

# **S Y L L A B U S**

**BACHELOR OF TECHNOLOGY**

**MECHANICAL ENGINEERING**  
(Semester Scheme)

**Four Year Degree Course**

B.Tech., Second Year Examination, 2010 / 2011

B.Tech., Third Year Examination, 2011 / 2012

B.Tech., Fourth Year Examination, 2012 / 2013



**JODHPUR NATIONAL UNIVERSITY**  
**JODHPUR**

# Jodhpur National University, Jodhpur

Teaching & Examination Scheme

## B.Tech II Year (Mechanical Engineering)

### IIIrd Semester

<b>Theory</b>						
S. No.	Code No.	Subject	L	T	MM	Ex. Hrs.
1.	3 ME 1	Advanced Engineering Mathematics	3	1	100	03
2.	3 ME 2	Engineering Thermodynamics -I	4	1	100	03
3.	3 ME 3	Materials Technology	3	0	100	03
4.	3 ME 4	Kinematics of Machines	3	1	100	03
5.	3 ME 5	Object Oriented Programming In C++	3	0	100	03
6.	3 ME 6	Mechanics of Solids	3	1	100	03
7.	GE307 A*	Special Mathematics I**	3	1	100	3
<b>TOTAL</b>			<b>22</b>	<b>5</b>	<b>600</b>	

<b>PRACTICALS &amp; SESSIONALS</b>				
S. No.	Code No.	Subject	P	MM
1.	3 ME 7	Machine Drawing	3	100
2.	3 ME 8	Kinematics Of Machines Lab	2	100
3.	3 ME 9	Computer Programming lab	2	100
4.	3 ME 10	Mechanics of Solids Lab	2	100
<b>TOTAL</b>			<b>09</b>	<b>400</b>

**Total Load: 32**

# Jodhpur National University

II B. TECH. III Semester

## 3 ME 1 ADVANCED ENGINEERING MATHEMATICS

Teaching Hrs.

L-3 T-1 P-0

Exam Hrs. – 3

Marks: Theory Exam.-80 Term Test – 20 Total 100

### Unit

- I Laplace Transform:** Elementary Formulae, Simple Properties and Theorems, Convolution Theorem, Inverse Laplace Transform, Applications to the Solutions of Ordinary and Partial Differential Equations having Constant Co-efficient with Special Reference to Wave and Diffusion Equations.
- II Fourier Transform:** Fourier Sine Transform, Fourier Cosine Transform, Complex Fourier Transform, Their Elementary Properties, Fourier Integral Representation, Convolution Theorem, Application to Partial Differential Equations.  
**Fourier Series:** Periodic Functions, Fourier Series, Even and Odd Functions, Half Range Series, Change of Interval, Harmonic Analysis.
- III Complex Analysis:** Function of Complex Variable, Limits, Continuity; Complex Differentiation; Analytic Functions; Cauchy –Riemann Equations; Conjugate Function; Complex Integration; Cauchy’s Integral Theorem; Taylor’s and Laurent’s Theorem.
- IV Boundary Value Problems:** Definition, solution of wave equation, Laplace equation, Heat equation; Diffusions equation by the method of separation of variables.  
**Statistics and Probability:** Elementary Theory of Probability, Baye’s Theorem with simple applications, Expected value, Theoretical probability distributions-Binomial, Poisson and normal distributions.
- V Numerical Analysis:** Difference operations; Forward; Backward; Central; Shift and Average Operations and Relation between them; Newton’s forward and Backward interpolation; Stirlings and Bessel’s central Interpolation; Lagrange’s Interpolation; Numerical Differentiation and Integration, Trapezoidal Rule; Simpson’s 1/3 rule and 3/8 rule.

### List of Reference Books:

1. Higher Engineering Mathematics.- Gaur & Koul
2. Mathematics III: Mehta D.M., Sharma.-Vardhan Publishers
3. Advanced Engineering Mathematics.- Kreyszig E. Wiley Eastern.
4. Numerical Methods for Scientists and Engineers.- Jain M.K., Iyengar S.R.K., Wiley Eastern.
5. Fourier Series & Bondary Value Problems, James Brawn and Churchill.-Tata McGraw Hill.

