University of Pune

Faculty of Engineering

Board of Production and Industrial Engineering

Second Year Engineering Syllabus 2012

Production Engineering / Industrial Engineering / Production Sandwich Engineering

SE (Production/Industrial Engineering) (2012 Course) Structure

Semester- I

Subject Code	Subject	Teaching Scheme			Examination Scheme					
		Lecture	Practical	Tutorial	Paper		TW	Oral	Practical	Total
					Written	Online				
207002	Engineering Mathematics III	4	-	1	50	50	25	-	-	125
211101	Heat and Fluid Engineering	4	2	-	50	50	25	-	-	125
211102	Strength Analysis of Materials	4	-	-	50	50	-	-	-	100
211103	Welding and Foundry	3	2	-	50	50	-	50	-	150
211104	Material Science	3	2	-	50	50	50	-	-	150
211105	Machine Drawing & Computer Graphics	-	4	-		-	50	50	-	100
	Total	18	10	1	250	250	150	100	-	750

Semester- II

Subject Code	Subject	Teaching Scheme		Examination Scheme					
		Lecture	Practical	Paper		TW	Oral	Practical	Total
				Written	Online				
203050	Electrical Technology	4	2	50	50	50	-	-	150
211107	Theory of Machines	4	2	50	50	25	50	-	175
211108	Machine Tool Operations	4	-	50	50	-	-	-	100
211109	Design of Machine Elements	4	-	50	50	-	-	-	100
211110	Engineering Metallurgy	4	2	50	50	-	50	-	150
211111	Production Practice I	-	2		-	-	50	-	50
211112	Soft Skills		2			25			25
	Total	20	10	250	250	100	150	-	750

UNIVERSITY OF PUNE
For Mechanical + SW / Production + SW / Industrial /Automobile Engineering (Sem I)
207002 ENGINEERING MATHEMATICS – III (2012 Course)

Teaching Scheme:
Lectures – 4 Hrs./Week
Tutorials – 1 Hr./Week

Examination Scheme:
Paper – 50 Marks (2 Hrs.)
Online – 50 Marks
Term work: 25 Marks

Section I

Unit I: Linear Differential Equations (**LDE**) and Applications (09 Hours)
LDE of nth order with constant coefficients, Method of variation of parameters, Cauchy's & Legendre's DE, Simultaneous & Symmetric simultaneous DE. Modeling of mass-spring systems, free and forced damped and undamped systems.

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

Unit III: Statistics and Probability (09 Hours)
Measure of central tendency, Standard deviation, Coefficient of variation, Moments, Skewness and Kurtosis, Correlation and Regression, Probability, Probability distributions: Binomial, Poisson and Normal distributions, Population and sample, Sampling distributions, t-distribution, Chi-square distribution.

Section II

Unit IV: 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 V: Vector Integral Calculus and Applications (09 Hours)
Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem. Applications to problems in Fluid Mechanics, Continuity equations, Stream lines, Equations of motion, Bernoulli's equations.

Unit VI: Applications of Partial Differential Equations (**PDE**) (09 Hours)
Basic concepts, modeling of Vibrating String, Wave equation, one and two dimensional Heat flow equations, method of separation of variables, use of Fourier series. Solution of Heat equation by Fourier Transforms, Two-dimensional wave equation.

Text Books:
1. Advanced Engineering Mathematics, 9e, by Erwin Kreyszig (Wiley India).
2. Advanced Engineering Mathematics, 7e, by Peter V. O'Neil (Cengage Learning).

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

Tutorial and Term Work:
i) Tutorial for the subject shall be engaged in minimum of four batches (batch size of 20 students maximum) per division.
ii) Term work shall consist of six assignments (one per each unit) based on performance and continuous internal assessment.

Heat and Fluid Engineering

211101

Teaching Scheme	Examination Scheme
Lectures: 4 hours / week	On-line: 50 marks
Practical: 2 hours / week	Paper: 50 marks
	Term Work: 25 marks

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Unit I
Introduction & Fluid properties (8)
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. (Numerical)
Static's of Fluid, Pascal's law, Pressure on plane/curved surface, pressure measurements, Manometers, centre of pressure, metacentric height.

