100	1
BMEE4-528	Training*	0	0	4	60	40	100	2
Total		**15**	**5**	**8**	**500**	**500**	**1000**	**26**

***The marks will be awarded on the basis of 06 weeks industrial training conducted after 4th semester**

6th Semester		Contact Hrs.			Marks			Credits
Code	**Course**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMEE4-629	Ship Operation Management	3	0	0	40	60	100	3
BMEE4-630	Design of Machines-I	3	1	0	40	60	100	4
BMEE4-631	Mechanics of Machines-II	3	1	0	40	60	100	4
BMEE4-632	Fluid Machinery	3	1	0	40	60	100	4
BMEE4-633	Naval Architecture	3	0	0	40	60	100	3
BMEE4-634	Marine Boilers Workshop	0	0	2	60	40	100	1
BMEE4-635	Fluid Machinery Lab.	0	0	2	60	40	100	1
BMEE4-636	Fire Fighting, Controls and Simulators Lab.	0	0	2	60	40	100	1
BMEE4-637	Material Testing Lab.	0	0	2	60	40	100	1
Total		**16**	**4**	**4**	**360**	**440**	**800**	**22**

Total Credits = 25 + 25 + 27 + 21 + 26 + 22 + 17 + 17 = 180

STRENGTH OF MATERIALS – I

Subject Code: BMEE4-301 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Course Objectives and Expected Outcomes: The course is designed to understand the basic concepts of stress, strain and their variations due to different type of loading. The concept of Mechanical properties, Poisson's ratio, bulk modulus, elastic modulus, modulus of rigidity, combined stress and strain, principal stress, principal plane, bending moment and shear force in beam under various loading conditions, understanding of torsional shear stress in solid and hollow shaft; principal and maximum shear stress in a circular shaft subjected to combined stresses, stresses in struts and columns subjected to axial load; bending stress, slope and deflection under different loading and supporting conditions. After the study of this course, a student is expected to analyze different stresses, strains and deflection for designing a simple mechanical element under various loading conditions.

Unit–I

Simple, Compound Stresses and Strains: Stress and Strain and their types, Hook's law, longitudinal and lateral strain, Poisson's ratio, stress-strain diagram for ductile and brittle materials, extension of a bar due to without and with self-weight, bar of uniform strength, stress in a bar, elastic constants and their significance, relation between elastic constants, Young's modulus of elasticity, modulus of rigidity and bulk modulus. Temperature stress and strain calculation due to axial load and variation of temperature in single and compound bars. Two dimensional stress system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress ellipse of stress and their applications. Generalized Hook's law, principal stresses related to principal strains.

Unit–II

Bending Moment (B.M.) and Shear Force (S.F.) Diagrams: S.F. and B.M. definitions; relation between load, shear force and bending moment; B.M and S.F diagrams for cantilevers, simply supported beams with or without overhangs, and calculation of maximum B.M. and S.F. and the point of contra flexure under the following loads:

a) Concentrated loads
b) Uniformity distributed loads over the whole span or part of span
c) Combination of concentrated and uniformly distributed load
d) Uniformly varying loads
e) Application of moments

Unit–III

Bending Stresses in Beams: Assumptions in the simple bending theory; derivation of formula and its application to beams of rectangular, circular and channel, I and T- sections. Combined direct and bending stresses in afore-mentioned sections, composite / flitched beams.

Torsion: Derivation of torsion equation and its assumptions and its application to the hollow and solid circular shafts. Torsional rigidity, combined torsion and bending of circular shafts; principal stress and maximum shear stresses under combined loading of bending and torsion.

Unit–IV

Columns and Struts: Introduction, failure of columns, Euler's formula, Rankine-Gordon's formula, Johnson's empirical formula for axially loaded columns and their applications.

Slope and Deflection: Relationship between moment, slope and deflection; method of integration, Macaulay's method, moment area method and use of these methods to calculate slope and deflection for the following:

a) Cantilevers
b) Simply supported beams with or without overhang
c) Under concentrated loads, uniformly distributed loads or combination of concentrated & uniformly distributed loads.

Recommended Books

1. D.S. Bedi, 'Strength of Materials', Khanna Book Publishing Company.
2. E.P. Popov, 'Mechanics of Materials', (SI Version), Prentice Hall India.
3. R.S Lehri and A.S. Lehri, 'Strength of Materials', Kataria and Sons.
4. S.S. Rattan, 'Strength of Materials', Tata McGraw Hill.
5. Timoshenko and Young, 'Elements of Strength of Materials', East West Press.
6. James M. Gere and Barry J. Goodno, 'Strength of Materials', Cengage Learning.

THEORY OF MACHINES-I

Subject Code: BMEE4-302 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Course Objectives &Expected Outcomes: The course under Theory of Machine-I has been designed to cover the basic concepts of kinematic aspects of mechanical machines and major parts used in running of the machines. The students will understand the basic concepts of machines and able to understand constructional and working features of important machine elements. The students should be able to understand various parts involved in kinematics of machines for different applications. The students shall also be able to understand requirements of basic machine parts which would help them to understand the design aspects of the machine parts.

Unit–I

Basic Concept of Machines: Link, Mechanism, Kinematic Pair and Kinematic Chain, Principles of Inversion, Inversion of a Four Bar Chain, Slider-Crank-Chain and Double Slider-Crank-Chain. Graphical and Analytical methods for finding: Displacement, Velocity, and Acceleration of mechanisms (including Corliolis Components).

Lower and Higher Pairs: Universal Joint, Calculation of maximum Torque, Steering Mechanisms including Ackerman and Davis approximate steering mechanism, Engine Indicator, Pentograph, Straight Line Mechanisms, Introduction to Higher Pairs with Examples.

Unit–II

Belts, Ropes and Chains: Material & Types of belt, Flat and V-belts, Rope & Chain Drives, Idle Pulley, Intermediate or Counter Shaft Pulley, Angle and Right Angle Drive, Quarter Turn Drive, Velocity Ratio, Crowning of Pulley, Loose and fast pulley, stepped or cone pulleys, ratio of tension on tight and slack side of belts, Length of belt, Power transmitted by belts including consideration of Creep and Slip, Centrifugal Tensions and its effect on power transmission.

Unit–III

Cams: Types of cams and follower, definitions of terms connected with cams. Displacement, velocity and acceleration diagrams for cam followers. Analytical and Graphical design of cam profiles with various motions (SHM, uniform velocity, uniform acceleration and retardation, cycloidal Motion). Analysis of follower motion for circular, convex and tangent cam profiles.

Friction Devices: Concepts of friction and wear related to bearing and clutches. Types of brakes function of brakes. Braking of front and rear tires of a vehicle. Determination of braking capacity, Types of dynamometers, (absorption, and transmission).

Unit –IV

Flywheels: Turning moment and crank effort diagrams for reciprocating machines' Fluctuations of speed, coefficient of fluctuation of speed and energy, Determination of mass and dimensions of flywheel used for engines and punching machines.

Governors: Function, types and characteristics of governors. Watt, Porter and Proell governors. Hartnell and Willson-Hartnell spring loaded governors. Numerical problems related to these governors. Sensitivity, stability, isochronisms and hunting of governors. Governor effort and power, controlling force curve, effect of sleeve friction.

Recommended Books

1. S.S. Rattan, 'Theory of Machines', Tata McGraw Hill, New Delhi.
2. Jagdish Lal, 'Theory of Mechanisms & Machines', Metropolitan Book Co.
3. Thomas Beven, 'Theory of Machines', Longman's Green & Co., London.
4. W.G. Green, 'Theory of Machines', Blackie & Sons, London
5. V.P. Singh, 'Theory of Machines', Dhanpat Rai.

APPLIED THERMODYNAMICS-I

Subject Code: BMEE4-304 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Course Objectives and Expected Outcomes: This course is designed for comprehensive study of combustion and thermal aspects in internal combustion engines, steam power plants and its allied components. This will enable the students to understand combustion phenomenon and thermal analysis of steam power plant components. The students will be able to identify, track and solve various combustion problems and evaluate theoretically the performance of various components involved in steam power plants and internal combustion engines.

Unit–I

Combustion: Combustion Equations (Stoichiometric and non- Stoichiometric). Combustion problems in Boilers and IC engines/Calculations of air fuel ratio, Analysis of products of combustion, Conversion of volumetric analysis into gravimetric analysis and vice-versa, Actual weight of air supplied, Use of mols, for solution of combustion problems, Heat of formation, Enthalpy of formation, Enthalpy of reaction, Adiabatic flame temperature.