### 3 ME2 ENGINEERING THERMODYNAMICS -I

Teaching Hrs.  
L-4 T-1 P-0

Exam Hrs. – 3  
Marks: Theory Exam.-80 Term Test – 20 Total 100

#### Unit

##### I Basic Concepts of Thermodynamics

Macroscopic and Microscopic approach, thermodynamic system, control volume, properties, state, process, Thermodynamic equilibrium, quastatic Process and cycle. Zeroth law of thermodynamics, thermometry, temperature scale, international temperature scale, Ideal gas and laws, universal gas constant. Heat and work transfer, displacement work in various processes.

II **Properties of pure substance:** Solid-liquid-vapour phase equilibrium in pure substance, PVT surfaces, Development of tables for thermodynamic properties, quality of steam, Mollier diagram. Representation of Various processes on P-v, T-s and mollier chart, problems through steam tables and mollier chart.

III **First law of Thermodynamics:** Law of conservation of energy, application to cyclic process and non cyclic process. Internal energy a property, specific heats, enthalpy, property changes in process, corollaries, applications to steady flow processes.

IV **Second law of Thermodynamics and Entropy:** Limitations of first law, heat engine, refrigerator, heat pump, Kelvin Planck and Clausius statements and their equivalence. Reversible process, irreversible process and causes of irreversibility. Carnot engine, efficiency; Carnot refrigerator, coefficient of performance, Carnot theorem and corollary. Thermodynamic temperature scale. Entropy, clausius theorem, clausius inequality, entropy a property, T-s plot, Entropy change for various processes (ideal gas). Entropy principle and applications, entropy changes in closed and open systems.

V **Availability and Irreversibility, Thermodynamics Relations:** Available energy, quality of energy, law of degradation of energy, Reversible work in open and closed systems, useful work, Availability of steady flow process and non flow process. Irreversibility, 2<sup>nd</sup> law analysis. Important mathematical relations, Maxwell relations, specific heat, entropy and energy relations, Joule Kelvin coefficient, Clausius Clapeyron's equation, applications to gases; Gibbs, Helmholtz functions.

#### List of Reference Books:

1. Engineering Thermodynamics by P.K. Nag.- Tata Mcgraw-Hill.
2. Thermal Science and Engineering by D.S. Kumar,- S.K. Kataria and Sons, New Delhi
3. Fundamental of Classical Thermodynamics by G.J. Van Wylen and R.E. Sonntag (S.I. Units) John Willey
4. Thermal Engineering Vol-1, M.L. Mathur and F.S. Mehta.- Jain Brothers, New Dehli.

Teaching Hrs.

Exam Hrs. – 3

L-3 T-0 P-0

Marks: Theory Exam.-80 Term Test – 20 Total 100

Unit

**I Crystal Structure:** Mechanism of crystallization; unit cells, space lattice and lattice constants; Crystal systems, and Bravais Lattices; Body centered cubic, Face centered cubic and Hexagonal closed packed structure; Miller indices for planes and directions; Crystal imperfections; point defects, line defects and surface defects.

**II Plastic Deformation of Metals:** The tensile stress strain curve, Deformation by slip & by twinning, Dislocation theory, Theory of work hardening its effect on properties of metals, Recovery, Recrystallisation and grain growth; Introduction to creep, fracture and fatigue behavior of metals.

6

**III Phase Diagrams:** Definition of phase, Equilibrium cooling of pure metals and binary alloys. Hume Rothery rule for solid solubility, Types of solid solution. Definition of phase diagram & objectives, Gibbs Phase rule. Classifications of phase diagrams, construction of phase diagram, Interpretation of phase diagrams, relation ship with microstructure, Eutectic, Eutectoid and Peritectic reactions, Allotropy of iron, Iron-Iron carbide equilibrium diagram & microstructures.

