

SE (Production- Sandwich) 2008 Course structure

Semester- I

Subject Code No.	Subject	Teaching Scheme (Hrs)		Examination Scheme				
		Lecture	Pr./Dwg	Theory	TW	Oral	Pr.	Total
207002*	Engineering Mathematics III	4	-	100	-	-	-	100
202085*	Heat & Fluid Engineering	4	2	100	50	-	-	150
211081*	Strength Analysis of Machine Elements	4	-	100	-	-	-	100
211121	Manufacturing Processes	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	200	50	-	750

Total of Part I = 750 Marks

Semester II

Subject Code No.	Subject	Teaching Scheme (Hrs)		Examination Scheme				
		Lecture	Pr./Dwg	Theory	TW	Oral	Pr.	Total
203050*	Electrical Technology	4	2	100	50	-	-	150
211086*	Theory of Machines	4	2	100	-	50	-	150
211122	Manufacturing Engineering & Metrology Practices	4	2	100	-	50	-	150
211088*	Design of Machine Element	4	2	100	50	-	-	150
211123	Production & Industrial Management-I	4	-	100	-	-	-	100
211124	Computer Graphics Lab	-	2	-	50	-	-	50
Total		20	10	500	150	100	-	750

Total of Part II = 750 Marks

Total of Part I & Part II = 1500 Marks

Pr- Practical Dwg- Drawing TW- Term Work

Note: Practical/Oral Based On Term Work

- Common to SE (Production/Industrial)

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

Theory: 4 hrs/week

Practical: 2 hrs/week

Examination Scheme

Theory: 100 marks

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, stiochiometric 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

Lectures: 4 hours/week

Examination scheme

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", Affiliated East-West Press PVT. LTD. New Delhi, 2006.
5. Ryder G. H., "Strength of Material", English Language Book Society , New Delhi, 2006

211121 MANUFACTURING PROCESSES

Teaching Scheme:

Lectures: 4 Hrs/ Week

Practical: 2 Hrs/Week

Examination Scheme

Theory: 100 Marks

Term Work: 50 Marks

Unit I

(8)

Pattern Making, Molding and Casting

Sand casting, Pattern types, materials, pattern making allowances. Molding sand types, properties and testing, hand and machine molding processes and equipments, core type and manufacturing. Furnaces- types, cupola, construction, operation, zones and chemistry etc. Gating system. Cleaning and finishing of castings. Defects in casting.

Special molding and casting processes

Shell molding, investment casting, die casting (Hot & Cold chamber), centrifugal casting, and continuous casting.

Unit II

(8)

Hot Working and Cold Working Processes

Principle- Rolling, Forging-drop, press, upset, roll forging. Extrusion, Drawing, Spinning. Effects of hot working.

Cold rolling Swaging. Forging. Extrusion-forward, backward, impact. Roll forming, tube drawing, wire drawing, spinning, shot peening and HERF.

Unit III

(8)

Joining Processes

Arc welding- Theory, SMAW, GTAW, GMAW, FCAW, Submerged arc welding, Stud welding.

Resistance welding-Theory, spot, seam, projection, butt, percussion welding processes.

Gas welding, friction welding, ultrasonic welding, thermit welding, electron beam and laser welding, explosive and plasma welding.

Soldering, brazing and braze welding.

Use of adhesives for joining. Classification of adhesives, types of adhesives, applications, surface preparation and various joints.

Unit IV

(8)

Lathes

Introduction to Lathe, types, construction, specifications, accessories, various mechanisms, various operations such as taper turning, eccentric turning, thread cutting. Concept of Speed, Feed, Depth of cut, process parameters, machining time estimation.

Single point cutting tool geometry.

Unit V

(8)

Milling Machines

Fundamentals of milling processes, milling cutters, operations performed on milling machine. Dividing head, different methods of indexing. Gear train calculations for helical and cam milling. Process parameters, machining time estimation.

Drilling Machines

Fundamentals of drilling processes, Types of drilling machines, operations performed on drilling machine. Tool holders, types of drill, drill geometry, process parameters, machining time estimation. Reaming processes, types of reamers, and geometry. Tap and its geometry.

Unit VI

(8)

Grinding Machines

Abrasives types, grinding wheels, wheel making, marking, selection, mounting, types of grinding machines, grinding faults.

Special grinding machining, Honing, Lapping, Super finishing, Buffing, Burnishing.

Term Work

Term work includes, working/ demonstration on lathe and other machine and writing the journal based on following.

1. Report on industrial visit to any casting/ foundry industry.
2. Study / demonstration of hot/cold working operations.
3. Use of arc welding machine for sample weld.
4. Demonstration on gas welding process.
5. Demonstration on milling machine for gear cutting, use of indexing mechanism with calculations.
6. Performing plane and taper turning of simple job on lathe, preparation of process sheet, selection of tools.
7. Demonstration of operations such as threading, knurling, boring etc on lathe.
8. Carrying out operations on drilling machine. Assignment in journal will include sketch and description of machine, job performed.
9. Assignment on grinding with demonstration on sharpening of single point cutting tool.

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 Koshert, “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.

