Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Course Structure and Syllabus

Second Year B.Tech. (Mechanical Engineering)

with efffect from Year 2021-22

Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405
Ph: 02563 259 802, Web: www.rcpit.ac.in

Semester-III (w.e.f.2021-22)

Sr	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme (CA)				ESE	Total	Credit
				L	T	P	TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Best of (TT1 & TT2)			
							[A]			[B]	[C]	[A+B+C]	
1	BS	BSME3010T	Engineering Mathematics III	3	1	—	20	15	15	15	65	100	4
2	PC1	PCME3020T	Engineering Thermodynamics	3	—	—	20	15	15	15	65	100	3
3	PC2	PCME3030T	Strength of Materials	3	–	—	20	15	15	15	65	100	3
4	PC2L	PCME3030L	Strength of Materials Laboratory	–	–	2	25	–	–	–	25	50	1
5	PC3	PCME3040T	Manufacturing Processes	3	–	—	20	15	15	15	65	100	3
6	PC4	PCME3050T	Materials Technology	2	–	–	20	15	15	15	65	100	2
7	PC4L	PCME3050L	Materials Technology Laboratory	–	–	2	25	–	–	–	–	25	1
8	PC5L	PCME3060L	Computer Aided Machine Drawing Laboratory	—	–	4	50	—	—	—	50	100	2
9	PC6L	PCME3070L	Machine Shop Practice I	—	—	4	50	–	—		50	100	2
10	PJ	PJME3080L	Semester Project I	—	—	2	25	—	—	—	25	50	1
11	MC	MCME3090T	Constitution of India	1	–	–	–	—		–	–	–	Audit Course
			Total	15	1	14	275	75	75	75	475	825	22

BS- Basic Science, PC-Professional Course, PJ-Project, HM-Humanity and Management

Semester-IV (w.e.f 2021-22)

Sr	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme (CA)				ESE	Total	Credit
				L	T	P	TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Best of (TT1 & TT2)			
							[A]			[B]	[C]	[A+B+C]	
1	BS	BSME4010T	Engineering Mathematics-IV	3	1	–	20	15	15	15	65	100	4
2	PC1	PCME4020T	Fluid Mechanics	3	–	–	20	15	15	15	65	100	3
3	PC1L	PCME4020L	Fluid Mechanics Laboratory	–	–	2	25	–	–	–	25	50	1
4	PC2	PCME4030T	Mechanical Measurements and Metrology	3	–	–	20	15	15	15	65	100	3
5	PC2L	PCME4030L	Mechanical Measurements and Metrology Laboratory	–	–	2	25	–	–	–	25	50	1
6	PC3	PCME4040T	Advanced Manufacturing Processes	3	–	–	20	15	15	15	65	100	3
7	PC4	PCME4050T	Kinematics of Machinery	3	–	–	20	15	15	15	65	100	3
8	PC4L	PCME4050L	Kinematics of Machinery Laboratory	–	–	2	25	–	–	–	–	25	1
9	PC5	PCME4060L	Machine Shop Practice II	–	–	4	50	–	–	–	50	100	2
10	HM	HMME4070T	Universal Human Values	2	–	–	20	15	15	15	65	100	2
11	PJ	PJME4080L	Semester Project II	–	–	2	25	–	–	–	25	50	1
12	HM	HMME4090L	Employability Skill Development Program- I	—	—	2	50	—	—	—	–	50	1
			Total	17	1	14	320	90	9 0	90	515	925	25

PC-Professional Course, HM-Humanity and Management, PJ-Project

Prepared by

Checked by

BOS Chairman

Dean Academic/Dy. Director

C.O.E.

Director

Mechanical Department R.C.P.I.T. OFFICE SEAL SHIRPUR

Engineering Mathematics III (BSME3010T)

Teaching Scheme	Examination Scheme
Lectures : 3 Hrs./week	Term Test : 15 Marks
Tutorial : 1 Hr/week	Teacher Assessment : 20 Marks
Credit : 4	End Sem Exam : 65 Marks
	Total: 100 Marks

Prerequisite:

Knowledge of integration, complex numbers and differential equations along with basic concepts in Mathematics.

Course Objectives:

1. To provide sound foundation in the mathematical fundamentals necessary to formulate, solve and analyse engineering problems.
2. To study the basic principles of Laplace Transform, Fourier Series, Complex variables

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Use Laplace and inverse Laplace Transform to the Ordinary Differential Equations	L3	Applying
CO2	Identify analytic and harmonic functions and solve real integrals using complex integration	L1	Remembering
CO3	Find Fourier Series of periodic functions and simplify infinite series	L1	Remembering
CO4	Solve certain partial differential equations analytically and numerically	L4	Analyzing
CO5	Correlate different variables of data	L4	Analyzing

Course Contents

Unit-I: Laplace, Inverse Laplace Transform and its applications

09 Hrs

LT of standard functions such as 1, t^n, e^{at}, sin at, cos at, sinh at, cosh at, Heaviside Unit step function, Dirac Delta function, Periodic functions

Linearity property of Laplace Transform, First Shifting property, Second Shifting property, Change of Scale property of L.T. (without proof).

$L\{t^n f(t)\}, L\{\frac{f(t)}{t}\}, L\{\int_0^t f(u)du\}, L\{\frac{d^n f(t)}{dt^n}\}$

Linearity property, Partial fractions method and convolution theorem. Applications to solve ordinary differential equations with one dependent variable with given boundary conditions.

Unit-II: Complex Variables, Differentiation and Integration

13 Hrs

Analytic functions, Cauchy-Riemann equations in Cartesian and polar coordinates (only statement) Milne-Thomson method to determine analytic function when its real or imaginary or its combination is given. Harmonic function, orthogonal trajectories, Bilinear Transformation with fixed points, cross-ratio.

Line integral, Cauchys theorem for analytic function, Cauchys integral formula (all without proof). Taylors and Laurents series.

Residue at removable singularity, poles and isolated singularity and its evaluation.Residue theorem, application to evaluate real integral of type:

$\int_0^{2\pi} f(\cos\theta, \sin\theta)d\theta, \int_{-\infty}^{\infty} f(x)dx,$

Unit-III: Fourier Series

07 Hrs

Fourier series of periodic function with period 2π, and, $2l$

Even and odd functions, Half range sine and cosine series, Parsevals identities (without proof).

Complex form of Fourier series.

Orthogonal and Orthonormal functions.

Unit-IV Partial Differential Equations

07 Hrs

Numerical Solution of PDE using Bender-Schmidt Method and Crank- Nicolson method.

Partial differential equations governing transverse vibrations of an elastic string its solution using Fourier series.

Heat equation, steady-state configuration for heat flow.

Unit-V: Correlation, Regression and Curve-Fitting

06 Hrs

Correlation-Karl Pearsonfs coefficient of correlation, Spearmanfs Rank correlation, Regression analysis-lines of regression.

Curve fitting by the method of least squares- fitting of the curves of the form,

y=ax+b, $y=ax^2+bx+c$, and, $y=e^{bx}$

Text Books

1. Higher Engineering Mathematics, Dr B. S. Grewal, Khanna Publication
2. Advanced Engineering Mathematics, E Kreyzig, Wiley Eastern Limited

Reference Books

1. Higher Engineering Mathematics, B.V. Ramana, McGraw Hill Education, New Delhi
2. Complex Variables: Churchill, Mc-Graw Hill
3. Integral Transforms and their Engineering Applications, Dr B. B. Singh, Synergy Knowledgeware,Mumbai
4. Numerical Methods, Kandasamy, S. Chand CO
5. Fundamentals of Mathematical Statistics by S.C. Gupta and Kapoor

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Tutorial

Minimum eight tutorials shall be conducted.

Engineering Thermodynamics (PCME3020T)

Teaching Scheme
Lectures : 3 Hrs./week
Credit : 3

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total: 100 Marks

Prerequisite:
Knowledge of basic Physics.

Course Objectives

1. To familiarize the concepts of Energy in general and Heat and Work in particular.
2. To study the fundamentals of quantification and grade of energy.
3. To study the effect of energy transfer on properties of substances in the form of charts and diagrams.
4. To familiarize application of the concepts of thermodynamics in vapour power, gas power cycles.

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Demonstrate application of the first law of thermodynamics to wide range of systems	L3	Applying
CO2	Write steady flow energy equation for various flow and non-flow thermodynamic systems	L1	Remembering
CO3	Compute heat and work interactions in thermodynamics systems	L4	Analyzing
CO4	Demonstrate the interrelations between thermodynamic functions to solve practical problems	L3	Applying
CO5	Use steam table and mollier chart to compute thermodynamics interactions	L3	Applying
CO6	Compute efficiencies of heat engines, power cycles etc.	L4	Analyzing

Course Contents

Unit-I: Basic Concepts First Law of Thermodynamics

08 Hrs

Basics concepts of thermodynamics, quasi-static process, Relation between Heat and Work- Joules Constant, First law of thermodynamics for a cyclic process, First law of thermodynamics for a closed system undergoing a process, Conservation principle, First Law of Thermodynamics applied to open system Steady Flow Energy Equation, Perpetual motion Machine of First kind, Application of first law of thermodynamics to closed system or Non flow Process, Application of first law of thermodynamics to Open Systems like Steam Nozzle, Boiler, Steam Turbine, Pump, Heat Exchanger, Throttling Process Joules Thompson Coefficient and its significance

Unit-II: Second Law of Thermodynamics

09 Hrs

Limitation of first law of thermodynamics, Thermal Reservoir Source and Sink, Concept of Heat Engine, Heat Pump and Refrigerator, Second law of thermodynamics Kelvin Planck and Clausius Statements. Equivalence of Clausius and Kelvin Planck Statement, Reversible and Irreversible Process. Causes of Irreversibility, Perpetual Motion Machine of Second Kind, Need of Carnot theorem and its corollaries, Carnot cycle, Thermodynamic Temperature Scale and its equivalence with Ideal Gas Scale Entropy: Clausius Inequality, Clausius Theorem, Entropy is Property of a system, Isentropic Process, Temperature Entropy Plot and its relationship with heat interactions, Entropy Principle, Entropy change During a Process. Interpretation of concept of entropy.

