Learning Outcomes based Curriculum Framework (LOCF)

For

B. Tech. (Mechanical Engineering) 2nd year

Batch 2022-23 Onward

Faculty of Engineering and Technology

Chaudhary Devi Lal University Sirsa-125055

Scheme of Examination & Detailed Syllabus of BTech (ME) 2nd Year (3rd & 4th Semester)

*Programme Specific Outcomes (PSOs)

PSO1	To prepare the students to understand mechanical systems, components and processes to address technical and engineering challenges.
PSO2	To empower the student to build up career in industry or pursue higher studies in mechanical/interdisciplinary program.
PSO 3	To enhance the skills of the students with the ability to implement the scientific concepts for betterment of the society considering ethical, environmental and social values.

Programme Outcomes (POs) of Bachelor Programmes in Engineering and Technology have been specified in First year common curriculum of B.Tech Programmes

Course Code	**Definition/ Category**
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management Courses
MC	Mandatory Audit Courses
PC	Program Core
PE	Program Elective Courses
OE	Open Elective Courses
EEC	Employability Enhancement Courses (Project work/ Summer Training/ Industrial Training/ Practical Training/ Internship/Seminar, etc.)

BTech Mech. Engg. 2nd Year Semester-III

#	Course Code	Course Title	Workload/ Credit			
			Theory	Tutorial	Practical	Total
1.	PC/ME/1-T	Engineering Mechanics	3/3	1/1	-/-	4/4
2.	PC/ME/2-T	Mechanics of Solids-I	3/3	1/1	-/-	4/4
3.	PC/ME/3-T	Production Technology	2/2	-/-	-/-	2/2
4.	PC/ME/4-T	Thermodynamics	3/3	1/1	-/-	4/4
5.	BSC/7-T	Mathematics-III	3/3	-/-	-/-	3/3
6.	PC/ME/2-P	Mechanics of Solids-I Lab	-/-	-/-	2/1	2/1
7.	PC/ME/3-P	Production Technology Lab	-/-	-/-	4/2	4/2
8.	PC/ME/5-P	Basics of Machine Drawing	-/-	-/-	4/2	4/2
9.	*MC/3-T	Indian Constitution	3/-	-/-	-	3/-
					Total	**30/22**

BTech Mech. Engg. 2nd Year Semester-IV

#	Course Code	Course Title	Workload/ Credit			
			Theory	Tutorial	Practical	Total
1.	BSC/8-T	Numerical Methods	2/2	-/-	-/-	2/2
2.	PC/ME/6-T	Material Science	3/3	-/-	-/-	3/3
3.	PC/ME/7-T	Fluid Mechanics	3/3	1/1	-/-	4/4
4.	PC/ME/8-T	Steam and Power Generation	3/3	-/-	-/-	3/3
5.	PC/ME/9-T	Mechanics of Solids-II	3/3	1/1	-/-	4/4
6.	BSC/8-P	Numerical Methods Lab	-/-	-/-	2/1	2/1
7.	PC/ME/6-P	Material Science Lab	-/-	-/-	2/1	2/1
8.	PC/ME/7-P	Fluid Mechanics Lab	-/-	-/-	2/1	2/1
9	EEC/ME/1-P	Skill and Innovation Lab	-/-	-/-	2/1	2/1
10.	*MC/4-T	Essence of Indian Traditional Knowledge	3/-	-/-	-/-	3/-
11.	**HSMC/2-T	Human Values and Personality Development	3/-	-/-	-/-	3/-
					Total Credits	**30/20**
1.	***EEC/ME/2	Industrial Training/ Internship-I	-/-	-/-	-/4	-/4

*Non-credit qualifying mandatory courses.

**Non-credit qualifying mandatory course. Evaluation will be internal only

***The students will have to undergo Industrial/Practical Training/ Internship for 4-6 weeks during summer vacations after the examination of 4th semester which will be evaluated in 5th semester.

Note: Students will be allowed to use non-programmable scientific calculators only, however, sharing of calculator should not be permitted.

ENGINEERING MECHANICS

General Course Information:

Course Code: PC/ME/1-T Course Credits: 4.0 Mode: Lecture (L) and Tutorial (T) Type: Program Core Teaching Schedule L T P: 3 1 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Describe scalar and vector techniques for analyzing forces in statically determinate structures.	**L1**
CO2.	Locate centroid, centre of gravity of different types of symmetrical and unsymmetrical sections.	**L2**
CO3.	Apply Newton's laws of Motions to solve real-world problems.	**L3**
CO4.	Examine the physical significance of moment of inertia e.g in railway, flyovers, Bridges, automobiles etc.	**L4**

Course Content

UNIT-I

Review of Basic Force System: Laws of mechanics, Vector algebra review, Moment of a force about a point and axis, Couple and couple moment, Addition and subtraction of couples, Moment of a couple about a line, Resultant of a force system. Problems

Equilibrium of forces: Introduction, Lami's theorem, Methods for the equilibrium of coplanar forces, Analytical method for the equilibrium of coplanar forces, free body diagram, general equations of equilibrium, Tension in a string, Problems

UNIT-II

Truss and Frames: Types of frames, Types of stresses in frames (Tensile and compressive), Assumptions for forces in the members of a perfect frame, Analytical methods for the forces,

Method of joints, Method of sections (or Method of moments), simply supported trusses, Problems

Centroid and centre of gravity: Definition, Centroid of regular shapes, Symmetrical sections, Unsymmetrical sections, Reference axis, Centre of gravity of solid bodies, Centroid and centre of gravity of hollow sections. Problems

UNIT-III

Moment of Inertia: Introduction and significance, Parallel axis theorem, Perpendicular axis theorem, Mass moment of inertia, Area moment of inertia of regular shapes: L-sections, T-sections, I-sections, Moment of inertia of unsymmetrical sections, hollow sections, Product of inertia, Properties of product of inertia, Principal axis. Problems

Particle dynamics- Rectilinear motion, Plane curvilinear motion (rectangular, path and polar coordinates), Newton's 2nd law (rectangular, path and polar coordinates), Work- kinetic energy, power, potential energy, Impulse-momentum (linear, angular), Impact (Direct and oblique). Problems

UNIT-IV

Virtual work: Introduction, Concept and principle of virtual work, Virtual displacements, Sign conventions, Applications of principle of virtual work on beams carrying point load, uniformly distributed load, Applications of virtual work on ladders. Problems

Friction: Introduction, Types of friction, Laws of friction, Equilibrium of a body on a rough horizontal plane and inclined plane, Equilibrium of a body on a rough inclined plane subjected to a force acting along the inclined plane, Equilibrium of a body on a rough inclined plane subjected to a force acting horizontally. Problems

