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University of Pune

Structure for Mechanical Engineering with effect from academic year 2013 – 14

S. E. (Mechanical) and S. E. (Automobile) Semester – I

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut	Practical	Theory		TW	PR	OR+	Total
					Paper	Online				
207002	Engineering Mathematics – III*	4	1	--	50	50	25++	--	--	**125**
202041	Manufacturing Process-I	3	--	--	50	50	--	--	--	**100**
202042	Computer Aided Machine Drawing*	1	--	2	--	--	--	50	--	**50**
202043	Thermodynamics*	4	--	2	50	50	--	--	50	**150**
202044	Material Science	3	1	--	50	50	25++	--	--	**125**
202045	Fluid Mechanics	3	--	2	50	50	--	--	50	**150**
202046	Workshop Practice II	--	--	2	--	--	25	--	--	**25**
202047	Soft Skills			2	--	--	25	--	--	**25**
Total of Semester – I		**18**	**2**	**10**	**250**	**250**	**100**	**50**	**100**	**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) and S. E. (Automobile) Semester – II

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut	Practical	Theory		TW	PR	OR+	Total
					Paper	Online				
202048	Theory of Machines-I*	4	--	2	50	50	25$	--	--	**125**
202049	Engineering Metallurgy	3	--	2	50	50	--	--	50	**150**
202050	Applied Thermodynamics	4	--	2	50	50	25	--	50	**175**
202051	Strength of Materials*	3	--	2	50	50	--	--	50	**150**
203152	Electronics and Electrical Engineering*	4	--	2	50	50	25	--	--	**125**
202053	Machine Shop-I	--	--	2	--	--	25	--	--	**25**
Total of Semester – II		**18**	**--**	**12**	**250**	**250**	**100**	**--**	**150**	**750**

+ 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.

*** Subjects Common with Mechanical Sandwich**

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.

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University of Pune, Pune
S.E. (Mechanical & Automobile) – I (2012 Pattern)
Manufacturing Processes-I (202041)

Teaching scheme
Lectures: 3Hrs/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 parameter and their effects on processes*
3. *To design the process and tooling.*
4. *To identify the defects and propose the remedies*

Unit I: CASTING PROCESSES: 09 Hrs

SAND CASTING – Pattern- types, material and allowances, Molding sand- types, properties and testing, Molding – types, equipment's, tools and machines, Core – types and manufacturing, Gating system and Riser – types and design (Numerical), Heating and pouring, cooling and solidification-process and time estimation (Numerical), Cleaning and Finishing, Defects and remedies, Inspection techniques.

Die casting, Investment casting, Centrifugal Casting, Continuous Casting- Types, equipment, process parameters, material to cast.

Unit II: METAL FORMING PROCESSES: 08 Hrs

Hot and Cold Working – Concepts and comparative study, Material behavior in metal forming, strain rate sensitivity, friction and lubrication in metal forming

Rolling – Types of rolling mills, flat rolling analysis, power required per roll for simple single pass two rollers. (Simple Numerical)

Forging – Types, process parameter, Analysis of open die forging (Numerical)

Extrusion – Types, process parameter, Extrusion dies, Shape factor (Numerical),

Drawing – Wire drawing and its analysis (Numerical), tube drawing

Unit III: PLASTIC PROCESSING 06 Hrs

Molding – Compression molding, Transfer molding, Blow molding, Injection molding – Process and equipment.

Extrusion of Plastic – Type of extruder, extrusion of film, pipe, cable and sheet

Thermoforming – Principle, pressure forming and vacuum forming.

Unit IV: JOINING PROCESSES: 06 Hrs

Surface preparation and types of joints. Welding Classification

Arc welding – Theory, SMAW, GTAW, FCAW, Submerged arc welding, Stud welding.

Resistance welding – Theory, Spot, seam and projection weld process.

Gas welding.

Soldering, brazing and braze welding.

Joint through Adhesive – classification of adhesive, types of adhesive, applications.

Weld inspection, Defects in various joints and their remedies.

