Semester III (Second year]

Course Type	Course Code	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
Professional Core courses	BTME301-18	Fluid Mechanics	3	1	0	40	60	100	4
Professional Core courses	BTME302-18	Theory of Machines -I	3	1	0	40	60	100	4
Professional Core courses	BTME303-18	Machine Drawing	1	0	6	40	60	100	4
Professional Core courses	BTME304-18	Strength of Materials-I	3	1	0	40	60	100	4
Engineering Science courses	BTEC305-18	Basic Electronics Engineering	3	0	0	40	60	100	3
Professional Core courses	BTME305-18	Basic Thermodynamics	3	1	0	40	60	100	4
Professional Core courses	BTME306-18	Strength of Material (Lab)	0	0	2	30	20	50	1
Professional Core courses	BTME307-18	Theory of Machine (Lab)	0	0	2	30	20	50	1
Professional Core courses	BTME308-18	Fluid Mechanics (Lab)	0	0	2	30	20	50	1
Mandatory courses	BMPD301-18	Mentoring and Professional Development	0	0	2	Satisfactory / Un-Satisfactory			Non-Credit
Total			16	4	14	330	420	750	26

Semester IV (Second year]

Course Type	Course Code	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
Professional Core courses	BTME401-18	Applied Thermodynamics	3	1	0	40	60	100	4
Professional Core courses	BTME402-18	Fluid Machines	3	1	0	40	60	100	4
Professional Core courses	BTME403-18	Strength of Materials-II	3	1	0	40	60	100	4
Engineering Science courses	BTME404-18	Materials Engineering	3	0	0	40	60	100	3
Professional Core courses	BTME405-18	Theory of Machines-II	3	1	0	40	60	100	4
Mandatory courses	EVS101-18	Environmental Science	3	-	-	100	0	100	0
Professional Core courses	BTME406-18	Applied Thermodynamics (Lab)	0	0	2	30	20	50	1
Professional Core courses	BTME407-18	Fluid Machines (Lab))	0	0	2	30	20	50	1
Professional Core courses	BTME408-18	Material Engineering (Lab)	0	0	2	30	20	50	1
Mandatory courses	BMPD401-18	Mentoring and Professional Development	0	0	2	Satisfactory / Un-Satisfactory			Non-Credit
Total			18	4	8	390	360	750	22

Semester V (Third year)

Course Type	Course Code	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
Professional Core courses	BTME501-18	Heat Transfer	4	1	0	40	60	100	5
Professional Core courses	BTME502-18	Design of Machine Elements	4	1	0	40	60	100	5
Professional Core courses	BTME503-18	Manufacturing Processes	4	0	0	40	60	100	4
Mandatory courses	BTME504-18	Management and Engineering Economics	3	0	0	40	60	100	3
Professional Core courses	BTME505-18	Heat Transfer (Lab)	0	0	2	30	20	50	1
Professional Core courses	BTME506-18	Manufacturing Processes (Lab)	0	0	2	30	20	50	1
Engineering Science courses	BTME507-18	Numerical Methods (Lab)	0	0	3	30	20	50	1.5
Mandatory courses	BTMC102-18	Essence of Indian knowledge Tradition	3	0	0	100	00	100	Non-Credit
	BTME409-18	4-weeks Industrial Training *	0	0	6	60	40	100	Non-credit
Total			18	2	13	410	340	750	20.5

* The grade of Satisfactory/ Un-satisfactory of Industrial/Institutional Training imparted at the end of 4th Semester will be included here.

Subject offered for Minor Degree in B. Tech. Mechanical Engineering

Core Subjects

Sr. No.	Subject Code	Couse Title	Credits
1	BTME-	Manufacturing Processes-I	3
2	BTME-	Manufacturing Processes-II	3

Elective Subject (Odd Semester)

Sr. No.	Subject Code	Couse Title	Credits
1	BTME301-18	Fluid Mechanics	4
2	BTME302-18	Theory of Machines-I	4
3	BTME304-18	Strength of Materials-I	4
4	BTME305-18	Basic Thermodynamics	4
5	BTME-	Heat Transfer	4

Elective Subject (Even Semester)

Sr. No.	Subject Code	Couse Title	Credits
1	BTME-	Automobile Engineering	4
2	BTME405-18	Theory of Machines-II	4
3	BTME403-18	Strength of Materials-II	4
4	BTME401-18	Applied Thermodynamics	4
5	BTME-	Refrigeration and Air Conditioning	4

BTME301-18 FLUID MECHANICS

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

1. Understand the concept of fluids and their properties.
2. Apply the concept to solve the problems related to statics, dynamics and kinematics of fluids.
3. Use and apply dimensional analysis and similitude techniques to various physical fluid phenomena.
4. Distinguish various types of flows and learn flow measurement methods.

Detailed Contents:

1. 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. **02 Hrs**

2. 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 subject to: (i) constant acceleration along horizontal, vertical and inclined direction (linear motion), (ii) constant rotation. **06 Hrs**

3. 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. **07 Hrs**

4. 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 motionand 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. **07 Hrs**

5. 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, Froude, Euler, Mach, and Weber) and their significance; Need of similitude; Geometric, kinematic and dynamic similarity; Model and prototype studies; Similarity model laws. **04 Hrs**

6. 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. **06 Hrs**

7. Pressure and Flow Measurement: Manometers; Pitot tubes; Various hydraulic coefficients; Orifice meters; Venturi meters; Borda mouthpieces; Notches (rectangular, V and Trapezoidal) and weirs; Rotameters. **04 Hrs**

Suggested Readings / Books:

1. S.K. Som, G. Biswas and S. Chakraborty, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill Publications, 3rd edition, 2011.
2. D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", S.K. Kataria and Sons Publishers, 1st Edition, 2009.
3. C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, "Fluid Mechanics and Machinery", Oxford University Press,1st Edition, 2010.
4. Y.A. Cengel and J.M. Cimbala, "Fluid Mechanics - Fundamentals and Applications", Tata McGraw Hill Publications, 3rd Edition, 2013.
5. V.L. Streeter, E.B. Wylie and K.W. Bedford, "Fluid Mechanics", McGraw Hill BookCompany, New York, 9th Edition, 1998.
6. Frank M. White, "Fluid Mechanics", Tata Mc Graw Hill Publications, 5th Edition, 2012.

BTME302-18 THEORY OF MACHINES -I

Course Outcomes:

After studying this course, students will be able to:

1. Understand constructional and working features of important machine elements.
2. Design belt, rope and chain drives for transmission of motion from one shaft to another.
3. Identify different Cam and follower pairs for different applications and construct cam profile for required follower motion.
4. Understand the function of brakes, dynamometers, flywheel and governors.