Unit-III: Thermodynamic Relations,Energy

05 Hrs

Thermodynamic Relations: Reciprocal Relation, Cyclic Relation Property relations, Maxwell Relations, TdS equations, Heat capacity relations, Volume Expansivity, Isothermal Compressibility, Clausius Clapeyron Equation

Energy: High grade and Low-Grade Energy, Available and Unavailable Energy, Dead State,Available energy with respect to a process and a cycle.

Unit-IV: Properties of Pure Substance, Vapour Power cycle,Gas Power cycles

13 Hrs

Properties of Pure Substance: Pure substance and Phase changes: Phase change processes of pure substance, Property diagrams for phase change process (T-v, T-s and p-h diagrams),Understanding of Steam Table and Mollier chart with suitable examples.

Vapour Power cycle: Carnot cycle and its limitations as a vapour cycle, Rankine cycle with different turbine inlet conditions, mean temperature of heat addition, Methods to improve thermal efficiency of Rankine cycle Reheat cycle and Regeneration Cycle.

Gas Power cycles: Assumptions of Air Standard Cycle, Otto cycle, Diesel Cycle and Dual cycle, Brayton Cycle, Actual Brayton cycle, open and closed cycle gas turbine, methods to improve efficiency and specific output, open cycle with intercooling, reheat, and regeneration, Effect of operating variable on thermal efficiency and work ratio.

Unit-V: Compressors

07 Hrs

Reciprocating Air Compressor, Single stage compressor computation of work done, isothermal efficiency, effect of clearance volume, volumetric efficiency, Free air delivery, Theoretical and actual indicator diagram, Multistage compressors Constructional details of multistage compressors, Need of multistage, Computation of work done, Volumetric efficiency, Condition for maximum efficiency, Inter cooling and after cooling (numerical), Theoretical and actual indicator diagram for multi stage compressors.

Text Books

1. Thermodynamics by P K Nag, Tata McGraw Hill Publishers
2. Thermodynamics by Onkar Singh, New Age International

Reference Books

1. Thermodynamics: An Engineering Approach by Yunus A. Cengel and Michael ABoles,7th edition, TMH
2. Fundamentals of Engineering Thermodynamics by Michael J. Moran and Howard N. Shapiro, Wiley
3. Fundamentals of Thermodynamics by Claus Borgnakke and Richard E. Sonntag, Wiley
4. Engineering Thermodynamics by P Chattopadhyay, Oxford University Press India
5. Applied thermodynamics for engineering technologists by T. D. Eastop and A McConkey, Pearson Education
6. Thermodynamics from Concepts to Applications by Arthur Shavit and Chaim Gutfinger

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Strength of Materials (PCME3030T)

Teaching Scheme	Examination Scheme
Lectures : 3 Hrs./week	Term Test : 15 Marks
Credit : 3	Teacher Assessment : 20 Marks
	End Sem Exam : 65 Marks
	Total: 100 Marks

Prerequisite:

Knowledge of Engineering mechanics.

Course Objectives

1. To gain knowledge of different types of stresses, strains and deformations induced in the mechanical components due to external loads.
2. To study the effect of component dimensions and properties of materials due to stresses and deformations.
3. To study the distribution of various stresses in the mechanical elements that deform under loads.

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Evaluate stresses, strains, deformation and properties of materials in mechanical components/ structures.	L4	Analyzing
CO2	Draw SFD and BMD for different types of loads and support conditions for a beam.	L4	Analyzing
CO3	Compute and plot direct, bending and shear stresses across sections of given beam.	L4	Analyzing
CO4	Compute torsional shear stresses and strain energy in mechanical components.	L4	Analyzing
CO5	Compute deflections and slopes in beams.	L4	Analyzing
CO6	Analyze buckling phenomenon in columns and struts.	L4	Analyzing

Course Contents

Unit-I: Stress and Strain,Elastic Constants,Principal stresses and Strains

10 Hrs

Stress and Strain: Definition, Simple stress-strain, uni-axial, bi-axial and tri-axial stresses, tensile stress, compressive stress and shear stresses, elastic limit, Hookes Law, deformation due to self-weight, bars of varying sections, composite sections, deformation of tapering members, Thermal Stresses.
Elastic Constants and their relations: Poissons Ratio, Modulus of elasticity, Modulus of rigidity, Bulk modulus, Yield stress, Ultimate stress. Factor of safety, state of simple shear, relation between elastic constants, Volumetric strain for tri-axial loading.
Principal stresses and Strains: Principal plane and principal stresses, analytical and graphical method (Mohrs circle) for determining of stresses on oblique section.

Unit-II: Shear Force and Bending Moment in Beams,Moment of Inertia

08 Hrs

Shear Force and Bending Moment in Beams: Axial force, shear force and bending moment diagrams for statically determinate beams (excluding beams with internal hinges), relationship between rates of loading, shear force and bending moment.
Moment of Inertia: Area Moment of Inertia, Parallel Axis theorem, Polar Moment of Inertia, Principal axes, Principal moment of inertia.

Unit-III: Bending stresses,Direct Bending Stresses,Shear Stresses

08 Hrs

Bending stresses: Theory of pure Bending, Assumptions, Flexural formula for straight beams, moment of resistance,bending stress distribution, Section modulus, beams of uniform strength.
Direct Bending Stresses: Combined stresses, Eccentricity, Stress distribution, Core /kernel of Section.
Shear Stresses: Distribution of shear stresses for the section of beam.

Unit-IV: Torsion,Strain Energy

08 Hrs

Torsion: Torsion of circular shafts-solid and hollow, stresses in shafts when transmitting power, shafts in series and parallel.
Strain Energy: Resilience, Proof Resilience, strain energy stored in the member due to gradually applies load, suddenly applied load, impact load. Strain energy stored due to Shear, Bending and Torsion.

Unit-V: Deflection of Beams,Columns and Struts

08 Hrs

Deflection of Beams: Deflection of Cantilever, simply supported and over hanging beams using Macaulays or double integration method for different type of loadings.
Columns and Struts: Buckling load, crushing load, Types of end conditions for column, Eulers column theory and its limitations, Rankine- Gordon Formula.

Text Books

1. Strength of Materials by S. Ramamrutham, Dhanpat Rai Pvt. Ltd
2. Mechanics of Materials by S.S.Ratan, Tata McGraw Hill Pvt. Ltd
3. Strength of Materials by R. Subramanian, Oxford University Press, Third Edition 2016

Reference Books

1. Strength of Materials by Ryder, Macmillan
2. Mechanics of Materials by James M. Gere and Barry J. Goodno, Cengage Learning.
3. Mechanics of Materials by Gere and Timoshenko, CBS
4. Strength of Materials by Basavrajaiah and Mahadevappa, Khanna Publishers,New Delhi
5. Elements of Strength of Materials by Timoshenko and Youngs, Affiliated East -West Press
6. Mechanics of Materials byBeer, Jhonston, DEwolf and Mazurek, TMH Pvt Ltd., New Delhi
7. Mechanics of Structures by S.B. Junnarkar, Charotar Publication
8. Introduction to Solid Mechanics by Shames, PHI
9. Strength of Materials by Nag and Chandra, Wiley India
10. Strength of Materials by W.Nash, Schaums Outline Series, McGraw Hill Publication, Special Indian Edition

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Strength of Materials Laboratory (PCME3030L)

Practical Scheme
Practical : 2 Hrs./week
Credits : 1

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total: 50 Marks

List of Laboratory Experiments

1. Tension test on mild steel bar (stress-strain behaviour, determination of yield strength and modulus of elasticity) using Universal Testing Machine (UTM).
2. Torsion test on mild steel bar / cast iron bar.
3. Impact test on metal specimen (Izod test/ Charpy test)
4. Hardness test on metals (Brinell Hardness Number / Rockwell Hardness Number)
5. Flexural test on beam (central loading)
6. Flexural test on beam (three-point loading)

Evaluation Scheme:

Continuous Assessment (A):

Laboratory work shall consist of minimum 5 experiments and subject specific 5 lab assignment/case study

The distribution of marks shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of laboratory journal/manual/report will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the teacher assessment.

End Semester Examination (C):

Oral / Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Manufacturing Processes (PCME3040T)

Teaching Scheme
Lectures : 3 Hrs./week
Credit : 3

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total: 100 Marks

Prerequisite:
Knowledge of basic Chemistry and Physics.

Course Objectives

1. To study basic manufacturing processes.
2. To study how to select appropriate production processes for a specific application.

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Demonstrate understanding of various machine tool operations for machining.	L3	Applying
CO2	Understand applications of casting process to produce metal/polymer components.	L2	Understanding
CO3	Demonstrate understanding of joining of metals through fastening, soldering, brazing and welding.	L3	Applying
CO4	Illustrate the concept of producing semi-finished rolled products, forged components, extrusions, wires and sheet metal components.	L4	Analyzing
CO5	Illustrate the concept of producing powder metallurgical components.	L4	Analyzing

Course Contents

Unit-I: Introduction to Various Production Processes: Examples and Application.

