University of Pune

Structure for Mechanical Engineering (Sandwich) w.e.f. academic year 2013 – 14

S. E. (Mechanical)-Sandwich Semester – I

Code	Subject	Teaching Scheme (Weekly Load in hours)			Examination Scheme (Marks)					
		Lecture	Tutorial	Practical	Theory		TW	PR	OR+	Total
					Paper	Online				
207002	Engineering Mathematics –III*	4	1	--	50	50	25++	--	--	125
202061	Material Science and Metallurgy	4	--	2	50	50	25	--	--	125
202043	Thermodynamics*	4	--	2	50	50	--	--	50	150
202062	Fluid Mechanics and Machinery	4	--	2	50	50	25	--	50	175
202051	Strength of Materials*	3	--	2	50	50	--	--	50	150
202063	Workshop Practice II	--	--	2	--	--	25	--	--	25
Total of Semester – I		**19**	**1**	**10**	**250**	**250**	**100**	**--**	**150**	**750**

+ Under Oral head, examination should be based on term work completed during practical and theory syllabus
++ Term work marks should be based on term work completed in tutorial sessions

S. E. (Mechanical)-Sandwich Semester – II

Code	Subject	Teaching Scheme (Weekly Load in hours)			Examination Scheme (Marks)					
		Lecture	Tutorial	Practical	Theory		TW	PR	OR+	Total
					Paper	Online				
202064	Thermal Engineering	4	--	2	50	50	25	--	50	175
202065	Metrology and Quality Control	3	--	2	50	50	25	--	50	175
202048	Theory of Machine-I*	4	--	2	50	50	25$	--		125
202066	Manufacturing Engineering	4	--	--	50	50	--	--	--	100
203152	Electronics and Electrical Engineering*	4	--	2	50	50	25	--	--	125
202042	Computer Aided Machine Drawing*	1	--	2	--	--	--	50	--	50
Total of Semester – II		**20**	**--**	**10**	**250**	**250**	**100**	**50**	**100**	**750**

*** Subjects Common with Mechanical Engineering**
+ Under Oral head, examination should be based on term work completed during practical and theory syllabus
$ Common Oral will be based on both TOM-I and TOM-II term work at end of First Semester of T.E.

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 n^{th} 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.

Mujumdar

University of Pune
S.E. (Mechanical Sandwich) Part-I (2012 Pattern)
Material Science and Metallurgy (202061)

Teaching scheme
Lectures: 4 Hrs/week
Lab: 2 hr/week

Examination Scheme
Theory (Online):-50 marks
Theory (Paper):-50 marks
Term Work: 25 marks^{++}

(++ Term work marks should be based on term work completed in Lab sessions)

Learning Objectives:

- ***To acquaint students with the basic concepts and properties of Material Science***
- ***To impart the knowledge on mechanical behavior of materials***
- ***To acquire knowledge in various class of materials and their applications.***
- ***To import knowledge on Heat Treatment, microstructure and Powder Metallurgy techniques***
- ***To acquire knowledge in Non Ferrous Alloys and Advanced Materials***

Prerequisite- Applied Science

Unit I: Introduction to Engineering Material & Material Structure

Development in Materials Science, Classification of Material, Crystal structures(BCC, FCC and HCP systems), Imperfections in crystals - point defects, line defects, surface and bulk defects, Mechanism of plastic deformation, deformation of single crystal by slip.
Elastic and plastic deformation of Isotropic and anisotropic materials, Structure and properties of ceramics, Polymers and Composites, Degradation of materials and its Preventation

Unit II: Mechanical Properties and their Testing

Destructive Testing:
Tensile test, engineering stress-strain curve, true stress-strain curve, types of stress-strain curves, compression test, formability, hardness testing, different hardness tests- Vickers, Rockwell, Brinell, Impact test, Erichsen cupping test
Failure - Ductile and brittle fracture, Fracture mechanics, , Ductile brittle transition, Fatigue test, Crack initiation and propagation, Crack propagation rate. Creep, Generalized creep behavior, Creep test, Stress and temperature effects

Non Destructive Testing (NDT) :
Visual Inspection, Magnetic particle inspection, dye penetrate inspection, ultrasonic inspection, radiography, eddy current testing, acoustic emission inspection, Selection of NDT

Unit III: Ferrous metals and Designation

Wrought and cast components, Allotropy of Iron, Iron-iron carbide diagram, plain carbon steels, limitations of plain carbon steel and advantages of alloy steels. Effect of alloying elements on mechanical properties of steel
Alloy steels, Tool steels, stainless steels, cast irons – an overview of phases and microstructure, types, effect of alloying elements
Designation of steels and cast iron, BIS, ASTM, AISI, SAE designation of steel

Unit IV: Heat Treatment

Heat treatment of steels, cooling media, annealing processes, normalizing, hardening, tempering, quenching and hardenability, surface hardening processes- nitriding, carbonitriding, flame hardening, induction hardening, Relationship of the microstructures with properties of steel and alloys

Unit V: Powder Metallurgy and Non Ferrous Metals & alloys

Steps in the making of Powder metallurgical component, sintering of powder compacts, Liquid phase sintering, Applications of P/M parts
Copper and its Alloys – Properties, Brasses, Bronzes, copper- nickel alloys
Aluminium and their alloys – Corrosion resistance, Magnesium, Titanium,
Bearing Materials

Unit VI: Polymers, Ceramics and Composites

Mechanical behavior of polymers, Mechanisms of deformation and strengthening of Polymers, Crystallization, melting and glass transition, Polymer types, Polymer synthesis and processing
Ceramics – crystal structures and properties, ceramic powder preparation, Synthesis of ceramic powders
Composites - Particle reinforced composites. Fiber reinforced composites. Structural composites, Nano-particle Composites

Term Work

1. Hardness Test any one of following: Rockwell, Vickers and Brinell Hardness test
2. Impact Test
3. Cupping Test of sheet materials
4. Magnetic Particle Test
5. Dye Penetranent Test
6. Observe and record following microstructures - Any four plain carbon steels
7. Observe and record following microstructures - Any two cast irons
   Any two non ferrous
8. Observe and record following microstructures - Heat affected zone of welded joint.
9. Annealing process and its microstructure
10. Normalizing of Steel and its microstructure
11. Jominy End Quench Test for hardenability
12. Industrial Visit/ component study (Heat Treatment)

Note: Out of above Twelve, Any eight Lab Experiments should be conducted.

