SE (Prod. /Industrial Engineering) (2008 Course) Structure

Semester- I

Subject Code	Subject	Teaching Scheme (Hrs)		Examination Scheme				
		Lecture	Pr./Dw	Theory	Tw	Oral	Pr.	Total
207002	Engineering Mathematics III	4	-	100	-	-	-	100
202085	Heat and Fluid Engineering	4	2	100	50	-	-	150
211081	Strength Analysis of Machine Elements	4	-	100	-	-	-	100
211082	Machine Tool Operations	4	2	100	-	50	-	150
211083	Material Science	4	2	100	50	-	-	150
211084	M/C Drawing & Computer Graphics	2	2	-	50	50	-	100
	Total	**22**	**8**	**500**	**150**	**100**	**-**	**750**

Semester II

Subject Code	Subject	Teaching Scheme (Hrs)		Examination Scheme				
		Lecture	Pr./Dw.	Theory	Tw	Oral	Pr.	Total
203050	Electrical Technology	4	2	100	50	-	-	150
211086	Theory of Machines	4	2	100	-	50	-	150
211087	Welding and Foundry	4	2	100	-	50	-	150
211088	Design of Machine Elements	4	2	100	50		-	150
211089	Industrial Organization and Management	4	-	100	-	-	-	100
211090	Workshop Practice	-	2	-	-	-	50	50
	Total	**20**	**10**	**500**	**100**	**100**	**50**	**750**

Pr- Practical Dwg- Drawing Tw- Term Work
Note: Practical/Oral Based On Term Work

207002 ENGINEERING MATHEMATICS – III (2008 Course)

Teaching Scheme:
Lectures: 4 hrs./week

Examination Scheme:
Paper: 100 marks
Duration: 3 hrs.

Section I

Unit I: Linear Differential Equations (**LDE**) of second and higher order (09 Hours)
LDE with constant coefficients, Homogeneous Equations, Cauchy's and Legendre's DE. Simultaneous & Symmetric Simultaneous DE, Mass spring mechanical systems, Damped and Undamped systems.

Unit II: Transforms (09 Hours)
a) Laplace Transform (**LT**): LT of standard functions, properties and theorems, Inverse LT, Application of LT to solve LDE.
b) Fourier Transform (**FT**): Fourier Integral theorem, Fourier transform Fourier Sine & Cosine transform, Inverse Fourier Transform.

Unit III: Partial Differential Equations (**PDE**) (09Hours)
Basic concepts, modeling: Vibrating String, Wave equation. Method of separation of variables, Use of Fourier series, Heat equation: one and two dimensional heat flow equations, Solution by Fourier Transforms, modeling Membrane two dimensional wave equation.

Section II

Unit IV: Statistics and Probability (09 Hours)
Measure of central tendency, dispersion, Correlation and Regression, Probability, Probability distributions, Binomial, Poisson and Normal distributions, Population and Sample, Sampling Distributions, t-distribution Chi Square distribution.

Unit V: Vector Differential Calculus (09 Hours)
Physical Interpretation of Vector Differentiation, Vector Differential Operator, Gradient, Divergence and Curl, Directional Derivative, Solenoidal, Irrotational and Conservative Fields, Scalar Potential, Vector Identities.

Unit VI: Vector Integral Calculus (09Hours)
Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence Theorem, Stoke's Theorem.

Text Books:

1. Advanced Engineering Mathematics by Peter V. O'Neil (Cengage Learning).
2. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.).

Reference Books:

1. Engineering Mathematics by B.V. Raman (Tata McGraw-Hill).
2. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).
3. Advanced Engineering Mathematics, Wylie C.R. & Barrett L.C. (McGraw-Hill, Inc.)
4. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi).
5. Applied Mathematics (Volumes I and II) by P. N. Wartikar & J. N. Wartikar (Pune Vidyarthi Griha Prakashan, Pune).
6. Advanced Engineering Mathematics with MATLAB, 2e, by Thomas L. Harman, James Dabney and Norman Richert (Brooks/Cole, Thomson Learning).

202085 Heat and Fluid Engineering

Teaching scheme	Examination Scheme
Theory: 4 hrs/week	Theory: 100 marks
Practical: 2 hrs/week	Term Work: 50 Marks

Unit I **(8)**

Introduction & Fluid properties

Definition of fluid, Newton's law of Viscosity, classification of fluid: Newtonian & Non-Newtonian fluids, Ideal & Real fluids, Fluid properties: viscosity, compressibility, cohesion, adhesion, surface tension, capillarity, vapour pressure, cavitations.

Static's of Fluid

Pascal's law, Pressure on plane/curved surface, pressure measurements, Manometers, center of pressure, metacentric height.

Unit II **(8)**

Fluid Flow

Types of flow, examples, forces acting on fluid flow, Stream lines, Path lines, Streak lines. Velocity potential, flownets, Euler's equation of motion along a stream line, Bernoulli's equation, applications of Bernoulli's equation, orifice meter, venturimeter, notches (rectangular & triangular), Pitot tube.

Unit III **(8)**

Flow through pipes

Laminar and turbulent flow through circular pipes, major loss-Darcy-weisbach equation, minor losses, pipes in series and parallel, water hammer, flow around a cylinder in immersed conditions, Buckingham's pie theorem, dimensionless numbers

Fluid Machinery

Construction, working and applications of hydraulic turbines, centrifugal pumps and reciprocating pumps.

Unit IV **(8)**

Fuels and lubricants

Mass function, combustion equation, proximate and ultimate analysis of fuel, stiochiometeric analysis of combustion products, volumetric and gravimetric analysis, types & properties of lubricants, flash point, fire point, viscosity, Vapor pressure, cloud point, pour point etc.

Steam generators

Steam generation, steam properties, Babcock and Wilcox boiler, Cochran boilers(construction and working),boiler accessories, boiler performance, boiler efficiency, equivalent of evaporation and energy balance.

Unit V **(8)**

Refrigeration

Air refrigeration, vapour compression refrigeration system, p-h and T-s diagram (with numerical), sub cooling, superheating, various refrigerants used in refrigeration systems, their effect on environment

Air conditioning

Psychrometry, properties of air, types of air conditioning, central, unit and industrial air conditioning, introduction to HVSC.