Unit V: SHEET METAL WORKING 07 Hrs

Types of sheet metal operations, Types of dies and punches, material for dies and punches, Die design for blanking, piercing, bending and drawing, clearance analysis, center of pressure, blank size

determination (Numerical), strip layout, sheet utilization ratio (Numerical), method of reducing forces

Unit VI: Centre lathe 07 Hrs

Introduction to centre lathe, types of lathe, construction and working of lathe, attachments and accessories, various operations on lathe, taper turning and thread cutting methods (numerical), machining time calculation (numerical)

Text Books:

1. Hajara Choudhari, Bose S.K. – Elements of workshop Technology Vol. I &II , Asian Publishing House
2. D. K. Singh – Fundamentals of Manufacturing Engineering – Ane's Books. Pvt. Ltd.

Reference Books:

1. B. Ravi – Metal Casting – Computer Aided design and analysis- Prentice Hall of India
2. Reikher – Casting: An analytical approach – Springer
3. Wang – Rapid tooling guidelines for sand casting – Springer
4. J. T. Black – Degormos Materials and process in manufacturing – John Willey and sons
5. M.P Grover – Fundamentals of modern manufacturing: Materials and systems
6. A.S Athalye – Processing of plastic – Colour Publication (Pvt.)Ltd. U.K
7. Cryil Donaldson and George H LeCain – Tool Design – Tata McGraw Hill Education Pvt. Ltd.
8. Dr. R. S. Parmar, Welding Processes And Technology, Khanna Publishers, New Delhi.

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

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

Course outcomes

- an ability to apply knowledge of mathematics, science, and engineering
- an ability to design and conduct experiments, as well as to analyze and interpret data
- an ability to communicate effectively
- a recognition of the need for, and an ability to engage in life-long learning
- a knowledge of contemporary issues, and
- 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

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

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.***

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

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

Material Science (202044)

Teaching scheme	**Examination Scheme**
Lectures: 3 Hrs/week	Theory (Online):-50 marks
Tutorial: 1 hr/week	Theory (Paper):-50 marks
	Term Work: 25 marks^{++}

(++ Term work marks should be based on term work completed in tutorial sessions and internal oral)

Learning Objectives:

- To acquaint students with the basic concepts and properties of Material Science.
- To impart a fundamental knowledge of Materials Processing .
- Selection and application of different Metals & Alloys.
- To understand the structure of Engineering Materials.
- To develop futuristic insight into Materials.

Unit I: Mechanical Behavior of Metals & Crystal Structure 6 Hrs.

Crystal structures (BCC, FCC and HCP systems), indexing of lattice planes & directions, Lattice parameters (co ordination number, no. of atoms per unit cell, atomic packing factor, density, Crystal imperfections; point defects, line defects- edge and screw dislocations, surface defects, volume defects, Mechanism of Elastic & plastic deformation(slip and twinning),deformation of single crystal by slip, plastic deformation of polycrystalline materials, work hardening theory, Changes in properties due to cold working & hot working.

Unit II: Study of Non-Metallic Materials 6 Hrs.

Introduction & Classification of Materials, Definition, Classification & characteristics of polymers, Types of polymerization, Polymer processing, Elastomers, properties and applications of engineering polymers. Properties, processing and applications of ceramic materials (WC, TIC, Al2O3), Cermets.
Composite materials, Classification & Types of composite, Properties & applications, Metal matrix composite, Ceramic matrix composite, Fiber Reinforced plastic , Numerical based on composite (isostress & isostrain conditions).

Unit III: Mechanical Testing of Metals

Study of destructive testing, Tensile test, engineering stress-strain curve, true stress-strain curve, types of stress-strain curves, Numerical based on Evolution of properties, compression test, bend test, torsion test, different hardness tests-Vickers, Rockwell, Brinell, Poldi, Micro Hardness Test, Durometers, Impact test, fatigue test, creep test, Erichsen Cupping Test.

Unit IV: Non – Destructive Testing 6 Hrs.

Non Destructive testing: Principals & procedure, advantages, disadvantages and Industrial applications of NDT, such as Visual Inspection ,Liquid /dye penetrate test, Magnaflux test, Eddy current test, Sonic & Ultrasonic testing and Radiography testing.

Unit V: Powder Metallurgy and Processes 6 Hrs.

Basic steps of powder metallurgy process, powder manufacturing, characteristics of metal powders, Conditioning of metal powders (Screening, Blending & mixing, annealing), Compacting (cold

compaction, hot compaction, Isostatic compaction & powder rolling) Pre-sintering & sintering secondary operations Advantages, limitations and applications of powder metallurgy. Production of typical P/M components (with flow charts), self lubricated bearing, cemented carbides, cermets, refractory metals, electrical contact materials, friction materials, and diamond impregnated tools.