Reference Books:

1) V.D. Kodgire and S.V. Kodgire, Material Science and Metallurgy for Engineers, Everest Publishing House, Pune, 24th edition, 2008.
2) A. K. Bhargava, C.P. Sharma. "Mechanical Behavior & Testing Of Materials", P H I Learning Private Ltd.
3) W.D. Callister, Jr., Materials Science and Engineering: An Introduction, John Wiley and Sons, 5th edition, 2001

University of Pune, Pune

S.E. (Mechanical, Mechanical Sandwich & Automobile) - I (2012 Pattern)

Thermodynamics (202043)

Teaching scheme
Lectures: 4 Hrs/week
Practical: 2 Hrs/week

Examination Scheme
Theory (Online): 50 marks
Theory (Paper): 50 marks
Term work: 25 marks
Oral: 50 marks

Learning Objectives:

- Identify and use units and notations in thermodynamics.
- State and illustrate the first and second laws of thermodynamics.
- Identify and explain the concepts of entropy, enthalpy, specific energy, reversibility, and irreversibility.
- Apply the first and second laws of thermodynamics to formulate and solve engineering problems for (i) closed systems, (ii) open systems, and (iii) power cycles.
- Use thermodynamic tables, charts, and equation of state to obtain appropriate property data to solve thermodynamics problems.
- To get conversant with steam generator and its performance calculations
- To understand the chemistry of combustion and analysis of combustion products.

Prerequisite:

1. **Engg. Mathematics**
2. **Engg. Physics/chemistry**

Unit: I Laws of thermodynamics 10 Hrs.

Introduction of thermodynamics, Review of basic definitions, Thermodynamic properties and their units, Zeroth law of thermodynamics, Macro and Microscopic Approach, First law of thermodynamics, Joules experiment, Applications of first law to flow and non flow processes and cycles. Steady flow energy equation and its application to different devices. Limitations of First law, Second Law of thermodynamics, Equivalence of Clausius and Kelvin Plank Statement, PMM I and II, Review of Heat engine, heat pump and refrigerator. Concept of Reversibility and Irreversibility.

Unit : II Entropy 4 Hrs.

Entropy as a property, Clausius inequality, Principle of increase of Entropy, Change of entropy for an ideal gas and pure substance.

Ideal Gas 6 Hrs.

Ideal Gas definition Gas Laws: Boyle's law, Charle's law, Avagadro's Law, Equation of State, Ideal Gas constant and Universal Gas constant, Ideal gas processes- on P-V and T-S diagrams Constant Pressure, Constant Volume, Isothermal, Adiabatic, Polytropic, Throttling Processes, Calculations of heat transfer, work done, internal energy. Change in entropy, enthalpy

Unit III: Gas Power cycles 6 Hrs.

Air Standard Cycle, Efficiency and Mean Effective Pressure, Otto Cycle, Diesel cycle, Dual cycle, Comparison of cycles, Brayton cycle, Refrigeration Cycle

Availability 4 Hrs.

Available and unavailable energy, concept of availability, availability of heat source at constant temperature and variable temperature, Availability of non flow and steady flow systems, Helmholtz and Gibbs function, irreversibility and second law efficiency.

Unit IV: Properties of Pure substances 5 Hrs.

Formation of steam, Phase changes, Properties of steam, Use of Steam Tables, Study of P-V, T-S and Mollier diagram for steam, Dryness fraction and its determination, Study of steam calorimeters (Barrel, Separating, Throttling and combined)

Non-flow and Steady flow vapour processes, Change of properties, Work and heat transfer.

Vapour Power Cycle 5 Hrs.

Carnot cycle, Rankine cycle, Comparison of Carnot cycle and Rankine cycle, Efficiency of Rankine cycle, Relative efficiency, Effect of superheat, boiler and condenser pressure on performance of Rankine cycle.

Unit V: Steam Generators 6 Hrs.

Classification, Constructional details of low pressure boilers,

Features of high pressure (power) boilers, Introduction to IBR Act

Boiler draught (natural and artificial draught)

Boiler performance calculations-Equivalent evaporation, Boiler efficiency Energy balance,

Unit VI Fuels and Combustion 6 Hrs.

Types of fuels, Proximate and ultimate analysis of fuel, Combustion theory, Combustion Equations, theoretical, excess air and equivalence ratio. Analysis of products of combustion, Calorific value – HCV & LCV, Bomb and Boy's gas calorimeters

List of Practicals:

1. Joule's experiment to validate first law of thermodynamics
2. Determination of calorific value using gas calorimeter.
3. Determination of calorific value using Bomb calorimeter.
4. Flue gas analysis using Orsat apparatus
5. Study of Boiler Mountings and Accessories
6. Determination of dryness fraction of steam
7. Trial on boiler to determine boiler efficiency, equivalent evaporation and Energy Balance.
8. Industrial visit to any process industry which uses boiler and submission of detailed report.
9. Measurement of fuel properties such as Flash point, Pour point, Cloud Point.
10. Assignment on Programming for Air standard cycle analysis.

Notes:

1. Minimum 8 experiments should be performed.
2. Practical No. 6, 7 and 8 are compulsory.

Text Books :

1. R. K. Rajput, Engineering Thermodynamics, EVSS Thermo Laxmi Publications
2. P. K. Nag, Engineering Thermodynamics, Tata McGraw Hill Publications

Reference Books:

1. Y. Cengel & Boles: Thermodynamics – An Engineering Approach, Tata McGraw Hill Publications
2. P. L Ballany: Thermal Engineering, Khanna Publishers
3. C.P. Arora: Engineering Thermodynamics, Tata McGraw Hill Publications

University of Pune, Pune

S.E. (Mechanical sandwich) – I (2012 Pattern)

FLUID MECHANICS AND MACHINERY (202062)

Teaching scheme
Lectures: 4 Hrs/week
Practical: 2 Hrs/week

Examination Scheme
Theory (Online): 50 marks
Theory (Paper): 50 marks
Term work: 25 marks
Oral: 50 marks

Learning Objectives:

1. Understand various properties of fluids, their uses and units.
2. Understand basics of fluid statics, concepts of fluid pressure its measurement, units.
3. Understand fluid kinematics and fluid dynamics.
4. Identify fluid flow types and understand concepts of boundary layer, drag and lift.
5. Understand principles of conservation of mass, energy and momentum and their applications in fluid flow
6. Understand flow through pipes, siphons, transmission of power, major and minor losses.
7. Understand concepts of power producing devices (turbines), their classifications, governing and performance characteristics.
8. Understand concepts of power consuming devices (pumps), their classifications, and performance characteristics.

Prerequisite:

1. **Engineering Mathematics**
2. **Engineering Physics**

Unit I: Properties of Fluids:

Characteristics of fluids, Mass density, Specific density, specific gravity, Dynamic viscosity, Kinematic viscosity, Surface tension, capillarity, compressibility, Vapour pressure.