10 Hrs

Machine Tools for Machining: Lathe Machine, Milling Machine, Drilling Machine, Shaping Machine, Broaching Machine, Grinding Machine, Lapping/Honing Machines.
Gear Manufacturing: Gear milling, standard cutters and limitations, gear hobbing, gear shaping,gear shaving and gear grinding processes.
Metal Cutting Tools: Machining parameters, Mechanics of machining process, Concept of shear plane, chip reduction coefficient, force analysis, Merchants circle of cutting forces, Merchants theory-original and modified, effect of various parameters on cutting forces. Expression for shear plane angle and coefficient of friction in terms of cutting forces and tool angles, Velocity in cutting, Power requirement in cutting.Different types of dynamometers and their operations, Tool life definition, Mechanism of tool wear and measurement, Factors influencing tool life, cutting tool material, cutting fluids,Machinability, Surface finish, Factors affecting surface finish.
Cutting Tools: Geometry of single point cutting tool, Types of milling cutters and their geometry.Geometry of drill, Geometry of broach.Specification Selection of grinding wheel, dressing truing and balancing of grinding wheels.

Unit-II: Metal Casting,Special Casting Processes

10 Hrs

Metal Casting: Sand casting, Pattern materials and allowances, Types of pattern, Sand properties,Sand moulding/Machine moulding, Gating system- Types of riser, types of gates, Solidification during casting process, Melting- Electric arc induction furnaces.
Special Casting Processes: CO2 and shell moulding, Investment casting, Die casting, Vacuum casting, Inspection and Quality control of casting, Casting defects and remedies.
Producing Plastic Components: Injection Moulding, Compression moulding, Transfer moulding, Blow moulding, Rotational Moulding, Thermoforming and Extrusion.

Unit-III: Joining Processes

08 Hrs

Joining Processes: Fusion and Non fusion joining processes.
Welding: Classification of welding, working principle, equipment used, process parameters, fluxes used in welding, working method/procedure, applications of following welding techniques:Oxy-acetylene Flame welding, metal arc welding, TIG MIG welding, submerged arc welding,electro-slag welding, PAM welding., Laser welding, electron beam welding, Thermit welding,Resistance welding, Friction welding, Welding defects and remedies.Soldering brazing techniques and applications.

Unit-IV: Forming Processes,Sheet Metal Forming

10 Hrs

Forming Processes: Rolling, Forging, Extrusion and Wire Drawing processes. Principles and process characteristics, Rolling types, Rolling parameters, Calculation of Rolling load and Power, Thread rolling roll forging, Production of seamless tubes through rolling, Rolling defects, Forging: Types of Forging, Forging press, Forging dies, Analysis of Forging process, Forging Defects.Extrusion: types of extrusion, extrusion process parameters, Extrusion defects, Wire drawing process, wire drawing equipment, geometry of wire drawing die,
Sheet Metal Forming: Introduction to Press Tools, Sheet metal operations, Types of Dies, scrap strip layout centre of pressure, selection of die sets, stock guides, strippers. Study and analysis of bending, forming and drawing operations.

Unit-V: Powder Metallurgy

04 Hrs

Powder Metallurgy: Working principle, Powder metallurgy process: Processes of powder making, mechanisms of sintering, CIP and HIP, Finishing operations in Powder metallurgy, Applications of Powder metallurgy.

Text Books

1. Manufacturing Engineering and Technology SI by Serope Kalpakjian, Steven R. Schmid, Prentice Hall

Reference Books

1. Manufacturing Processes by P. N. Rao, Vol. 1 and 2, McGraw Hill Publishers
2. Production Technology by R. C. Patel and C. G. Gupta Vol I, II.
3. Foundry technology by P.L. Jain
4. Production Technology by P.C. Sharma
5. Workshop Technology by W. A. J. Chapman part I, II III
6. Production Technology, HMT publishers

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Materials Technology (PCME3050T)

Teaching Scheme
Lectures : 2 Hrs./week
Credit : 2

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total: 100 Marks

Prerequisite:

Knowledge of basic Chemistry and Physics and Engineering Mechanics.

Course Objectives

1. To study basic engineering materials, their properties, applications and selection.
2. To study types and causes of failure of components in service.
3. To study new materials and their applications.

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Demonstrate fundamental knowledge about various types of materials, crystal structure, crystal imperfection, material property, deformation in materials.	L3	Applying
CO2	Understand different types of failure mechanism in materials and its significance	L2	Understanding
CO3	Interpret Iron-Iron carbide diagram, TTT diagram and their significance.	L4	Analyzing
CO4	Select appropriate heat treatment process for specific applications.	L1	Remembering
CO5	Understand advance engineering materials, their properties, applications and selection.	L2	Understanding

Course Contents

Unit-I: Classification of Materials,Lattice Imperfections,Deformation

06 Hrs

Classification of Materials: Metallic materials, Polymeric Materials, Ceramics and Composites: Definition, general properties and applications with examples.

Lattice Imperfections: Definition, classification and significance of Imperfections. Point defects: Their formation and effects. Dislocation: Edge and screw dislocations, Burgers vector, Motion of dislocations and their significance.Surface defects: Grain boundary, sub- angle grain boundary and stacking faults. Their significance. Generation of dislocation, Frank Reed source, Conditions of multiplication and significance.

Deformation: Definition, elastic and plastic deformation, Mechanism of deformation and its significance in design and shaping, Critical Resolved shear stress. Deformation in single crystal and polycrystalline materials.

Strain Hardening: Definition importance of strain hardening. Dislocation theory of strain hardening, Effect of strain hardening on engineering behaviour of materials. Recrystallization Annealing: stages of recrystallization annealing and factors affecting it.

Unit-II: Failure mechanisms: Fracture and Failure

05 Hrs

Fracture: Definition and types of fracture, Brittle fracture: Griffiths theory of fracture, Orowans modification. Dislocation theory of fracture. Ductile fracture: Mechanism, Notch effect on fracture, Fracture toughness. Ductility to Brittle transition, Definition and signification, Conditions of ductility transition factors affecting it.

Fatigue Failure: Definition of fatigue and significance of cyclic stress. Mechanism of fatigue and theories of fatigue failure, Fatigue testing. Test data presentation and statistical evolution. S-N Curve and its interpretation. Influence of important factors on fatigue.

Creep Failure: Definition and significance of creep. Effect of temperature and creep on mechanical behaviors of materials. Creep testing and data presentation analysis. Mechanism of creep. Creep Resistant materials.

Unit-III: Theory of Alloys and Alloys Diagrams, Effect of Alloying Elements in Steels

06 Hrs

Theory of Alloys Alloys Diagrams: Significance of alloying, Definition, Classification and properties of different types of alloys. Different types of phase diagrams (Isomorphous, Eutectic, Peritectic, Eutectoid, Peritectoid) and their analysis. Importance of Iron as engineering material, Allotropic forms of Iron, Influence of carbon in Iron-Carbon alloying. Iron-Iron carbide diagram and its analysis. TTT diagram, CCT diagram, Hardenability concepts and tests, Steels types steels, microstructure, properties and applications. Cast Irons- Grey iron, White iron, Nodular and Malleable irons. Their microstructures, properties and applications.

Effect of Alloying Elements in Steels: Limitation of plain carbon steels. Significance of alloying elements. Effects of major and minor constituents, Effect of alloying elements on ferrite, carbide, austenite, Effect of alloying elements on phase transformation. Stainless steels- types and applications. Classification of tool steels and metallurgy of tool steels.

Unit-IV: Heat treatment Process, Surface hardening

06 Hrs

Heat treatment Process: Technology of heat treatment. Classification of heat treatment process. Annealing- various annealing processes and applications, Normalizing, Hardening Tempering, Austempering, Martempering, Maraging and Ausforming heat treatment processes and Applications.

Surface hardening: Surface hardening methods. Their significance and applications.Carburizing, Nitriding, Cyaniding, Carbonitriding, induction hardening and flame hardening processes.

Unit-V: Introduction to New materials

04 Hrs

Introduction to New materials: Composites: Basic concepts of composites, Processing of composites, advantages over metallic materials, various types of composites and their applications. Nano Materials: Introduction, Concepts, synthesis of nano materials, examples, applications and nano composites. High temperature alloys, Smart materials.

Text Books

1. Materials Science and Engineering, William D. Callister, Jr. Adapted by R.Balasubramaniam, Wiley India (P)Ltd.

Reference Books

1. Mechanical Metallurgy, G.E. Dieter, McGraw Hill International New Delhi
2. Engineering Physical Metallurgy, Y. Lakhtin, Mir Publishers, Moscow
3. Introduction to Physical Metallurgy, Sydney Avner, McGraw Hill
4. Production Technology by P.C. Sharma
5. Metallurgy for Engineers, E.C. Rollason - ELBS SOC and Edward Arnold, London
6. Material Science and Metallurgy, V.D. Kodgire, Everest Publishing House

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Materials Technology Laboratory (PCME3050L)

Practical Scheme
Practical : 2 Hrs./week
Credit : 1

Examination Scheme
Teacher Assessment : 25 Marks
Total : 25 Marks

List of Laboratory Experiments

1. Study of metallurgical microscope.
2. Metallographic sample preparation and etching
3. Microstructures of plain carbon steels
4. Microstructures of cast irons
5. Annealing, Normalizing and Hardening of medium carbon steel and observation of microstructures
6. Study of tempering characteristics of hardened steel
7. Determination of hardenability of steel using Jominy end Quench Test
8. Fatigue test to determine number of cycles to failure of a given material at a given stress

Evaluation Scheme:
Continuous Assessment (A):
Laboratory work shall consist of minimum 6 experiments and subject specific 5 lab assignment/case study

The distribution of marks shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of laboratory journal/manual/report will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the teacher assessment.

