Vivekananda Global University

B.Tech in Mechanical Engineering **Semester III**

MAT104 ADVANCED ENGINEERING MATHEMATICS

3L-1T-0P-3.5C **MM 100**

Module I

Fourier Series and Method of Separation of Variables (Boundary Value Problems):Expansion of simple functions in Fourier series, half range series, change of interval, harmonic analysis, application to the solution of wave equation and diffusion equation in one dimension and Laplace's equation in two dimensions by method of separation of variable.

Module II

Laplace transform, Inverse transform, properties, Transforms of derivatives and integrals,Unit step function, Dirac's delta function, Differentiation and integration of transforms,Applications to differential equations.

Module III

Errors and significant digits, Roots of algebraic equations Bisection method, secant method, Newton Raphson method, Graff's root- squaring method, Iterated synthetic division withquadratic factors method for finding complex roots.

Module IV

Forward, Backward, Central and Divided differences, Newton's formula of interpolation forequal and unequal intervals. Lagrange's interpolation formula, Stirling's and Bessell'sformula, Solutions of systems of equations (Gauss elimination, Gauss Jordan and Partitionmethod for linear system of equations, power method for partition, method for linear systemof equations, power method for finding Eigen values).

Module V

Numerical solution of simultaneous algebraic equation by Gauss elimination and GaussSeidel method. Numerical differentiation, Numerical integration- Trapezoidal rule,Simpson's one third and Simpson's three eight rule. Numerical solution of ordinarydifferential equation of first order-Picard's method, Euler's method, and Modified Euler'smethod, Milne's methods and RungaKutta fourth order method.

Text/Reference Books:

1 Numerical Method, DrB.S.Gravel, Khanna Publication, DARYA GANJ, Delhi - 110003, India
2 Numerical Methods, S.uha, R.Shrinivasan, Oxford Publication.
3 Numerical Methods, M.K.Jain ,R.K.Jain, New Age Publication, new delhi.
4 Higher Engg Mathematics, B.V.Ramana, TATA MCGRAW HILL PUBLISHING COMPANY; Place: New Delhi.
5 Higher Engineering Mathematics, B.S. Grewal, Khanna Publication, DARYA GANJ, Delhi – 110003.

Vivekananda Global University

B.Tech in Mechanical Engineering **Semester III**

BME301 ENGINEERING THERMODYNAMICS

3L-1T-0P-3.5C **MM 100**

Module I: Introduction:- Dimensions and units, Microscopic and Macroscopic approaches, Systems, surroundings and universe, Concept of continuum, Control system boundary, control volume and control surface, Properties and state, Thermodynamic properties, Thermodynamic path, process and cycle, Thermodynamic equilibrium, Reversibility and irreversibility, Quasi static process, Energy and its forms, Work and heat, Gas laws, Ideal gas, Real gas, Zeroth law of thermodynamics, Temperature and its measurement, Temperature scales.

Module II: First law of thermodynamics:- thermodynamic definition of work, Thermodynamic processes, Calculation of work in various processes and sign convention, Non-flow work and flow work, Joules' experiment, First law of thermodynamics, Internal energy and enthalpy, First law of thermodynamics applied to open systems

Steady flow systems and their analysis: - Steady flow energy equation, Boilers, Condensers, Turbine, Throttling process, Pumps etc. First law analysis for closed system (non flow processes), Analysis of unsteady processes such as filling and evacuation of vessels with and without heat transfer, Limitations of first law of thermodynamics

Module III: Second law of thermodynamics:- Devices converting heat to work, Thermal reservoir, Heat engines, Efficiency, Devices converting work to heat, Heat pump, refrigerator, Coefficient of Performance, Reversed heat engine, Kelvin Planck statement of second law of thermodynamics, Clausius statement of second law of thermodynamics, Equivalence of two statements of second law of thermodynamics, Reversible and irreversible processes, Carnot cycle and Carnot engine, Carnot theorem and it's corollaries, thermodynamic temperature scale, PMM II.

Module IV: Entropy :- Clausius inequality, Concept of Entropy, Entropy change in different thermodynamic processes, T-ds equations, Principle of entropy increase, T-S diagram, Statement of the third law of thermodynamics.

Availability & Irreversibility: Available and unavailable energy, Availability and Irreversibility, Second law efficiency, Helmholtz & Gibb's function.

Module V: Properties of steam :- Pure substance, Property of steam, Triple point, Critical point, Sub-cooled liquid, Saturation states, Superheated states, Phase transformation process of water, Graphical representation of pressure, volume and temperature, P-T & P-V diagrams, T-S and H-S diagrams, use of property diagram, Steam-Tables &Mollier charts, Dryness factor and it's measurement, processes involving steam in closed and open systems, Working of simple Rankine cycle.

Text/Reference Books:-

1. Fundamentals of Thermodynamics, Sonntag, Wiley India Pvt. Ltd.
2. Thermodynamics, J.P. Holman, McGraw Hill.
3. Engineering Thermodynamics,P.K.Nag, Tata McGraw Hill Pub.
4. Fundamental of Engineering Thermodynamics, E. Rathakrishnan, publisher. PHI
5. Thermodynamics – An Engineering Approach, Y.A. Cengel and M.A. Boles, McGraw Hill.

Vivekananda Global University

B.Tech in Mechanical Engineering **Semester III**

BME302 STRENGTH OF MATERIALS

3L-1T-0P-3.5C **MM 100**

Module I

STRESS & STRAIN: Concepts and analysis of stresses and strains; Stress-strain relationships; mechanical properties; ductile and brittle materials; Hooke's law; relations of Elastic constants for a isotropic and hookean materials, thermal stresses, hoop stress & strains in pressure vessels, composite bars; simple elastic, stress due to self weight ,bar of uniform strength, Concept of factor of safety & permissible stress, Tensors.

Module II

SHEAR FORCE & BENDING MOMENT: Theory of simple bending, bending moment and shear force diagrams for different types of static loading and support conditions on beams. Bending stresses, Section modulus. Transverse shear stress distribution in circular, hollow circular, I, Box, T, angle sections etc.

Module III

PRINCIPLE STRESSES: Principle planes, stresses & strains: Members subjected to combined axial, bending & Torsional loads, maximum normal & shear stresses; Concept of equivalent bending & equivalent twisting moments. Mohr's circle of stress & strain.

THEORIES OF ELASTIC FAILURES: The necessity for a theory, different theories, significance and comparison, applications.

Module IV

TORSION: Torsional shear stress in solid, hollow and stepped circular shafts, angular deflection and power transmission capacity.

COLUMNS: Instability & elastic stability. Long & short columns, ideal strut, Euler's formula for crippling load for columns of different ends, concept of equivalent length, eccentric loading, Rankine formulae and other empirical relations.

Module V

TRANSVERSE DEFLECTION OF BEAMS: Transverse deflection of beams and shaft under static loading, area moment method, direct integration method, method of superposition and conjugate beam method.

ELASTIC STRAIN ENERGY : Strain energy due to axial, bending and Torsional loads; stresses due to suddenly applied loads; use of energy theorems to determine deflections of beams and twist of shafts. Castiglione's theorem. Maxwell's theorem of reciprocal deflections.

Text/Reference Books:

1 Mechanics of Materials, James M. Gere, Cengage Learning (Brooks\Cole).
2. Mechanics of Material, Pytel and Kiusalaas, Thomson (Brooks\Cole).
3. An Introduction to the Mechanics of Solids, Crandall, Dahl and Lardner, Tata McGraw Hill.
4. Mechanics of Materials, Beer, Johnston, Dewolf and Mazurek, Tata McGraw Hill.
5. Strength of Materials, Ryder G.H., Macmillan India.
6. Strength of Materials, Sadhu Singh, Khanna Publishers.
7. Mechanics of Material, Punmia, Jain and Jain, Laxmi Publications.

Vivekananda Global University

B.Tech in Mechanical Engineering **Semester III**

BCE303 FLUID MECHANICS

3L-1T-0P-3.5C **MM 100**

Module I

BASIC DEFINITIONS & FLUID PROPERTIES: Definition of Fluid, Incompressible and compressible fluids, Fluid as a continuum, mass, density, specific weight, relative density, specific volume, bulk modulus, velocity of sound Ideal fluid viscosity, Newtonian and Non Newtonian fluid, kinematic viscosity, effect of temperature and pressure on viscosity, surface tension capillarity, vapour pressure and cavitation.

Module II

FLUID STATICS: General differential equation, hydrostatics manometry, fluid forces on submerged surfaces, curved surfaces, aerostatics, Isothermal atmosphere, polytropic atmosphere, static stability, the international atmosphere, submerged bodies, floating bodies.

Module III

KINEMATICS & CONSERVATION OF MASS: Flow classifications, Fluid velocity and acceleration, streamlines and the stream function, pathlines and streak lines, deformation of a fluid element, vorticity and circulation. Irrotational and rotational flow, flow net, laplace equation, conservation ofmass and the continuity equation for three dimensions.

FLUID MOMENTUM: The Momentum theorem, applications of the momentum theorem, equation of motion, Euler's equation of motion, Integration of Euler's equation of motion, Bernoulli's equation, applications of Bernoulli's pilot tube, equation of motion for viscous fluid, NavierStoke's equation.

Module IV

ORIFICE DISCHARGING: Free Jet, vena contracts, co-efficient of contraction, velocity and discharge, coefficient of resistance, orifices and mouthpieces, nozzles and weires.

FLOW THROUGH PIPES: Reynold's experiment, Darcy's Weisback equation, loss of head due to sudden enlargements, contraction, entrance, exit obstruction, bend, pipe fittings, total and hydraulic gradient lines, Flow through pipe line, pipes in series, parallel, transmission of power through pipes.

Module V

LAMINAR FLOW: Simple solution of Navier Stokes equations, Hagen – Poiseuille flow, Plans Poiseuille flow and coutte flow.

TURBULANT FLOW: Variation of friction factor with Reynold's number, Prandtl mixing length hypothesis applied to pipe flow, velocity distribution in smooth pipes, sough pipes, Universal pipe friction laws, Colebrook White formula.Introduction to boundary layer theory.

Text/Reference Books:

1. Fluid Mechanics, Frank M. White, McGraw-Hill Publications.
2. Fluid Mechanics, Cengel and Cimbala, Tata McGraw-Hill, New Delhi.
3. Hydraulics and Fluid Mechanics, Modi and Seth, Standard Book House.
4. Fluid Mechanics, Jain A.K., Khanna Publishers.
5. Introduction to Fluid Mechanics, Fox and McDonald, John Wiley and Sons.

Vivekananda Global University

B.Tech in Mechanical Engineering **Semester III**

BME 304 PRODUCTION ENGINEERING - I

3L-0T-0P-3C **MM 100**

Module I

FOUNDARY TECHNOLOGY: Casting: Definition and major classification; Casting materials, Sand mould casting: Patterns: types, material and design including pattern allowances. Moulding sands; composition, preparation, properties and testing; Grain fineness; moisture content, clay content and permeability test. Gating system: types, pouring basin, sprue, runner and risers; Foundry equipment and furnaces.

Module II

CASTING TECHNOLOGY: Principles and method of floor mould casting, shell mould casting, pit mould and loam mould casting; CO2 mould casting; centrifugal casting, investment casting; Permanent mould casting. Die casting; Slush casting; Casting defects; types, causes and remedy

Module III

FORMING PROCESSES: Classification; Hot working and cold working; principle, advantages, disadvantages and applications. Forging: Classification; different forging operations, drop forging and press forging methods and use; Rolling: Characteristics and applications of hot rolling and cold rolling; Extrusion; Work materials and products; Press tool works; Basic principles, system, operations and applications. Shearing; Parting, notching, trimming, nibbling, blanking and piercing, Drawing: wire drawing, tube drawing and deep drawing. Spinning, flow turning, Bulging, Coining and embossing; basic principle and methods.metal working defects, cold heading, riveting, thread rolling, bending and forming operation.

Module IV

METAL JOINING PROCESSES: Welding, Brazing and soldering, Fusion welding: -Principle, characteristics and applications of gas welding, thermit welding, electrical arc welding; Submerged arc welding; TIG and MIG welding; Induction welding; Plasma arc welding; Resistance welding; Spot welding; Butt welding; Seam welding; Projection welding. Laser beam welding and Electron beam welding. Solid state welding process; Principles, process details of Forge welding; Friction welding; Diffusion welding; Ultrasonic welding. Pressure welding; Explosive welding. Welding defects; Types, causes, effects and remedy. Electrodes and Electrode Coatings

Module V

POWDER METALLURGY: Properties of Powder processed materials, Powder manufacturing, mechanical pulverization, sintering, Electrolytic Process, chemical reduction, atomization, properties of metal powders, compacting of powders sintering, advantages and applications of Powder metallurgy.

Text/Reference Books:

1. Manufacturing Technology Dr.P.N.Rao.,Vol 1,2 and 3, TMH
2. Science Manufacturing A.Ghosh, &A.K. Mallik. 1986.: Ellis Horwood.
3. Introduction to Manufacturing Processes, Schey, TMH
4 Manufacturing processes for engineering materials .S.. Kalpakjian, &S.R.Schmid Pearson Education.
5. Principles of manufacturing materials and processes: J.S.Campbell, Tata McGraw-Hill
6. Manufacturing Process, H.S.Shah, Pearson Education.
7. Production Technology, O.P.Khanna, DhanpatRai Publications, New Delhi
8. Workshop Technology, Vol. I by S.K. HazraChoudhary and A.K. HazraChoudhary Media Promotors&Publishers Pvt. Ltd., Bombay

Vivekananda Global University

B.Tech in Mechanical Engineering **Semester III**

BCS302 OBJECT ORIENTED PROGRAMMING WITH C++

3L-0T-0P-3C **MM 100**

Module 1

Different paradigms for problem solving, need for OOP, differences between OOP and Procedure oriented programming, Abstraction, Overview of OOP principles, Encapsulation, Inheritance and Polymorphism.

Module2

C++ Basics: Structure of a C++ program, Data types, Declaration of variables, Expressions, Operators, Operator Precedence, Evaluation of expressions, Type conversions, Pointers, Arrays, Pointers and Arrays, Strings, Structures, References.
Flow control statement- if, switch, while, for, do, break, continue, goto statements. Functions-Scope of variables, Parameter passing, Default arguments, inline functions, Recursive functions, Pointers to functions.

Module3

Dynamic memory allocation and de-allocation operators-new and delete, Preprocessor directives. C++ Classes And Data Abstraction: Class definition, Class structure, Class objects, Class scope, this pointer, Friends to a class, Static class members, Constant member functions, Constructors and Destructors, Dynamic creation and destruction of objects, Data abstraction, ADT and information hiding.