Detailed Contents:

1. 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. **06 Hrs**

2. 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. **05 Hrs**

3. 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.**05 Hrs**

4. 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 camprofiles with various motions (SHM, uniform velocity, uniform acceleration and retardation,cycloidal Motion). Analysis of follower motion for circular, convex and tangent cam profiles. **05 Hrs**

5. Friction Devices: Concepts of friction and wear related to bearing and clutches. Types of brakes function of brakes. Braking of front and rear tyres of a vehicle. Determination of braking capacity, Types of dynamometers, (absorption, and transmission). **06 Hrs**

6. 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. **03 Hrs**

7. **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. **06 Hrs**

Suggested Readings / 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.

BTME303-18 MACHINE DRAWING

Course Outcomes:

After studying this course; the student will be able to:

1. Read, draw and interpret the machine drawings and related parameters.
2. Use standards used in machine drawings of machine components and assemblies.
3. Learn the concept of limits, fits and tolerances in various mating parts.
4. Visualize and generate different views of a component in the assembly.
5. Use CAD tools for making drawings of machine components and assemblies.

Note:

1. Drawing Practice is to be done as per IS code SP 46:2003 by Bureau of Indian Standards.
2. The Question paper shall have following structure/weightage:
   Section A – Short answer type Questions based upon whole syllabus – 10 question of 02 marks each (All questions are compulsory).
   Section B – Free hand sketching of machine parts etc.; – out of 03 questions of 05 marks each, 02 Questions are to be attempted.
   Section C – Assembly drawing (from Unit-III) of machine parts with at least two views (with bill of materials) – out of 02 questions of 30 marks each;01 question is to be attempted.

Detailed Contents:

1. Introduction: Classification of drawings, Principles of drawing, Requirements of machine Drawing, sectional views and conventional representation, dimensioning, concept of limits, fits & tolerances and their representation, machining symbols, various types of screw threads, types of nuts and bolts, screw fasteners, welded joints and riveted joints, introduction and familiarization of code SP 46:2003 by Bureau of Indian Standards. **15 Hrs**

2.Free hand sketches of:

a. **Couplings**: solid and rigid couplings, protected type flange coupling, pin type flexible coupling, muff coupling.
b. Knuckle and cotter joints.
c. **Pipe and Pipe fittings**: Flanged joints, spigot and socket joint, union joint, hydraulic and expansion joint. **15 Hrs**

3.Assembly of:

a. **IC Engine Parts:** piston and connecting rod.
b. **Boiler Mountings**: Steam stop valve, blow off cock, feed check valve and spring loaded safety valve.
c. **Bearing:** Swivel bearing, Plummer Block and Foot Step bearing.
d. **Miscellaneous:** Screw jack, Tail Stock and crane hook. **20 Hrs**

4. Practice using Computer Aided Drafting (CAD) tools for:

(a) Machine components, screw fasteners, Keys cotters and joint, shaft couplings, Pipe joints and fittings, riveted joints and welded Joints.

(b) Assemblies: - Bearings (Plumber Block, Footstep, Swivel), boiler mountings, screw jack, Exercise in computer Plots of drawing

(c) Case studies in computer plots and industrial blueprint **10 Hrs**

Suggested Reading/Books:

1. P.S Gill, "Machine Drawing", S K Kataria and sons, 18th edition, 2017 reprint
2. N.D.Bhatt, "Machine Drawing". Charotar publications, 49th edition, 2014
3. Ajeet Singh, "Machine Drawing (including Auto CAD)", Tata McGraw Hill, 2nd edition,2012
4. G. Pohit, "Machine Drawing with Auto CAD", Pearson Education Asia, 2007.
5. IS code SP 46(2003): Engineering Drawing Practice for schools and colleges by Bureau of Indian Standards.

Topic for Self-Learning (TSL)
1. Conventional representation of common feature like Springs, Gear Assembly, Braking of shaft, Pipe, Screw threads etc.
2. Drawing of special Types of bolts, nuts and washers.
3. Importance of bill of materials (BOM)
4. Free hand sketch of bearings (i.e. ball bearing and roller bearing).

BTME304-18 STRENGTH OF MATERIALS-I

Course Outcomes:

At the end of the course, the student will be able to

1. Understand the concepts of stress and strain at a point, in the members subjected to axial, bending, torsional loads and temperature changes.
2. Determine principal stresses, maximum shearing stress and their angles, and the stresses acting on any arbitrary plane within a structural element.
3. Find bending moment and shear force over the span of various beams subjected to different kinds of loads.
4. Calculate load carrying capacity of columns and struts and their buckling strength.
5. Evaluate the slope and deflection of beams subjected to loads.

Detailed Contents:

1. 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. Generalized Hook's law, principal stresses related to principal strains. **08 Hrs**

2. 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 different loads: Concentrated loads, Uniformity distributed loads over the whole span or part of span, Combination of concentrated and uniformly distributed load, Uniformly varying loads and Application of moments. **06 Hrs**

3. 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. **05 Hrs**

4. 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. **05 Hrs**

5. **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.

05 Hrs

6. **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: Cantilevers, Simply supported beams with or without overhang, Under concentrated loads, uniformly distributed loads or combination of concentrated &uniformly distributed loads. **07 Hrs**

Suggested Readings/Books:

1. Timoshenko and Gere, "Mechanics of Materials", CBS Publishers and Distributors, New Delhi.
2. Pytel&Kiusalaas, "Mechanics of Materials", Cengage Learning, New Delhi.
3. S. S. Rattan, "Strength of Materials", Tata McGraw Hill, New Delhi.
4. R. K. Bansal, "A Text Book of Strength of Materials", Laxmi Publications, New Delhi.
5. D. K. Singh, "Strength of Materials", Ane Books Pvt. Ltd., New Delhi.
6. Sadhu Singh, Strength of Materials, Khanna Publishers, Delhi.

BTEC305-18 BASIC ELECTRONICS ENGINEERING

Course Objectives:
The objective of this Course is to provide the students of B.Tech Mechanical Engineering with an introductory and broad treatment of the field of Electronics Engineering to facilitate better understanding of the basic Electronics devices.

Course Outcomes:
After undergoing this course students will be able to

1. Understand construction of diodes and their rectifier applications.
2. Appreciate the construction and working bipolar junction transistors and MOSFETs.
3. Design Op-Amp IC based fundamental applications.
4. Comprehend working of basic elements of digital electronics and circuits.

Unit I: **Semiconductor Diodes and Applications** - Semiconductor Diode - Ideal versus Practical, 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;

Unit II: **Transistors & Amplifiers** - Bipolar Junction Transistor (BJT) – Construction, Operation, Common Base, Common Emitter and Common Collector Configurations, Distortion, Operating Point, Voltage Divider Bias Configuration; Introduction to nMOS and pMOS.

Unit III: Operational Amplifiers and Applications - Introduction to Op-Amp, Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal Op-Amp, Concept of Virtual Ground, Op-Amp Applications – Adder, Subtractor, Voltage Follower and Comparator; Differentiator and Integrator, Square Wave and Triangular Wave Generation.

Unit IV: Digital Electronics -Boolean Algebra - Binary, Octal, Hexadecimal Number Systems, Addition, Subtraction using 1's and 2's compliment method, Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR Integrated Circuits (ICs); K-Map simplification Truth Tables and Functionality of Flip-Flops – SR, JK and D Flip-Flop.