Computer Aided Machine Drawing Laboratory (PCME3060L)

Teaching Scheme
Practical : 4 Hrs./week
Credit : 2

Examination Scheme
Teacher Assessment : 50 Marks
End Sem Exam : 50 Marks
Total : 100 Marks

Prerequisite:

Knowledge of engineering drawing.

Course Objectives

1. To familiarize conversion of an object into a drawing
2. To study conventional representation of various machining and mechanical details as per IS
3. To become conversant with 2-D and 3-D drafting

1. To familiarize conversion of an object into a drawing
2. To study conventional representation of various machining and mechanical details as per IS
3. To become conversant with 2-D and 3-D drafting

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Visualize and prepare detail drawing of a given object	L1	Remembering
CO2	Read and interpret the drawing	L2	Understanding
CO3	Draw details and assembly of different mechanical systems	L3	Applying
CO4	Convert detailed drawing into assembly drawing using modelling software	L4	Analyzing
CO5	Convert assembly drawing into detailed drawing using modelling software	L4	Analyzing
CO6	Prepare detailed drawing of any given physical object/machine element with actual measurements	L3	Applying

Course Contents

Unit-I: Machine Elements,Solid Geometry

06 Hrs

Machine Elements: Preparation of 2-D drawings of standard machine elements (nuts, bolts, keys, cotter, screws, spring etc) Conventional representation of threaded parts, Types of threads; thread designation, Conventional representation of machine components and materials, Designation of standard components.

Solid Geometry: Intersection of surfaces and interpenetration of solids- Intersection of prism or cylinder with prism; cylinder or cone, both solids in simple position only. Primary auxiliary views.

Unit-II:Geometric Dimensioning and Tolerancing (GDT)

16 Hrs

Geometric Dimensioning and Tolerancing (GD and T):
Dimensioning with tolerances indicating various types of fits. **Details and assembly drawing:** Types of assembly drawings, part drawings, drawings for catalogues and instruction manuals, patent drawings, drawing standards, Introduction to unit assembly drawing, steps involved in preparing assembly drawing from details and vice-versa,

Preparation of details and assembly drawings of any three from: Clapper block, Single tool post, Lathe and Milling tail stock, jigs and fixtures

Cotter, Knuckle joint, Keys: keys-sunk, parallel woodruff, saddle, feather etc.

Couplings: simple, muff, flanged Protected flange coupling, Oldhams coupling,Universal coupling

Unit-III:Preparation of details and assembly drawings of Bearings

09 Hrs

Preparation of details and assembly drawings of Bearings: Simple, solid, Bushed bearing, I.S. conventional representation of ball and roller bearing, Pedestal bearing, footstep bearing.

Unit-IV: Preparation of details and assembly drawings of pulleys, Pipe joints

20 Hrs

Classification of Pulleys, pipe joints

Pulleys: Flat belt, V-belt, rope belt, Fast and loose pulleys.

Pipe joints (any two): Flanged joints, Socket and spigot joint, Gland and stuffing box, expansion joint

Engine parts: Types of Valves, introduction to I.C. Engine

Preparation of details and assembly drawings (any three): Air cock; Blow off cock, Steam stop valve, Gate valve, Globe valve, Non-return Valve, I.C. Engine parts: Piston, Connecting rod, Cross head, Crankshaft, Carburettor, Fuel pump, injector, and Spark plug.

Unit-V: Reverse Engineering of a physical model

05 Hrs

Disassembling of any physical model having not less than five parts, measure the required dimensions of each component, sketch the minimum views required for each component, convert these sketches into 3-D model and create an assembly drawing with actual dimensions.

List of Laboratory Experiments

1. Details of machine system-1
2. Details of machine system-2
3. Details of machine system-3
4. Details of machine system-4
5. Details of machine system-5
6. Assembly of machine system-1
7. Assembly of machine system-2
8. Assembly of machine system-3
9. Assembly of machine system-4
10. Assembly of machine system-5
11. Reverse engineering drawing of machine system

Text Books

1. Machine Drawing by N.D. Bhatt.
2. A textbook of Machine Drawing by Laxminarayan and M.L. Mathur, Jain brothers Delhi

Reference Books

1. Machine Drawing, Kamat and Rao
2. Machine Drawing, M. B. Shah
3. A text book of Machine Drawing, R. B. Gupta, Satyaprakashan, Tech. Publication
4. Machine Drawing, K.I.Narayana, P. Kannaiah, K.Venkata Reddy
5. Machine Drawing, Sidheshwar and Kanheya
6. Autodesk Inventor 2011 for Engineers and Designers, ShamTickoo and SurinderRaina, Dreamtech Press
7. Engineering Drawing, P J Shah

Evaluation Scheme:

Continuous Assessment (A):

1. Part A. Minimum two questions from theory part of each module should be solved as a home work in A-3 size sketch book.
2. Part B. A-3 size Printouts/plots of the minimum 7 problems solved in practical class from the practical part of each module.
3. Problems from practical parts of each module should be solved using any standard CAD packages like IDEAS, PRO-E, CATIA, Solid Works, Inventor etc.
4. The distribution of marks for Term work shall be as follows: Homework = sketch book 25 marks Printouts/Plots = 25 marks

End Semester Examination (C):

1. Practical examination of three hours duration is to be conducted by pair of Internal and External Examiners.

2. It will be based on Part-B of the Term work, and will have two sessions as follows: Session-I: Preparation of 3-D models of parts, assembling parts and preparing views of assembly from given 2-D detailed drawing. Session-II: Preparation of minimum five detailed 3-D part drawings from given 2-D assembly drawing.

3. Oral examination should also be conducted to check the knowledge of conventional and CAD drawing.

4. Questions provided for practical examination should contain minimum five and not more than ten parts.

5. The distribution of marks for practical examination shall be as follows: Session-I = 20 marks Session-II = 20 marks Oral = 10 marks

6. Evaluation of practical examination to be done based on the printout of students work.

7. Students work along with evaluation report to be preserved till the next examination.

Machine Shop Practice I (PCME3070L)

Teaching Scheme
Practical : 4 Hrs./week
Credit : 2

Examination Scheme
Teacher Assessment : 50 Marks
End Sem Exam : 50 Marks
Total : 100 Marks

Prerequisite:

Knowledge of Engineering drawing, and Manufacturing Processes.

Course Objectives

1. To study basic machining processes.
2. To perform various machining operations and machine protocols.

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Perform plain turning, taper turning, and thread cutting etc. on lathe machine	L3	Applying
CO2	Perform machining operations on shaper	L3	Applying
CO3	Perform Drilling-Boring operations on drilling machine and milling operations	L3	Applying
CO4	Perform grinding operations to obtain a finished assembly	L3	Applying

Course Contents

Module-I:16 Hrs.

Introduction to Lathe Machine, demonstration of various machining operations performed on Lathe Machine.One Job on Plain and Taper Turning – Precision Turning, Taper Turning and ThreadCutting

Module-II:12 Hrs.

Introduction to Shaping Machine, demonstration of various machining operations performed on Shaping Machine One job on shaping machine to make horizontal and inclined surface.

Module-III: 16 Hrs.

One job involving Drilling-Boring operations and Milling operation.

Module-IV: 12 Hrs.

Grinding operation to the above jobs to obtain finished components and assembly of these components.

Reference Books

1. Workshop Technology by W. A. J. Chapman Vol I II
2. Workshop Technology by Hazra Choudhary Vol. I II

Evaluation Scheme:

Continuous Assessment (A):

1. Term work shall consist of Work-Shop book giving details of drawings of the completed jobs and time sheet.
2. The distribution of marks for term work shall be as follows: Laboratory work (Performance of job and workshop book): 50 marks
3. The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (C):

1. Practical examination of three hours duration will be held and evaluation will be done based on the performance during the examination for 50 marks.

Semester Project-I (PJME3080L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

Students are expected to design, simulate/implement a project based on the knowledge acquired from current semester subjects.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Conduct a survey of several available literatures in the preferred field of study.	L4	Analyze
CO2	Demonstrate various/alternate approaches to complete a project.	L2	Understand
CO3	Ensure a collaborative project environment by interacting and dividing project work among team members.	L3	Apply
CO4	Present their project work in the form of a technical report / paper and thereby improve the technical communication skill.	L3	Apply
CO5	Demonstrate the ability to work in teams and manage the conduct of the research study.	L2	Understand

Semester Project:

The purpose of introducing semester project at second year level is to provide exposure to students with a variety of projects based on the knowledge acquired from the semester subjects. This activity is supposed to enrich their academic experience and bring enough maturity in student while selecting the project. Students should take this as an opportunity to develop skills in implementation, presentation and discussion of technical ideas/topics. Therefore, proper attention shall be paid to the content of semester project report which is being submitted in partial fulfillment of the requirements of the Second Year and it is imperative that a standard format be prescribed for the report.

Each student shall work on project approved by departmental committee approved by the Head of Department, a group of 03 to 05 students (max allowed: 5 students in extraordinary cases, subject to the approval of the department committee and the Head of the department) shall be allotted for each Semester Project. Each group shall submit at least 3 topics for the Semester Project. The departmental committee shall finalize one topic for every group. Semester Project Title or Theme should be based on knowledge acquired during semester. The project work shall involve sufficient work so that students get acquainted with different aspects of knowledge acquired from semester subjects.

Student is expected to:

- Select appropriate project title based on acquired knowledge from current semester subjects.
- Maintain Log Book of weekly work done(Log Book Format will be as per Table 1).
- Report weekly to the project guide along with log book.

Assessment Criteria:

- At the end of the semester, after confirmation by the project guide, each project group will submit project completion report in prescribed format for assessment to the departmental committee (including project guide).
- Assessment of the project (at the end of the semester) will be done by the departmental committee (including project guide).