Heat transfer- Applications of conduction, convection and radiation in manufacturing.

Unit VI **(8)**

Reciprocating compressor

FAD, work done, efficiency-volumetric (with clearance volume), isothermal, multistage compression

IC engines

Cycle diagram, diesel and otto cycle (no numericals) IC engine systems --starting, ignition, cooling and lubrication systems, testing and performance of IC engine.

Practical and Term Work

Any eight, (Any one trail should be computer interfaced)

1. Verification of Bernoulli's equation
2. Determination of friction factor for laminar and turbulent flow through pipes
3. Determination of losses in various pipe fitting
4. Calibration of venture meter/orifice meter
5. Trial on boiler
6. Trial on vapour compression refrigeration system
7. Trial on petrol engine
8. Trial on diesel engine
9. Trial on air compressor.
10. Trail on Air conditioning system

Text Books

1. Bansal R.K., **"**Fluid Mechanics and Hydraulic Machines", 9th ed**.,** Laxmi Publication, 1990, ISBN 81-7008-311-7.
2. Jain A.K**.,** **"**Fluid Mechanics including Hydraulic Machines", Khanna Publishers, 1990, ISBN 81-7409-194-7.
3. Kumar A., "Thermal Engineering", Narosa Publishing House, ISBN 97-88-1731-95281

Reference Books

1. Kothanaraman C. P., Khajuria P. P., Arora S. and Domkundawars, "A course in Thermodynamics and heat engines Thermal engineering with solar energy", 3ed., Dhanpat rai & sons, 1989.
2. Modi P. N. and Seth S. M, "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 1987.
3. Deshpande V. M., "Hydraulics Machinery Textbook of Fluid Machinery", Everest Publication, 1998.
4. Khurmi R. S. and Gupta J. K., "Textbook of Refrigeration and Air Conditioning", S. Chand and Co.

211081 Strength Analysis of Machine Elements

Teaching scheme | **Examination scheme**
Lectures: 4 hours/week | Theory: 100 marks

Unit I **(8)**

Simple stresses and strains: Basic Concept

Concept of stress and strain (linear, lateral. shear and volumetric), Hooke's law, Poisson's ratio, modulus of elasticity, modulus of rigidity, stress strain diagrams for ductile and brittle materials, factor; of safety, working stress, generalized Hooke's law, concept of 3-D stress state, bulk modulus, interrelation between elastic constants**.**

Unit II **(8)**

Axially Loaded Components

Axial force diagram, stresses, strains, strains & deformations in determinate and indeterminate, homogenous and composite bars under concentrated loads, self weight and temperature changes.

Transversely Loaded Components

Shear Force and Bending Moment in Determinate Beams due to Concentrated Loads, Uniformly Distributed Loads. Relation between SF and BM Diagrams for Cantilevers, Simple and Compound Beams, Bends Defining Critical and Maximum Values and Positions of Points of Contra Flexure- Construction of Loading Diagram and BMD from SFD and Construction of Loading Diagram and SFD from BMD.

Unit III **(8)**

Bending stresses

Theory of simple bending, assumptions, derivation of flexure formula, second moment of area of common cross sections with respect to centroidal and parallel axes. bending stress.

Shear stresses:

Concept, derivation of shear stress distribution formula, shear stress distribution diagram for common symmetrical sections, maximum and average shear stress, shear connection between flange and web.

Unit IV **(8)**

Transformation of Stresses and Strains

Normal and shear stresses on any oblique plane. Concept of principal planes. Derivation of expressions for principal stresses and maximum shear stress, position of principal planes and planes of maximum shear, graphical solution using Mohr’s circle of stresses.

Strain energy and impact

Concept of strain energy, derivation and use of expressions for deformations of axially loaded members under gradual impact loads. Strain energy due to self-weight.

Unit V **(8)**

Torsion of circular shafts:

Stresses, strains and deformations in determinate and indeterminate shafts of solid and hollow homogeneous and composite circular cross section subjected to twisting moment. Derivation of torsion equation. Stresses due to combined torsion, bending and axial force on shafts.

Unit VI **(8)**

Slope and deflection of Beams:

Relation between BM and slope, slope and deflection of determinate beams, Double Integration Method (Macaulay's Method). Derivation of Formulae for Slope and Deflection for Standard Cases.

Buckling

Concept of buckling of columns. Derivation of Euler's formula for buckling load for column with hinged ends. Concept of equivalent length for various end conditions. Limitations of Euler's formula. Rankin's formula. Johnson's formula, safe load on columns.

Text Books

1. Beer F. P., Johnston E. R and Dewolf J. T., "Mechanics of Materials", McGraw Hill Higher Education, 5th edition, 2004, ISBN 978-007 3529 387.
2. Junnarkar and Shah H J., "Mechanics of Structures", Charotar Press, 2002, ISBN 81-85594-06-6.
3. Ramamrutham S. and Narayan R., "Strength of Materials", Dhanapat Rai and sons, 1992.
4. Rajput R. K., "Strength of Materials", S. Chand Publication.
5. Shah V. L., "Strength of Materials", Structural Publisher Pune.

Reference Books

1. Gere J. M. and Timoshenko S. P., "Mechanics of Material", 4th Edition, PWS Pub. Co, 2001, ISBN 978-0534934293.
2. Popov E. P., "Engineering Mechanics of Solids", Prentice Hall of India LTD, New Delhi, 2008.
3. Singer and Pytel, "Strength of Materials", Addison Wesley Publishing Corporation, 1999, ISBN 0 321 04541 6.
4. Timoshenko S P. and Young D. N., "Strength of Materials", Affilated East-West Press PVT. LTD. New Delhi, 2006.
5. Ryder G. H., "Strength of Material", English Language Book Society , New Delhi,2006

211082 Machine Tool Operations

Teaching Scheme	Examination Scheme
Lectures-4hrs/Week	Theory-100 marks
Practical-2hrs/Week	Oral -50 marks

Unit I **(8)**

Lathes

Classification, Specification, lathe parts, bed, headstock, tailstock, lathe accessories and attachments, lathe operations, taper turning methods, thread mechanism, back geared, tumbler geared, all geared headstock, Capstan & turret lathe, comparison, Machining time calculations, Introduction to CNC lathe.