IC Engines Introduction: Actual Engine Indicator diagrams and valve-timing diagrams for two stroke and four stroke S.I. and C.I. Engines; Construction and Working Principle of Wankel rotary engine; Principle of simple carburetor, Injection systems in Diesel and Petrol Engines (Direct Injection, MPFI in SI and CI Engines, respectively). Essential requirements for Petrol and Diesel Fuels. Theory of combustion in SI and CI Engines; Various stages of combustion; Pressure time/crank- Angle diagrams; Various phenomenon such as turbulence, squish and swirl, dissociation, pre-ignition/auto- ignition, and after burning etc.; Theory of knocking (i.e., detonation) in SI and CI Engines; Effect of engine variables on the Delay Period in SI and CI engines; Effect of various parameters on knock in SI and CI Engines; Methods employed to reduce knock in SI and CI Engines; Octane and Cetane rating of fuels; Knockmeter; Dopes and inhibitors; Performance curves/maps of SI and CI Engines; Effect of knocking on engine performance; Effect of compression ratio and air-fuel ratio on power and efficiency of engine; Variation of engine power with altitude; Supercharging and turbo charging of SI and CI Engines; Advantages and applications of supercharging; Emissions from SI and CI Engines and methods to reduce/control them. Logarithmic plotting of PV-diagrams. High speed Engine Indicators.

Unit–II

Properties of Steam: Pure substance; Steam and its formation at constant pressure: wet, dry, saturated and super-heated steam; Sensible heat(enthalpy), latent heat and total heat (enthalpy) of steam; dryness fraction and its determination; degree of superheat and degree of sub-cool; Entropy and internal energy of steam; Use of Steam Tables and Mollier Chart; Basic thermodynamic processes with steam (isochoric, isobaric, isothermal, isentropic and adiabatic process) and their representation on T-S Chart and Mollier Charts (h-s diagrams). Significance of Mollier Charts.

Steam Generators: Definition: Classification and Applications of Steam Generators; Working and constructional details of fire-tube and water-tube boilers: (Cochran, Lancashire, Babcock and Wilcox boilers); Merits and demerits of fire-tube and water-tube boilers; Modern high pressure boilers (Benson boiler, La Mont boiler) and Super critical boilers (Once through boilers-Tower type); Advantages of forced circulation; Description of boiler mountings and accessories: Different types of Safety Valves, Water level indicator, pressure gauge, Fusible plug, Feed pump, Feed Check Valve, Blow-off Cock, Steam Stop-Valve, Economiser, Super-heater; Air pre-heater and Steam accumulators; Boiler performance: equivalent evaporation, boiler efficiency, boiler trial and heat balance; Types of draught and Calculation of chimney height.

Unit–III

Vapour Power Cycle: Carnot Cycle and its limitations; Rankine steam power cycle, Ideal and actual; Mean temperature of heat addition; Effect of pressure, temperature and vacuum on Rankine Efficiency; Rankine Cycle Efficiency and methods of improving Rankine efficiency: Reheat cycle, Bleeding (feed-water-heating), Regenerative Cycle, Combined reheat-regenerative cycle; Ideal working fluid; Binary vapour cycle, Combined power and heating cycles.

Steam Nozzles: Definition, types and utility of nozzles; Flow of steam through nozzles; Condition for maximum discharge through nozzle; Critical pressure ratio, its significance and its effect on discharge; Area of throat and at exit for maximum discharge; Effect of friction; Nozzle efficiency; Convergent and convergent-divergent nozzles; Calculation of Nozzle dimensions (length and diameters of throat and exit); Supersaturated (or metastable) flow through nozzle.

Steam Turbines: Introduction; Classification; Impulse versus Reaction turbines. Simple impulse turbine: pressure and velocity variation, Velocity diagrams/triangles; Combined velocity diagram/triangle and calculations for force, axial thrust, work, power, blade efficiency, stage efficiency, maximum work and maximum efficiency, effect of blade friction on velocity diagram, effect of speed ratio on blade efficiency, condition for axial discharge;

Unit–IV

DeLaval Turbine: Compounding of impulse turbines: purpose, types and pressure and velocity variation, velocity diagrams/triangles, combined velocity diagram/triangle and calculations for force, axial thrust, work, power, blade efficiency, stage efficiency, overall efficiency and relative efficiency;

Impulse-Reaction Turbine: pressure and velocity variation, velocity diagrams/triangles, Degree of reaction, combined velocity diagram/triangle and calculations for force, axial thrust, work, power, blade efficiency, stage efficiency, overall efficiency and relative efficiency, maximum work and maximum efficiency; Calculations of blade height;

Multistaging: Overall efficiency and relative efficiency; Reheating, Reheat factor and condition curve; Losses in steam turbines; Back pressure and extraction turbines; Co-generation; Economic assessment; Governing of steam turbines.

Steam Condensers: Function; Elements of condensing unit; Types of condensers; Dalton's law of partial pressures applied to the condenser problems; Condenser and vacuum efficiencies; Cooling water calculations; Effect of air leakage; Method to check and prevent air infiltration; Description of air pump and calculation of its capacity; Cooling towers: function, types and their operation.

Recommended Books

1. R. Yadav, Sanjay and Rajay, 'Applied Thermodynamics', Central Publishing House.
2. J.S. Rajadurai, 'Thermodynamics and Thermal Engineering', New Age International (P) Ltd. Publishers.
3. D.S. Kumar and V.P. Vasandani, 'Heat Engineering', Metropolitan Book Co. Pvt. Ltd.
4. K. Soman, 'Thermal Engineering', PHI Learning Pvt. Ltd.
5. G. Rogers and Y. Mayhew, 'Engineering Thermodynamics', Pearson.
6. W.A.J. Keartan, 'Steam Turbine: Theory and Practice', ELBS Series.
7. Heywood, 'Fundamentals of IC Engines', McGraw Hill.
8. V. Ganeshan, 'Internal Combustion Engines', Tata McGraw Hill.

WORKSHOP TECHNOLOGY

Subject Code: BMEE4-305 **L T P C** **Contact Hrs.: 45**
3 1 0 4

UNIT-I

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.

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 planning machines, Milling and broaching machines.

UNIT-II

3. 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 ii 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.

4. Abrasive Process: Grinding, honing and lapping by hand and machines. Shears and punches. Wood working machines. Principles of jigs and fixtures Standardization.

UNIT-III

5. 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 interchange ability, limit system, Use of limit gauge.

6. 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.

UNIT-IV

7. Safety Measures: Sources of danger and methods of protection. Types of guards and safety devices, Factory Act regulations.

8. 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

Recommended Books

1. A. Manna, 'A Textbook of Manufacturing Science and Technology', PHI Publishers.
2. H.S. Shan, 'Manufacturing Processes', Vol.-I, Pearson Publishers.
3. P.N. Rao, 'Manufacturing Technology, Foundry, Forming & Welding', Tata McGraw Hill.
4. R.S. Parmar, 'Welding Engineering & Technology', Khanna Publishers.
5. Serope Kalpakjian and Steven R. Schmid, 'Manufacturing Engineering and Technology', Pearson Publishers.

ENGINEERING MATERIALS & METALLURGY

Subject Code: BMEE4-306 **L T P C** **Contact Hrs.: 37**
3 0 0 3

Course Objectives and Outcomes: This course is designed to develop fundamental concepts of crystallography, phase transformation and heat treatment processes. The students will learn the atomic structure of metals, imperfections, diffusion mechanisms and theories of plastic deformation. They will also understand equilibrium diagrams, time-temperature transformation curves and heat treatment processes. Upon completion of the course, the students will be able to understand the concepts of crystal structure, microstructure and deformation. They will also be able to understand the phase diagrams which are useful for design and control of heat treating processes.

Unit–I

Crystallography: Atomic structure of metals, atomic bonding in solids, crystal structures, crystal lattice of body centered cubic, face centered cubic, closed packed hexagonal; crystalline and non-crystalline materials; crystallographic notation of atomic planes; polymorphism and allotropy; imperfection in solids: theoretical yield strength, point defects, line defects and dislocations, interfacial defects, bulk or volume defects. Diffusion: diffusion mechanisms, steady-state and non-steady state diffusion, factors affecting diffusion. Theories of plastic deformation, recovery, recrystallization.

Unit–II

Phase Transformation: General principles of phase transformation in alloys, phase rule and equilibrium diagrams, Equilibrium diagrams of Binary systems. Iron carbon equilibrium diagram and various phase transformations. Time temperature transformation curves (TTT curves): fundamentals, construction and applications.

Unit–III

Heat Treatment: Principles and applications. Processes viz. annealing, normalizing, hardening, tempering. Surface hardening of steels: Principles of induction and oxyacetylene flame hardening. Procedure for carburizing, nitriding and cyaniding. Harden-ability: determination of harden-ability. Jominy end-quench test. Defects due to heat treatment and their remedies; effects produced by alloying elements. Composition of alloy steels.