Module 4

POLYMORPHISM - Function overloading, Operator overloading, Generic programming necessity of templates, Function templates and class templates.Inheritance: Defining a class hierarchy, Different forms of inheritance, Defining the Base and Derived classes, Access to the base class members, Base and Derived class construction, Destructors, Virtual base class.

Module 5

VIRTUAL FUNCTIONS AND POLYMORPHISM - Static and Dynamic bindings, Base and Derived class virtual functions, Dynamic binding through virtual functions, Virtual function call mechanism, Pure virtual functions, Abstract classes, Implications of polymorphic use of classes, Virtual destructors.

Text/Reference Books:

1. Problem solving with C++, The OOP, 4th Edition, Walter Savitch, Pearson Education.
2. C++, The Complete Reference, 4th Edition, Herbert Schildt, TMH.
3. C++ Primer, 3rd Edition, S.B.Lippman and J.Lajoie, Pearson Education.
4. The C++ Programming Language, 3rd Edition, B.Stroutstrup, Pearson Education.
5. OOP in C++, 3rd Edition, T.Gaddis, J.Walters and G.Muganda, Wiley DreamTech Press.
6. Object Oriented Programming in C++, 3rd Edition, R.Lafore, Galigotia Publications pvt ltd.

Vivekananda Global University

B.Tech in Mechanical Engineering **Semester III**

BME305 THERMAL ENGINEERING LAB.

0L-0T-2P-1C **MM 100**

LIST OF EXPERIMENTS:

1. Study of 2 stroke IC(SI & CI) engines (cut models) and Performance parameters.
2. Study of 4 stroke IC(CI & SI) engines (cut models) and Performance parameters.
3. Totudy& draw valve timing diagram for a single cylinder diesel engine.
4. To perform constant speed load test on a single cylinder diesel engine and to plot performance curves: brake thermal efficiency v/s Brake power, specific fuelconsumption v/s Brake power.
5. To prepare heat balance sheet of a four stroke diesel engine.
6. Morse Test: To estimate the Indicated Power, Friction Power and Mechanical Efficiency of a multi-cylinder Petrol Engine.
7. Study of fire tube boilers-its mountings and accessories.
8. Study of water tube boiler-its mountings and accessories.
9. Study of two stage reciprocating air compressor.
10. To Plot P-θ diagrams for constant speed C.I.Engine.

B.Tech in Mechanical Engineering **Semester III**

BME306 STRENGTH OF MATERIALS LAB.

0L-0T-2P-1C **MM 100**

1. Izod Impact testing.
2. Rockwell/Vickers/BrinellHardness Testing of a given material
3. Spring Testing
4. Column Testing for buckling
5. Torsion Testing
6. Tensile Testing
7. Fatigue testing

Text/Reference Books:

1. Vander Voort, Metallography: Principles and Practice, McGraw-Hill, 1984
2. Prabhudev K.H., Handbook of Heat Treatment of Steels, Tata McGraw-Hill, 2000.
3. Suryanarayanan, A.V.K. "Testing of Metalic materials" TataMcGraw Hill,1993

Vivekananda Global University

B.Tech in Mechanical Engineering **Semester III**

BCE307 FLUID MECHANICS LAB.

0L-0T-2P-1C **MM 100**

LIST OF EXPERIMENTS:

1 Determine Metacentric height of a given body.
2 Determine Cd, Cv and Cc for given orifice.
3 Determine flow rate of water by V-notch.
4 Determine velocity of water by pitot tube.
5 Verify Bernoulli's theorem.
6 Determine flow rate of air by Venturi meter.
7 Determine flow rate of air by orifice meter.
8 Determine head loss of given length of pipe.
9 Determine flow rate of air by nozzle meter.

B.Tech in Mechanical Engineering **Semester III**

BME 308 PRODUCTION ENGINEERING LAB. I

0L-0T-2P-1C **MM 100**

LIST OF EXPERIMENTS:

Machine Shop

1To study lathe machine construction and various parts including attachments, lathe tools cutting speed, feed and depth of cut.
2 To perform taper turning by tailstock offset method as per drawing.
3 To cut metric thread on lathe machine as per drawing.
4 To perform drilling and boring on lathe machine as per drawing.
6. To study shaper machine, shaper tools and prepare job on shaper machine.

Foundry Shop

1. To prepare Moulding and casting of Aluminium.
2. To perform moisture test
3 To perform clay content test.
3. Strength Test (compressive, Tensile, Shear Transverse etc. in green and dryconditions).
4. To perform permeability test.
5. A.F.S. Sieve analysis test.

Welding Shop

1. To study Metal Inert Gas (MIG)welding.
2. To study Tungsten Inert Gas (TIG)welding.
3. To Study Spot welding.
4. To study Submerged Arc welding

Vivekananda Global University

B.Tech in Mechanical Engineering **Semester III**

BCS305 OBJECT ORIENTED PROGRAMMING WITH C++ Lab.

0L-0T-2P-1C **MM 100**

1. Create a user defined function (any) and use it inside the program.
2. Implement "call by value" & "call by reference " function call techniques by using any user defined functions.
3. Implement the working of classes and objects by using any real world object.
4. Create a Stack object model in C++ & also make use of default and parameterized constructor to make the class more flexible in use.
5. Make all the member functions, including constructors, non-inline in the above class.
6. Create any user defined class using the concept of static data and member functions.
7. Create a Class or program implementing the concept of passing and returning object to/from member functions.
8. WAP to implement polymorphism through function overloading (Area of different shapes).
9. Create a user defined type Complex and do all the Complex number arithmetic. And also make use of operator overloading.
10. Implement single level inheritance by using Student and Marks class.
11. Implement multilevel inheritance by using the Stack class.
12. Demonstrate the calling mechanism of constructors and destructors in Multilevel Inheritance.
13. Create generic Stack model for storing different types of data.
14. Create a user defined type Matrix and perform all matrix operations. Also make use of operator overloading.
15. Implement the concept of Abstract classes and virtual functions by using Shape, Rectangle and Triangle class.

Vivekananda Global University

B.Tech in Mechanical Engineering **Semester III**

ENG 115 SOFT SKILL & PROFESSIONAL APTITUDE

0L- 0T- 2P- 1.0C **MM 100**

Module I

INTERPERSONAL RELATIONSHIP MANAGEMENT-Importance & Benefits of IPR, Developing Interpersonal Abilities, Team Building- Definition and Types, Team work skills, Qualities of a Team Player, Leadership- Understanding the qualities of a Good Leader, 4 Factors of Leadership, Bring out the Leader in You

Module II

RESUME WRITING- Concepts of Resume, Curriculum Vitae and Bio-data, Resume – Information and Details, Sample Resume and Template, Cover Letter- Cover letter Writing, Sample Cover letter and Template

Module III

PERSONAL GROOMING AND INTERVIEW ETIQUETTE- Basic Personal Hygiene, Professional Attire – Men& Women, Interview Etiquette Guide, Telephonic Interview- Importance and Preparation, Advantages and Disadvantages, Things to Remember, Video Interview- Preparation and Practice, Guide to a Successful Video Interview, Importance and Types of Personal Interviews, FAQs with Answers

Module IV

GROUP DISCUSSION- Group Discussion Guide, Topics for Group Discussion, Mock GD

Module V

EXTEMPORE-Guide to Successful Extempore, Extempore Topics, Practice Session

Text/Reference Books:

1. Business communication Design, Angell, Pamela, Mcgraw-Hill, New York.
2. Grammar Finder, Eastwood, John, Oxford university press.
3. Effective technical communication, Mitra, K. Barun,Oxford university press.
4. Communicate to conquer: A handbook of group discussion and interviews, PHI learning, New Delhi.

Vivekananda Global University

B.Tech in Mechanical Engineering **Semester IV**

BME401 HEAT TRANSFER

3L-1T-0P-3.5C **MM 100**

Module I:

INTRODUCTION TO HEAT TRANSFER PROCESSES: Conduction and radiation, Fourier's law of heat conduction,thermal conductivity, thermal conductivity of solids, liquids and gases, effect of temperature on thermalconductivity, Newton's law of cooling, definition of overall heat transfer coefficient, general parameters influence the value of heat transfer coefficient.

CONDUCTION : General 3-Dimensoinal conduction equation in Cartesian, cylindrical and spherical coordinates, different kinds of boundary conditions, nature of differential equations, one dimensional heat conduction with and without heat generation, electrical analogy, heat conduction through composite walls, critical thickness of insulation.

Module II:

HEAT TRANSFER FROM FINNED SURFACES: fin efficiency and effectiveness, two dimensional steady state heatconduction using analytical and numerical methods, periodic heat conduction.

CONVECTION: Review of Navier–Stokes and energy equation, hydrodynamic and thermal boundary layers,laminar boundary layer equations, forced convection appropriate non dimensional members, effect of prandtl number, empirical relations for flow over a flat plate and flow through pipes.

Module III:

NATURAL CONVECTION: Dimensional analysis, grashoff number, boundary layers in external flows (flow over a flat plate only), boundary layer equations and their solutions, heat transfer correlations.

HEATTRANSFER WITH CHANGE OF PHASE: Nature of vaporization phenomena, different regimes of boiling heat transfer, correlations for saturated liquid vaporization, condensation on flat plates, correlation of experimental results, drop wise condensation.

Module IV:

HEAT EXCHANGER: Different types of heat exchangers, arithmetic and logarithmic mean temperature differences, heat transfer coefficient for parallel, counter and cross flow type heat exchanger, effectiveness of heat exchanger, N.T.U. method, fouling factor, constructional and manufacturing aspects of Heat Exchangers.

Module V:

THERMAL RADIATION: Plank distribution law, Kirchhoff's law, radiation properties, diffuse radiations, Lambert's law, radiation intensity, heat exchange between two black bodies heat exchanger between gray bodies, shapefactor, electrical analogy, reradiating surfaces heat transfer in presence of reradiating surfaces.

Text/Reference Books:

1. Heat Transfer, Holman J.P., Tata McGraw-Hill, New Delhi**.**
2. Heat and Mass Transfer, Cengel, Tata McGraw-Hill, New Delhi.
3. Heat and Mass Transfer, Kumar D.S., Kataria and Sons.
4. Heat Transfer, Sharma and Lal, Vardhan Publisher Jaipur.
5. Heat and Mass Transfer, Nag P.K., Tata McGraw-Hill, New Delhi

Vivekananda Global University

B.Tech in Mechanical Engineering **Semester IV**

BME402 PRODUCTION ENGINEERING. – II

3L-0T-0P-3C **MM 100**

Module I

CLASSIFICATION OF METAL REMOVAL PROCESS & MACHINES: Concept of generatrixanddirectrixGeometry of single point cutting tool and tool angles, tool nomenclature in ASA,ORS, NRS and interrelationship. Concept of orthogonal and oblique cutting.**MECHANISM OF CHIP FORMATION**: Type of chips, chip breakers. Mechanics of metal cutting, interrelationshipsbetween cutting force, shear angle relationship. Cutting strain, cutting strain rate.Various theories of metal cutting. Thermal aspects of machining and measurement ofchip tool interface temperature. Friction in metal cutting.Introduction to tool geometry ofmilling cutters and drills.

Module II

CONCEPT OF MACHINABILITY: machinability index, factors affecting machinability, Tool Wear, ToolLife and Tool Material- Different mechanism of tool wear. Types of tool wear (crater, flank etc), Measurement and control of tool wear, Concept of tool life, Taylor's tool life equation(including modified version). Different tool materials and applicationsincludingeffect of tool coating.**MACHINING TIME**: Estimation of machining time in different machining operations, Introduction to economics of machining.**CUTTING FLUIDS**: Types, properties, selectionand application methods

Module III

BASIC MACHINE TOOLS: Constructional configuration and specifications of lathe, drillingmachine, shaping machine, milling machine, grinding machine. Broaching operation.**SPECIAL PURPOSE MACHINE TOOLS**: Automatic lathes, capstan and turret lathe machines. Operational planning and turret tool layout, sequence of operations. Tracer attachment in Machine Tools

Module IV

GRINDING: Need and different methods of grinding, Abrasives; natural and synthetic, manufacturing and selection of grinding wheels, Wheel specifications, mountingand dressing. **SURFACE FINISHING**: Honing, lapping, super finishing, polishing and buffingprocesses.**Thread Manufacturing**: casting; thread chasing; thread cutting on lathe; thread rolling, die threading and tapping; thread milling and thread grinding.**GEAR MANUFACTURING**: hot rolling; stamping; powder metallurgy; extruding etc.Gear generating processes: gear hobbling, gear shaping. Gear finishing processes: shaving,grinding, lapping, shot blasting, phosphate coating, Gear testing.

Module V

HIGH VELOCITY FORMIMG: Definition; Hydraulic forming, Explosive forming,Electro hydraulic forming, Magnetic pulse forming. Industrial Safety: precautions to be takenby operators for safe working on different machine tools.**RAPID PROTOTYPING**: Introduction, subtractive processes, additive processes, VirtualPrototyping and applications

Text/Reference Books:

1. Introduction to Machining Science ,LalG.K.,New Age international Publishers.
2. Manufacturing Science, Ghosh, A., &Mallik, A. K. , East West Press Private Limited.
3. Production Engineering Science, Pandey& Singh, Standard Publishers Distributer, Delhi.
4. All About Machine Tools,KarlH.Heller, Wiley Eastern Ltd., New Delhi
5. A. Principles of Machine Tools ,Sen, G. C., & Bhattacharyya,: New Central Book Agency
6 Theory& Practice of Metal Cutting,Bhattacharyya A, New Central Book Agency

Vivekananda Global University

B.Tech in Mechanical Engineering **Semester IV**

BME403 THEORY OF MACHINES - I

3L-1T-0P-3.5C **MM 100**

Module I

KINEMATICS: Elements, pairs , mechanisms, four bar chain and its inversions, velocity and acceleration, Klein's construction, coriolis component, instantaneous center method, Synthesis of mechanisms, panto graph, scott-Russel, Tchbeicheff straight line, indicator diagram mechanisms. Automotive vehicle mechanisms: Overhead valve mechanism, Davis and Ackerman steering mechanism, Trifler suspension and Hookes joint.

Module II

POWER TRANSMISSION: Introduction, Types of Flat belt drives, Velocity ratio, Slip of belt, Creep of belt, Length of an open and cross belt drive, Power transmitted by a belt, Ratio of driving tension, Centrifugal tension, condition for the transmission of maximum power, initial tension in the belt, Chain drives.

Module III

BRAKES & DYNAMOMETERS: Band, block and band & block brakes, braking action, absorption and transmission type dynamometers, prony, rope and hydraulic dynamometers braking system of automobiles.

