B. Tech. Mechanical Engineering
Scheme of Syllabus

Semester III

Code	Subject	L	P	C	MSE	ESE
	Materials Science and Metallurgy	4	0	8	30	70
	Strength of Materials	4	0	8	30	70
	Machine Drawing and Computer-aided Drafting	2	0	4	30	70
	Thermodynamics	4	0	8	30	70
	Fluid Mechanics	4	0	8	30	70
	Engineering Mathematics-III	4	0	8	30	70
	Machine Drawing and Computer-aided Drafting Lab	*0*	*2*	*4*	*50*	*50*
	*Seminar Report and Presentation***			*4*		
	NCC/NSS/Sports/Arts					
		22	*2*	*52*	*230*	*470*

*** Self Study Report on any Topic of Choice based on the Subjects studied so far or beyond*

Semester IV

Code	Subject	L	P	C	MSE	ESE
	Manufacturing Processes-I	4	0	8	30	70
	Theory of Machines and Mechanisms-I	3	0	6	30	70
	Machine Design-I	4	0	8	30	70
	Applied Thermodynamics	4	0	8	30	70
	Elective -I	3	0	6	30	70
	*History of Science and Technology**			*4*	*50*	
	Fluid Mechanics Lab	*0*	*2*	*2*	*50*	*50*
	Manufacturing Processes Lab-I	*0*	*2*	*2*	*50*	*50*
	Strength of Materials Lab	*0*	*2*	*2*	*50*	*50*
	Materials Science and Metallurgy Lab	*0*	*2*	*2*	*50*	*50*
	*Industrial Exposure***					
	NCC/NSS/Sports/Arts					
		18	*8*	*48*	*400*	*550*

** Self Study Course (Objective type University Level Common Exam.)*

*** Two weeks in Industry*

Elective I:

- Renewable Energy Sources
- Sheet Metal Processes and Products

Syllabus for B. Tech. Mechanical Engineering
Semester III

Materials Science & Metallurgy

Unit 1: Structure of Materials
Crystal structures, indexing of lattice planes, Indexing of lattice directions, Imperfections in crystals - point defects, line defects, surface and bulk defects, Mechanism of plastic deformation, deformation of single crystal by slip, plastic deformation of polycrystalline materials

Unit 2: Mechanical Properties and their Testing
Tensile test, engineering stress-strain curve, true stress-strain curve, types of stress-strain curves, compression test, bend test, torsion test, formability, hardness testing, different hardness tests- Vickers, Rockwell, Brinnel, Impact test, fatigue test, creep test

Unit 3: Equilibrium Diagrams
Definitions of terms, rules of solid –solubility, Gibb's phase rule, solidification of a pure metal, plotting of equilibrium diagrams, lever rule, Iron-iron carbide equilibrium diagram, critical temperatures, solification and microstructure of slowly cooled steels, non-equilibrium cooling of steels, property variation with microstructures, classification and application of steels,, specification of steels, transformation products of austenite, TTT diagram, critical cooling rate, CCT diagram

Unit 4: Heat Treatment
Heat treatment of steels, cooling media, annealing processes, normalizing, hardening, tempering, quenching and hardenability, surface hardening processes- nitriding, carbonitriding, flame hardening, induction hardening

Unit 5: Metallography
Microscopy, specimen preparation, polishing abrasives and cloths, specimen mounting, electrolytic polishing, etching procedure and reagents, electrolytic etching, optical metallurgical microscope, macroscopy, sulphur printing, flow line observations, examination of fractures, spark test, electron microscope

Unit 6: Strengthening Mechanisms and Non-destructive Testing
Refinement of grain size, cold working/strain hardening, solid solution strengthening, dispersion strengthening, Precipitation hardening,
Magnetic particle inspection, dye penetrant inspection, ultrasonic inspection, radiography, eddy current testing, acoustic emission inspection.

Text Books:

1) V.D. Kodgire and S.V. Kodgire, Material Science and Metallurgy for Engineers, Everest Publishing House, Pune, 24th edition, 2008.

