Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Syllabus Structure

Second Year B.Tech in Mechanical Engineering

(Auto Scheme) with effect from Year 2021-22
(only TA policy revised for Year 2022-23)

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

Institute Vision and Mission

Vision of the Institute

"To become a leading Institute in Technical education fostering innovation, research, ethical values, and sustainable development for the betterment of society."

Mission of the Institute

To impart high quality Technical Education through:

M1: Innovative and Interactive learning process and high quality globally recognized instructional programs.

M2: Fostering a collaborative scientific temper among students with ethical responsibility towards the society.

M3: Preparing students from diverse backgrounds to have aptitude for employment, entrepreneurship and research with a spirit of Professionalism.

M4: To contribute to nation's sustainable development.

Mechanical Engineering Department

Vision Statement

"To achieve excellence in Mechanical Engineering education through innovation, research, and strong ethical values for sustainable societal development."

Mission Statements

M1: To deliver innovative and practical mechanical engineering education through quality instruction and hands-on learning.

M2: To promote teamwork, ethical values, and scientific curiosity through collaborative and socially relevant projects.

M3: To develop competent engineers with technical expertise, research aptitude, and entrepreneurial spirit for sustainable national growth.

Programme Educational Objectives (PEOs)

PEO 1: Graduates will apply scientific, mathematical, and engineering principles to solve complex mechanical problems ethically and sustainably.

PEO 2: Graduates will design and implement efficient mechanical solutions addressing societal needs through innovation, collaboration, and environmental stewardship.

PEO 3: Graduates will demonstrate professional competence, communication, teamwork, and lifelong learning for career growth, entrepreneurship, and higher education.

Programme Specific Outcomes (PSOs)

PSO 1: Students will be able to apply Mechanical Engineering principles and modern tools to design and improve mechanical systems with innovative solutions.

PSO 2: Students will demonstrate ethical practice, teamwork, and communication to develop engineering solutions for societal and sustainable development.

Department of Mechanical Engineering
(Autonomous)

Semester – III (w.e.f.2022-23)

Sr. No	Course Category	Course Code	Course Title	Teaching Scheme (hrs.)			Evaluation Scheme (CA) (marks)				ESE (marks)	Total	Credit	
				L	T	P	TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Best (TT1 & TT2)				
							[A]			[B]	[C]	[A+B+C]		
1	BS	BSME3010T	Engineering Mathematics III	4	-	-	20	15	15	15	65	100	4	4
2	PC	PCME3020T	Engineering Thermodynamics	3	-	-	20	15	15	15	65	100	3	3
3	PC	PCME3030T	Strength of Materials	3	-	-	20	15	15	15	65	100	3	4
		PCME3030L	Strength of Materials Laboratory	-	-	2	25	-	-	-	25	50	1	
4	PC	PCME3040T	Manufacturing Processes	3	-	-	20	15	15	15	65	100	3	3
5	PC	PCME3050T	Materials Technology	2	-	-	20	15	15	15	65	100	2	3
		PCME3050L	Materials Technology Laboratory	-	-	2	25	-	-	-	-	25	1	
6	PC	PCME3060L	Computer Aided Machine Drawing Laboratory	-	-	4	50	-	-	-	50	100	2	2
7	PC	PCME3070L	Machine Shop Practice I	-	-	4	50	-	-	-	50	100	2	2
8	PJ	PJME3080L	Semester Project I	-	-	2	25	-	-	-	25	50	1	1
9	MC	MCME3090T	Constitution of India	1	-	-	-	-	-	-	-	-	A	A
			Total	**16**	**0**	**14**	**275**	**75**	**75**	**75**	**475**	**825**	**22**	**22**

BS – Basic Science, PC-Professional Course, PJ- Project, MC- Mandatory Course, A-Audit Course.