Module IV

CAMS: Type of cams, Types of followers,displacement, velocity and acceleration curves for different cam followers, consideration of pressure angle and wear, analysis of motion of followers for cams with specified contours.

Module V

FRICTION: Laws of static, dynamic and rolling friction,dry& viscous friction,inclined plane & screw jack,pivots& friction axis,bearing,clutches,theory of film lubrication.

Text/Reference Books:

1. Kinematic analysis and synthesis of mechanisms A.K.Mallik,,A.Ghosh., & G. Dittrich, CRC Press.
2. Theory of machines and mechanisms J.J.Uicker, G.R.Pennock, &J.E.Shigley, Oxford University Press
3. Kinematics and Dynamics of Machinery Robert L. Norton, , TMH
4. Theory of Machine ,S. S. Rattan, TMH , New delhi
5. The Theory Of Machines Through Solved Problems J.S.Rao,: New Age International.

Vivekananda Global University

B.Tech in Mechanical Engineering **Semester IV**

BME404 MATERIALS SCIENCE

3L-0T-0P-3C **MM 100**

Module I

CRYSTAL STRUCTURE: unit cell, crystallographic planes and directions, miller indices. Crystal imperfections, point, line, planar and volume defects – Grain size, ASTM grain size number. Frank Reed source of dislocation, Elastic & plastic modes of deformation, slip & twinning, strain hardening, seasons cracking, cold/hot working recovery, re-crystallization and grain growth, Constitution of alloys: Solid solutions - substitutional and interstitial. Iron – Iron carbide equilibrium diagram. Classification of steel and cast iron, microstructure, properties and application.

Module II

FERROUS & NON FERROUS METALS: Effect of alloying additions on steel (Mn, Si, Cr, Mo, V, Ti & W) - stainless and tool steels. Gray, White, malleable, spheroidal -Graphite – alloy cast-iron. Copper and Copper alloys – Brass, Bronze and. Aluminium – Bearing alloys.

Module III

HEAT TREATMENT: Definition – Annealing, stress relieving, spheroidizing, normalising, hardening and tempering of steel. critical cooling rate, Hardenability, Case hardening, carburising, nitriding, cyaniding, Flame and Induction hardening.

Module IV

NON METALLIC MATERIALS: Polymers – types of polymer, commodity and engineering polymers, Properties and applications of Polymers. Urea and Phenol formaldehydes

MECHANICAL PROPERTIES & TESTING: Types of fracture, testing of materials under tension, compression and shear loads , hardness tests (Brinell, Vickers and Rockwell) Impact test, Izod and charpy, fatigue and creep test.

Module V

ENGINEERING CERAMICS: Properties and applications of Al_2O_3, SiC, Si_3N_4, PSZ etc.Fibre and particulate reinforced composites and resin plastics.

INTRODUCTION TO NANO MATERIALS: Nano structured materials,Low-dimensional structures: Quantum wells, Quantum wires, and Quantum dots, Nano clusters & Nano crystals. Electronic and optical properties of nano crystallites, Metallic and semiconducting super lattices. Synthesis of nano structured materials.

Text/Reference Books:

1.Engineering Materials G.Budinski Kenneth and K.Budinski Michael, Prentice-Hall of India
2. Material Science and Engineering DCallister William , John Wiley and Sons.
3. Materials Science and Engineering Raghavan.V, Prentice Hall of India.
4. Material Science & Engineering, V. Raghavan, PHI, Delhi.
5. Engineering Materials, B.K.Agarwal, TMH, New Delhi.
6. Engg. Metallurgy, Part - I Raymond A. Higgins, ELBS

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B.Tech in Mechanical Engineering **Semester IV**

BME405 MECHANICAL MEASUREMENT & METROLOGY

3L-0T-0P-3C **MM 100**

Module-I

Fundamentals of measurement; Introduction to measurement and measuring instruments, Measurement methods; direct and indirect measurements, primary, secondary and tertiary measurements, contact and non-contact type measurements.Generalised measurement system and its functional elements.Instrument characteristics; static and dynamic characteristics.Measurement errors and statistical analysis; concept of error, classification of error, sources of error, statistical analysis of test data, Concept and need of calibration.

Module-II

Sensors and transducers; Transducer classification, Transducer sensitivity, Hall effect, potentiometer and Wheatstone bridge circuits. Pressure measurement; Basic terminology and pressure units, Pressure measuring instruments; Manometers, Bourdon gauge, Diaphragm gauges, Bellow gauges, Low pressure gauges; Mcleod gauge, Thermal conductivity gauge, Calibration of pressure measuring instruments using dead weigh pressure gauge. Temperature measurement; temperature scales, temperature measuring instruments; liquid in glass thermometers, bimetallic thermometers, Thermocouple, RTD, thermistors, Radiation and optical pyrometers.

Module-III

Measurement of flow; types of flow regimes, classification of flow measurement devices, study of Venturimeter, orifice meter, Pitot tube, hot wire anemometer, Rotameter, Ultrasonic flow meters. Overview of strain measurement, Force measurement; scales and balances, elastic force meters, mechanical load cells. Torque measurement; mechanical torsion measurement, optical torsion meter. Miscellaneous measurements; Density and specific gravity, Viscosity, Thermal conductivity and Orsat apparatus.

Module-IV

Metrology; Introduction to metrology, standards for linear measurement, Length measurements: - Vernier calipers, micrometer, vernier height gauge, vernier depth gauge, surface plate, dail gauge, gauge blokcs Angular measurements: - Protractors, sine bars, angle gauges,

Module-V

Comparators; Mechanical, optical and electrical comparators, Screw thread measurement, gear tooth measurement, surface roughness measurement, area measurement Surface Finish Measurement: - Definitions, Surface texture terminology, Measurement of surface roughness**,** Symbols and values of surface roughness

Text/Reference Books:

1.Engineering Metrology – K.J. Hume - MacDonald and Company

2.Engineering Metrology – I.C. Gupta - DhanpatRai& Sons

3.Mechanical & Industrial Measurements – R.K. Jain – Khanna Publishers.

4.D.S. Kumar, Mechanical Measurement and control, Metropolitan Book Company, 1979

5.R. K. Rajput, Mechanical Measurements and Instrumentation, Katson books publication.

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B.Tech in Mechanical Engineering **Semester IV**

BME406 PROJECT MANAGEMENT

3L-0T-0P-3C **MM 100**

Module I

INTRODUCTION TO PROJECT MANAGEMENT: Definition, functions, evolution of Project Management, classification of projects, Project management in different environments.

THE PROJECT MANAGEMENT SYSTEMS, METHODOLOGIES & SYSTEM DEVELOPMENT CYCLE: Systems approach, systems analysis, systems development, project feasibility, project life cycle, project appraisal, project contracting, the phases of system development life cycle.

Module II

PROJECT FEASIBILITY STUDY: Developing a project plan, market and technical analysis, financial analysis evaluation of project proposals, risk analysis, sensitivity analysis, and social cost benefit analysis.

Module III

PROJECT PLANNING: Planning fundamentals, project master plan, work breakdown structure & other tools of project planning, work packages project organization structures & responsibilities, responsibility matrix.

PERT, CPM, RESOURCE ALLOCATION: Tools & techniques for scheduling development, crashing of networks, time-cost relationship, and resource leveling multiple project scheduling.

Module IV

COST ESTIMATING, BUDGETING: Cost estimating process elements of budgeting, project cost accounting &management information systems, cost schedules & forecasts.

MANAGING RISKS IN PROJECTS: Risk concept & identification, risk assessment, risk priority, risk response planning, risk management methods.

PROJECT CONTROL: Information monitoring, internal & external project control, cost accounting systems for project control, control process, performance analysis, variance limits, and issues in project control.

Module V

PROJECT MANAGEMENT INFORMATION SYSTEM: Computer based tools, features of PMIS, using project management software, (MS Projects)

PROJECT EVOLUATION, REPORTING& TERMINATION: Project reviews & reporting, closing the contract.

Text/Reference Books:

1 Project Management K. Nagarajan, New AGE International
2 PROJECT Management S.Choudhary, TMH, new delhi.
3 Project Management ,Vasant Desai, Himalya Publication
4 Projects ,PrasnnaChandra,TMH, new delhi
5 Project Management, BhaveshM., Patel Vikas Publishing House.

B.Tech in Mechanical Engineering **Semester IV**

BME407 PRODUCTION ENGINEERING LAB.– II

0L-0T-2P-1C **MM 100**

LIST OF EXPERIMENTS:

1 To study of single point cutting tool geometry and to grind the tool as per given Tool geometry.
2 To study the milling machine, milling cutters, indexing heads and indexing methods and to cut teeth of spur gears on milling machine.
3 To machine a hexagonal / octagonal nut using indexing head on milling machine.
4 To cut BSW/Metric internal threads on lathe machine.
5 To cut multi-start Square/Metric threads on lathe machine.
6 To prepare the job by eccentric turning on lathe machine using four jaw chuck.
7 Study of capstan lathe and its tooling and prepare a tool layout & job as per given drawing.
8 Exercise on milling machine for generation of plane surfaces and use of end milling cutters.
9 Grinding of milling cutters and drills.
10 Exercise on cylindrical and surface grinding on grinding machine as per drawing.

B.Tech in Mechanical Engineering **Semester IV**

BME408 MECHANICAL MEASUREMENT AND METROLOGY LAB

0L-0T-2P-1C **MM 100**

1. To Study various Temperature Measuring Instruments and to Estimate their Response times.
   (a) Thermocouple.
   (b) RTD
2. To study the working of Bourdon Pressure Gauge and to check the calibration of the gauge in a deadweight pressure gauge calibration set up.
3. To study a Linear Variable Differential Transformer (LVDT) and use it in a simple experimental set up to measure a small displacement.
4. Measurement of flow rate using Rotameter.
5. Experiment on sine bar for measurement of taper angle.
6. Measurement of screw thread using floating carriage micrometer.
7. Measurement of lengths, heights, diameters by Vernier Callipers, Micrometers etc.

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B.Tech in Mechanical Engineering **Semester IV**

BME409 MACHINE DRAWING LAB.

0L-0T-2P-1C **MM 100**

DETAILED SYLLABUS: Review of sectioning, Review of BIS Standard (SP 46), Assemblies involving machine elements like shafts, couplings, bearing, pulleys, gears, belts, brackets. Tool drawings including jigs and fixtures.Engine mechanisms-assembly and disassembly. Production drawings - limits, fits and tolerances, dimensional and geometric tolerances, surface finish symbols. Layout drawings.Schematics, process and instrumentation diagrams, piping drawings.Structural drawings - examples for reading and interpretation.

ASSEMBLY DRAWING WITH SECTIONING & BILL OF MATERIAL: Universal Coupling, Forming punch and die, Jigs for inspecting shaft etc.(1 drawing sheet of any assembly)Lathe tail stock, shaper tool head, steam stop valve, feed check-valve, swivel machine vice etc.

DETAILED PARTS DRAWINGS FROM ASSEMBLY DRAWING: indicating fits, tolerances and surface finish symbols by referring BIS codes Check-valve, Junction Valve etc.

FREE HAND SKETCHES: Connecting rod, crank shaft, machine arbor and cutter, universal dividing head, jigs and fixtures, Step less drive, sliding gear box, safety valve, three way stop valve, blow-off cock, Swivel bearing, Turret Tool Post, drill-press vice, screw jack

Text/Reference Books:

1. Engineering Drawing by Parkinson
2. Gill P S, Machine Drawing, Kataria& Sons
3. Basudeb Bhattacharya, Machine Drawing, Oxford University Press
4. Siddeshswar N., P Kannaiah, VVS Shastry, Machine Drawing,Tata McGraw Hill
5. Engineering drawing Practice for School and Colleges, SP46-1988 (BIS)

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B.Tech in Mechanical Engineering **Semester IV**

BME410 THEORY OF MACHINE LAB.-I

0L-0T-2P-1C **MM 100**

PERFORM FIVE EXPERIMENTS:

1. To plot slider displacement, velocity & acceleration against crank rotation for single slider crank mechanisms.
2. To study various types of cam and follower arrangements.
3. To study various types of Gear Trains- Simple, Compound, Reverted, Epicyclic and differential Gear Trains.
4. To study various types of steering mechanisms.
5. To study the working of screw jack and determine its efficiency.
6. Create various types of linkage mechanisms in CAD and Simulate for motion output and study the relevant effect.
7. To determine radius of gyration of compound pendulum.
8. To determine natural frequency of free torsional vibrations of single rotor system.
    i. Horizontal rotor
    ii. Vertical rotor
9. To conduct experiment of trifler suspension.
10. Determination of resonant frequencies of cantilever beam in Harmonic excitation using electro-dynamic shaker.

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B.Tech in Mechanical Engineering **Semester IV**

BME411 HEAT TRANSFER LAB

0L-0T-2P-1C **MM 100**

Experiments to be performed

1. To Determine Thermal Conductivity of Insulating Powders.
2. To Determine Thermal Conductivity of a Good Conductor of Heat (Metal Rod).
3. To Measure the thermal Conductivity of Liquid.
4. To determine the transfer Rate and Temperature Distribution for a Pin Fin.
5. To Measure the Emissivity of the Test plate Surface.
6. To Determine Stefan Boltzmann Constant of Radiation Heat Transfer.
7. To Determine the Surface Heat Transfer Coefficient For Heated Vertical Cylinder in Natural Convection.
8. Determination of Heat Transfer Coefficient in Drop Wise and Film Wise condensation.
9. To Determine Critical Heat Flux in Saturated Pool Boiling.
10. To Study Performance of Simple Heat Pipes.
11. To Study and Compare LMTD and Effectiveness in Parallel and Counter Flow Heat Exchangers.
12. To Find the Heat transfer Coefficient in Forced Convection in a tube.
13. To determine the total thermal conductivity and thermal resistance of the given Compound resistance in series.
14. To find out the thermal conductivity of given slab material.
15. To determine the individual thermal conductivity of different lagging in a lagged pipe.
16. To study the rates of heat transfer for different materials and geometries
17. To understand the importance and validity of engineering assumptions through theLumped heat capacity method.
18. Testing and performance of different heat insulators.

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MGT 101 SOCIOLOGY AND ELEMENTS OF ECONOMICS

0L-0T-2P-1C **MM 100**

Objective: The objective of this course is to equip the students with the basic understanding of Economics and sociology and to provide an insight into the application of modern analytical tools and techniques for the purpose of management decision-making.