REFERENCES:

1. Irving H. Shames, Engineering Mechanics, 4th Edition, Prentice Hall
2. R.C. Hibbler (2017), Engineering Mechanics: Statics and Dynamics, Pearson Press.
3. Hibler and Gupta (2010), Engineering Mechanics (Statics, Dynamics) by Pearson Education
4. Reddy Vijaykumar K. and K. Suresh Kumar (2010), Singer's Engineering Mechanics
5. Bansal R.K.(2015), A Text Book of Engineering Mechanics, Revised eighth edition, Laxmi Publications
6. Khurmi R.S., Engineering Mechanics, 20th revised edition, S. Chand & Co.
7. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

Course Articulation Matrix:															
Course/Course Code: Engineering Mechanics (PC/ME/1-T), Semester: III															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	2	1	1	1	1	1	3	3	3	1
CO2	3	3	2	2	2	1	1	1	1	2	1	3	3	3	1
CO3	3	3	3	2	1	2	1	1	1	2	1	3	3	3	2
CO4	3	3	3	3	2	3	2	2	2	1	2	3	3	3	2

Correlation level: **1-** Slight /Low **2-** Moderate/ Medium **3-** Substantial/High

MECHANICS OF SOLIDS-I

General Course Information:

Course Code: **PC/ME/2-T** Course Credits: 4.0 Mode: Lecture (L) and Tutorial (T) Type: Program Core Teaching Schedule L T P: 3 1 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Understand the concept of stress and strain at a point.	**L1**
CO2.	Illustrate 2D & 3D stress systems and determine principal stresses & planes and maximum shearing stresses & planes using analytical and graphical methods.	**L2**
CO3.	Draw Shear and Bending Moment diagrams for various beams subjected to different types of transverse loads.	**L3**
CO4.	Employ stress-strain relationship for axially loaded members, circular torsion members and members subjected to bending loads.	**L4**
CO5.	Design machine components subjected to combined torsion, bending and axial loads.	**L5**

Course Contents

UNIT-I

Simple stresses and strains: General equations of equilibrium, free body diagram, Types of stresses and strains, Hooks law, elastic constants & their relationships, concept of stress at a point, stress-strain diagrams, stresses and strains in compound bars under axial loading, stresses in composite systems, thermal stresses.

Complex stresses: Two and three dimensional stress systems, rectangular stress components, principal stresses and planes, Mohr's stress circle.

UNIT-II

Shear force and bending moment diagrams: Relation between the rate of loading, the shear force and the bending moment. SF & BM calculations & diagrams for (i) cantilevers (ii) simply supported beams with or without over-hang (iii) fixed beams under (i) concentrated loads, (ii) uniformly distributed loads over whole span or a part of it, (iii) combination of concentrated loads and uniformly distributed loads, (iv) uniform varying loads (v) application of moments.

UNIT-III

Centroid and Moment of Inertia: Centroid and MOI for different shaped beam cross sections, Parallel axes theorem, perpendicular axis theorem, principal axes, principal moments of inertia, product of inertia, ellipse of inertia, Properties of beam cross section.

Bending stresses in beams: Theory of simple bending, position of neutral axis, flitched beams. Unsymmetrical Bending, Slope of the neutral axis, stresses & deflections, shear center and the flexural axis.

Shearing stresses in beams: Introduction, shearing stress variation, variation of shear stress in beam cross section, shear stress distribution for typical sections.

UNIT-IV

Torsion: Torsion of circular shafts, comparison of Solid and hollow circular shafts, stepped shaft & composite circular shafts, statically indeterminate shafts, stresses in shafts under combined torsion, bending and axial loads.

Columns & Struts: Column under axial load, concept of instability and buckling, slenderness ratio, derivation of Euler's formulae for the elastic buckling load, Eulers, Rankine, Gordon's formula, Johnson's empirical formula for axial loading columns and their applications, eccentric compression of a short strut of rectangular & circular sections.

REFERENCES:

1. Mechanics of Solid by Muubeen Abdul, Pearson Publications, India.
2. Engineering Mechanics of Solids by Popov E.P, Prentice Hall of India
3. Mechanics of Materials by Ferdinand P. Beer and E. Russel Johnston, Jr. Second Edition, McGraw Hill.
4. Solid Mechanics by Kazmi, Tata Mc Graw Hill.
5. Strength of Materials by G.H.Ryder, Macmillan, India.
6. Strength of Materials by D.S. Bedi, S. Chand & Co. Ltd.
7. Advanced Mechanics of Solids and Structures by N. Krishan Raju and D.R.Gururaje, Narosa Publishing House.
8. Strength of Materials by Andrew Pytel and Fredinand L. Singer, Int. Student Ed. Addison, Wesley Longman.
9. Strength of Materials by Sadhu Singh, Khanna Publishers, India.
10. Strength of Materials by Timoshenko S, East-West Press Pvt. Ltd., New Delhi.

Course Articulation Matrix:

Course/Course Code: Mechanics of Solids-I (PC/ME/2-T), Semester: III

	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	1	2	--	--	--	--	--	1	1	2	3	3	3	1
CO2	3	1	2	2	2	--	--	--	1	1	2	3	3	3	1
CO3	3	1	2	--	--	--	--	--	1	1	2	3	3	3	1
CO4	3	1	2	2	2	--	--	--	1	1	2	3	3	3	1
CO5	3	2	3	3	2	--	--	--	1	1	2	3	3	3	1

Correlation level: 1- Slight /Low **2-** Moderate/ Medium **3-** Substantial/High

PRODUCTION TECHNOLOGY

General Course Information:

Course Code: **PC/ME/3-T** Course Credits: 2.0 Mode: Lecture (L) and Tutorial (T) Type: Program Core Teaching Schedule L T P: 2 0 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course Outcomes

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Define the various tools including machine tools, cutting tools and measuring tools, forces involved and their effect in cutting, work holding devices and methods required to manufacture different components	L1
CO2.	Describe different types of tools, work holding devices and manufacturing methods along with their principles.	L2
CO3.	Solve different kind of problems related to tools and manufacturing methods selection.	L3
CO4.	Analyse various tools on the basis of economics of machining.	L4
CO5.	Select and design appropriate tool and method required to manufacture a particular component economically	L5

Course Content

UNIT-I

Theory of Metal Cutting: Introduction, Metal Cutting Machines and Tools, Elements of Metal Cutting, Geometry of Cutting Tools, Orthogonal and Oblique Cutting, Chip Formation, Chip Control, Forces Acting on a Single Point Tool, Measurement of Cutting Forces, Mechanics of Metal Cutting, Shear Plane, Chip Thickness Ratio, Shear Angle, Velocity Relationship in Orthogonal