Unit–IV

Ferrous Metals and Their Alloys: Introduction, classification, composition of alloys, effect of alloying elements (Si, Mn, Ni, Cr, Mo, W, Al) on the structures and properties of steel.

Recommended Books

1. B. Zakharov, 'Heat Treatment of Metals', University Press.
2. T. Goel and R.S. Walia, 'Engineering Materials & Metallurgy'.
3. Sidney H. Avner, 'Introduction to Physical Metallurgy', Tata McGraw Hill.

4. V. Raghavan, 'Physical Metallurgy: Principles and Practice', PHI Learning.
5. Y. Lakhin, 'Engineering Physical Metallurgy', Mir Publishers.

ENGINEERING MATERIALS & METALLURGY LAB.

Subject Code: BMEE4-307 **L T P C**
0 0 2 1

EXPERIMENTS

1. Preparation of models/charts related to atomic/crystal structure of metals.
2. Annealing the steel specimen and study the effect of annealing time and temperature on hardness of steel.
3. Hardening the steel specimen and study the effect of quenching medium on hardness of steel.
4. Practice of specimen preparation (cutting, mounting, polishing, etching) of mild steel, aluminium and hardened steel specimens.
5. Study of the microstructure of prepared specimens of mild steel, Aluminium and hardened steel.
6. Identification of ferrite and pearlite constituents in given specimen of mild steel.
7. Determination of hardenability of steel by Jominy End Quench Test.

STRENGTH OF MATERIALS LAB

Subject Code: BMEE4-308 **L T P C**
0 0 2 1

EXPERIMENTS

1. To perform tensile test in ductile and brittle materials and to draw stress-strain curve and to determine various mechanical properties.
2. To perform compression test on Cast Iron.
3. To perform any one hardness tests (Rockwell, Brinell & Vicker's test).
4. To perform impact test to determine impact strength.
5. To perform torsion test and to determine various mechanical properties.
6. To perform Fatigue test on circular test piece.
7. To perform bending test on beam and to determine the Young's modulus and modulus of rupture.
8. Determination of Bucking loads of long columns with different end conditions.
9. To evaluate the stiffness and modulus of rigidity of helical coil spring.

APPLIED THERMODYNAMICS LAB.

Subject Code: BMEE4-309 **L T P C**
0 0 2 1

EXPERIMENTS

1. Study of construction and operation of 2 stroke and 4 stroke Petrol and Diesel engines using actual engines or models.
2. To plot actual valve timing diagram of a 4 stroke petrol and diesel engines and study its impact on the performance of engine.
3. Study of working, construction, mountings and accessories of various types of boilers.
4. To perform a boiler trial to estimate equivalent evaporation and efficiency of a fire tube/ water tube boiler.

5. Determination of dryness fraction of steam and estimation of brake power, Rankine efficiency, relative efficiency, generator efficiency, and overall efficiency of an impulse steam turbine and to plot a Willian's line.
6. Determine the brake power, indicated power, friction power and mechanical efficiency of a multi cylinder petrol engine running at constant speed (Morse Test).
7. Performance testing of a diesel engine from no load to full load (at constant speed) for a single cylinder/ multi- cylinder engine in terms of brake power, indicated power, mechanical efficiency and specific fuel consumption and to measure the smoke density. Draw/obtain power consumption and exhaust emission curves. Also make the heat balance sheet.
8. Performance testing of a petrol engine from no load to full load (at constant speed) for a single cylinder/ multi- cylinder engine in terms of brake power, indicated power, mechanical efficiency and specific fuel consumption and to measure the exhaust emissions. Also draw/obtain power consumption and exhaust emission curves.
9. Study of construction and operation of various types of steam condensers and cooling towers.

STRENGTH OF MATERIALS-II

Subject Code: BMEE4-411 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Course Objectives and Outcomes: The course is designed to understand the concepts of strain energy, resilience, stress under impact loading; shear stress distribution in a beam of various cross sections; stress in curved cross sections; stresses in helical, spiral and leaf springs; stress and strain analysis of thin, thick cylinder and spheres subjected to internal pressure; and various failure theories. The outcome of the course is to enhance deep and vigorous understanding of stress analysis in various machine elements, so that a student can properly analyze and design a mechanical member from the strength point of view under various conditions.

Unit–I

Strain Energy: Introduction to strain energy, energy of dilation and distortion. Resilience, stress due to suddenly applied loads. Castigliano's and Maxwell's theorem of reciprocal deflection.

Theories of Failure: Maximum principal stress theory, maximum shear stress theory, maximum principal strain theory, total strain energy theory, shear strain energy theory. Graphical representation and derivation of equation for these theories and their application to problems related to two dimensional stress systems.

Unit–II

Springs: Open and closed coiled helical springs under the action of axial load and/or couple. Flat spiral springs- derivation of formula for strain energy, maximum stress and rotation. Leaf spring deflection and bending stresses.

Thin cylinders and Spheres: Calculation of Hoop stress, longitudinal stress in a cylinder, effects of joints, change in diameter, length and internal volume. Principal stresses in sphere, change in diameter and internal volume.

Unit–III

Thick Cylinders: Derivation of Lame's equations, calculation of radial, longitudinal and hoop stresses and strains due to internal pressure in thick cylinders, compound cylinders, hub shrunk on solid shafts, shrinkage allowance and shrinkage stress.

Bending of Curved Beams: Calculation of stresses in cranes or chain hooks, rings of circular and trapezoidal section, and chain links with straight sides.

Unit–IV

Shear Stresses in Beams: Shear stress distribution in rectangular, circular, I, T and channel section; built up beams. Shear centre and its importance.

Rotational Discs: Stresses in rotating discs and rims of uniform thickness; disc of uniform strength.

Recommended Books

1. D.S. Bedi, 'Strength of Materials', Khanna Book Publishing Company.
2. G.H. Ryder, 'Strength of Materials', Macmillan India Ltd.
3. R.S. Lehri and A.S. Lehri, 'Strength of Materials', Vol.-2, S.K. Kataria and Sons.
4. S.S. Rattan, 'Strength of Materials', Tata McGraw Hills.
5. Timoshenko and Gere, 'Mechanics of Materials', CBS Publishers.

THEORY OF MACHINES – II

Subject Code: BMEE4-412 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Course Objectives & Outcomes: The students will understand the basic concepts of inertia forces & couples applied to reciprocating parts of a machine. Students should be able to understand balancing of masses and design of gears & gear trains. They will also gain knowledge of kinematic synthesis and different applications of gyroscopic effect.

Unit–I

Static Force Analysis: Concept of force and couple, free body diagram, condition of equilibrium, static equilibrium of mechanism, methods of static force analysis of simple mechanisms. Power transmission elements, considerations of frictional forces.

Dynamic Force Analysis: Determination of forces and couples for a crank, inertia of reciprocating parts, dynamically equivalent system, analytical and graphical method, inertia force analysis of basic engine mechanism, torque required to overcome inertia and gravitational force of a four bar linkage.

Unit–II

Balancing: Necessity of balancing, static and dynamic balancing, balancing of single and multiple rotating masses, partial unbalanced primary force in an engine, balancing of reciprocating masses, and condition of balance in multi cylinder in line V-engines, concept of direct and reverse crank, balancing of machines, rotors, reversible rotors.

Unit–III

Gears: Toothed gears, types of toothed gears and its terminology. Path of contact, arc of contact, conditions for correct gearing, forms of teeth, involutes and its variants, interference and methods of its removal. Calculation of minimum number of teeth on pinion/wheel for involute rack, helical, spiral, bevel and worm gears. Center distance for spiral gears and efficiency of spiral gears.

Gear Trains: Types of gear trains, simple, compound and epicyclic gear trains, problems involving their applications, estimation of velocity ratio of worm and worm wheel.

Unit–IV

Gyroscopic Motion and Couples: Effect on supporting and holding structures of machines. stabilization of ships and planes, Gyroscopic effect on two and four wheeled vehiclesand stone crusher.

Kinematic Synthesis of Mechanism: Freudenstien equation, Function generation errors in synthesis, two and three-point synthesis, Transmission angles, least square techniques.

Recommended Books

1. S.S. Rattan, 'Theory of Machines', Tata McGraw Hill.
2. John, Gordon and Joseph, 'Theory of Machines and Mechanisms', Oxford University Press.
3. Hams Crone and Roggers,' Theory of Machines'.
4. Shigley, 'Theory of Machines', McGraw Hill.
5. V.P. Singh, 'Theory of Machines', Dhanpat Rai and Sons.