Unit II **(8)**

Drilling, Boring and Reaming

Classification, specification, sensitive, radial, gang, multi-spindle, spindle and drill head assembly, types of drills, twist drill nomenclature, reamer, types of reamer, taps, cutting parameters, tool holding devices. Classification of boring machines, specifications, types boring tools, various operations performed, Machining time calculations, Introduction to jig boring.

Unit III **(8)**

Milling Machines

Classification, specification, Column and knee type milling machine, milling operations, standard milling cutters, geometry of milling cutter, attachments, universal dividing head, methods of indexing, gear train calculations, machining time calculations, Introduction to CNC milling.

Unit IV **(8)**

Shaper, Planer, Slotter and Broaching Machines

Standard parts of shaper, planner, slotter and broaching machine, specification, Crank and slotted link mechanism, hydraulic shaper mechanisms, auto feed mechanism, open and cross belt drive mechanism for planner, operations, Types of broaching machine, specification, broach geometry, machining time calculations.

Unit V **(8)**

Grinding Machine

Classification, Abrasives, bonds, grit, grade, structure of grinding wheels, wheel shape and sizes, standard marking system, dressing & truing, glazing, loading, mounting and balancing of grinding wheels, Selection of grinding wheels. Grinding operations, machining time calculations.

Unit VI **(8)**

Surface finishing processes and coating

Super finishing processes, honing, lapping, buffing, polishing, tumbling, electroplating, galvanizing, metal spraying, and burnishing. Hot dipping, Study of process parameters of above processes.

Term-Work:

Term wok should contain at least six assignments on following topics:

1. Lathe: - Back gear, All Gear, Apron, Thread cutting Mechanisms.
2. Milling: - Machine parts, motions, Indexing mechanism, Cam milling.
3. Drilling: -Types of drill machines, Tool Holder, Floating holders.
4. Study of Shaper, Planer, Slotting: -Quick Return mechanisms, Crank and slotted link mechanism, Open and cross belt mechanism.
5. Study of Grinding machines: - Types, Selection of grinding wheels.
6. Study of cutting tools: - Single point cutting tools, Drills, Reamers, Broaches, Taps, Milling Cutters, Grinding wheels.
7. Industrial visits & report based on it.
8. Demonstration & video display of various operations carried out of advanced machine tools & report based on it.

Oral shall be based on the above term-work.

Text Books

1. Hajara Choudhuri, Bose S. K., "Elements of Workshop Technology", Vol I, II, Asia Publishing House, 2002.
2. Rao P. N., "Manufacturing Technology & Foundry, Forming & Welding", Vol I, II, Tata McGraw Hill Publishing Co., 2004, ISBN – 0 07 451863 1.

Reference Books

1. Jain R.K., "Production Technology", Khanna Publishers, 2008, ISBN 81-7409-099-1.
2. Sharma P.C., "A Text Book of Production Technology- Manufacturing Processes", S. Chand & Co., 2008, ISBN 81-219-111-4-1
3. Chapman W .A. J., "Workshop Technology" Vol. I, II & III, Edward Arnold Publishers, 1998, ISBN – 0 7131 3287 6
4. HMT, "Production Technology", Tata McGraw Hill Publishing Co., 1980.
5. Degarmo, Black and Kosherth, "Materials & Processes in manufacturing", 8th Edition, Prentice Hall of India Ltd, Delhi, 2002.
6. Raghuwanshi B. S., "A course in Workshop Technology", Vol. I, II, Dhanpat Rai & Co.
7. Machine manuals of reputed manufacturers of machine tool.

211083 Material Science

Teaching Scheme	Examination Scheme
Lectures: 4 Hrs/Week	Theory: 100 Marks
Practical: 2 Hrs/Week	Term Work: 50 Marks

Unit I **(8)**

Introduction

Classification of Engineering Materials, Structures and their property relationship in relation to engineering materials, indexing of planes and directions. Plastic deformation - Mechanisms. Deformation of Single crystal and Polycrystalline materials. Numerical based on it. Imperfections in crystals. Dislocations, work hardening. Cold and Hot working of metals. Numericals based on plastic deformation, future trends in new materials & applications.

Unit II **(10)**

Material Testing:

(a) Destructive Testing

Engineering and True Stress - True strain curves, conversion Relationships, Evaluation of properties. Numericals based on Tension Test. Engineering stress - Strain curves of different materials. Compression Test, Cupping Test on Sheet metal, Hardness Tests – Brinell, Poldi, Vickers, Rockwell Shore scleroscope, Durometer, Moh's test, Microhardness test and hardness conversions. Impact tests, Fatigue and Creep tests. Shear and Bend Test, Torsion Test.

(b) Non-destructive tests

Visual Inspection, Magna flux test Dye penetrant test, Sonic and Ultrasonic test, Radiography. Examples of selection of NDT & mechanical testing methods for selected components like crankshafts,. gears, razor blades, welded joints, steel and cast iron castings, rolled products, forged products.

Unit III **(8)**

Equilibrium diagrams

Related terms and definitions Hume Rothery's rule of solid solubility. Gibb's phase rule. Polymorphism, Solidification, Dendritic growth. Cooling curves, plotting of equilibrium diagrams, Lever rule, Isomorphous system. Coring. Eutectic systems, Partial eutectic systems. Uses of eutectic alloys. Layer type system, other transformation, non-equilibrium cooling and its effects

Unit IV **(8)**

Strengthening Mechanisms

Refinement of grain size, Solid solution hardening, Dispersion hardening, Age hardening, Martensitic transformation, Composite materials etc.

Pyrometry

Principle, Operation and uses of various pyrometers like thermocouples Resistance pyrometer, Disappearing filament pyrometer, Total radiation pyrometer.