Cutting, Forces on the Chips, Stress and Strain in the chip, Work done during Metal Cutting, Heat Generation and Temperatures in Metal Cutting

Tool Wear and Machinability: Introduction, Tool Failure, Tool Wear, Tool Life, Cutting Speed, Feed and Depth of Cut, Tool Materials, Cutting Fluids, Power required for cutting, Machinability, Single Pass, Multi Pass and Multistage Machining

UNIT-II

Jigs and Fixtures: Introduction, Definitions and Concepts of Jig and Fixture, Advantages of Using Jigs and Fixtures, Elements of Jigs and Fixtures, Degree of Freedom, Types of Jigs, Types of Fixtures

Work Holding Devices: Basic Requirements of Work Holding Devices, Location: Principles, Methods and Devices, Clamping: Principles, Methods and Devices

UNIT-III

Manufacturing Methods: Turret Lathes and Their Characteristics, Classification of Gear Production Methods, Gear generation, Indexing of Gears, Gear Hobbing, Gear Shaping, Gear Finishing Methods: Shaving, Burnishing, Grinding, Honing

Economics of Machining: Introduction, Choice of Feed, Economic Cutting Speed, Economics of Metal Removal, Minimum Cost/Component, Determination of Cutting Speed for Minimum Cost, Tool Life for Minimum Cost, Cutting Speed for Maximum Production, Tool Life for Maximum Production, Maximum Production Rate, Maximum Profit Rate

UNIT-IV

Non-Conventional Machining: Introduction, Classification of Non-Conventional Machining Processes, Process Selection, Ultrasonic Machining, Abrasive Jet Machining, Electro Chemical Machining, Electric Discharge Machining, Wire Electric Discharge Machining(WEDM), Electron Beam Machining, Laser Beam Machining

Metrology: Measurements, Linear and Angular Simple Measuring Instruments, Screw Gauge, Sine Bar, Auto-Collimator, Comparator-Mechanical, Electrical, Optical, Surface Finish and its Measurement

REFERENCES:

1. Manufacturing science: Ghosh and Malik, E.W. Press
2. Principles of metal cutting: Sen and Bhattacharya, New Central Book.
3. Metal cutting principles: Shaw, MIT Press Cambridge
4. Manufacturing analysis: Cook, Adisson-Wesley
5. Modern machining processes: Pandey and Shan, Tata McGraw Hill Publications
6. Production Technology: P.C. Sharma, S. Chand Publication
7. Production Technology: O.P. Khanna, Dhanpat Rai Publication

Course Articulation Matrix:

Course/Course Code: Production Technology (PC/ME/3-T) Semester: III															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	--	--	--	--	--	--	--	3	3	--	--
CO2	3	2	1	1	--	--	--	--	--	2	--	3	3	--	--
CO3	3	3	2	1	1	--	--	--	1	2	--	3	3	--	--
CO4	3	3	2	2	1	--	--	1	2	2	--	3	3	1	1
CO5	3	2	3	2	2	--	--	1	2	2	--	3	3	2	3

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3-** Substantial/High

THERMODYNAMICS

General Course Information:

Course Code: **PC/ME/4-T** Course Credits: 4.0 Mode: Lecture (L) Type: Program Core Teaching Schedule L T P: 3 1 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Describe the conditions involving heat and work interactions.	L1
CO2.	Differentiate high and low grade energies	L2
CO3.	Solve the problems involving change in thermodynamic properties of substances.	L3
CO4.	Examine and compare the performance of energy conversion devices.	L4

Course Content

UNIT- I

Basic Concepts: Macroscopic and Microscopic Approaches, Thermodynamic Systems, Surrounding and Boundary,Thermodynamic Property– Intensive and Extensive, Thermodynamic Equilibrium, State, Path, Process and Cycle, Quasistatic, Reversible and Irreversible Processes, Working Substance, Concept of Thermodynamic Work and Heat, Equality of Temperature, Zeroth Law of Thermodynamic and its utility. Problems.

First Law of Thermodynamics: Energy and its Forms, Energy and 1st law of Thermodynamics, Internal Energy and Enthalpy, PMM-1, Steady flow energy equation, 1st Law Applied to Non- flow process, Steady Flow Process and Transient Flow Process, Throttling Process and Free Expansion Process. Problems.

UNIT- II

Second Law of Thermodynamics: Limitations of First Law, Thermal Reservoir, Heat Source and Heat Sink, Heat Engine, Refrigerator and Heat Pump, Kelvin- Planck and Clausius Statements and their Equivalence, PMM-2, Carnot Cycle, Carnot Heat Engine and Carnot Heat Pump, Carnot Theorem and its Corollaries, Thermodynamic Temperature Scale, Entropy, Clausius Inequality, Principle of Entropy Increase, Temperature Entropy Plot, Entropy Change in Different Processes, Introduction to Third Law of Thermodynamics. Problems.

Availability and Irreversibility: High and Low Grade Energy, Availability and Unavailable Energy, Loss of Available Energy Due to Heat Transfer Through a Finite Temperature Difference, Dead state of a system, Availability of a Non- Flow or Closed System, Availability of a Steady Flow System, Helmholtz and Gibb's Functions, Effectiveness and Irreversibility, Second law efficiencies of processes & cycles. Problems.

UNIT- III

Ideal and Real Gases: Concept of an Ideal Gas, Basic Gas Laws, Characteristic Gas Equation, Avogadro's law and Universal Gas Constant, P-V-T surface of an Ideal Gas, Vander Waal's Equation of state, Reduced Co-ordinates,Compressibility factor and law of corresponding states, Mixture of Gases, Mass, Mole and Volume Fraction, Gibson Dalton's law, Gas Constant and Specific Heats, Entropy for a mixture of non-reactive gases. Problems.

Pure Substance: Pure Substance and its Properties, Phase and Phase Transformation, Vaporization, Evaporation and Boiling, Saturated and Superheat Steam, Solid – Liquid – Vapour Equilibrium, T-V, P-V and P-T Plots During Steam Formation, Properties of Dry, Wet and Superheated Steam, Property Changes During Steam Processes, Temperature – Entropy (T-S) and Enthalpy – Entropy (H-S) Diagrams, Throttling and Measurement of Dryness Fraction of Steam. Problems.