Prepared by	Checked by	BOS Chairman	Dean Academic & Dy. Director	C.O.E.	Director
Mr. N. G. Shinde	Mr. S. V. Yeole	Prof. P. L. Sarode	Prof. Dr. P. J. Deore	Mr. S. P. Shukla	Prof. Dr. J. B. Patil

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

Department of Mechanical Engineering
(Autonomous)

Semester – IV (w.e.f.2022-23)

Sr. No	Course Category	Course Code	Course Title	Teaching Scheme (hrs.)			Evaluation Scheme (CA) (marks)				ESE (marks)	Total	Credit	
				L	T	P	TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Best (TT1 & TT2)				
							[A]			[B]	[C]	[A+B+C]		
1	BS	BSME4010T	Engineering Mathematics IV	4	-	-	20	15	15	15	65	100	4	4
2	PC	PCME4020T	Fluid Mechanics	3	-	-	20	15	15	15	65	100	3	4
		PCME4020L	Fluid Mechanics Laboratory	-	-	2	25	-	-	-	25	50	1	
3	PC	PCME4030T	Mechanical Measurements and Metrology	3	-	-	20	15	15	15	65	100	3	4
		PCME4030L	Mechanical Measurements and Metrology Laboratory	-	-	2	25	-	-	-	25	50	1	
4	PC	PCME4040T	Advanced Manufacturing Processes	3	-	-	20	15	15	15	65	100	3	3
5	PC	PCME4050T	Kinematics of Machinery	3	-	-	20	15	15	15	65	100	3	4
		PCME4050L	Kinematics of Machinery Laboratory	-	-	2	25	-	-	-	-	25	1	
6	PC	PCME4060L	Machine Shop Practice II	-	-	4	50	-	-	-	50	100	2	2
7	HM	HMME4070T	Universal Human Values	2	-	-	20	15	15	15	65	100	2	2
8	PJ	PJME4080L	Semester Project II	-	-	2	25	-	-	-	25	50	1	1
9	HM	HMME4090L	Employability Skill Development Program - I	-	-	2	50	-	-	-	-	50	1	1
			Total	**18**	**-**	**14**	**320**	**90**	**90**	**90**	**515**	**925**	**25**	**25**

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

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

Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Syllabus Details of Semester-III

Second Year B.Tech in Mechanical Engineering

(Auto Scheme) with effect from Year 2021-22
(TA modified in 2022-23)

Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405 Ph: 02563 259 802,
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Program: Mechanical Engineering	S.Y. B.Tech.	Semester: III
Engineering Mathematics III (BSME3010T)		

Prerequisites:

1. 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 analyze engineering problems.
2. To study the basic principles of Laplace Transform, Fourier Series, Complex variables

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Use Laplace and inverse Laplace Transform to the Ordinary Differential Equations.	L3	Apply
CO2	Determine analytic and harmonic functions and solve real integrals using complex integration.	L3	Apply
CO3	Apply Fourier series to periodic functions to simplify and evaluate infinite series.	L3	Apply
CO4	Solve certain partial differential equations analytically and numerically.	L4	Analyze
CO5	Analyze different variables of data.	L4	Analyze

Engineering Mathematics III (BSME3010T)

Course Contents

Unit-I **12 Hrs.**

Laplace, Inverse Laplace Transform and its applications

L.T. 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).
$L\{t^n f(t)\}$, $L\left\{\frac{f(t)}{t}\right\}$, $L\left\{\int_0^t f(u)\,du\right\}$, $L\left\{\frac{d^n f(t)}{dt^n}\right\}$.
Linearity property, Partial fractions method and convolution theorem.
Applications to solve ordinary differential equations with one dependent variable with given boundary conditions.

Unit-II **16 Hrs.**

Complex Variables, Differentiation and Integration

Analytic functions, Cauchy-Riemann equations in Cartesian and polar coordinates (only statement). Milne-Thomson method to determine analytic function when it's real or imaginary or its combination is given. Harmonic function, orthogonal trajectories.
Bilinear Transformation with fixed points, cross-ratio.
Line integral, Cauchy's theorem for analytic function, Cauchy's integral formula (all without proof). Taylor's and Laurent's series.
Residue at removable singularity, poles and isolated singularity and its evaluation. Residue theorem, application to evaluate real integral of type
$\int_0^{2\pi} f(\cos\theta, \sin\theta)\,d\theta, \quad \int_{-\infty}^{\infty} f(x)\,dx$

Unit-III **10 Hrs.**

Fourier Series

Fourier series of periodic function with period 2 2l .
Even and odd functions, Half range sine and cosine series, Parseval's identities (without proof).
Complex form of Fourier series. Orthogonal and Orthonormal functions.

Unit-IV **10 Hrs.**

Partial Differential Equations

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 **08 Hrs.**

Correlation, Regression and Curve-Fitting

Correlation-Karl Pearson's coefficient of correlation, Spearman's 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 $y = e^{bx}$

Books Recommended

Textbooks

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.