2) W.D. Callister, Jr., Materials Science and Engineering: An Introduction, John Wiley and Sons, 5th edition, 2001.
3) V. Raghvan, Material Science Engineering, Prentice Hall of India Ltd., 1992
4) S.H. Avner, Introduction to Physical Metallurgy, Tata McGraw-Hill, 2nd edition, 1997
5) R.A. Higgins, Engineering Metallurgy: Part I, ELBS, 6th edition, 1996

Reference Books:

- V.B. John, Introduction to Engineering Materials, ELBS, 6th edition, 2001
- G.F. Carter and D.E. Paul, Materials Science and Engineering, ASM International, 3rd edition, 2000
- T.E. Reed-Hill and R. Abbaschian, Physical Metallurgy Principles, Thomson, 3rd edition, 2003

Strength of Materials

Unit 1

Simple Stresses and Strains: Mechanical properties of materials, analysis of internal forces, simple stress and strain, stress-strain curve, Hooke's law, modulus of elasticity, shearing, thermal stress, Hoop stress, Poisson's ratio, volumetric stress, bulk modulus, shear modulus, relationship between elastic constants.

Unit 2

Principle stresses and strains: Uni-axial stress , simple shear, general state of stress for 2D element, ellipse of stress, principle stresses and principal planes, principal strains, shear strains, strain rosettes, Mohr's circle for stresses and strains.

Strain energy and resilience: Load deflection diagram, strain energy, proof resilience, stresses due to gradual, sudden and impact loadings, shear resilience, strain energy in terms of principal stresses.

Unit 3

Combined Stresses: Combined axial and flexural loads, middle third rule, kernel of a section, load applied off the axes of symmetry.

Shear and Moment in Beams: Shear and moment, interpretation of vertical shear and bending moment, relations among load, shear and moment.

Unit 4

Stresses in Beams: Moment of inertia of different sections, bending and shearing stresses in a beam, theory of simple bending, derivation of flexural formula, economic sections, horizontal and vertical shear stress, distribution shear stress for different geometrical sections- rectangular, solid circular, I-section, other sections design for flexure and shear.

Unit 5

Beam Deflections: Differential equation of deflected beam, slope and deflection at a point, calculations of deflection for determinate beams by double integration, Macaulay's method, theorem of area-moment method (Mohr's theorems), moment diagram by parts, deflection of

cantilever beams, deflection in simple supported beams, mid-span deflection, conjugate beam method, deflection by method of superstition.

Unit 6

Torsion: Introduction and assumptions, derivation of torsion formula, torsion of circular shafts, stresses and deformation in determinate solid/ homogeneous/composite shafts, torsional strain energy.

Columns and Struts: Concept of short and long Columns, Euler and Rankine's formulae, limitation of Euler's formula, equivalent length, eccentrically loaded short compression members.

Text Books:

1. S. Ramamrutham, Strength of Materials, Dhanpat Rai & Sons, New Delhi.
2. F.L. Singer and Pytle, Strength of Materials, Harper Collins Publishers, 2002.
3. S. Timoshenko, Strength of Materials: Part-I (Elementary Theory and Problems), CBS Publishers, New Delhi.

Reference Books:

1. E.P. Popov, Introduction to Mechanics of Solid, prentice- Hall, Second Edition 2005.
2. S.H. Crandall, N.C. Dahl.and T.j.Lardner, An introduction to the Mechanics of Solids, Tata McGraw Hill, 1978.
3. S.B. Punmia, Mechanics of Structure, Charotar Publishers, Anand.
4. B.C. Punmia, Ashok Jain, and Arun Jain, Strength of Materials, Laxmi Publications.

Machine Drawing & Computer Aided Drafting

Unit 1

Sectional Views

Full section, half section, partial section, off-set section, revolved sections, removed sections, auxiliary section, guidelines for hatching, examples on all above types of sections of machine elements.

Unit 2

Study of Machine Elements

Study of simple machine elements and components such as screwed fasteners, shaft couplings, pipe joints, riveted and welded joints, bearings, gears, etc.