**IV Heat Treatment of Steels:** Definition, principle, and purpose of heat treatment. Description of heat treatment methods: Hardening, Annealing, Normalizing, Tempering and case hardening with microstructure changes. Martempering & Austempering, Hardenability and its determination. Precipitation Hardening. Isothermal Transformation of steel, Transformation on continuous cooling, Critical cooling rate, Heat treatment furnace.

**V Engineering Materials:** Classification of plain carbon steels; composition, properties & applications of low, medium & high carbon steels. Alloysteels: Free cutting steels; structural steel, spring steel, tool steel, high speed steels, stainless steels. Effects of alloy element on properties of steels. Type of Cast irons: composition, properties & applications of each. Properties of aluminium; alloy of aluminium, (wrought & cast alloys). Duralumin & Y-alloy; properties of copper, copper alloys (Brasses & Bronzes); Biomaterials.

**List of Reference Books:**

1. Introduction to physical Metallurgy by Sidney H. Avnen,- Tata McGraw-Hill
2. Material Science & Metallurgy for Engineering by Dr.V.D. Kodgire.- Everest Pub. House, Pune.
3. Materials Science & Engineering by V. Raghavan.- Prentice Hall of India, New Delhi.
4. Heat Treatment principles & Technology by T.V. Rajan, O.P. sharma.-
5. Engineering Metallurgy Part –I by Raymond A. Higgins, ELBS.
6. Introduction to Engineering materials by B.K. Agrawal.-
7. Physical Metallurgy for Engineering by Donald S. Clark & Willbur R. Varney, EWP.

### 3 ME4 KINEMATICS OF MACHINES

Teaching Hrs.

Exam Hrs. – 3

L-3 T-1 P-0

Marks: Theory Exam.-80 Term Test – 20 Total 100

#### Unit

- 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.
- II Automotive Vehicle Mechanisms:** Overhead valve mechanism, Davis and Ackerman steering mechanism, Trifler suspension and Hooke's joint.  
**Power Transmission:** Belts and ropes, effect of centrifugal force, creep, chain drive.
- III Friction:** Laws of static, dynamic and rolling friction, dry and viscous friction, inclined plane and screw jack, pivots and friction axis, bearing, clutches, theory of film lubrication.
- IV Brakes:** Band, block and band & block brakes, internal expanding brakes, braking of a vehicle.  
**Dynamometers:** Absorption and transmission type dynamometers, prony, rope and hydraulic dynamometers.
- V Cams:** Type of cams, 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.

#### List of Reference Books:

1. Theory of Machines by S.S. Ratan.- Tata McGraw-Hill.
2. Theory of Machines and Mechanisms by P.L. Ballaney.- Khanna Pub.
3. Theory of Machines by B.K. Sarkar.- Tata McGraw Hil

## 3 ME 5 OBJECT ORIENTED PROGRAMMING IN C++

**Teaching Hrs.**  
L-3 T-0 P-0

**Exam Hrs. – 3**  
**Marks: Theory Exam.-80 Term Test – 20 Total 100**

### Unit

- I Introduction to Object Oriented Programming:** Basic concepts: Class, Object, Method, Message passing, Inheritance, Encapsulation, Abstraction, Polymorphism.
- II Basics of C++ Environment:** Variables; Operators; Functions; user defined, passing by reference, passing an array to the function, inline function, scope, overloading; Pointers: objects and lvalue, arrays and pointers, the new and delete operators, dynamic arrays, arrays of pointers and pointers to arrays, pointers to pointers and functions; Strings: String I/O, character functions in ctype.h, string functions in string.h.
- III Object oriented concepts using C++:** Classes: Member functions, Friend functions, Constructors, Access functions, Private member functions, class destructor, static data and function members; Overloading: inline functions, this operator, overloading various types of operators, conversion operators; the String Class; Composition and Inheritance: Hierarchy and types of inheritance, protected class members, private versus protected access, virtual functions and polymorphism, virtual destructors, abstract base classes.
- IV Templates and Iterators:** function and class templates, container classes, subclass templates, iterator classes; Libraries: standard C++ library, contents of a standard C headers, string streams, file processing: Files and streams classes, text files, binary files, classification of files, the standard template library.
- V Data Structures Using C++:** Linked lists – Singly linked list, Doubly linked lists, Circular lists, Stacks and Queues priority Queues, Stacks, Queues.