Text/Reference Books:

2. David. A. Bell (2003), Laboratory Manual for Electronic Devices and Circuits, Prentice Hall, India.
3. SantiramKal (2002), Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India.
4. Thomas L. Floyd and R. P. Jain (2009), Digital Fundamentals by Pearson Education.
5. Paul B. Zbar, A.P. Malvino and M.A. Miller (2009), Basic Electronics – A Text-Lab. Manual, TMH
6. R. T. Paynter (2009), Introductory Electronic Devices & Circuits, Conventional Flow Version, Pearson.

BTME305-18 BASIC THERMODYNAMICS

Course Objectives:

The course has been designed to cover the interconversion of heat energy into work energy and vice versa; balance of energy between the System and its Surroundings; to learn about the application of First and Second law to various thermodynamic Systems, to learn about gas power cycles and IC Engines, to learn about steam formation and its properties, to learn about vapor power cycles.

Course Outcomes:

1. Apply energy balance to Systems and Control Volumes in situations involving heat and work interactions.
2. Evaluate changes in thermodynamic properties of substances.
3. Evaluate performance of energy conversion devices.
4. Explain and apply various gas power and vapor power cycles.

1. Basic Concepts

Definition of thermodynamics, Concept of Thermodynamic System and of thermodynamic equilibrium, Boundary and Surroundings; Open, Closed and Isolated Systems. Property, state, path, process and cycle; dot/point functions and path functions, Phase and pure substances, Equation of State, reversible, Quasi-static and irreversible processes; Energy and its forms, Energy transfer across the System boundaries. Types of work transfer, heat and work; sign conventions for heat and work interaction, Concept of temperature and heat, microscopic and macroscopic approach, Concept of continuum, Zeroth law of thermodynamics. Concept of thermal equilibrium and principles of thermometry. Ideal gas and characteristic gas equation. (4)

2. First Law of Thermodynamics

Concept of First law of thermodynamics, essence and corollaries of First law; internal energy and enthalpy, analysis of non flow and flow processes for an ideal gas for constant volume(*isochoric*), constant pressure(*isobaric*), constant temperature(*isothermal)*, adiabatic and polytropic processes. Changes in various properties, work done and heat exchange during these processes, free expansion and throtting process and its applications in Engineering processes; Steady Flow Energy Equation and its application to various thermodynamic Systems(ie, in *engineering devices*); (8)

3. Second Law of Thermodynamics

Limitations of First law of thermodynamics, concept of Kelvin Plank and Clausius statements of the Second law and their ***equivalence*** *and* their application *to Refrigerator, Heat Pump and Heat Engine*. Thermodynamic temperature scale, Efficiency and philosophy of Carnot cycle and its consequences, Carnot Engine and Carnot theorem; Carnot refrigerator, Heat Pump and Heat Engines. Clausius theorem; Clausius inequality; concept of entropy, principle of increase in entropy, representation of various processes on T-S coordinates and change in entropy for different processes, concept of entropy generation in Closed and Open systems, high grade and low grade energy, available and unavailable energy; availability and unavailability, Second law efficiency and energy analysis of Thermodynamic Systems, Third law of Thermodynamics (definition only). (8)

4. Gas Power Cycles

Air-standard efficiency, Nomenclature of Piston-Cylinder arrangement w.r.t. swept volume; clearance volume, compression ratio and mean effective pressure; Analysis and philosophy of Air-Standard Cycles i.e. Otto Cycle, Diesel Cycle and Dual Cycle; their compression ratio, mean effective pressure, power output and Efficiency; Comparison between the three Cycles.
(9)

5. Internal Combustion Engines

Classification and application, constructional and working details of two stroke and four stroke cycle engines.

6. Properties of Steam

Pure Substance; steam formation at constant pressure and the properties of steam; use of steam tables, constant volume, constant pressure and isentropic process, simple Ranking cycle. Construction, working, classification and applications of gas turbines, comparison of gas turbines with steam turbines and IC engines, performance analysis of constant pressure gas turbine cycle (Brayton cycle), thermal refinements like regeneration, inter-cooling and re-heating, selection

Suggested Books:

1. Sonntag R. E, Borgnakke C. and Van Wylen G. J., Fundamentals of Thermodynamics, Wiley India Pvt. Ltd.
2. Jones, J. B. and Duggan R. E., Engineering Thermodynamics, Prentice-Hall of India.
3. Moran M. J. and Shapiro H. N., Fundamentals of Engineering Thermodynamics, John Wiley and Sons.
4. Nag P.K., Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.
5. Mahesh Rathore, Thermal Engineering, McGraw-Hill Education (India) Pvt. Ltd.
6. R. Yadav, Sanjay and Rajay, Applied Thermodynamics, Central Publishing House.

BTME306-18 Strength of Material Lab

Course Outcomes:

After studying this course, students shall be able to:

1. Measure the various mechanical properties such as tensile and compressive strength, impact strength, torsion strength and fatigue strength and hardness of brittle and ductile materials.
2. Calculate load carrying capacity of long columns and their buckling strength.

List of Practical

1	To perform tensile and compression 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 hardness tests (Any one from 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.

BTME307-18 Theory of Machine (Lab)

Course Outcomes:

After studying this course, students shall be able to:

1. Determine gyroscopic couple, balancing of rotating masses and Cam profile analysis.
2. Determine gear- train value of compound gear trains and epicyclic gear trains.

List of Practical

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.

BTME308-18 Fluid Mechanics (Lab)

Course Outcomes:

After studying this course, students shall be able to:

1. Distinguish various type of flows and flow measurement methods and concept of statics and dynamics of liquids.
2. Determine discharge and head loss, hydraulic and friction coefficient, for different types of flow in pipe and open channels.

List of Practical

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

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.
For achieving the above, suggestive list of activities to be conducted are:

Part – A
(Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B
(Outdoor Activities)

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B
Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

BTME401-18 APPLIED THERMODYNAMICS

Course Outcomes:

After studying this course, students will be able to:

1. Learn the functioning and performance evaluation of reciprocating air compressors.
2. Analyze the combustion phenomenon in boilers and I.C. engines.
3. Use of Steam Tables and MollierChart to solve vapour power cycle problems.
4. Explain the constructional features and working of steam power plants and to evaluate their performance.

1. 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 and 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. **5 Hrs**

2. Thermodynamics of Combustion in Boilers and IC Engines: Principle of Combustion; Stoichio-metric and non-stoichiometeric combustion; Combusion Problems in boilers & 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/combustion and it's evaluation; first law analysis of reacting system: steady flow and Closed Systems, adiabatic flame temperature and its determination. Various stages of combustion in IC Engines.

5 Hrs

3. Steam: Properties of Steam Pure substance ; Steam and its formation at constant pressure: wet, dry and super-heated(*super-saturated*) steam; Sensible heat*(sensible enthalpy)*, latent heat(*latent enthalpy*) and total/stagnation heat(*total/stagnation 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 Charts; Basic thermodynamic processes with steam(isochoric, isobaric, isothermal, isentropic and adiabatic processes) and their representation on T-S Charts and Mollier Charts(**h-s** diagrams), significance of Mollier Charts.