Unit 3

Interpenetration of surfaces (emphasis on applied cases)

Line or curve of intersection of two penetrating cylinders, Cone and cylinder, prism and a cylinder, cone and prism, Forged ends, etc.

Unit 4

Drawing of Assembly and Details

Assembly and details part drawing of standard machine components such as valves, components of various machine tools, pumps, shaft couplings, joints, pipe fittings, engine parts, etc.

Unit 5

Production Drawing and Reading Blue Prints

Types of production drawings, size, shape and description, limits, fits and tolerances, surface roughness and surface roughness symbols, reading the blue prints.

Unit 6

Computer Aided Drafting

Introduction to Computer Aided Design and Drafting, Advantaged of CADD, study of preliminary AutoCAD commands like drawing, dimensioning, viewing commands. Drawing 3D views in AutoCAD, Introduction AutoLISP programming.

Text books:

1. N.D. Bhatt and Panchal, "Engineering Drawing" Charotar Publishing House, Anand, India.
2. N.D. Bhatt and Panchal, "Machine Drawing" Charotar Publishing House, Anand, India
3. Ajeet Sing, "Working with AutoCAD 2000, "Tata McGraw Hill, New Delhi.
4. George Omura, "ABC of Autolisp " BPB Publications, New Delhi

References Books:

1. Narayana, Kannaiah, Reddy, " Machine Drawing" New Age International Publishers
2. AutoCAD and AutoLISP manuals from Autodesk Corp. U.S.A.
3. IS Code: SP 46- 1988, Standard Drawing Practices for Engineering Institutes.

Thermodynamics

Unit 1

Fundamental Concepts and Definitions: Thermodynamic systems, properties, processes and cycles. Thermodynamic equilibrium, Quasi- static process, Macroscopic vs. Microscopic viewpoint, Work and heat Transfer: Work transfer, p.dv and other types of work, Heat transfer, temperature and its measurement (principle of measurement, various instruments etc.)Zeroth law of thermodynamics, specific heat and latent heat, point function, path function.

Unit 2

First Law of Thermodynamics: Firt law of thermodynamics for a closed system undergoing a cycle and change of state, Energy, different forms of energy, Enthalpy, PMM-I control volume, application of first law of steady flow processes (nozzle, turbine, compressor pump, boiler, throttle valve etc.)

Unit 3

Second Law of Thermodynamics: Limitation of first law of thermodynamics, cycle heat engine, refrigetor and heat pump, Kelvin- Plank and Clausius statements and their equivalence,

Reversibility and Irreversibility, Carnot cycle, Carnot theorem, Absolute thermodynamic temperature scale.

Unit 4
Entropy: Introduction, Clausius theorem, T-s plot, Clausis inequality, Entropy and Irreversibility, Entropy principle and its application, combined I and II law, Entropy and direction, Entropy and disorder.

Unit 5
Availability: Avaibable energy pertaining a cycle, Quality of energy, law of degradation of energy, maximum work in a reversible process, Dead state, Availability in steady flow and non-flow processes, Second law efficiency.

Unit 6
Ideal gas: Avogadro's law, Equation of state, ideal gas and process, relation between and cv, other equation of states.

Properties of Pure Substance : Phase change of pure substance, phase diagram of pure substance, p-v, T-s, and h-s diagrams properties of steam ,property table, representation of processes of steam on p-v, T-s, and diagrams, Dryness fraction and its measurement.

Text Books:
- P.K. Nag, Engineering Thermodynamics, Tata Mc-Graw Hill, 3rd edition, 2005 New Delhi.
- Y.A. Cengel and M.A. Boles, Thermodynamics – An Engineering Approach, McGraw Hill, 5th edition, 2006.

Reference Books:
- G.J. Van Wylen and R.E. Sonntag, Fundamental of Thermodynamics, John Wiley & Sons, 5th edition, 1998.
- M.J.Moran and H.N. Shaprio, Fundamentals of Engineering Thermodynamics, John Wiley and Sons, 4th edition, 2004.