### List of Reference Books:

1. The Complete Reference C++: Patrick Naughton, Herbert Schidt, Tata McGraw Hill.
2. Object Oriented Programming with C++: E. Balagurusamy, Tata McGraw Hill.

### 3 ME6 MECHANICS OF SOLIDS

Teaching Hrs.

Exam Hrs. – 3

L-3 T-1 P-0

Marks: Theory Exam.-80 Term Test – 20 Total 100

Unit

- I Stress & Strain:** Tension, compression, shearing stress & strain; Poisson's ratio: Stress-strain relationship, Hooke's law; equations of static equilibrium for 2D & 3D. Elastic constants and their relations for a isotropic hookean material, anisotropy & orthotropy, thermal stresses, composite bars; simple elastic, plastic & visco-elastic behavior of common materials in tension and compression test, stress-strain curves. Concept of factor of safety & permissible stress. Conditions for equilibrium. Concept of free body diagram; Introduction to mechanics of deformable bodies
- II Members Subjected To Flexural Loads:** 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 and transverse shear stress distribution in circular, hollow circular, I, Box, T, angle sections etc.
- III Principal 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, application.
- IV Torsion:** Torsional shear stress in solid, hollow and stepped circular shafts, angular deflection and power transmission capacity. Stability of equilibrium: 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 formula and other empirical relations.
- V Transverse Deflection of Beams:** Relation between deflection, bending moment, shear force and load, Transverse deflection of beams and shaft under static loading, area moment method, direct integration method: method of superposition and conjugate beam method. Various approaches to determine deflection and stresses in beam.  
**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. Castigliano's theorem. Maxwell's theorem of reciprocal deflections.

**List of Reference Books:**

1. Mechanics of Solids by B.C. Punmia, A.K. Jain, Laxmi Pub. Ltd.
2. Strength of Materials by R.K. Rajput, S. Chand & Co. Ltd.
3. Strength of Materials by G.H. Ryder, ELBS Pub. Co. London
4. Strength of Materials by R.S. Lehari, S.K. Katariya & Sons, Delhi
5. Advanced Mechanics of Solids by L.S. Srinath; McGraw Hill International Edition,

# GE 307\* Special Mathematics\*\* I

(Common for all branches CSE/ECE/IT/ME/CSE/CIVIL for Diploma Holders)

Teaching Hrs.  
3L + 1T

Exam Hrs. 3 Hrs.  
Total-100

Unit	Topics	
I	Trigonometry	Trigonometric functions, simple identities, range and values of trigonometric functions, inverse functions, De Moivre's theorem, Euler's theorem. <b>Lectures Req : 6</b>
II	Basic Algebra	Binomial theorem for positive and negative index, logarithmic and simple properties, exponential, Logarithmic and trigonometric series. <b>Lectures Req : 6</b>
III	Differential Calculus:	Function, single variable and multivariable function, polynomial, trigonometric, logarithmic and exponential fun's, derivative of a function, elementary formulae. <b>Lectures Req : 6</b>
IV	Differential Calculus:	Derivative of sum and difference of two functions, derivative of product and quotient of two functions, logarithmic differentiation, partial differentiation. <b>Lectures Req : 6</b>
V	Integral Calculus:	Integration of a function standard integrals and properties, integration by substitution, Integration by parts, definite integral and properties. <b>Lectures Req : 6</b>