Prescribed project report guidelines:

Size of report shall be of minimum 25 pages. Project Report should include appropriate content for:

- Introduction
- Literature Survey
- Related Theory
- Implementation details

- Project Outcomes
- Conclusion
- References

Assessment criteria for the departmental committee (including project guide) for Continuous Assessment:

Guide will monitor weekly progress and marks allocation will be as per Table 2.

Assessment criteria for the departmental committee (including project guide) for End Semester Exam:

Departmental committee (including project guide) will evaluate project as per Table 3.

Each group shall present/publish a paper based on the semester project in reputed/peer reviewed Conference/Journal/TechFest/Magazine before end of the semester.

Table 1: Log Book Format

Sr	Week (Start Date:End Date)	Work Done	Sign of Guide	Sign of Coordinator
1				
2				

Table 2: Continuous Assessment Table

Sr	Exam Seat No	Name of Student	Student Attendance	Log Book Maintain	Literature Review	Depth of Understanding	Report	Total
			5	5	5	5	5	25

Table 3: Evaluation Table

Sr	Exam Seat No	Name of Student	Project Selection	Design/ Methodology	Fabrication/ Modeling/ Simulation	Result Verification	Presentation	Total
			5	5	5	5	5	25

Constitution of India (MCME3090T)

Teaching Scheme
Lectures : 1 Hrs./week

Course Objectives

1. To provide basic information about Indian constitution.
2. To identify individual role and ethical responsibility towards society.
3. To understand human rights and its implications.

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Have general knowledge and legal literacy and thereby to take up competitive examinations.	L1	Remembering
CO2	Understand state and central policies, fundamental duties.	L2	Understanding
CO3	Understand Electoral Process, special provisions.	L2	Understanding
CO4	Understand powers and functions of Municipalities, Panchayats and Co- operative Societies.	L2	Understanding
CO5	Understand Engineering ethics and responsibilities of Engineers.	L2	Understanding
CO6	Understand Engineering Integrity and Reliability.	L2	Understanding

Course Contents

Unit-I: Introduction to the Constitution of India

02 Hrs

The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights its limitations..

Unit-II: Directive Principles of State Policy:

03 Hrs

Relevance of Directive Principles State Policy Fundamental Duties. Union Executives President, Prime Minister Parliament Supreme Court of India.

Unit-III: State Executives:

03 Hrs

Governor, Chief Minister, State Legislature High Court of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th 91st Amendments.

Unit-IV: Special Provisions,Human Rights:

03 Hrs

Special Provisions: For SC ST Special Provision for Women, Children Backward Classes Emergency Provisions.

Human Rights: Meaning and Definitions, Legislation Specific Themes in Human Rights- Working of National Human Rights Commission in India Powers and functions of Municipalities, Panchyats and Co Operative Societies.

Unit-V: Scope Aims of Engineering Ethics

03 Hrs

Responsibility of Engineers Impediments to Responsibility. Risks, Safety and liability of Engineers, Honesty, Integrity Reliability in Engineering

Text Books

1. Durga Das Basu: Introduction to the Constitution on India, (Students Edn.) Prentice Hall EEE, 19th / 20th Edn., 2001
2. Charles E. Haries, Michael S Pritchard and Michael J. Robins Engineering Ethics Thompson Asia, 2003-08-05.

Reference Books

1. M. V. Pylee, An Introduction to Constitution of India, Vikas Publishing, 2002.
2. Govindarajan, S. Natarajan, V. S. Senthilkumar, Engineering Ethics, Prentice Hall of India Pvt. Ltd. New Delhi, 2004
3. Brij Kishore Sharma, Introduction to the Constitution of India, PHI Learning Pvt. Ltd., New Delhi, 2011.
4. Latest Publications of Indian Institute of Human Rights, New Delhi

Website Resources:

1. www.nptel.ac.in
2. www.hnlu.ac.in
3. www.nspe.org
4. www.preservearticles.com

Engineering Mathematics-IV (BSME4010T)

Teaching Scheme	Examination Scheme
Lectures : 3 Hrs./week	Term Test : 15 Marks
Tutorial : 1 Hr/week	Teacher Assessment : 20 Marks
Credit : 4	End Sem Exam : 65 Marks
	Total: 100 Marks

Prerequisite:

Knowledge of differentiation, integration, matrices and probability along with basic concepts in Mathematics.

Course Objectives:

1. To inculcate an ability to relate engineering problems to mathematical context
2. To provide a solid foundation in mathematical fundamentals required to solve engineering problem
3. To study the basic principles of Vector analyses, complex integration, probability, test of hypothesis and correlation between data.
4. To prepare students for competitive exams

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Identify diagonalizable and derogatory matrices and find functions as a square matrix using eigenvalues and eigenvectors	L1	Remembering
CO2	Evaluate vector integrals	L3	Applying
CO3	Use probability to solve real-life engineering problems	L4	Analyzing
CO4	Draw conclusions on population based on large and small samples taken	L5	Evaluating
CO5	Analyze the variances of multiple variables simultaneously	L4	Analyzing

Course Contents

Unit-I: Linear Algebra

10 Hrs

Characteristic equation, Eigenvalues and Eigenvectors with properties.
Cayley-Hamilton theorem to find higher order matrices and inverse of matrix.
Diagonalizability of similar matrices.
Functions of a matrix.
Quadratic Forms: Canonical form using Congruent transformations, Orthogonal Transformation to find rank, index, signature and value class.

Unit-II: Vector differentiation and Integration

10 Hrs

Scalar and vector point functions. Gradient of a scalar function, Divergence, curl and Scalar Potential of a vector function. Solenoidal, Irrotational and conservative Fields.Line integrals, Greens theorem (without proof) for planes and verification of line integrals.
Stokes theorem and Gauss divergence theorem (without proof and verification)

Unit-III: Probability

09 Hrs

Discrete and Continuous random variables, Probability mass and density function,Probability distribution for random variables, Expected value, Variance.
Probability Distributions: Binomial, Poisson and Normal Distributions (for detailed study).

Unit-IV Sampling Theory

09 Hrs

Sampling distribution. Test of Hypothesis. Level of significance, critical region. One tailed and two tailed tests. Interval Estimation of population parameters. Large and small sample.
Test of significance for Large samples: Test for significance of the difference between sample mean and population means, Test for significance of the difference between the means of two samples.
Students t-distribution and its properties. Test of significance of small samples: Test for significance of the difference between sample mean and population means, Test for significance of the difference between the means of two Samples, paired t-test.
Chi-square test, Test for the Goodness of fit, Association of attributes.

Unit-V: ANOVA

04 Hrs

Analysis of Variance (F-Test): One-way classification, Two-way classification (short-cut method).

Text Books

1. Higher Engineering Mathematics, Dr B. S. Grewal, Khanna Publication
2. Advanced Engineering Mathematics, E Kreyzig, Wiley Eastern Limited

Reference Books

1. Higher Engineering Mathematics, B.V. Ramana, McGraw Hill Education, New Delhi
2. Integral Transforms and their Engineering Applications, Dr B. B. Singh, Synergy Knowledge ware, Mumbai
3. Numerical Methods, Kandasamy, S. Chand CO
4. Fundamentals of Mathematical Statistics by S.C. Gupta and Kapoor

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Tutorial

Minimum eight tutorials shall be conducted.

Fluid Mechanics (PCME4020T)

Teaching Scheme
Lectures : 3 Hrs./week
Credit : 3

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total: 100 Marks

Prerequisite:

Knowledge of Partial Differential Equations, Calculus and Engineering Mechanics.

Course Objectives:

1. To study fluid statics and fluid dynamics.
2. To study application of mass, momentum and energy equations in fluid flow.
3. To learn various flow measurement techniques.

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the key fluid properties, calculate the pressure, hydrostatic pressure force, buoyant force and discuss the stability of floating or submerged bodies.	L3	Analyzing
CO2	Identify various flow characteristics based on the velocity field and determine the streamline pattern and acceleration field given a velocity field.	L1	Remembering
CO3	Explain the development, uses, and limitations of the Bernoulli equation and apply the Reynolds transport theorem and the material derivative, analyze certain types of flows using the Navier-Stokes equations.	L3	Analyzing
CO4	Identify and understand various characteristics of the flow in pipes, calculate losses in straight portions of pipes as well as those in various pipe system components, apply appropriate equations and principles to analyze a variety of pipe flow situations.	L1	Remembering
CO5	Explain the fundamental characteristics of a boundary layer, including laminar, transitional, and turbulent regimes, calculate boundary layer parameters for flow past a flat plate, provide a description of boundary layer separation.	L3	Analyzing
CO6	Understand some important features of different categories of compressible flows of ideal gases, solve useful problems involving isentropic and non-isentropic flows including flows across normal shock waves	L2	Understand

Course Contents

Unit-I: Properties of fluids and Fluid Statics,Fluid Kinematics:

12 Hrs

Properties of fluids and Fluid Statics: Fluid Definition and properties, Newtons law of viscosity concept of continuum, Classification of fluids, Fluid Statics: Definition of body and surface forces. Pascals law, Basic hydrostatic equation, Forces on surfaces due to hydrostatic pressure, Buoyancy and stability of floating or submerged bodies.

Fluid Kinematics: Eulerian and Lagrangian approach to solutions; Velocity and acceleration in an Eulerian flow field; Definition of streamlines, path lines and streak lines; types of fluid flows; Definition of control volume and control surface, circulation, vorticity. Understanding of differential and integral methods of analysis. Definition and equations for stream function, velocity potential function in rectangular and cylindrical co-ordinates, rotational and irrotational flows; Definition and equations for source, sink, irrotational vortex.