211083 Material Science

Teaching Scheme

Lectures: 4 Hrs/Week

Practical: 2 Hrs/Week

Examination Scheme

Theory: 100 Marks

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. Asklund, 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)

Fundamentals 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., Kannaiyah 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:

Lectures: 4 Hrs/week

Practical: 2 Hrs/week

Examination Scheme:

Theory: 100 Marks

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 & TRIAC
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. Bhimra 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

Theory: 4 hrs/week
Practical: 2 hrs/week

Examination Scheme

Theory: 100 marks
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.

Unit VI (6)

Static force analysis of slider-crank mechanism, Theory of compound pendulum, Bifilar and Trifilar 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.

211122 MANUFACTURING ENGINEERING & METROLOGY PRACTICES

Teaching Scheme

Lectures: 4 Hrs/ Week

Practical: 2 Hrs/Week

Examination Scheme

Theory: 100 Marks

Oral : 50 Marks

Unit I**(8)****Theory of Metal Cutting**

Cutting tools, tool geometry, concept of speed, feed, depth of cut and cutting action and effect of these on cutting forces. Types of chips, Merchant's circle of forces. Estimation of cutting forces, machinability. Tool life for minimum cost and maximum production. Cutting fluids.

New technology in metal cutting for higher productivity. Measurement of cutting forces and power required.

Design of Cutting Tools – Single point cutting tool, drill,

Unit II**(8)****Production Machines**

Turret and capstan lathe, automatic and semiautomatic lathe, single & multi spindle automats, setup, tool layout, operation sheet, cam layout, for single spindle automats, concept of transfer lines. Planning, Shaping & Slotting machines.

Unit III**(8)****Broaching**

Types of broaching machines. Parts of the machines and their functions. Components machined on broaching machine. Broach geometry.

Gear Manufacturing

Gear cutting processes- Gear hobbing, Gear shaping, Gear shaving, Gear lapping and gear grinding. Construction and working of the machines.

Thread Manufacturing

Thread cutting, chasers and dies. Thread milling, thread rolling, thread lapping and thread grinding

Unit IV**(8)****Introduction to NC, CNC Machines**

Introduction to NC, CNC machines, machining centers-Principles, working, advantages and applications. Parts programming.

Introduction to FMS.

Unit V**(8)****Sheet Metal Working**

Study of various press tools and presses. Study of Piercing, Notching, Forming, Coining, Drawing processes. Elements of dies and punch set. Types of dies and punches of different press working operations.

Calculations of clearances, center of pressure, different forces, press tonnage, blank size, number of draws, strip layout, sheet utilization ratio, methods of reducing forces.

Unit VI

(8)

Jigs and Fixtures

Introduction, Definitions, elements, basic principles. Introductions to locators and clamping- basic principles, types. Types of jigs and fixtures.

Design of Jigs & Fixtures, General Guidelines & Procedures for design of jigs & fixtures.

Term Work

Term work consists of following and writing the journal based on the same.

1. Demonstration on chip formation and effect of tool geometry, cutting speed, feed etc. on machining operations.
2. Demonstration of measurement of cutting forces.
3. Demonstration on single spindle automats/ production lathe along with tool layout/cam layout.
4. Preparing part programming & demonstration of same job on CNC lathe.
5. Design and working drawing of drilling jig and milling fixture.
6. Determination of Linear/Angular dimension of a part using precision and non precision measuring instrument.
7. Machine tool alignment test on any one machine like lathe, milling, drilling.
8. Go-NoGo gauge design by Taylor's principle.
9. Measurement of gear tooth thickness by Gear tooth vernier caliper/ constant chord/base tangent method.
10. Study and application of Profile Projector.

- Before conducting the above practicals, teacher should explain the meaning of Metrology, Precision, Accuracy, Errors in measurement, Calibration, Line & End standard.

Text Books

1. Rao P. N., "Manufacturing Technology & Foundry, Forming & Welding", Vol. I, II, Tata McGraw Hill Publishing Co., 2004, ISBN 0-07-451863-1.
2. Sharma P.C., "A Text Book of Production Technology- Manufacturing Processes", S. Chand & Co., 2008, ISBN 81-219-111-4-1

Reference Books

1. Jain R.K., "Production Technology", Khanna Publishers, 2008, ISBN 81-7409-099-1.
2. Chapman W .A. J., "Workshop Technology" Vol. I, II & III, Edward Arnold Publishers, 1998, ISBN – 0 7131 3287 6
3. HMT, "Production Technology", Tata McGraw Hill Publishing Co., 1980.
4. Hoffman E.G., "Jigs & Fixtures Design", Thomson Asia Pvt Ltd., ISBN 981-243- 508-5
5. Raghuwanshi B. S., "A course in Workshop Technology", Vol. I, II, Dhanpat Rai & Co.
6. Hajara Choudhari, Bose S. K., "Elements of Workshop Technology" Vol. II, Asia Publishing House, 2002.
7. Drozda T. J., "Tool Engineering Handbook", ASTM, Vol. I, ISBN 0-87263-085- 4
8. Joshi P. H., "Press Tool Design & Productions", Wheeler Publishing, ISBN 81- 85814-46-5.