MODULE 1: Introduction to sociological concepts-structure, system, organization, social institutions, Culture social stratification (caste, class, gender, power). State & civil society. Social change in contemporary India: Modernization and globalization, Secularism and communalism, Nature of development.

MODULE 2: Socialization: Meaning, Types, Agents & Process. Social Group: Concepts, Characteristics and Types. Ecology and Environment.

MODULE 3: Basic Principles and Methodology of Economics. Demand/Supply-elasticity-. Theory of the Firm and Market Structure. Basic Macroeconomic Concepts (including GDP/GNP/NI/Disposable Income)

MODULE 4: Public Sector Economics – Welfare, Externalities, Demand & Supply of Labor.
Monetary and Fiscal Policy Tools & their impact on the economy – Inflation and Phillips Curve

MODULE 5: Liberalization, Privatization & Globalization (LPG): Concept, Reasons for implementation of LPG and Pros & Cons of Liberalization, Privatization & Globalization (LPG) , Indian economy Brief overview of post independence period – plans

TEXT BOOK

1	Dutt Gaurav & Mahajan Ashwani, Indian Economy, S Chand	2015
2	B Shalini, K Aman, T Deepika, Sociology and element of Economics for engineers, Neelkant Publications	2014

REFERENCE BOOKS

S.No.	Name of Authors / Books /Publisher	Year of Pub.
1	Giddens, A, Sociology, Polity, 6th edn.	2009
2	Robert S.Pindyck & Daniel L. Rubinfield: Microeconomics, Printce hall	
3	Xaxa, V, State, Society and Tribes Person	2008
4	Chandoke, Neera & Praveen Priyadarshi, Contemporary India: Economy, Society and Politics, Pearson	2009
5	Mohanty, M, Class, Caste & Gender- Volume 5, Sage	2004
6	M.C. Petersen &W.Cris Lewis, Managerial economics(II Edn), Macmillan publishing co. Newyork.	
7	Bhowmik, S (ed.) Street Vendors in the Global Urban Economy, Routledge	2010
8	Misra, S.K. and Puri, Indian Economy, Himalaya	2009

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B.Tech in Mechanical Engineering **Semester IV**

MGT 110 GENERAL APTITUDE

0L-0T-2P-1.0C **MM 100**

Module I

LEVEL 1:- Number System:-Number Series, HCF and LCM of Numbers, Fractions and Decimals, Square Root and Cube Roots, Indices and Surds, Simplification and Approximation,

Module II

LEVEL-2 Problems on Ages and Numbers Percentage, Profit, Loss and Discount, Average, Ratio and Proportion, Time, Work and Wages, Pipes and Cisterns, Simple Interest, Compound Interest,

Module III

LEVEL-3 Growth and Depreciation, Time and Distance, Trains, Boats and Streams, Races, Clocks, Calendar

Module IV

LEVEL-4: Area of Plane Figures, Volume and Surface Area of Solid Figures Elementary Algebra, Linear Equations, Quadratic Equations and In-equation, Progression,

Module V

LEVEL-5: Permutation and Combination, Probability, Geometry, Trigonometry, Data Interpretation, Data Sufficiency

Text/Reference Books:

1. R. S. Agarwal- Aptitude Mathematics
2. Mathuria- Quicker Mathematics

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B.Tech in Mechanical Engineering **Semester V**

BME 501 FLUID MACHINES

3L-0T-0P-3C **MM 100**

Module I

DIMENSIONAL ANALYSIS: Buckingham variables, Model Similitude, force ratio, Reynolds, Froude's Mach, Weber and Euler numbers and their applications. Undistorted model distorted model scale effect.

Module II

IMPACT OF FREE JETS: Impulse momentum principle, force exerted by the jet on stationary flat and curved plate, hinged plate, moving plate and moving curve vanes.

IMPULSE TURBINE: Classification of turbine. Impulse turbines, Pelton wheel, Construction, working. Work done, head, efficiency and design aspects. Governing of impulse turbine.

Module III

REACTION TURBINE: Radial flow reaction turbine, Francis turbine: construction and working. Work done, efficiency, design aspects.

AXIAL FLOW REACTION TURBINE: Propeller and Kaplan turbine, bulb or tubular turbine, construction and working. Draft tube, governing of reaction turbine. Performance characteristics and comparison of all the turbines .Cavitation Phenomenon in hydraulic machines

Module IV

RECIPROCATING PUMPS: Classification, component and working. single acting and double acting, discharge, work done and power required. coefficient of discharge, indicator diagram, slip, effect of friction and acceleration theory of air vessels.

CENTRIFUGAL PUMPS:

Classifications of centrifugal pumps, Vector diagram, Work done by impellor, Efficienciesof Centrifugal pumps, Specific speed, Cavitation & separation, Performance characteristics.

Module V

FLUID SYSTEM: Hydraulic accumulator, 1 Iydraulic intensifier, Hydraulic Press, hydraulic crane, hydraulic lift, hydraulic Ram, hydraulic coupling. hydraulic torque converter, air lift pump, jct pump.

Text/Reference Books:

1. Hydraulic Machines by JagdishLal, Metropolitan book co. pvt ltd.
2. Hydraulic Machines by K Subramanya, Tata McGraw Hill
3. Fluid Mechanics and Machinery by C.S.P.Ojha, R. Berndtsson, P.N. Chandramouli, Oxford University Press
4. Fluid Mechanics and Fluid Power Engineering by D S Kumar, S K Kataria& Sons
5. Fluid Mechanics and Turbo machines by Das, PHI
6. Fluid Power with Applications, by Esposito, Pearson
7. Fluid Mechanics and hydraulic machines by Modi& Seth, Standard Book House
8. Fundamentals of Turbomachinery by Venkanna B.K., PHI

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B.Tech in Mechanical Engineering **Semester V**

BME 502 GAS DYNAMICS

3L-0T-0P-3C **MM 100**

Module I

BASIC CONCEPTS AND ISENTROPIC FLOWS: Energy and momentum equations of compressible fluid flows, Stagnation states, Mach waves and Mach cone, Effect of Mach number on compressibility, isentropic flow through variable ducts, Nozzle and Diffusers, Use of Gas tables.

Module II

FLOW THROUGH DUCTS: Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow), variation of flow properties, Use of tables and charts, Centralized gas dynamics.

Module III

NORMAL AND OBLIQUE SHOCKS: Governing equations, Variation of flow parameters across the normal and oblique shocks, PrandtlMeyer relations, Use of table and charts, Applications.

Module IV

JET PROPULSION: Theory of jet propulsion, Thrust equation, Thrust power and propulsive efficiency, Operation principle, cycle analysis and use of stagnation stale performance of mm jet, turbojet, turbofan and turbo prop engines.

ModuleV

SPACE PROPULSION: Types of rocket engines, Propellants-feeding systems, Ignition and combustion, Theory of rocket propulsion, Performance study, Staging, Terminal and characteristic velocity, Applications, space flights.

Text/Reference Books:

1. Anderson, J.D., "Modern Compressible flow", 3rd Edition, McGraw Hill, 2003.
2. Yahya, S.M. "Fundamentals of Compressible Flow", New Age International (P) Limited, New Delhi, 1996.
3. Hill. P. and C. Peterson, "Mechanics and Thermodynamics of Propulsion", Addison – Wesley Publishing company, 1992.
4. Zucrow. N.J., "Aircraft and Missile Propulsion", Vol.1 & II, John Wiley, 1975.
5. Zucrow. N.J., "Principles of Jet Propulsion and Gas Turbines", John Wiley, New York, 1970.
6. Ganesan. V., "Gas Turbines", Tata McGraw Hill Publishing Co., New Delhi, 1999.

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B.Tech in Mechanical Engineering **Semester V**

BME 503 THEORY OF MACHINES-II

3L-0T-0P-3.0C **MM 100**

Module l:
GOVERNORS: Watt, Porter, Proell, Hartnell and spring controlled governors, governor effort, power, stability inertia effects.

Module II:
GYROSCOPE: Principle of gyroscopic couple, effect of gyroscopic couple and centrifugal force on vehicle taking a turn, stabilization of sea vessels. Inertia force analysis, Velocity and acceleration of slider crank and four bar mechanism, inertia force, piston thrust and forces on connecting rod, turning moment diagram, flywheel.

Module III:
GEARS: law of gearing, terminology. tooth form, standard interchangeable tooth profile, minimum number of teeth on pinion in contact with gear or rack, interference anti undercutting. Bevel, helical and spiral gears.

Module IV:
GEAR TRAINS: Simple, compound, reverted and epicyclic gear trains, analytical, tabular, graphical and vector methods for velocity ratio, gear boxes- sliding and constant mesh for automobiles.

Module V:
BALANCING: Balancing of rotating masses, balancing of reciprocating masses, locomotives. IC engines, balancing machines.

Text/Reference Books:
1. Theory of Machines, Rattan S.S.. Tata McGraw Hill.
2. Theory of Machines, Thomas Bevan, Pearson Education.
3 Theory of Machines and Mechanisms, Uicker, Pennocle and Shigley, Oxford University Press.Mechanism Ami Machine Theory, Ambekar A.G., Prentice-hall Of India

Vivekananda Global University

B.Tech in Mechanical Engineering **Semester V**

BME 504 INTERNAL COMBUSTION ENGINES

3L-0T-0P-3C **MM 100**

Module I: INTRODUCTION: IC. engines and their classification. Piston - Cylinder Arrangement and Related Terms, parts and their functions, Cycle of operation of four strokes and two stroke Engines, Applications, Analysis of Air Standard Otto, Diesel and Dual Cycles, Air Standard Efficiency and Mean Effective Pressure, Valve Timing Diagrams for IC. Engines. TWO STROKE ENGINES: Principle of working, Scavenging and Scavenging Methods, Port Timing Diagram, Merits and Demerits, Applications, Comparison with Four Stroke Engines.

Module II: CARBURATION: Purpose, Main Requirements and Principle of a Carburetor, Constructional and Operational Details of a Single jet Carburetor, Solex Carburetor, Carter Carburetor, SU type Carburetor Compensating Devices. FUEL IGINTION SYSTEMS: Salient Features and Comparative Merits/Demerits of Battery Ignition system and Magneto Ignition System, Timings and Spark Advance, Firing Order. Introduction of Basic Electronic Petrol Injection System, and Multipoint Fuel Injection System FUEL INJECTION IN C.l. ENGINES: Requirements of Diesel Fuel Injection System, Air Injection and Airless Injection systems, constructional and Operational Details of Fuel Pump and Fuel Atomizer.

Module III: COMBUSTION PROCESS: Stages of combustion in SI. Engines, Flame Ignition and Propagation, Effect of Engine Variables on Flame Speed, Pre-ignition and Detonation, Engine Variables Affecting Detonation, Theories of Detonation, Highest Useful Compression Ratio. Combustion in Cl Engines, Effect of Operating Variables on Delay Period and Diesel Knock, Comparison between Knocking in SI and Cl Engines. FUELS: Conventional Petroleum, structure, Refusing Fuels for SI &Cl engines, Octane rating of gasoline fuels and Cetane rating of diesel fuels Knock rating, Additives. Alternative Fuels: Alcohol, LPG, Hydrogen, Relative Merits and Demerits of these Fuels.

Module IV: LUBRICATION SYSTEMS: Function of ,, Lubricating System, Splash and Pressure Lubrication System, Wet and Dry Sump Lubrication, Lubrication of different Engine Parts, S.A.E. Rating of Lubricants. ENGINE COOLING: Need for Cooling, Classification of Cooling Systems -Thermo System, Radiator and Air-Cooling Systems. SUPERCHARGING: Thermodynamic cycle & performance of super charged SI&Cl engines Methods of super charging, Limitation.

Module V: ENGINE TESTING & PERFORMANCE: Purpose of Testing, Performance Parameters: Brake Power, Indicated Power, Mechanical Efficiency, Fuel and Air Consumption. Thermal Efficiency and Specific Fuel consumption. Heat balance Calculations and Performance Maps, Supercharging: Objective, Effects and its limits in SI and CJ Engines, Numerical Problems. Dual & MULTI FUEL ENGINES: Principle, fuels, Combustion, performance Advantages, Modification in fuel system. Working principles of Rotary, Stratified charge, free piston, Variable compression ratio engines.

Text/Reference Books:

1. Ramalingam. K.K., "Internal Combustion Engine Fundamentals", Scitech Publications, 2002.
2. Ganesan, "Internal Combustion Engines", II Edition, TMH, 2002.
3. Mathur. R.B. and R.P. Sharma, "Internal Combustion Engines".,DhanpatRai& Sons 2007.

Vivekananda Global University

B.Tech in Mechanical Engineering **Semester V**

BME 505 MACHINE DESIGN-I

3L-1T-0P-3.5C **MM 100**

Module I

Introduction

Definition, Design requirements of machine elements, Design procedure, Standards in design, Selection of preferred sizes, Indian Standards designation of carbon & alloy steels, Selection of materials for static and fatigue loads.

Design for Static Load

Modes of failure, Factor of safety, Principal stresses, Stresses due to bending and torsion, Theory of failure.

Module II

Design for Fluctuating Loads Cyclic stresses, Fatigue and endurance limit, Stress concentration factor, Stress concentration factor for various machine parts, Notch sensitivity, Design for finite and infinite life, Soderberg, Goodman & Gerber criteria.

Riveted Joints

Riveting methods, materials, Types of rivet heads, Types of riveted joints, Caulking and Fullering, Failure of riveted joint, Efficiency of riveted joint, Design of boiler joints, Eccentric loaded riveted joint.

Module III

Shafts

Cause of failure in shafts, Materials for shaft, Stresses in shafts, Design of shafts subjected to twisting moment, bending moment and combined twisting and bending moments, Shafts subjected to fatigue loads,

Design for rigidity.

Keys and Couplings Types of keys, splines, Selection of square & flat keys, Strength of sunk key, Couplings, Design of rigid and flexible couplings.

Module IV

Mechanical Springs:-Types, Material for helical springs, End connections for compression and tension helical springs, Stresses and deflection of helical springs of circular wire, Design of helical springs subjected to static and fatigue loading.

ModuleV

Power Screws

Forms of threads, multiple threads, Efficiency of square threads, Trapezoidal threads, Stresses in screws, Design of screw jack.

Text/Reference Books:

1. Bhandari, V. 13., Introduction to Machine Design, McGrnw Hill Education (India)
2. Shigley, Joseph E., Mechanical Engineering Design, McGraw Hill Education (India)
3. Sharma and Aggarwal, Machine Design, 5.K.Kataria and Sons, Delhi.
4. Sharma and Purohit, Design of Machine Elements, Prentice Hall I ndia.
5. Kulkarni S. G., Machine Design, Tata McGrnw Hill
6. Karwa A., A Text Book of Machine Design, Laxmi Publications.