Fluid Mechanics

Unit 1
Basics: Definition of fluid, fluid properties such as viscosity, vapour pressure, compressibility, surface tension, capillarity, Mach number etc, pressure at a point in the static mass of fluid, variation of pressure, Pascal's law, pressure measurement by simple and differential manometers using manometric expression.

Unit 2

Fluid Statics: Hydrostatic forces on the plane and curved surfaces, centre of pressure, Buoyancy, centre of buoyancy, stability of floating bodies, metacentre and metacentric height its application in shipping.

Unit 3

Fluid Kinematics: velocity of fluid particle, types of fluid flow, description of flow, continuity equation, Coordinate free form, acceleration of fluid particle, rotational & irrotational flow, Laplace's equation in velocity potential and Poisson's equation in stream function, flow net.

Unit 4

Fluid Dynamics: Momentum equation, development of Euler's equation, Introduction to Navier-Stokes equation, Integration of Euler's equation to obtain Bernoulli's equation, Bernoulli's theorem , Application of Bernoulli's theorem such as venture meter, orifice meter, rectangular and triangular notch, pitot tube, orifices etc.

Unit 5

a) Laminar Flow: Flow through circular pipe, between parallel plates, Power absorbed in viscous flow in bearings, loss of head due to friction in viscous flow.

b) Turbulent Flow: Reynolds's experiment, frictional loss in pipe flow, shear stress in turbulent flow, major and minor losses, HGL and TEL, flow through series and parallel pipes.

Unit 6

a) Dimensional Analysis: Dimensional homogeneity, Raleigh's method, Buckingham's theorem, Model analysis, similarity laws and dimensionless numbers.

b) Introduction to boundary layer theory and its analysis.

c) Forces on Submerged bodies: Drag, lift, Drag on cylinder, Development of lift in cylinder.

Text Books:

1. Modi and Seth, Fluid Mechanics and Hydraulic Machinery, Standard Book House, Tenth Edition , 1991
2. Robert W. Fox and Alan T. McDonald, Introduction to Fluid Mechanics, John Wiley and Sons, 5^{th} edition.

Reference Books:

1. V.L. Streeter, K.W. Bedford and E.B.Wylie, Fluid Dynamics, McGraw-Hill, 9th edition, 1998.
2. S.K. Som and G. Biswas, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw-Hill, 2^{nd} edition, 2003.

Engineering Mathematics – III

Unit 1: Laplace Transform
Transform of elementary functions, Transform periodic function, Transform of special function, Transform of derivative, Transform of integral, Properties of Laplace Transform, Evaluation of integrals by Laplace Transform

Unit 2: Inverse Laplace Transform
Properties of Inverse Laplace Transform, Other method for finding inverse Laplace Transform, Convolution Theorem for inverse Laplace Transform, application to the differential equations, Simultaneous linear equation with constant coefficients

Unit 3: Partial differential equations and applications
Formation of partial differential equations, Linear equations of the first order, homogeneous linear equations with constant coefficient, rules for finding complementary and particular integrals, working procedure to solve the equation, Non-homogeneous linear equations, Wave equation, One dimensional heat flow equation, Laplace equation

Unit 4: Series solution of differential equation and Special function
Validity of series solution, Series solution when $x = 0$ is an ordinary point, Frobenius method, Bessel's equation, Recurrence relation for $J_n(x)$, Orthogonality of Bessel function

Unit 5: Fourier Transform
Fourier integral – Fourier since and cosine integral – complex forms of Fourier integral, Fourier transform – Fourier sine and cosine transform – finite Fourier sine and cosine transform, properties of F-transform, Convolution theorem for F-transform, Parse Val's identity of for F-transforms

Unit 6: Integral equations
Conversion of linear differential equation to an integral equation and vice versa, conversion of boundary value problem to integral equation using green's function, solution of an integral equation, integral equation of the convolution type, Able's integral equation, integro-differential equation, solution of Fred Holm and Volterra equation by the method of approximation