Program: Mechanical Engineering	S.Y. B.Tech.	Semester: III
Engineering Thermodynamics (PCME3020T)		

Prerequisites:

1. 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:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Demonstrate application of the first law of thermodynamics to a wide range of systems .	L3	Apply
CO2	Analyze and apply the steady flow energy equation to evaluate energy interactions in various flow and non-flow thermodynamic systems.	L2	Understand
CO3	Compute heat and work interactions in thermodynamic system.	L4	Analyze
CO4	Demonstrate the interrelations between thermodynamic functions to solve practical problems.	L3	Apply
CO5	Use steam table and mollier chart to compute thermodynamics interactions.	L3	Apply
CO6	Compute efficiencies of heat engines, power cycles etc.	L3	Apply

Engineering Thermodynamics (PCME3020T)

Course Contents

Unit-I **08 Hrs.**

Basic Concepts & First Law of Thermodynamics

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 **09 Hrs.**

Second Law of Thermodynamics

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 **05 Hrs.**

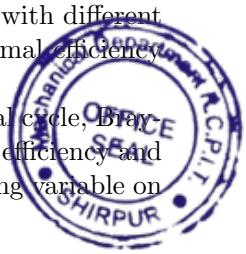
Thermodynamic Relations

Thermodynamic Relations: Reciprocal Relation, Cyclic Relation Property relations, Maxwell Relations, TdS equations, Heat capacity relations, Volume Expansivity, Isothermal Compressibility, Clausius Clapeyron Equation.
Exergy: High grade and Low-Grade Energy, Available and Unavailable Energy, Dead State, Available energy with respect to a process and a cycle.

Unit-IV **13 Hrs.**

Properties of Pure Substance and Vapour Power Cycle

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 **07 Hrs.**

Compressors

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.

Books Recommended

Textbooks

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.

Program: Mechanical Engineering	S.Y. B.Tech.	Semester: III
Strength of Materials (PCME3030T)		
Strength of Materials Laboratory (PCME3030L)		

Prerequisites:

1. 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:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Calculate stresses, strains, deformation and properties of materials in mechanical components/ structures.	L3	Apply
CO2	Outline SFD and BMD for different types of loads and support conditions for a beam.	L4	Analyze
CO3	Calculate and Illustrate direct, bending and shear stresses across sections of a given beam.	L3	Apply
CO4	Calculate torsional shear stresses and strain energy in mechanical components.	L3	Apply
CO5	Calculate deflections and slopes in beams.	L3	Apply
CO6	Demonstrate buckling phenomenon in columns and struts.	L3	Apply

Strength of Materials (PCME3030T)

Course Contents

Unit-I **10 Hrs.**

Stress and Strain

Stress and Strain: Definition, Simple stress-strain, uni-axial, bi-axial and tri-axial stresses, tensile stress, compressive stress and shear stresses, elastic limit, Hooke's Law, deformation due to self-weight, bars of varying sections, composite sections, deformation of tapering members, Thermal Stresses.
Elastic Constants and their relations: Poisson's 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 (Mohr's circle) for determining of stresses on oblique section.

Unit-II **08 Hrs.**

Shear Force and Bending Moment

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 **08 Hrs.**

Bending stresses and Shear Stresses

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 **08 Hrs.**

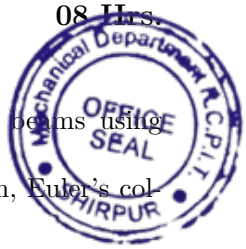
Torsion and Strain Energy

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 **08 Hrs.**

Deflection

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



Strength of Materials Laboratory (PCME3030L)

Suggested Experiments

A Any 5 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).
Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

B Assignments

Term work shall consist of minimum 5 experiments and 6 assignments. Oral examination will be based on the entire syllabus including, the experiments performed during laboratory sessions.

Books Recommended

Textbooks

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, Schaum's Outline Series, McGraw Hill Publications, Special Indian Edition

Program: Mechanical Engineering	S.Y. B.Tech.	Semester: III
Manufacturing Processes (PCME3040T)		

Prerequisites:

1. 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:

On completion of the course, the learner will be able to:

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

Manufacturing Processes (PCME3040T)

Course Contents

Unit-I **10 Hrs.**

Introduction to Various Production Processes

Introduction to Various Production Processes: Examples and Application.
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 **10 Hrs.**

Casting

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 **08 Hrs.**

Joining

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 **10 Hrs.**

Forming

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 **04 Hrs.**

Powder Metallurgy

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.