Unit V **(8)**

Methods of Surface Improvements and Corrosion Prevention

Corrosion Prevention Methods: Design and material selection, atmosphere control, electroplating, Inhibitors, Cathodic and anodic protection, Coatings etc. Introduction to surface modification techniques such as Electro deposition, Diffusion coatings, Vapor deposition Thermal Spray Coatings, Ion implantation etc.

Unit VI **(8)**

Powder Metallurgy

Process in brief, powder characteristics, powder manufacturing, Production of sintered structural components such as self lubricated bearing, cemented carbide tools, cermets, refractory metals, electrical contact materials, friction materials, Diamond impregnated tools etc

Term Work: Term work shall consist of following experiments.

List of Experiments:

1) Tensile test on mild steel and aluminum test pieces.
2) Compression test on cast iron and brass test pieces.
3) Brinell hardness test on different materials.
4) Poldi hardness test on different materials.
5) Vickers hardness test on different materials
6) Rockwell and Rockwell superficial test on different materials with different Scales.
7) Izod and Charpy impact tests.
8) Erichsen cupping test on minimum three different sheet metal samples.
9) Non- destructive testing - Magnaflux testing, Dye penetrant test, ultrasonic testing, eddy current testing

Text Books

1. Kodgire V. D., "Material Science and Metallurgy for Engineers", Everest Publishing House, Pune, 2008, ISBN 81-86314-00-8.
2. Smith W.F., "Principles of Material Science and Engineering", McGraw Hill Book Co., 2002.
3. Shigley J. E., "Applied Mechanics of Materials", McGraw Hill Book Company, 1985.

Reference Books

1. Davis H. E., Troxell G.E. and Wiskocil C. T., "Testing of Engineering Materials", McGraw Hill Book Co.
2. Van Vlack L.H., "Elements of Material Science", Addison- Wesley Publishing Co., 1998.
3. Baldev Raj, Jayakumar T. and M. Thavsimuthu, "Practical Non-Destructive Testing", Narosa Publishing House. Delhi, 1999.
4. Hull and T. W. Clyne, "An introduction to Composite Materials", Second Edition Cambridge Solid State Science Series.
5. "Structure and Properties of Materials II", Willey Eastern (P) Ltd.
6. Murthy, "Structure and properties engineering materials", Tata McGraw Hill 2003.
7. Donald R. Askland, Phule P. P., "Science and engineering of materials", Thomson Learning, 2003.
8. Catalogue of reputed manufacturers

211084 Machine Drawing & Computer Graphics

Teaching Scheme:
Lectures: 2 Hrs/Week
Practical: 2 Hrs/Week

Examination Scheme:
Term Work: 50 Marks
Oral: 50 Marks

Unit-I **(4)**

Conventions in Machine Drawing

Introduction to machine drawing, Dimensioning technique for machine components, Conventional representation of machine components as per IS code: SP-46 such as screw threads, springs, gears, bearing, tapped holes, knurling, splined shafts, tapers, chamfers, countersunk and counter bores, keys, & welded joints,

Surface Roughness

Introduction, terminology**,** machining symbol with all parameters, roughness values (Ra) and roughness grade numbers, indicating surface roughness on drawing.

Unit-II **(4)**

Tolerances & Fits

Definitions applied to tolerances, types of tolerance, types of fits, fit system.
Geometrical tolerances – Nomenclature, tolerance frame, types of geometrical tolerances & their symbols, indicating geometric tolerances on drawing,

Standard Fasteners & Rivets.

Thread terminology, thread forms, thread designations, single and multi-start threads, right and left hand threads, types of screws , bolts and nuts, nut locking arrangements using pins, washers & screws.

Rivets: forms & proportions of rivet heads, types of riveted joints.

Unit-III **(4)**

Assembly & Details of Machine Parts

Introduction to assembly & part drawing ,examples-Revolving Centers, Machine Vice, Tool post, Screw Jack, jigs & fixtures, tailstock, Cotter Joint, Knuckle Joint, Flange Joint, Rigid and Flexible Coupling, Drawing reading. – Title block, part list / bill of material, revision block etc.

Unit IV **(4)**

Basics of computer graphics

Software configurations, functions of graphics package, constructing the geometry, mathematical representation of various graphics elements such as line, circle, rectangle, ellipse, arc, spline etc.

2-D transformations

Geometric transformations, translations, rotation, mirror, concatenations.

Unit V **(4)**

Fundaments of solid modeling

Geometry and topology use of primitives in solid modeling, Basics of Boolean operations, and representations schemes of solids, B-rep and CSG, Development of simple solids.

Unit VI **(4)**

Autolisp programming:

Introduction to Autolisp, data types in Autolisp-integers, Real numbers, strings, Data type conversion, Math functions, logical functions, working with list and entities, filtering from lists,

entity handling, list operators, string functions, branching and looping, introduction to visual lisp. Parametric programming.

Term Work:

The term work shall consist of sketches following drawn in the sketchbook.

Sketches of conventional representation of machine components as per IS code: SP 46 such as screw threads, tapped holes, holes on circular pitch, bearing, knurling, splined shafts, springs, gears, tapers, chamfers, countersunk and counter bores, keys, welded joints, structural sections in the sketch book.

Also the term work shall consist of a computer printouts of following exercises:

1. Printout on Half imperial drawing sheet - Conventional Representation of Machine Components as per IS Code: SP 46 such as Screw Threads, Tapped Holes, Holes on Circular Pitch, Bearing, Knurling, Splined Shafts, Springs, Gears, Tapers, Chamfers, Countersunk And Counter Bores.
2. Printout on Half imperial drawing sheet- Types of Screws, Bolts and Nuts, Nut Locking Arrangements.
3. Printout on Half imperial drawing sheet- Assembly and details of any one of Machine Components -Cotter Joint, Knuckle Joint, Flange Joint, Rigid and Flexible Coupling, Stop Valve, Non Return Valve, Revolving Centers, Machine Vice, Tool Holder.
4. Mathematical representation of any two primitives.
5. 2D transformation of a simple two dimensional component.
6. Development of simple 3D model & Boolean algebra.
7. Any Two Programs on Parametric Programming involving - Programming for Standard Machine Components, Programming involving Decision Making and Looping.