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B.Tech in Mechanical Engineering **Semester V**

BME 506 MECHATRONICS

3L-0T-0P-3C **MM 100**

Module I:MECHATRONICS, SENSORS AND TRANSDUCERS:-Introduction to Mechatronics Systems – Measurement Systems – Control Systems – Microprocessor based Controllers. Sensors and Transducers – Performance Terminology – Sensors for Displacement, Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Light Sensors – Selection of Sensors

Module II:ACTUATION SYSTEMS– Directional Control Valves – Rotary Actuators. Mechanical Actuation Systems – Cams – Gear Trains – Ratchet and pawl – Belt and Chain Drives – Bearings. Electrical Actuation Systems – Mechanical Switches – Solid State Switches – Solenoids – Construction and working principle of DC and AC Motors – speed control of AC and DC drives, Stepper Motors-switching circuitries for stepper motor – AC & DC Servo motors.

Module III:SYSTEM MODELS AND CONTROLLERS:- Building blocks of Mechanical, Electrical, Fluid and Thermal Systems, Rotational – Transnational Systems, Electromechanical Systems – Hydraulic – Mechanical Systems. Continuous and discrete process Controllers – Control Mode – Two – Step mode – Proportional Mode – Derivative Mode – Integral Mode – PID Controllers – Digital Controllers – Velocity Control – Adaptive Control – Digital Logic Control – Micro Processors Control.

Module IV: PROGRAMMING LOGIC CONTROLLERS: -Programmable Logic Controllers – Basic Structure – Input / Output Processing – Programming – Mnemonics – Timers, Internal relays and counters – Shift Registers – Master and Jump Controls – Data Handling – Analogs Input / Output – Selection of a PLC.

Module V:DESIGN OF MECHATRONICS SYSTEM:-Stages in designing Mechatronics Systems – Traditional and Mechatronic Design - Possible Design Solutions. Case studies of Mechatronics systems- Pick and place Robot- Autonomous mobile robot-Wireless surveillance balloon- Engine Management system- Automatic car park barrier.

Text/Reference Books:

1. Rajput. R.K, A textbook of mechatronics, S. Chand & Co, 2007
2. Michael B. Histand and David G. Alciatore, " Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 2000.
3. Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, "Mechatronics", Chapman and Hall, 1993.
4. Dan Necsulesu, "Mechatronics", Pearson Education Asia, 2002 (Indian Reprint).
5. Lawrence J. Kamm, "Understanding Electro – Mechanical Engineering", An Introduction to Mechatronics, Prentice – Hall of India Pvt., Ltd., 2000.

B.Tech in Mechanical Engineering **Semester V**

BME 507 FLUID MACHINES LAB

0L-0T-2P-1C **MM 100**

LIST OF EXPERIMENTS:

1. Performance testing of a single stage centrifugal pump.
2. Performance testing of a multi-stage centrifugal pump.
3. Performance testing of a Reciprocating Pump,
4. Performance testing of an axial flow compressor.
5. Performance Testing of a multi-stage Reciprocating compressor.
6. Performance characteristics of Pelton turbine.
7. Performance characteristics of-Francis turbine.
8. Performance characteristics of Kaplan turbine

B.Tech in Mechanical Engineering **Semester V**

BME 508 GAS DYNAMICS LAB

0L-0T-2P-1C **MM 100**

LIST OF EXPERIMENTS

1. Study and Demonstration nm of thrust stand (entire class)
2. Study of Alignment of a Schlierensystem for viewing of thermal plumes
3. Tank Blow down

(a) Derivation (statement) of pressure/ time equations
(b) Measurement of tank pressure and temperature as a function of time

4. Nozzle Pressure Measurement -

(a) Review of prediction of wall pressure from1 D theory
(b) Measurement of nozzle.wall static pressure at varying total pressures

5. CfD Component -

(a) CfD Overview
(b) Compare results from Fluent Flow lab templates to theory and experiment

B.Tech in Mechanical Engineering **Semester V**

BME 509 INTERNAL COMBUSTION ENGINE LAB

0L-0T-2P-1C **MM 100**

1 Study and comparison of 2 stroke IC engines (cut models) and Performance parameters ..
2. Study and comparison of SI and Cl Engines (Cut section models].
3. To draw valve timing diagram for a single cylinder diesel engine.
4.To perform constant speed load test on a single cylinder diesel engine and to plot performance curves: indicated thermal efficiency, brake thermal efficiency, mechanical efficiency Vs. Brake power.
5. To prepare heat balance sheet of a four stroke diesel engine.
6. To perform constant speed load test on computerized test rig and to plot performance Curves along with pressure-theta diagram.
7. Morse Test: To estimate the Indicated Power, Friction Power and Mechanical Efficiency of a multi-cylinder Petrol Engine.
8. Study and comparison of 4 stroke IC engines (cut models) and Performance parameters.

B.Tech in Mechanical Engineering **Semester V**

BME 510 MACHINE DESIGN SESSIONAL-I

0L-0T-2P-1C **MM 100**

1. Design & drawing of Cotter joint.
2. Design & drawing of Knuckle joint
3. Design of machine components subjected to combined steady and variable loads
4. Design of eccentrically loaded riveted joint
5. Design of boiler riveted joint
6. Design of shaft for combined constant twisting and bending loads
7. Design of shaft subjected to fluctuating loads
8. Design and drawing of flanged type rigid coupling
9. Design and drawing of flexible coupling
10. Design and drawing of helical spring
11. Design and drawing of screw jack

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B.Tech in Mechanical Engineering **Semester V**

BME 511 THEORY OF MACHINE LAB –II

0L-0T-2P-1C **MM 100**

1 To verify the relation $T=I_W W_P$ for gyroscope.
2. To plot force vs. radius and lift vs. Speed curves for governors.
3. To plot pressure distribution curves on a journal bearing.
4. To perform wheel balancing.
5. To perform static and dynamics balancing on balancing set up.
6. TO Determine the mass moment of inertia of flywheel.
7. Study of a lathe gear box.
8. Study of a sliding meshautomobilegear box.
9. Study of a Planetarygear box.

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B.Tech in Mechanical Engineering **Semester V**

BME 512 Skill Development Course: AutoCAD

0L-0T-2P-1.0C **MM 100**

1) Introduction of Engineering Drawings, Views & AutoCAD, History, GUI, Units, Limits, Line, Circle, Erase, Trim, Extend. File Management- New, Open, Save, Close, Exit, Arc, Ellipse, Rectangle, Polygon, Move, Copy, Mirror, Offset.
2) CO-Ordinate System- Absolute, Relative- Rectangular, Polar, Zoom, Pan, Regenerate, Array- Rectangular, Polar, Path, Array Edit.
3) Ray Line, Construction Line, Multiline, Polyline, Spline. Rotate, Scale, Stretch, Lengthen, Isometric View, Hatch, Gradient, Hatch edit, Boundary, Region, Wipeout, Revision Cloud.
4) Fillet, chamfer, Break, Join, Explode, Object Properties- color, Line type, scale, lineweight
5) Block- Make, Save, Insert Block Editor, Table, Text, Helix, Donut, Match Properties,
6) Dimensions- Linear, Angular, aligned, radius, diameter, jogged, tolerance, center mark, inspection, Oblique, align text, Dimension Style- Modify, Override, Update,
7) tools- Workspace, tool Palettes, Dynamic Block, Clear Screen, Command Line, Quick Select, External Reference, Xbind, Xopen, PDF Underlay, Raster Image, Hyperlink, OLE Object., Mini Project 4, Field, Update Filed
8) Edit- Copy, Copy with base point, copy link, paste, paste as block, paste Special, Paste to Original Co-ordinate, Import, Export, Etansmit, Dwg Convert,
9) Page Setup, Plot, Publish, View- Zoom, Pan, Orbit, View Port, , Mini Project 4,
10) Introduction of 3D, 3D Views, Visual Style. √ Modeling- Box, Polysolid, Cylinder, Cone, Sphere, Pyramid, Wedge, Tours
11) Extrude, Revolve, Sweep, Loft, Union, Subtract, Intersect, Presspull,
12) 3D Operations'- move, rotate, align, mirror, array, Slice, Extract Edges, Extract Isolines,
13) Solid Editing-Face, Edge, Body, Material Browser, Render,

Text/Reference Books:

1. AutoCAD 2012 Instructor, James Leach, Thomas Bledsaw, McGraw-Hill Education, 15-Jun-2011
2. AutoCAD 2013 and AutoCAD LT 2013: (Autodesk Official Training Guides) by Donnie Gladfelter

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B.Tech in Mechanical Engineering **Semester VI**

BME 601 REFRIGERATION AND AIR CONDITIONING

3L-0T-0P-3C **MM 100**

Module I

INTRODUCTION: Refrigeration and second law of Thermodynamics, Refrigeration effect and unit of Refrigeration Heat pump, reversed Carnot cycle.

VAPOUR COMPRESSION REFRIGERATION SYSTEM: Analysis of simple vapour compression Refrigeration cycle by p-hand T-S diagram, Effect of operating conditions, liquid vapour heat exchangers, Actual refrigeration cycle.

MULTIPLE EVAPORATOR & COMPRESSOR SYSTEM: Application, air compressor system, Individual compressor, compound compression, cascade system.

Module II

GAS CYCLE REFRIGERATION: Limitation of Carnot cycle with gas, reversed Brayton cycle, Baryton cycle withregenerative heat exchanger, Air cycle for air craft, Necessity of cooling of air craft, Basic cycle, boot strap, regenerative type air craft refrigeration cycle.

Module III

VAPOUR ABSORPTION SYSTEM: Simple Vapor absorption system, Electrolux Refrigerator, Analysis of Ammoniaabsorption refrigeration system, Lithium Bromide Absorption Refrigeration. System.

REFRIGERANTS: Classification, Nomenclature, selection of refrigerants, global warming potential of CFC Refrigerants, Refrigeratio11 Equipment's - Compressor, condenser, evaporator, expansion devices - types and working.

Module IV

PSYCHOMETRIC: Psychometric properties, psychometric relations, psychometric charts, psychometricprocesses. cooling coils, By-pass factor and air washers.

HUMAN COMFORT: Mechanism of body heat losses, factors affecting human comfort, effective temperature. Comfort chart.

COOLING LOAD CALCULATIONS: Internal heat gain, system heat gain, RSI-II', ERSHF, GSHF, cooling load estimation, heating load estimation, psychometric calculation for cooling, selection of air conditioning. Apparatus for cooling and dehumidification, air conditioning system.

Module V

Refrigeration Equipment & Application:

Elementary knowledge of refrigeration & air conditioning equipmentse.g compressors, condensers, evaporators & expansion devices, Food preservation, Cold storage, Refrigerates Freezers, Ice plant, Water coolers, Elementary knowledge of transmission and distribution of air through ducts and fans, Basic difference between comfort and industrial air conditioning..

Text/Reference Books:

1. Refrigeration and Air Conditioning, Stoecker W.F., McGraw Hill Publication,
2. Modern Refrigeration and Air Conditioning, Andrew D. Althouse, Goodl le-art-Willcox Co.
3. Refrigeration and Air Conditioning, Arora C.P., Tata McCr.1w I-Jill New Delhi,

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B.Tech in Mechanical Engineering **Semester VI**

BME 602 AUTOMOBILE ENGINEERING

3L-0T-0P-3C **MM 100**

Module-I VEHICLE STRUCTURE AND ENGINES
Types of automobiles, vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines –components-functions and materials, variable valve timing (VVT).

Module-IIENGINE AUXILIARY SYSTEMS
Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

Module-IIITRANSMISSION SYSTEMS
Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints ,Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

Module-IVSTEERING, BRAKES AND SUSPENSION SYSTEMS
Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control.

Module-VALTERNATIVE ENERGY SOURCES
Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

Text/Reference Books:
1. Kirpal Singh, "Automobile Engineering", Vol 1 & 2, Seventh Edition, Standard Publishers, New Delhi, 1997.
2. Jain K.K. and Asthana .R.B, "Automobile Engineering" Tata McGraw Hill Publishers, New Delhi, 2002.
3. Newton ,Steeds and Garet, "Motor Vehicles", Butterworth Publishers,1989.
4. Joseph Heitner, "Automotive Mechanics," Second Edition, East-West Press, 1999.
5. Martin W, Stockel and Martin T Stockle , "Automotive Mechanics Fundamentals," The Good heart –Will Cox Company Inc, USA ,1978.

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B.Tech in Mechanical Engineering **Semester VI**

BME 603 MACHINE DESIGN –II

3L-1T-0P-3.5 **MM 100**

Module I

Principle of transmission and conjugate action

Spur Gears

Tooth forms, System of gear teeth, contact ratio, Standard proportions of gear systems, Interference in involute gears, Backlash, Selection of gear materials, Gear manufacturing methods, Design considerations, Beam strength of gear tooth, Dynamic tooth load, Wear strength of gear tooth, Failure of gear tooth, Design of spur gears, AGMA and Indian standards.

Helical Gears

Terminology, Proportions for helical gears, Forces components on a tooth of helical gear, Virtual number of teeth, Beam strength& wear strength of helical gears, Dynamic load on helical gears, Design of helical gears.

Module II

Bevel gears

Terminology of bevel gears, Force analysis, Virtual number of teeth, Beam strength and wear strength of bevel gears, Effective load of gear tooth, Design of a bevel gear system.

Worm Gears

Types of worms, Terminology, Gear tooth proportions, Efficiency of worm gears, Heat dissipation in worm gearing, Strength and wear tooth load for worm gears, Design of worm gearing system.

Module III

Sliding Contact Bearing

Types, Selection of bearing, Plain journal bearing, Hydrodynamic lubrication, Properties and materials, Lubricants and lubrication, Hydrodynamic journal bearing, Heat generation, Design of journal bearing, Thrust bearing-pivot and collar bearing, Hydrodynamic thrust bearing.

Module IV

Rolling Contact Bearing

Advantages and disadvantages, Types of ball bearing, Thrust ball bearing, Types of roller bearing, Selection of radial ball bearing, Bearing life, Selection of roller bearings, Dynamic equivalent load for roller contact bearing under constant and variable loading, Reliability of Bearing, Selection of rolling contact bearing, Lubrication of ball and roller bearing, Mounting of bearing.

Module V

IC ENGINE parts,

Selection of type of IC engine, General design considerations, Design of cylinder and cylinder head; Design of piston and its parts like piston ring and gudgeon pin etc.; Design of connecting rod; Design of crankshaft.

