Semester –III

Subject Code	Course Title	Hours per week			Max Marks		Total Marks	Credits
		L	T	P	Int.	Ext.		
BMECE0-001	Engineering Mechanics	3	1	0	40	60	100	4
BMECS1-301	Strength of Materials-I	3	1	0	40	60	100	4
BMECS1-302	Fluid Mechanics	3	1	0	40	60	100	4
BMECS1-303	Thermodynamics	3	1	0	40	60	100	4
BECEE0-002	Basic Electronics & Instrumentation	3	1	0	40	60	100	4
BMECS1-304	Mechanical Engineering Lab-I (Design-I)	0	0	2	60	40	100	1
BMECS1-305	*Workshop Training	0	0	0	60	40	100	4
BMNCC0-002	Environmental Science	1	0	0	---	---	---	0
BMNCC0-007	Advisory Counselling	1	0	0	---	---	---	0
Total Credits		17	5	2	320	380	700	25

*Workshop training will be imparted in the institution at the end of 2nd semester for four-week duration.

Semester –IV

Subject Code	Course Title	Hours per week			Max Marks		Total Marks	Credits
		L	T	P	Int.	Ext.		
BMECS1-401	Materials Engineering	3	0	0	40	60	100	3
BMECS1-402	Strength of Materials-II	3	1	0	40	60	100	4
BMECS1-403	Fluid Machines	3	1	0	40	60	100	4
BMECS1-404	Applied Thermodynamics	3	1	0	40	60	100	4
BMECS1-405	Machine Drawing using CAD	1	0	4	40	60	100	3
BMECS1-406	Mechanical Engineering Lab-1 (Thermal Lab-I)	0	0	2	60	40	100	1
XXXXX	*Elective-1	3	0	0	40	60	100	3
BMNCC0-007	Advisory Counselling	1	0	0	---	---	---	0
Total Credits		17	3	6	300	400	700	22

*** Elective-1 (Chose any one from the following)**

1. Biology (BMECS1-E 1.1)
2. Mathematics III (PDE, Probability & Statistics) (BMECS1-E 1.2)
3. Industrial Automation & Robotics (BMECS1-E 1.3)

ENGINEERING MECHANICS

Subject Code: BMECE0-001 **L T P C** **Duration: 60 Hrs.**

3 1 0 4

Course Objectives:

1. The concepts of friction in screw jack & inclined plane.
2. To draw shear force and bending moment diagrams by analytical method
3. To find forces in simple trusses by using joints and section methods
4. The concepts related to torsions and mechanics of fluids.

UNIT-I

Introduction to Engineering Mechanics covering, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy. **15 Hrs.**

UNIT-II

Friction: Types of Friction, Limiting Friction, Angle of Repose, Coefficient of Friction, Laws of Friction, Static & dynamic Friction, Screw Jack, Minimum force required to drag a body on rough horizontal plane, body tending to move upwards on an inclined plane, body moving down the plan **12 Hrs.**

UNIT-III

Centroid and Centre of gravity: Centroid of composite sections, Parallel & perpendicular axes theorem, Moment of area, Moment of inertia of standard sections and composite sections, mass moment of inertia of cylinder cone sphere, and Polar moment of inertia. **12 Hrs.**

Shear force and bending moment diagram, simple trusses, Method of joints, Method of section **11 Hrs.**

UNIT-IV

Kinematics of Particles: Rectilinear motion, plane curvilinear motion-rectangular coordinates, normal and tangential component. Kinetics of Particles: Equation of motion, rectilinear motion and curvilinear motion, work energy equation, conservation of energy, impulse and momentum conservation of momentum, impact of bodies, co-efficient of restitution, loss of energy during impact. **10 Hrs.**

Expected Outcomes:

After going through these contents the student shall be able to solve the simple problems related to kinematics of particles, Co-planar and concurrent forces, solids mechanics, moment of inertia centre of gravity and role of friction in screw Jack and inclined planes.

Recommended Books:

1. Theory of machines by V.P Singh Dhanpat rai& Co
2. Jindal U.C Engineering Mechanics Part-I Galgotia Publications
3. Sadhu Singh, 'Strength of Materials', Khanna Publishers
4. Dr. Kirpal Singh, 'Mechanics of Materials', Standard Publishers
5. E.P.Popov, 'Mechanics of Materials', Pearson Education
6. K.L. Kumar, 'Engineering Fluid Mechanics', S. Chand
7. P.N. Chandramouli, 'Engineering Mechanics', PHI

STRENGTH OF MATERIALS-I

Subject Code: BMECS1-301 **L T P C** **Duration: 60 Hrs.**

3 1 0 4

Course Objective: 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 beams 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, forces and reactions in frames, stresses in struts and columns subjected to axial load; bending stress, slope and deflection under different loading and supporting conditions.