Text Books

1. Gill P. S., “A Text book of Machine Drawing”, Revised Edition K. Kataria and Sons, New Delhi, 2008, ISBN 81-85749-79-5.
2. Farazdak Haideri, “Machine Drawing and Computer Graphics”, Nirali Prakashan, Pune, 1998.
3. William M. Oliver, “Illustrated Autolisp”, BPB Publications, New Delhi, 1997.
4. George Omura, “ABC’s of Autolisp”, BPB Publications, 2002.
5. Bhagat N. K., “Autolisp and Customisation Made Simple”, BPB Publication, 1997, ISBN 81 7029 712 5.
6. Zeid Ibrahim, “Mastering CAD/CAM”, Tata McGraw Hill.
7. Xiang Z. & Roy P., “Computer Graphics”, 2nd Edition, McGraw-Hill International Edition, 2001, ISBN 0-07-118885-1.
8. Groover M. P., “Automation Production Systems & Computer Integrated Manufacturing”, Prentice Hall of India, 1999, ISBN 81-203-0618-X.

Reference Books

1. Narayana K. L., Kannaiah P., Venkatata Readdy K., “Machine Drawing”, 2nd Edition, New age international Publishers, Delhi, 2008, ISBN 81-224-1917-8.
2. Bhat N. D., Panchal , “Machine Drawing”, Charotar Pub. House, 2000.
3. Auto LISP Reference Manual”.
4. John Hood D., “Using AutoCAD with Auto LISP", McGraw Hill Book Company 1990.

203050 Electrical Technology

Teaching Scheme:	**Examination Scheme:**
Lectures: 4 Hrs/week	Theory: 100 Marks
Practical: 2 Hrs/week	Term work: 25 Marks

Unit I **(8)**

a) Electrical Power Measurement: Measurement of active power in three phase balanced loads by using one wattmeter & two wattmeter, Concept of reactive power using two wattmeter, effect of power factor on wattmeter readings.

b) Electrical Energy Measurement: Single Phase and three phase energy meter, construction and Working. Use of CT & PT for measurement of Power / Energy in single phase and three phase system (Theoretical Treatment only). Standard specifications of single and three phase energy meter, CT & PT for LT & HT measurements.

c) Tariff: Introduction, objectives & Details of H.T. and L.T tariff, TOD tariff, advantages and improvement of power factor (Theoretical Treatment only)

d) Illumination: Various terms related to illumination, types and requirement good lighting scheme, special purpose lighting.

Unit II **(8)**

a) Single phase transformer:Types, KVA rating, approximate equivalent circuit, voltage regulation and efficiency of transformer, condition for maximum efficiency.

b) Three phase transformers: Types of transformer connection (star/star, star/delta, delta/star, and delta/delta) and applications based on connections. (Theoretical Treatment only) Introduction of power transformer, distribution transformer, study of typical distribution transformer substation, specifications of transformer (KVA rating, voltage ratio, current rating)

c) Three phase Induction Motor: Constructional feature, working principle of three phase induction motors, types; torque equation, torque slip characteristics; power stages; efficiency; types of starters; methods of speed control, Industrial applications.

Unit III **(6)**

a) **Single phase induction motors:** Types, construction, working principle of split phase and shaded pole type induction motors, applications. Specifications of induction motors (KW rating, rated voltage, current rating, frequency, speed, class of insulation)

b) **Synchronous Generator**: Constructional features, (Salient and non- salient),working principle, e m f equation, synchronous speed of an alternator, concept of synchronous reactance and impedance, phasor diagram of loaded alternator, voltage regulation of alternator by direct loading method and synchronous impedance method. Specifications of synchronous generator

Unit IV **(6)**

D.C. Machines

Construction, working principle of D.C. generator, emf equation of D C generator. (Theoretical concept only).

Working principle of D.C. motor. Types of D. C. motor, back emf , torque equation for D.C. motor, characteristics of D. C. motor (series, shunt and compound), starters of D.C. shunt and series motor, methods for speed control of D.C shunt and series motors, Industrial applications.

Special purpose motors: Construction, working principle, characteristic and applications of stepper motors, A.C. and D.C servomotors, universal motors.

Unit V **(8)**

Semiconductor power devices:

SCR: Construction detail, V-I Characteristics, Methods to turn ON, switching action during ON & OFF, specification, Concept of commutation of SCR. applications

DIAC: Construction, V-I Characteristics

TRIAC: Construction, V-I Characteristics, turning ON process.

MOSFET: Construction, transfer Characteristics, output characteristics, Methods to turn ON & OFF, applications

IGBT:- Construction detail, transfer Characteristics, output characteristics, Methods to turn ON & OFF, applications.

GTO: Construction, working, advantages and disadvantages

Unit VI **(8)**

Drives: Advantages of Electrical Drives, Individual & Group drives, selection of drives depending on load characteristics.

Speed Control: Single phase full converter fed D.C. Drives, Three phase converter fed D.C. Drives, Chopper Drives, two quadrant & four quadrant chopper drives, stator voltage control of three phase induction motor, frequency control of three phase induction motor, V/F control of three phase induction motor.

Term Work:

A term work shall consist of a record of eight practical of the following:

(Experiment no. 9 & 10 are compulsory, 6 experiments out of expt. No 1 to 8).

1. Speed control of a D. C. shunt motor by armature voltage and flux control methods.
2. Load test on a D. C. shunt motor.
3. Load test on a D. C. series motor.
4. Measurement of active power in a three phase balanced inductive load using two wattmeter method.
5. Regulation of an alternator by synchronous impedance method.
6. Regulation of an alternator by direct loading method.
7. Load test on a three phase induction motor.
8. Study of a) D.C. motor starters, b) three phase induction motor starter.
9. Study of V-I characteristics of SCR & TRAIC
10. Study of a distribution transformer substation and HT/LT energy bill.