Unit-II: Fluid Dynamics

08 Hrs

Integral equations for the control volume: Reynolds Transport theorem, equations for conservation of mass, energy and momentum, Bernoullis equation and its application in flow measurement, pitot tube, Venturi, orifice and nozzle meters. Differential equations for the control volume: Mass conservation in 2 and 3 dimension in rectangular coordinates, Eulers equations in 2,3 dimensions and subsequent derivation of Bernoullis equation; Navier-Stokes equations (without proof) in rectangular Cartesian co-ordinates; Exact solutions of Navier-Stokes Equations to viscous laminar flow between two parallel planes (Couette flow and plane Poiseuille flow)

Unit-III: Real fluid flows

08 Hrs

Definition of Reynolds number, Laminar flow through a pipe (Hagen-Poiseuille flow), velocity profile and head loss; Turbulent flows and theories of turbulence-Statistical theory, Eddy viscosity theory and Prandtl mixing length theory; velocity profiles for turbulent flows universal velocity profile, Velocity profiles for smooth and rough pipes Darcys equation for head loss in pipe (no derivation).Moodys diagram, pipes in series and parallel, major and minor losses in pipes.

Unit-IV Boundary Layer Flows

07 Hrs

Concept of boundary layer and definition of boundary layer thickness, displacement, momentum and energy thickness; Growth of boundary layer, laminar and turbulent boundary layers, laminar sub-layer; Von Karman Momentum Integral equation for boundary layers (without proof), analysis of laminar and turbulent boundary layers, drag, boundary layer separation and methods to control it, streamlined and bluff bodies, Aerofoil theory: Definition of aerofoil, lift and drag, stalling of aerofoils, induced drag.

Unit-V: Compressible Fluid flow

07 Hrs

Propagation of sound waves through compressible fluids, Sonic velocity and Mach number; Application of continuity , momentum and energy equations for steady state conditions; steady flow through nozzle, isentropic flow through ducts of varying cross-sectional area, Effect of varying back pressure on nozzle performance, Critical pressure ratio, Normal shocks, basic equations of normal shock, change of properties across normal shock.

Text Books

1. Fluid Mechanics by R K Bansal
2. Introduction to Fluid Mechanics and Fluid Machines by S. K. Som and Gautam Biswas

Reference Books

1. Fluid Mechanics by Frank W. White, McGraw Hill Education
2. Fluid Mechanics by Yunus A Cengel and John M Cimbala, McGraw Hill Education, 3rd Edition
3. Fundamentals of Fluid Mechanics by Bruce Munson, John Wiley and sons
4. Introduction to Fluid Mechanics by Fox and McDonald, John Wiley and sons
5. Fluid Mechanics by Victor Streeter, Benjamin Wylie and K W Bedford, McGraw Hill Education, 9th Edition
6. Fluid Mechanics by john F. Douglas, Prentice Hall
7. Mechanics of Fluids by Merle Potter, Cengage Learning
8. Engineering Fluid Mechanics by Donald F. Elger, John Wiley and sons
9. Fluids Mechanics by Russel C. Hibbeler, Prentice Hall

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Fluid Mechanics Laboratory (PCME4020L)

Practical Scheme
Practical : 2 Hrs./week
Credit : 1

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

List of Laboratory Experiments

1. Flow measurement using Venturimeter
2. Flow measurement using Orificemeter
3. Flow measurement using Rotameter
4. Determination of friction factor for Pipes
5. Determination of major and minor losses in Pipe systems
6. Verification of Bernoullis Equation
7. Experiment on Laminar flow in pipes (Reynolds Apparatus).
8. Verification of impulse momentum principle.
9. Flow over notches / weirs.

Evaluation Scheme:
Continuous Assessment (A):
Laboratory work shall consist of minimum 7 experiments and subject specific 5 lab assignment/case study The distribution of marks shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of laboratory journal/manual/report will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the teacher assessment.

End Semester Examination (C):
Oral / Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Mechanical Measurements and Metrology (PCME4030T)

Teaching Scheme
Lectures : 3 Hrs./week
Credit : 3

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total: 100 Marks

Prerequisite:

Knowledge of basic concepts of Engineering Drawing, Machine Drawing and Manufacturing Processes.

Course Objectives:

1. To impart knowledge of architecture of the measurement system
2. To deliver working principle of mechanical measurement system
3. To acquaint with measuring equipment used for linear and angular measurements.
4. To familiarize with different classes of measuring instruments and scope of measurement in industry and research
5. To acquaint with operations of precision measurement, instrument/equipment for measurement

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Classify various types of static characteristics and types of errors occurring in the system.	L4	Analyzing
CO2	Classify and select proper measuring instrument for displacement, strain, pressure and temperature measurement.	L4	Analyzing
CO3	Classify and select proper measuring instrument for linear and angular measurement.	L4	Analyzing
CO4	Demonstrate inspection methods and design of different limit gauges.	L2	Understand
CO5	Demonstrate characteristics of surface texture, screw threads, and gear measurements	L2	Understand

Course Contents

Unit-I:

06 Hrs

Introduction: Significance of Mechanical Measurements, Classification of measuring instruments, generalized measurement system, types of inputs: Desired, interfering and modifying Inputs.
Static characteristics: Static calibration, Linearity, Static Sensitivity, Accuracy, Static Error, Precision, Reproducibility, Threshold, Resolution, Hysteresis, Drift, Span Range etc. Errors in measurement: Types of errors, Effect of component errors, Probable errors.

Unit-II:

08 Hrs

Displacement Measurement: Transducers for displacement, displacement measurement, potentiometer, LVDT, Capacitance Types, Digital Transducers (optical encoder), Nozzle,Flapper Transducer.
Strain Measurement: Theory of Strain Gauges, gauge factor, temperature Compensation, Bridge circuit, orientation of strain gauges for force and torque, Strain gauge-based load cells and torque sensors

Unit-III:

10 Hrs

Pressure Measurement: Elastic pressure transducers viz. Bourdon tubes, diaphragm, bellows and piezoelectric pressure sensors, High Pressure Measurements, Bridge man Gauge. Vacuum measurement: Vacuum gauges viz. McLeod gauge, Ionization and Thermal Conductivity gauges
Flow Measurement: Bernoulli flow meters, Ultrasonic Flow meter, Magnetic flow meter, Rota meter
Temperature Measurement: Electrical methods of temperature measurement Resistance thermometers, Thermistors and thermocouples, Pyrometers.

Unit-IV:

08 Hrs

Introduction to Metrology: Fundamental Definitions, Types of Standards, Precision and Accuracy, Measurement, Errors, Linear measurements, Angular Measurement.
Design of Gauges: Limits, Fits, Tolerances, Types of Gauges, Taylors Principle of Limit Gauges, IS 919 for design of gauges.

Unit-V:

10 Hrs

Surface Texture measurement: Surface roughness, Waviness, Roughness Parameter Ra, Rz, RMS etc., working of Tomlinson surface meter, Tally-surf surface roughness tester, Surface roughness symbols
Screw Thread Measurement: Screw threads Terminology, screw thread errors, Effective diameter measurement of screw thread by Floating Carriage micrometer
Gear Measurement: Gear Terminology, Gear errors, Measurement by Parkinson Gear tester and Gear tooth Vernier Caliper

Text Books

1. Mechanical Engineering Measurements, A K Sawhney, Dhanpat Rai Sons, New Delhi
2. Instrumentation Mechanical Measurements, A K Thayal
3. Engineering Metrology, K.J. Hume, Kalyani Publications
4. A text book of Engineering Metrology, I.C. Gupta, Dhanpat Rai Publications
5. Engineering Metrology and Measurements, Bentley, Pearson Education

Reference Books

1. Measurement Systems: Applications and Design, by EO Doebelin,5th Edition, McGraw Hill
2. Instrumentation and Control System, W. Bolton, Elsevier
3. Mechanical Measurements, S P Venkateshan, Ane books, India
4. Mechanical Measurements and Metrology, R K Jain, Khanna Publishers
5. Metrology and Measurement, Anand,Bewoor and VinayKulkarni, McGraw Hill
6. Engineering Metrology and Measurement, N V Raghavendra and Krishnamurthy, Oxford University Press.

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Mechanical Measurements and Metrology Laboratory (PCME4030L)

Practical Scheme
Practical : 2 Hrs./week
Credit : 1

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 (Oral) Marks
Total : 50 Marks

List of Laboratory Experiments

1. Dead Weight Pressure gauge
2. Calibration of Vacuum Gauges
3. Torque measurement using strain gauges
4. Speed Measurement using tachometer, optical and magnetic pickup
5. Flow measurement using Rota meter
6. Study of Vernier Caliper, Micrometer.
7. Gear measurement using Gear tooth Vernier caliper
8. Thread Measurement using Floating carriage micrometer
9. Optical profile projector for miniature linear / angular measurements of screw / gear or components
10. Tool makers microscope for linear / angular measurement of single point tools

Evaluation Scheme:
Continuous Assessment (A):
Laboratory work shall consist of minimum 7 experiments and subject specific 5 lab assignment/case study

The distribution of marks shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of laboratory journal/manual/report will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the teacher assessment.

End Semester Examination (C):
Oral / Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Advanced Manufacturing Processes (PCME4040T)

Teaching Scheme
Lectures : 3 Hrs./week
Credit : 3

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total: 100 Marks

Prerequisite:

Knowledge of basic manufacturing processes.

Course Objectives:

1. To study advanced manufacturing processes.
2. To study how to select appropriate manufacturing processes for a specific application.