Books Recommended

Textbooks

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

Program: Mechanical Engineering	S.Y. B.Tech.	Semester: III
Materials Technology (PCME3050T)		
Materials Technology Laboratory (PCME3050L)		

Prerequisites:

1. Knowledge of basic Chemistry and Physics and Engineering Mechanics.

Course Objectives:

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

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Demonstrate fundamental knowledge about various types of materials, crystal structure, crystal imperfection, material property, deformation in materials.	L3	Apply
CO2	Explain different types of failure mechanism in materials and its significance.	L2	Understand
CO3	Illustrate Iron-Iron carbide diagram, TTT diagram and their significance.	L4	Analyze
CO4	Predict appropriate heat treatment process for specific applications.	L3	Apply
CO5	Explain advance engineering materials, their properties, applications and selection.	L2	understand

Materials Technology (PCME3050T)

Course Contents

Unit-I **06 Hrs.**

Introduction to Engineering Materials

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, Burger's 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 behavior of materials. Recrystallization Annealing: stages of recrystallization annealing and factors affecting it.

Unit-II **04 Hrs.**

Failure mechanisms: Fracture and Failure

Fracture: Definition and types of facture, Brittle fracture: Griffith's theory of facture, Orowan's modification. Dislocation theory of facture. 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 **08 Hrs.**

Alloy Phase Diagrams

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 **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 **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.

Materials Technology Laboratory (PCME3050L)

Suggested Experiments

A Any 6 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.

B Assignments.

Term work shall consist of minimum 6 experiments and 5 assignments.

Books Recommended

Textbooks

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 Metallurgy for Engineers, E.C. Rollason - ELBS SOC and Edward Arnold, London

5 Material Science and Metallurgy, V.D. Kodgire, Everest Publishing House

Program: Mechanical Engineering	S.Y. B.Tech.	Semester: III
Computer Aided Machine Drawing Laboratory (PCME3060L)		

Prerequisites:

1. 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.

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Visualize and develope detail drawing of a given object.	L6	Create
CO2	Interpret the drawing.	L2	Understand
CO3	Develope the detail and assembly drawings of different mechanical systems.	L6	Create
CO4	Develope assembly drawing from detailed drawing using modelling software.	L6	Create
CO5	Develope detailed drawing from assembly drawing using modelling software.	L6	Create
CO6	Develope detailed drawing of any given physical object/machine element with actual measurements.	L6	Create

Computer Aided Machine Drawing Laboratory (PCME3060L)

Course Contents

Unit-I **06 Hrs.**

Machine Elements

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 **16 Hrs.**

GD&T and Details and assembly drawing

Geometric Dimensioning and Tolerancing (GDT) : 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, Oldham's coupling, Universal coupling.

Unit-III **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 **20 Hrs.**

Preparation of details and assembly drawings of pulleys, Pipe joints

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 **05 Hrs.**

Reverse Engineering of a physical model

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.

Computer Aided Machine Drawing Laboratory (PCME3060L)

Suggested Experiments

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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

Problems from practical parts of each module should be solved using any standard CAD packages like IDEAS, PRO-E, CATIA, Solid Works, Inventor etc.
Practical examination of two hours duration is to be conducted by pair of Internal and External Examiners. It will be based on the Term work

Books Recommended

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

Program: Mechanical Engineering	S.Y. B.Tech.	Semester: III
Machine Shop Practice I (PCME3070L)		

Prerequisites:

1. 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:

On completion of the course, the learner will be able to:

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

Machine Shop Practice I (PCME3070L)

Suggested Experiments

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1 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 Thread Cutting) [16 Hours]

2 Introduction to Shaping Machine, demonstration of various machining operations performed on Shaping Machine.
(One job on shaping machine to make horizontal and inclined surface) [12 Hours]

3 One job involving Drilling-Boring operations and Milling operation. [16 Hours]

4 Grinding operation to the above jobs to obtain finished components and assembly of these components. [12 Hours]

Books Recommended

Reference Books

1 Workshop Technology by W. A. J. Chapman Vol I & II

2 Workshop Technology by Hazra Choudhary Vol. I & II

Program: Mechanical Engineering	S.Y. B.Tech.	Semester: III
Semester Project I (PJME3080L)		