Unit VI: Introduction to Advanced Materials 6 Hrs.

Classification of biomaterials - Comparison & properties of some common biomaterials, Metallic, Ceramic and Polymeric implant materials, Introduction to bio sensors.

Basic concepts of Nano science and technology, Properties and technological advantages of Nano materials, Carbon Nanotubes and applications.

Magnetic materials: Soft & Hard Ferrites, Dielectric materials: Piezo electric and ferro electric materials and their applications, superconductors.

Modern Materials for high, low temperatures and Cryogenic applications Smart materials, Shape memory alloys.

List of Tutorials

1 Numerical based on Indexing, Atomic packing factor, Density.
2 Study of recent composite Materials
3 Numerical based on composite (isostress & isostrain conditions).
4 Study of Non-Metals for Mechanical Engineering Application
5 Study and Trial of Tensile Test & numerical based on tensile test.
6 Study of Compression Test
7 Study and Trial of Rockwell Hardness Test & Hardness conversion number.
8 Study of Ultra Sonic Test.
9 Study of Eddy Current Test.
10 Study of Self lubricated Bearings / Cemented carbide tips, in Powder Metallurgy
11 Study of recent Nano materials.
12 Case study of selection of materials according to applications.

Note: Out of above Twelve Tutorials, any Eight Tutorials should be conducted.

Text Books :

1. "Material Science & Metallurgy For Engineers", Dr. V.D. Kodgire & S. V. Kodgire, Everest Publication.
2. "Mechanical Behavior & Testing Of Materials", A. K. Bhargava, C.P. Sharma. P H I Learning Private Ltd.

Reference Books:

1) Science of Engineering Materials, Smith, Prentice-Hall
2) Materials Science and Engineering, Callister W. D., John Wiley
3) "Engineering Metallurgy", Higgins R. A., Viva books Pvt. Ltd., 2004.
4) "Material Science & Engg." Raghvan V., Prentice Hall of India , New Delhi. 2003
5) Introduction to Physical Metallurgy, Avner, S.H., Tata McGraw-Hill, 1997.
6) Mechanical Metallurgy, Dieter, G.E., McGraw-Hill, 1988.
7) Material Science and Metallurgy, U. C. Jindal, Pearson Edu., 2012

University of Pune, Pune
S.E. (Mechanical & Automobile) – I (2012 Pattern)
FLUID MECHANICS (202045)

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

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

Learning Objectives:

- Identify various properties of fluids and its use units.
- State and illustrate the basics Fluid Statics and Dynamics.
- Identify and explain the fluid properties and concepts of Boundary layer, Drag Lift
- Applications of Bernoulli's Equation for various applications.
- To get conversant with Internal , External flows and it's applications.
- To understand the physics of fluid flow and its applications.

Prerequisite:

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

Unit I: Properties of Fluids 7 Hrs.
Characteristics of Fluids ,Density, Specific Weight, Specific Gravity, Dynamic Viscosity, Kinematics Viscosity, Surface Tension, Capillarity, Compressibility, Vapour pressure.
Pascal's Law, Pressure at a point, Total Pressure, Centre of pressure, Pressure on a plane inclined and curved surfaces, Buoyancy, metacenter and floatation
(No numerical treatment for Buoyancy, metacenter and floatation)

Unit II: Kinematics of Fluid Motion 6 Hrs.
Eulerian and langragian approach of fluid flow, total or material derivative for velocity field, types of flows (One , two, three dimensional , steady unsteady, uniform, non-uniform, laminar, turbulent, compressible, incompressible, rotational, Irrotational) . Visualization of flow field (Stream, Path and Streak line), vorticity in two dimensional flow, stream function and velocity potential function,

Unit III: Fluid Dynamics 8 Hrs.
Introduction to flow models- control volume and infinitesimally small element, Continuity and Linear momentum Equation using differential Approach, Introduction to Navier – Stokes Equation,

Euler equation of motion, derivation of Bernoulli's equation along stream line , concept of HGL and THL or TEL, application of Bernoulli's equation to venture meter, Pitot tube, Orifices, Orifice meter, types of notches
(Only descriptive treatment for notches: No derivations & numerical)

Unit IV: Internal Flow 6 Hrs.
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, hydro dynamically smooth and rough boundaries, Velocity profile of Turbulent flow.