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Demonstrate understanding of machining operations through CNC machine.	L2	Understanding
CO2	Understand concepts of Additive Manufacturing Technology.	L2	Understanding
CO3	Demonstrate understanding of production of metal components through Non-Traditional Machining.	L2	Understanding
CO4	Understand techniques of and Destructive testing of components and machines through Non-destructive Testing techniques.	L2	Understanding
CO5	Understand basics of some futuristic manufacturing concepts	L2	Understanding

Course Contents

Unit-I: Computer Enabled Subtractive Processes

10 Hrs

CNC machine: Introduction, principles of operation, Types Vertical machining centres and horizontal machining centres, major elements, functions, applications, controllers, open loop and closed loop systems.Types of Automatic Machines, Transfer Lines.

Unit-II: Additive Manufacturing

10 Hrs

Fundamentals of Rapid Prototyping, Introduction to Additive Manufacturing (AM), Classifications of AM / RP System. New AM Classification Schemes as per ASTM F42 and ISO TC 261. 3D Printing: Procedure, techniques and material used.

Unit-III: Non-traditional Subtractive Processes (NTM)

08 Hrs

Ultrasonic Machining (USM), Abrasive Jet Machining (AJM), Water Jet Machining, Electrochemical Machining (ECM), Chemical Machining (CHM) Electrical Discharge Machining (EDM), Plasma Arc Machining (PAM), Laser Beam Machining (LBM), Electron Beam Machining (EBM)

Unit-IV:Inspection and Testing of Produced Parts

08 Hrs

Non-Destructive Testing Techniques (NDT): Visual Inspection, Dye Penetrant Testing, Magnetic Particle Inspection, X-ray Radiography, Ultrasonic Testing and Eddy Current Testing. Applications of NDT. CMM, Scanning, CT Scan.
Destructive Testing: UTM, Impact testing, Izod testing, Fatigue testing

Unit-V: Introduction to Future Manufacturing Scenarios

06 Hrs

Cyber Physical Systems, Parametric Design, Hybrid Manufacturing, AI in Manufacturing VR / AR and MR in manufacturing.

Reference Books

1. Additive Manufacturing Technologies, Ian Gibson, David Rosen, Brent Stucker, Springer Publication.
2. Manufacturing Processes, P. N. Rao, Vol. 1 and 2, McGraw Hill Publishers.
3. Manufacturing, Engineering and Technology, Serope Kalpakjian, Steven R. Schmid, Prentice Hall.
4. Production Technology, HMT.
5. Production Technology, O. P. Khanna, Dhanpat Rai Publications.

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Kinematics of Machinery (PCME4050T)

Teaching Scheme
Lectures : 3 Hrs./week
Credit : 3

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total: 100 Marks

Prerequisite:
Knowledge of Engineering Mechanics and Strength of Materials.

Course Objectives:

1. To acquaint with basic concept of kinematics and kinetics of machine elements
2. To acquaint with various basic mechanisms and inversions
3. To study basics of power transmission

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyse kinetics of rigid bodies	L5	Analyzing
CO2	Define various components of mechanisms	L1	Remembering
CO3	Draw velocity and acceleration diagrams of various mechanisms	L3	Applying
CO4	Draw Cam profile for the specific follower motion	L3	Applying
CO5	Select appropriate power transmission system for specific application	L3	Applying

Course Contents

Unit-I:

07 Hrs

Kinetics of Rigid Bodies: Mass M.I. about centroidal axis and about any other axis, Radius of Gyration, DAlemberts Principle of bodies under rotational motion about a fixed axis and plane motion, Application to motion of bars, cylinders and spheres only.

Kinetics of Rigid bodies: Work and Energy. Kinetic energy in translating motion, Rotation about fixed axis and in general plane motion, Work Energy Principle and Conservation of energy.

Basic Kinematics: Structure, Machine, Mechanism, Kinematic link and its types, Kinematic pairs, Types of constrained motions, Types of Kinematic pairs, Kinematic chains, Types of joints, Degree of freedom (mobility), Kutzbach mobility criterion, Grublerś criterion and its limitations. Four bar chain and its inversions, Grashoff's law, Slider crank chain and its inversions, Double slider crank chain and its inversions.

Unit-II:

10 Hrs

Velocity Analysis of Mechanisms (mechanisms up to 6 links): Velocity analysis by instantaneous center of rotation method (Graphical approach),Velocity analysis by relative velocity method (Graphical approach). Analysis extended to find rubbing velocities at joints, mechanical advantage (Graphical approach)

Velocity and Acceleration Analysis of Mechanism: Velocity and Acceleration- analysis by relative method (mechanism up to 6 link) including pairs involving Coriolis acceleration (Graphical Approach)

Unit-III:

06 Hrs

Cam Mechanism: Fundamentals of cams and followers, Classification of cams and followers. Motion analysis and plotting of displacement - time, velocity-time, acceleration-time, jerk-time graphs for uniform velocity, UARM, SHM, and Cycloid motions (combined motions during one stroke excluded)

Unit-IV:

10 Hrs

Belts, Chains and Brakes:

Belts: Introduction, types and all other fundamentals of belting, dynamic analysisbelt tensions, condition of maximum power transmission

Chains: Types of chains, chordal action, variation in velocity ratio, length of chain.

Brakes: Introduction, types and working principles, Introduction to braking of vehicles

Unit-V:

09 Hrs

Gears and Gear Trains: Gears- Introduction, types, Law of gearing, Details of gear terminology, Involutes and cycloidal tooth profile, Interference in involutes gears, Critical numbers of teeth for interference free motion. Methods to control interference in involutes gears, Static force analysis in spur gears.

Gear Trains: Kinematic analysis of simple and compound gear trains, reverted gear trains, epicycle gear trains with spur gear combination

Text Books

1. Theory of Machines by S. S. Ratan
2. Theory of Machines by R. S. Khurmi
3. Theory of Machines by P. L. Ballaney

Reference Books

1. Theory of Mechanisms and Machines, Amitabh Ghosh and A. Kumar Mallik.
2. Theory of Machines and Mechanism, Uicker Jr, Garden Pennock J.F. Shigley, Oxford University Press.
3. Mechanism Design: Analysis and Synthesis Vol I by A. Erdman and G N Sander, Prentice Hall.
4. Kinematics and Dynamics of Planer mechanisms, Jeremy Hirsihham, McGraw Hill.
5. Theory of Machines, W. G. Green, Bluckie Sons Ltd.

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Kinematics of Machinery Laboratory (PCME4050L)

Practical Scheme
Practical : 2 Hrs./week
Credit : 1

Examination Scheme
Teacher Assessment : 25 Marks
Total : 25 Marks

List of Laboratory Experiments

1. Study of Straight line generating mechanisms (Exact line generating mechanisms - Peaucillier's, Hart's mechanisms, Approximate line generating mechanisms - Watt's, Grasshopper, Tchebicheff's mechanisms)
2. Study of Steering gear mechanisms (Ackerman, Davis steering gears)
3. Study of Offset slider crank mechanisms (Pantograph, single and double Hook-joint).
4. Analysis of velocity of mechanisms by Instantaneous Center of Rotation (3-5 problems)
5. Analysis of velocity of mechanism by Relative method (3-5 problems)
6. Analysis of acceleration of mechanism by Relative method (3-5 problems)
7. Layout of cam profiles and plotting of displacement-time, velocity-time and acceleration-time, jerk-time and layout of cam profiles (3-5 problems)
8. Construction of Involute and Cycloid gear tooth profile - 2 problems

Text Books

1. Theory of Machines by S. S. Ratan
2. Theory of Machines by R. S. Khurmi
3. Theory of Machines by P. L. Ballaney

Reference Books

1. Theory of Mechanisms and Machines, Amitabh Ghosh and A. Kumar Mallik.
2. Theory of Machines and Mechanism, Uicker Jr, Garden Pennock J.F. Shigley, Oxford University Press.
3. Mechanism Design: Analysis and Synthesis Vol I by A. Erdman and G N Sander, Prentice Hall.
4. Kinematics and Dynamics of Planer mechanisms, Jeremy Hirsihham, McGraw Hill.
5. Theory of Machines, W. G. Green, Bluckie Sons Ltd.

Evaluation Scheme:

Continuous Assessment (A):

Laboratory work shall consist of minimum 7 experiments and subject specific 5 lab assignment/case study

The distribution of marks shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of laboratory journal/manual/report will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the teacher assessment.

Machine Shop Practice II (PCME4060L)

Teaching Scheme
Practical : 4 Hrs./week
Credit : 2

Examination Scheme
Teacher Assessment : 50 Marks
End Sem Exam : 50 Marks
Total : 100 Marks

Prerequisite:

Knowledge of basic Physics and manufacturing processes.

Course Objectives:

1. To understand various machining operations done on CNC machine
2. To study various techniques of 3 D Printing.

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand turning operations done on Turning Centre	L2	Understanding
CO2	Understand machining operations done on Vertical Machining Centre	L2	Understanding
CO3	Perform 3D Printing techniques to manufacture a simple component	L3	Applying

Course Contents

Unit-I:

16 Hrs

One job involving turning operations on Turning Centre.

Unit-II:

20 Hrs

One job involving turning, milling, shaping, drilling, grinding operations on Vertical Machining Centre.

Unit-III:

20 Hrs

One simple component each (3 components) using 3 D Printing Techniques : 1) Selective Laser Printing 2) Stereolithography 3) Fused Deposition Modelling

Reference Books

1. Workshop Technology, W. A. J. Chapman Vol I II
2. Workshop Technology, Hazra Choudhary Vol. I II
3. Additive Manufacturing Technologies, Ian Gibson, D.W. Rosen, and B. Stucker, , 2nd Edition, Springer 2015

Evaluation Scheme:

Continuous Assessment (A):

1. Term work shall consist of Work-Shop book giving details of drawings of the completed jobs and time sheet.
2. The distribution of marks for term work shall be as follows: Laboratory work (Performance of job and workshop book): 50 marks
3. The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (C):

1. Practical examination of three hours duration will be held and evalnation will be done based on the performance during the examination for 50 marks.