5 Hrs

4. 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. 5 Hrs

5. **SteamNozzles**: 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; Areas 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.

5 Hrs

6. **Steam Turbines(Impulse Turbine**): Introduction; Classification; Impulse v/s Reaction turbines. Simple **impulse/De Level** turbine: Pressure and velocity variation, Compounding of impulse turbines: purpose types; pressure and velocity variation, velocity diagrams/triangles; Combined velocity diagram/triangles and calculations for force, axial thrust, work, power, blade efficiency, stage efficiency, maximum work and maximum efficiency, overall efficiency and relative efficiency, effect of blade friction on velocity diagram, effect of speed ratio on blade efficiency, condition for axial discharge. **5 Hrs**

7. **Reaction Turbine**:- Pressure and velocity variation, velocity diagrams/triangles, Degree of reaction, combined velocity diagram/triangles 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.

5 Hrs

8. **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. 5 Hrs

Suggested Books:

1. R. Yadav, "Applied Thermodynamics", Central Publishing House , Allahabad.
2. D.S. Kumar and V.P. Vasandani, "Heat Engineering", Metropolitan Book Co. Pvt. Ltd.
3. G Rogers and Y.Mayhew , "Engineering Thermodynamics", Pearson, Wesley Longman (Singapore) Pte, 482 F.I.E Patparganj, Delhi-110 092.
4. W.A.J. Keartan, Steam Turbine: , "Theory and Practice", ELBS Series.
5. V. Ganeshan, "Internal Combustion Engines", Tata McGraw Hill Education Pvt. Ltd., 7 West Patel Nagar, New Delhi-110 008.
6. P.K.Nag, "Basic & Applied Thermodynamics", Tata McGraw Hill Education Pvt. Ltd., 7 West Patel Nagar, New Delhi-110 008.
7. P.K. Nag, "Engineering Thermodynamics", Tata McGraw Hill Education Pvt. Ltd., 7 West Patel Nagar, New Delhi-110 008.
8. E.F. Obert, "Concepts of Thermodynamics", Tata McGraw Hill Education Pvt. Ltd., 7 West Patel Nagar, New Delhi-110 008.
9. C.P. Arora, "Thermodynamics", Tata McGraw Hill Education Pvt. Ltd., 7 West Patel Nagar, New Delhi-110008.

BTME402-18 FLUID MACHINES

Course Outcomes:

After studying this course, students shall be able to:

1. Recognize basic components of turbo machines and understand related fundamental laws/ principles and apply these for calculation of various parameters like work done, force efficiency etc.
2. Know about constructional details, working and design aspects of runner/wheel and evaluate the performance of various turbines like Pelton, Kaplan and Francis.
3. Know about constructional details, working and evaluate the performance of centrifugal pump under different vane shape conditions.
4. Know about constructional details, working and evaluate the performance of reciprocating pump and evaluate the effect of various deviations from the ideal conditions on the work done.
5. Know about constructional details and working of hydraulic devices like fluid coupling, accumulator and intensifier.

Detailed Contents:

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. Euler's equation for energy transfer in a turbo machine and specifying the energy transfer in terms of fluid and rotor kinetic energy changes. **07 Hrs**

2. 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. **05 Hrs**

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; governing of reaction turbines. **06 Hrs**

4. 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; submersible pumps. Construction and operation; Axial and mixed flow pumps; Trouble shooting - field problems; causes and remedies. **06 Hrs**

5. Similarity Relations and Performance Characteristics: Unit quantities; specific speed and model relationships; scale effect; Cavitation and Thomas's cavitation number; Concept of Net PositiveSuction Head (NPSH) and its application. **04 Hrs**

6. 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. **05 Hrs**

7. 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. **03 Hrs**

Suggested Reading/ Books:

1. R.L. Daughaty, Hydraulic Turbines, McGraw Hill
2. Jagdish Lal, Hydraulic Machines by Metropolitan Book Co
3. D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, SK Kataria and Sons,
4. K. Subramaniam, Hydraulic Machines, Tata Mc Graw Hill
5. R.K. Purohit., Hydraulic Machines, Scientific Publishers
6. C.S.P.Ojha, R.Berndtsson, P.Chandramouli, "Fluid Mechanics and Machinery", Oxford University Press, 2010

BTME403-18 STRENGTH OF MATERIALS II

Course Outcomes:

At the end of the course, the student will be able to:

1. Apply the basics to find stresses in various applications (shells, curved beams and rotating discs).
2. Analyse the change in dimensions of shells, curved beams and rotating discs under operation.
3. Determine stresses, deflection and energy stored in various kinds of springs subjected to load and twist.
4. Understand the concept of failure theories and strain energy.
5. Evaluate shearing stress variation in beams of different cross-section and materials.

Detailed Contents:

1. **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. **05 Hrs**

2. **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. **05 Hrs**

3. **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. **05 Hrs**

4. **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. **05 Hrs**

5. **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. **05 Hrs**

6. **Bending of Curved Beams**: Calculation of stresses in cranes or chain hooks, rings of circular and trapezoidal section, and chain links with straight sides. **04 Hrs**

7. **Shear Stresses in Beams**: Shear stress distribution in rectangular, circular, I, T and channel section; built up beams. Shear centre and its importance. **04 Hrs**

8. **Rotational Discs:** Stresses in rotating discs and rims of uniform thickness; disc of uniform strength. **03 Hrs**

Suggested Readings/Books:

1. S. S. Rattan, "Strength of Materials", Tata McGraw Hill, New Delhi.
2. R. K. Bansal, "A Text Book of Strength of Materials", Laxmi Publications, New Delhi.
3. Sadhu Singh, Strength of Materials, Khanna Publishers, Delhi.
4. Kirpal Singh, "Mechanics of Materials", Standard Publishers, New Delhi.
5. R.S. Lehri, "Strength of Materials", Katson Publishers, New Delhi.

BTME404-18 MATERIALS ENGINEERING

Course Outcomes:

After studying this course, students shall be able to:

1. Understand the significance of structure-property-correlation for engineering materials including ferrous and nonferrous.
2. Explain the use and importance of various heat treatment processes used for engineering materials and their practical applications.
3. Understand the various structural changes occurred in metals with respect to time temperature transformations.
4. Understand the significance of Fe-C and TTT diagram for controlling the desired structure and properties of the materials.