UNIT-I

Stresses and Strains: Basic definitions: Stress and strain and their types, fatigue, creep, ductility, brittleness, hardness, toughness, impact strength, stress concentration, Elasticity, Plasticity. Hook's law, longitudinal and lateral strain, Poisson's ratio, stress-strain diagram for ductile and brittle materials, extension of a bar with or without self-weight, bar of uniform strength and of varying cross section, elastic constants and their significance, Young's modulus of elasticity, modulus of rigidity and bulk modulus, thermal stress and strain in single and compound bars. Two dimensional stress

system, stress at a point on a plane, principal stresses and principal planes, Generalized Hook's law, Mohr's circle of stresses, Condition of plane stress and strain.

16 Hrs.

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) Uniformly distributed loads over the whole span or part of span

c) Combination of concentrated and uniformly distributed load

d) Uniformly Varying load (optional)

e) Application of moments **16 Hrs.**

Bending Stresses in Beams: Derivation of bending equation and its application to find stresses in beams of rectangular, circular and channel, I and T- sections. Flexural Rigidity, combined direct and bending stresses in afore-mentioned sections, stresses in composite / flitched beams**.**

UNIT–III

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

a) Cantilevers

b) Simply supported beams with or without overhang

c) beams under concentrated loads, uniformly distributed loads and their combination.

Columns and Struts: Introduction of columns and struts, end conditions, failure of columns, Euler's formula, empirical formulas to find buckling load. **14 Hrs.**

UNIT–IV

Torsion: Derivation of torsion equation and its application to the hollow and solid circular shafts. Torsional rigidity, Angle of twist, combined torsion and bending of circular shafts; Principal stress and maximum shear stresses under combined loading of bending and torsion, comparison of solid and hollow shaft in terms of strength.

Frames: Introduction of frames, types of frames, assumptions made in finding out the forces in frame, reactions of the supports of a frame, analysis of frames: method of joints, method of sections, graphical method and its applications. **14 Hrs.**

Expected Outcome/s:

After studying the course, the student will be able to analyze different stresses, strains and deflection for designing a simple mechanical element e.g. beams, shafts, columns and frames under various loading conditions.

Recommended Books

1. Sadhu Singh, 'Strength of Materials', Khanna Publishers.
2. Kirpal Singh, 'Mechanics of Materials', Standard Publishers.
3. G.H. Ryder, 'Strength of Materials', Macmillan India Ltd.
4. S.S. Rattan, 'Strength of Materials', Tata McGraw Hills.
5. Timoshenko and Gere, 'Mechanics of Materials', CBS Publishers.
6. E.P. Popov, 'Mechanics of Materials', Pearson Education.
7. R. K. Bansal, 'Strength of Materials', Laxmi Publication P) Ltd

FLUID MECHANICS

Subject Code: BMECS1-302 **L T P C** **Duration: 60 Hrs.**

3 1 0 4

Course Objectives:

1. To make conceptual understanding of fluids and their properties,
2. To apply analytical tools to solve different types of problems related to fluid flow
3. To learn about the application of mass and momentum conservation laws for fluid flows.
4. To understand the importance of dimensional analysis.

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.

10 Hrs.

Unit –II

Fluid Statics: Concept of static fluid pressure; Pascal's law and its engineering applications; Hydrostatic paradox; Action of fluid pressure on a plane suBMECS1rged 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 suBMECS1rged 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.Flow Measurement: Manometers.

12 Hrs.

Unit –III

Fluid Kinematics: Classification of fluidsand fluid flows; Lagrangian and Euler flow dBMECS1riptions; Velocity and acceleration of fluid particle; Local and convective acceleration; Normal and tangential acceleration; Path line, streak line, streamline and timelines; continuity equation; Continuity equation in Cartesian (x,y,z), polar (r,θ) and cylindrical (r,θ,z) coordinates; Rotational flows: rotation, vorticity and circulation; Stream function and velocity potential function, and relationship between them; Flow net.

10 Hrs.

Fluid Dynamics: Derivation of Euler's equation of motion, 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, Impulse momentum equation; Kinetic energy and momentum correction factors; Flow along a curved streamline; Free and forced vortex motions. Momentum equation, Introduction to Computational fluid dynamics. Flow Measurement: Pitot tubes, Venturi meters, Rotameters,Orifice meters; mouthpieces; Notches (rectangular, V and Trapezoidal) and weirs.

12 Hrs.

Unit –IV

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. **08 Hrs.**

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. **08 Hrs.**

Expected Outcomes:

1. Identify and obtain the values of fluid properties and relationship between them and understand the principles of continuity, momentum, and energy as applied to fluid motions.
2. Gains knowledge to calculate and design engineering applications involving fluid.
3. Apply dimensional analysis to predict physical parameters that influence the flow in fluid mechanics.