Text Books

1. Harold G, “Electrical Machinery Transformers and Controls”, Prentice Hall Publication
2. Theodore Wildi, “Electrical Machine Drives and Power Systems”, Pearson Education Asia, 2004, ISBN 81 7808 972 6.
3. Bhag S., Guru and Hussein R. Hiziroglu, “Electrical Machinery and Transformers”, Oxford University Press, 2007, ISBN 0-19-5685-77-6.
4. Dr. Bhimbra P. S., “Power Electronics”, Khanna Publication.
5. Pratap H., “Art & Science of utilization of Electrical Energy”, 3rd Edition, Dhanpat Rai & Sons.
6. Theraja B. L., “Electrical Technology”, S. Chand Publication Co. Ltd.
7. Rao P. V., “Power Semiconductor Drives”, BS Publication, Hyderabad.

Reference Books

1. Bhattacharya S. K., “Electrical Machines”, TATA McGraw Hill LTD, New Delhi, 2003, ISBN 0-07-463310 4.
2. Hughes E. and Smith I., “Electrical and Electronics Technology”, Pearson Education Asia, New Delhi, 2008, ISBN 81 317 1468.
3. Syed A. Nasar, “Electrical Machine Drives and Power Systems”, Vol. I, Pearson Education Asia, ISBN 81 7808 9726.
4. Veinott C. G. and Martits J. E., “Fractional and sub fractional Horse power Electrical Motors”, McGraw Hill Inc.US; 3rd Edition, 1993, ISBN 978-0070673908.
5. Siemens, “Electrical Engineering Handbook”, Wiley Eastern LTD, 1986.
6. Kothari D. P. and Nagrath I. J., “Electrical Machines”, 3rd edition, Tata McGraw Hill.

211086 Theory of Machines

Teaching scheme	**Examination Scheme**
Theory: 4 hrs/week	Theory: 100 marks
Practical: 2 hrs/week	Oral: 50 Marks

Unit I **(8)**

Basics : Kinematic Link ,Types of links, Difference between machines, mechanism and structure, Kinematics pair, Types of constrained motion, Classification of Kinematics pairs, Kinematics chain, Degrees of freedom of mechanisms, Kutzbach and Grubler criterion, Equivalent linkage concept, Inversion of mechanism

Mechanisms: Straight line mechanisms- Exact straight line and approximate straight line type, Steering gear mechanisms -Davis and Ackerman type.

Unit II **(10)**

Kinematic Analysis of Mechanisms: (Velocity Analysis)

Concept of position, displacement and velocity of a point and link of a given mechanism, Kinematic analysis of mechanisms by -- Relative velocity method, graphical method, analytical method, Instantaneous Center method, (Numerical treatment expected)

Kinematic Analysis of Mechanisms: (Acceleration Analysis)

Concept of acceleration of a point and link of a given mechanism, Kinematic analysis of mechanisms by -- Relative velocity method, graphical method, analytical method, Coriolis Component of Acceleration, Klein's construction (Numerical treatment expected)

Unit III **(8)**

Friction and Wear: Laws of friction, Types of friction, mechanism of friction, friction analysis, types of wear, mechanism of wear, wear equation, factors responsible wear and friction, methods of reducing wear, lubrication and its mode, lubrication technique, tribology in metal cutting and working.

Unit IV **(8)**

Belt Drives : Types of belt drives, Types, Materials used for Belt. Velocity Ratio, Slip, Creep of belt. Length of an open and cross belt drive, Maximum power transmitted, Tension ratio, maximum tension in a belt, Advantage and disadvantages of a V-Belt Drive, Ratio of Driving Tension for V-Belt.

Unit V **(8)**

Brakes: - Types of brakes, Force analysis of brakes, external and internal expanding shoe brakes, block brakes, band brakes, block and band brakes, Breaking torque. (Numerical treatment expected)

Dynamometer: - Different types of Absorption and transmission dynamometers.

UnitVI **(6)**

Static force analysis of slider-crank mechanism, Theory of compound pendulum, Bifilar and Trifler suspension methods, dynamically equivalent two mass systems, correction couple, Dynamic force analysis of slider crank mechanism (Analytical and Graphical method)

Term Work

1) Study of Straight line mechanisms
2) Velocity analysis of mechanism by Relative velocity, Klein's construction and ICR method.
3) Acceleration analysis of mechanism by Relative velocity and acceleration (coriolis component),Klein's construction method
4) Study of friction and wear of materials
5) Study of belt drives.
6) Study of different types of brakes and dynamometer
7) Determine mass MI of rigid body using bifilar and trifler suspension method.
8) Determine radius of gyration & mass MI of rigid body using compound pendulum method

Text Books

1. Ballaney P. L., "Theory of Machines and Mechanisms", Khanna Publisher Delhi, 1999.
2. Rattan S.S**.,** "Theory of Machines", 2ed**.,** Tata McGraw-hill publishing, 2005, ISBN 0-07-059120-2
3. Ghosh Amitabh and Malik Ashok Kumar, "Theory of mechanisms and Machines", 3ed, Affiliated East West press, 2000, ISBN 81-85938-93-8.

Reference Books

1. Shigley Joseph Edward and Vicker John Joseph**.** "Theory of Machines and Mechanisms"**,** 3ed., 1995, Oxford University Press. ISBN 0-19-515598-x
2. Thomas Bevan, "Theory of machines", CBS publishers and Distributors, 1984.

211087 Welding & Foundry

Teaching Scheme	**Examination Scheme**
Lectures: 4 hrs /week	Theory: 100 Marks
Practical: 2 hrs/week	Oral 50: Marks

Unit I **(8)**

Introduction & classification of welding processes, Basic electrical – Electrodes – coding of electrodes – Electrode efficiency, Welding symbol. Physics of welding – arc structure, characteristics and power – chemical heat source- contact resistance heat source- heat flow characteristics- cooling of weld.

Arc welding processes- carbon arc, submerged arc, Tungsten inert gas (TIG), Metal Inert gas (MIG), Plasma arc, stud welding- Theory, comparison on merits, limitations and applications. Fluxes used in arc welding.

Unit II **(8)**

GAS welding: - processes and equipment used, type of flames, adjustment of flames, oxyacetylene welding, gas cutting –merits, limitations and applications.