Text Books

1. Grewal B. S., Higher engineering Mathematics, Khanna Publication, New Delhi
2. Keyszig E., Advanced Engineering Mathematics, Wiley Eastern Publication
3. Peter V. O. Neil, Advanced Engineering mathematics, Thomson Publication

Machine Drawing & Computer Aided Drafting Lab

List of Practicals: (minimum six assignments should be completed)

1. One full imperial drawing sheet consisting the drawing/ sketches of representation of standard components, symbols of pipe joints, weld joints, rivet joint etc, surface finish symbols and grades, limit, fit and tolerance sketches.
2. Two full imperial drawing sheets, one consisting of assembly and the other consisting of details of any one standard component such as valves, components of various machine tools, pumps, joints, engine parts, etc.
3. Two assignment of AutoCAD: Orthographic Projections of any one simple machine component such as bracket, Bearing Housing or Cast component for Engineers such as connecting rod, Piston, etc. with dimensioning and detailing of three views of components
4. 3-D model at least one simple machine component.

Syllabus for B. Tech. Mechanical Engineering
Semester IV

Manufacturing Processes – I

Unit 1: Introduction to Manufacturing
What is manufacturing? Examples of manufactured products, Classification of manufacturing processes, Selection of materials, Types of manufacturing strategies

Unit 2: Metal Casting Processes
Patterns, allowances, moulding sand properties and preparation, Cores, core prints, sand moulding procedure, melting practice and furnaces, solidification of metals, casting defects and inspection, Specialized casting processes such as shell mould casting, die casting, centrifugal casting, investment casting and permanent mould casting

Unit 3: Joining Processes
Gas welding, gas cutting, Electric arc-welding with consumable and non-consumable electrodes (MMAW, GMAW, TIG, SAW), Solid State Welding: resistance welding, spot and seam welding, thermit welding, friction welding, welding defects, Brazing and soldering.

Unit 4: Turning, Shaping and Planing
Centre lathe, lathe operations, taper turning, methods of taper turning, work holding and cutting tool, thread cutting, machining time and power estimation, shaper, Planing machine and their operations

Unit 5: Milling and Gear cutting
Milling machine and its types, milling operations, milling cutters, milling time and power estimates, Gear cutting using indexing mechanism, indexing types - simple, compound and differential indexing, gear shaping, gear forming, gear hobbing, and gear shaving

Unit 6: Drilling, Boring, Broaching
Drilling machine, its types, twist drill, drilling time and power estimates, counter boring, spot facing, boring, reaming, tapping, and broaching, broach tool, broaching types and operations

Text Books:

- P.N. Rao, Manufacturing Technology, Foundry, Forming and Welding, Vol. 1, 3rd edition, Tata Mc Graw Hill Publishing Co. Ltd, New Delhi, 2004
- P.N. Rao, Manufacturing Technology, Metal Cutting and Machine Tools, Vol. 2, 2nd edition, Tata Mc Graw Hill Publishing Co. Ltd, New Delhi, 2002

References Books:

1. M.P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes and systems, Prentice Hall, Upper Saddle River, New Jersey,1999
2. S. Kalpakjian and S.R. Schmid, Manufacturing Engineering and Technology, Addison Wesley Longman (Singapore) Pte. India Ltd., 4th edition, 2000

Theory of Machines & Mechanisms – I

Unit 1
Definition of link, pair, kinematics chain, inversions, inversions of single and double slider crank chain, kinematic diagrams of mechanisms, equivalent linkage of mechanism, degree of freedom.

Unit 2
Study of various mechanisms such as straight line mechanisms, pantograph, Geneva mechanism, steering gear mechanisms and Hooke's joint

Unit 3
Instantaneous centre of rotation, body and space centrodes and their applications, Kennedy's theorem and its applications.

Unit 4
Velocity and acceleration analysis and its purpose, velocity and acceleration diagrams using relative velocity method, Corioli's component of acceleration

Unit 5
Velocity and acceleration analysis by vector methods, coordinate system, Loop closure equation, Chase solutions, velocity and acceleration by vector and complex algebra

Unit 6
Velocity and acceleration of slider crank mechanism by analytical method and Klein's construction.