FLUID MECHANICS

Subject Code: BMEE4-413 **L T P C** **Contact Hrs.: 38**
3 0 0 3

Course Objectives and Expected Outcomes: This course is designed for the undergraduate mechanical engineering students to develop an understanding of the behavior of fluids at rest or in motion and the subsequent effects of the fluids on the boundaries as the mechanical engineers has to deal with fluids in various applications. This course will also develop analytical abilities related to fluid flow. It is expected that students will be able to have conceptual understanding of fluids and their properties, apply the analytical tools to solve different types of problems related to fluid flow in pipes, design the experiments effectively and do the prototype studies of different types of machines and phenomenon.

Unit–I

Fundamentals of Fluid Mechanics: Introduction; Applications; Concept of fluid; Difference between solids, liquids and gases; Concept of continuum; Ideal and real fluids; Fluid properties: density, specific volume, specific weight, specific gravity, viscosity (dynamic and kinematic), vapour pressure, compressibility, bulk modulus, Mach number, surface tension and capillarity; Newtonian and non-Newtonian fluids.

Fluid Statics: Concept of static fluid pressure; Pascal's law and its engineering applications; Hydrostatic paradox; Action of fluid pressure on a plane submerged surface (horizontal, vertical and inclined): resultant force and centre of pressure; Force on a curved surface due to hydrostatic pressure; Buoyancy and flotation; Stability of floating and submerged bodies; Metacentric height and its determination; Periodic time of oscillation; Pressure distribution in a liquid subjected to:

i) constant acceleration along horizontal, vertical and inclined direction (linear motion),
ii) constant rotation.

Unit–II

Fluid Kinematics: Classification of fluid flows; Lagrangian and Euler flow descriptions; Velocity and acceleration of fluid particle; Local and convective acceleration; Normal and tangential acceleration; Path line, streak line, streamline and timelines; Flow rate and discharge mean velocity; One dimensional continuity equation; Continuity equation in Cartesian (x, y, z), polar (r, θ) and cylindrical (r, θ, z) coordinates; Derivation of continuity equation using the Lagrangian method in Cartesian coordinates; Rotational flows: rotation, vorticity and circulation; Stream function and velocity potential function, and relationship between them; Flow net.

Unit–III

Fluid Dynamics: Derivation of Euler's equation of motion in Cartesian coordinates, and along a streamline; Derivation of Bernoulli's equation (using principle of conservation of energy and equation of motion) and its applications to steady state ideal and real fluid flows; Representation of energy changes in fluid system (hydraulic and energy gradient lines);

Impulse momentum equation; Kinetic energy and momentum correction factors; Flow along a curved streamline; Free and forced vortex motions.

Dimensional Analysis and Similitude: Need of dimensional analysis; Fundamental and derived units; Dimensions and dimensional homogeneity; Rayleigh's and Buckingham's π - method for dimensional analysis; Dimensionless numbers (Reynolds, Froudes, Euler, Mach, and Weber) and their significance; Need of similitude; Geometric, kinematic and dynamic similarity; Model and prototype studies; Similarity model laws.

Unit–IV

Internal Flows: Laminar and Turbulent Flows: Reynolds number, critical velocity, critical Reynolds number, hydraulic diameter, flow regimes; Hagen – Poiseuille equation; Darcy equation; Head losses in pipes and pipe fittings; Flow through pipes in series and parallel; Concept of equivalent pipe; Roughness in pipes, Moody's chart.

Pressure and Flow Measurement: Manometers; Pitot tubes; Various hydraulic coefficients; Orifice meters; Venturi meters; Borda mouthpieces; Notches (rectangular, V and Trapezoidal) and weirs; Rotameters.

Recommended Books

1. D.S. Kumar, 'Fluid Mechanics and Fluid Power Engineering', S.K. Kataria and Sons Publishers.
2. S.K. Som, G. Biswas and S. Chakraborty, 'Introduction to Fluid Mechanics and Fluid Machines', Tata McGraw Hill.
3. C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, 'Fluid Mechanics and Machinery', Oxford University Press.
4. Y.A. Cengel and J.M. Cimbala, 'Fluid Mechanics - Fundamentals and Applications', Tata McGraw Hill.
5. B.R. Munson, D.F. Young, T.H. Okiishi and W.W. Huebsch, 'Fundamentals of Fluid Mechanics', John Wiley and Sons.
6. J.F. Douglas and J.M. Gasiorek, J.A. Swaffield and L.B. Jack, 'Fluid Mechanics', Pearson.
7. V.L. Streeter, E.B. Wylie and K.W. Bedford, 'Fluid Mechanics', Tata McGraw Hill.

APPLIED THERMODYNAMICS-II

Subject Code: BMEE4-414 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Course Objectives and Expected Outcomes: This course is designed for providing comprehensive understanding and thermodynamic analysis of positive displacement air compressors and thermal turbo machines used in power generation, aircraft, spacecraft and rocket propulsion. The students will be able to understand the thermodynamic working as well as performance of thermal turbo power machinery. They will also be able to select various thermal devices required for aforesaid applications.

Unit–I

Air Compressors: Introduction: Classification of Air Compressors; Application of compressors and use of compressed air in industry and other places; Complete representation of compression process on P-v and T-s coordinates with detailed description of areas representing total work done and polytropic work done; Areas representing energy lost in internal friction, energy carried away by cooling water and additional flow work being done for un-cooled and cooled compression on T-S coordinates; Best value of index of compression; Isentropic, polytropic and isothermal efficiencies and their representation in terms of ratio of areas representing various energy transfers on T-s coordinates.

Reciprocating Air Compressors: Single stage single acting reciprocating compressor (with and without clearance volume): construction, operation, work input and best value of index of compression, heat rejected to cooling medium, isothermal, overall thermal, isentropic, polytropic, mechanical efficiency, Clearance Volumetric efficiency, Overall volumetric efficiency, effect of various parameters on volumetric efficiency, free air delivery; Multistage compressors: purpose and advantages, construction and operation, work input, heat rejected in intercoolers, minimum work input, optimum pressure ratio; isothermal, overall thermal, isentropic, polytropic and mechanical efficiencies; Performance curves.

Unit–II

Positive Displacement Rotary Compressors: Introduction: Comparison of rotarypositive displacement compressors with reciprocating compressors; Classification of rotary compressors; Construction, operation, work input and efficiency of positive displacement type of rotary compressors like Roots blower, Lysholm compressor and Vane Type Blower.

Thermodynamics of Dynamic Rotary Compressors: Applications of Steady Flow Energy Equation and thermodynamics of dynamic (i.e., centrifugal and axial flow m/cs) compressors; Stagnation and static values of pressure, Temperature and enthalpy etc. for flow through dynamic rotary machines; Complete representation of compression process on T-S coordinates with detailed description of areas representing total work done, polytropic work done; ideal work required for compression process, areas representing energy lost in internal friction, energy carried away by cooling water on TS coordinates for an uncooled and cooled compression; isentropic, polytropic, and isothermal efficiencies as ratios of the areas representing various energy transfers on T-S coordinates.

Unit–III

Centrifugal Compressors: Complete thermodynamic analysis of centrifugal compressor stage; Polytropic, isentropic and isothermal efficiencies; Complete representation of compression process in the centrifugal compressor starting from ambient air flow through the suction pipe, Impeller, Diffuser and finally to delivery pipe on T-S coordinates; Pre-guide vanes and pre-whirl; Slip factor; Power input factor; Various modes of energy transfer in the impeller and diffuser; Degree of Reaction and its derivation; Energy transfer in backward, forward and radial vanes; Pressure coefficient as a function of slip factor; Efficiency and out-coming velocity profile from the impeller; Derivation of non-dimensional parameters for plotting compressor characteristics; Centrifugal compressor characteristic curves; Surging and choking in centrifugal compressors.

Axial Flow Compressors: Different components of axial flow compressor and their arrangement; Discussion on flow passages and simple theory of aero foil blading; Angle of attack; coefficients of lift and drag; Turbine versus compressor blades; Velocity vector; Vector diagrams; Thermodynamic analysis; Work done on the compressor and power calculations; Modes of energy transfer in rotor and stator blade flow passages; Detailed discussion on work done factor, degree of reaction, blade efficiency and their derivations; Isentropic, polytropic and isothermal efficiencies; Surging, Choking and Stalling in axial flow compressors; Characteristic curves for axial flow compressor; flow parameters of axial flow compressor like Pressure Coefficient, Flow Coefficient, Work Coefficient, Temperature-rise Coefficient and Specific Speed; Comparison of axial flow compressor with centrifugal compressor and reaction turbine; Field of application of axial flow compressors.