Recommended Books:

1. S.K. Som, G. Biswas and S. Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill.
2. Y.A. Cengel and J.M. Cimbala, Fluid Mechanics - Fundamentals and Applications, Tata McGraw Hill.
3. D. S Kumar, Fluid Mechanics and Fluid Power Engineering, S. K Kataria and Sons

THERMODYNAMICS

Subject Code: BMECS1-303 **L T P C** **Duration: 60 Hrs.**

3 1 0 4

Objectives:

1. To learn about work and heat interactions, and balance of energy between system and its surroundings
2. To learn about application of I law to various energy conversion devices
3. To evaluate the changes in properties of substances in various processes
4. To understand the difference between high grade and low grade energies and II law limitations on energy conversion

Unit –I

Fundamentals - System & Control volume; Property, State & Process; Exact & Inexact differentials; Work-Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work. 10 **Hrs.**

Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy ‘E’ Demonstration that ‘E’ is a property; Various modes of energy, Internal energy and Enthalpy. 10 **Hrs.**

Unit –II

Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Use of steam tables and R134a tables;

Saturation tables; Superheat tables; Identification of state & determination of properties, Mollier's chart. **12 Hrs.**

Unit –III

First Law for Flow Processes - Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of unsteady flow applications for system and control volume. **10 Hrs.**

Unit –IV

Second law - Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale. **06 Hrs.**

Clausius inequality; Definition of entropy 'S' ; Demonstration that entropy 'S' is a property; Evaluation of 'S' for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of 'S' from steam tables- Principle of increase of entropy; Illustration of processes in T-S coordinates; Definition of Isentropic efficiency for compressors, turbines and nozzles - Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Lost work. Second law analysis for a control volume. Energy balance equation and Energy analysis.

08 Hrs.

Thermodynamic cycles - Basic Rankine cycle; Basic Brayton cycle; comparison with Carnot cycle.

04 Hrs.

Course Outcomes:

1. After completing this course, the students will be able to apply energy balance to systems and control volumes, in situations involving heat and work interactions
2. Students can evaluate changes in thermodynamic properties of substances
3. The students will be able to evaluate the performance of energy conversion devices
4. The students will be able to differentiate between high grade and low grade energies.

Recommended Books:

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, *Fundamentals of Thermodynamics*, John Wiley and Sons.
2. Jones, J. B. and Duggan, R. E., 1996, *Engineering Thermodynamics*, Prentice-Hall of India

3. Moran, M. J. and Shapiro, H. N., 1999, *Fundamentals of Engineering Thermodynamics*, John Wiley and Sons.
4. Nag, P.K, 1995, *Engineering Thermodynamics*, Tata McGraw-Hill Publishing Co. Ltd.

BASIC ELECTRONICS & INSTRUMENTATION

Subject Code: BECEE0-002 **L T P C** **Duration: 60 Hrs.**

3 1 0 4

Course Objectives:

1. Know broadly the concepts and functionalities of the electronic devices, tools and instruments.
2. Understand use, general specifications and deployabilities of the electronic devices, and assemblies.
3. learning of handling and usage of electronic devices, tools and instruments in engineering applications.

UNIT – I

Diodes and Applications covering, Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications; Silicon Controlled Rectifier (SCR) – Operation, Construction, Characteristics, Ratings, Applications. **15 Hrs.**

UNIT – II

Transistor Characteristics covering, Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Divider Bias Configuration; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Depletion and Enhancement Type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuits. **15 Hrs.**

UNIT –III

Measurements:SI units, systematic and random errors in measurement, expression of uncertainty – accuracy and precision index, propagation of errors. PMMC, MI and dynamometer type instruments; dc potentiometer; bridges for measurement of R, L and C, Q-meter. Measurement of voltage, current

and power in single and three phase circuits; ac and dc current probes; true rms meters, voltage and current scaling, instrument transformers, timer/counter, time, phase and frequency measurements, digital voltmeter, digital multimeter; oscilloscope, shielding and grounding.

15 Hrs.

UNIT-IV

Sensors and Industrial Instrumentation: Resistive-, capacitive-, inductive-, piezoelectric-, Hall effect sensors and associated signal conditioning circuits; transducers for industrial instrumentation: displacement (linear and angular), velocity, acceleration, force, torque, vibration, shock, pressure (including low pressure), flow (differential pressure, variable area, electromagnetic, ultrasonic, turbine and open channel flow meters) temperature (thermocouple, bolometer, RTD (3/4 wire), thermistor, pyrometer and semiconductor); liquid level, pH, conductivity and viscosity measurement.