Text Books:
1. A. Ghosh and A.K. Malik, Theory of Mechanisms and Machines, Affiliated East-West Press Pvt. Ltd., New Delhi.
2. S. S. Rattan, Theory of Machines, Tata-McGraw Hill, New Delhi.

Reference Books:
1. Thomas Beven, Theory of Machines, CBS Publishers and Distributors, Delhi.
2. J.E. Shigely and J.J. Uicker Theory of Machines and Mechanisms, McGraw Hill, New York, International Student Edition, 1995.

Machine Design - I

Unit 1
Mechanical engineering Design Process: Traditional design methods, general industrial design procedure, design considerations, phases in design ,creativity in design, use of standardization, preferred series, introduction to ISO 9000, use of design data book, aesthetic and ergonomic considerations in design.

Unit 2
Design of Machine Elements against Static Loading: Theories of Failure (Yield and Fracture Criteria) - Maximum normal stress theory, Maximum shear stress theory, Maximum distortion energy theory, comparison of various theories of failure, Direct loading and combined loading, Joints subjected to static loading e.g. cotter and knuckle joint, turnbuckle, etc. introduction to fluctuating loads.

Unit 3
Design of Shafts Keys and Couplings: Various design considerations in transmission shafts, splinted shafts, spindle and axles strength, lateral and torsional rigidity, ASME code for designing transmission shaft.

Types of Keys: Classification and fitment in keyways, Design of various types of keys.
Couplings: Design consideration, design of rigid, muff and flange type couplings, design of flexible couplings.

Unit 4
Design of Threaded joints: Stresses in screw fasteners, bolted joints under tension, torque requirement for bolt tightening, preloading of bolt under static loading, eccentrically loaded bolted joints.
Power Screws: Forms of threads used for power screw and their applications, torque analysis for square and trapezoidal threads, efficiency of screw, collar friction, overall efficiency, self locking

in power screws, stresses in the power screw, design of screw and nut, differential and compound screw, re-circulating ball screw.

Unit 5

Welded Joints: Type of welded joints, stresses in butt and fillet welds, strength of welded joints subjected to bending moments.

Unit 6

Mechanical Springs: Stress deflection equation for helical spring, Wahl's factor, style of ends, design of helical compression, tension and torsional spring under static loads, construction and design consideration in leaf springs, nipping, stain energy in helical spring, shot peening.

Text Books:

1. V.B. Bhandari, Design of Machine Elements, Tata McGraw Hill, New Delhi, 2008.
2. R.L. Nortan, Machine Design: An Integrated Approach, Pearson Education Singapore, 2001.
3.

Reference Books:

1. R.C. Juvinall and K.M. Marshek, Fundamental of machine component design , John Wiley & Sons, Inc, New York, Third Edition 2002.
2. B.J. Hamrock, B. Jacobson and Schmid Sr., Fundamentals of Machine Elements, International Edition, New York, Second Edition 1999
3. A.S. Hall, A.R. Holowenko and H.G. Langhlin, "Theory and Problems of Machine Design, Schaum's Outline Series, McGraw Hill book Company, New York, 1982.
4. J.E. Shigley and C. Mischke, Mechanical Engineering Design, McGraw Hill, 7th edition, 2004.
5. M.F. Spotts, Design of Machine Elements, Prentice Hall of India, New Delhi.

Applied Thermodynamics

Unit 1

Fuels and Combination: Types of fuels, calorific values of fuels and its determination, combustion equation for hydrocarbon fuel, determination of minimum air required for combustion and excess air supplied conversion of volumetric analysis to mass analysis, fuel gas analysis.

Unit 2

Steam Generators: Classification of boilers, boiler details, requirements of a good boiler, merits and demerits of fire tube and water tube boilers, boiler mountings and accessories.

Boiler Draught: Classification of draught, natural draught, determination of height and diameter of the chimney, Condition for maximum discharge, efficiency of the chimney, draught losses, types of boiler draught.