Unit–IV

Gas Turbines: Classification and comparison of the Open and Closed cycles; Classification on the basis of combustion (at constant volume or constant pressure); Comparison of gas turbine with a steam turbine and IC engine; Fields of application of gas turbines; Position of gas turbine in power industry; Thermodynamics of constant pressure gas turbine cycle

(Brayton cycle); Calculation of net output, work ratio and thermal efficiency of ideal and actual cycles; Cycle air rate, temperature ratio; Effect of changes in specific heat and that of mass of fuel on power and efficiency; Operating variables and their effects on thermal efficiency and work ratio; Thermal refinements like regeneration, inter-cooling and re-heating and their different combinations in the gas turbine cycle and their effects on gas turbine cycle i.e. gas turbine cycle. Multistage compression and expansion; Dual Turbine system; Series and parallel arrangements; Closed and Semi-closed gas turbine cycle; Requirements of a gas turbine combustion chamber; Blade materials and selection criteria for these materials and requirements of blade materials; Gas turbine fuels.

Jet Propulsion: Principle of jet propulsion; Description of different types of jet propulsion systems like rockets and thermal jet engines, like,

(i) Athodyds (ramjet and pulsejet),
(ii) Turbo jet engine, and
(iii) Turboprop engine.

Thermodynamics of turbojet engine components; Development of thrust and methods for its boosting/augmentation; Thrust work and thrust power; Propulsion energy, Propulsion and thermal (internal) efficiencies; Overall thermal efficiency; Specific fuel consumption; Rocket propulsion, its thrust and thrust power; Propulsion and overall thermal efficiency; Types of rocket motors (e.g. solid propellant and liquid propellant systems); Various common propellant combinations (i.e. fuels) used in rocket motors; Cooling of rockets; Advantages and disadvantages of jet propulsion over other propulsion systems; Brief introduction to performance characteristics of different propulsion systems; Fields of application of various propulsion units.

Recommended Books

1. R. Yadav, Sanjay and Rajay, 'Applied Thermodynamics', Central Publishing House.
2. J.S. Rajadurai, 'Thermodynamics and Thermal Engineering', New Age International (P) Ltd. Publishers.
3. D.S. Kumar and V.P. Vasandani, 'Heat Engineering', Metropolitan Book Co. Pvt. Ltd.
4. K. Soman, 'Thermal Engineering', PHI Learning Pvt. Ltd.
5. G. Rogers and Y. Mayhew, 'Engineering Thermodynamics', Pearson.
6. D.G. Shephered, 'Principles of Turbo machinery', Macmillan.
7. H. Cohen, G.F.C. Rogers and M. Sarvan, 'Gas Turbine Theory, Longmans.

BASIC SHIP STRUCTURE & DESIGN-1

Subject Code: BMEE4-415 **L T P C** **Contact Hrs.: 38**
3 0 0 3

UNIT-I

1. Ships Terms: Various terms used in ship Construction with reference to Ship's parameter e.g. L.B.P. Moulded Depth, Moulded draught etc. General Classification of Ships. Stresses in Ship's structure: Hogging, Sagging, Racking, Pounding, Panting, etc. and Strength members to counteract the same.

UNIT-II

2. Sections and Materials Use: Type of section like Angles, Bulb Plates. Flanged beams used in ship construction. Riveting & Welding. Testing of welds. Fabricated components. Bottom & side Framing: Double bottoms, Water tight floors, Solid and bracket floors, Longitudinal framing keels, side framing like Tank side brackets, Beam knee, Web Frame, etc.

3. Shell & Decks: Planting system for shells, Deck plating & Deck girders, discontinuities like hatches and other openings. Supporting & closing arrangements, mid-ship Section of ships.

UNIT-III

4. Bulk heads & Deep Tanks: Water tight bulkheads, Arrangements of plating and stiffeners. Water tight openings through bulkheads for electric cables pipes and shafting. Deep tank for oil fuel or oil cargo corrugated bulk heads.

UNIT-IV

5. Theory of Fire: Introduction, safety and fire triangle, fire prevention Construction, operation and merits of different types of portable and non-portable fire extinguishers and fixed fire extinguishing installations for ships.

6. Firefighting Equipment: Fire pumps, construction, firefighting in port and dry dock, 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.

Recommended Books

1. Djeyers, 'Ship Design'.
2. Reeds, 'Ship Design'.

FLUID MECHANICS LAB.

Subject Code: BMEE4-416 **L T P C**
0 0 2 1

EXPERIMENTS

1. To determine the metacentric height of a floating vessel under loaded and unloaded conditions.
2. To study the flow through a variable area duct and verify Bernoulli's energy equation.
3. To determine the coefficient of discharge for an obstruction flow meter (venturi meter/ orifice meter)
4. To determine the discharge coefficient for a V- notch or rectangular notch.
5. To study the transition from laminar to turbulent flow and to ascertain the lower critical Reynolds number.
6. To determine the hydraulic coefficients for flow through an orifice.
7. To determine the friction coefficients for pipes of different diameters.
8. To determine the head loss in a pipe line due to sudden expansion/ sudden contraction/ bend.
9. To determine the velocity distribution for pipeline flow with a pitot static probe.
10. Experimental evaluation of free and forced vortex flow.

WORKSHOP TECHNOLOGY LAB.

Subject Code: BMEE4-417 **L T P C**
0 0 2 1

EXPERIMENTS

Casting:

1. To determine clay content, moisture content, hardness of a moulding sand sample.
2. To determine shatter index of a moulding sand sample.
3. To test tensile, compressive, transverse strength of moulding sand in green condition.
4. To determine permeability and grain fineness number of a moulding sand sample.

Welding:

1. To make lap joint, butt joint and T- joints with oxy- acetylene gas welding and manual arc welding processes
2. To study MIG, TIG and Spot welding equipment and make weld joints by these processes.

Machining and Forming:

1. To study constructional features of following machines through drawings/sketches:
   a) Grinding machines (Surface, Cylindrical)
   b) Hydraulic Press
   c) Draw Bench
   d) Drawing and Extrusion Dies
   e) Rolling Mills
2. To grind single point and multipoint cutting tools
3. To prepare job on Lathe involving specified tolerances; cutting of V- threads and square threads.
3. To prepare job on shaper involving plane surface,
4. Use of milling machines for generation of plane surfaces, spur gears and helical gears; use of end mill cutters.
5. To determine cutting forces with dynamometer for turning, drilling and milling operations.

Note: At least one industrial visit must be arranged for the students for the live demonstration of Casting, Welding, Forming and Machining processes.

THEORY OF MACHINES LAB.

Subject Code: BMEE4-418 **L T P C**
0 0 2 1

EXPERIMENTS

1. To draw displacement, velocity & acceleration diagram of slider - crank and four bar mechanism.
2. To study the various inversions of kinematic chains.
3. Conduct experiments on various types of governors and draw graphs between height and equilibrium speed of a governor.
4. Determination of gyroscopic couple (graphical method).
5. Balancing of rotating masses (graphical method).
6. Cam profile analysis (graphical method)
7. Determination of gear- train value of compound gear trains and epicyclic gear trains.
8. To draw circumferential and axial pressure profile in a full journal bearing.
9. To determine coefficient of friction for a belt-pulley material combination.
10. Determination of moment of inertia of flywheel.

MARINE AUXILIARY MACHINERY

Subject Code: BMEE4-519 **L T P C** **Contact Hrs.: 45**
3 1 0 4

UNIT-I

ENGINE ROOM LAYOUT: Layout of main and auxiliary machinery in Engine Rooms in different ships.

Engine Room Piping Arrangements & Fittings: 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 AND COCKS: Straight way cocks, right angled cock, 'T' cock, spherical cock, Boiler gauge glass cock (cylindrical cock).

Valves: 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.

Jointings: 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.

Filters and Strainers: Filtration, filter elements basket strainers, duplex strainers, edge type strainers, autokleen strainers, back flushing strainers, magnetic filter, rotary filters, fine filters.

OPERATION & MAINTENANCE: 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-III

THEORY OF OIL PURIFICATION: 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.

METHODS OF SHAFT ALIGNMENT: 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: 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.

LINE SYSTEMS: Piping diagrams - Drawing and working principle of the line diagram of – Bilge-Ballast- Fuel oil transfer Fuel oil Service-. Cooling Water – Lubricating oil – Compressed Air - Steam Line – Exhaust Gas – Feed Water.

Recommended Books

1. D.W. Smith, 'Marine Auxiliary Machinery', 6th Edn., Butterworth, London, **1987**.
2. H.D. McGeorge, 'Marine Auxiliary Machinery', 7th Edn., Butterworth, London, **2001**.
3. D.W. Smith, 'Marine Auxiliary Machinery', 6th Edn., Butterworth, London, **1987**.
4. H.D. McGeorge, 'Marine Auxiliary Machinery', 7th Edn., Butterworth, London, **2001.**

SHIP CONSTRUCTION

Subject Code: BMEE4-520 **L T P C** **Contact Hrs.: 45**
3 1 0 4

UNIT-I

SHIP TERMS: Various terms used in ship construction with reference to ship's parameter e.g. L.B.P. – Moulded Depth - Moulded draught etc. - General classification of ships. Stresses in Ship's structure: Hogging – Sagging – Racking – Pounding – Panting etc., and Strength members to counteract the same.
Sections and Materials Use: Type of sections like angles – Bulb plates flanged beams used in ship construction – Riveting & Welding testing of welds – Fabricated components.