Unit V: Flow Through Pipes 9 Hrs.

Energy lossesthroughpipe-Major and Minor losses, Darcy-Weisbach equation, pipes in series, pipes in parallel and concept of equivalent pipe, Moody's diagram,Siphons, Transmission of power, (No derivations for minor losses)

Dimensional Analysis : Dimensions of Physical Quantities, dimensional homogeneity, Buckingham π Theorem, important dimensionless numbers, Model analysis (Reynolds, Froude and Mach).

Unit VI: External flows 6 Hrs.

Boundary layer formation for flow over Flat plate, boundary layer thickness:-displacement, momentum and energy,Separation ofBoundaryLayer andMethodsofControlling.

Forces on immersed bodies: -Lift andDrag, flow around cylinder and aerofoil (Pressure distribution and Circulation).

Laboratory Assignments

(Any eight of the following)

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 Orifice meter/ /notch.
5. Determination of hydraulic coefficients of orifice.
6. Laminar and Turbulent flows by Reynolds's apparatus.
7. Determination of Major losses through pipes of different Materials
8. Determination of minor losses due to pipe fittings
9. Determination of metacentric height of floating object
10. Flow around immersed bodies, point of stagnation, formation of wake etc. by Haleshaw apparatus.
11. Pressure distribution on flow over cylinder using wind tunnel/CFD tool

Text Books

1. Fundamentals of Fluid Mechanics- Munson, Young and Okiishi- Wiley India
2. Fluid Mechanics- Potter Wiggert –Cengage Learning
3. Introduction to Fluid Mechanics- Fox, Pichard , McDonald- Wiley
4. Fluid Mechanics,- Dr. R.K. Bansal- Laxmi Publication (P) Ltd. New Delhi
5. .Hydraulics and Fluid Mechanics, - Modi P. N. and Seth S. M -Standard Book House.
6. Fluid Mechanics,- Cengel&Cimbla- TATA McGraw-Hill
7. Fluid Mechanics- White- TATA McGraw-Hill

Reference Books

1. Fluid Mechanics- Kundu, Cohen, Dowling- Elsevier India
2. Fluid Mechanics – Chaim Gutfinger David Pnueli-Cambridge University press.
3. Introduction to Fluid Mechanics-Edward Shaughnessy, Ira Katz James Schaffer- OXFORD University Press.

University of Pune, Pune

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

Workshop Practice II (202046)

Teaching scheme
Practical: 2 Hrs/week

Examination Scheme
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 parameter for obtaining desired characteristic on work piece.***
3. ***To understand the operational problems and suggest remedial solution for adopted manufacturing process.***

Each student must complete and submit following term work

I. Jobs[Any Two out of 1st to 4th and 5th Job is compulsory]

1. Casting of pattern components like pulley, gear, Flywheel, Flanges Etc. (Casting of at least one same component per batch)
2. Any two plastic component like bottle, bottle caps, machine handles, etc.
3. Manufacturing any one component involving minimum four types of joint by appropriate welding process.
4. Manufacturing any one sheet metal component involving minimum three different operation (use dies and press).
5. Any one Composite job on centre lathe involving minimum six operations including taper turning and threading.

II. Journal consisting of following assignments (Any three out of first five and Sixth compulsory)

1. Study of casting process
2. Study of plastic molding process.
3. Study of welding process, its defects and remedial solutions
4. Report on sheet metal operations described in job no.4 (Analytical Treatment)
5. Report of composite job on centre lathe and single point cutting tool geometry.
6. Report on Industrial visit to sheet metal Industry / Foundry

Text Books:

1. Hajara Choudhari, Bose S.K. – Elements of workshop Technology Vol.I &II , Asian Publishing House
2. A.S Athalye – Processing of plastic – Colour Publication (Pvt)Ltd. U.K
3. Cyril Donaldson and George H Le Cain – Tool Design – Tata McGraw Hill Education Pvt.Ltd.

University of Pune, Pune

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

SOFT SKILLS (202047)

Teaching scheme | **Examination Scheme**
Practical: 2 Hrs/week | Term work: 25 marks

Unit I : Self Awareness & self Development: 04 Hrs.

a) Self Assessment, Self Appraisal, SWOT, Goal setting - Personal & career - Self-Assessment, Self-Awareness, Perceptions and Attitudes, Positive Attitude, Values and Belief Systems, Self-Esteem, Self appraisal, Personal Goal setting,

b) Career Planning, Personal success factors, Handling failure, Depression and Habit, relating SWOT analysis & goal setting, prioritization.