UNIT- IV

Thermodynamic Air Cycles: Introduction, Assumptions in Thermodynamic Cycles, Classifications of Thermodynamic Cycles, Reversible Cycle, Irreversible Cycle, Working of an Ideal Engine, Stirling Cycle, Ericsson Cycle, Bryton Cycle, Otto Cycle, Diesel Cycle, Dual Combustion Cycle. Problems.

Thermodynamic Relations: Maxwell Relations, Clapeyron Equation, Relations for changes in Enthalpy and Internal Energy & Entropy, Specific Heat Capacity Relations, Joule Thomson coefficient & inversion curve.

REFERENCES:

1. Advanced engineering thermodynamics – Adrian Bejan, Wiley, 4th edition.
2. Engineering thermodynamics- P. Chattopadhay, OXFORD, Revised 1st edition.
3. Thermodynamics: An Engineering Approach- Yunus Cengel and Michael Boles, Tata McGraw Hill, 8th edition.
4. Engineering Thermodynamics - P K Nag, Tata McGraw Hill, 5th edition.
5. Fundamentals of Engineering Thermodynamics - Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner and Margaret B. Bailey, Wiley, 7th edition.

Course Articulation Matrix:

Course/Course Code: Thermodynamics (PC/ME/4-T) Semester: III															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	--	2	1	1	1	1	1	2	3	3	1
CO2	3	3	3	2	--	2	1	1	1	1	1	2	3	3	1
CO3	3	3	3	3	--	3	1	1	2	2	2	2	3	3	2
CO4	3	3	3	3	--	3	1	1	2	2	2	3	3	3	2

Correlation level: 1- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

MATHEMATICS-III

General Course Information:

Course Code: **BSC/7-T** Course Credits: 3.0 Mode: Lecture (L) Type: Program Core Teaching Schedule L T P: 3 0 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Define concepts and terminology of Fourier series and Fourier transforms, Functions of complex variables, Power Series and, Probability distributions and hypothesis testing.	**L1**
CO2.	Solve problems using Fourier transforms in domains like digital electronics and image processing.	**L2**
CO3.	Apply mathematical principles to solve computational problems	**L3**
CO4.	Compare various probability distributions	**L4**
CO5.	Select suitable hypothesis testing methods for given problems and interpret the respective outcomes.	**L5**
CO6.	Integrate the knowledge of Fourier series and Fourier transforms, Functions of complex variables, Power Series and, Probability distributions and hypothesis testing for solving real world problems.	**L6**

Course Content

UNIT- I

Fourier Series and Fourier Transforms: Euler's formulae, conditions for a Fourier expansion, change of interval, Fourier expansion of odd and even functions, Fourier expansion of square wave, rectangular wave, saw-toothed wave, half and full rectified wave, half range sine and cosine series.

UNIT-II

Fourier integrals, Fourier transforms, Shifting theorem (both on time and frequency axes), Fourier transforms of derivatives, Fourier transforms of integrals, Convolution theorem, Fourier transform of Dirac delta function.

Linear Programming Problem (LPP): Introduction, Formulation of linear programming problem (LPP); Graphical method for its solution; Standard form of LPP; Basic feasible solutions; Simplex Method and Dual Simplex Method for solving LPP.

UNIT-III

Functions of Complex Variable: Definition, Exponential function, Trigonometric and Hyperbolic functions, Logarithmic functions. Limit and Continuity of a function, Differentiability and Analyticity. Cauchy-Riemann equations, necessary and sufficient conditions for a function to be analytic, polar form of the Cauchy-Riemann equations. Harmonic functions.

UNIT-IV

Complex integral, Cauchy Goursat theorem (without proof), Cauchy integral formula (without proof), Power series, radius and circle of convergence, Taylor's Maclaurin's and Laurent's series. Zeroes and singularities of complex functions, Residues. Evaluation of real integrals using residues (around unit and semi-circle only).

Text and Reference Books:

1. F. Kreyszig, Advanced Engineering Mathematics, 10th edition, Wiley, 2015.

2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th edition, 1965.

3. R. K. Jain, S.R.K. Iyenger. Advance Engineering. Mathematics, 4thedition, Narosa Publishing House, 2012.

4. Michael D. Greenberg, Advanced Engineering Mathematics, 2nd edition, Pearson Education, 2002.

5. Johnson and Miller Probability and statistics for Engineers, 8th edition, Pearson Education India, 2015.

CO-PO Articulation Matrix

Course/Course Code: Mathematics-III (BSC201-T), Semester: III															
List of Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO13**	**PSO14**	**PSO15**
CO1: Define concepts and terminology of Fourier series and Fourier transforms, Functions of complex variables, Power Series and, Probability distributions and hypothesis testing. **(LOTS L1: Remembering)**	1	-		-	-	-	-	-	-	-	-	0	2	2	2
CO2: Solve problems using Fourier transforms in domains like digital electronics and image processing. (**HOTS L2: Remembering)**	2	2	2	2	-	-	-	-	-	-	-	-	3	2	2
CO3: Apply mathematical principles to solve computational problems (**LOTS L3: Apply)**	2	2	2	2	-	-	-	-	-	-	-	-	3	2	2
CO4:Compare various probability distributions **(HOTS L4: Analyzing)**	3	3	2	3	-	-	-	-	-	-	-	-	3	2	3
CO5: Select suitable hypothesis testing method for given problems and interpret the respective outcomes.**(HOTS L5: Evaluating)**	3	3	2	3	-	-	-	-	-	-	-	-	3	2	3
CO6: Integrate the knowledge of Fourier series and Fourier transforms, Functions of complex variables, Power Series and, Probability distributions and hypothesis testing for solving real world problems. **(LOTS L6: Creating)**	3	3	2	3	-	-	-	-	-	-	-	-	2	2	3
Level of Attainments:															

Correlation level: 1- slight /Low **2-** Moderate/ Medium **3-** Substantial/High

INDIAN CONSITUTION

General Course Information:

Course Code: **MC/3-T** Course Credits: 0.0 Mode: Lecture (L) Type: Program Core Teaching Schedule L T P: 3 0 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course Content: Basic features and fundamental principles

1. Meaning of the Constitution law and Constitutionalism.
2. Historical perspective of the Constitution of India.
3. Salient features and characteristics of the Constitution of India.
4. Scheme of the fundamental rights.
5. The scheme of the fundamental duties and its legal status.
6. The directive principles of state policy- its importance and implementation.
7. Federal structure and distribution of legislative and financial power between theUnion and the States.
8. Parliamentary form of government in India- the constitution power and status of the President of India.
9. Amendment of the constitutional powers and procedure.
10. The historical prospective of the constitutional amendments in India.
11. Emergency provisions: national emergency, President rule, financial emergency.
12. Local self-government: constitutional scheme in India.
13. Scheme of the fundamental rights of equality.
14. Scheme of the fundamental rights to certain freedom under Article 19.
15. Scope of the right to Life and personal liberty under Article 21.