Fluid Statics: Pascal's law, Pressure at appoint, Total pressure, Centre of pressure, Pressure on a plane, Inclined and curved surfaces, Buoyancy, Metacenter and Metacentic height, stability of submerged and floating bodies (No numerical on Buoyancy, metacentre, floatation)

Unit II: Fluid Kinematics:

Types of flows, visualization of flow field (stream, path and streak Line) ; Stream function and velocity potential function;

Internal Flows flow: Laminar and Turbulent flow physics, entrance region and fully developed flow, Velocity and shear stress distribution for laminar flow in a pipe, Fixed parallel plates and Couette flow; (No numericals)

Unit III: Fluid Dynamics

Euler's equation of motion along a stream line, Derivation of Berounalli's equation, Applications of Bernaulli"s equation, Venturimeter Orifice meter Notches, pitot tube, concept of HGL and TEL; (No derivation and numericals for notches)

Flow through Pipes: Darcy weisbach equation, major and minor losses, Pipes in series Pipes in parallel and concept of Equivalent Pipe, Transmission of Power (no derivations for minor losses)

Unit IV: Impulse Momentum Principle

Force exerted on fixed flat and curved plate, moving plate,

Impulse Turbines: Pelton wheel, construction, Principal of working, Velocity diagrams and analysis, Design aspects, Governing and performance characteristics,

Unit V: Reaction Turbies

Classifications, Francis and Kaplan turbine, constructional details, Velocity diagrams and analysis, Design aspects, Draft tubes, Governing and performance characteristics, Specific speed, Cavitation;

Dimensional Analysis: Buckingham pi theorem, Important dimensionless numbers, similarity applied to turbines and pumps;

Unit: VI: Hydrodynamic Pumps

Classification, components of Centrifugal pumps, various terms associated with Centrifugal pumps, various heads, velocity triangles and their analysis, Cavtation, NPSH, specific speed, performance characteristics of Centrifugal pumps

Non conventional pumps: Air lift pump, Jet pump, submersible pumps, Hydraulic ram, construction and working;

Laboratory Assignments

1. Study of pressure measuring devices
2. Determination of viscosity of liquids and its variation with temperature
3. Verification of modified Bernoulli's equation
4. Calibration of venture meter / orifice meter
5. Laminar and turbulent flows by Reynold's apparatus
6. Determination of major losses through pipes
7. Flow around immersed bodies, point of stagnation, formation of wake etc by Heleshaw's apparatus
8. Determination of Metacentric height of floating object
9. Verification of Momentum principle
10. Study and trial on Pelton wheel and plotting of operating / Main characteristics
11. Study and trial on any one reaction turbine and plotting of operating / Main characteristics
12. Study and trial on centrifugal pump and plotting of operating characteristics

(Minimum eight experiments out of which Sr no.2, 3,4 10, 11 and12 are compulsory)

[Data of any one trial performed should be analyzed using any suitable software]

Text Books

1. Fundamentals of Fluid Mechanics Munson, Young and okiishi-Wiley India
2. Fluid Mechanics- Potter Wiggert-cengage Learning
3 .Fluid Mechanics –Dr R.K. Bansal- Laxmi Publication,New Delhi
4. Fluid Mechanics-Cengle&cambla-TATA McGraw Hill
5. Fluid Mechanics –White-TATA McGraw-HILL
6. Hydraulics and Fluid Mechanics-Modi P.N. and Seth S.M.-Standard book house

Reference Books

1. Fluid Mechanics Kunda,Cohen,Dowling,Elsevier India
2. Fluid Mechanics Chaim Gutfinger David Pnueli Cambrigge university press
3. V. P. Vasandani Theory of hydraulic Machinery
4. Dr. J. Lal Hydraulic Machines Metropolitan Book Co. Pvt Ltd Delhi

University of Pune, Pune

S.E. (Mechanical, Mechanical Sandwich & Automobile) – II (2012 Pattern)

Strength of Materials (202051)

Teaching scheme
Lectures: 3 Hrs/week
Practical: 2 Hrs/week

Examination Scheme
Theory (Online): 50 marks
Theory (Paper): 50 marks
Oral: 50 marks

Prerequisites:

1. Fundamentals of engineering mechanics
2. Analysis of forces and moments
3. Laws of motion, kinetics, kinematics
4. Algebra and trigonometry

Learning objectives:

To understand

1. Mechanical behavior of the body by determining the stresses, strains and deflections produced by the loads up to the elastic limit.
2. Fundamental concepts related to deformation, strain energy, moment of inertia, load carrying capacity, slope an deflection of beams, shear forces, bending moments, torsional moments, column and struts, principal stresses and strains and theories of failure

Course outcomes:

1. an ability to apply knowledge of mathematics, science, for engineering applications
2. an ability to design and conduct experiments, as well as to analyze and interpret data
3. an ability to design a component to meet desired needs within realistic constraints of health and safety
4. an ability to identify, formulate, and solve engineering problems
5. an understanding of professional and ethical responsibility
6. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Unit I: Simple stresses & strains

Stress, strain, Hooke's law, Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity, Bulk Modulus. Interrelation between elastic constants,

Stress-strain diagrams for ductile & brittle materials. Various strengths of material- Yield strength, Ultimate tensile strength etc, Factor of Safety.

Stresses and strains in determinate & indeterminate, homogeneous & composite bars under concentrated loads & self weight.

Temperature stresses in simple members.

Unit II: Shear Force & Bending Moment Diagrams

Shear forces & bending moment diagrams for statically determinate beams due to concentrated loads, uniformly distributed loads, uniformly varying loads & couples, Relationship between rate of loading, shear force and bending moment.

Maximum bending moment & positions of points of contra flexure.

Unit III: Stresses in Machine Elements

Bending stresses : Theory of simple bending, assumptions, derivation of flexural formula, second moment of area of common cross sections(rectangular, I,T,C) with respective centroidal & parallel axes, bending stress distribution diagrams, moment of resistance & section modulus.

Shear stresses: Concept, derivation of shear stress distribution formula, shear stress distribution diagrams for common symmetrical sections, maximum and average shears stresses, shear connection between flange & web.

Unit IV:

Slope & deflection of beams: Relation between BM & slope, slope & deflection of determinate beams, double integration method (Macaulay's method), derivation of formula for slope & deflection for standard cases.

Strain energy: Strain energy due to axial load (gradual, sudden and impact). Strain energy due to bending and torsion.

Unit V:

Torsion : Stresses, strain & deformations in determinate shafts of solid & hollow, homogeneous & composite circular cross section subjected to twisting moment, derivation of torsion equation, stresses due to combined torsion, bending & axial force on shafts.

Buckling of columns: 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, Rankine's formula, safe load on columns

Unit VI:

Principal stresses & strains: Normal & shear stresses on any oblique plane. Concept of principal planes, derivation of expression for principal stresses & maximum shear stress, position of principal planes & planes of maximum shear.

Graphical solution using Mohr's circle of stresses.

Principal stresses in shaft subjected to torsion, bending moment & axial thrust (solid as well as hollow), Concept of equivalent torsional and bending moments.