Universal Human Values (HMME4070T)

Teaching Scheme
Lectures : 2 Hrs./week
Credit : 2

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total : 100 Marks

Course Objectives:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society, and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society, and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. They would have better critical ability.	L3	Applying
CO2	Become sensitive to their commitment towards what they have understood (human values, human relationship, and human society)	L3	Applying
CO3	Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.	L3	Applying

Course Contents

Unit-I: Introduction: Need, Basic Guidelines, Content and Process for Value Education

05 Hrs

Purpose and motivation for the course. Self-Explorationwhat is it? - Its content and process; Natural Acceptance and Experiential Validation- as the process for selfexploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Unit-II:Understanding Harmony in the Human Being - Harmony in Myself!

06 Hrs

Understanding human being as a co-existence of the sentient I and the material Body. Understanding the needs of Self (I) and Body - happiness and physical facility. Understanding the Body as an instrument of I (I am being the doer, seer and enjoyer). Understanding the characteristics and activities of I and harmony in I. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Health.

Unit-III: Understanding Harmony in the Family and Society: Harmony in Human-Human Relationship.

06 Hrs

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Unit-IV:Understanding Harmony in the Nature and Existence: Whole existence as Coexistence.

05 Hrs

Understanding the harmony in the Nature 19. Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all pervasive space. Holistic perception of harmony at all levels of existence.

Unit-V: Implications of the above Holistic Understanding of Harmony on Professional Ethics

06 Hrs

Natural acceptance of human values 23. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order, b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists, and managers, b. At the level of society: as mutually enriching institutions and organizations.

Text Books

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. 11.India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Semester Project-II (PJME4080L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

Students are expected to design, simulate/implement a project based on the knowledge acquired from current semester subjects.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Conduct a survey of several available literatures in the preferred field of study.	L4	Analyze
CO2	Demonstrate various/alternate approaches to complete a project.	L2	Understand
CO3	Ensure a collaborative project environment by interacting and dividing project work among team members.	L3	Apply
CO4	Present their project work in the form of a technical report / paper and thereby improve the technical communication skill.	L3	Apply
CO5	Demonstrate the ability to work in teams and manage the conduct of the research study.	L2	Understand

Semester Project:

The purpose of introducing semester project at second year level is to provide exposure to students with a variety of projects based on the knowledge acquired from the semester subjects. This activity is supposed to enrich their academic experience and bring enough maturity in student while selecting the project. Students should take this as an opportunity to develop skills in implementation, presentation and discussion of technical ideas/topics. Therefore, proper attention shall be paid to the content of semester project report which is being submitted in partial fulfillment of the requirements of the Second Year and it is imperative that a standard format be prescribed for the report.

Each student shall work on project approved by departmental committee approved by the Head of Department, a group of 03 to 05 students (max allowed: 5 students in extraordinary cases, subject to the approval of the department committee and the Head of the department) shall be allotted for each Semester Project. Each group shall submit at least 3 topics for the Semester Project. The departmental committee shall finalize one topic for every group. Semester Project Title or Theme should be based on knowledge acquired during semester. The project work shall involve sufficient work so that students get acquainted with different aspects of knowledge acquired from semester subjects.

Student is expected to:

- Select appropriate project title based on acquired knowledge from current semester subjects.
- Maintain Log Book of weekly work done(Log Book Format will be as per Table 1).
- Report weekly to the project guide along with log book.

Assessment Criteria:

- At the end of the semester, after confirmation by the project guide, each project group will submit project completion report in prescribed format for assessment to the departmental committee (including project guide).
- Assessment of the project (at the end of the semester) will be done by the departmental committee (including project guide).

Prescribed project report guidelines:

Size of report shall be of minimum 25 pages. Project Report should include appropriate content for:

- Introduction
- Literature Survey
- Related Theory
- Implementation details

- Project Outcomes
- Conclusion
- References

Assessment criteria for the departmental committee (including project guide) for Continuous Assessment:

Guide will monitor weekly progress and marks allocation will be as per Table 2.

Assessment criteria for the departmental committee (including project guide) for End Semester Exam:

Departmental committee (including project guide) will evaluate project as per Table 3.

Each group shall present/publish a paper based on the semester project in reputed/peer reviewed Conference/Journal/TechFest/Magazine before end of the semester.

Table 4: Log Book Format

Sr	Week (Start Date:End Date)	Work Done	Sign of Guide	Sign of Coordinator
1				
2				

Table 5: Continuous Assessment Table

Sr	Exam Seat No	Name of Student	Student Attendance	Log Book Maintain	Literature Review	Depth of Understanding	Report	Total
			5	5	5	5	5	25

Table 6: Evaluation Table

Sr	Exam Seat No	Name of Student	Project Selection	Design/ Methodology	Fabrication/ Modeling/ Simulation	Result Verification	Presentation	Total
			5	5	5	5	5	25

Employability Skill Development Program- I (HMME4090L)

Teaching Scheme	Examination Scheme
Practical : 2 Hrs./week	Teacher Assessment : 50 Marks
Credit : 1	Total : 50 Marks

Course Objectives

1. To enhance the problem solving skills.
2. To improve the basic mathematical skills for solving real life examples.
3. Able to implement the algorithms and draw flowcharts for solving Mathematical and Engineering problems.
4. Demonstrate an understanding of computer programming language concepts.

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand and apply the basic concepts of Quantitative Ability i.e. profit, loss, time, work and geometry.	L2 and L3	Understand, Apply
CO2	Understand and apply the concepts of Quantitative Ability for the problem solving.	L2 and L3	Understand, Apply
CO3	Illustrate the concept of Variables and Functions	L2 and L3	Understand, Apply
CO4	Understand and illustrate the concept of Multithreading and string handling.	L2 and L3	Understand, Apply
CO5	Understand and describe the fundamental of object-oriented programming	L2	Understand

Course Contents

Unit-I: Aptitude

06 Hrs

Quantitative Aptitude : Algebra, Profit and Loss, Average and Allegation / Mixture, Time and Work, Geometry Mensuration, Numbers , Percentage, Permutation and Combina- tion, Probability, Ratios Proportion, Time and Distance. Reasoning : Analytical, Puzzles, Blood relationship, Data Interpretation, Data suffi- ciency

Unit-II: Fundamental of Programming

10 Hrs

Variables: Local variables, Global variables, global keyword, Rules of Identities Functions : Introduction, Prototype, Classification of functions, No arguments and No return values, With arguments and With return values No arguments and With return values : With arguments and No return values, Re- cursion, Argument type functions, Default arguments functions, Required arguments functions, Keyword arguments functions, Variable arguments function Operators : Arithmetic Operators, Relational operators, Logical operators, Bitwise op- erators, Shift operators.

Unit-III: Statements

06 Hrs

Control Statements : Conditional Control Statements, if, if-else, if-elif-else, nested-if, Loop Control Statements, While, For Branching Statements: Break, Continue, pass, return, exit Exception Handling: Introduction, The need of exception handling, Getting exceptions, Default exception handler, Handling exception, Try, Except Try with multiple except blocks: Handling exceptions using Exception class, Finally, block, Releasing resources using Finally block, Raise, Creating a user exception class.Raise exception manually, Exceptions based application

Unit-IV: Multithreading

07 Hrs

Multithreading : Introduction, Multitasking, Multi tasking v/s Multithreading, thread- ing module, Thread class introduction, Creating thread, The life cycle of a thread, Single-threaded application, Multi-threaded application, Sleep() method. Sleep() v/s run(), Join() v/s Sleep(), Multiple custom threads creation, The execution time of single- threaded application, The execution time of multi-threaded application, Synchronization of threads. Inner classes: Basic syntax of inner class, Advantages of Inner classes, Access class level members of inner classes, Access object level members of inner classes, Local inner classes, Complex inner classes, Accessing data of inner classes. Regular expressions: re module, Match(), Search(), Find() etc, and actual projects web scrapping Mail extraction: Date extraction, Mobile number extraction, Vehicle number extraction, zoom chat analysis Expressions using operators and symbols: Split string into characters, Split string into words, Lambda expressions String handling using regex: Introduction to Strings, Indexing and Slicing, Special operators in String handling, Old style String formatting, String library methods, Quotes and Escape characters in a String representation, String Immutability, Logical programs using Strings.

Unit-V: Object Oriented Programming

06 Hrs

Object Oriented Programming : Introduction to OOPs, Classes, Objects, Structure to OOP application, Contexts of OOP application, Class level members, Object level mem- bers, self variable, Constructor and Initialization of object. Access modifiers : Private, Protected, Public, Program codes. Encapsulation Rules, Implementation, Abstraction, Polymorphism Inheritance Introduction, Types of Inheri- tance, Single inheritance, Multi-Level inheritance, Method overriding, Object initializa- tion using constructor, Multiple inheritances, Hierarchical inheritance, Method overrid-ing in Multi level inheritance

Reference Books

1. Quantitative Aptitude for Competitive Examinations by Dr. R S Aggarwal, S Chand Publication.
2. Programming Techniques through C, by M. G. Venkateshmurthy, Pearson Publi- cation.
3. A Computer Science Structure Programming Approaches using C, by Behrouz Forouzan, Cengage Learning.
4. Let Us C, by YashwantKanetkar, BPB Publication.

Evaluation Scheme:

Continuous Assessment (A):

1. Teacher's assessment (TA) will carry weightage of 50 marks.Components of TA are: a. MCQ Test based on Aptitude: 20 Marks b. MCQ Test based on Programming skills: 20 Marks. c. Mock Interview: 10 Marks
2. Any other component recommended by BOS and approved by Dean Academics. grading.