Prerequisites:

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Course Objectives:

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

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Analyze a survey of several available literatures in the preferred field of study.	L4	Analyze
CO2	Describe various/alternate approaches to complete a project.	L2	Understand
CO3	Apply a collaborative project environment by interacting and dividing project work among team members.	L3	Apply
CO4	Use technical communication skills to present project work in the form of a technical report/paper.	L3	Apply
CO5	Apply teamwork and project management skills to plan, execute, and manage the research study.	L3	Apply

Semester Project I (PJME3080L)

The purpose of introducing a semester project at the 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 to the student while selecting the project. Students should take this as an opportunity to develop skills in implementation, presentation, and discussion of technical ideas/topics. Proper attention shall be paid to the content of 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 a project approved by the departmental committee approved by the Head of the Department. A group of 3 to 5 students (maximum 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. The Semester Project Title or Theme should be based on the knowledge acquired during the 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 an appropriate project title based on acquired knowledge from current semester subjects.
- Maintain a Log Book of weekly work done (Log Book Format will be as per Table 1).
- Report weekly to the project guide along with the log book.

Table 1: Log Book Format

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

Assessment Criteria:

- At the end of the semester, after confirmation by the project guide, each project group will submit a project completion report in the 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:

The Project Report (minimum of 25 pages) 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.

Table 2: Continuous Assessment table

Sr	PRN	Name of Student	Student Attendance	Log Book Maintain	Literature Review	Depth of Understanding	Report	Total
			5	5	5	5	5	25

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

The departmental committee (including project guide) will evaluate the project as per Table 3.

Table 3: Evalution Table

Sr	PRN	Name of Student	Project Selection	Design/ Simulation	model/ programming	Result Verification	Presentation	Total
			5	5	5	5	5	25

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

Program: Mechanical Engineering	S.Y. B.Tech.	Semester: III
Constitution of India (MCME3090T)		

Prerequisites:

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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:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Explain the historical background, philosophy, and salient features of the Indian Constitution.	L2	Understand
CO2	Interpret the fundamental rights, duties, and directive principles enshrined in the Constitution for responsible citizenship.	L2	Understand
CO3	Describe the structure, roles, and functions of the legislative, executive, and judiciary branches of government.	L2	Understand
CO4	Analyze the federal structure, center-state relations, and constitutional provisions for governance and emergency powers.	L4	Analyze
CO5	Apply constitutional principles to contemporary socio-political and legal issues, fostering ethical and democratic values.	L3	Apply

Constitution of India (MCME3090T)

Course Contents

Unit-I **02 Hrs.**

Introduction to the Constitution of India

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

Unit-II **03 Hrs.**

Directive Principles of State Policy

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

Unit-III **03 Hrs.**

State Executives

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

Unit-IV **03 Hrs.**

Special Provisions and Human Rights

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 **03 Hrs.**

Scope & Aims of Engineering Ethics

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

Books Recommended

Textbooks

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 M. 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

Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Syllabus Details of Semester-IV

Second Year B.Tech in Mechanical Engineering

(Auto Scheme) with effect from Year 2021-22
(TA modified in 2022-23)

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

Program: Mechanical Engineering	S.Y. B.Tech.	Semester: IV
Engineering Mathematics-IV (BSME4010T)		

Prerequisites:

1. 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:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Use eigenvalues and eigenvectors to identify diagonalizable and derogatory matrices and evaluate functions of square matrices.	L3	Apply
CO2	Evaluate vector integrals.	L5	Evaluate
CO3	Use probability to solve real-life engineering problems.	L3	Apply
CO4	Apply concepts of large and small sampling to draw valid conclusions about the population.	L3	Apply
CO5	Analyze the variances of multiple variables simultaneously.	L4	Analyze

Engineering Mathematics-IV (BSME4010T)

Course Contents

Unit-I **14 Hrs.**

Linear Algebra

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 **14 Hrs.**

Vector differentiation and Integration

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, Green's theorem (without proof) for planes and verification of line integrals.
Stokes theorem and Gauss divergence theorem (without proof and verification)

Unit-III **11 Hrs.**

Probability

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 **11 Hrs.**

Sampling Theory

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.
Student's 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 **06 Hrs.**