15 Hrs.

Expected Outcomes:

1. Upon completion of this course, the students will be able to understand the measurement of various quantities using instruments, their accuracy & range, and the techniques for controlling devices automatically.
2. An ability to apply knowledge of mathematics, science and engineering fundamentals appropriate to the discipline.
3. An ability to identify, formulate and solve problems by applying the principles of electronic instrumentation and control system.
4. An ability to use the techniques, skills and modern engineering tools necessary for his engineering practice.

Recommended Books:

1. David. A. Bell (2003), Laboratory Manual for Electronic Devices and Circuits, Prentice Hall, India.
2. Santiram Kal (2002), Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India.
3. Alan S Morris (2001), Measurement and Instrumentation Principles, 3rd/e, Butterworth Hienemann.
4. David A. Bell (2007), Electronic Instrumentation and Measurements 2nd/e, Oxford Press.
5. E.O Doebelin, Measurement System: Application and Design, McGraw Hill.

MECHANICAL ENGINEERING LAB-I (DESIGN-I)

Subject Code: BMECS1-304 **L T P C**

0 0 2 1

Course Outcomes: After studying this course, students shall be able to:

1. Measure the various mechanical properties such as tensile strength, compressive strength, shear strength, torsion strength, impact strength, fatigue strength and hardness of various materials.
2. To measure the bending stress and deflection in beams.
3. To measure the strain energy and spring stiffness of a helical spring.
4. Calculate load carrying capacity of long columns and their buckling strength.

EXPERIMENTS

1. Tension test on a mild steel rod specimen and to draw stress-strain curve.
2. Compression test on Mild steel and Cast Iron specimen.
3. Double shear test on Mild steel and Aluminum rod specimens.
4. Torsion test on mild steel rod specimen.
5. Impact test on metal specimen to determine impact strength.
6. Fatigue test on Mild Steel specimen.
7. Hardness test on metals and alloys - (Rockwell, Brinell & Vicker's test).
8. Bending test on steel bar under point load.
9. Deflection test on beams under point load.
10. Compression test on helical spring.
11. Determination of Bucking loads of long columns with different end conditions.

ENVIRONMENTAL SCIENCES

Subject Code: BMNCC0-002 **L T P C** **Non credited course**

1 0 0 0

Course Objectives:

1. To identify global environmental problems arising due to various engineering/industrial and technological activities and the science behind these problems
2. To realize the importance of ecosystem and biodiversity for maintaining ecological balance.
3. To identify the major pollutants and abatement devices for environmental management and sustainable development.
4. To estimate the current world population scenario and thus calculating the economic growth, energy requirement and demand.
5. To understand the conceptual process related with the various climatologically associated problems and their plausible solutions.

. UNIT-I

1. The Multidisciplinary Nature of Environmental Studies:

Definition, scope and importance, Need for public awareness.

2. **Natural Resources**

Renewable and Non-renewable Resources: Natural resources and associated problems.

(a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

(b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

(c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

(d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

(e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

UNIT-II

Environmental Pollution: Definition

(a) Causes, effects and control measures of:

i) Air pollution

ii) Water pollution

iii) Soil pollution

iv) Marine pollution

v) Noise pollution

vi) Thermal pollution

vii) Nuclear pollution

(b) **Solid Waste Management**: Causes, effects and control measures of urban and industrial wastes.

(c) Role of an individual in prevention of pollution.

(d) Pollution Case Studies.

(e) Disaster management: floods, earthquake, cyclone and landslides.

UNIT-III

Social Issues and the Environment

(a) From unsustainable to sustainable development

(b) Urban problems and related to energy

(c) Water conservation, rain water harvesting, Watershed Management

(d) Resettlement and rehabilitation of people; its problems and concerns, Case studies.

(e) Environmental ethics: Issues and possible solutions

(f) Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Case studies.

(g) Issues involved in enforcement of environmental legislation

UNIT-IV

Human Population and the Environment

(a) Population growth, variation among nations

(b) Population explosion – Family Welfare Programmes

(c) Environment and human health

(d) Human Rights

(e) Value Education

(f) Women and Child Welfare

(g) Role of Information Technology in Environment and Human Health

(h) Case Studies.

Environmental Science related activities:

We as human being are not an entity separate from the environment around us rather we are a constituent seamlessly integrated and co-exist with the environment around US. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa. Ancient

wisdom drawn from Vedas about environment and its sustenance reflects these ethoses. There is a direct application of this wisdom even in modern times. Idea of an activity based course on environment protection is to sensitize the students on the above issues through following two types of activities.

(a) Awareness Activities:

i) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste.

ii) Slogan making event

iii) Poster making event

iv) Cycle rally

v) Lectures from experts.