Text/Reference Books:

1. Design of Machine Elements-V.B. Bhandari, Tata McGraw Hill Co.
2. Machine Design-Sharma and Agrawal, S.K. Kataria& Sons.
3. Machine Design, U C Jindal, Pearson Eductaion.
4. Design of Machine Elements, Sharma and Purohit, PHI.

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B.Tech in Mechanical Engineering **Semester VI**

BME 604 OPERATION RESEARCH

3L-1T-0P-3.5C **MM 100**

Module I

ORIGIN OF OR & ITS ROLE IN SOLVING INDUSTRIAL PROBLEMS: General approach for solving OR problems. Classification of mathematical models, various decision making environments. DETERMINISTIC MODELS: Formulation of deterministic linear mathematical models, Graphical and simplex techniques for solution of linear programing problems, Big M method and two phase method.

Module II

INTRODUCTION TO DUALITY THEORY & SENSITIVITY ANALYSIS: transportation, assignment and sequencing models; Introduction to goal programming: Solution techniques of linear goal programming problems.

QUEUING THEORY: Types of queuing situation: Queuing models with Poisson's input and exponential service, their application to simple situations.

Module III

GAME THEORY: Decision making under uncertainty, Maximum and Minimum models; Introduction to decision tree. Game theory: Solution of simple two person zero-sum games .Examples of simple competitive situation.

SIMULATION: Concept general approach and application. Use of Monte-Carlo simulation technique to queuing and inventory problems,

Module IV

INVENTORY MODELS: Classification of inventory control models: Inventory models with deterministic demand, inventory models with probabilistic demand, inventory models with price breaks.

ModuleV

NETINORK MODELS : Shortest route and traveling sales- man problems, PERT & CPM introduction, analysis of time bound project situations, construction of networks, identification of critical path, slack and float, crashing of network for cost reduction, resource leveling and smoothening.

Text/Reference Books:

1. Shennoy G.V. and Srivastava U.K., "Operation Research for Management", Wiley Eastern, 1994.
2. Bazara M.J., Jarvis and Sherali H., "Linear Programming and Network Flows", John Wiley, 1990.
3. Philip D.T. and Ravindran A., "Operations Research", John Wiley, 1992.
4. Hillier and Libeberman, "Operations Research", Holden Day, 1986
5. Budnick F.S., "Principles of Operations Research for Management", Richard D Irwin, 1990.
6. Taha H.A., "Operations Research", Sixth Edition, Prentice Hall of India, 2003.

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B.Tech in Mechanical Engineering **Semester VI**

BME 605 FINITE ELEMENT MEHOD

3L-0T-0P-3C **MM 100**

Module I

Introduction to FEM and its applicability, Review of:Matrix algebra,Gauss elimination method, Uniqueness of solution, Banded symmetricmatrix and bandwidth.Structure analysis: Two-force member element, Local stiffness matrix,coordinate transformation, Assembly, Global stiffness matrix, imposition of Boundary conditions, Properties of stiffness matrix

ModuleII

One-dimensional Finite Element Analysis: Basics of structuralmechanics, stress and strain tensor, constitutive relation, Principle ofminimum Potential, General steps of FEM, Finite element model concept / Discretization, Derivation of finite elements, equations usingpotential energy approach for linear and quadratic 1-D bar element, shape functions and their properties, Assembly, Boundary conditions,Computation of stress and strain.

ModuleIII

Two Dimensional Finite Element Analysis: Finite element formulationusing three nodded triangular (CST) element , Plane stress and Plainstrain problems, Shape functions, node numbering and connectivity, Assembly,Boundary conditions, Isoparametric formulation of 1-D bar elements, Numerical integration using gauss quadrature formula, computation ofstress and strain.

ModuleIV

Finite Element Formulation from Governing Differential Equation:Method of Weighted Residuals, Collocation, Sub domain method, Least Square method and Galerkin'smethod, Application to one dimensional problems, one-dimensional heattransfer, etc. introduction to variational formulation (Ritz Method.)

ModuleV

Higher Order Elements: Lagrange's interpolation formula for one andtwo independent variable, Convergence of solution, compatibility,element continuity, static condensation, p and h methods of meshrefinement, Aspect ratio and element shape,Application of FEM, Advantages of FEM, Introduction to concept ofelement mass matrix in dynamic analysis.

Text/Reference Books:

1. SeshuP.,"Text Book of Finite Element Analysis", Prentice Hall India.
2. Dixit, U. S., "Finite Element Methods for Engineers" Cengage Learning
3. Finite Element Procedures in Engineering Analysis, Bathe K.J., Prentice Hall India.
4. 3 An Introduction to the Finite Element Method, Reddy J.N., Tata McGraw- Hill, New Delhi
5. 4 Concepts & Applications of Finite Element Analysis, Cook and Plesha, Willey India New Delhi.
6. Introduction to Finite Elements in Engineering, Chandupatla and Belegundu, Prentice Hall India.

B.Tech in Mechanical Engineering **Semester VI**

MGT 102 ENTREPRENEUR DEVELOPMENT

3L-0T-0P-3C **MM 100**

Module I

Entrepreneurship: Historical perspective of entrepreneurship - Traits of Entrepreneurs - Types of Entrepreneurs – Intrepreneur -Difference between entrepreneur and intrepreneur - entrepreneurship in Economic growth - Factors affecting **e**ntrepreneurial growth, Major motives influencing entrepreneur.

Module II

Business: Small Enterprises: Definition Classification - Characteristics Web and e business - Ownership structure -Project formulation - Sources of information - Steps involved in setting up a business – Identifying, selecting a good business opportunity - Market survey and research - Techno economic feasibility assessment – Preliminary Project report – Project appraisal – Project implementation.

Module III

Financing & Accounting: Sources of finance - Institutional Finance - Term loans - Capital structure - Management of working capital -Costing, Break even analysis – Taxation - Income Tax, Excise Duty - Sales Tax - Purchasing Policies and procedures - Methods of purchasing - Stores management - Book keeping

Module IV

Marketing & Growth Strategies: Principles of marketing - Assessment of market needs - Demand forecasting, Product life cycle – Sales promotion Strategies - Product mix – Advertising - Distribution Channels - Growth strategies – Expansion –Diversification - Joint venture, Merger - Sub-contracting

Module V

Institutional Support To Entrepreneurs: Institutional support to entrepreneurs - Government policy for small scale industries - Institutions forentrepreneurial growth – Various schemes - Self Help Group - Sickness in industry – Causes - Steps forcorrection and rehabilitation

Text/Reference Books:

1. Entrepreneurial Development, Khanka, S. S., S.Chand and Co Ltd, New Delhi, 1999.
2. Principles of Marketing, Philip Kotler, Prentice Hall of India, 1995.
3. Purchasing and Materials Management, Lamer Lee and Donald W. Dobler, TMH
4. EDII–Faculty and External Experts, A Hand Book of new Entrepreneurs, Published by Entrepreneurship Development Institute of India, Ahmedabad, 1986.
5. Entrepreneurial Development, Saravanavel, P., Ess Pee Kay Publishing House, Chennai, 1997.
6. Hand book of Materials Management, Gopalakrishnan, P., Prentice Hall of India, 1996.

B.Tech in Mechanical Engineering **Semester VI**

BME 606 REFRIGERATION & AIR CONDITIONING LAB

0L-0T-2P-1C **MM 100**

LIST OF EXPERIMENTS:

1. To study the analysis of simple vapor compression cycle and explain the types of vapor compression cycle with T-H and P-H diagram.
2. To study refrigeration cycle, determine the co efficient of performance of cycle and determine of tonnage capacity of refrigeration unit.
3. To determine the COP and tonnage capacity of Air conditioning system.
4. To study about the Mechanical heat pump.
5. To study the cut section model of reciprocating rotary and centrifugal compressor.
6. To study works principle of steam jet refrigeration system.
7. To study different psychometric process and chart.
8. To study various controls used in Refrigeration and Air conditioning system.
9. To impart knowledge of on the erection and maintenance of different A/C systems.

B.Tech in Mechanical Engineering **Semester VI**

BME 607 AUTOMOBILE ENGINEERING LAB.

0L-0T-2P-1C **MM 100**

1) Study and demonstration of Layout of an Automobile
2) Study and Demonstration of Differential
3) Study and Demonstration of Clutches
4) Study and Demonstration of Brakes
5) Study and Demonstration of Gear box
6) Study and Demonstration of Steering Mechanism
7) Study and Demonstration of Suspension System
8) Study and Demonstration of Internal Combustion Engine

B.Tech in Mechanical Engineering **Semester VI**

BME 608 MACHINE DESIGN SESSIONAL-II

0L-0T-2P-1C **MM 100**

Problems on:-

1 Fatigue loading for infine life & for finite life .
2 Helical compression, tension and torsional springsdesign.And combination of spring for different type of loading.
3 Curved Beams.U clamp.
4 Preloaded bolts and bolts subjected to variable stresses.
5 Belt, Rope and Chain drive system.
6 Gear Design forspur , helical , bevel & worm and wheel gears.
7 Sliding contact bearing design.
8 Anti-friction bearing selection.

B.Tech in Mechanical Engineering **Semester VI**

BME 609 FINITE ELEMENT METHOD SESSIONAL

0L-0T-3P-1.5C **MM 100**

Laboratory work for the solution of solid mechanics problems, heat transfer problems, and free vibration problems

A: by using FE packages such as NASTRAN/ ANSYS/ SIMULIA/ ABAQUS

2 Introduction of GUI of the software in the above mentioned areas realistic problems.
3 Analysis of beams and frames (bending and torsion problems)
4 Plane stress and plane strain analysis problems
5 Problems leading to analysis of axisymmetric solids
6 Problems leading to analysis of three dimensional solids
(a) Heat transfer problems
(b) Modal analysis problem

B: by writing own code for finite element analysis using MATLAB for:

7 Plane stress and plane strain analysis problems
8 Modal Analysis problem

B.Tech in Mechanical Engineering **Semester VI**

BME 610 INDUSTRIAL ENGINEERING LAB

0L-0T-2P-1C **MM 100**

LIST OF EXPERIMENTS:

1 Determination of time standard for a given job using stopwatch time-study.

2. Preparation of flow process chart, operation process chart and man-machine charts for an existing setup and development of an improved process.

3. Study of existing layout of a workstation with respect to controls and displays and suggesting improved design from ergonomic viewpoint.

4. To carry out a work sampling study.

5. To conduct process capability study for a machine in the workshop.

6. To design a sampling scheme based on OC curve.

7. To conduct Shewart's experiments on known population

8. Generation of random numbers for system simulation such as facility planning, job shop scheduling etc.

B.Tech in Mechanical Engineering **Semester VI**

BME 611 CAMPUS RECRUITMENT TRAINING (Technical)

0L-0T-2P-1.0C **MM 100**

Module I

Fluid Mechanics: Basic Concepts and Properties of Fluids, Manometry, Fluid Statics, Buoyancy, Equations of Motion, Bernoulli's equation and applications, Viscous flow of incompressible fluids, Laminar and Turbulent flows, Flow through pipes and head losses in pipes.

Module II

Thermodynamics and Heat transfer: Thermodynamic systems and processes; properties of pure substance; Zeroth, First and Second Laws of Thermodynamics; Entropy; analysis of thermodynamic cycles related to energy conversion: Rankine, Otto, Diesel and Dual Modes of heat transfer, Steady and unsteady heat conduction, Thermal resistance, Fins, Free and forced convection, Correlations for convective heat transfer.

Module III

IC Engines, Refrigeration and Air conditioning:
SI and CI Engines, Engine Systems and Components, Performance characteristics and testing of IC Engines; Fuels; Emissions and Emission Control. Vapor compression refrigeration, Refrigerants and Working cycles, Compressors.

Module IV

Engineering Materials: Basic Crystallography, Alloys and Phase diagrams, Heat Treatment, Ferrous and Non Ferrous Metals, Non metallic materials, Mechanical Properties and Testing, Corrosion prevention and control

Mechanisms and Machines: Types of Kinematics Pair, Mobility, Inversions, Kinematic Analysis, Velocity and Acceleration Analysis of Planar Mechanisms, CAMs with uniform acceleration and retardation, cycloidal motion, oscillating followers; Vibrations –Free and forced vibration of undamped and damped .

Module V

Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as riveted, welded and bolted joints. Shafts, Spur gears, rolling and sliding contact bearings, Brakes and clutches, flywheels.

Text/Reference Books:

1. Mechanical Engineering for Competitions, R. K. Jain, Khanna Publishers, New Delhi.
2. Questions & Answers in Mechanical Engineering, R.K.Rajput, S.Chand and Co Ltd, New Delhi.

B.Tech in Mechanical Engineering **Semester VII**

BME 701 POWER PLANT ENGINEERING

3L-0T-0P-3C **MM 100**

Module I

LAYOUT OF POER PLANTS: Schematics of various power plant systems – steam, hydel, Gas turbine, Combined Cycle, Fuel cell, Cogeneration, Solar, Wind mill, Comparisons, Selection.

Module II

STEAM & NUCLEAR PLANTS :Steam generators including FBC, cycle analyses, subsystems of thermal analyses power plants, coal gasification technologies, Types of Nuclear Reactor plants – Indian Scenario, Environmental aspects of thermal and nuclear plants, Development trends.

Module III

HYDEL & OTHER POWER PLANTS :Essential elements of hydel power plants, selection of turbines, microhydel plant developments, pumped storage plants, Wind mill developments, specialities of fuel cell power plants – PAFC, MCFC, SOFC and PEM systems, Hybrid power plants, advanced piston engine and gas turbine power plants, geothermal power plants.

Module IV

INSTRUMENTATION & CONTROLS: Modern Control system of power plants, instrumentation for vital parameters like temperature, pressure, flow of steam, gas, water, flue gas etc., flue/exhaust gas analyses, automatic controls.

Module V

ECONOMICS, RENOVATION & MODERNIZATION OF POWER PLANTS: Load duration curves, costing of electrical energy, tariff types, load sharing economics, Renovation and modernization of aged power plants, Development pathways for power plants, national and global scenario.

Text/Reference Books:

1. Power Plant Engineering, P.K. Nag, Tata McGraw – Hill Publishing Company Ltd., Third Edition, 2007.
2. Standard Handbook of Powerplant Engineering, Thomas C. Elliott, Kao Chen and Robert
3. Swanekamp, McGraw – Hill, 1998, Second Edition.
4. Power Plant Engineering, Frederick T. Morse, Affiliated East-West-Press Private Ltd., New Delhi 1953.