Text and Reference Books:

1. M, Laxmikanth, Indian Polity for Civil Services Examination, 5th edition, McGraw Hill Education (India) Private Limited, 2017.

MECHANICS OF SOLIDS-I LAB

General Course Information:

Course Code: **PC/ME/2-P** Course Credits: 1 Mode: Practical Type: Program Core Contact Hours: 2 hours per week.	**Course Assessment Methods (Internal: 50; External: 50)** Internal continuous assessment of 50 marks by course coordinator as per the course assessment method (Annexure I). For the end semester practical examination, the assessment will be done out of 50 marks by the external and internal examiners as per the course assessment method (Annexure I).

Course Outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Perform tensile test, compression test, bending test, shear test, hardness test, impact test and torsion test to determine mechanical properties such as strength, hardness, impact strength and toughness of ductile and brittle materials.	L1
CO2.	Predict the behaviour of ductile and brittle materials under different types of loading.	L2
CO3.	Interpret the experimental results for material selection in engineering applications	L3
CO4.	Compare the materials and utilize the appropriate materials in design considering engineering properties, sustainability, cost and weight.	L4

***Revised Bloom's Taxonomy Action verbs/Level**

LIST OF EXPERIMENTS:

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1. To study the Universal Testing Machine (UTM) and perform the tensile test on the given specimen (Mild steel and Cast Iron).
2. To perform compression test on UTM on the given specimen (Mild steel and Cast Iron).
3. To perform bending tests on UTM on the given specimen.
4. To perform the shear test on UTM on the given specimen.
5. To perform the torsion test on the given specimen (Mild steel and Cast Iron).
6. To perform the Rockwell hardness test.
7. To perform the Brinell hardness test.
8. To perform the Vickers hardness test.
9. To perform the Impact tests (Izod & Charpy).
10. To perform the Erichsen cupping sheet metal test.

NOTE: The list is indicative. The teacher can alter/add more number of experiments as per the requirement

CO-PO Articulation Matrix

Course/Course Code: Mechanics of Solids –I Lab (PC-ME/2-P), Semester: III															
List of Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1. Perform tensile test, compression test, bending test, shear test, hardness test, impact test and torsion test to determine mechanical properties such as strength, hardness, impact strength and toughness of ductile and brittle materials	3	1	2	2	2	--	--	--	1	1	2	3	3	3	2
CO2. Predict the behaviour of ductile and brittle materials under different types of loading.	3	2	2	2	2	--	--	--	1	1	2	3	3	3	2
CO3. Interpret the experimental results for material selection in engineering applications	3	3	2	2	2	--	--	--	1	1	2	3	3	3	2
CO4. Compare the materials and utilize the appropriate materials in design considering engineering properties, sustainability, cost and weight.	3	3	2	2	2	--	--	--	1	1	2	3	3	3	2

Correlation level: 1- slight /Low **2-** Moderate/ Medium **3**- Substantial/High

PRODUCTION TECHNOLOGY LAB

General Course Information

Course Code: **PC/ME/3-P** Course Credits: 2 Mode: Practical Type: Program Course Contact Hours: 4 hours/week.	**Course Assessment Methods (Internal: 50; External: 50)** Internal continuous assessment of 50 marks by course coordinator as per the course assessment method (Annexure I). For the end semester practical examination the assessment will be done out of 50 marks by the external and internal examiners as per the course assessment method (Annexure I).

Course Outcomes

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT*Level
CO1.	Define the various manufacturing processes like casting, machining and welding, and machine tools.	L1
CO2.	Describe different manufacturing processes and machine tools which can be used to manufacture a component	L2
CO3.	Choose a particular type of method required to manufacture a particular component.	L3
CO4.	Experiment on various machine tools for components manufacturing	L4
CO5.	Judge and design appropriate manufacturing processes and machine tool required to manufacture of a particular component.	L5

LIST OF EXPERIMENTS:

1. To make a pattern for a given casting with all the necessary allowances, parting line, running system details. Prepare the mold and make the casting. Investigate the casting defects and suggest the remedial measures.
2. To make a component involving horizontal and vertical welding and study the welding defects and suggests their remedies.
3. To prepare a job on surface grinder/cylindrical grinder and measure the various parameters of the finished piece.
4. To cut external threads on a lathe.
5. Leveling of machine tools and testing their accuracy.
6. Disassembly and assembly of small assemblies such as tail stock, bench vice, screw jack etc.
7. Development and manufacture of complex sheet-metal components such as funnel etc.
8. Multi slot cutting on milling machine by indexing.
9. Drilling and boring of a bush.
10. To study and prepare a job on wire electric discharge machine.

NOTE: The list is indicative. The teacher can alter/add more number of experiments as per the requirement.

CO-PO Articulation Matrix

Course/Course Code: Production Technology Lab (PC/ME/3-P), Semester: III															
List of Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1. Define the various manufacturing processes like casting, machining and welding, and machine tools.	3	1	1	1	--	--	--	--	--	--	--	3	3	--	--
CO2. Describe different manufacturing process and machine tools which can be used to manfacture a component	3	2	1	1	--	--	--	--	--	2	--	3	3	--	--
CO3. Choose a particular type of method required to manfacture a particular component	3	3	2	1	1	--	--	--	1	2	--	3	3	--	--
CO4. Experiment on various machine tools for components manufacturing	3	3	2	2	1	--	--	1	2	2	--	3	3	1	1
CO5. Judge and design appropriate manufacturing processes and machine tool required to manufacture of a particular component	3	2	3	2	2	--	--	1	2	2	--	3	3	2	3

Correlation level: 1- slight /Low 2- Moderate/ Medium 3- Substantial/High

BASICS OF MACHINE DRAWING

General Course Information:

Course Code: **PC/ME/5-P** Course Credits: 2 Mode: Practical Type: Program Core Contact Hours: 4 hours per week. Examination Duration: 03 hours**.**	**Course Assessment Methods (Internal: 50; External: 50)** Internal continuous assessment of 50 marks by course coordinator as per the course assessment method (Annexure I). For the end semester practical examination the assessment will be done out of 50 marks by the external and internal examiners as per the course assessment method (Annexure I).