(b) Actual Activities:

i) Plantation

ii) Gifting a tree to see its full growth

iii) Cleanliness drive

iv) Drive for segregation of waste

v) To live some big environmentalist for a week or so to understand his work

vi) To work in kitchen garden for mess

vii) To know about the different varieties of plants

viii) Shutting down the fans and ACs of the campus for an hour or so

Recommended Books

1. Agarwal, K. C. 2001 Environment Biology, Nidi Publ. Ltd. Bikaner.
2. Jadhav, H & Bhosale, V.M. 1995. Environment Protection and Laws. Himalaya Pub House, Delhi 284p.
3. Rao M. N. & Datta A.K. 1987. Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345 p.
4. Principle of Environment Science by Cunninghan, W.P.
5. Essentials of Environment Science by Joseph.

MATERIALS ENGINEERING

Subject Code: BMECS1-401 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

1. Understanding of the correlation between the internal structure of materials, their mechanical properties.
2. To provide a detailed interpretation of equilibrium phase diagrams
3. Learning about different phases and heat treatment methods to tailor the properties of Fe-C alloys.

Unit - I

Crystal Structure: Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, Diffusion: diffusion mechanism, steady state and non-steady state diffusion

08 Hrs.

Unit - II

Advanced Materials and Tools: Smart materials, exhibiting ferroelectric, piezoelectric, optoelectric, semiconducting behavior, lasers and optical fibers, photoconductivity and superconductivity, nanomaterials, properties and applications, biomaterials, superalloys, shape memory alloys. Materials characterization techniques such as, scanning electron microscopy, transmission electron microscopy, atomic force microscopy, scanning tunneling microscopy, atomic absorption spectroscopy, differential scanning calorimetry.

14 Hrs.

Unit - III

Alloys, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstrctural aspects of ledeburite, austenite, ferrite and cementite, cast iron.

09 Hrs.

Unit - IV

Heat treatment of Steel: Annealing, tempering, normalising and spheroidising, isothermal transformation diagrams for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case

hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening.

06 Hrs.

Alloying of steel, properties of stainless steel and tool steels, maraging steels- cast irons; grey, white, malleable and spheroidal cast irons- copper and copper alloys; brass, bronze and cupro-nickel; Aluminium and Al-Cu – Mg alloys- Nickel based superalloys and Titanium alloys

08 Hrs.

Course Outcomes:

1. Student will be able to identify crystal structures for various materials and understand the defects in such structures.
2. Understand how to tailor material properties of ferrous and non-ferrous alloys.

Recommended Books:

1. W. D. Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition,Wiley India.
2. Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall ofIndia Private Limited, 4th Indian Reprint, 2002.
3. V. Raghavan, "Material Science and Engineering', Prentice Hall of India Private Limited,1999.U. C. Jindal, "Engineering Materials and Metallurgy", Pearson, 2011.
4. K.M. Gupta, "Material Science, Metallurgy and Engineering Materials", Umesh, 2012.

STRENGTH OF MATERIALS-II

Subject Code: BMECS1-402 **L T P C** **Duration: 60 Hrs.**

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 beams; stresses in helical, spiral, leaf and flat spiral springs; stress and strain analysis of thin, thick cylinder and spheres subjected to internal pressure; various theories of failure.

UNIT-1

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

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 related to two dimensional stress systems.

15 Hrs.

UNIT-II

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

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, shrinkage allowance and shrinkage stress.

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

15 Hrs.

UNIT –III

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

Shear Stresses in Beams: Shear stress distribution in rectangular, circular, triangular, I, T and channel section beams.

15 Hrs.

UNIT-IV

Springs: Types of springs, derivation of strain energy (S.E.) equation, stress and S.E. in open and closed coiled helical springs under the action of axial load and/or couple. Bending stress, deflection and S.E. in Leaf spring, S.E. in flat spiral springs.

15 Hrs.

Expected Outcome/s:

The outcome of the course is to understand the stress analysis in various mechanical members e.g. thin and thick cylinders, rotating discs, curved beams and springs under various load conditions. The student will be able to properly analyze and design these mechanical members from the strength point of view.

Recommended Books:

1. Sadhu Singh, 'Strength of Materials', Khanna Publishers.
2. Kirpal Singh, 'Mechanics of Materials', Standard Publishers.
3. G.H. Ryder, 'Strength of Materials', Macmillan India Ltd.
4. S.S. Rattan, 'Strength of Materials', Tata McGraw Hills.
5. Timoshenko and Gere, 'Mechanics of Materials', CBS Publishers.
6. E.P. Popov, 'Mechanics of Materials', Pearson Education.
7. R. K. Bansal, 'Strength of Materials', Laxmi Publication P) Ltd

FLUID MACHINES

Subject Code: BMECS1-403 **L T P C** **Duration: 60 Hrs.**

3 1 0 4

Course Objectives:

1. To recognize basic components of turbo machines and understand related fundamental laws/ principles
2. To Know about constructional, working and design aspects various turbines and pumps
3. Able to evaluate working and performance of various turbo machines.
4. Know about constructional details and working of hydraulic devices.