Performance of Boilers: Evaporation, equipment evaporation, boiler efficiency, boiler trial and heat balance.

Unit 3

Vapor and gas power cycles: Carnot cycle, ideal Rankine cycle, calculation of thermal efficiency, specific steam consumption, work ratio, Air standard Otto, Diesel and Dual cycle, Strirling cycle, Joule-Brayton cycle

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Unit 4

Steam Nozzles: Types of Nozzles, flow of steam through nozzles, condition for maximum discharge, expansion of steam considering friction, super saturated flow through nozzles, General relationship between area, velocity and pressure.

Unit 5

Steam Turbines: Advantages and classification of steam turbines, compounding of steam turbines, velocitiy diagrams, work one done and efficiencies, losses in turbines.

Condensers and Cooling Towers:

Elements of steam condensing plants, advantages of using condensers, types of condensers, thermodynamic analysis of condensers, efficiencies, cooling towers.

Unit 6

Reciprocating air compressor: Classification constructional details, theoretical and actual indicator diagram, FAD, multi staging, condition for maximum efficiency, capacity control.

Internal combustion engines, applications, nomenclature, engine components, Engine classification, two and four stroke cycle engines; fundamental different between SI and CI engines, valve timing diagames

Text Books:

1. T.D. Eastop and A. McConkey, " Applied Thermodynamics" Addison Wesley Longman
2. P.K. Nag " Basic and Applied Thermodynamics,: Tata McGraw Hill
3. Gill and Smith, " Fundamental of internal combustion engines
4. Sharma and Mathur, " Internal Combustion ngines", Tata McGraw Hill

Reference Books:

1. Yunus A. Cengel, "Thermodynamics- An Engineering Approach, " Tata McGraw Hill
2. Rayner Joel, " Basic engineering Thermodynamics" Addison Wesley Longman
3. P.K. Nag "Power Plant Engineering" ,Tata McGraw Hill, 2nd edition

Elective-I

(a) Renewable Energy Sources

Unit 1: Introduction

Energy resources, Estimation of energy reserves in India, Current status of energy conversion technologies relating to nuclear fission and fusion, Solar energy.

Unit 2: Solar Radiations

Spectral distribution, Solar geometry, Attenuation of solar radiation in Earth's atmosphere, Measurement of solar radiation, Properties of opaque and transparent surfaces.

Unit 3: Solar Collectors

Flat Plate Solar Collectors: Construction of collector, material, selection criteria for flat plate collectors, testing of collectors, Limitation of flat plate collectors, Introduction to ETC. **Concentrating type collectors**: Types of concentrators, Advantages, paraboloid, parabolic trough, Heliostat concentrator, Selection of various materials used in concentrating systems, Tracking.

Unit 4: Solar Energy Applications

Air/Water heating, Space heating/cooling, solar drying, and solar still, Photo-voltaic conversion.

Unit 5: Wind Energy & Biomass

Types of wind mills, Wind power availability, and wind power development in India. Evaluation of sites for bio-conversion and bio-mass, Bio-mass gasification with special reference to agricultural waste,

Unit 6: Introduction to Other Renewable Energy Sources

Tidal, Geo-thermal, OTEC, Mini/micro hydro-electric, Geo-thermal, Wave, Tidal.
System design, components and economics.

Text Books:

1. Chetansingh Solanki, *Renewable Energy Technologies*, Prentice Hall of India, 2008

Reference Books:

1. Sukhatme S.P., *Solar Energy: Principles of Thermal Collection and Storage*, Tata McGraw Hill, New Delhi, 1992.
2. G.D. Rai, *Solar Energy Utilization*, Khanna Publisher, Delhi, 1992.

Elective-I

(b) Sheet Metal Processes and Products

Unit 1

- Introduction and Importance of sheet metal engineering, materials used, desirable properties of materials in sheet metal products

Unit 2

- Basic applications: shearing processes like blanking, piercing, and punching.

Unit 3

- Drawing processes like shallow and deep drawing of cylindrical and rectangular bodies, forming and bending including spring-back.