**Total Lectures Req : 30**

**\*\* It will be sessional paper: marks shall not be counted for awarding division.**

# Jodhpur National University, Jodhpur

Teaching & Examination Scheme

## B.Tech II Year (Mechanical Engineering)

### IV Semester

<b>Theory</b>						
S. No.	Code No.	Subject	L	T	MM	Ex. Hrs.
1.	4 ME 1	Fluid Mechanics	3	1	100	03
2.	4 ME 2	Engineering Thermodynamics-II	4	1	100	03
3.	4 ME 3	Manufacturing Science-I	3	0	100	03
4.	4 ME 4	Dynamics of Machine	3	1	100	03
5.	4 ME 5	Instrumentation & Control	3	0	100	03
6.	4 ME 6	Advance Mechanics of Solids	3	1	100	03
7.	GE407 A*	Special Mathematics II**	3	1	100	3
<b>TOTAL</b>			<b>22</b>	<b>5</b>	<b>600</b>	

<b>PRACTICALS &amp; SESSIONALS</b>				
S. No.	Code No.	Subject	P	MM
1.	4 ME 7	Fluid Mechanics Lab	2	80
2.	4 ME 8	Thermal Engineering Lab-I	2	80
3.	4 ME 9	Dynamics of Machines Lab	2	80
4.	4 ME 10	Manufacturing Science Lab-I	3	80
5.	4 ME 11	Instrumentation & Control Lab	2	80
<b>TOTAL</b>			<b>11</b>	<b>400</b>

**Total Load: 34**

**\*\* Sessional Exam: marks shall not be counted for awarding division.**

**II B. TECH. IV Semester**

## 4 ME1 FLUID MECHANICS

Teaching Hrs.  
L-3 T-1 P-0  
Unit

Exam Hrs. – 3  
Marks: Theory Exam.-80 Term Test – 20 Total 100

- I Introduction:** Definition of fluid- incompressible and compressible fluids, Fluid as a continuum, Fluid properties, Mass Density, Specific volume, Bulk Modulus, velocity of sound. Fluid viscosity, Newtonian fluid, Kinematic viscosity, Effect of temperature and pressure on viscosity, surface tension, capillarity; vapour pressure and cavitation.  
**Fluid Statics:** General differential equation, Hydrostatics, Manometry. Fluid forces on Plane and curved submerged surfaces, Aerostatics, isothermal atmosphere, polytropic atmosphere. The International standard atmosphere. Static stability of floating bodies.
- II Kinematics and conservation of mass:** Flow classifications, Fluid velocity and acceleration, streamlines and the stream tube. Path lines and streak lines. Deformation of a fluid element vertically and circulation, Irrotational and Rotational Flows. Flow net, Laplace equation. Conservation of mass and the continuity equation for three dimensions. Equation of motion, Euler's equation of motion, Integration of Euler's equation of motion. Bernoulli's equation. Application of Bernoulli's equation- pitot tube, Venturimeter. Equation of motion for Viscous fluid. Navier-stokes equation. Orifice discharging free Jet, Vena contracta, co-efficients of contraction, velocity and discharge. Orifices and mouthpieces, Nozzles and weirs.  
**Fluid Momentum:** The Momentum theorem, Applications of the momentum theorem
- III Flow through Pipes:** Reynolds's experiment, Darcy-Weisback equation, loss of head due to sudden enlargement, contraction, entrance, exit obstruction, bend pipe fittings. Total energy and Hydraulic gradient lines. Flow through pipe line, Pipes in series and parallel, Equivalent pipe. Transmission of power through pipes. Water hammer in pipes.  
**Laminar Flow:** Simple Solution of Navier-stokes equations, Plain & Couette flow and Hagen Poiseuille flow.
- IV Turbulent Flow:** Turbulence in pipe flow. The Prandtl Mixing length hypothesis applied to pipe flow, Variation of friction factor with Reynolds number, velocity distribution in smooth and rough pipes. The Universal pipe friction laws, Colebrook-White formula.  
**Dimensional Analysis:** Units and dimensions. Dimensional analysis using Buckingham's theorem, Similitude and Model testing.  
**Force ratios:** Reynolds number, Froude number, Mach number, Weber number and Euler number, and their applications. Undistorted model, Distorted model and scale ratio for distorted model. Scale effect.
- V The Boundary Layer:** Description of the boundary layer. Boundary layer thickness, boundary layer separation and control. The Prandtl boundary layer equation. Solution for laminar boundary layer. The momentum equation for the boundary layer. The flat plate in uniform free stream with zero pressure gradients.  
**Flow Round A Body:** Drag, friction drag, pressure drag, combined skin friction and pressure drag. Flow past-sphere and cylinder. Magnus effect, Airfoil theory. Induced drag.