ANOVA

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

Books Recommended

Textbooks

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

Program: Mechanical Engineering	S.Y. B.Tech.	Semester: IV
Fluid Mechanics (PCME4020T)		
Fluid Mechanics Laboratory (PCME4020L)		

Prerequisites:

1. 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:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Illustrate the key fluid properties, calculate the pressure, hydrostatic pressure force, buoyant force and discuss the stability of floating or submerged bodies.	L3	Applying
CO2	Explain various flow characteristics based on the velocity field and determine the streamline pattern and acceleration field given a velocity field.	L2	Understanding
CO3	Illustrate 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	Applying
CO4	Explain 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.	L2	Understanding
CO5	Illustrate 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	Applying
CO6	Explain 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 wave.	L2	Understanding

Fluid Mechanics (PCME4020T)

Course Contents

Unit-I **12 Hrs.**

Fluid Statics and Fluid Kinematics

Properties of fluids and Fluid Statics:
Fluid Definition and properties, Newton's law of viscosity concept of continuum, Classification of fluids, Fluid Statics: Definition of body and surface forces, Pascal's 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 **08 Hrs.**

Fluid Dynamics

Integral equations for the control volume: Reynold's Transport theorem, equations for conservation of mass, energy and momentum, Bernoulli's 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, Euler's equations in 2,3 dimensions and subsequent derivation of Bernoulli's 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 **08 Hrs.**

Real fluid flows

Definition of Reynold's 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 Darcy's equation for head loss in pipe (no derivation),Moody's diagram, pipes in series and parallel, major and minor losses in pipes.

Unit-IV **07 Hrs.**

Boundary Layer Flows

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 for control of it, streamlined and bluff bodies, Aerofoil theory: Definition of aerofoil, lift and drag, stalling of aerofoils, induced drag.

Unit-V **07 Hrs.**

Compressible Fluid flow

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.

Fluid Mechanics Laboratory (PCME4020L)

Suggested Experiments

A Any 7 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 Bernoulli's Equation
7 Experiment on Laminar flow in pipes (Reynolds Apparatus).
8 Verification of impulse momentum principle.
9 Flow over notches / weirs.
Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept

B Assignments (minimum 5)

Books Recommended

Textbooks

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.

Program: Mechanical Engineering	S.Y. B.Tech.	Semester: IV
Mechanical Measurements and Metrology (PCME4030T)		
Mechanical Measurements and Metrology Laboratory (PCME4030L)		

Prerequisites:

1. 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:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Classify various types of static characteristics and types of errors occurring in the system.	L4	Analyze
CO2	Classify and select proper measuring instrument for displacement, strain, pressure and temperature measurement.	L4	Analyze
CO3	Select proper measuring instrument for linear and angular measurement.	L4	Analyze
CO4	Demonstrate inspection methods and design of different limit gauges.	L3	Apply
CO5	Demonstrate characteristics of surface texture, screw threads, and gear measurements.	L3	Apply

Mechanical Measurements and Metrology (PCME4030T)

Course Contents

Unit-I **06 Hrs.**

Introduction to Mechanical Measurements

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 and Strain Measurement Measurement

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, Flow and Temperature Measurement

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

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, Taylor's Principle of Limit Gauges, IS 919 for design of gauges.

Unit-V **10 Hrs.**

Surface Texture, Screw Thread and Gear measurement

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

Mechanical Measurements and Metrology Laboratory (PCME4030L)

Suggested Experiments

A Any 7 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 maker's microscope for linear / angular measurement of single point tools

B Assignments (minimum 5)

Oral and Practical examination of 25 marks will be based on the entire syllabus including, the practical performed during laboratory sessions.

Books Recommended

Textbooks

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, 2017

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 Metrology and Measurement, N V Raghavendra and Krishnamurthy, Oxford University Press.

Program: Mechanical Engineering	S.Y. B.Tech.	Semester: IV
Advanced Manufacturing Processes (PCME4040T)		

Prerequisites:

1. 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:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Apply knowledge of machining operations using CNC machines.	L3	Apply
CO2	Apply the concepts of Additive Manufacturing Technology.	L3	Apply
CO3	Apply knowledge of Non-Traditional Machining processes for the production of metal components.	L3	Apply
CO4	Apply Destructive and Non-Destructive Testing techniques for evaluating components and machines.	L3	Apply
CO5	Explain basics of some futuristic manufacturing concepts.	L2	Understand

Advanced Manufacturing Processes (PCME4040T)

Course Contents

Unit-I **10 Hrs.**

Computer Enabled Subtractive Processes

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 **10 Hrs.**

Additive Manufacturing

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 **08 Hrs.**

Non-traditional Subtractive Processes (NTM)

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 **08 Hrs.**

Inspection and Testing of Produced Parts

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 **06 Hrs.**

Introduction to Future Manufacturing Scenarios

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

Books Recommended

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.