Unit 4

- Types of dies: compound dies, progressive dies, and combination dies

Unit 5

- Mechanical and hydraulic presses and modern developments in press tools, formability.

Unit 6

- Case studies for manufacturing of sheet metal products in various engineering applications

TEXTS / REFERENCES:

- P. N. Rao, Manufacturing Technology, Foundry, Forming and Welding, Vol. 1, 3rd edition, Tata Mc Graw Hill Publishing Co. Ltd, New Delhi, 2004
- Donaldson et al :Tool Design; Tata McGraw-Hill, New Delhi,1998
- ASM Handbook (10th edition) Vol. 15 on Metal Forming, ASM Publication, Metals Park, Ohio, 1989.
- Die Design Handbook, ASTME, 1989.
- A. S. Deshpande, Sheet Metal Engineering Notes, IIT Bombay, 1999.

Fluid Mechanics Lab

List of Experiments (any eight experiments from the list)

1. Flow visualization technique: characteristics of laminar and turbulent flow patterns using Helleshaw Apparatus
2. Verification of Bernoulli's theorem
3. Determination of Critical Reynolds number using Reynolds Apparatus
4. Determinations of pressure drop in pipes of various cross-sections
5. Determinations of pressure drop in pipes of various pipe fittings etc.
6. Viscosity measurement using viscometer (at least one type)
7. Verification of momentum equation using impact of jet apparatus
8. Determination of metacentric height of a floating body
9. Calibration of a selected flow measuring device and Bourdon pressure gauge
10. Gauge and differential pressure measurements using various types of manometers, Bourdon type pressure gauge. Demonstration of measurement using these instruments in lab
11. Experiment to study hydraulic jump

Manufacturing Processes Lab - I

Each student shall be required to submit one job each of the following term work:

1. Making a job with a process plan involving plain, step and taper turning operations on a centre lathe.
2. Preparation of process planning sheet for a job including operations such as milling, drilling and shaping.
3. Making a spur gear using universal dividing head on milling machine.
4. Making a simple component by sand casting using a split pattern.
5. A cutting of a sheet plate using oxyacetylene flame cutting/plasma cutting.
6. Making a butt joint on two stainless steel plates using TIG Welding.
7. Making a butt joint on two stainless steel plates using TIG Welding.

Strength of Materials Lab

List of Experiments (any 8 experiments from the list)

1. Tension test on ferrous and non-ferrous alloys (mid steel/cast iron/aluminum, etc.
2. Compression test on mild steel, aluminum, concrete, and wood
3. Shear test on mild steel and aluminum (single and double shear tests)
4. Torsion test on mild steel and cast iron solid bars and pipes
5. Flexure test on timber and cast iron beams
6. Deflection test on mild steel and wooden beam specimens
7. Graphical solution method for principal stress problems
8. Impact test on mild steel, brass, aluminum, and cast iron specimens
9. Experiments on thermal stresses
10. Strain measurement in stress analysis by photo-elasticity
11. Strain measurement involving strain gauges/ rosettes
12. Assignment involving computer programming for simple problems of stress, strain computations.

Materials Science & Metallurgy Lab

List of Experiments (any eight experiments from the list):

1. Brinell Hardness Test
2. Rockwell Hardness test
3. Erichson Cupping Test
4. Magnaflux Test
5. Dye Penetrant Test
6. Specimen Preparation for Microscopy
7. Sulphur Print Test
8. Spark Test
9. Study and drawing of microstructures of plain carbon steels of varying carbon percentage
10. Study and drawing of microstructures of heat treated steels
11. Jominy End Quench Test
12. Study and drawing of microstructures of cast irons
13. Study and drawing of microstructures of non-ferrous alloys
14. Hardening of steels of varying carbon percentage

Reference Books:

1. Vander Voort, Metallography: Principles and Practice, McGraw-Hill, 1984
2. K.H. Prabhudev, Handbook of Heat Treatment of Steels, Tata McGraw-Hill, 2000.

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