### List of Reference Books:

1. Fluid Mechanics and Machines by V.P. Gupta and Alam Singh, CBS Publications
2. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K. Katariya & Sons, Delhi
3. Hydraulics and Fluid Mechanics including Hydraulic Machines by P.N. Modi, S.M. Seth; Standard Book House, Delhi.
4. Fluid Mechanics & Hydraulics with computer application by Jagdish Lal, Metropolitan Books Co. Pvt. Ltd.

## 4ME2 ENGINEERING THERMODYNAMICS -II

Teaching Hrs.  
L-4 T-1 P-0

Exam Hrs. – 3  
Marks: Theory Exam.-80 Term Test – 20 Total 100

- I PVT relationship for Ideal gas and real gas:** Vander wall's equation, other equations of state, Compressibility factor, law of corresponding states, use of generalized compressibility chart, Gas mixture; laws of gas mixture, relations for molecular weight, gas constant, entropy, and specific heat of mixtures; Gravimetric and volumetric analysis; gas and vapour mixture.
- II Steam Boilers:** Classifications, simple vertical boiler, Cochran, Lancashire boiler Babcock and Wilcox boiler, mountings accessories, Boiler performance, Heat balance sheet.  
**Steam Nozzles:** Types of nozzles steady flow energy equation in nozzles, friction, condition for maximum discharge through a nozzle, diameter of throat and exit, supersaturated flow through nozzle.
- III Vapour Power Cycle:** Simple steam power plant, Carnot cycle, Rankine cycle, actual cycle. Reheat, regenerative feed heating, water extraction cycle, process heat and by- product power, ideal working fluid, Binary vapour power cycle, Thermal efficiency, work ratio, specific steam consumption, factors affecting these efficiencies in steam power plant, state point locus, reheat factor. The reversed carnot cycle and bell Coleman cycle, introduction to vapour compression cycle.
- IV Gas Power Cycle:** Otto, Diesel, and Dual cycles, Air standard efficiency, mean effective pressure. Stirling, Ericsson Atkinson, and Joule cycle, air standard efficiency, comparison among Otto, Diesel and Dual cycles. Actual petrol and Diesel engine cycles.
- V I.C. Engine & Compressors:** Classification, Two and Four Stroke Petrol and diesel engines, construction and working, valve timing diagram. Comparison between petrol and diesel engine and between two stroke and four stroke engines. Introduction to performance parameters. Reciprocating compressors, work done, single stage, effect of clearance, volumetric efficiency, indicated diagram, multi stage compressor, condition for maximum efficiency, work done, inter cooler, free air delivery.

### List of Reference Books:

1. Engineering Thermodynamics by P.K. Nag, Tata McGraw-Hill.
2. Thermal Science and Engineering by D.S. Kumar, S.K. Kataria and Sons, New Delhi
3. Fundamental of Classical Thermodynamics by G.J. Van Wylen and R.E. Sonntag (S.I. Units) John Willey
4. Thermal Engineering Vol-2, M.L. Mathur and F.S. Mehta, Jain Brothers, New Dehli.