Electric resistance welding- processes and equipment used, spot, seam, projection, butt, percussion welding, resistance tube welding, - merits, limitations and applications.

Unit III **(8)**

Pressure welding, diffusion welding, ultrasonic, friction, explosive, forge, thermit welding, laser, electron beam welding- equipment used- merits, limitations and applications of above processes. Brazing, braze welding and soldering processes.

Inspection and testing of welding:- visual inspection, destructive & non-destructive testing. Estimation of welding cost. Protection and safety in welding.

Unit IV **(8)**

Sand casting processes

Principles of casting, steps involved in casting, Introduction of sand casting. Patterns, Pattern materials, pattern allowances and design. Core prints and core seats.

Mould strength, Ingredients of molding materials and their effect on mould strength- testing of mould strength, testing of molding sand.

Melting and pouring of metals:- melting furnace- types, Cupola, electric arc furnace, Induction furnace- Construction, operations and zones, cleaning, finishing of casting.

Unit V **(8)**

Special casting processes

Pressure and gravity die casting (hot and cold chamber), shell molding, centrifugal casting, continuous casting, investment casting, - their typical applications, merits and limitations.

Casting defects- defects, Inspection- analysis of casting defects- Quality control.

Foundry mechanization and automation.

Unit VI **(8)**

Casting Design

Metal pouring, Gating system- design of gating system, solidification time, riser design, Principles of gating, risering and their design methods. Progressive and directional

solidification, casting design consideration, Chvornov's rule, numericals on casting, defects in casting.
Fluidity- method of measuring fluidity of metal by spiral technique.
Computer applications in casting design and software.

Term work should contain at least eight assignments/ practical out of followings.

1. To find out grain fineness number by using sand sieve shaker test.
2. Permeability testing of green sand.
3. Green compression test for molding sand.
4. Fluidity testing of any metal using fluidity spiral.
5. Study of TIG/MIG welding process parameters for ferrous and nonferrous metals.
6. Tensile test on a welded specimen.
7. Impact test on a welded specimen.
8. Non-destructive test on a weldment- Dye penetrant test.
9. Non-destructive test on a weldment- Magnaflux test.
10. An Industrial visit to any foundry.

Oral will be based on above assignment/ Practical.

Text Books

1. Rao P.N**.,** "Manufacturing Technology, Foundry, Forming and welding"**,** 2ed., Tata McGraw-hill publishing, 2006, ISBN 0-07-463180-2.
2. Khanna O.P., "Welding Technology", Dhanpat Rai & sons, 1996.
3. Khanna O.P**.,** "Foundry Technology", Dhanpat Rai & sons, 1999.
4. Parmar R.S., "Welding Process and Technology", 2ed., Khanna Publishers, 1997.

Reference Books

1. Kalpakjian Serope and Schmid Steven, "Manufacturing Engineering & Technology", 2004.
2. Degarmo E.P. and Black J.T**.,** "Materials & Processes in Manufacturing", 9ed**.,** Printice hall of India pvt. Ltd., 2002.
3. Little Richard., "Welding & welding Technology",Tata Mcgraw hill Publishing, 1992, ISBN 0-07-099409-9.

211088 Design Of Machine Elements

Teaching scheme	**Examination Scheme**
Lectures: 4 hrs/week	Theory: 100 marks
Practical: 2 hrs/week	Term Work: 50 Marks

Unit I **(8)**

Design Process :-Machine Design, Traditional design methods, Basic procedure of Machine Design, Requisites of design engineer, Design of machine elements, Sources of design data, Use of standards in design, Selection of preferred sizes.

Simple stresses: - Tension, compression, bending and torsion, combined effect of different stresses.

Theories of Failures :- Maximum principal Stress Theory, Maximum shear stress theory, Maximum principal strain Theory, Maximum strain energy Theory, Maximum Distortion energy Theory

Design of Simple Machine Parts: - Factor of safety, Service factor, Design of simple machine parts-Cotter joint, Knuckle joint, lever and Stresses in curved beams (for circular cross-section only).

Unit II **(8)**

Shafts : Design considerations in Transmission shafts with spur gear and pulley , splined shafts, Shaft design on strength basis, Shaft design on torsional rigidity basis, A.S.M.E. code for shaft design,

Keys: Classification of keys, Design considerations in parallel and tapered sunk keys, Design of square, flat and Kennedy keys, Splines.

Couplings: Design considerations, Classification, Design of Rigid, Muff coupling, Flange coupling and Flexible bushed pin coupling.

Unit III **(10)**

Threaded Joints: Bolts under tension, Design of bolts and turn buckle. Eccentrically loaded bolted joint in shear, Eccentric load perpendicular to axis of bolt, Eccentric load on circular base, Torque requirement for bolt tightening,

Welded Joints : Stresses in butt and fillet welds, Strength of butt welds, parallel and transverse fillet welds, Axially loaded unsymmetrical welded joint, Eccentric load in plane of welds, Welded joint subjected to bending and torsional moments

Unit IV **(6)**

Power Screws: Types of screw threads, multiple threaded screws, Torque analysis with square and trapezoidal threads, Self-locking screw, Collar friction torque, Stresses in power screws, design of screw and nut, design of Screw jack.

Unit V **(8)**

Mechanical Springs :Types, Applications and materials of springs, Stress and deflection equations for helical springs, Types of ends, Design of helical compression and tension springs, Springs in series and parallel, Concentric helical springs, Helical torsion spring, surge in spring, Multi-leaf spring.

Unit VI **(8)**

Aesthetic and ergonomic considerations in design of products:-

Basic types of product forms , Designing for appearance – Shape, features, materials and finishes, proportions symmetry, contrast etc. Morgan's colour code. Ergonomic considerations - Relation between Man, machine and environmental factors. Design of displays and controls. Practical examples of products or equipments using ergonomic and aesthetic design principles.

Design for manufacture:-

General principles of design for manufacture and assembly (DFM & DMFA). Principles of design of castings and forgings, Design for machining, Design for powder metallurgy, Design for welding, cost estimation.