Unit II
Fluid Flow (8)
Types of flow, examples, forces acting on fluid flow, Stream lines, Path lines, Streak lines. Velocity potential, Euler's equation of motion along a stream line, Bernoulli's equation, applications of Bernoulli's equation, orifice meter, venturimeter, Pitot tube (Numerical)

Unit III
Losses through pipes (8)
Flow through pipes ,Laminar and turbulent flow through circular pipes, major loss-Darcy-Weisbach equation, minor losses, , water hammer, Buckingham's pie theorem, dimensionless numbers Fluid Machinery, Construction, working and applications of hydraulic turbines, centrifugal pumps and reciprocating pumps.

Unit IV
Fuels and lubricants (8)
Mass function, combustion equation, proximate and ultimate analysis of fuel, stoichiometric analysis of combustion products, volumetric and gravimetric analysis, types & properties of lubricants, flash point, fire point, viscosity, Vapour pressure

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.(Numerical)

Unit V (8)
Refrigeration
Air refrigeration, vapour compression refrigeration system, , various refrigerants used in refrigeration systems, their effect on environment
Air conditioning
Psychometry, 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
Reciprocating compressor   (8)
FAD, work done, efficiency-volumetric (with clearance volume), isothermal, multistage compression (Numerical)
IC engines, Cycle diagram, diesel and otto cycle (no numerical) IC engine systems --starting, ignition, cooling and lubrication systems, testing and performance of IC engine (Numerical)

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 /Assignment   on major and minor looes
4. Calibration of venture meter/orifice meter
5. Trial/Assignment on boilers.
6. Trial on vapour compression refrigeration system
7. Trial/Assignment   on petrol engine
8. Trial on diesel engine
9. Trial on air compressor.
10. Trail / Assignment on Air conditioning system

Text Books
1. Bansal R.K., "Fluid Mechanics and Hydraulic Machines", 9th Edition, 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. Munson, Young, Okiishi and Huebsch, "Fundamentals of Fluid Mechanics, Sixth Edition, Wiley – India Edition, 2010.
4. 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.

S. E. [Production Engineering /Production Sandwich Engineering / Industrial Engineering]
Syllabi 2012

Strength Analysis of Materials
211102

Teaching Scheme

Lectures: 4 hours / week

Examination Scheme

On-line: 50 marks

Paper: 50 marks

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Unit I
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
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
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
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
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.
Cylinders and spherical shells
Thin and thick cylinders, thin spheres, volumetric strains, pre-stress in cylinders, cylinders under combined loading, compound cylinders analysis, spherical shells analysis.

Unit VI
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.

References
1. Ramamrutham S. and Narayanan R., "Strength of Materials", Dhanapat Rai and sons,1992, ISBN: 818743354X
2. Rao Prakash "Strength Of Materials- A Practical Approach", Vol I, Universities Press India Limited, ISBN: 8173711259
3. Rattan S. S., "Strength of Materials", Tata McGraw-Hill Education,2011, ISBN: 007107256X
4. Junnarkar and Shah H J., "Mechanics of Structures", Charotar Press, 2002, ISBN: 81-85594-06-6.
5. Rajput R. K., "Strength of Materials", S. Chand Publication. ISBN-10 : 8188458104
6. Khurmi R. S., "Strength of Materials", S. Chand Publication., ISBN:8121928222
7. 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.
8. Gere J. M. and Timoshenko S. P., "Mechanics of Materials", 4th Edition, PWS Pub. Co, 2001, ISBN 978-0534934293.
9. Popov E. P., "Engineering Mechanics of Solids", Prentice Hall of India LTD, New Delhi, 2008.ISBN-10 :0137261594
10. Singer and Pytel, "Strength of Materials", Addison Wesley Publishing Corporation, 1999, ISBN 0 321 04541 6.
11. Timoshenko S P. and Young D. N., "Strength of Materials", Affiliated East-West Press PVT. LTD. New Delhi, 2006, ISBN : 8176710199

Welding and Foundry
211103

Teaching Scheme   **Examination Scheme**
Lectures: 3 hours / week   On-line: 50 marks
Practical: 2 hours / week   Paper: 50 marks
                                                      Oral: 50 marks

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Unit I
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
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
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
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 moulding materials and their effect on mould strength- testing of mould strength, testing of moulding 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

Special casting processes Pressure and gravity die casting (hot and cold chamber), shell moulding, 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

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, numerical on casting, defects in casting. Fluidity- method of measuring fluidity of metal by spiral technique.

Computer applications in casting design and software.

Term work shall consist of at least eight assignments on the topics mentioned below and workshop jobs:

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. Industrial visit to any foundry.