Unit II: Communication Skill 06 Hrs.

a) Importance of communication, types, barriers of communication, effective communication

b) Speaking Skills – Public Speaking, Presentation skills, Group discussion- Importance of speaking effectively, speech process, message, audience, speech style, feedback, conversation and oral skills, fluency and self expression, body language phonetics and spoken English, speaking techniques, word stress, correct stress patterns, voice quality, correct tone, types of tones, positive image projection techniques.

c) Listening Skills: Law of nature- you have 2 ears and 1 tongue so listen twice and speak once is the best policy, Empathic listening, Avoid selective listening-

d) Group Discussion - characteristics, subject knowledge, oral and leadership skills, team management, strategies and individual contribution and consistency.

e) Presentation skills - planning, preparation, organization, delivery.

f) Written Skills – Formal & Informal letter writing, Report writing, Resume writing - Sentence structure, sentence coherence, emphasis. Paragraph writing. letter writing skills - form and structure, style and tone. Inquiry letters, Instruction letters, complaint letters,
Routine business letters, Sales Letters etc.

Unit III: Corporate / Business Etiquettes 02 Hrs.

Corporate grooming & dressing, Email & telephone etiquettes, etiquettes in social & office setting- Understand the importance of professional behaviour at the work place, Understand and Implement etiquettes in workplace, presenting oneself with finesse and making others comfortable in a business setting. Importance of first impression, Grooming, Wardrobe, Body language, Meeting etiquettes (targeted at young professionals who are just entering business environment) , Introduction to Ethics in engineering and ethical reasoning, rights and responsibilities,

Unit IV: Interpersonal relationship 04 Hrs.

a) Team work, Team effectiveness, Group discussion, Decision making - Team Communication. Team, Conflict Resolution, Team Goal Setting, Team Motivation Understanding Team Development, Team Problem Solving, Building the team dynamics. Multicultural team activity

b) Group Discussion- Preparation for a GD, Introduction and definitions of a GD, Purpose of a GD, Types of GD, Strategies in a GD , Conflict management, Do's and Don'ts in GD

Unit V: Leadership skills 02 Hrs

Leaders' role, responsibilities and skill required - Understanding good Leadership behaviours, Learning the difference between Leadership and Management, Gaining insight into your Patterns, Beliefs and Rules, Defining Qualities and Strengths of leadership, Determining how well you perceive what's going on around you, interpersonal Skills and Communication Skills, Learning about Commitment and

How to Move Things Forward, Making Key Decisions, Handling Your and Other People's Stress, Empowering, Motivating and Inspiring Others, Leading by example, effective feedback

Unit VI: Other skills 02Hrs.

a) Time management- The Time management matrix, apply the Pareto Principle (80/20 Rule) to time management issues, to prioritise using decision matrices, to beat the most common time wasters, how to plan ahead, how to handle interruptions , to maximise your personal effectiveness, how to say "no" to time wasters, develop your own individualised plan of action

b) Stress management- understanding the stress & its impact, techniques of handling stress

c) Problem solving skill, Confidence building Problem solving skill, Confidence building

Term Work/Assignments

Term work will consist the record of any 8 assignments of following exercises

1. SWOT analysis
2. Personal & Career Goal setting – Short term & Long term
3 Presentation Skill
4. Letter/Application writing
5. Report writing
6. Listening skills
7. Group discussion
8. Resume writing
9. Public Speaking
10. Stress management
11. Team Activity-- Use of Language laboratory

*** Perform any 8 exercises out of above 11 with exercise no. 11 as compulsory.**

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 Assignments (Term work)

Minimum 8 assignments are compulsory and teachers must complete them during the practical sessions within the semester. The teacher should explain the topics mentioned in the syllabus during the practical sessions followed by the actual demonstration of the exercises. . Students will submit report of their exercise (minimum 8) 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. **SWOT analysis**

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. **Personal & Career Goal setting – Short term & Long term**

3 **Presentation Skills**

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. **Letter/Application writing**

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

5. **Report writing**

The teacher should teach the students how to write report .. The teacher should give proper format and layouts. Each student will write one report based on visit / project / business proposal etc.

6. **Listening skills**

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.