UNIT-II

BOTTOM & SIDE FRAMING: Double bottoms, watertight floors solid and bracket floors – Longitudinal framing keels –side framing like tank side brackets – Beam knee – Web frame etc.
Shell & Decks: Plating systems for shells – Deck plating & Deck Girders-discontinuities like hatches and other openings – supporting & closing arrangements-mid-ship section of ships.
Bulk heads & Deep Tanks: water tight bulkheads – Arrangement of platings 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 bulkheads.

UNIT-III

FORE & AFT END ARRANGEMENTS: Fore end arrangement, arrangements to resist pounding bulbous bow – Types of sterns stern frame and rudder – Types of rudder – Supporting of rudder – Locking pintle –Bearing pintle – Pallister bearing shaft tunnel – Tunnel bearings.
FREE BOARD AND TONNAGE: Significance and details of markings various international Regulations. Shipyard Practice: layout of a shipyard – Mould loft –Optical marking – Automatic plate cutting, Fabrication and assembly etc.
Ship Types: Tankers – Bulk Carriers – Container ships – L.N.G., L.P.G., and Chemical carriers – Lash ships – Passenger ships – Dredgers – Tugs etc., - Constructional details and requirements.

UNIT-IV

OFFSHORE TECHNOLOGY: Drilling ships and Platforms – Supply vessels – firefighting arrangement – Pipe laying ships – special auxiliary service ships.
Ship Surveys: Survey rules – Functions of ship classification – Societies – Surveys during construction – Periodical surveys for retention of class.

Recommended Books

1. D.J. Eyres, 'Ship Construction', 4th Edn., Butterworth – Heinemann, Oxford, **1994**.
2. E.A. Stokoe, 'Reed's Ship Construction for Marine Engineers', 1st Edn., Thomas Reed Publication, London, **2000**.
3. A.J. Young, 'Ship Construction sketch & Notes', 1st Edn., Butterworth–Heinemann, London, **1980**.
4. H.J. Pursey, 'Merchant Ship Construction'.

ELECTRICAL MACHINES

Subject Code: BMEE4-521 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Alternators-general arrangement of alternators, construction of salient pole and cylindrical rotor 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 drops, production of rotating magnetic field, resultant magnetic field distribution, mathematical derivation of the rotating field condition, magneto-motive force or ampere-turn waveform distribution, reversal of direction of rotation of rotating field.
Synchronous alternator and motor Armature reaction in synchronous alternator, armature reactance, prediction of voltage regulation, open circuit test, short circuit test, synchronous impedance method, torque/angle characteristics, infinity bus bar, 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, principle of action of three-phase synchronous motor, effects of varying load and excitation, methods of starting, advantages and disadvantages of synchronous motor.

MECHANICS OF MACHINES - I

Subject Code: BMEE4-522 **L T P C** **Contact Hrs.: 45**
3 1 0 4

UNIT-I

MECHANISMS: 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: 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: Types of cams and followers – follower's motions – uniform, parabolic, SHM, cycloidal and polynomial – synthesis of cam profiles for different followers – undercutting in cams – pressure angle – determination of minimum radius of curvature using design charts – Vamum's Nomogram – cams of specified contour – eccentric circle cam.
THEORY OF GEARING: 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-stadard 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-IV

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.

Recommended Books

1. J.S. Rao, and R.V. Dukkipatti, 'Mechanism and Machinery Theory', 2nd Edn., New Age International, Mumbai, **1992**.
2. S.S. Rattan, 'Theory of Machines', Tata McGraw Hill Publishing Company Ltd., New Delhi, **1998**.
3. J.E. Shingley & John Joseph Uivker, Jr., 'Theory of Machines and Mechanisms', 2nd Edn., McGraw Hill International Editions, London, **1981**.
4. A. Ghosh and A.K. Mallick, 'Theory of Mechanisms and Machines', Affiliated East-West Pvt. Ltd., New Delhi, **1988**.

ELECTRONICS

Subject Code: BMEE4-523 **L T P C** **Contact Hrs.: 45**
3 1 0 4

Transistor: Transistor as a small signal amplifier and Frequency Response. Transistorised power amplifier. Relation between Maximum Output Power, Efficiency & Power Dissipation. Characteristics and applications of Field Effect Transistor (FET) &Injunction Transistor (UJT).

Regulated Power Supplies: Series & Shunt Regulated Power Supplies. Regulator ICs like 78XX,79XX, 723.

Oscillators: Requirements for Oscillations, phase shift Oscillators, Wein Bridge Oscillator, Crystal Oscillators, Decoupling Filters.

Transistor Power Amplifier: Design Theory, Basic Complementary symmetry, Pracitcal Complementary push-pull amplifier, Transistor, Phase inverter Relation between Maximum Output power and load resistance and Transistor dissipation.

Wave Shaping and Switching: Clipping, Clamping, time base or Sweep Generator, Multivibrators & Schmitt Triggers.

Operation Amplifier Theory: Concept of Differential Amplifiers. Its use in DP-AMPS. Linear OP –amp circuits.

Converters: Digital to Analog Converters (Binary weighted, R2R) with applications. Analog to Digital Converters (Simultaneous, Counter Type) with applications Digital Circuit &

Boolean Algebra: Logic systems, Logic Gates, Codes. Boolean Algebra and simplification of logical equations. Types of flip-flops, Shift Registers, Counters, Multiplexers and Demultiplexers.

TTL & CMOS Logic Families: TTL NAND gate. Different TTL Series with typical specifications. Development of CMOS Logic. Typical specifications of CMOS family.

Electronics 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. Q-meters.

Industrial Electronics: Silicon Controlled Rectifier (SCR) and other devices, VI characteristic. Application of Power rectification, Speed control of DC motor, Inverters. Photo Electric Devices. IC 555 Internal Block Diagram, application as Monostable & Bistable Multivibrator.

Communication Equipment Overview: Need of Modulation & Demodulation. Generation of AM & FM with waveforms. Pulse Communication. Radio Transmitter & Receivers. Introduction to RADAR.

Introduction to Microprocessors: 8085 Microprocessors architecture, instruction sets. Introduction to Microcontrollers.

Recommended Books

1. P.S. Bhimbra, 'Power Electronics'.
2. Malvino Leach, 'Digital Principles and Applications'.
3. Ramesh Gaonkar, 'Microprocessors and Microcomputers'.

WORKSHOP PRACTICAL (MARINE)

Subject Code: BMEE4-524 **L T P C**
0 0 2 1

EXPERIMENTS

1. Dismantling, overhauling, inspection & assembling of a A/E cyl. Head.
2. Dismantling, overhauling, inspection & assembling of Cylinder liner, piston & piston ring.
3. Dismantling, overhauling, inspection & assembling of main bearing & bottom end bearing.
4. C/Shaft deflection & inspection of C/case.
5. Dismantling & overhauling of M/E exhaust valve.
6. Dismantling & overhauling of M/E cylinder head relief v/v, Air staring v/v.
7. Dismantling & overhauling of Turbochargers.
8. Working principles & demonstration of working of a hydraulic steering gear system, safety checks & routine inspection.
9. Detection of cracks & dealing with cracked pieces
10. To fabricate & weld a pipe with given pipe length & flanges.
11. To repair leaks, pipe by fitting a doubler.
12. To make a pipe line with bends (welding).
13. Practice of welding.
14. Practice of Brazing & Soldering.
15. Detection of cracks & dealing with cracked pieces
16. Tracing of pipelines.
17. Turning, cutting and similar operations by Lathe machine.

Using a simulator, the Following experiments are to be performed

1. To start and stop the engine;
2. To change engine's load and speed;
3. To change ambient operating conditions;
4. To simulate engine faults in varying degrees;
5. To mix different simulations;
6. To watch engine operation parameters'
7. To watch functions inside the cylinder;

8. To simulate the engine sound which varies with speed;
9. To carry out maintenance and repairs;
10. To try out different maintenance strategies;
11. To print engine data.

ELECTRICAL ENGINEERING, ELECTRONICS AND MICRO PROCESSOR LAB.