Theories of elastic failure: Maximum principal stress theory, maximum shear stress theory, maximum distortion energy theory, maximum strain theory – their applications & limitations.

Term Work: The term work shall consist of 5 experiments and 3 assignments listed below.

[A] List of Experiments: [Any five]

01) Tension test for ductile and brittle material using extensometer.
02) Compression test for ductile and brittle material using extensometer.
03) Shear test of ductile material on Universal Testing Machine.
04) Experimental verification of flexural formula in bending for cantilever beam.
05) Experimental verification of flexural formula in bending for simply supported beam.
06) Measurement of stresses and strains in beams for different end conditions using strain gauges.
07) Torsion Test on circular bar.

[B] Assignments: [Any three]

01) Shear force and bending moment diagrams with different end conditions.
02) Slope and deflection.
03) Principal stresses through graphical and analytical method.
04) Above problems may be solved by simulation technique.

Term work will be assessed along with oral examination at end of semester. Internal examiner or subject teacher keeps the record of continuous assessment and help the external examiner while conducting oral examination so that there should not be injustice to the students.

Text Books:

01) G.H.Ryder- Strength of Materials- 3rd Edition, Macmillan Pub, India
02) S.S. Rattan - Strength of Material – Tata McGraw Hill Publication Co. Ltd.
03) S. Ramamurtham - Strength of material - Dhanpat Rai Publication.
04) Timoshenko and Young - Strength of Materials - CBS Publication.

Reference Books :

01) Beer and Johnston - Strength of materials - CBS Publication.

02) E.P. Popov - Introduction to Mechanics of Solids - Prentice Hall Publication.
03) Singer and Pytel - Strength of materials - Harper and row Publication.
04) B.K. Sarkar - Strength of Material - Tata McGraw Hill New Delhi.

University of Pune

S.E. Mechanical Sandwich – I (2012 Pattern)

Workshop Practice - II (211063)

Teaching Scheme: Practical 2hr/week Term Work: - 25 Marks

Learning Objectives:

1. To set the manufacturing set-up appropriately and study the corresponding set up parameters.
2. To Select appropriate process parameters for obtaining desired characteristic on work piece.
3. To understand the operational problems and suggest remedial solutions for adopted manufacturing process.

Prerequisites:

1. Basics of Workshop practices
2. Basics of Engineering graphics
3. Basic of Engineering mathematics

Each student must complete and submit following Term work:

1. Manufacturing of Jobs:

1) Manufacturing one composite job consisting of taper turning and threading operation.
2) Manufacturing of Spur gear.
3) Grinding of one component using cylindrical or surface grinder.
4) Demonstration of one job on CNC Lathe machine.

2. Journal and demonstration:

A journal containing record of following assignments based on the following topics
(With sketches and relevant description)

1. Block diagrams (Any two)
   a. Lathe
   b. Universal milling machine
   c. Radial drilling machine
   d. Cylindrical grinder
2. Mechanisms (Any two)
   a. All geared head stock of a center lathe
   b. Any two quick acting clamping devices for fixture.
   c. Crank and slotted lever quick return drive of shaping machine
   d. Components of one type of die.
3. Casting and super finishing processes (Any two)
   a. Types of pattern
   b. Different casting methods
   c. Honing
   d. Buffing
4. Welding (Any two)
   a. Classification of welding processes
   b. Different types of welding symbols and joints
   c. Testing of welded joints
   d. Welding defects

Note: Teaching Faculty should explain construction, working, tooling and operations of concerned Machine Tool/machining process during practical work.

Text Books:

1) Hajara Chaudhary, Bose S.K. Elements of Workshop Technology Vol I and II, Asia Publishing House
2) Rao P.N. Manufacturing Technology and Foundry, Forming and Welding, Tata Mc. Graw Hill
3) Parmar R.S. Welding Process and Technology, Khanna Publisher

Semester – II

University of Pune, Pune

S.E. (Mechanical Sandwich) Part- II (2012 Course)

THERMAL ENGINEERING (202064)

Teaching Scheme:

Lectures; 4hrs/week
Practical; 2hrs/week

Examination scheme:
Theory (Online): 50 Marks
Theory (Paper): 50 Marks
Oral: 50Marks
Term Work: 25 marks

Learning Objectives :

By the end of course student should be able to

1. Describe all refrigeration and air conditioning processes.
2. To plot processes on P-V,T-S,P-h diagrams.
3. Calculate performance of refrigeration cycles and calculate psychrometric properties.
4. Understand all the I.C.Engine systems ,layouts and its importance.
5. Analyse the performance of engine.
6. Understand the concept of normal and abnormal combustion in engine.
7. Conversant with gas turbines and Jet propulsion.

Prerequisite:

1. Thermodynamics.
2. Engineering Mathematics.

Unit I: Reciprocating Air Compressor 8 Hrs.

Uses of compressed air, classification of compressors, constructional details of single and multistage compressor, computation of work done, isothermal work done, isothermal efficiency, effect of clearance, volumetric efficiency, need of multi staging, intercooling and after cooling.

Rotary Air Compressor: Basic principles, classification, construction, working of roots, vane, scroll compressors. . Selection of compressors for various applications.

Unit II: Refrigeration: 10 Hrs.

Definition, refrigeration load, unit of refrigeration, reverse carnot cycle, systems of refrigeration, Bell-Coleman cycle, vapour compression cycle (VCC), effect of operating parameters on VCC, use of P-h charts, refrigerants, properties of refrigerants, alternative refrigerants, simple vapour absorption system, comparison of vapour compression and vapour absorption cycle.

Unit III:Air-Conditioning: 8 Hrs.

Psychrometry, properties, relations, use of chart, processes, air conditioning equipments, air-conditioning systems; comfort and industrial air conditioning, factors affecting human comfort, effective temperature and comfort chart, central and unitary air conditioning systems, applications of air conditioning.

Unit IV: I. C. Engines 8 Hrs.

Fuel feeding system, Starting system, Ignition System, Engine Cooling System, Lubrication System, Governing System.

Supercharging: Need for supercharging, supercharging and turbocharging, types of superchargers, Limitations of supercharging in S.I. and C.I. engines (Descriptive treatment).

Testing & Performance of I. C. Engine: Determination of brake power, indicated power, friction power. Determination of brake thermal efficiency, mechanical efficiency, volumetric efficiency, Energy Balance.

Unit V: Combustion in S.I. engines 6 Hrs

Stages of combustion, flame propagation, factors influencing, flame speed, abnormal combustion- pre-ignition and detonation, Octane number, types of combustion chambers in S.I. engines.

Combustion in C.I. engines: Stages of combustion, ignition delay and factors affecting delay period, diesel knock, , cetane number, comparison of diesel knock and detonation, types of combustion chambers for C.I. engines.