Workshop Jobs
1. Making simple solid pattern involving wood turning operation and preparing mould and aluminium casting.(one job)
2. Gas welding / Arc welding (one job)

Note: Oral examination will be based on above term work.

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., Prentice hall of India Pvt.Ltd., 2002.
3. Little Richard., "Welding & Welding Technology",Tata Mc-graw hill Publishing, 1992, ISBN 0-07-099409-9.

S. E. [Production Engineering /Production Sandwich Engineering / Industrial Engineering]
Syllabi 2012

Material Science
211104

Teaching Scheme
Lectures: 3 hours / week
Practical: 2 hours / week

Examination Scheme
On-line: 50 marks
Paper: 50 marks
Term Work: 50 marks

Unit I
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
Material Testing: 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.

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
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
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
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, Vapour deposition Thermal Spray Coatings, Ion implantation etc

Unit VI
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 the following experiments:

1. Tensile test on mild steel and aluminium 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.ISBN: 0070591695
3. Shigley J. E., "Applied Mechanics of Materials", McGraw Hill Book Company, 1985.ISBN:0070568456

Reference Books
1. Davis H. E., Troxell G.E. and Wiskocil C. T., "Testing of Engineering Materials", McGraw Hill Book Co.ISBN:0070662479
2. Van Vlack L.H., "Elements of Material Science", Addison- Wesley Publishing Co., 1998.ISBN: 8131706001
3. Baldev Raj, Jayakumar T. and M. Thavsimuthu, "Practical Non-Destructive Testing", Narosa Publishing House.Delhi, 1999.ISBN: 8173197970
4. Hull and T. W. Clyne, "An introduction to Composite Materials", Second Edition Cambridge Solid State Science Series.ISBN:0521735483

5. Structure and Properties of Materials II, Willey Eastern (P) Ltd.

6. Murthy, "Structure and properties engineering materials", Tata McGraw Hill 2003.ISBN: 007048287X

7. Donald R. Askland, Phule P. P., "Science and engineering of materials", Thomson Learning, 2003.ISBN: 0534553966

Machine Drawing & Computer Graphics
211105

Teaching Scheme	**Examination Scheme**
Practical: 4 hours / week	Term Work: 50 marks
	Oral: 50 marks

Unit-I
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
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
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
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
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
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 following:

Part I: 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 shaft, springs, gears, tapers, chamfer, countersunk and counter bore, keys, welded joints, structural sections etc., drawn neatly in the sketch book.

Part II: To compile the AutoCAD drawing prints etc., as mentioned below:
1. On half imperial drawing sheet - Conventional representation of machine components as per **IS Code: SP 46** such as: Screw threads, Tapped hole, Holes on circular pitch, Bearing, Knurling, Splined shaft, Springs, Gears, Tapers, Chamfer, Countersunk and counter bore.
2. On half imperial drawing sheet- Types of screws, Bolts and nuts, Nut locking arrangement.
3. On half imperial drawing sheet- Assembly and details of any one of machine component: 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 standardmachine 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. FarazdakHaideri, "Machine Drawing and Computer Graphics", NiraliPrakashan, Pune, 1998.ISBN: 9380725272
3. William M. Oliver, "Illustrated Autolisp", BPB Publications, New Delhi, 1997. ISBN: 1556221614
4. George Omura, "ABC's of Autolisp", BPB Publications, 2002.ISBN: 0895886200

5. Bhagat N. K., "Autolisp and Customisation Made Simple", BPB Publication, 1997, ISBN: 817029712 5.
6. Zeid Ibrahim, "Mastering CAD/CAM", Tata McGraw Hill.ISBN: 0070634343
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., VenkatataReaddy 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.ISBN: 9380358466
3. Auto LISP Reference Manual".
4. John Hood D., "Using AutoCAD with Auto LISP", McGraw Hill Book Company 1990.ISBN:0070297487

Electrical Technology
203050

Teaching Scheme
Lectures: 4 hours / week
Practical: 2 hours / week

Examination Scheme
On-line: 50 marks
Paper: 50 marks
Term Work: 50 marks

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Unit I
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.

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.

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

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

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

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)

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
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)

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
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
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
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:
Term work shall consist of experiments as listed below. Any 6 experiments from 1 to 8 in the list should be performed, and expt. no. 9 and 10 are compulsory.