B.Tech in Mechanical Engineering **Semester VII**

BME 702 COMPUTER INTEGRATED MANUFACTURING

3L-0T-0P-3C **MM 100**

Module I

INTRODUCTION: Overview of manufacturing processes, types of manufacturing systems, the product cycle, computer's role in manufacturing, sources and types of data used in manufacturing. THE BEGINNING OF CAM: Historical Background, Basic components of NC systems, NC Procedure, NC coordinate system and machine motions, applications and economics of NC.

Module II

PART PROGRAMMING: Manual and computer assisted such as APT Language. COMPUTER CONTROLS IN NC SYSTEMS: Problems with conventional NC computer numerical control, Direct numerical control, combined CNC/ DNC systems, adaptive control machining system computer process interfacing, New development and latest trends.

Module III

COMPUTER AIDED PROCESS PLANNING: Traditional Process Planning, Retrieval process planning system, Generative Process Planning, Machinability data system, computer generated time standards. GROUP TECHNOLOGY: Introduction, part families, part classification and coding, coding system and machining cells.

Module IV

COMPUTER AIDED PRODUCTION MANAGEMENT SYSTEMS: Introduction to computer aided PPC, Introduction to computer aided inventory management, manufacturing resource planning (MRPII), computer process monitoring and shop floor control, computer process control. COMPUTER AIDED QUALITY CONTROL: Computer in quality control, contact inspection methods, Non-contact inspection methods, optical and non-optical computer aided testing. COMPUTER AIDED MATERIAL HANDLING: Computer control on material handling, conveying, picking. Ware house control, computerized material handling for automated inspection and assembly.

Module V

COMPUTER AIDED MANUFACTURING SYSTEMS: Introduction, types special manufacturing systems, flexible manufacturing systems (FMS). COLLABORATIVE ENGINEERING: Introduction, Faster Design throughput, Web based design, changing design approaches, extended enterprises, concurrent engineering, Agile and lean manufacturing.

Text/Reference Books:

1. Computer Aided manufacturing, Chang and Wang, Pearson Publisher.
2. Automation Production Systems and Computer Integrated manufacturing, Grover M.P., Pearson Publisher.
3. CAD/CAM: Principles and Applications, Rao P.N., McGraw-Hill Publication.
4. Computer Control of Manufacturing System, Koren Y., McGraw-Hill Publication.
5. Computer Aided Manufacturing, Rao and Khundra, McGraw-Hill Publication.
6. Computer Numerical Control: Machining and Turning Center, Ruesada and Jeyapoovan, PearsonPublisher

B.Tech in Mechanical Engineering **Semester VII**

BME 703 MECHANICAL VIBRATION

3L-1T-0P-3.5C **MM 100**

Module-I

Introduction, Classification of Vibration Systems, Harmonic motion, Vector re[presentation of harmonic motion, Natural frequency & response, Effects of vibration, superposition of simple harmonic motions, beats, Fourier analysis-analytical and numerical methods.

Single Degree Freedom System, Equation of motion, Newton's method, D'Alembert's principle, Energy method etc., Free vibration, Natural frequency, Equivalent systems, Displacement, Velocity and acceleration, Response to an initial disturbance, Torsional vibrations, Damped vibrations, Vibrations of systems with viscous damping, Logarithmic decrement, Energy dissipation in viscous damping.

Module-II

Single Degree Freedom: Forced Vibration Forced vibration, Harmonic excitation with viscous damping, steady state vibrations, Forced vibrations with rotating and reciprocating unbalance, Support excitation, Vibration isolation, Transmissibility, Vibration measuring instruments, Displacement, velocity and acceleration measuring instruments

Module-III

Two Degree Freedom systems Introduction, Principal modes, Double pendulum, Torsional system with damping, Coupled system, Principle of vibration absorber, Undamped dynamic vibration absorbers, Torsional vibration absorber, Centrifugal pendulum absorbers, Vibration isolators and Dampers.

Module-IV

Multi-degree Freedom system: Exact Analysis, Undamped free and forced vibrations of multi-degree freedom systems, influence coefficients, Reciprocal theorem, Torsional vibration of multi-degree rotor system, Vibration of gear system, Principal coordinates, Continuous systems- Longitudinal vibrations of bars, Torsional vibrations of circular shafts.

Module-V

Multi Degree Freedom system: Numerical Analysis by Rayleigh's method, Dunkerely's, Holzer's and Stodola methods, Rayleigh-Ritz method, Critical speed of shafts, Whirling of uniform shaft, Shaft with one disc with and without damping, Multi-disc shafts, Secondary critical speed.

Text/Reference Books:

1. Mechanical Vibrations – G. K. Groover, Jain Brothers, Roorkee.
2. Mechanical Vibrations-Theory & Practice, S Bhave, Pearson Education.
3. Mechanical Vibrations-Theory & Applications, Singhal, Katson Books.
4. Theory of Vibrations with Applications, Thomson&Dahleh, Pearson Education.
5. Elements of Vibration Analysis, L Meirovitch, McGraw-Hill Education.
6. Mechanical Vibrations – Tse, Morse & Hinkle
7. Mechanical Vibrations – V. Rama Murthy, Narosa Publications
8. Mechanical Vibrations – D. Nag, Wiley

B.Tech in Mechanical Engineering **Semester VII**

BME 704 THEORY OF COMBUSTION AND EMISSION

3L-0T-0P-3C **MM 100**

Module 1
COMBUSTION PRINCIPLES : Combustion – Combustion equations, heat of combustion - Theoretical flame temperature - chemical equilibrium and dissociation - Theories of Combustion - Pre-flame reactions - Reaction rates - Laminar and Turbulent Flame Propagation in Engines.

Module II
COMBUSTION IN S.I. ENGINE: Initiation of combustion, stages of combustion, normal and abnormal combustion, knocking combustion, pre-ignition, knock and engine variables, features and design consideration of combustion chambers. Flame structure and speed, Cycle by cycle variations, Lean burn combustion, stratified charge combustion systems. After treatment devices for SI engines.

Module III
COMBUSTION IN C.I. ENGINE: Stages of combustion, vaporization of fuel droplets and spray formation, air motion, swirl measurement, knock and engine variables, features and design considerations of combustion chambers, delay period correlations, heat release correlations, Influence of the injection system on combustion. Direct and indirect injection systems. After treatment devices for diesel engines.

Module IV
EMISSIONS: Main pollutants in engines, Kinetics of NO formation, NOx formation in SI and CI engines. Unburned hydrocarbons, sources, formation in SI and CI engines, Soot formation and oxidation, Particulates in diesel engines, Emission control measures for SI and CI engines, Effect of emissions on Environment and human beings.

Module V
Combustion and Flames: Gaseous fuel flames: laminar and turbulent premixed flames, explosion limits, flame ignition and quenching, diffusion flames, simple models Combustion of liquid fuels: fuel spray (formation and size distribution),evaporation of a single droplet, simple model of droplet burningCombustion of solid fuels: simple models of carbon combustion.

Text/Reference Books:
1. Ramalingam, K.K., Internal Combustion Engines, Scitech Publications (India) Pvt. Ltd., 2004.
2. Ganesan, V, Internal Combustion Engines, Tata McGraw Hill Book Co., 2003.
3. John B.Heywood, Internal Combustion Engine Fundamentals,McGraw Hill Book, 1998
4 Mathur,M.L., and Sharma,R.P., A Course in Internal Combustion Engines, DhanpatRai Publications Pvt. New Delhi-2, 1993.
5 Obert,E.F., Internal Combustion Engine and Air Pollution, International Text Book Publishers, 1983.
6 Cohen,H, Rogers,G,E.C, and Saravanamuttoo, H.I.H., Gas Turbine Theory, Longman

BME 705 TRIBOLOGY

3L-0T-0P-3C **MM 100**

Module I: Introduction to trobological systems and their characteristic features; analysis and assessment of surface; topography; deterministic and stochastic tribo-models for asperity contacts; techniques of surface examination; technological properties of surfaces.

Module II: Quantitative laws of sliding friction, causes of friction, adhesion theory, laws of rolling friction, measurement of friction

Module III: Introduction, mechanism of wear, types of wear, quantitative laws of wear, measurement of wear, wears resistance materials

Module IV: Introduction, dry friction, boundary lubrication, hydrodynamic, hydrostatic and elasto-hydrodynamic lubrication, functions of lubricants, types and properties, lubricant additives. Principles, application to rolling contact bearings, cams, Gears

Module V: Geometry and pressure equation of journal bearing, hydrostatic bearings, thrust bearings, porous bearings and hydrodynamic gas bearings. Journal bearings with specialized applications.General requirements and different types of bearing materials.

Text/Reference Books:

1 Tribology in Indertrion- By Sushil Kumar Srivastava
2 Introduction to Tribology of Bearings- By B.C. Majumdar ;A.H.Wheeler
3 Principles of Tribology – By J. Halling, Macmillan
4 Mechanics and Chemistry in Lubrication- By Dorinson and Ludema , Elsevier
5 Friction and wear of Materials- By E. Robinowicz, Johan Wiley
6 Principles of Lubrication-By A. Cameron, Longmans

B.Tech in Mechanical Engineering **Semester VII**

BME 706 WELDING TECHNOLOGY

3L-0T-0P-3C **MM 100**

Module I
Laser Beam Welding: Types of lasers, equipment, power calculation, applications, dual laser beam welding, use of fibre optics in LBW. Friction Stir Welding; Details of process and process parameters, specific applications.Electron Beam Welding; The interaction of electron beam with matter, mode of heat generation, mode of energy losses, details of the equipment, product design for EBW, case studies. Ultrasonic Welding; Propagation of ultrasonic waves in matter, mode of joint formation, joint types and design of product for ultrasonic welding, details of equipment and case studies cutting and gauging, flame cutting plasma arc welding, laser assisted cutting.

Module II
Heat flow in Welding: Significance, theory of heat flow cooling rate determination, selection of welding parameters based on heat flow analysis, residual stresses and distortion. Joint design, analysis of fracture and fatigue of welded joints.Automated welding systems.

Module III
Investment casting, shell moulding, squeeze casting, vacuum casting, counter-gravity flow-pressure casting, directional and monocrystal solidification, squeeze casting, semisolid metal casting, rheocasting.

Module IV
Solidification Gating and Risering, Nucleation and grain growth, solidification of pure metals, short and long freezing range alloys. Gating and riseringdesing calculations, Fluidity and its measurement.

Module V
CAE Of Welding And Casting: Design of weldment, application of finite element method in welding – determination of distortion in weldments, modeling of temperature distribution – case studies. Design for casting, application of finite element method in casting- determination of hot spots, location of turbulence and other defects, modeling of flow in molds, modeling of heat transfer in castings- casestudies.

Text/Reference Books:
1. John Campbell, "Casting Practice" Elsevier Science Publishing C0.,2004
2. Larry Jeffus, " Welding Principles and Applications" Delmar Publishers, 2004.
3. John Campbell " Casting Butterworth Heinemann, 2003.
4. KlasWeman, :Welding Processes Handbook", 2003.
5. Ravi B, "Metal Casting: Computer Aided Design and Analysis" Prentice Hall ,2005.
6. Richard L Little, "Welding and Welding Technology" Tata McGraw Hill, 2004.

B.Tech in Mechanical Engineering **Semester VII**

BME 707 INTRODUCTION OF BIO-MECHANICS

3L-0T-0P-3C **MM 100**

Module I
Introduction of Mechanics: Review of the principles of mechanics, Vector mechanicsResultant forces of Coplaner&Noncoplaner and Concurrent & non-concurrent forces, parallel force in space, Equilibrium of coplanar forces, Newton's laws of motion, Work and energy, Moment of inertia.

Module II
Biomechanics of Joints: Skeletal joints, forces and stresses in human joints, Analysis of rigid bodies in equilibrium, free body diagrams, types of joint, biomechanical analysis of elbow, shoulder, spinal column, hip knee and ankle.
Biofluid Mechanics: Introduction, viscosity and capillary viscometer, Rheological properties of blood, laminar flow, Couette flow and Hagen-poiseuille equation, turbulent flow.

Module III
Hard Tissues: Bone structure & composition mechanical properties of bone, cortical and cancellous bones, viscoelastic properties, Maxwell&Voight models – anisotropy.
Soft Tissues: Structure and functions of Soft Tissues: Cartilage, Tendon, Ligament, and Muscle; Material Properties: Cartilage, Tendon, Ligament, and Muscle; Modeling: Cartilage, Tendon, Ligament, and Muscle Cardiovascular Mechanics: Cardiovascular system, artificial heart valves, biological and mechanical valves development, testing of valves.

Module IV
Respiratory Mechanics: Mechanism of air flow, respiratory cycle, lung ventilation model, methods of determining pressure, flow rate and volume; spirometry.

Module V
Biomechanics of Implants: Design of orthopedic implant, specifications for a prosthetic joint, biocompatibility, requirement of a biomaterial, characteristics of different types of biomaterials, manufacturing process of implants, fixation of implants.

Text/Reference Books:
1. Y C Fung, Biomechanics: Mechanical Properties of Living Tissues, springer, 2nd edition, 1993.
2. N. Ozkaya and M. Nordin, Fundamentals of Biomechanics-Equilibrium, Motion and Deformation, springer-verlag, 2nd edition 1999
3. J. G Webster, Medical instrumentation –Application & design, John Wiley and sons Inc. 3rd ed. 2003.
4. D. J. Schneck and J. D. Bronzino, Biomechanics- Principles and Applications, CRC Press, 2nd Edition, 2000.

B.Tech in Mechanical Engineering **Semester VII**

BME 708 COMPUTATIONAL FLUID DYNAMICS

3L-0T-0P-3C **MM 100**

Module I
Philosophy of Computational Fluid Dynamics, Forms of Governing equations particularly suitable for CFD , Mathematical behavior of Partial Differential Equations – Hyperbolic equations – Parabolic equations – Elliptical equations.

Module II
Discretization – Introduction to finite differences- Difference equations – Explicit and Implicit approaches- stability – Simple CFD Techniques- Lax-Wendroff – Mac Cormack's – Viscous flow-Conservation form – Space marching- The Relaxation Technique – Pressure correction – Stream function, Vorticity method of solution.

Module III
Finite Volume Method – One Dimensional steady state diffusion – Two and Three Dimensional diffusion problems – One Dimensional steady convection & diffusion – Central differencing scheme – Upwind differencing scheme – QUICK scheme – SIMPLE, SIMPLER, SIMPLEC, PISO

Module IV
Finite Volume Method for Unsteady flow – One Dimensional Steady heat conduction – Explicit scheme – Crank-Nicholson scheme – Fully implicit scheme – Turbulence models- K- εmodel – Reynolds stress equation model.