Emission and pollution control: Emissions from S.I. and C.I. engines and their harmful effects. Catalytic converters – construction and working (elementary treatment). Contemporary and proposed emission norms. (Descriptive treatment).

Unit VI: Gas Turbines: 8 Hrs.

Theory and fundamentals of gas turbines, principles, classifications, thermodynamic cycles, assumptions for simple gas turbine cycle analysis, work ratio, concept of optimum and maximum pressure ratio, actual cycle, effect of operating variables on thermal efficiency, regeneration, intercooling, reheating and their effect on performance, close and semi close cycle gas turbine plant, application of gas turbine.

Jet Propulsion: Introduction, theory of jet propulsion, types of jet engines, turbo jet, turboprop, turbofan, pulse jet and ramjet engines, applications of jet engine, , introduction to rocket engines . (Descriptive treatment).

Term Work:

The term shall consist of record of minimum eight experiments from the followings.

1. Trial on refrigeration test rig to find theoretical COP,actual COP and relative COP.
2. Trial on air conditioning test rig .
3. Trial on ice plant test rig.
4. Trial on reciprocating air compressor to find volumetric efficiency and Isothermal efficiency.
5. Test on diesel engine to determine BP, bsfc, thermal efficiency, and relative efficiency for one load.
6. Trial on Petrol engine – Morse test.
7. Study of combustion chambers in SI and CI engines.
8. Study of supercharging and turbocharging.
9. Study and demonstration of exhaust gas analyzer and smoke meter.
10. Assignment on any one advanced technology related to I.C Engine/ RAC.
11. Visit to any refrigeration plant / air conditioning plant /automobile service station.

Text Books:

1. Ganesan V.: Internal combustion engines. Tata McGraw Hill.
2. Mathur and Sharma: Internal combustion engines, Dhanpatrai and Company.
3. Arrora and Domkundwar: Refrigeration and airconditioning, Dhanpatrai and Company.
4. C P Arrora:Engineering Thermodynamics, Tata McGraw Hill.

Reference Books:

1. P L Ballaney: Thermal engineering, Khanna Publishers.
2. Heywood :Internal combustion Engine Fundamentals, Tata McGraw Hill.
3. Domkundwar and Domkundwar: Internal combustion engines, Dhanpatrai and Company.
4. C P Arrora: Refrigeration and Airconditioning, Tata McGraw Hill.

University of Pune, Pune

S.E. (Mechanical Sandwich) Part- II (2012 Course)

METROLOGY AND QUALITY CONTROL (202065)

Teaching Scheme -	Examination Scheme –
Lectures – 3 Hrs / week	Term Work – 25 Marks
Theory – Paper – 50 Marks	Practical – 2 Hrs / Week
Online – 50 Marks.	**Oral - 50 marks

Learning objectives

1. To develop and evaluate measurement techniques
2. To create awareness among the students regarding different gauges used in industries
3. Knowledge of limits, fits and tolerances will aid them while assembling different parts to perform desired function developing interchangeability concept
4. Knowledge of SQC tools will help the students in continual improvement process.

Course outcomes:-

1. To develop ability in students to use appropriate measuring instruments which will aid in giving precise results.
2. An ability to design and develop gauging systems.
3. Students will be capable to meet the demanding higher level of accuracy in today's modern manufacturing scenario.
4. Capable of analyzing the accuracy of measuring methods establishing uncertainty of it then researching into the causes of measuring errors and eliminating the same.

Pre-requisites:-

1. Hand on using basic measuring instruments.
2. Algebra and trigonometric relations.
3. Machine drawing

Unit I:- Measurement standards and comparators 6 Hrs

Principles of Engineering metrology, Types of measurement standards, Types and sources of errors, Accuracy and Precision, linear measuring instruments, angular measuring instruments and their applications.

Calibration : concept and procedure , traceability, uncertainty in measurement.

Comparators - Mechanical, Pneumatic, Optical, Electronic (Inductive), Electrical (LVDT).

Checking of geometrical forms

Unit II: – Design of gauges, Interferometers and surface finish measurements 8 Hrs

Design of Gauges- Taylor's principle, Types of gauges, limits, fits, tolerances.

Interferometer- Principle, NPL Interferometer, Flatness measuring of slip gauges, Laser Interferometer

Surface Finish Measurement- Surface texture, measuring surface finish by Stylus Probe, Tomlinson & Taly-surf, Methods to analyze surface traces.

Unit III: – Metrology of Screw Thread, Gears and Advance Metrology 7 Hrs

Measurement of thread form- Minor, Major, effective, Flank angle, pitch, Types & effect of Screw threaded error, Floating Carriage Micrometer.

Gear Metrology- Gear error, Gear measurement: Gear tooth Vernier, constant chord, base tangent, Rolling, Profile Projector, Tool maker's microscope.

Advancements in Metrology- Co-ordinate measuring machine, Universal measuring machine, Laser in metrology, Automatic inspection system, Online-Offline inspection machine vision.

Unit IV: - Introduction to Quality and Quality Tools 7 Hrs

Deming's PDCA,PDSA cycles & Juran Trilogy approach, Quality Statements, Cost of quality & value of quality, Seven Quality Tools: check sheet, flow chart, Pareto analysis, cause & effect diagram, scatter diagram, Brain storming; Quality circle; Concurrent engineering; Malcom Balbridge national quality award.

Unit V: – Total Quality Management 6 Hrs

Quality function deployment, 5S, Kaizen, Kanban, JIT, Poka yoke, QMS (ISO 9000, TS 16949, ISO 14000, Quality audit); TPM, FMECA, FTA; Zero defects.

Unit VI: – Statistical quality control 8 Hrs

Statistical quality control- Statistical concept, Frequency diagram, Concept of variance analysis, control chart for variable & attribute, Process capability, statistical process Control, Concept of Six sigma: DMAIC, Production part approval Method (PPAP)

Acceptance Sampling: Sampling Inspection, OC Curve and its characteristics, sampling methods, Sampling Plan: comparison, calculation of sample size, AOQ, Probability of Acceptance.

Reference Books: Metrology

1. Hume K.J. - Engineering Metrology, Macdonald Publications
2. Jain R.K. - Engineering Metrology, Khanna Publication.
3. Narayana K.L. Engineering Metrology.
4. Galyer J.F & Shotbolt C.R. Metrology for engineers.
5. Gupta I.C. —Engineering Metrology, Dhanpatrai Publiartions
6. Judge A.W. —Engineering Precision Measurements, Chapman and Hall
7. ASTME, —Handbook of Industrial Metrology", Prentice Hall of India Ltd

Reference Books : Quality Control

1. Juran J. M., —Quality Handbook, McGraw Hill Publications.
2. Grant S.P., —Statistical Quality Control, Tata McGraw hill Publication.
3. Dale H. Besterfield – Quality control, Pearson Education
4. Mahajan – Quality control, Dhanpatrai Publiartions
5. John Oakland – statistical Process Control Butterworth- Heinnemann.