Course outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Introduction to fundamentals of basic concepts of Machine Drawing.	L1
CO2.	Understand the conventions used in industrial machine drawing ar able to remember orthographic views of machine parts.	L2
CO3.	Able to draw the assembly of mechanical machine parts.	L3
CO4.	Able to analyzethe standard system of all industrial fasteners, pipir and valves.Riveting and rivetted joints used in various engineerir problems.	L4

Course Content

UNIT- I

Introduction to Machine Drawing, Bill of Material (BOM), Limits, fits and Tolerance (Dimensional and Geometrical Tolerance), Surface finish representation. Gear: Gear terminology, I.S. convention representation of assembly of spur gears, helical gears, bevel gears, worm and worm wheel.

Different types of rivet heads for general purposes-proportions of riveted joints, riveted joints – single riveted and double riveted lap joint (Chain and zig-zag), single riveted single strap butt joint and single riveted double strap butt joint.

UNIT- II

Keys, shafts, nut & bolt, threads, fasteners for joints, Temporary & Permanent joints, foundations for avoiding vibrations, chatter.Foundation bolts, common types, special types.

Assembly of cotter joints, Assembly and detailed drawings of knuckle joint, Assembly and detailed drawings of Flange coupling.

UNIT- III

Classification of bearings- Types of journal and thrust bearings -Bearing brasses and their support - Prevention of rotation of brasses. Assembly and Detailed drawings of Bushed bearing.Assembly and Detailed drawings of Bushed bearing.

Assembly and Detailed drawings of Plummer block. Assembly and Detailed drawings of Stuffing box, Connecting rod.

UNIT- IV

Orthographic views form isometric views of machine parts/components. Dimensioning. Sectioning. Classification of welds- Elementary welding symbols.

Types of pipes-Methods of connecting pipes-pipe threads-Representation of pipe threads-Types of pipe joints. Single line and double line orthographic layout of a piping system using standard conventions, Pipe fittings and valves. Assembly of Non return valve.

REFERENCES:

1. Machine Drawing by P.S. Gill
2. Machine Drawing-N.D. Bhatt
3. Machine Drawing- P.I Varghese & K.C. John.
4. A Text book of Machine Drawing by V.Lakshmi Narayan.
5. Machine Drawing-K.L.Narayana,P. Kannaiah &K. Venkata Reddy, New Age Publishers.
6. Machine Drawing-Dhawan,S. Chand Publications.

Course Articulation Matrix:

Course/Course Code: Basics of Machine Drawing (PC/ME/5-P), Semester: III															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	-	-	2	-	-	-	-	1	3	2	-
CO2	2	2	2	2	-	-	-	-	-	-	-	-	2	3	1
CO3	3	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO4	3	3	-	2	-	2	-	-	-	-	-	-	-	3	1

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

Detailed Syllabus
of
B. Tech (ME)
4th Semester

NUMERICAL METHODS

General Course Information:

Course Code: **BSC/8-T** Course Credits: 2.0 Mode: Lecture (L) Type: Program Core Teaching Schedule L T P: 2 0 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO5.	Memorize and describe various interpolation formulae	L1
CO6.	Make comparison between direct and iterative methods	L2
CO7.	Solve problems relating to numerical differentiation and integration	L3
CO8.	Differentiate between single step and multi-step methods of ordinary differential equations	L4
CO9.	Construct polynomial from the tabular data	L5

Course Content

UNIT- I

Finite differences operators and their relationship, difference table. Interpolation with equal intervals: Newton-Gregory forward & backward interpolation formulae. Central Differences interpolation: Gauss's forward and backward difference interpolation formulae. Interpolation with unequal intervals: Lagrange interpolation, Newton Divided difference.

UNIT- II

Non-Linear Equations: Bisection method, Regula-Falsi method, Secant method, Newton-Raphson's method, Newton's iterative method for finding pth root of a number. Simultaneous Linear Algebraic Equations: Gauss Elimination method, Gauss-Jordan method, Jacobi's method, Gauss-Seidal method, Relaxation method.

UNIT- III

Numerical Differentiation: Derivatives from differences tables, Higher order derivatives. Numerical Integration: Newton -Cotes integration formula, Trapezoidal rule, Simpson's one- third rule and Simpson's three-eighth rule, Boole's rule and Weddle's rule.

UNIT- IV

Numerical Solution of Ordinary Differential Equations: Taylor series method, Euler method, modified Euler method, and Runge-Kutta methods. Multiple step methods of Ordinary Differential Equations: Predictor-corrector method, Milne's method, Adams-Moulton method.

REFERENCES:

1. Applied Numerical Analysis: Curtis F. Gerald and Patrick G. Wheatley, Person, Education Ltd.
2. Numerical Method: E. Balagurusamy, TataMcGraw-Hill
3. Numerical methods for Scientific and Engg. Computations: M.K. Jain, S.R.K. Iyengar and R.K. Jain, Wiley Eastern Ltd.
4. Introductory methods of Numerical Analysis: S.S. Sastry, P.H.D.
5. Numerical Methods in Engg. & Science: B.S. Grewal.

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Course Articulation Matrix:

Course/Course Code: Numerical Methods (BSC/8-T), Semester: IV															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	--	2	1	--	--	--	--	--	--	--	--	1	--
CO2	3	2	--	2	2	--	--	--	--	--	--	--	--	1	--
CO3	3	3	--	3	2	--	--	--	--	--	--	--	--	2	--
CO4	3	3	--	3	2	--	--	--	--	--	--	--	--	2	--
CO5	1	2	--	2	1	--	--	--	--	--	--	--	--	1	--

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

MATERIAL SCIENCE

General Course Information:

Course Code: **PC/ME/6-T** Course Credits: 3.0 Mode: Lecture (L) and Tutorial (T) Type: Program Core Teaching Schedule L T P: 3 0 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course Outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Define crystals, its basic concepts, imperfection in crystals, equilibrium diagrams and their objectives.	L1
CO2.	Understand phase & phase diagram, heat treatment, failure of materials & their protection, applications of materials	L2
CO3.	Examine the mechanical behavior of materials in different operating conditions	L3
CO4.	Select the materials accordance to their structure and properties	L4

Course Content

UNIT-I

Crystallography: Review of crystal structure, space lattice, crystal planes and crystal directions, co-ordination number, number of atoms per unit cell, atomic packing factor, Numericals related to crystallography.

Imperfection in metal crystals: Crystal imperfections and their classifications, point defects, line defects, edge & screw dislocations, surface defects, volume defects & effects of imperfections on metal properties.