Detailed Content:

1. Crystallography: Atomic structure of metals, atomic bonding in solids, crystal structures, crystallattice of body centered cubic, face centered cubic, closed packed hexagonal; crystalline and noncrystalline 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 nonsteady-state diffusion, factors affecting diffusion. Theories of plastic deformation, recovery,re-crystallization. **12 Hrs**

2. Phase Transformation: General principles of phase transformation in alloys, phase rule andequilibrium diagrams, Equilibrium diagrams of Binary systems. Iron carbon equilibrium diagramand various phase transformations. Time temperature transformation curves (TTT curves): fundamentals, construction and applications. **09 Hrs**

3. Heat Treatment: Principles and applications. Processes viz. annealing, normalizing, hardening, tempering. Surface hardening of steels: Principles of induction and oxyacetylene flame hardening.Procedure for carburising, nitriding and cyaniding. Harden-ability: determination of harden-ability.Jominy end-quench test. Defects due to heat treatment and their remedies; effects produced byalloying elements. Composition of alloy steels. **09 Hrs**

4. Ferrous Metals and Their Alloys: Introduction, classification, composition of alloys, effect ofalloying elements (Si, Mn, Ni, Cr, Mo, W, Al) on the structures and properties of steel. **06 Hrs**

Suggested Readings / 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

BTME405-18 THEORY OF MACHINES-II

Course Outcomes:

After studying this course, students will be able to:

1. Understand the basic concepts of inertia forces & couples applied to reciprocating parts of a machine.
2. Understand balancing of rotating and reciprocating parts of machines.
3. Select suitable type of gears for different application and analyse the motion of different elements of gear trains.
4. Understand the concept and application of gyroscopic effect.
5. Gain knowledge of kinematic synthesis.

Detailed Contents:

1. 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. **05 Hrs**

2. 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. **05 Hrs**

3. 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. **06 Hrs**

4. 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. **07 Hrs**

5. 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. **05 Hrs**

6. Gyroscopic motion and couples: Effect on supporting and holding structures of machines. stabilization of ships and planes, Gyroscopic effect on two and four wheeled vehicles. **03 Hrs**

7. Kinematic synthesis of Mechanism: Freudenstien equation, Function generation errors in synthesis, two- and three-point synthesis Transmission angles, least square technique. **05 Hrs**

Suggested Readings / Books:

1. S.S. Rattan, Theory of Machines, Tata Mc. Graw 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, Mc Graw Hill.
5. V.P. Singh, Theory of Machines, Dhanpat Rai and Sons.

BTME406-18 Applied Thermodynamics (Lab)

Course Outcomes:

After studying this course, students shall be able to:

1. Understand the construction and working of IC engines, and evaluate their performance.
2. Identify the various types of boilers & condensers.

List of Practical

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.Study of working, construction, mountings and accessories of various types of boilers.

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 Petrol and 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 exhaust emission. 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.

BTME407-18 Fluid Machines (Lab)

Course Outcomes:

After studying this course, students shall be able to:

1. Conduct experiments on scaled down models or on actual size hydraulic machines and evaluate results in terms of unit or specific quantities for comparison purpose.
2. Understand the working of various hydraulic machines (turbines and pumps) and can suggest remedial solutions for various faults.

List of Practical

1	Determination of various efficiencies of Hydraulic Ram
2	To draw characteristics of Francis turbine/Kaplan 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/Blower
7	A visit to any Hydroelectric Power Station

BTME408-18 Material Engineering (Lab)

Course Outcomes:

After studying this course, students shall be able to:

1. Analyse the microstructure of different ferrous and non-ferrous samples.
2. Explore the effect of heat treatment on various engineering materials by analysing its microstructure and hardness.

List of Practical

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. 3.3

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 milsteel.

7 Determination of hardenability of steel by Jominy End Quench Test.

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.
For achieving the above, suggestive list of activities to be conducted are:

Part – A
(Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B
(Outdoor Activities)

3. Sports/NSS/NCC
4. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B
Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

ENVIRONMENTAL STUDIES FOR B.TECH CIVIL, ELECTRONICS, ELECTRICAL ENGINEERING, MECHANICAL AND COMPUTER SCIENCE

Sl. No.	Category	Course Code	Course Title	Hours per week			Total contact hrs,	Credits
				Lecture	Tutorial	Practical		
1	Mandatory Non-credit Course	EVS101-18	Environmental Studies	3	0	0	21	0

*** 40 Hours are kept for various activities under the head of activities. There will be a final theory examination for the students of 50 marks but these marks will not be added to their final result as assessment will be satisfactory or non-satisfactory.**

Course Outcomes:

1. Students will enable to understand environmental problems at local and national level through literature and general awareness.
2. The students will gain practical knowledge by visiting wildlife areas, environmental institutes and various personalities who have done practical work on various environmental Issues.
3. The students will apply interdisciplinary approach to understand key environmental issues and critically analyze them to explore the possibilities to mitigate these problems.
4. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world

Environmental Studies [L:2; T:0; P:0 (Credits-0)]

1. Environment Science (Mandatory non-credit course)

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 ethos. 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.

Detailed Contents

Module 1 : 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 forest 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.

f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resoureces for sustainable lifestyles.

Module 2 : Ecosystems

Concept of an ecosystem. Structure and function of an ecosystem.
Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystems:

a. Forest ecosystem
b. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Module 3 : Biodiversity and its conservation

- Introduction – Definition : genetic, species and ecosystem diversity.
- Biodiversity at global, National and local levels.
- Inida as a mega-diversity nation
- Hot-sports of biodiversity.
- Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India

Module 4 : Social Issues and the Environment

- From Unsustainable to Sustainable development
- Resettlement and rahabilitation of people; its problems and concerns.
- Environmental ethics : Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion,

  Nuclear accidents and holocaust. Case Studies.
- Public awareness.

***ACTIVITIES**

Nature club (bird watching, recognizing plants at institute/at home, recognizing local animals, appreciating biodiversity

Impart knowledge and inculcate the habit of taking interest and understanding biodiversity in and around the college campus. The students should be encouraged to take interest in bird watching, recognizing local plants, herbs and local animals. The students should be encouraged to appreciate the difference in the local biodiversity in their hometown, in the place of their study and other places they visit for vacation/breaks etc.

Following activities must be included.

Identify a tree fruit flower peculiar to a place or having origin from the place.

Making high resolution big photographs of small creatures (bees, spiders, ants. mosquitos etc.) especially part of body so that people can recognize (games on recognizing animals/plants).

Videography/ photography/ information collections on specialties/unique features of different types of common creatures.

Search and explore patents and rights related to animals, trees etc. Studying miracles of mechanisms of different body systems.

1 *(A) Awareness Activities:*

a) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste
b) Slogan making event
c) Poster making event
d) Cycle rally
e) Lectures from experts
f) Plantation
g) Gifting a tree to see its full growth
h) Cleanliness drive
i) To live with some eminent environmentalist for a week or so to understand his work vi) To work in kitchen garden for mess
j) To know about the different varieties of plants
k) Shutting down the fans and ACs of the campus for an hour or so
l) Visit to a local area to document environmental assets

   river/forest/grassland/hill/mountain/lake/Estuary/Wetlands
m) Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
n) Visit to a Wildlife sanctuary, Pushpa Gujral Science City, Kapurthala, National Park or Biosphere Reserve

Suggested Readings

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)
3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
4. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)

5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p

6. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)

7. Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.

8. Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)

9. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)

10. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p

11. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
12. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media (R)

13. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)

14. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p.