## 4 ME3 MANUFACTURING SCIENCE-I

Teaching Hrs.  
L-3 T-0 P-0

Exam Hrs. – 3  
Marks: Theory Exam.-80 Term Test – 20 Total 100

### Unit

- I Foundry Technology**, Molding materials and types of molding sands, properties of molding sands,  
**Molding methods:** Green, Dry and floor molding; Shell molding; and Carbon dioxide molding.  
**Casting methods:** Die Casting, centrifugal casting; Investment casting; permanent mould casting. Advantages, limitation and application of each. Casting defects causes and remedies. Introduction to core & core making.
- II Melting furnaces:** Constructional features & working of cupola, Charge Calculation, Electric arc furnaces, Pit, Tilting, their operation & applications.
- Welding Processes:** Submerged arc welding, Gas metal arc welding (MIG), Gas tungsten arc welding (TIG), Thermit welding, Electro slag welding, Plasma arc welding, Atomic Hydrogen welding, Spot welding, Seam welding, Projection welding, Flash welding.
- III Metal Working & Metal forming processes:** Hot & cold working of metals advantage and disadvantage, Principles of rolling, Types of rolling mills. Forward, Backward & Impact extrusion:  
**Power forging:** Die forging, Drop hammers & press forging.  
**Sheet metal forming:** Classifications of Presses, Press operations: shearing; drawing, squeezing, deep drawing, coining & embossing. Compound and progressive dies, punch and dies set.
- IV Powder Metallurgy:** Methods of powder manufacturing; Mechanical pulverization; Electrolytic process; Chemical reduction process; Atomization process. Blending; Compacting and sintering process Characteristics of metal powder, advantages, disadvantages & applications of powder metallurgy.
- V Machine Tools:** Constructional details, Working principle and specifications of centre lathe, Shaper and Drilling machine and Milling machine; Common operations related to above machines, Indexing head and indexing methods;

**Unit**

**I Governors:** Watt, Porter, Proell, Hartnell and spring controlled governors, governor effort, power, stability, inertia effects.

**Gyroscope:** Principle of gyroscopic couple, effect of gyroscopic couple and centrifugal force on vehicle taking a turn, stabilization of sea vessels.

**II Gears:** Law of gearing, terminology, tooth form, standard interchangeable tooth profile, minimum number of teeth on pinion in contact with gear or rack, interference and undercutting, bevel, helical and spiral gears.

**III 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.

**IV Balancing:** Balancing of rotating masses, balancing of reciprocating masses, locomotives, IC engines, balancing machines.

**V Inertia Force Analysis:** Velocity and acceleration of slider crank mechanism and four bar mechanism, inertia force, piston thrust and forces on connecting rod, turning moment diagram and flywheel.

**List of Reference Books:**

1. Theory of Machines by S.S. Ratan; Tata McGraw-Hill Pvt. Ltd.
2. Theory of Machines and Mechanisms by P.L. Ballaney; Khanna Pub.
3. Theory of Machines by B.K. Sarkar; Tata McGraw Hill Pvt. Ltd.

## 4 ME5 INSTRUMENTATION & CONTROL

Teaching Hrs.  
L-3 T-0 P-0

Exam Hrs. – 3  
Marks: Theory Exam.-80 Term Test – 20 Total 100

### Unit

- I System configuration**, basic characteristic, calibration, classification and performance characteristics of a instrumentation system, Specification and testing of dynamic response. Strain Measurement : Electric Strain Gauges - Types; Selection and Installation, Strain gauge circuits; temperature compensation and calibration; Use of Strain Gauges on Rotating Shafts, Load Cells, Mechanical and Optical Strain Gauges.
- II Various Mechanical**, Electro- Mechanical & Photoelectrical Sensors for sensing of Displacement, Velocity, Acceleration, Torque, Force, Temperature from Low to High Range, flow, level of fluid , pressure, angular speed, voltage, frequency and current.
- III Introduction to Multi-Channel** Data-Acquisition System, Measurement Pods, Interface Hardware, Data Analysis Software, Interfacing. Concepts and examples of automatic control systems, systems by differential equations, transfer function, block diagram, open and feed back control systems, signal flow graphs & its constructions. Control System components, error sensing devices and servo motors.
- IV Control for mechanical systems & processes**; speed control system for steam/gas turbines. A constant tension reeling system, Electro-mechanical systems. Thermal systems, Pneumatic systems; Mathematical Models of physical systems, Feed back characteristics of Control Systems. Time response analysis; transient response analysis, time response specifications, steady state-error.
- V Concepts of stability**, Routh-Hurwitz stability criterion, relative stability. The root locus technique, use of construction rules without any derivation. Frequency response analysis, Polar plots; stability in frequency domain, Bode / Logarithmic plots. Nyquist stability criterion.