7. **Group discussion**

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.

8. **Resume writing**

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

9. **Public Speaking**

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)

10. **Team Activity--** Use of Language laboratory

Text Books:

1 Communication Skills : Sanjay Kumar and Pushpa Lata , Oxford University Press
2 Developing Communication Skill : Krishna Mohan, Meera Banerji,- McMillan India Ltd.
3 English for Business Communication : Simon Sweeney , Cambridge University Press

Books for references:

1.NASSCOM-Global Business Foudation Skills: Accenture,Convergys,Dell et.al. Foundation Books : Cambridge University Press
2. Basic Managerial Skills for all E. H. McGrath, Eastern Economy Edition, Prentice hall India.
3. Personality Development and Group Discussions,Barun K. Mitra, Oxford University Press
4 Group Dissussions and Interview Skills : Priyadarshi Patnaik : Foundation Books : Cambridge University Press
5.Thinks and Grow Rich: Napoleon Hill, Ebury Publishing, ISBN 9781407029252
6. Awaken the Giant Within: Tony Robbins HarperCollins Publishers, ISBN-139780743409384
7. Change Your Thoughts, Change Your Life: Wayne Dyer, Hay House India, ISBN-139788189988050
8 Habits of Highly Effective People: Stephen Covey Pocket Books, ISBN-13

9781416502494
9The Power of Your Subconscious Mind: Dr Joseph Murphy Maanu Graphics , ISBN-13 9789381529560
10- The new Leaders: Daniel Coleman Sphere Books Ltd , ISBN-139780751533811
11 The 80/20 Principal: by Richard Koch, Nicholas Brealey Publishings , ISBN-13 9781857883992
12 Time management from inside out: Julie Morgenstern, Owl Books (NY), ISBN-13 9780805075908
13.Wonderland of Indian Manageress: Sharu Ranganekar, Vikas Publishing Houses, ISBN-13 9788125942603
14. You can win: Shiv Khera, Macmillan, ISBN-139789350591932
15. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success: Gopalaswamy Ramesh, Mahadevan Ramesh

Semester – II

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

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

Engineering Metallurgy (202049)

Teaching scheme	**Examination Scheme**
Lectures: 3 Hrs/week	Theory (Online): 50 marks
Practical: 2 Hrs/week	Theory (Paper): 50 marks
	Oral: 50 marks+

+ Under Oral head, examination should be based on term work completed during practical and theory syllabus

Learning Objectives:

- To acquaint students with the basic concepts of Metal Structure
- To impart a fundamental knowledge of Ferrous & Non Ferrous Metal Processing
- Selection and application of different Metals & Alloys
- To Know Fundamentals of Metallography
- To develop futuristic insight into Metals

Prerequisite:

Material Science of Semester - III.

Unit I: Type Of Equilibrium Diagrams & Metallurgical Concepts.

Related terms and their definitions : System, Phase, Variable, Component, Alloy, Solid solution, Hume Ruther's rule of solid solubility, Allotropy and polymorphism, Concept of solidification of pure metals & alloys, Nucleation : homogeneous and heterogeneous, Dendritic growth, supercooling , equiaxed and columnar grains, grain & grain boundary effect.

Cooling curves, Plotting of Equilibrium diagrams, Lever rule, Coring, Eutectic system, Partial eutectic and eutectoid system. Non Equilibrium cooling and it's effects.

Microscopy, specimen preparation, specimen mounting, electrolytic polishing, etching procedure and reagents, electrolytic etching. Macroscopy : sulphur printing, flow line observations.

Unit II: Classification Of Steels And Alloy Steels.

Iron-iron carbide equilibrium diagram, critical temperatures, solidification and microstructure of slowly cooled steels, non-equilibrium cooling of steels, widmanstaten structure, structure & property relationship, classification and application of steels & alloy steels, specification of steels.

Classification & Effect of alloying elements, examples of alloy steels, stainless steels, sensitization & weld decay of stainless steel, tool steels, heat treatment of high speed steel, special purpose steels with applications, superalloys.

Unit III: Heat- treatment Of Steels & Non-Ferrous Metals.

Transformation products of Austenite, Time Temperature Transformation diagrams, critical cooling rate, continuous cooling transformation diagrams. Heat treatment of steels : Annealing, Normalising, Hardening & Tempering, quenching media, other treatments such as Martempering, Austempering, Patenting, Ausforming. Retention of austenite, effects of retained austenite. Elimination of retained austenite (Sub zero treatment). Secondary hardening, temper embrittlement, quench cracks, Hardenability & hardenability testing, Defects due to heat treatment and remedial measures.