BTME501-18 HEAT TRANSFER

Course objectives:
To provide knowledge about application of conduction, convection and radiation heat transfer concepts to different practical applications
Course Outcomes:

1. To teach students the basic principles of conduction, radiation, and convection heat transfer. Students will demonstrate an understanding of the basic concepts of conduction, radiation, and convection heat transfer.

2. To extend the basic principle of conservation of energy to systems that involve conduction, radiation, and heat transfer. Students will demonstrate an understanding of the concept of conservation of energy and its application to problems involving conduction, radiation, and/or convection heat transfer. This principle will be used to formulate appropriate mathematical models and associated thermal boundary conditions.

3. To train students to identify, formulate, and solve engineering problems involving conduction heat transfer. Students will demonstrate the ability to formulate practical conduction heat transfer problems by transforming the physical system into a mathematical model, selecting an appropriate solution technique, and evaluating the significance of results.

4. To train students to identify, formulate, and solve engineering problems involving forced convection heat transfer, natural convection heat transfer, and heat exchangers. Students will demonstrate the ability to formulate practical forced and natural conduction heat transfer problems by transforming the physical system into a mathematical model, selecting an appropriate solution technique, and evaluating the significance of results. Students will also demonstrate an ability to analyze the performance of heat exchangers

5. To train students to identify, formulate, and solve engineering problems involving radiation heat transfer among black surfaces and among diffuse gray surfaces. Students will demonstrate the ability to formulate practical radiation heat transfer problems by transforming the physical system into a mathematical model, selecting an appropriate solution technique, and evaluating the significance of results.

Detailed Contents:
Unit-1
Introduction to Heat Transfer: Thermodynamics and Heat Transfer. Modes of Heat Transfer: Conduction, convection and radiation. Effect of temperature on thermal conductivity of materials; Introduction to combined heat transfer mechanism.
Conduction: Fourier's law of heat conduction. Coefficient of thermal conductivity. Effect of temperature and pressure on thermal conductivity of solids, liquids and gases. Three-dimensional general conduction equations in rectangular, cylindrical and spherical coordinates.
Steady State one-dimensional Heat conduction-I: Deduction of one-dimensional steady state heat conduction equation in rectangular; cylindrical and spherical coordinates with and without internal heat generation for uniform thermal conductivity of material. Concept of variable thermal conductivity.
Steady State one-dimensional Heat conduction-II: Electrical network analysis for heat transfer through composite/multilayer material. Application of heat conduction with internal heat generation in case of piston crown and in nuclear fuel rod with/ without cladding. Concept of equivalent area. Conduction shape factor. Conduction through edges and corners of walls. Critical thickness of insulation layers on electric wires and pipes carrying hot fluids.
Unit-II
One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance – Significance of Biot and Fourier Numbers –Infinite bodies- Chart solutions of transient conduction systems- Concept of Semi-infinite body.
Theory of Fins: Concept of fin. Classification of fins and their applications. Straight fins of uniform cross-section. Individual and total fin effectiveness and efficiency. Application of fins in temperature measurement of flow through pipes and determination of error in its measurement.
Unit-III
Convection: Classification of systems based on causation of flow, condition of flow, configuration of flow and

medium of flow. Dimensional analysis as a tool for experimental investigation. Buckingham Pi Theorem and method. Application for developing semi-empirical, non- dimensional correlation for convection heat transfer, Significance of non-dimensional numbers. Concepts of continuity, momentum and energy Equations.

Forced convection: External Flows: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer. -Flat plates and Cylinders. Internal Flows: Concepts about Hydrodynamic and Thermal Entry Lengths Division of internal flow based on this Use of empirical relations for Horizontal Pipe Flow and annulus flow.

Natural Convection: Physical mechanism of natural convection. Buoyant force. Empirical heat transfer relations for natural convection over vertical planes and cylinders, horizontal plates and cylinders, and sphere. Combined free and forced convection

Unit-IV

Heat Exchanger: Types of heat exchangers; Fouling factors; Overall heat transfer coefficient; Logarithmic mean temperature difference (LMTD) method; Effectiveness-NTU method; Compact heat exchangers. 3 **Condensation and Boiling** Boiling: Definition and types of boiling. Different regimes and heat transfer during pool boiling of a liquid. Nucleation and different theories accounting for increased heat transfer coefficient during nucleate phase of boiling. Condensation: Definition and types of condensation, film wise condensation on a vertical and inclined surface.

UNIT-V

Thermal Radiation: Process of heat flow due to radiation. Definition of emissivity, absorptivity, reflectivity and transmissivity. Concept of black and grey bodies. Plank's law of non chromatic radiation. Wien's displacement law. Kirchoff's law. Stefan Boltzmann's law. Lambert's Cosine law. Definition of intensity of Radiation, irradiation and radiosity. Geometric/ configuration factor and its use in heat exchange between two black bodies. Electrical network analysis for radiation exchange between two, three or four bodies (e.g. boiler or other furnaces). Simplification of electrical network analysis for its application to simple bodies like two parallel surfaces, concentric cylinders/spheres and a body enveloped by another body. Use of radiation shields.

Text/Reference Books: 1. Incropera F.P. and De Witt D.P., "Fundamentals of Heat and Mass transfer", John Wiley, 7th Edition, 2011.

2. Cengel, A. Yunus, "Heat and Mass Transfer", Tata McGraw Hills Education Private Ltd, 4 th Edition, 2013.
3. Kumar, D.S. "Fundamentals of Heat and Mass Transfer", S K Kataria & Sons, 7th Edition, 2013.
4. Chapman. A. J, "Heat Transfer", McGraw Hill, 7th Edition, 1990.
5. Holman, J.P. "Heat Transfer", Tata McGraw-Hill Publishing Company Ltd, 9th Edition, 2008.

BTME502-18 DESIGN OF MACHINE ELEMENTS

Course objectives:

To provide knowledge of design procedure for simple components like keys, cotters, fasteners, shafts, couplings, pipe joints and levers under static and fatigue loading. Objective of this course is to make the students capable of designing mechanical systems consisting of wide range of machine elements.

Course Outcomes:

After successfully completing this course, the students/learners will be able to:

1. Demonstrate recalling and applying knowledge of Basic Sciences, Graphics & Drawing, Basic Manufacturing Processes and Material Science, for design procedures of various Mechanical components.
2. Comprehend the effect of different stresses and strains under various loading conditions on the mechanical components and identify the mechanism/mode of failure.
3. Examine and solve design problems involving machine elements on the basis of various theories of failure.
4. Synergize forces, moments and strength information to develop ability to analyze, design and/or select machine elements aiming for safety, reliability, and sustainability.

Detailed Contents:

Introduction

Meaning of design with special reference to machine design, general design considerations, concept of tearing, bearing, shearing, crushing, bending and fracture.

Design for Fatigue

Soderberg, Goodman and Gerber design Criteria

Design of shaft

Design of shafts under static and fatigue loadings, Design of solid and hollow shafts for transmission of torque, bending moments and axial forces, Design of shaft for rigidity.