Module V
Time integration Methods: Single and multilevel methods; predictor corrector methods; stability analysis; Applications to transient conduction and advection diffusion problems
Numerical Grid Generation: Numerical grid generation; basic ideas; transformation and mapping.
Navier-Stokes Equations: Explicit and implicit methods; SIMPLE type methods; fractional step methods.

Text/Reference Books:
1. John D Anderson Jr - "Computational Fluid Dynamics"– McGraw Hill
2. H.K Versteeg& W Malalasekera - "An Introduction to Computational Fluid Dynamics"–
3. S.V. Patankar Hemisphere - "Numerical Fluid Flow & Heat transfer"
4. HoftmanKlaw Vol-1 & 2 " Computational Fluid Dynamics"
5. T. Sundernajan- Narosa "Computational Fluid Flow and Heat Transfer"

B.Tech in Mechanical Engineering **Semester VII**

BME 709 PRODUCT DESIGN & DEVELOPMENT

3L-0T-0P-3C **MM 100**

Module-I
Introduction
Significance of product design, product design and development process, sequential engineering design method, the challenges of product development, Product Planning and Project Selection: Identifying opportunities evaluate and prioritize projects, allocation of resources

Module-II
Identifying Customer Needs: Interpret raw data in terms of customers need, organize needs in hierarchy and establish the relative importance of needs., Product Specifications: Establish target specifications, setting final specifications,

Module-III
Concept Generation: Activities of concept generation, clarifying problem, search both internally and externally, explore the output, Industrial Design: Assessing need for industrial design, industrial design process, management, assessing quality of industrial design, Concept Selection: Overview, concept screening and concept scoring, methods of selection.

Module-IV
Theory of inventive problem solving (TRIZ): Fundamentals, methods and techniques, General Theory of Innovation and TRIZ, Value engineering Applications in Product development and design, Model-based technology for generating innovative ideas Concept Testing: Elements of testing: qualitative and quantitative methods including survey, measurement of customers' response,

Module-V
Intellectual Property: Elements and outline, patenting procedures., claim procedure, Design for Environment: Impact, regulations from government, ISO system.,

Text/Reference Books:
1. Ulrich K. T, and Eppinger S.D, Product Design and Development, Tata McGraw Hill
2. Otto K, and Wood K, Product Design, Pearson
3. Engineering of creativity: introduction to TRIZ methodology of inventive Problem Solving, By Semyon D. Savransky, CRC Press.
4. Inventive thinking through TRIZ: a practical guide, By Michael A. Orloff, Springer.
5. Systematic innovation: an introduction to TRIZ ; (theory of inventive Problem Solving), By John Terninko, AllaZusman, CRC Press.

B.Tech in Mechanical Engineering **Semester VII**

BME 710 PROJECT

0L-0T-6P-3C **MM 100**

Objectives:

- To practice the steps involved for the selection, execution, and reporting of the project.
- To train the students for group activities to accomplish an engineering task.

Individual students are required to choose a topic of their interest. The subject content of the mini project shall be from emerging /thrust areas, topics of current relevance having research aspects or shall be based on industrial visits. At the end of the semester, the students should submit a report duly authenticated by the respective guide, to the head of the department.

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B.Tech in Mechanical Engineering **Semester VII**

BME 711 PRODUCTION AND OPERATION MANAGEMENT AND OPTIMIZATION

3L-0T-0P-3C **MM 100**

Objective: The objective is to get the students acquainted with the design aspects of operations and material management and to develop relevant skill.

UNIT I : **Operations Management** – Meaning – Importance – historical contributions – System view of OM - Operation strategy and competitiveness - Functions of OM – types of production systems

UNIT II: Product design and process selection – Evaluation and Selection of appropriate Production and Operations technology, Product Design and process selection, Types of layout – analysis and selection of layout – Product and / or Process layout, **Transportation, Transshipment and Assignment problems.**

UNIT III : **Production planning and control** – meaning – functions – aggregate planning – master production schedule (MPS) – Material requirement planning (MRP) – BOM – Capacity requirement planning (CRP) – Techniques – problems in MRP and CRP – an introduction to MRP II and ERP – Business Process Re-engineering - Total Productive Maintenance (TPM)

UNIT IV : **Materials management** – functions – material planning and budgeting – Value Analysis - purchase functions and procedure - inventory control – types of inventory – safety stock – order point – service level – inventory control systems

Deterministic and Stochastic Inventory Models: Single and multi period models with continuous and discrete demands, Service level and reorder policy.

UNIT V :**Simulations:** Simulation Versus mathematical modelling, Monte Carlo simulation, simulation language ARENA, Example and cases.

Decision Theory: Decision under various conditions. **Total Quality Management Concept** (Case studies are compulsory)

Text/Reference Books:

1. Production and Operations Management – Everest E Adam & Ebert – PHI – publication forth edition.
2. Operations Management (Theory and Problems) – Joseph G Monks – McGraw Hill Intl.
3. Production and Operations Management – S N Chary – TMH Publications
4. Production and Operations Management – Pannerselvam, PHI
5. Lee J. Krajewski and Larry P. Ritzman, ―Operations Management: Process and value Chains‖, 7th Edition, PHI, 2007
6. Hunawalla and Patil – production and Operations Management, Himalaya.
7. Modern Production and operations management – E.S Buffa.
8. Lee J. Krajewski and Larry P. Ritzman, ― Operations Management: Strategy and Analysis‖, Addison Wesley.
9. Chase, Aquilano& Jacobs ―Production and Operations Management‖,Tata McGraw Hill..
10. Operations Research: Hira& Gupta, S. Chand. Publications

B.Tech in Mechanical Engineering **Semester VII**

BME 712 MECHANICAL VIBRATION LAB

0L-0T-2P-1C **MM 100**

1. To study the forced vibration of the beam for different damping.
2. To determine the radius of gyration 'k' of a given compound pendulum.
3. To determine the radius of gyration of trifilar suspension.
4. To determine the radius of gyration of given bar using bi-filler suspension.
5. To verify the dunker lay's rule viz.
6. To study the pressure profile of lubricating conditions of load and speed.
7. To determine the natural frequency of undampedtorsional vibration of a single rotor shaft system.
8. To determine the natural frequency of undamped torsional vibration of two rotor shaft system.
9. To determine the frequency of undampedfree vibration of an equivalent spring mass system.
10. To determine the frequency of damped force vibration of a spring mass system.

B.Tech in Mechanical Engineering **Semester VII**

BME 713 COMPUTER INTEGRATED MANUFACTURING LAB

0L-0T-2P-1C **MM 100**

1. Study of CNC Lathe including G Codes and M Codes.
2. Programming and Step turning on CNC Lathe.
3. Programming and Taper turning on CNC Lathe.
4. Programming and circular interpolation clock wise on CNC Lathe.
5. Programming and circular interpolation anti clock wise on CNC Lathe.
6. Programming and threading _16 mm on CNC Lathe.
7. Programming and drilling 8 mm x 20 mm depth on CNC Lathe.
8. Programming and grooving operation on CNC Lathe.
9. Programming and grooving on CNC Milling.
10. Programming and Drilling on CNC Milling.

MGT 103 PROJECT FORMULATION AND APPRAISAL TECHNIQUES

0L-0T-2P-1C **MM 100**

Objective: The objective of this course is to help the students in understanding how project ideas are generated, how these ideas are translated into project report through the process of various appraisals and the tools for managing the project. The section on financial management aims to enlighten the students on appraising the projects from financial angle and the models to be considered for analyzing the financial risks of the project.

Module 1 Introduction – project attributes; project life cycle; role of managers; Management – scheduling; Gantt charts; CPM; PERT; crashing; Generation of project ideas – resource allocation; environment analysis – PEST analysis, porter's model; analysis of strategic capabilities – value chain, BCG matrix, flexibility

Module 2 Appraisal methods in project scanning and selection – market appraisal; technical appraisal; environmental appraisal; evaluating intangibles, social appraisal – SCBA, UNIDO, LM, CSR.

Module 3 Total quality management: Introduction - Need for quality - Evolution of quality - Definition of quality -Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, TQM principles , The seven traditional tools of quality – New management tools – Six-sigma.

Module 4 **Financial Appraisal:** Time value of money; cost of capital – equity, debt, preference; weighted average cost; marginal and average cost; Capital budgeting – investment appraisal techniques; NPY; IRR; Payback period; replacement decisions; selection of exact discount factor – problems, inflation, taxation;

Module 5: **Risk Analysis** models – single probability analysis; sensitivity analysis; break even analysis; certainty equivalent; uncertainty analysis, simulation; decision tree model; risk and utility.

Recommended Books

- Khatua Sitangshu. *Project Management and Appraisal*, Oxford University Press
- Pandey, I.M. *Financial Management*. Vikas Publishing House
- Prasanna, Chandra. *Financial Management*. Tata McGraw-Hill
- Maheshwari, S .N. & Maheshwari, S. K. *Advanced Management Accounting Vol.1 & Vol.2*. Vikas Publishing House
- Paresh Shah. *Management Accounting*. Oxford University Press

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B.Tech in Mechanical Engineering **Semester VII**

BME 714 POWER PLANT ENGINEERINGLAB

0L-0T-2P-1C **MM 100**

1. Study of fluidized bed combustor
2. Study of power plant instruments
3. Trial on steam power plant
4. Study of non-conventional power plant
5. Tariff study
6. Study of environmental impact of power plant
7. Trial on diesel power plant

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B.Tech in Mechanical Engineering **Semester VII**

BME 715 BASIC INDUSTRIAL ROBOTICS

0L-0T-2P-1.0C **MM 100**

Module-I

1. Robot Definition: Definition of robots, Evolution of robots, Laws of robots, International Robotic Standards, Why Robots? Types of robots, Selection of robots.

2. Robot Classifications: degrees of freedom; degrees of movements, robot configuration; accuracy and repeatability, specification of a robot ,actuators and sensors, drives and transmission systems used in robotics. Applications of robots.

Module-II

Coordinate Transformation: Direct kinematic problem in robotics, geometry based direct kinematic analysis coordinate & vector transformation using matrices, the orientation matrix & translator vector, homogeneous transformation matrices, three dimensional homogeneous transformations.

Module-III

Trajectory interpolation: Introduction, the necessity of interpolators, the generation of motion commands, the trajectory planning, basic structure of interpolators. The solvability of the inverse, kinematics problem. particular solutions for the inverse kinematics problem - two – axis planar mechanisms, example of three-axis spherical mechanism, specific solutions for six-axis manipulators.

Module-IV

Autonomous mobile robots: Introduction, locomotion - key issues for locomotion, legged mobile robots, leg configurations & stability , examples of legged robot locomotion , wheeled mobile robots, wheeled locomotion-the design space, wheeled locomotion: case studies.

Module-V

Mobile robot kinematics: introduction, kinematics models & constraints, representing robot position, forward kinematics models, wheel kinematics constraints, robot kinematics constraints, examples robot kinematics models & constraints. Mobile robot maneuverability- degree of mobility, degree of steerability, robot maneuverability. Mobile robot workspace-degree of freedom, holonomic robots, path & trajectory considerations. Motion control - open loop control, feedback control.

Text/Reference Books:

1) Robotics & Control – R.K. Mittal & I.J. Nagrath – TMH Publications
2) Robotics for engineers - Yoram Korean- McGrew Hill Co.
3) Industrial Robotics Technology programming and Applications - M.P.Groover, M.Weiss, R.N.Nagel, N.G.Odrey.
4) Robotics Control Sensing, Vision and Intelligence - K.S.Fu, R.C.Gonzalex, C.S.G.Lee- McGrew hill Book co.
5) Kinematics and Synthesis of linkages - Hartenberg and Denavit - McGrew Hill Book Co
6) Kinematics and Linkage Design - A.S. Hall - Prentice Hall

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B.Tech in Mechanical Engineering **Semester VII**

BME716 SUSTAINABLE MANUFCATURING

3L-0T-0P-1.0C **MM100**

Module 1:
Introduction: Concept of sustainability, manufacturing, operations, processes, practices, Resources in manufacturing, five M's, system approach to manufacturing, Basic experimental design, factor identification, quantification, comparison, selection.

Module2:
Life Cycle Analysis: product life cycles, life cycle of a manufacturing system Life Cycle Analysis: reduce, reuse, recycle; waste vs value approach, Life Cycle Analysis: remanufacture and disposal, tools for LCA, Optimization for achieving sustainability in unit manufacturing.

Module3:
Concept of lean manufacturing: Lean techniques for sustainable manufacturing Waste assessment, strategies for waste reduction in sustainable manufacturing, implementation of lean methods: validating requirements, Social aspects of Sustainable manufacturing: Long term and short term goals.

Module4:
Modern approaches for Sustainable Manufacturing Toxic substances in industry, and need of Renewable sources, Industry Symbioses for reducing Carbon footprint. Sustainable manufacturing systems: closed loop production systems, product acquisition management.

Module5:
Green manufacturing techniques: dry and near-dry machining , edible oil based cutting fluids Green manufacturing techniques: cryogenic machining for eco-efficiency Green manufacturing techniques: improving work environment.

Text/Reference Books:

1. Klemes, J., 2011. Sustainability in the process industry. McGraw-Hill.
2. Seliger, G., Khraisheh, M.M. and Jawahir, I.S. eds., 2011. Advances in sustainable manufacturing. Springer Science & Business Media.
3. Dornfeld, D.A. ed., 2012. Green manufacturing: fundamentals and applications. Springer Science & Business Media.

B.Tech in Mechanical Engineering **Semester VIII**

BME 801 PRACTICAL TRAINING IN INDUSTRY (ONE SEMESTER)

0L+0T+0P+ 16C

Practical Training in industry is a need to interact with industry by student to understand working and culture of industries which helps the student to get practical experience.

Students will attend industrial training of six months in any industry or reputed organization in VIII semester.

The students will be assigned a faculty guide who would be the supervisor of the student. The faculty would be identified before the end of the VIII semester and shall be the nodal officer for coordination of the training.

Students will also be required to prepare an exhaustive technical report of the training during the semester which will be duly signed by the officer under whom training was taken in the industry/ organization. The covering format shall be signed by the concerned office in charge of the training. The officer-in-charge of the trainee would also give his rating of the student in the standard university format in a sealed to the higher authority.

The students will present his report about the training every month. A committee constituted by the Dean Engineering which would be comprised of at least three members comprising of the department coordinator, class coordinator and a nominee of the Dean Engineering. The students guide would be a special invitee to the presentation. The seminar session shall be an open house. The internal marks would be the average of the marks given is an open house session. The internal marks would be the average of the marks given be each member of the committee separately in a sealed envelope to the Dean Engineering

The marks by the external examiner would be based on the report submitted by the students which shall be evaluated by the external examiner and cross examination done of the student concerned.