UNIT I

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. **10 Hrs.**

UNIT II

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. Euler's equation for energy transfer in a turbo machine. **8 Hrs.**

Pelton Turbine: Component parts and operation; velocity triangles; 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; governing of Pelton turbine.

8 Hrs.

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 dBMECS1ription of commonly used surge tanks; governing of reaction turbines. **8 Hrs.**

UNIT III

Centrifugal Pumps: Layout and installation; Main elements and their functions; Various types and classification; Pressure changes in a pump; Heads of a pump - suction; delivery; static; manometric; total; net positive suction head and Euler’s head; 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; model testing and Priming and priming devices; Multistage pumps - series and parallel arrangement; suBMECS1rsible pumps.

Construction and operation; Axial and mixed flow pumps; Trouble shooting - field problems; causes and remedies. **12 Hrs.**

Reciprocating Pumps: Introduction to single acting and double acting reciprocating pumps; their components; and 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; Functions of Air vessels. **4 Hrs.**

UNIT IV

Similarity Relations and Performance Characteristics: Unit quantities; specific speed and model relationships; scale effect; Cavitation and Thomas's cavitation number; Concept of Net Positive Suction Head (NPSH) and its application. **5 Hrs**

Hydraulic Devices and Systems: Construction; operation and utility of simple and differential accumulator; intensifier; fluid coupling and torque converter; Air lift and jet pumps; gear; vane and piston pumps; Hydraulic Ram; Hydraulic lift; Hydraulic crane and Hydraulic press. **5 Hrs**

Expected Outcomes:

After completion of the course, the students will have a strong foundation on Fluid Machines and will be able to apply the basic principles, the laws, and the pertinent equations to engineering design of the machines for required applications.

Recommended Books:

1. R.L. Daughaty, Hydraulic Turbines, McGraw Hill
2. Shiv Kumar, Fluid Systems, Satya Prakashan
3. Jagdish Lal, Hydraulic Machines by Metropolitan Book Co
4. D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, SK Kataria and Sons,
5. K. Subramaniam, Hydraulic Machines, Tata Mc Graw Hill
6. R.K. Purohit., Hydraulic Machines, Scientific Publishers

APPLIED THERMODYNAMICS

Subject Code: BMECS1-404 **L T P C** **Duration: 60 Hrs.**

3 1 0 4

Course Objectives:

1. To learn about of I law for reacting systems and heating value of fuels
2. To learn about gas and vapor cycles and their first law and second law efficiencies
3. To learn about gas dynamics of air flow and steam through nozzles
4. To learn the about reciprocating compressors with and without intercooling

5. To analyze the performance of steam turbines

Unit I

Introduction to solid, liquid and gaseous fuels–Stoichiometry, exhaust gas analysis- First law analysis of combustion reactions- Heat calculations using enthalpy tables- Adiabatic flame temperature- Chemical equilibrium and equilibrium composition calculations using free energy.

12 Hrs.

Unit II

Vapor power cycles, Rankine cycle with superheat, reheat and regeneration, energy analysis. Supercritical and ultra super-critical Rankine cycle- Gas power cycles, Air standard Otto, Diesel and Dual cycles-Air standard Brayton cycle, effect of reheat, regeneration and intercooling- Combined gas and vapor power cycles- Vapor compression refrigeration cycles.

16 Hrs.

Analysis of steam turbines, velocity and pressure compounding of steam turbines.

06 Hrs.

Unit III

Basics of compressible flow. Stagnation properties, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows- normal shocks- use of ideal gas tables for isentropic flow and normal shock flow- Flow of steam and refrigerant through nozzle, super saturation compressible flow in diffusers, efficiency of nozzle and diffuser.

14 Hrs.

Unit IV

Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of intercooling, minimum work for multistage reciprocating compressors. **12 Hrs.**

Expected Outcomes:

1. After completing this course, the students will get a good understanding of various practical power cycles and heat pump cycles.
2. They will be able to analyze energy conversion in various thermal devices such as combustors, air coolers, nozzles, diffusers, steam turbines and reciprocating compressors
3. They will be able to understand phenomena occurring in high speed compressible flows

Recommended Books:

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, *Fundamentals of Thermodynamics*, John Wiley and Sons.