Subject Code: BMEE4-525 **L T P C**
0 0 2 1

EXPERIMENTS

(A) ELECTRICAL ENGG. LABORATORY

1. Load Test on D.C. Shunt Motor
2. Load Test on D.C. Series Motor
3. O.C.C. & load characteristic of self/separately excited D.C. Generator.
4. Parallel operation of D.C. Shunt Generator
5. Speed control of D.C. Shunt Motor.
6. Load O.C. & S.C. test on single-phase transformer.
7. Parallel operation of single-phase transformers.
8. To connect similar single-phase transformers in the following ways.
9. Y-Y, A-A, A-Y and Y-A.
10. Pole changing motor for various speeds.
11. Determination of characteristics of an A/C brush less generator.
12. Synchronization of 3-phase alternator.
13. Trouble shooting in Electric Motors and Transformers.
14. Exercises in Power Wiring and earthing.

(B) ELECTRONICS / MICROPROCESSOR LABORATORY

1. To study the volt-ampere characteristics of a high current semiconductor diode.
2. To study the volt-ampere characteristics of a diode and Zener diode.
3. To study the half wave and full wave rectification circuit without and with filter circuit.
4. To study the volt-ampere characteristics of a Transistor.
5. To study the volt-ampere characteristics of Field Effect Transistor.
6. To study the characteristics of Silicon Control Rectifier.
7. To study the Transistor Feed Back Amplifier.
8. To study the Integrated Circuit operational amplifier.
9. To study the logic training board.
10. To study the speed control of D.C. motor using Thyristor.
11. Arithmetic operations using 8085
12. Logical operations using 8085
13. Array operations using 8085
14. Speed & Direction Control of Stepper motor using 8085.

ELECTRICAL MACHINES LAB.

Subject Code: BMEE4-526 **L T P C**
0 0 2 1

EXPERIMENTS

1. To study and run rotary convertor under different conditions to record the generated voltage on d.c. side against variation of load.

2. To perform load test on a 6-pulse, 2-way bridge rectifier and to obtain the characteristic curves.
3. To study the slip-torque characteristics of an induction motor and to find out the full load slip.
4. To study the different types of Motors, connect the motor AG. supply, run the motor and obtain its speed load characteristics. (The experimental multi-motor set).
5. To determine the regulation of a 3-phase alternator by synchronous impedance method.
6. To compute full load input, torque, slip, power factor and efficiency of 3-phase induction motor from circle diagram. Also to compare the results from the circle diagram with actual full load test on the motor.
7. Synchro-transmitter and Repeater.
8. Transformer connections.
9. Determination of phase-sequence of the given 3-phase supply.
10. Study of single-phase controller.
11. Observation of the wave-form of magnetizing current and hysteresis loop.
12. Study of transformer differential relay.

COMPUTER AIDED MARINE ENGINEERING DESIGN ANDANALYSIS LAB.

Subject Code: BMEE4-527 **L T P C**
0 0 2 1

EXPERIMENTS

UNIT-I

ENGINEERING DESIGN AND COMPUTER AIDED DESIGN:
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:
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 – Wireframe, 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:
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:
Design of cotter joints, knuckle joints, bolted joints, welded joints, riveted joints. Design of shafts and couplings – Drafting using CAD packages.

BELTS, FRICTION CLUTCHES AND BRAKES:
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.

Recommended Books

1. Goutam Prohit and Goutam Ghosh, 'Machine Drawing with AutoCAD', 1st Impression, Dorling Kindersley (India) Pvt. Ltd., New Delhi, 2007.
2. J.E. Shigley, 'Mechanical Engineering Design', 1st metric Edn., McGraw Hill, New Delhi, **1986**.
3. R.S. Khurmi and J.K. Gupta, 'Machine Design', 5th Edn., Eurasia Publishing, New Delhi, **2005**.
4. Sadhu Singh, 'Computer Aided Design and Manufacturing', Khanna Publishers, New Delhi, **1998**.
5. Abdulla Sharif, 'Machine Design', 3rd Edn., Dhanpat Roy & Sons, New Delhi, **1995**.
6. Pandya & Shaw, 'Elements of Machine Design', 1st Edn., Charotar Publishing, Mumbai, **1997**.
7. Groover and Zimmers, 'CAD / CAM: Computer Aided Design and Manufacturing', Prentice Hall of India, New Delhi, **1994**.

SHIP OPERATION AND MANAGEMENT

Subject Code: BMEE4-629 **L T P C** **Contact Hrs.: 37**
3 0 0 3

Brief History of Shipping: Modern shipping practice. Marine vehicles and cargoes. Development in Shipping and cargo handling Principal shipping organizations. Liner and tramp shipping services, Conference systems. Chartering, Charter parties. Theory of freight rates and fares. Rate fixation machinery and government control. Bills of lading. Carriage of goods by sea act. Cargo Surveys and protests.

Role of Classification Society

Marine Insurance: Underwriting and loss adjusting principles applied to Marine cargo insurance. Hull policy, particular average General average, P & I Clubs. Ownerships of vessels, Shipping Company and its administration. Capitalization and finance, Ecemonics of new and second hand tonnage. Subsidies.

Ship Operations: Planning sailing schedules. Voyage estimates Economic factors. Commercial Shipping Practice. Manning of ships. Engagement and disadvantage of crew D. L. B. Seaman's welfare.

Merchant Shipping Act: Registration of ship. Ship's papers. Port Procedures. Pilotage, Duties regarding pollution. Collision, Explosion fire etc. Vessels in distress. Shipping casualty's penalties under Merchant Shipping Act.

MACHINE DESIGN-I

Subject Code: BMEE4-630 **L T P C** **Contact Hrs.: 45**
3 1 0 4

UNIT-I

1. Meaning of design with special reference to machine design. Definition and understanding of various types of design, Elaborated Design process.

2. Design and Creativity: Systematic design conceptualization, product design definition,

underlying principles of design in Aesthetics and ergonomics, free body diagram for components design.

UNIT-II

3. **General Design Considerations:**

a) Concept of tearing, bearing, shearing, crushing, bending etc.
b) Selection of materials, Basic criteria of selection of material, their designation, mechanical properties of those materials in brief.
c) Study of Stress concentration, factor of safety under different loading conditions.

3. Basic Design: Design for static loading, design for variable loading for both limited and unlimited life, concept of fatigue and endurance strength.

4. Design of fasteners:

a) **RIVETS:** Design of rivets for boiler joints, lozenge joints (uniform strength joint), eccentrically loaded riveted joints.
b) **BOLTS:** Understanding the various stresses/failure in bolted joints, design of cylindrical covers, basic and eccentrically loaded bolts
c) **WELDS:** Design for various loading conditions in torsion, shear or direct load, eccentrically loaded welded joints.
d) **MISCELLENEOUS:** Design of spigot and socket cotter joint, Gib and Cotter joint and knuckle joint.

UNIT-III

5. Design of Transmission Shaft Design of both solid and hollow shafts for transmission of torque, bending moments and axial forces, Design of shaft for critically speed, Design of shaft for rigidity and Design of stepped shafts for assembly.

6. Design of Keys and Couplings: Design of sunk keys under crushing and shearing, design of splines, design of sleeve and solid muff coupling, clamp or compression coupling, rigid and flexible flange coupling, design of universal joint

UNIT-IV

7. Lever Design: Basic lever design, design of foot and hand lever, cranked lever, bell crank lever, safety valve lever and shoe brake lever.

8. Design of Pipe Joints: Stresses in pipe joints, design of circular flange pipe joint, oval flanged pipe joints, square flange pipe joint.

Recommended Books

1. Shigley, ‘Machine Design’, Tata McGraw Hill.
2. Juvinal, ‘Machine Design’, John Wiley Publishers.
3. Spots, ‘Machine Design’, Prentice Hall.
4. Norton, ‘Machine Design’, Prentice Hall.
5. Khurmi, ‘Machine Design’.
6. Goyal and Bahl, ‘Machine Design’, Standard Publishers.
7. ‘Product Design and Development’, Prentice Hall.
8. ‘Design Data Book’, Compiled by PSG College of Engineering & Technology, Coimbatore.

MECHANICS OF MACHINES – II

Subject Code: BMEE4-631 **L T P C** **Contact Hrs.: 45**
3 1 0 4

UNIT-I

Toothed Gearing: Types of gears, condition for transmission of constant velocity; methods

of avoiding interference; Transmission of power by gear trains on parallel shafts; Rack and pinion, Bevel gears, Worm and worm wheel, Spur gears Helical gears, Spiral gears; Epicylic gear trains, Torque on gear trains, acceleration of gear trains.
Balancing: Balancing of masses rotation in different planes, dynamic forces at bearings; Primary and secondary balance of multicylinder in-line Engines and configurations.

UNIT-II

Gyroscope: Gyroscopic couple. Vector representation to torque and angular movement, Steady rectangular precession, vector treatment; Steady conical precession; Motion involving Steady precession; Application to Ship's stabilization. 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.