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 methods.
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 ISBN: 0132473208.
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. ISBN: 817409279X.
5. Pratap H., "Art & Science of utilization of Electrical Energy", 3rd Edition, DhanpatRai& Sons.
6. Theraja B. L., "Electrical Technology", S. Chand Publication Co. Ltd. ISBN: 8121924405
7. Rao P. V., "Power Semiconductor Drives", BS Publication, Hyderabad. ISBN: 8178001608

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. ISBN: 0855012315.
6. Kothari D. P. and Nagrath I. J., "Electrical Machines", 3rd edition, Tata McGraw Hill. ISBN: 0070699674

Theory of Machines
211107

Teaching Scheme
Lectures: 4 hours / week
Practical: 2 hours / week

Examination Scheme
On-line: 50 marks
Paper: 50 marks
Term Work: 25marks
Oral: 50 marks

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Unit I
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
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
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
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
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

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 shall consist of the following:
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. ISBN: 817409122X.
2. Rattan S.S**.,** "Theory of Machines", 2ed**.,**Tata McGraw-hill publishing, 2005, ISBN 007-059120-2.
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. ISBN: 8131729656

Machine Tool Operations
211108

Teaching Scheme

Lectures: hours / week

Practical: 4 hours / week

Examination Scheme

On-line: 50 marks

Paper: 50 marks

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Unit I
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
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
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
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
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
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.

Text Books
1. S.K. HajraChoudhury, A.K. HajraChoudhury, Nirjhar Roy, "Elements of Workshop Technology" Vol II, Media Promoters, ISBN-10: 8185099154

2. Rao P. N., "Manufacturing Technology & Foundry, Forming & Welding", Vol I, II, Tata McGraw Hill Publishing Co., 2004, ISBN: 0 07 451863 1.
3. Jain R.K., "Production Technology", Khanna Publishers, 2008, ISBN 81-7409-099-1.
4. Sharma P.C., "A Text Book of Production Technology- Manufacturing Processes", S. Chand & Co., 2008, ISBN: 81-219-111-4-1.
5. Chapman W .A. J., "Workshop Technology" Vol. I, II & III, Edward Arnold Publishers, 1998, ISBN: 0 7131 3287 6.
6. HMT, "Production Technology", Tata McGraw Hill Publishing Co., 1980. ISBN: 0-07-096443-2.
7. Degarmo, Black and Kosherth, "Materials & Processes in manufacturing", 8th Edition, Prentice Hall of India Ltd, Delhi, 2002. ISBN: 8126525223.
8. Raghuwanshi B. S., "A course in Workshop Technology", Vol. I, II, DhanpatRai& Co. ISBN: 81-7409-099-1

Design of Machine Elements
211109

Teaching Scheme

Lectures: 4 hours / week

Examination Scheme

On-line: 50 marks

Paper: 50 marks

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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.
Design of Simple Machine Parts: Factor of safety, Service factor, Design of simple machine parts-Cotter joint, Knuckle joint and lever.

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

Unit III **(8)**
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 IV **(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, Helical torsion spring, surge in spring.

Unit V **(8)**
Spur Gears: Various design consideration, Beam Strength, tangential loading module calculations, width calculations, type of gear tooth failures, Estimation of dynamic load by velocity factors and Spott's equation.

Unit VI **(8)**
Rolling Contact Bearings: Type, static and dynamic loading capacity, stribeck's equation, concept of equivalent load, load life relationship, selection of bearing from manufacturers catalogue, design for variable load and speeds, bearing probability of survival other than 90%, lubrication and mounting of bearing.

Term Work:
1) Term work shall consist of ONE design project. 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.

Engineering Metallurgy
211110

Teaching Scheme

Lectures: 4 hours / week

Practical: 2 hours / week

Examination Scheme

On-line: 50 marks

Paper: 50 marks

Oral: 50 marks

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Unit I:

Steels: Introduction to Metallographic, micro and macro examination, metallurgical microscope, etching. Steels: iron-iron carbide equilibrium diagram, Critical temperatures, Allotropy, cooling curve and volume changes of pure iron. Microstructure, non-equilibrium cooling of steel, widmanstatten structure, structure property relationship. Classification and applications of steels, specifications of some commonly used steels like BIS, EN, AISI, SAE.

Unit II:

Heat treatment of Steels: Introduction to heat treatment furnaces and Furnace atmospheres, Transformation products of austenite, Time-temperature- transformation diagrams, Critical cooling rate, Continuous cooling transformation diagrams. Heat treatment of steels Quenching media, Annealing" Normalizing" Hardening" Retention of austenite" Effects of retained austenite" Elimination of retained austenite, Tempering" Secondary hardening, Temperembrittlement, Quench cracks, Hardenability testing" Defects due to heat treatment and remedial measure.