2. Jones, J. B. and Duggan, R. E., 1996, *Engineering Thermodynamics*, Prentice-Hall of India
3. Moran, M. J. and Shapiro, H. N., 1999, *Fundamentals of Engineering Thermodynamics*, JohnWiley and Sons.
4. Nag, P.K, 1995, *Engineering Thermodynamics*, Tata McGraw-Hill Publishing Co. Ltd

MACHINE DRAWING USING CAD

Subject Code: BMECS1-405 **L T P C** **Duration: 45 Hrs.**

1 0 4 3

Course Objectives:

The objective of this course is to make students understand the principles and requirements of production drawings and learning how to assemble and disassemble important parts used in major mechanical engineering applications.

Unit –I

Introduction: Principles and classification of Drawing, Requirements of production drawing, Sectioning and conventional representation, Dimensioning, symbols of standard tolerances, Machining Symbols, introduction and Familiarization of Code IS: 296. Manual Drafting and Computer Aided Drafting using software like Pro-desktop or Pro-E or AutoCAD / any other software. **4 Hrs.**

Unit –II

Practical applications& working of

a) Fasteners: Types of screw threads, types of nuts and bolts, screwed fasteners, welding joints and riveted joints
b) Couplings: Solid or Rigid Coupling, Protected Type Flange coupling, Pin type flexible coupling, muff coupling, Oldham, universal coupling, claw coupling.
c) Knuckle and cotter joints
d) Pipe and Pipe Fittings: flanged joints, spigot and socket joint, union joint. **8 Hrs.**

Unit –III

Assembly and Disassembly:

a) IC Engine Parts: Piston, connecting rod
b) Boiler Mountings: Steam stop valve, feed check valve, Safety valve, Blow off cock.
c) Bearings: Swivel bearing, Thrust bearing, Plummer block
d) Miscellaneous: Screw Jack, Drill Press Vice, Crane hook, Tool Post **25 Hrs.**

Unit – IV

Computer Aided Drafting (CAD)

Drawing using software like Pro-E or AutoCAD / other

a) Machine Components: Screw fasteners, Keys cotters and joints, Shaft Couplings, Pipe joints and fittings, Riveted joints.

b) Assemblies: Bearings (Plumber Block, Footstep, Swivel), Engine Parts, Machine components, Valves. Exercise in computer plots of drawings/ blueprints. **8 Hrs.**

Expected Outcomes:

1. After going through this course, the student shall be able to understand the drawings of mechanical components and their assemblies along with their utility for design of components.
2. The student shall be in the position to carry out the assemblies both on sheet and on the computer using software.

Recommended Books:

1. P.S. Gill, 'Machine Drawing', S.K. Kataria and Sons.
2. N.D. Bhatt, 'Machine Drawing', Charotar Publishing House
3. G. Pohit, 'Machine Drawing with AutoCAD', Pearson Education Asia.
4. R.K. Dhawan, 'Machine Drawing', S. Chand & Company Limited, 2003
5. K.L. Narayana, P. Kannaiah and K.V. Reddy, 'Machine Drawing', New Age International Publishers.

BIOLOGY

Subject Code: **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Unit –I

Introduction: Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry

Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry. **06 Hrs**.

Classification: Purpose: To convey that classification per se is not what biology is all about. The underlyingcriterion, such as morphological, biochemical or ecological be highlighted.

Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitataacquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus **10 Hrs.**

Unit –II

Genetics: Purpose: To convey that "Genetics is to biology what Newton's laws are to Physical Sciences"

Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

05 Hrs.

Biomolecules: Purpose: To convey that all forms of life have the same building blocks and yet the manifestations areas diverse as one can imagine

Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss aboutsugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids. **04 Hrs.**

Enzymes: Purpose: To convey that without catalysis life would not have existed on earth

Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyse reactions.Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

04 Hrs.

Unit –III

Information Transfer: Purpose: The molecular basis of coding and decoding genetic information is universalMolecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structurefrom single stranded to double helix to nucleosomes. Concept of genetic code. Universality anddegeneracy of genetic code. Define gene in terms of complementation and recombination.

04 Hrs.

Macromolecular analysis: Purpose: How to analyses biological processes at the reductionistic level Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary andquaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

05 Hrs.

Unit –IV

Metabolism: Purpose: The fundamental principles of energy transactions are the same in physical and biological world.

Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonicand exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge

04 Hrs.

Microbiology: Concept of single celled organisms. Concept of species and strains. Identification and classificationof microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization andmedia compositions. Growth kinetics.