UNIT-II

Solid solutions and phase diagram: Introduction to single and multiphase solid solutions and types of solid solutions, importance and objectives of phase diagram, systems, phase and structural constituents, cooling curves, unary & binary phase diagrams, Gibbs's phase rule, Lever rule, eutectic and eutectoid systems, peritectic and peritectoid systems, iron carbon equilibrium diagram and TTT diagram.

Heat Treatment: Principles, purpose, classification of heat treatment processes, annealing, normalizing, stress relieving, hardening, tempering, carburizing, nitriding, cyaniding, flame and induction hardening, Allotropic transformation of iron and steel, Properties of austenite, ferrite, pearlite, martensite.

UNIT-III

Deformation of Metal: Elastic and plastic deformation, mechanism of plastic deformation, twinning, conventional and true stress strain curves for polycrystalline materials, yield point phenomena, strain ageing, work hardening, Bauschinger effect, season cracking, Recovery, re-crystallization and grain growth.

Failures of metals: Failure analysis, fracture, process of fracture, types of fracture, fatigue, characteristics of fatigue, fatigue limit, mechanism of fatigue, factors affecting fatigue.

UNIT-IV

Creep & Corrosion: Definition and concept, creep curve, mechanism of creep, impact of time and temperature on creep, creep fracture, creep testing and prevention against creep. Corrosion: Mechanism and effect of corrosion, prevention of corrosion.

Plastic, Composite and Ceramics: Polymers, formation of polymers, polymer structure and crystallinity, polymers to plastics types, reinforced particles-strengthened and dispersion strengthened composites. Ceramic materials: Types of ceramics, properties of ceramic, ceramic forming techniques, mechanical behavior of ceramic.

REFERENCES:

1. Elements of Material Science and Engineering: VanVlack, Wesley Pub. Comp.
2. Material Science - Narula, Narula and Gupta. New Age Publishers
3. Material Science & Engineering –V. Raghvan, Prentice Hall of India Pvt. Ltd, New Delhi
4. A Text Book of Material Science & Metallurgy – O.P. Khanna, Dhanpat Rai & Sons
5. Material Science and Engineering-An Introduction - Callister; W.D., John Wiley & Sons., Delhi.
6. Engineering Materials: Kenneth G. Budinski, Prentice Hall of India, New Delhi

Course Articulation Matrix:

Course/Course Code: Material Science (PC/ME/6-T), Semester: IV															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	--	2	1	1	1	2	--	2	3	2	2
CO2	3	2	2	1	--	2	1	1	2	2	--	2	3	2	2
CO3	3	1	2	1	--	3	1	1	2	2	--	2	3	2	2
CO4	3	1	2	1	--	3	1	1	2	2	--	3	2	2	2

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

FLUID MECHANICS

General Course Information:

Course Code: **PC/ME/7-T** Course Credits: 4.0 Mode: Lecture (L) and Tutorial (T) Type: Program Core Teaching Schedule L T P: 3 1 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Define the fluid, its properties and various laws governing fluid flow.	L1
CO2.	Identify and explain fluid flow under static, kinematics and dynamic conditions.	L2
CO3.	Apply engineering knowledge to solve the fluid flow problems under given conditions.	L3
CO4.	Examine flow through pipes and boundary layer phenomenon on a flat surface.	L4
CO5.	Evaluate various parameters related to laminar and turbulent flows.	L5

Course Content

UNIT- I

Fluid Properties and Fluid Statics: Introduction, fluid continuum, fluid properties, types of fluids, Pascal's law, hydrostatic law, Manometers: simple and differential, Hydrostatic forces on plane and curved surfaces, Buoyancy and Flotation: Centre of buoyancy, Archimedes' principle, Metacentre and Metacentric height, Stability of floating and submerged bodies, Numerical Problems.

Fluid Kinematics: Types of fluid flows, description of fluid flow: stream, streak, path and time lines, Eulerian and Lagrangian methods, flow rate and continuity equation in 3-D and in cylindrical

and polar coordinates, rotation,vorticity and circulation, stream and potential functions, flow net, Numerical Problems.

UNIT- II

Fluid Dynamics: Energy and forces acting on a flowing fluid, Equations of motion, Euler's equation, Bernoulli's equation, Venturimeter, orifice meter, Pitot tube, Impulse momentum relationship and its applications, Numerical Problems.

Orifices, Mouthpieces, Notches and Weirs: Classification of orifices and mouthpieces, Hydraulic coefficients, Discharge through a large rectangular orifice, Time of emptying a tank through an orifice, Classifications of notches and weirs, Empirical formulae for discharge over rectangular weirs, Discharge over rectangular & triangular notch or weir, Numerical Problems.

UNIT- III

Laminar Flow (Viscous Flow): Introduction, Reynolds experiment, Laminar flow in circular pipes (Hagen-Poiseuille theory), Laminar flow between two parallel plates when both plates are at rest, Laminar flow between two parallel plates when one plate moves and other at rest (Couette flow), Numerical Problems.

Turbulent Flow: Loss of head in pipes (Darcy-Weisbach equation), Characteristics of turbulent flow (turbulence), Shear stresses in turbulent flow: Boussinesq's theory, Reynolds theory, Prandtl's mixing length theory, Von-Karman similarity concept, Universal velocity distribution equation, hydrodynamically smooth and rough boundaries, velocity distribution for smooth and rough pipes, friction coefficients for smooth and rough pipes, Moody diagram, Numerical Problems

UNIT- IV

Flow Through Pipes: Major and minor head losses in pipes, hydraulic gradient and total energy lines, Pipes in series and parallel, equivalent pipe, branched pipes, power transmission through pipes, numerical Problems.

Boundary Layer Flow: Description of boundary layer, displacement, momentum and energy thickness, Drag force on a flat plate (Von Karman momentum integral equation), Blasius solution for laminar boundary layer flows, Velocity profiles for laminar boundary layer, boundary layer separation and control, Numerical Problems.

REFERENCES:

1. Fluid Mechanics and Hydraulics Machines, Mahesh Kumar, Pearson Education, 2019.
2. Fluid Mechanics – Streeter V L and Wylie E B, Mc Graw Hill
3. Mechanics of Fluids – I H Shames, Mc Graw Hill
4. A text book of Fluid Mechanics and Hydraulic Machines", R.K Rajput., S. Chand & Company Ltd., New Delhi
5. Fluid Mechanics and Hydraulics Machines, R.K. Bansal, Laxmi publications (P) Ltd., New Delhi
6. Hydraulics and Fluid Mechanics, Modi P.N., & Seth S.M Standard Book House, New Delhi
7. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas, TMH
8. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar, S.K. Kataria and Sons
9. Fluid Mechanics and Machinery – S.K. Agarwal, TMH, New Delhi
10. Fluid Mechanics, Yunus A Cengel & John M. Cimbala, Tata McGraw Hill Edition, New Delhi, 2006
11. Fluid Mechanics White, F.M, Tata McGraw-Hill, 5th Edition, New Delhi, 2003.
12. Fluid Mechanics & Fluid Machines: Basic Concepts & Principles, Shiv Kumar, Ane Books Pvt. Ltd., New Delhi, 2010.