Unit III:

Surface Hardening & Isothermal Treatments: Carburising, heat treatment after carburising, Nitriding, Carbonitriding, Flame hardening and Induction hardening. Commercial heat treatment practice of gears of different sizes, tools, springs. Isothermal heat treatments such as austempering, patenting, iso-forming, martempering, ausforrning.

Unit IV:

Alloy Steels: Effects of alloying elements, classification of alloying elements. Stainless Steels, Sensitization of stainless steel, weld decay of stainless steel. Tool steels and tool materials, Heat treatment of high-speed steel. Special purpose steels with applications.

Cast irons: Classification, Gray cast iron, White cast iron, Malleable cast iron" Ductile Iron, Chilled and alloy cast irons. Effects of various parameters on structures and properties of cast irons, Heat treatments of cast iron. Applications of cast irons for different components of machine tool, automobiles, pumps etc.

Unit V:

Non-Ferrous Alloys: Copper alloys - Brasses, Bronzes-: Tin, Aluminium, Beryllium, Silicon Copper nickel alloys, Nickel - Silver, Aluminium and aluminium alloys. Solders, Bearing

materials and their applications, Precipitation hardening alloys. High Temperature materials such as Nimonics, Super alloys, Ti-alloys etc.

Unit VI:
Modern Engineering Materials: Composites- Types, Characterization, Production techniques & applications. Metal -Matrix composites, Particulate & Fibre composites. Biomaterials, Nano materials, Sports materials.

Term work shall consist of the list of experiments mentioned below. Any eight experiments should be included in the file with suitable discussion.

1. Study and drawing of microstructures of mild steel, medium carbon steel, eutectoid steel and hypereutectoid steel.
2. Study and drawing of microstructures of white, malleable, grey and nodular cast iron.
3. Study and drawing of microstructures of alpha brass, alpha-beta brass, aluminium bronze, tin bronze and bearing metal.
4. Study and drawing of microstructures of hardened steel, tempered steel.
5. Hardening of steel- study of effect of carbon on hardness of hardened steel.
6. Tempering of steels - study of effect of temperature on hardness of tempered steel.
7. Study of change in microstructure on annealing and normalizing of tempered steel.
8. Sulphur print test on a steel specimen & flow lines examination of a forged component.
9. Jominy hardenability test on a steel sample.
10. Testing of composite materials (Like Hardness, Impact, Tension etc.)

Text-books:
1. Kodgire V. D., "Material science and metallurgy for Engineers", Everest Publishing House, Pune, ISBN 81 86314 00 8.
2. K. G. Bundinski, M. K. Bundinski , "Engineering Materials" Prentice Hall of India Pvt. Ltd., New- Delhi.
3. Higgins "Engineering Metallurgy", Part I Applied Physical Metallurgy, English Language book Society / Edward Arnold.
4. Smith W. F., "Principles of Material Science and Engineering", McGraw- Hill Inc. Book Company ISBN 0 07 122920 5.

Reference Books:
1. Rollason E. C., "Metallurgy for Engineering", ELBS Publishing.
2. Clark D.S.and Vamey W. R. "Physical Metallurgy for Engineers", East-West PressPvt. Ltd., New Delhi.
3. Avner, *"An* introduction to physical metallurgy", TMH publication.
4. Donald R. Askeland&PradeepPhule. ," The science and engineering of materials",Thomson Asia Pvt.LTD, ISBN 981 243 855 6.

Production Practice-I
211111

Teaching Scheme   **Examination Scheme**

Practical: 2 hours / week   Oral: 50 marks

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

Part I: Assignments based on Machine Tools (any five)

1. Major operations on a lathe.
2. Working principle of apron mechanism in a lathe.
3. Thread cutting operation on a lathe using half-nut and lead screw.
4. Indexing mechanism and universal dividing head in milling machine.
5. Operations on drilling machine and the different work and tool holding devices used.
6. Single and multi-point cutting tools used on the conventional machines.
7. Calculation of machining time for different operations on lathe, milling and drilling machines.
8. To prepare the process sheet for the job(s) manufactured in turning (machine) shop during the practical session.

Part II: Jobs (any two)

1. Plain & taper turning (one job)
2. Gear cutting (one job)
3. Forging and grinding of a tool with one end consisting of knife edge and other end of Vee shape (one job).

Note: Oral examination will be based on the Term Work submitted by the candidate.