Term work:

A] Experiments (Write up's based on experiments conducted.) **(Any Eight)**

LIST OF EXPERIMENTS

1. To measure the angle of taper ring gage by two calibrated balls method. Measurement of angle of taper plug gauge with sine bar.
2. To calibrate the given Dial gauge using Calibration Tester.
3. To determine the flatness of given specimen using the optical flat.
4. To measure the effective diameter of screw plug gauge using floating carriage micrometer.
5. To study the gear rolling tester and then to check the given specimen gear for effective diameter, Depth of tooth, and eccentricity and to calculate the backlash. Or to measure gear tooth thickness by using gear tooth Vernier caliper.
6. To check the surface roughness of given specimen using surface roughness tester.
7. To study the working of Profile projector and then to measure the various angles of a single point cutting tool.
8. To perform alignment test on Radial drilling machine and Lathe Machine.
9. To study the toolmakers microscope and then to measure pitch and angle of screw thread.
10. Study of co-ordinate measuring machine.

B] Term Work –

- In addition at least two assignments on statistical quality control.

**** Under oral head examination should be based on term work completed during practical and theory syllabus**

University of Pune, Pune

S.E. (Mechanical, Mechanical Sandwich & Automobile) – II (2012 Pattern)

Theory of Machines – I (202048)

Teaching scheme	**Examination Scheme**
Lectures: 4 Hrs/week	Theory (Online): 50 marks
Practical: 2 Hrs/week	Theory (Paper): 50 marks
	Term work: 25 marks

($ Common Oral will be based on both TOM-I and TOM-II term work at end of First Semester of T.E.)

LEARNING OBJECTIVES:

1. To make the student conversant with commonly used mechanism for industrial application.
2. To develop competency in drawing velocity and acceleration diagram for simple and complex mechanism.
3. To develop analytical competency in solving kinematic problems using complex algebra method.
4. To develop competency in graphical and analytical method for solving problems in static and dynamic force analysis.
5. To develop competency in conducting laboratory experiments for finding moment of inertia of rigid bodies, verification of displacement relation for Hooke's joints, to measure power transmitted and absorbed by dynamometer and brakes respectively.

Unit I: Fundamentals of Kinematics and Mechanisms 10 Hrs.

Kinematic link, Types of links, Kinematic pair, Types of constrained motions, Types of Kinematic pairs, Kinematic chain, Types of joints, Mechanism, Machine, Degree of freedom (Mobility), Kutzbach crieterion, Grubler's criterion.

Four bar chain and its inversions, Grashoff's law, Slider crank chain and its inversions, Double slider crank chain and its inversions.

Equivalent linkage of mechanisms.

Exact and Approximate Straight line mechanism, Steering gear mechanisms: Condition for correct steering, Davis steering gear mechanism, Ackermann steering gear mechanism.

Unit II: Static and Dynamic Force Analysis 8Hrs.

Theory and analysis of Compound Pendulum, Concept of equivalent length of simple pendulum, Bifilar suspension, Trifilar suspension.

Dynamics of reciprocating engines: Two mass statically and dynamically equivalent system, correction couple, static and dynamic force analysis of reciprocating engine mechanism (analytical method only), Crank shaft torque, Introduction to T-θ diagram.

Friction: Friction and types of friction, laws of friction, Friction in turning pair, friction circle, friction axis, friction in four bars and slider crank mechanism.

Unit III: Friction Clutches, Brakes and Dynamometer 8Hrs.

Pivot and collar friction, plate clutches, cone clutches, centrifugal clutch, torque transmitting capacity.

Different types of brakes, shoe brakes, external and internal shoe brakes, block brakes, band brakes, and band and block brakes, Braking torques, and different types of absorption and transmission type dynamometer.

Unit IV: Kinematic Analysis of Mechanisms: Analytical Methods 8 Hrs.

Analytical method for displacement, velocity and acceleration analysis of slider crank Mechanism.

Position analysis of links with vector and complex algebra methods, Loop closure equation, Chase solution, Velocity and acceleration analysis of four bar and slider crank mechanisms using vector and complex algebra methods.
Hooke's joint, Double Hooke's joint.

Unit V: Velocity and Acceleration Analysis of Simple Mechanisms: Graphical Methods-I 8 Hrs.

Relative velocity method : Relative velocity of a point on a link, Angular velocity of a link, Sliding velocity, Velocity polygons for simple mechanisms.
Relative acceleration method : Relative acceleration of a point on a link, Angular acceleration of a link, Acceleration polygons for simple mechanisms.
Instantaneous center of rotation (ICR) method: Definition of ICR, Types of ICRs, Methods of locating ICRs, Kennedy's Theorem, Body and space centrode.

Unit VI: Velocity and Acceleration Analysis of Mechanisms: Graphical Methods-II 8Hrs.

Velocity and acceleration diagrams for the mechanisms involving Coriolis component of acceleration.
Klein's construction.

Term Work :

The term work shall consist of:

[A] Assignments/Tutorial:

The following two assignments shall be completed and record to be submitted in the form of journal.

1. Minimum one problem on Static and Dynamic force balancing, Friction Clutches Brakes and Dynamometer.
2. One problem on velocity and acceleration analysis using:

A) Vector algebra and B) Complex algebra and comparison of results.

[B] Laboratory Experiments:

Any four of the following experiments shall be performed and record to be submitted in the form of journal.

1. Demonstration and explanation of configuration diagram of working models based on four bar chain, single slider crank mechanism, and double slider crank mechanism for various link positions (any two models).
2. To determine the mass moment of inertia of a connecting rod using a compound pendulum method.
3. To determine the mass moment of inertia of a flat bar using bifilar suspension method.
4. To determine the mass moment of inertia of a flywheel/gear/circular disc using trifilar suspension method.
5. To determine the angular displacements of input and output shafts of single Hooke's joint for different shaft angles and verification of the results using computer programme.
6. To measure torque transmitting capacity of friction clutch.
7. To measure the power transmitted by the dynamometer or power absorbed by the brake.

[C] Drawing Assignments (3 sheets of ½ imperial size) :

1. To study and draw (any four) mechanisms for practical applications such as: mechanical grippers in robot, lifting platform, foot pump, toggle clamp, folding chair etc.; straight line

2. Mechanisms such as: Peaucellier Mechanism, Scott Russell Mechanism, Grasshopper Mechanism etc., for various link positions.
3. Two problems on velocity and acceleration analysis using Graphical methods i.e., polygons or ICR (Based on Unit 5).
4. Two problems on velocity and acceleration analysis using Graphical methods i.e., polygons involving Coriolis component or Klein's construction (Based on Unit 6).