Classification of surface hardening treatments, Carburising, heat treatment after Carburizing, Nitriding, Carbo-nitriding, Flame hardening, and Induction hardening.

Heat treatment of Non ferrous metals: Precipitation/ Age Hardening, Homogenization.

Strengthening mechanisms: Refinement of grain size, cold working/strain hardening, solid solution strengthening, dispersion strengthening.

Unit IV: Corrosion and Its Prevention.

Mechanism of Corrosion, Classification of Corrosion: General, Pitting, Crevice, Intergranular, Stress corrosion & cracking .Velocity related corrosion: Erosion, Impingement, and Cavitations corrosion. Corrosion fatigue, Hydrogen Blistering. High temperature corrosion.

Corrosion prevention methods: Inhibitors, Internal & External coating, Cathodic & Anodic protection, Use of special alloys, Control over temperature & velocity, Dehydration, Improvement in design/ changes in design to prevent or control corrosion

Unit V: Cast Irons

Classification, Manufacturing, Composition , Properties & applications of white C.I., Grey cast iron, malleable C.I., S.G. cast iron, chilled and alloy cast iron, effect of various parameters on structure and properties of cast irons. Specific applications such as machine tools, automobiles, pumps, valves etc.

Unit VI: Non Ferrous Metals & Alloys

Classification, Composition, Properties & applications of: Copper and Its alloys, Nickel and Its alloys, Aluminum and Its alloys, Titanium and Its alloys. Specific alloys: soldering & brazing alloy, Precipitation hardening alloys. Bearing materials and their applications.

List of Practicals:

1. Study & Demonstration of Specimen Preparation for microscopic examination.
2. Study of Optical Metallurgical microscope.
3. Study and Drawing of Microstructure of Steels of various compositions.
4. Study and Drawing of Microstructure of Cast Irons.
5. Study and Drawing of Microstructure of Non Ferrous Metals.
6. Heat treatment of Plain Carbon Steel and determination of relative hardness.
7. Study and Drawing of Microstructure of Heat Affected Zone in Welding.
8. Jominy End Quench Test for hardenability.
9. Impact Test.
10. Vickers Hardness Test.
11. Brinell & Poldi Hardness Test.
12. Magnetic Particle & Dye Penetrant Test.

Notes :

1) Practicals 1 & 8 are Compulsory.
2) From 2 to 7, any four should be conducted.
3) From 9 to 12 any Two should be conducted.

Text Books :

1. "Material Science & Metallurgy For Engineers", Dr. V.D. Kodgire & S. V. Kodgire , Everest Publication.
2. " Mechanical Behaviour & Testing Of Materials ", A . K. Bhargava, C.P. Sharma. P H I Learning Private Ltd.

Reference Books:

1) "Engineering Metallurgy", Higgins R. A., Viva books Pvt. Ltd., 2004.
2) "Material Science & Engg." Raghvan V., Prentice Hall of India , New Delhi. 2003
3) Introduction to Physical Metallurgy, Avner, S.H., Tata McGraw-Hill, 1997.
4) Engineering Metallurgy Dr. O.P. Khanna,

University of Pune

S.E. (Mechanical and Automobile) – II (2012 Course)

Applied Thermodynamics (202050)

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

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

Learning Objectives:

1. To get familiar with the fundamentals of I.C engines, construction and working principle of an engine, and testing of an engine for analyzing its performance.
2. To study the combustion and its controlling factors in order to design efficient engine
3. To study emissions from I.C. engines and its controlling methods, various emission norms.
4. To understand theory and performance calculation of positive displacement compressors.

Prerequisite:

1. Basics of Thermodynamics
2. Engg. Mathematics

Unit I: Basics of IC Engines 5 Hrs.

Heat Engine, IC and EC engines, I.C. Engine construction - components and materials, Engine nomenclature, Valve timing diagram, Intake and exhaust system, Engine classification, Applications.

Fuel Air Cycle and Actual Cycle 5 Hrs.

Fuel air cycle, Assumptions, Comparison with air standard cycle, Effect of variables on performance, Actual cycle and various losses.

Unit II: SI Engines 5 Hrs.