References
1. S.K. HajraChoudhury, A.K. HajraChoudhury, Nirjhar Roy, "Elements of Workshop Technology" Vol II, Media Promoters, ISBN-10: 8185099154.
2. Gerling H., All about machine tools, New Age International, ISBN-108122418260.
3. JutzzH., "Westermann Tables for the Metal Trade", New Age International, ISBN-10: 8122417302.

Second Year – Production Engineering– Sandwich 2012

Subject Code	Subject	Teaching Scheme			Examination Scheme					
Second Year – Production Engineering Sandwich – Semester I										
		Lecture	Practical	Tutorial	Paper		TW	Oral	Practical	Total
					Written	Online				
207002	Engineering Mathematics III *	4	-	1	50	50	25	-	-	125
211101	Heat and Fluid Engineering *	4	2	-	50	50	25	-	-	125
211102	Strength Analysis of Materials *	4	-	-	50	50	-	-	-	100
211121	Manufacturing Processes	4	2	-	50	50	-	50	-	150
211104	Material Science *	3	2	-	50	50	50	-	-	150
211105	Machine Drawing & Computer Graphics *	-	4	-		-	50	50	-	100
	Total	19	10	1	250	250	150	100	-	750
Second Year – Production Engineering Sandwich – Semester II										
Subject Code	Subject	Teaching Scheme			Examination Scheme					
		Lecture	Practical	Tutorial	Paper		TW	Oral	Practical	Total
					Written	Online				
203050	Electrical Technology *	4	2	-	50	50	50	-	-	150
211107	Theory of Machines *	4	2	-	50	50	25	50	-	175
211122	Manufacturing Engineering & Metrology Practices	4	2	-	50	50	-	50	-	100
211109	Design of Machine Elements *	4	-	-	50	50	-	-	-	100
211123	Production & Industrial Management I	4	-	-	50	50	-	-	-	150
211124	Computer Graphics Lab.	-	2	-	-	-	-	50	-	50
211112	Soft Skills*		2	-	-	-	25	-	-	25
	Total	20	10	-	250	250	100	150	-	750

* Common with S. E. Production Engineering & Industrial Engineering Syllabus

MANUFACTURING PROCESSES
211121

Teaching Scheme   **Examination Scheme**
Lectures: 4 hours / week   On-line: 50 marks
Practical: 2 hours / week   Paper: 50 marks
                                                         Oral: 50 marks

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UNIT 1
Pattern Making, Moulding and Casting   **8 Hrs**
Sand casting, Pattern types, materials, pattern making allowances, Moulding sand types, properties and testing, hand and machine moulding process and equipments, core-type and manufacturing, Furnaces – types- cupolas – construction, operation , zones and chemistry etc. Gating system. Cleaning and finishing of castings, Defects in casting.
Special moulding and casting processes Shell moulding, investment casting, Die casting(Hot & Cold chamber), Centrifugal casting, Continuous casting

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UNIT 2
Hot Working and Cold Working Processes   **8 Hrs**
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, HERF.

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UNIT 3
Joining Processes   **8 Hrs**
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 4   **8Hrs**
Lathe Machines
Introduction to lathe, types, Construction, specifications, accessories, various mechanism, various operations such as taper turning, eccentric turning, thread cutting. Concept of Speed, Feed, Depth of cut, process parameters, maching time estimation. Single point cutting tool geometry.

UNIT 5
Milling Machines   **4 Hrs**

Fundamentals of milling process, milling cutters,. Operations performed on milling machines. Dividing head, methods of indexing. Gear train calculations for helical and cam milling. Process parameters, machining time estimation.

Drilling Machines   **4 Hrs**

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

UNIT 6
Grinding Machines   **8 Hrs**

Abrasive types, grinding wheels, wheel making, marking, selection, mounting, types of grinding machines, grinding faults.
Special grinding machines – honing, lapping, super finishing, buffing, burnishing.

Practicals
Each candidate shall be required to complete and submit the following term work.

1. **Jobs**
   a. Plane turning, taper turning, drilling and thread cutting and knurling.- One Job
   b. Gas welding/Arc welding – One Job
   c. Demonstration on milling machine for gear cutting, use of indexing mechanism with calculations.
   d. Demonstration on forging and grinding of lathe tool with one knife and other end vee- One Job

2. **Journal based on following**
   1. Report on industrial visit to any casting/ foundry industry.
   2. Study of lathe machine
   3. Study of arc and gas welding processes.
   4. Study of milling machine and drilling machine
   5. Study of grinding machine.
   6. Study of hot working and cold working processes.