UNIT-III

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.
Forced Vibrations: Forced Linear and angular Vibrations, Periodic force transmitted to support, periodic movement of the support. 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. Whirling of Shafts-Whirling of shafts, critical speed, effect to slope of the disc, effect of end thrust.

UNIT-IV

Damped Vibrations: Idea of Viscous and Coulomb damping, Linear and angular vibrations with Viscous damping, Forced damped liner and angular Vibrations, Periodic movement of support.

FLUID MACHINERY

Subject Code: BMEE4-632 **L T P C** **Contact Hrs.: 45**
3 1 0 4

UNIT-I

1. General Concepts: Impulse momentum principle; jet impingement on stationary and moving flat plates, and on stationary or moving vanes with jet striking at the centre and tangentially at one end of the vane; calculations for force exerted, work done and efficiency of jet. Basic components of a turbo machine and its classification on the basis of purpose, fluid dynamic action, operating principle, geometrical features, path followed by the fluid and the type of fluid etc. Euler's equation for energy transfer in a turbomachine and specifying the energy transfer in terms of fluid and rotor kinetic energy changes.

UNIT-II

2. Pelton Turbine: Component parts and operation; velocity triangles for different runners, work output; Effective head, available power and efficiency; design aspects such as mean diameter of wheel, jet ratio, number of jets, number of buckets with working proportions
3. Francis and Kaplan Turbines: Component parts and operation; velocity triangles and work output; working proportions and design parameters for the runner; Degree of reaction; Draft tubes – its function and types. Function and brief description of commonly used surge tanks.

UNIT-III

4. Centrifugal Pumps Layout and Installation: Main elements and their functions; Various types and classification; Pressure changes in a pump - suction, delivery and manometric heads; vane shape and its effect on head-capacity relationships; Departure from Euler's theory and losses; pump output and efficiency; Minimum starting speed and impeller diameters at the inner and outer periphery; Priming and priming devices, Multistage pumps - series and parallel arrangement; submersible pumps. Construction and operation; Axial and mixed flow pumps; Trouble shooting - field problems, causes and remedies.

5. Similarity Relations and Performance Characteristics: Unit quantities, specific speed and model relationships, scale effect; cavitation and Thoma's cavitation number; Concept of Net Positive Suction Head (NPSH) and its application in determining turbine / pump setting

UNIT-IV

6. Reciprocating Pumps: Components parts and working; pressure variations due to piston acceleration; acceleration effects in suction and delivery pipes; work done against friction; maximum permissible vacuum during suction stroke; Air vessels.

7. Hydraulic Devices and Systems: Const., operation and utility of simple and differential accumulator, intensifier, fluid coupling and torque converter, Air lift and jet pumps; gear, vane and piston pumps.

Recommended Books

1. R.L. Daughaty, 'Hydraulic Turbines', McGraw Hill Book Co.
2. Jagdish Lal, 'Hydraulic Machines', Metropolitan Book Co. Pvt. Ltd.
3. D.S. Kumar, 'Fluid Mechanics and Fluid Power Engineering', S.K. Kataria and Sons, Delhi.

NAVAL ARCHITECTURE

Subject Code: BMEE4-633 **L T P C** **3 0 0 3** **Contact Hrs.: 37**

UNIT-I

Geometry of Ship & Hydrostatic Calculation: Ships lines, Displacement Calculation, First and Second moment of area, Simpsons rules, application to area and volume, Trapezoidal rule, mean and mid-ordinate rue, Tchebycheff's rule and their applications, Tonnes per Cm. Immersion. Coefficient of form, Wetted surface area, Similar figures. Centre of gravity, effect of addition and removal of masses, Effect of suspended mass.

UNIT-II

Transverse Stability of Ships: Statical stability at small angles of heel, Calculation of B.M. Metacentric, inclining experiment, Free surface effect, stability at large angles of heel, curves of statical stability, dynamical stability, angle of loll; stability of a wall sided ship. Resistance & Power: Frictional, Residuary & Total resistance, Froude's Law of comparison, Effective power calculations, Ships correlation Factor (SCF), Admiralty co-efficient, Fuel Coefficient and Fuel consumption. Effect of viscosity and application of ITTC formula.

Longitudinal Stability and Trim: Longitudinal BM, Moment to change trim one Cm. Change of trim, change of L.C.B. with change of trim, Change of trim due to adding or deducting weights, alteration of draft due to change in density, flooding calculations, Floodable length curves, M.O.T. method for determination of floodable lengths, factors of subdivision, Loss of stability due to grounding, Docking stability. Pressure on chocks.

UNIT-III

Strength of Ships: Curves of buoyancy and weight, curves of load, shearing force and bending moments, Alternate methods, standard Conditions, Balancing Ship on wave,

Approximation of max, shearing force and bending moment, method of estimating B.M. & Deflection. Longitudinal Strength, Moment of Inertia of Section Modulus.

Propulsion & Propellers: Definitions, apparent and real ship wake, thrust, relation between power, relation between mean pressure and speed, measurement of pitch, cavitation, propeller types, fixed pitch, Variable Pitch, ring propeller, Kort nozzles, Voith Schneider propeller, theory, Blade element theory, Law of similitude and model tests with propellers, propulsion test, Geometry and geometrical properties of screw propellers, ship model correlation ship trials.

UNIT-IV

Rudder Theory: Action of the Rudder in turning a ship, force on rudder, Torque on stock, calculation of force torque on non-rectangular rudder, angle of heel due to force torque on rudder, Angle of heel when turning. Types of rudder, model experiments and turning trials, Area and shape of rudder, position of rudder, stern rudder Bow rudders.

Motion of Ship on Waves: Theory of waves, Trochoidal waves, relationship between line of orbit centres and the undisturbed surface, Sinusoidal waves. Irregular wave pattern, Wave spectra, Wave amplitudes, rolling in unresisting media, rolling in resisting media, practical aspects of rolling, Antirolling devices, Forces caused by rolling and pitching, Heaving and Yawing.

MARINE BOILERS WORKSHOP

Subject Code: BMEE4-634 **L T P C**
0 0 2 1

1. **Types of Marine Boilers:** Comparison of smoke tube and water boilers.
2. **Smoke Tube Boilers:** Various types in marine use, Principal dimensions and staying of flat surface of multitubular cylindrical Boilers. Vertical Auxiliary Boilers. Water Tube Boilers.
3. **Superheater:** Economizer, Air preheater & steam preheater; circulation and use of Unheated Down comers in highly rated boilers; Superheat temperature control.
4. **Attemperators and Desuperheaters:** Waster heat boilers; Waste heat recovery calculation.
5. **Safety Valves:** Improved High Lift, Full lift and full Bore type: Gauge glass- Ordinary plate type and remote Indicator.

FLUID MACHINERY LAB.

Subject Code: BMEE4-635 **L T P C**
0 0 2 1

EXPERIMENTS

1. Determination of various efficiencies of Hydraulic Ram
2. To draw characteristics of Francis turbine
3. To study the constructional features of reciprocating pump and to perform test on it for determination of pump performance
4. To draw the characteristics of Pelton Turbine
5. To draw the various characteristics of Centrifugal pump
6. Determine the effect of vane shape and vane angle on the performance of centrifugal fan.

FIRE FIGHTING, CONTROLS AND SIMULATOR LAB.

Subject Code: BMEE4-636 **L T P C**
0 0 2 1

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 firefighting systems and equipment on different vessels.
4. Firefighting 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 cabondioxide, 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.
9. First aid, Fire organisation on ships. Fire signal and muster.

MATERIAL LAB.

Subject Code: BMEE4-637 **L T P C**
0 0 2 1

EXPERIMENTS

1. To determine the behaviour of different materials when subjected to Tension and to obtain the following Tensile properties of materials on Universal Testing Machine:
   (i) UTS, (ii) Yield Stress, (iii) Young's Modulus, (iv) Breaking Stress, (v) Percentage Elongation, (vi) Percentage reduction in area and (vii) Plotting of Curve of –Stress vs. Strain.
2. To determine the behaviour of materials under direct shear force and to study the effect of it and to calculate the shear stress of material.
3. To study the behaviour of materials when subjected to bending and to find out the effect of such act on material and to calculate the bending stress of materials.
4. Determination of the behaviour of different materials when subjected to sudden shock and to the impact resistance quality or the impact strength of the materials.
5. To determine the hardness of materials by indenting a hardened steel ball into the specimen under test by an applied specified load on the ball.
6. Determination of behaviour of ductile materials when subjected to torsion and to obtain: i) Max. torsion stress ii) Modulus of rigidity iii) Plotting of curve of Angle of Twist vs. Torque.
7. To determine the stiffness of spring for a) round wire, b) square section wire when subjected to compression.
8. Determination of compressive stress and strain of materials under compressive force applied to the material.
9. To find out the Tensile stress of materials on hand operated Tensile testing machine.