211088 Design Of Machine Elements

Teaching scheme

Lectures: 4 hrs/week

Practical: 2 hrs/week

Examination Scheme

Theory: 100 marks

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. Orthwein and William C. Orthwein, “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.

211123 Production & Industrial Management I

Teaching Scheme:

Examination Scheme

Lectures: 4 Hrs/ Week

Theory: 100 Marks

Unit I

(7)

Evolution of Management Practices

Characteristics, Objectives, Functions, Principles & Types of Management, Scientific Management - Contribution of F.W. Taylor & H. Fayol & Others to the Management thoughts.

Organization

Definition, Principles, Functions & Types of Organization.

Group dynamics

Definition, Types, Characteristics, Functions & Objectives, Groups & Group Dynamics. Objectives of Business Enterprise, Concept of Firm & Industry, Different forms of Business Ownership - Proprietor, Partnership Firm, Private & Public Limited Company, Cooperatives, Private & Public Trusts.

Unit II

(8)

Production Management

- The Production function, Operations Concept, Productivity, Objective of Production Management, Elements of Production function.
- Industrial Engineering- History, Development, Definitions, Functioning & Application of Industrial Engineering, Contribution of various persons to the field of Industrial Engineering.
- Types of Production (Job, batch etc.) & their characteristics, Degree of repetitiveness & Volume of Production.
- Facilities (Plant) Location & Layout.
- Introduction to Production Planning & Control.
- Process Planning, Maintenance Function.

Unit III

(7)

Method Study

Steps, Tools & Techniques used in the Method Study, Process Chart, Symbols, Flow Diagrams, Two Hand Chart, Multiple Activity Chart, 5W & 1H, Use of Motion Pictures & its analysis. SIMO chart, Chronocyclograph. Developing, Presentation, Installation & Maintenance of new Methods. Meaning, Definition & Importance of Ergonomics in Industry.

Unit IV

(7)

Work Measurement

Time Study: Aim & Objectives, Terminology & Tools, Use of stopwatch procedure in making Time Study. Time Study Forms, Performance rating, allowances and its types. Calculations of standard Time. Time study for indirect functions such as Maintenance & Marketing. Criticism of Time Study.

Synthetic & Standard data Methods: Concepts, Introduction to PMTS, MTM1, WFS, & Basic Motion Time Study. MTM2 & Other second Generation Methods, MOST.

Unit V

(7)

Motivation

Human Needs & Different Theories of Human Needs. Definition, Types of Motivation, Theories of Motivations - McGregor's Theory of X & Theory of Y, Herzberg's Theory of Two Factor, David C. McClelland's Theory of Achievements, Expectance, Valence Theory of Victor Vroom & Porter & Lawler's Model.

Leadership: Definition, Styles & functions of Leadership. Qualities for good leadership. Role of the Leader.

Entrepreneurship: Concept & Qualities of Good Entrepreneur.

Unit VI

A. Human Resources Management

(5)

Introduction & Importance, Difference between HRM & Personnel Management. Man power planning, Job Evaluation & Merit Ratings. Training & Development. Meaning & Types of Remuneration & Incentive Systems.

B. Financial Management.

(3)

Costing, Definition & types of costs. Elements of costs. Types & methods of costing. Break Even Analysis.

Types & Sources of Finance, Different Financial Institutions and their role in Industrial Development.

Text Books

1. Banga & Sharma, "Industrial Organisation & Engg. Economics", Khanna Publishers, 2001, ISBN 81-7409-078-9
2. Jhamb L. C., "Production (Operations) Management", Everest Publishing House, ISBN 81-86314-24-5

Reference Books

1. "Introduction to Work Study", ILO Publication, ISBN 81-85027-27-7.
2. Mansoor Ali & Dalela, "Industrial Engineering and Management Systems", Standarda Publisher Distributor, ISBN 81-86308-36-9.
3. Memoria C. B. & Gankar S. V., "Personnel Management", 12th Edition 1994, Himalaya Publications, 2003, ISBN 81-7040-875

211124 Computer Graphics Lab II

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
TW: 50 Marks

Term work consists of writing the Journal based on following topics after performing minimum of two assignments each.

A) Customization of AutoCAD

Introduction to Auto Lisp.

- 1) A program for customization of any one Menu using Auto Lisp.
- 2) A program for customization of any one Toolbar using Auto Lisp.

B) CAD Modeling

- 1) One assignment based on assembly modeling and drafting of any assembly consisting of at least four to five components with one of CAD packages like Pro- E, Ideas, UG – NX, CATIA, Solid Edge, Solid Works, etc.
- 2) Surface modeling of at least one component using Pro- E, Ideas, UG – NX, CATIA, Solid Edge, Solid Works, etc.

C) Finite Element Analysis

- 1) Introduction to Finite Element Analysis and concepts like meshing, Stiffness Matrix, etc with a demonstration using any one of the packages like Nastran, Ansys, Hypermesh, LS Dyna, etc
- 2) Introduction of Product Life Cycle Management and Product Development Management.