<u>**Text Books:**</u>

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

Reference Books:

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

MANUFACTURING ENGINEERING & METROLOGY PRACTICES
211122

Teaching Scheme

Lectures: 4 hours / week

Practical: 2 hours / week

Examination Scheme

On-line: 50 marks

Paper: 50 marks

Oral: 50 marks

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Unit I

Theory of Metal Cutting   **8Hrs**

Cutting tools, tool geometry, concept of speed, feed, depth of cut and cutting action and effect of these on cutting forces. Types of chips, Merchants 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

Production Machines   **8Hrs**

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

Broaching   **8Hrs**

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

Gear Manufacturing   **8Hrs**

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

Introduction to NC, CNC Machines   **8Hrs**

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

Unit V (8)
Sheet Metal Working   **8Hrs**
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
Jigs and Fixtures   **8Hrs**

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.
11. Surface Finish Measurement by using any suitable method.

 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. 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", ASTME, Vol. I, ISBN 0-87263-085- 4
8. Joshi P. H., "Press Tool Design & Productions", Wheeler Publishing, ISBN 81- 85814-46-5.

Production & Industrial Management- I
211123

Teaching Scheme   **Examination Scheme**
Lectures: 4 hours / week   On-line: 50 marks
                                                  Paper: 50 marks

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Unit I
Evolution of Management Practices   **7Hrs**
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
Production Management   **7Hrs**
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
Types of Production (Job, batch etc,) & their characteristics, Degree of repetitiveness & Volume
of Production Engineering
Facilities (Plant) Location & Layout
Introduction to Production Planning & Control
Process Planning, Maintenance Function

Unit III
Method Study   **7Hrs**
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, Chronocylograph. Developing, Presentation, Installation & Maintenance of new Methods.
Meaning, Definition & Importance of Ergonomics in Industry.

Unit IV
Work Measurement   **7Hrs**

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.23

Unit V
Motivation   **7Hrs**
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. McCelland'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   **5Hrs**
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.   **3Hrs**
Costing, Definition & types of costs. Elements of costs. Types & methods of costing. Break Even Analysis.
Types & Sources of Finance, Different Financial Intuitions 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", Standara

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

Computer Graphics Lab II
211124

Teaching Scheme   **Examination Scheme**

Practical: 2 hours / week   Oral: 50 marks

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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

Text Books:

[1]Auto CAD by Paul F. Aubin .
[2] Auto LISP by George Omura .
[3] Finite Element Analysis By P. Seshu , PHI Publicatation ISBN -81-203-2315-7.

SOFT SKILLS
211112

Teaching Scheme

Practical: 2 hours / week

Examination Scheme

Term Work: 25 marks

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Objectives

- To encourage all round development of students by training them in necessary soft skills.

- To make the engineering students realize the importance of soft skills in the holistic development of personality.

- To foster the students soft skills with a special emphasis on improving their communicative competence in English.

Overview

Soft skills are a set of skills required for a holistic development of an individual. Through this course, the students of engineering will be trained in the necessary soft skills which are required for them not only to do well academically but also to excel in each significant aspect of life. Effective communication skills in English have become a prerequisite for students to enhance their academic performance as well as earn a good placement. These skills are also essential for their professional growth. Therefore, the necessary soft skills will be taught with a special emphasis on communication skills in English. Today, the employability of a student is defined by not only his command over technical skills but also his sound soft skills. The soft skills improve students' confidence and enable them to implement the technical skills learnt more efficiently. Training in soft skills infuses in students positive attitude and makes them self assured. They can do well in every walk of life and achieve success in their endeavors. Thus, soft skills contribute significantly to the all round development of students and therefore need to be taught effectively with an emphasis on adequate practical exposure.

Teaching Methodology

Each class should be divided into three batches of 20-25 students each. The sessions should be activity based and should give students adequate opportunity to participate actively in each activity. Teachers and students must communicate only

in English during the session. Specific details about the teaching methodology have been explained in every activity given below.

Practical Activities (Term work)

Following 10 activities are <u>compulsory</u> and teachers must complete them during the practical sessions within the semester. The teacher should give students 10 assignments on the basis of the 10 activities conducted in the practical sessions. Students will submit these 10 assignments as their term work at the end of the semester but it should be noted that the teacher should assess their assignment as soon as an activity is conducted. The continual assessment process should be followed.