Design of Bearings

Slider: Principle of hydrodynamic lubrication, modes of lubrication, bearing performance parameters, slider bearing design.

Roller: Types, selection guidelines, static and dynamic load carrying capacity, Stribeck's equation, equivalent bearing load, load life relationship.

Design of Transmission Drives

Belt drives: Design of Flat belt, V-belt, Design of the pulley for the same. Chain Drives: Roller chains, polygonal effect, power rating. Selection from the manufacturer's catalogue.

Gear drives: Standard system of gear tooth and gear module, gear tooth failure, strength of gear tooth, terminology of spur, helical, bevel, worm and worm wheel, Design of spur, helical, straight bevel gears, worm and worm wheel.

Design of Springs

Design of springs: helical compression, tension, torsional and leaf springs

Design of clutches and brakes

Design of contact clutches i.e. plate, multi-disc, cone and centrifugal clutches, Design of band, disc, block with shoe and internal expanding brakes.

Design of joints: Threaded fasteners, pre-loaded bolts and welded joints.

Design, Analysis and Applications of Power screws and flexible coupling.

Books

1. Joseph E. Shigley, Charles Russell Mischke, Richard Gordon Budynas, Mechanical Engineering Design, McGraw-Hill
2. Robert L. Norton, Machine Design; An Integrating Approach, Pearson Publication.
3. Robert C. Juvinall Fundamentals of machine component design, JohnWiley Eastern
4. V.K Jadon, Analysis and design of machine elements, I.K. International
5. V.B Bhandari, Design of Machine elements, Tata Mc-Graw. Hill

Note: Design Data book is allowed in Examination.

BTME503-18 MANUFACTURING PROCESSES

Course objectives:

To motivate and challenge students to understand and develop an appreciation of the processes in correlation with material properties which change the shape, size and form of the raw materials into the desirable product by conventional or unconventional manufacturing methods.

Course Outcomes:

Upon completion of this course, students will be able to understand the different conventional and unconventional manufacturing methods employed for makingdifferent products.

Detailed Contents:

Unit -1 Conventional Manufacturing Processes:

Casting and moulding: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses.

Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming (forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending) principles of powder metallurgy.

Metal cutting: Single and multi-point cutting; Orthogonal cutting, various force components: Chip formation, Tool wear and tool life, Surface finish and integrity, Machinability, Cutting tool materials, Cutting fluids, Coating; Turning, Drilling, Milling and finishing processes, Introduction to CNC machining.

Unit II: Additive manufacturing:

Rapid prototyping and rapid tooling

Unit III: Joining/fastening processes:

Physics of welding, brazing and soldering; design considerations in welding, Solid and liquid state joining processes; Adhesive bonding.

Unit IV Unconventional Machining Processes:

Unconventional Machining Processes: Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and process parameters.

Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits, wire EDM; Electro-chemical machining (ECM), etchant &maskant, process parameters, MRR and surface finish. Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining

Unit V Tooling

Tooling for conventional and non-conventional machining processes: Mould and die design, Press tools, Cutting tools; Holding tools: Jigs and fixtures, principles, applications and design; press tools – configuration, design of die and punch; principles of forging die design.

Text/Reference Books:

1. Rao P N, Manufacturing Technology, Foundry, Forming & Welding, Tata McGraw Hill.
2. Kalpakjian S and Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Publishers.
3. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems
4. Degarmo, Black &Kohser, Materials and Processes in Manufacturing
5. Ghosh A, & Mallik A K 1986. Manufacturing science: Ellis Horwood.
6. Campbell J S, Principles of manufacturing materials and processes: Tata McGraw-Hill
7. Shan H S, Manufacturing Processes, Vol. I, Pearson Publishers.
8. Little, Welding and Welding Technology, McGraw-Hill Education (India) Pvt Ltd.
9. NPTEL courses, http://www.nptel.iitm.ac.in/courses.php?disciplineId=112 web and video resources on Manufacturing Processes I

BTME504-18 MANAGEMENT AND ENGINEERING ECONOMICS

Course objectives:

- Acquire knowledge of economics to facilitate the process of economic decision making
- Acquire knowledge on basic management aspects

Course Outcomes:

On completion of this subject students will be able to

6. Explain the development of management and the role it plays at different levels in an organization.
7. Comprehend the process and role of effective planning, organizing and staffing for the development of an organization.
8. Understand the necessity of good leadership, communication and coordination for establishing effective control in an organization.
9. Understand engineering economics demand supply and its importance in economics decision making and problem solving.
10. Calculate present worth, annual worth and IRR for different alternatives in economic decision making.
11. Understand the procedure involved in estimation of cost for a simple component, product costing and depreciation, its methods.

Detailed Contents:

Unit-1: **Management**

Introduction: Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as a science, art of profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought early management approaches – Modern management approaches.

Planning:

Nature, importance and purpose of planning process Objectives -Types of plans (Meaning Only)
Decision making Importance of planning -steps in planning & planning premises - Hierarchy of plans.

Unit-II: Organizing and Staffing

Nature and purpose of organization Principles of organization - Types of organization - Departmentation Committees- Centralization Vs Decentralization of authority and responsibility - Span of control - MBO and MBE (Meaning Only) Nature and importance of staffing: Process of Selection & Recruitment (in brief).

Directing & Controlling:

Meaning and nature of directing Leadership styles, Motivation Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of Co Ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief)

Unit-III: **Introduction**

Engineering and economics, Problem solving and decision making, Laws of demand and supply, Difference between Microeconomics & Macroeconomics, equilibrium between demand & supply, elasticity of demand, price elasticity, income elasticity. Law of Returns, Interest and interest factors, simple and compound interest, Cash flow diagrams, personal loans and EMI payment calculation with flexible interest rates, Discussion and problems

Unit-IV: **Present, future and annual worth and rate of returns**

Basic present worth comparisons, Present worth-equivalence, Assets with unequal lives and infinites lives, future worth comparisons, payback comparisons, Equivalent annual worth comparisons, situations for annual worth comparisons. Asset life, Rate of return, minimum acceptable rate of return, IRR anomalies and misconceptions, Cost of capital, comparisons of all present future and annual worth with IRR, product costing, Discussions and problems

Unit-V: **Costing and Depreciation**

Costing and depreciation:
Components of costs, estimation of selling price, marginal cost, first cost, all kinds of overheads, indirect cost estimation with depreciation, mensuration and estimation of material cost, cost estimation of mechanical process, idling time. Product costing (approaches to product costing), causes of depreciation, methods of computing depreciation charges, straight line method, declining balance method, sum of years method, sinking fund method, service output methods, taxation concepts, personal income taxes and corporate taxes, Discussions and problems.