### List of Reference Books:

1. Control systems engineering, I.J. Nagrath & M. Gopal, Wilay Eastern Ltd.
2. Automatic Control Engg., F.H. Raxen. McGraw Hill, International Edition.
3. Modern Control Engineering, J.K.Ogata, Prentice Hall of India Pvt. Ltd. New Delhi.

## 4 ME 6 ADVANCE MECHANICS OF SOLIDS

Teaching Hrs.

Exam Hrs. – 3

L-3 T-1 P-0

Marks: Theory Exam.-80 Term Test – 20 Total 100

Unit

- I Analysis of stresses in 3-Dimensions:** Body force, surface force and stress vectors, state of stress at a point, normal shear stress components, stress component on arbitrary plane, principal stresses in 3-Dimensions, stress invariants, decomposition of stress matrix into hydrostatic and pure shear states, Lamé's stress ellipsoid, differential equations of equilibrium.
- II Analysis of strain in 3-Dimensions:** introduction, deformation in neighborhood of a point, change of length of linear element, state of strain at a point, principal axes of strain and principal strains, compatibility conditions.
- III Stress strain relations** for linearity elastic bodies, generalized Hooke's law, Stress-strain Relations for anisotropic, orthotropic and isotropic materials.
- IV Bending of curved beam** (Winkler Bach formula), Stresses in ring, stresses in chain link unsymmetrical bending of beams, shear centre.
- V Cylinders:** Thin cylinder stresses, spherical shell. Thick cylinder, shrunk cylinder, Thick spherical shell, stresses in rotating disc. Disc of uniform strength.

### List of Reference Books:

1. Mechanics of Solids by S.H. Crandall, N.C. Dahl & T.J. Lardner; McGraw Hill International Edition,
2. Advanced Mechanics of Solids by L.S. Srinath; McGraw Hill International Edition,
3. Strength of Material by G.H. Ryder, ELBS Pub. Co. London,
4. Mechanical of solids, B.C. Punmia, Laxmi Pub. Ltd. Delhi
5. Solid of Mechanics by S.M.A. Kazimi; Tata McGraw Hill Pub. Co. Ltd, N. Delhi.
6. Strength of Material by R.S. Lahri, S.K. Kataria & Sons Delhi

**GE 407\* Special Mathematics\*\* II**

(Common for all branches CSE/ECE/IT/ME/CSE/CIVIL for Diploma Holders)

Teaching Hrs.  
3L + 1TExam Hrs. 3 Hrs.  
Total-100

Unit	Topics	
I	<b>Differential equation of first Order</b>	Definition, order and degree of differential equation, Method of separation of variable, Homogeneous differential equation. <b>Lectures Req : 6</b>
II	<b>Differential equation of first Order</b>	Exact differential equation of first order, Reducible to exact form, Linear form, Reducible to linear form. <b>Lectures Req : 6</b>
III	<b>Differential equation of second Order</b>	Linear differential equation with constant coefficients, complementary function, particular integral <b>Lectures Req : 6</b>
IV	<b>Elementary Complex variable</b>	Complex Numbers, Real and imaginary parts of complex, complex conjugate, modulus and argument of complex number. Euler's theorem and De' moivre's theorem (only statement) polar form of complex number. <b>Lectures Req : 6</b>
V	<b>Matrices and Determinants</b>	Determinants and Matrices of order two and three properties of determinants, Evaluation of Determinants, Addition, Subtraction, Multiplication, Transpose, Adjoint and inverse of Matrix. <b>Lectures Req : 6</b>

**Total**  
**Lectures Req : 30**

**\*\* It will be sessional paper: marks shall not be counted for awarding division.**