1. Self Assessment: (2 hours)

The students should be made aware of their goals, strengths and weaknesses, attitude, moral values, self confidence, etiquettes, non-verbal skills, achievements etc. through this activity. The teacher should explain to them on how to set goals, SWOT Analysis, Confidence improvement, values, positive attitude, positive thinking and self esteem. The teacher should prepare a questionnaire which evaluate students in all the above areas and make them aware about these aspects.

2. Public Speaking (4 hours)

Any one of the following activities may be conducted :

a. **Prepared speech** (topics are given in advance, students get 10 minutes to prepare the speech and 5 minutes to deliver.
b. **Extempore speech (**students deliver speeches spontaneously for 5 minutes each on a given topic)
c. **Story telling (Each student narrates a fictional or real life story for 5 minutes each)**
d. **Oral review** (Each student orally presents a review on a story or a book read by them)

3. Power-point Presentations (4 hours)

Students should make a presentation on any informative topic of their choice. The topic may be technical or non-technical. The teacher should guide them on effective presentation skills. Each student should make a presentation for at least 10 minutes.

4. Formal Group Discussion (4 hours)

Each batch is divided into two groups of 12 to 14 students each. Two rounds of a GD for each group should be conducted and teacher should give them feedback.

5. English Language Proficiency Test (2 hours)

The teacher should conduct a 50 mark English proficiency test in the lab and discuss the answers with explanation and more illustrations.

6. Mock Meetings (2 hours)

In order to enhance students' formal oral communication, mock meetings can be conducted. Teacher should give a topic for the meeting and teach students how a notice and agenda for a meeting is prepared. Students will participate in the meeting assuming the roles assigned by the teacher. After the meeting, teacher should guide students on how minutes of meeting are recorded.

7. Letter, Report & Resume writing (4 hours)

Each student will write one formal letter, one report and a resume. The teacher should teach the students how to write the letter, report and build resume. The teacher should give proper format and layouts.

8. Reading and Listening skills (4 hours)

The batch can be divided into pairs. Each pair will be given an article (any topic) by the teacher. Each pair would come on the stage and read aloud the article one by one. After reading by each pair, the other students will be asked questions on the article by the readers. Students will get marks for correct answers and also for their reading skills. This will evaluate their reading and listening skills. The teacher should give them guidelines on improving their reading and listening skills. The teacher should also give passages on various topics to students for evaluating their reading comprehension.

9. Conflict Management and decision making skills (2 hours)

The teacher should teach students how to make sound and practical decisions by dealing with conflicts. Students should know how to manage internal and external conflicts. The teacher can conduct a case study activity to train students in these skills.

10. Stress management (2hours)

The teacher should conduct a session on stress management and guide students on how to manage stress. The teacher may conduct a stress relieving activity in the class. He/she may counsel students individually to know their problems and guide them on dealing with them effectively.

Scheme of Evaluation

The teacher should give marks out of 10 for each activity. The total marks for all 10 activities will be 100 marks. At the end of semester, the marks scored by a student out of 100 will be scaled down to marks out of 25. Thus, each student will get marks out of 25 for this subject.

References

1. Rutherford A. J. : Communication skills for Technical Communication, Pearson Education

2. Meenakshi Raman, Sangeeta Sharma : Technical Communication – Principles and practice, Oxford

3. Scot Ober : Contemporary Business Communication (Indian adaptation) Biztantra

4. Dutt et.al. : A course in Communication Skills, Foundation

5. Ibbotson: Cambridge English for Engineering, Cambridge

6. Turk: Effective Speaking, Taylor & Francis

7. Patnaik: Group Discussion and Interview Skills, Foundation

8. Mishra: A companion to communication skills in English, PHI

9. Lynch: listening, Cambridge

10. Sasikumar, Dutt & Rajeevan: A course in Listening & Speaking I & II, Foundation

11. Malcom Goodale: Professional Presentations, Cambridge

12. Ham-Lyons & Heasley: Writing, 2nd Edition, Cambridge

13. ASTD: 10 steps to successful meetings, Cengage Learning

14. E. Suresh Kumar, P. Sreehari, J. Savitri: Communication Skills & Soft Skills An Integrated Approach, Pearson

15. Barun K. Mishra: Personality Development and Group Discussions, Oxford University Press

16. Accenture, Convergys, Dell et.al: NASSCOM - Global Business Foundation Skills: A Foundation Books, Cambridge University Press