Text Books:
1. Principles of Management by Tripathy and Reddy
2. Mechanical estimation and costing, T.R. Banga & S.C. Sharma, 17th edition 2015
3. Engineering Economy, Riggs J.L. McGraw Hill, 2002
4. Engineering Economy, Thuesen H.G. PHI , 2002

Reference Books:
1. Management Fundamentals- Concepts, Application, Skill Development - RobersLusier - Thomson
2. Basics of Engineering Economy, Leland Blank & Anthony Tarquin, McGraw Hill Publication (India) Private Limited
3. Engineering Economics, R.Paneerselvam, PHI publication
4. Fundamentals of Management: Essential Concepts and Applications, Pearson Education, Robbins S.P. and Decenzo David A.
5. Economics: Principles of Economics, N Gregory Mankiw, Cengage Learning
6. Modern Economic Theory, By Dr. K. K. Dewett& M. H. Navalur, S. Chand Publications

BTME505-18 HEAT TRANSFER LAB.

Course objectives:

To provide knowledge about application of conduction, convection and radiation heat transfer concepts to different practical applications

Course Outcomes:

After undergoing this course, students shall be able to:

1. Design and fabricate the experimental setups related to heat transfer phenomena.
2. Measure and analyse different heat transfer parameters.
3. Apply finite difference methods to solve simple heat transfer problems.

A. Two to three students in a group are required to do one or two practicals in the form of Lab. Project in the topic/s related to the subject matter of Heat Transfer and in consultation with teacher. The complete theoretical and experimental analysis of the concerned topic is required to be performed (including design and fabrication of new experimental set up; if required; or modifications/retrofitting in the existing experimental set ups).

B. Each student is required to use Finite Difference Method for analysis of steady state one dimensional and two dimensional conduction problems (Minimum two problems one may be from the Lab. Project) such as conduction through plane/cylindrical/spherical wall with or without internal heat generation; heat transfer through fins; bodies with irregular boundaries subjected to different boundary conditions.

Minimum twelve experiments from the following:

1. Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Heat transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
7. Heat transfer in forced convection apparatus.
8. Heat transfer in natural convection
9. Parallel and counter flow heat exchanger.
10. Emissivity apparatus.
11. Stefan Boltzman Apparatus.
12. Critical Heat flux apparatus.
13. Study of heat pipe and its demonstration.
14. Film and Drop wise condensation apparatus

BTME506-18 MANUFACTURING PROCESSES LAB

Course Outcomes:

After studying this course, students shall be able to:

1. Determine/calculate the clay content, moisture content, hardness, permeability and grain fineness number of moulding sand sample.
2. Use oxy-acetylene gas welding, manual arc welding, MIG, TIG and spot-welding processes to make various joints.
3. Use machine tools such as lathe, shaper and milling machine for machining/cutting various profiles on work pieces.
4. Learn about the constructional features and working of grinding machines, hydraulic press, draw bench, rolling mills, drawing and extrusion equipment.

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.
4. To prepare job on shaper involving plane surface,
5. Use of milling machines for generation of plane surfaces, spur gears and helical gears; use of end mill cutters.
6. 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, machining (Conventional and non-conventional) processes.

BTME507-18 Numerical Method Lab

Course Objectives

This course provides understanding of implementations of basic numerical methods for solving different problems *viz.* nonlinear equations, system of equations, numerical integration and ordinary differential equations etc. The basic objective of this course is to develop capability of programming of numerical methods in the students so that they can develop and implement their own computer programs of the methods for solving different problems arising in science, engineering and technology etc.

Course Outcomes: After completion of this course, the students will be able to:

- Understand different implementation modes of numerical methods.
- Use the numerical methods with the understanding of limitations of these methods for solving problems.
- Develop and implement their own computer programs.
- Solve problems more accurately and efficiently in low computational time.
- Handle the problems conveniently which are difficult to deal with manually.

.**List of experiments:**

1. Make a program of bisection method for solving algebraic/transcendental equations and implement it on some problems.
2. Develop a program of Newton-Raphson's method for solving algebraic/transcendental equations and implement it on some problems.
3. Develop and implement a program of Method of False Position for solving algebraic/transcendental equations.
4. Develop and implement a program of Gauss-elimination method for solving a system of linear equations.
5. Develop and implement a program of trapezoidal rule to approximate a definite integral.
6. Develop and implement a program of Simpson's rule to approximate a definite integral.
7. Develop and implement a program of Euler's method for solving initial value problems of ordinary differential equations.
8. Develop and implement a program of fourth order Runge-Kutta method for solving initial value problems of ordinary differential equations.
9. Develop and implement a program of two-step Adams-Bashforth method for solving initial value problems of ordinary differential equations.
10. Develop and implement a program of two-step Adams-Moulton method for solving initial value problems of ordinary differential equations.

Note. Use any programming language/computer algebra system to develop and implement the following programs

BTMC-102-18	**Essence of Indian Traditional Knowledge**	**3L:0T:0P**	**0 credits**

Internal Marks: 40 *External Marks: 60* *Total Marks: 100*

Part-1

Course objective

The course aims at imparting basis principals of thought process. Reasoning and inferencing Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit Literature are also important in modern society with rapid technological advancements and societal disruptions Part-1 focuses on introduction to Indian Knowledge System. Indian perspective of modern scientific world -view and basis principal of Yoga and holistic health care system.

Course contents

i. Basic Structure of Indian Knowledge system
ii. Modern Science and Indian Knowledge system
iii. Yoga and Holistic Health Care
iv. Case studies

References

- Fritzof Capra Too of Physics
- Fritzof Capra The Wave of life
- Yoga Sutra of Patanjali. Ramakrishna Mission. Kolkata.
- RN Jha Science of Consciousness Psychotherapy and Yoga Practices. Vidyanidhi Prakashan. Delhi2016
- PB Sharma (English translation) ShodashangHridayam

Pedagogy: Problem based learning, group discussion, collaborative mini projects
Outcome: Ability to understand connect up and explain basics of Indian traditional Knowledge in Modern scientific perspective.

Part-2

Course objective

The course aims at imparting basis principals of thought process. Reasoning and inferencing Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit Literature are also important in modern society with rapid technological advancements and societal disruptions Part-2 focuses on Indian philosophical traditions. Indian linguistic Tradition, and Indian artistic tradition.

Course contents

i. Philosophical Tradition
ii. Indian Linguistic Tradition (Phonology, morphology, syntax and semantics)
iii. Indian Artistic Tradition
iv. Case studies

References

- V.Sivaramakrishnan (Ed.), Cultural Heritage of India-Course material, Bhartiya Vaidya Bhawan Mumbai 5th Edition 2014
- S.C Chaterjee &D.M .Datta , An introduction to Indian Philosophy ,University of Calcutta 1984

- KS Subrahmanialyer ,Vakyapadiya of Bhattaraihari (Brahma Kanda), Deccan College Pune 1965
- VN Jha, Language Thought and Reality
- Pramod Chandra. India Arts Howard Univ. Press 1983
- Krishna Chaitanya Arts of India. Abhinav Publications. 1987
- R Nagaswamy , Foundations of Indian Art Tamil Arts Academy.2002

Pedagogy: Problem based learning, group discussion, collaborative mini projects
Outcome: Ability to understand connects up and explain basics of Indian traditional Knowledge in Modern scientific perspective.