Program: Mechanical Engineering	S.Y. B.Tech.	Semester: IV
Kinematics of Machinery (PCME4050T)		
Kinematics of Machinery Laboratory (RPCME4050L)		

Prerequisites:

1. 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:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Analyse kinematics of rigid bodies.	L4	Analyze
CO2	Explain various components of mechanisms.	L2	Understand
CO3	Draw velocity and acceleration diagrams of various mechanisms.	L3	Apply
CO4	Draw Cam profile for the specific follower motion.	L3	Applying
CO5	Select appropriate power transmission system for specific application.	L4	Analyze

Kinematics of Machinery (PCME4050T)

Course Contents

Unit-I **07 Hrs.**

Kinetics of Rigid Bodies

Mass M.I. about centroidal axis and about any other axis, Radius of Gyration, D'Alembert's 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 & its types, Kinematic pairs, Types of constrained motions, Types of Kinematic pairs, Kinematic chains, Types of joints, Degree of freedom (mobility), Kutzbach mobility criterion, Grűbler's criterion & 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 and Acceleration Analysis of Mechanism

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 analysis –belt 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

Kinematics of Machinery Laboratory (PCME4050L)

Suggested Experiments

A Any 7 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

B Assignments/ Mini project

The mini project or assignments based on the syllabus will be included as part of term work

Books Recommended

Textbooks

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.

Program: Mechanical Engineering	S.Y. B.Tech.	Semester: IV
Machine Shop Practice II (PCME4060L)		

Prerequisites:

1. 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:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Perform turning operations done on Turning Centre.	L3	Apply
CO2	Perform machining operations done on Vertical Machining Centre.	L3	Apply
CO3	Perform 3D Printing techniques to manufacture a simple component.	L3	Apply

Manufacturing Processes Laboratory Machine Shop Practice II (PCME4060L)

Suggested Experiments

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1 One job involving turning operations on Turning Centre. [16 Hours]

2 One job involving turning, milling, shaping, drilling, grinding operations on Vertical Machining Centre. [20 Hours]

3 One simple component each (3 components) using 3 D Printing Techniques [20 Hours]

   (a) Selective Laser Printing

   (b) Stereolithography

   (c) Fused Deposition Modelling

Books Recommended

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.

Program: Mechanical Engineering	S.Y. B.Tech.	Semester: IV
Universal Human Values (HMME4070T)		

Prerequisites:

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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:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Identify the need, relevance, and role of universal human values in personal, academic, and professional life.	L1	Remember
CO2	Demonstrate understanding of self-exploration, harmony in human relationships, and ethical conduct in daily interactions.	L3	Apply
CO3	Apply principles of trust, respect, and responsibility to foster sustainable and compassionate social environments.	L3	Apply
CO4	Analyze the interdependence between individual values, societal well-being, and ecological balance.	L4	Analyze
CO5	Use human values into decision-making processes for holistic development and responsible engineering practice.	L3	Apply

Universal Human Values (HMME4070T)

Course Contents

Unit-I **05 Hrs.**

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

Purpose and motivation for the course. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self- exploration.
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 **06 Hrs.**

Understanding Harmony in the Human Being - Harmony in Myself!

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 **06 Hrs.**

Understanding Harmony in the Family and Society: Harmony in Human-Human Relationship

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 **05 Hrs.**

Understanding Harmony in the Nature and Existence: Whole existence as Coexistence

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 spaces.
Holistic perception of harmony at all levels of existence.