Text Books

1. Thomas Bevan, "Theory of Machines" CBS Publisher and Distributors, Delhi.
2. S. S. Ratan, "Theory of Machines", Tata McGraw Hill.
3. Ashok G. Ambekar, "Mechanism and Machine Theory", Prentice Hall, India
4. Sadhu Singh, "Theory of Machines", Pearson

Reference Books:

1. Shigley J. E., and Uicker J.J., "Theory of Machines and Mechanism", McGraw Hill Inc.
2. Ghosh Amitabh and Mallik A. K. "Theory of Machines and Mechanism", East- West Press.
3. Hall A. S., "Kinematics and Linkage Design", Prentice Hall.
4. Wilson C.E., Sandler J. P. Kinematics and Dynamics of Machinery", Person Education.
5. Erdman A.G. and Sandor G.N., "Mechanism Design, Analysis and Synthesis" Volume-I, Prentice –Hall of India.

University of Pune
SE (Mechanical Sandwich) (2012 Pattern)
Manufacturing Engineering (202066)

Teaching Scheme
Lectures: 4 Hrs/week

Examination Scheme
Theory (Online): 50 Marks
Theory (Paper): 50 marks

Learning Objectives:

1) To select appropriate manufacturing process for producing part under consideration.
2) To identify various process parameters and their effects on processes.
3) To design the process and tooling.
4) To identify the defects and propose the remedies.

Prerequisites:

1) Basics of Mechanical Engineering
2) Workshop Practices
3) Basics of Engineering graphics

Unit I: CASTING AND FORMING PROCESSES 10 Hrs.

Casting Processes

Sand Casting: Pattern types, materials, Pattern making allowances, Moulding sand types, Properties and testing. Hand and machine moulding processes and equipment's. Defects in casting, Inspection techniques.

Core: Types and manufacturing. Gating Systems (numerical). Cleaning and finishing. Defects in casting. Inspection techniques, Shell moulding, Investment casting, Die casting, Centrifugal casting. Continuous casting**.**

Forming Processes : Introduction to hot working and cold working.

Rolling: Types of rolling mills, Roll forming, Roll forging

Forging: Drop, press and upset, defects, Extrusion- Direct and indirect

Drawing- Wire drawing (numerical), tube drawing, Swaging, shot peening.

Unit II: JOINING PROCESSES 8 Hrs.

Surface preparation and various joints. Welding Classification.

Arc Welding- Theory, SMAW, GTAW, FSAW, Submerged arc welding, Stud Welding. Resistance welding- Theory, Spot, Seam and Projection weld process.

Gas Welding: Types of Flames and applications. Soldering, brazing and braze welding.

Weld inspection, Welding defects and their remedies.

Use of adhesives for joining - Classification of adhesives, types of adhesives, applications.

Unit III: MACHINE TOOLS 10 Hrs.

Center lathe: Introduction to, types of lathes. Construction and working of lathe, attachments and accessories, lathe mechanisms. Thread cutting and taper turning methods.

Milling machine: Types of milling machines, Construction, Working and Mechanism of Column and Knee type milling machine. Cutter- types, geometry and their applications, Speed, feed and depth of cut. Universal Dividing head, methods of indexing. simple numerical on indexing, machining time calculation.

Drilling Machine: Twist drill geometry, tool holder, Types of drilling machines, Types of drill and operations, speed, feed of drill, Simple numerical to calculate machining time.

Unit IV: METALCUTTING AND NON CONVENTIONAL PROCESSES 8 Hrs.

Theory of Metal Cutting Cutting tool: tool geometry, Concept of cutting variables and their effect on cutting forces. Merchant's force circle . Estimation of cutting forces. Machinability, Toollife, Tool wear, economics of machining, cutting fluids.

Non Conventional Machining

Introduction, Types of Non-Conventional Methods of Machining, applications.
Working Principles, Process Parameters and applications of: AJM and USM, LBM, ECM, EDM, PAM.

Unit V: PRESS TOOL DESIGN 8 Hrs.

Introduction to Press working operations. Types of dies, accessories and punches for press working, materials for punches and dies.
Die design: for blanking, piercing, bending and drawing.
Effect of clearance, center of pressure, different forces, press tonnage, blank size, number of draws, strip layout, sheet utilization ratio, methods of reducing forces.

Unit VI: PRINCIPLES OF JIGS AND FIXTURES 8 Hrs.

Jigs and fixtures: Definitions, elements of, Basic principles and guidelines for design.
Locating devices: types of locators and their selection. Clamping devices – basic principles, types of bushes and their selection. indexing methods
Types of jigs and fixtures
Power work holding devices, Jig bushes, modular fixturing,
Working drawings (two views) for design of simple components.

Text Books:

1) P. N. Rao, Manufacturing Technology Vol I & II -Tata McGraw Hill Publishers
2) Hajara Choudhari, Bose S. K. Elements of Workshop Technology Vol. I & II -Asia Publishing House
3) P. C. Sharma, Production Engineering - Khanna Publishers
4) D. K. Singh, Fundamentals of manufacturing technology-Ane's Books Pvt.ltd.
5) Kempstar Mha, Introduction to Jig and Tool design, Edward Arnold Pub.
6) P. H. Joshi, Jig and Fixtures, Tata McGraw Hill Publishing Co.

Reference Books:

1) Chapman W.A. J., Workshop Technology Vol. I, II, III -ELBS Publishers
2) HMT- Production Technology -Tata McGraw Hill Publishing Co.
3) B. Ravi-Metal Casting: Computer Aided Design and analysis-Prentice Hall of India
4) J.T.Black- DeGormos, Materials and Processes in Manufacturing -John Willey and Sons
5) M.P.Grover-Fundamentals of modern manufacturing: Materials and Systems
6) Cyril Donaldson and George H LeCaine, Tool Design -Tata McGraw Hill Publishing Co.
7) Dr. R. S. Parmar- Welding Processes and Technology -Khanna Publishers, New Delhi.
8) S. K. Basu- Fundamentals of Tool Design -Oxford IBH
9) R. K. Jain, Production technology
10) Suchy Ivna, Handbook of die design, Tata McGraw Hill.

University of Pune, Pune

S.E. (Mechanical, Mechanical Sandwich & Automobile) – II (2012 Pattern)
Electronics and Electrical Engineering (203152)

Teaching scheme
Lectures: 4 Hrs/week
Practical: 2 Hrs/week

Examination Scheme
Theory (Online): 50 marks
Theory (Paper): 50 marks
Term work: 25 marks

Prerequisite:
1. Basic Electrical Engineering
2. Basic Electronics Engineering

Learning Objectives:
1. Students should conversant with Electrical and Electronic controls basic
2. It will be prerequisite for Mechatronics.
3. To study Microcontrollers
4. To study Electrical drive system required to drive machines

UNIT I: 8 Hrs.
Intel 8051 microcontroller architecture, pin diagram, special function registers, operation of I/O ports, Addressing modes, Instruction set.