Theory of Carburetion, Types of carburetors, Electronic fuel injection system, Combustion in spark Ignition engines, stages of combustion, flame propagation, rate of pressure rise, abnormal combustion, Phenomenon of Detonation in SI engines, effect of engine variables on Detonation. Combustion chambers, Rating of fuels in SI engines, Additives.

Unit III: CI Engines 5Hrs

Fuel supply system, types of fuel pump, injector and distribution system, Combustion in compression ignition engines, stages of combustion, factors affecting combustion, Phenomenon of knocking in CI engine. Effect of knocking, Methods of knock control, Types of combustion chambers, rating of fuels in CI engines. Dopes & Additives, Comparison of knocking in SI & CI engines.

Unit IV: Testing of IC Engines 5 Hrs.

Objective of testing, Various performance parameters for I.C. Engine - Indicated power, brake power, friction power, SFC, AF ratio etc. Methods to determine various performance parameters, characteristic curves, heat balance sheet.

Supercharging 2 Hrs.

Supercharging and turbo-charging methods and their limitations

Unit V: I.C. Engine Systems 6 Hrs

Cooling System, Lubrication System, Ignition System, Governing system, Starting System

I.C. Engine Emissions and Control 4 Hrs.

Air pollution due to IC engine and its effect, Emissions from petrol/gas and diesel engines, Sources of emissions, Euro norms, Bharat stage norms, Emission control methods for SI and CI engines

Unit VI: Positive Displacement Compressors (Reciprocating and Rotary) 10 Hrs.

Reciprocating Compressor - Single stage compressor – computation of work done, isothermal efficiency, effect of clearance volume, volumetric efficiency, Free air delivery, Theoretical and actual indicator diagram, Multistaging of compressor, Computation of work done, Volumetric efficiency, Condition for maximum efficiency, Inter-cooling and after cooling, Capacity control of compressors

Rotary Compressor – Introduction, vane compressors, roots blower, screw compressor

List of Practicals

1. Study of Carburetor
2. Study of Fuel pump and injector
3. Study of Ignition System
4. Demonstration & study of commercial exhaust gas analyzers.
5. Test on Multi cylinder Petrol/ Gas engine for determination of Friction power.
6. Test on diesel engine to determine various efficiencies, SFC and Heat balance sheet.
7. Test on variable speed diesel / petrol engine.
8. Test on variable compression ratio engine.
9. Visit to Automobile service station
10. Test on Positive Displacement Air Compressor
11. Assignment on any one advanced technology related to I.C. Engine such as VVT, VGT, HCCI
12. Assignment on alternative fuels used in I.C. Engines.

Note

1. Total 8 Practicals should be performed.
2. Out of Practical No. 5,6,7,8 any three should be performed.
3. Practical No. 9, 10 are compulsory.
4. Out of Practical No. 11, 12 any one should be performed.

Text Books

1. V. Ganesan: Internal Combustion Engines, Tata McGraw-Hill
2. M.L. Mathur and R.P. Sharma: A course in Internal combustion engines, Dhanpat Rai
3. H.N. Gupta, Fundamentals of Internal Combustion Engines, PHI Learning Pvt. Ltd.

Reference Books

1. Heywood: Internal Combustion Engine Fundamentals, Tata McGraw-Hill
2. Domkundwar & Domkundwar: Internal Combustion Engine, Dhanpat Rai
3. R. Yadav: Internal Combustion Engine, Central Book Depot, Allahabad

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, 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 multimeters, 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 & Automobile) - II (2012 Pattern)

Machine Shop-I (202053)

Teaching scheme
Practical: 2 Hrs/week

Examination Scheme
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 parameter for obtaining desired characteristic on work piece.
3. To understand the operational problems and suggest remedial solution for adopted manufacturing process.

Each student must complete and submit following term work

I. Jobs:

1. Manufacturing any one assembly consisting of minimum two components and involving all the lathe operations.
2. Spur gear.
3. Grinding of component using table grinding machine.

II. Journal and Demonstration:

1. Demonstration of Single point tool grinding
2. Demonstration of various milling operations
3. Report on Industrial visit with reference to various machining (metal removing) operations.

Text Books:

1. Hajara Choudhari, Bose S.K. – Elements of workshop Technology Vol.II , Asian Publishing House
2. M.P Grover – Fundamentals of modern manufacturing: Materials and systems