Unit-V **06 Hrs.**

Implications of the above Holistic Understanding of Harmony on Professional Ethics

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:

1 Ability to utilize the professional competence for augmenting universal human order,

2 Ability to identify the scope and characteristics of people friendly and eco-friendly production systems,

3 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:

1 At the level of individual: as socially and ecologically responsible engineers, technologists, and managers,

2 At the level of society: as mutually enriching institutions and organizations.

Books Recommended

Textbooks

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 India Wins Freedom - Maulana Abdul Kalam Azad

12 Vivekananda - Romain Rolland (English)

13 Gandhi - Romain Rolland (English)

Program: Mechanical Engineering	S.Y. B.Tech.	Semester: IV
Semester Project II (PJME4080L)		

Prerequisites:

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Course Objectives:

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

Course Outcomes:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Analyze a survey of several available literatures in the preferred field of study.	L4	Analyze
CO2	Describe various/alternate approaches to complete a project.	L2	Understand
CO3	Apply a collaborative project environment by interacting and dividing project work among team members.	L3	Apply
CO4	Use technical communication skills to present project work in the form of a technical report/paper.	L3	Apply
CO5	Apply teamwork and project management skills to plan, execute, and manage the research study.	L3	Apply

Semester Project II (PJME4080L)

The purpose of introducing a semester project at the 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 to the student while selecting the project. Students should take this as an opportunity to develop skills in implementation, presentation, and discussion of technical ideas/topics. Proper attention shall be paid to the content of 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 a project approved by the departmental committee approved by the Head of the Department. A group of 3 to 5 students (maximum 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. The Semester Project Title or Theme should be based on the knowledge acquired during the 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 an appropriate project title based on acquired knowledge from current semester subjects.
- Maintain a Log Book of weekly work done (Log Book Format will be as per Table 1).
- Report weekly to the project guide along with the log book.

Table 1: Log Book Format

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

Assessment Criteria:

- At the end of the semester, after confirmation by the project guide, each project group will submit a project completion report in the 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:

The Project Report (minimum of 25 pages) 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.

Table 2: Continuous Assessment table

Sr	PRN	Name of Student	Student Attendance	Log Book Maintain	Literature Review	Depth of Understanding	Report	Total
			5	5	5	5	5	25

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

The departmental committee (including project guide) will evaluate the project as per Table 3.

Table 3: Evalution Table

Sr	PRN	Name of Student	Project Selection	Design/ Simulation	model/ programming	Result Verification	Presentation	Total
			5	5	5	5	5	25

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

Program: Mechanical Engineering	S.Y. B.Tech.	Semester: IV
Employability Skill Development Program- I (HMME4090L)		

Prerequisites:

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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:

On completion of the course, the learner will be able to:

CO	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Explain the basic concepts of Quantitative Ability, including profit, loss, time, work, and geometry.	L2	Understand
CO2	Demonstrate the concepts of Quantitative Ability for problem solving.	L3	Apply
CO3	Demonstrate the concept of Variables and Functions through examples	L3	Apply
CO4	Demonstrate the concept of Multithreading and String Handling.	L3	Apply
CO5	Explain the fundamentals of Object-Oriented Programming.	L2	Understand
CO6	Describe the concepts of Distributed Database.	L2	Understand

Employability Skill Development Program- I (HMME4090L)

Course Contents

Unit-I **04 Hrs.**

Aptitude

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

Unit-II **08 Hrs.**

Fundamental of Programming

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, Recursion, Argument type functions, Default arguments functions, Required arguments functions, Keyword arguments functions, Variable arguments function Operators: Arithmetic Operators, Relational operators, Logical operators, Bitwise operators, Shift operators.

Unit-III **06 Hrs.**

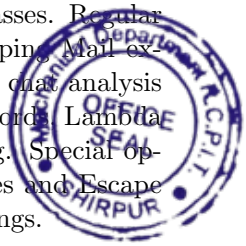
Statements

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 **05 Hrs.**

Multithreading

Multithreading: Introduction, Multitasking, Multi tasking v/s Multithreading, threading 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 **05 Hrs.**

Object Oriented Programming

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 Inheritance, Single inheritance, Multi-Level inheritance, Method overriding, Object initialization using constructor, Multiple inheritances, Hierarchical inheritance, Method overriding in Multi level inheritance

Books Recommended

Reference Books

1 Quantitative Aptitude for Competitive Examinations by Dr. RS Aggarwal, S Chand Publication.

2 Programming Techniques through C, by M. G. Venkateshmurthy, Pearson Publication.

3 A Computer Science Structure Programming Approaches using C, by Behrouz Forouzan, Cengage Learning.

4 Let Us C, by Yashwant Kanetkar, BPB Publication.