03 Hrs.

Course Outcomes

After studying the course, the student will be able to:

1. DBMECS1ribe how biological observations of 18th Century that lead to major discoveries.
2. Convey that classification per se is not what biology is all about but highlight the underlyingcriteria, such as morphological, biochemical and ecological
3. Highlight the concepts of recessiveness and dominance during the passage of genetic materialfrom parent to offspring
4. Convey that all forms of life have the same building blocks and yet the manifestations are asdiverse as one can imagine
5. Classify enzymes and distinguish between different mechanisms of enzyme action.
6. Identify DNA as a genetic material in the molecular basis of information transfer.
7. Analyse biological processes at the reductionistic level
8. Apply thermodynamic principles to biological systems.
9. Identify and classify microorganisms.

Recommended Books:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman andCompany
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, PrBMECS1ott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

Mathematics III (PDE, Probability & Statistics)

Subject Code: **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

1. To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering
2. To provide an overview of probability and statistics to engineers

Unit –I

Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation.

08 Hrs.

Unit –II

Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables.

10 Hrs.

Unit –III

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality. Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities. Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

14 Hrs.

Unit –IV

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis -Probability

distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances - Chisquare test for goodness of fit and independence of attributes.

13 Hrs.

Course Outcomes:

Upon completion of this course, students will be able to solve field problems in engineering involving PDEs. They can also formulate and solve problems involving random variables and apply statistical methods for analysing experimental data.

Recommended Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
3. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
4. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

INDUSTRIAL AUTOMATION AND ROBOTICS

Subject Code: BMECS1-E 1.3 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objective

1. To understand the role of automation in modern industry.
2. To study Fluid power control elements, automation in material handling systems.
3. To study robotic anatomy and control of robotic manipulators.

Unit-I

Introduction

Concept, scope and challenges in automation, social- economic aspect of automation, types of production systems, Levels of automation, Industry 4.0 concept, Artificial Intelligence (AI). **03 Hrs.**

Unit-II

Fluid Power

Classification, Functions and graphical representation of fluid control elements, Fluid properties, Classification and working of Fluid power generators (Hydraulic and pneumatic), working and applications of Hydraulic and pneumatic Valves. **10 Hrs.**

Unit-III

Basic hydraulic and pneumatic circuits:

Logic circuit design for a given time displacement diagram & sequence of operations, Hydraulic & Pneumatic Circuits such as Time Delay Valve & Quick Exhaust Valve, Memory Circuit & Speed Control of a Cylinder, Troubleshooting (Causes, Effects and diagnosis), Designation of specific Elements in a Circuit. **10 Hrs.**

Fluidics:

Boolean algebra, Truth Tables, Logic Gates, Coanda effect. **04 Hrs.**

Discrete control Using Programmable Logic Controllers

Basics of Programmable logic controllers (PLC), Architecture & Components of PLC, Ladder Logic Diagrams **04 Hrs.**

Unit-IV

Material handling Devices:

Overview and Automation in material handling systems, principles of material handling, Classification, Constructional details and Applications of Transfer devices and feeders. Automated Guided Vehicle Systems. Introduction to automated assembly systems. **05 Hrs.**

Robot anatomy, Classification, Robot Specifications, End effectors, Robot Performance Parameters, Robotic Programming, Machine Vision, Teach pendants, Industrial Applications of Robots.

09 Hrs.

Expected outcomes

Upon completion of this course, the student will be able to understand the necessity of automation, implementation of fluid power control elements in modern industry, Material handling systems and control of robotic manipulators.

Recommended Books

1. Anthony Esposito, Fluid Power with applications, Pearson
2. S. R Majumdar, Pneumatic Control, McGraw Hill
3. S. R Deb, Robotic Technology and Flexible Automation, Tata Mc Hill
4. Groover Mikell P. Automation, Production Systems, and Computer Integrated Manufacturing

MECHANICAL ENGINEERING LABORATORY (THERMAL-I)

Subject Code: BMECS1-406 **L T P C**

0 0 2 1

Objectives:

(i) To understand the principles and performance characteristics of flow and thermal devices

(ii) To know about the measurement of the fluid properties

Contents:

1. To study the flow through a variable area duct and verify Bernoulli's energy equation.
2. Determination of the density & viscosity of an oil and friction factor of oil flow in a pipe.
3. Measurement of Coefficient of Discharge of given Orifice and Venturi meters
4. Determination of the performance characteristics of a centrifugal pump
5. Determination of the performance characteristics of Pelton Wheel
6. Determination of the performance characteristics of a Francis Turbine
7. Determination of the performance characteristics of a Kaplan Turbine
8. Determination of the calorific value of a given fuel and its flash & fire points
9. Study the construction and operation of 2 stroke and 4 stroke Petrol and Diesel engines; and draw the valve timing diagram.
10. Determine the brake power, indicated power, friction power and mechanical efficiency of a multi-cylinder petrol engine running at constant speed (Morse Test).
11. 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 smoke density. Also make the heat balance sheet.
12. 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. Also make the heat balance sheet.