UNIT II: 8 Hrs.
Counters and timers in 8051, timer modes, Parallel Data transfer scheme, Serial data input, output, Serial data modes and serial interface with pc.

UNIT III: 8 Hrs.
Electronic voltmeters – analog and digital, Digital multi-meters, Audio oscillators, signal generators and frequency counter.
C.R.O. construction & principle measurement of voltage, current, frequency and phase by oscilloscope

UNIT IV: 8 Hrs.
Electrical Power Measurement: - Measurement of active and reactive power in three phase balanced loads by using one wattmeter & two wattmeter, effect of power factor on wattmeter reading.
Introduction to D.C. and A.C. Potentiometers,
Measurement of high voltage: Measurement of R.M.S value of voltage using Potential Divider method, Measurement of Peak value of voltage using Sphere Gap.
Electrostatic instruments: Quadrant type voltmeter, Attracted disc type voltmeter.
A.C. Bridges: General equation for bridge balance, Maxwell's Inductance Bridge, Maxwell's Inductance-Capacitance Bridge, Schering Bridge for Capacitance measurement, Wien's Bridge for Frequency measurement.

UNIT V: D.C. Machines 8 Hrs.
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), Three point starter for D.C Shunt motor, methods for speed control of D.C shunt and series motors, Industrial applications.

UNIT VI: Three phase Induction Motor 8 Hrs.

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.

Term Work:

Total eight experiments are to be performed.

Any five experiments out of these six experiments are required to be performed.

1. Study of Op-amp in inverting, non-inverting, summer and subtractor mode.
2. Study of Op-amp as Integrator, Differentiator, Comparator
3. Assembly language Programming using 8051.(8 bit addition, 16 bit addition, multiplication, largest number, smallest number, ascending order, descending order)
4. Assembly language Programming using 8051.(8 bit addition of 10 numbers, multiplication, largest number, smallest number, Ascending order, Descending order)
5. Interfacing of DAC 0800 with 8051 microcontroller.
6. Control of stepper motor using 8051 microcontroller.

Any three experiments out of these five experiments are required to be performed.

1. Speed control of a D. C. shunt motor by armature voltage and flux control methods.
2. Measurement of active power in a three phase balanced and unbalanced load using two wattmeter method.
3. Measurement of reactive power in a three phase balanced load using one and two wattmeter method.
4. Estimation of voltage regulation and efficiency of single phase transformer by open circuit and short circuit test.
5. Load test on a three phase induction motor.

Text Books:

1. Ajay Deshmukh Microcontroller 8051 –TATA McGraw Hill
2. The 8051 Microcontroller and Embeded Systems by Muhammad Ali Mazidi, J.G. Mazidi Pearson Education.
3. Operational Amplifier by Gaikwad R. PHI New Delhi.
4. Integrated Circuits by K. R. Botkar, Khanna Publication, New Delhi.
5. Electrical Machines-D P Kothari and I J Nagrath, Tata McGraw Hill ,Third Edition
6. Electrical Machinery-S.K. Bhattacharya, TTTI Chandigad

Reference Books:

1. The 8051 Microcontrollers - Architecture, Programming and Applications by K. J. Ayala, Penram International Publishing(I) Pvt Ltd.
2. Operational Amplifier and Linear Integrated Circuits Theory and Application by James M. Flore, A Jaico Books.
3. Electrical Technology- Vol I & Vol II- B. L.Theraja, S Chand Publication Co Ltd.
4. Electrical Technology-Edward Hughes, Pearson Education.
5. Electrical Machines by Ashfaq Husain, Dhanpat Rai & Sons.

University of Pune, Pune

S.E. (Mechanical, Mechanical Sandwich & Automobile) – I (2012 Pattern)

Computer Aided Machine Drawing (202042)

Teaching scheme
Lectures: 1 Hrs/week
Practical: 2 Hrs/week

Examination Scheme
Practical: 50 marks

Course Prerequisites

1. Fundamentals Engineering Drawing
2. Projection of Solids
3. Basic knowledge of 2-D drafting using graphics software

Learning objectives

1) To understand
   a) Parametric Modeling Fundamentals
   b) Basic Parametric Modeling Procedure
   c) "Shape before Size" Approach
2) To develop an ability to
   a) Create 2-D Sketches
   b) Create Solid Models of machine components
   c) Use the Dynamic Viewing Commands
   d) Create and Edit Parametric Dimensions
   e) Create assembly models of simple machine (minimum 5 components)

Course outcomes

1. an ability to apply knowledge of mathematics, science, and engineering
2. an ability to design and conduct experiments, as well as to analyze and interpret data
3. an ability to communicate effectively
4. a recognition of the need for, and an ability to engage in life-long learning
5. a knowledge of contemporary issues, and
6. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Unit I: 1 Hr.
Introduction – solid modeling, introduction to Graphical User Interface (GUI) of any commercially used solid modeling software

Unit II: 3 Hrs.
Parametric solid modeling – fundamentals, apply/modify constraints and dimensions, transform the parametric 2-D sketch into a 3D solid, feature operations.

Unit III: 1 Hr.
Free form feature modeling, design by features, feature recognition

Unit IV: 3 Hrs.
Geometric dimensioning and tolerancing - Introduction to ASME Y14.5 – 2009, straightness, perpendicularity, flatness, angularity, roundness, concentricity, cylindricity, runout, profile, true position, parallelism, orientation.

Unit V: 2 Hrs.
Assembly modeling – defining relationship between various parts of machine, creation of constraints, generation of exploded view

Unit VI: 2 Hrs.
Production drawing – generation of 2-D sketches from parts and assembly 3-D model, appropriate dimensioning and tolerancing

Term Work:

List of assignments

1. Assignment on 2-D sketching with geometrical and dimensional constraints using any commercially used solid modeling software (2 hrs.)
2. Assignment on parametric solid modeling of a machine component using various commands and features of the software. (4 hrs.)
3. Assignment on solid modeling of the parts of a machine (min. 5 components) (10 hrs.)
4. Assignment on assembly modeling of the parts modeled in assignment 3 using proper mating conditions and generation of exploded view. (4 hrs.)
5. Generation of production drawings of the parts and assembly with appropriate tolerancing. (4 hrs.)

Important Notes:-

1. ***Submission of all above assignments should be in electronic format only (preferably in single CD/DVD for all batches/students) and should be reviewed by external examiner at the time of Practical Examination***
2. ***Practical examination for this subject shall consist of creation of part models and assembly of a machine with minimum Five components.***

References –

1. N. D. Bhatt and V.M. Panchal, Machine Drawing, Charoter Publications
2. ASME Y14.5 – 2009
3. Ibrahim Zeid, Mastering CADCAM, McGraw-Hill
4. Help manuals and tutorials of referred software