Term Work:

1) Term work shall consist of **ONE** design projects. Design project shall consist of two imperial size sheets –one involving assembly drawing with a part list and overall dimensions and other sheet involving drawings of individual components. Manufacturing tolerances, surface finish symbols and geometric tolerances should be specified so as to make it working drawing. A design report giving all necessary calculations of the design of components and assembly should be submitted in a separate file.
   Design projects should be in the form of 'Design of Mechanical System' comprising of machine elements studied and topics covered in the syllabus. Design data book shall be used wherever necessary to achieve selection of standardized components.
2) Problem based assignment on each unit

Text Books

1. Shigley J. E. and Mischke C. R., "Mechanical Engineering Design", McGraw- Hill publication Co. Ltd., 1989, ISBN 0-07-049462-2.
2. Spotts M. F. and Shoup T. E., "Design of Machine Elements", 8ed., Pearson Education pvt. Ltd., 2008, ISBN 81 -7758- 4219.
3. Bhandari V.B., "Design of Machine Elements", Tata Mcgraw-hill publishing, 1984, ISBN 0-07-0611416
4. Kannaiah, "Machine Design", Scitech publications Pvt. Ltd., 2003, ISBN 81-88429-10-4.
5. PSG, "Design Data", M/S DPV Printers, 1984.

Reference Books

1. Orthewein and William C. Orthewein, "Machine Component Design".
2. Robert C. Juvinall, "Fundamentals of Machine Component Design", 1999.
3. "PSG Design data**",** M/S DPV printers, Coimbatore, 2000.
4. Black paul H.and Adams O. Eugene**,** "Machine Design", 3ed., McGraw-hill Book Company, 1999, ISBN 0–07-085037-2.
6. Hall Allens, Holowenko Alfred R., Laughlin Herman G., "Theory & Problems of Machine Design"**,** McGraw-hill Book Company, 2000, ISBN 48333-7.

211089 Industrial Organization & Management

Teaching scheme	**Examination Scheme**
Theory: 4 hrs/week	Theory: 100 marks

Unit I **(8)**

Evolution of Management Practices: Characteristics, objectives Functions, Principles and Types of Management., Scientific Management-Contribution of F. W. Taylor, Henry Fayol and Indian contributors to the Management thought.

Organization :Definition, Principles, Function and Types of organization structure, Different forms of Business—Proprietor, Partnership Firm, Private & Public limited company, Cooperative, Private & Public Trusts.

Unit II **(8)**

Motivation :Human Needs and Types of Motivation, Theories of Motivations-Maslow's theory, McGregor's Theory of X and Theory of Y, Herzberg's Theory of two factor, David C.McCelland's Theory of Achievement, Expectance/valence Theory of Victor Vroom, Porter & Lawler's Model.

Group dynamics: Types, characteristics, objectives of Group Dynamics

Leadership: Definition, styles & functions of leadership, qualities for good leadership, role of the leader, Theories of leadership, Managerial grid.

Unit III **(8)**

Entrepreneurship development: Characteristics of successful entrepreneurs, communications skill, problem solving skill and process, Basic element of Business plans, Sources of finance, Selection of Business location, Record keeping system, Analysis financial performance, Break even analysis, Technology and Business, Strategies for Business Growth

Unit IV **(8)**

Marketing Management: Marketing Function, Marketing Management Process and Marketing planning, Market Research, Consumer Behavior, Product Life Cycle, Product, Product Lines and Brands, Physical Distribution Channels, Sales Promotion & advertising programs.

Unit V **(8)**

Human Resource Management: Definition, Objective of Human Resource Management, Characteristics, Functions/Scope, Principles of Human Resource Management, and Manpower Planning –factors Affecting Manpower Planning, Steps in Manpower Planning, recruitment and selection procedure of Manpower.

Training and Development of Manpower: Need of Training, Benefits of Training, Method of Training Workers, Foreman or Supervisory Training, Executive/Managers Training and Development, learning curves and classifications.

Unit VI **(8)**

Industrial relations:

Wages and Incentives: Concept of wages, factors affecting wages, Types of wage plans. Job Analysis, Job Evaluation and Merit Rating, Trade unionism in India.

Industrial Act/legislations: The Indian Factories Act, 1948, The Industrial Dispute Act-1947.Payment of wages act-1936, The Energy Conservation Act (preamble applicability and definitions of all these Acts).

Industrial safety: Provisions under the Factories Act 1948, Problems of industrial accidents and the causes of accidents, cost of safety, safety programs and personal protective devices.

Text Books

1. Khanna O. P., "Industrial Engineering and Management", Dhanpat Rai and sons, 2007.
2. Banga T. R. and Sharma S. C., "Industrial Organization & Engineering economics", 23ed**.,** Khanna Publishers, 2001, ISBN 81-7409-078-9.
3. Mahajan M., "Industrial Engineering and Production Management" Dhanpat rai and Sons Publishers, 2005, ISBN-81-7700-047-0
4. Chabra T. N., "Principles & Practices of Management", Dhanpat lal & compony

Reference Books

1. Koontz Harold and Weihrich Heinz, "Essentials of management", 7ed, Tata McGraw - Hill publishing, 2008, ISBN 0-07-0623030-x.
2. Luthans f**.,** "Organizational Behaviour", McGraw-Hill Company, 2008, ISBN 81-317-05021.
3. Kotler Philip & Keller K.L., "Marketing Management.", Dorling Kindersley pvt.Ltd., 2008, ISBN-978-81-317-1683-0
4. Cynthia L.Greene , "Entrepreneurship: Ideas In Action", Thomson, ISBN-981-243-257-1.
5. Mamoria C.B. and Gankar S.V., "Personnel Management", Himalaya Publishing House, 2003.

211090: Workshop Practice

Teaching scheme	**Examination Scheme**
Practical: 2 hrs/week	Term Work: 50 Marks

Each candidate shall be required to complete and submit the following Term Work

Jobs

1. Plain & taper turning (one job) and Gear Cutting (one job)
2. Forging and grinding of lathe tool with one knife and other Vee end (one job).
3. Making simple solid pattern involving wood turning (one job)
4. Gas welding / Arc welding (one job)