Course Articulation Matrix:

Course/Course Code: Fluid Mechanics (PC/ME/7-T), Semester: IV															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	--	1	1	--	2	1	1	--	1	--	3	3	2	3
CO2	3	3	2	2	1	3	2	--	1	1	1	3	2	1	3
CO3	3	2	3	3	2	2	2	2	2	2	1	3	2	2	2
CO4	3	2	2	2	1	2	2	--	--	2	2	3	3	2	3
CO5	3	2	2	2	3	2	2	--	1	2	2	3	3	2	2

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3-** Substantial/High

STEAM AND POWER GENERATION

General Course Information:

Course Code: **PC/ME/8-T** Course Credits: 3.0 Mode: Lecture (L) and Tutorial (T) Type: Program Core Teaching Schedule L T P: 3 0 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course Outcomes

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Define combustion process of fuels and change in thermodynamic properties of steam in boilers, turbines, engines and condensers.	L1
CO2.	Discuss the construction and working of bomb calorimeter, steam generators, steam turbines, steam engines and steam condensers.	L2
CO3.	Examine the process of energy conversion in fuel combustion and steam power generating devices.	L3
CO4.	Formulate the performance parameters for the equipments used in fuel combustion and power generation through steam.	L4

Course Content

UNIT-I

Fuels and Combustion: Characteristics of fuels, Laws of combustion and reactions, Gravimetric and volumetric analysis, Air-fuel ratio, Exhaust gas analysis, Orsat apparatus. Calorific values of fuel, Bomb calorimeter, Numericals.

Steam: Formation of steam at constant pressure, Variation in steam properties during phase change, Steam tables and their uses, Enthalpy – entropy (Mollier) diagram, Carnot and Rankine vapour cycles, Rankine cycle with reheat and regeneration, Numericals.

UNIT-II

Steam Generators: Classification of steam boilers, Essentials of a good boiler, Construction and operational details of Cochran, Babcock Wilcox, Locomotive, Benson, Lamont, and Loeffler Boilers, Boiler mountings and accessories.

Boiler Draught (Draft) and Performance: Natural (Chimney) draught, Maximum discharge through a chimney, Artificial draught, Evaporative capacity and efficiency of boilers, Energy balance in a boiler, Numericals.

UNIT-III

Steam Nozzles: Steam flow through a nozzle, Critical pressure ratio (maximum discharge condition) and its physical significance, Flow through actual nozzles, Supersaturated expansion of steam, Numericals.

Steam Turbines: Working principle of impulse and reaction steam turbines, Vector diagrams of velocities, Optimum operating conditions of turbines, Compounding of impulse turbines, Performance analysis of steam turbines, Numericals

UNIT-IV

Steam Engines: Construction and working of steam engines, Indicator diagrams, Performance of steam engines, Governing of steam engines, Numericals.

Steam Condensers: Elements of a condensing plant, Types of condensers, Comparison of jet and surface condensers, Condenser and vacuum efficiency, Cooling towers, Numericals.

REFERENCES:

1. P. L. Ballaney, "Thermal Engineering", Khanna Publishers, 2005
2. Mahesh M. Rathore, "Thermal Engineering", Tata McGraw-Hill Education, 2010
3. R. K. Rajput, "Thermal Engineering", Laxmi Publication, 2018.
4. D. S. Kumar, "Steam and Power Generation", S.K. Kataria and Sons, 2012

Course Articulation Matrix:

Course/Course Code: Steam and Power Generation (PC/ME/8-T), Semester: IV															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	--	2	2	1	1	2	1	3	3	3	2
CO2	3	3	2	1	--	2	3	1	1	2	1	3	3	3	3
CO3	3	3	2	1	--	2	2	1	1	2	1	3	3	3	2
CO4	3	3	3	1	--	2	2	1	1	2	1	3	3	3	2

Correlation level: **1-** Slight /Low **2-** Moderate/ Medium **3-** Substantial/High

MECHANICS OF SOLIDS-II

General Course Information:

Course Code: **PC/ME/9-T** Course Credits: 4.0 Mode: Lecture (L) and Tutorial (T) Type: Program Core Teaching Schedule L T P: 3 1 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes:

Sr.No.	Course Outcomes At the end of the semester, students will be able to:	RBT* Level
CO 1	Determine stresses in pressure vessels, beam columns, rotating rims & discs and springs.	L1
CO 2	Calculate slope and deflection in various beams subjected to different types of transverse loads using Energy, Double Integration, Macaulay's and Area Moment methods.	L2
CO 3	Carry out stress-strain analysis in solids subjected to bi-axial, tri-axial and combined torsion, bending & axial loads.	L3
CO 4	Design mechanical components such as pressure vessels, springs, flywheels, shaft, etc. in accordance with realistic constraints of safety and economical constraints.	L4

Course Content

UNIT–I

Thin Pressure Vessels: Hoop and Longitudinal stresses & strains in cylindrical and spherical vessels under internal pressure, wire would thin cylinders.

Thick Cylinders & Spheres: Derivation of Lame's equations, radial & hoop stresses and strains in thick and compound cylinders and spherical shells subjected to internal fluid pressure only, wire wound cylinders, hub shrunk on solid shaft.

UNIT-II

Rotating Rims & Discs: Stresses in uniform rotating rings & discs, rotating discs of uniform strength, stresses in (I) rotating rims, neglecting the effect of spokes, (ii) rotating cylinders, hollow cylinders & solids cylinders

Beam columns: Beam columns subjected to single concentrated load, number of concentrated loads, continuous lateral Load, end couple, couples at both ends triangular loads.

UNIT- III

Strain Energy & Impact Loading: Definitions, expressions for strain energy stored in a body when load is applied (i) gradually, (ii) suddenly and (iii) with impact, strain energy of beams in bending, beam deflections, strain energy of shafts in twisting, energy methods in determining spring deflection, Castigliano's & Maxwell's theorems.

Springs: Stresses in open coiled helical spring subjected to axial loads and twisting couples, leaf springs, flat spiral springs, concentric springs.

UNIT-IV

Slope & deflection: Relationship between bending moment, slope & deflection, calculations for slope and deflection using Integration, Macaulay's and area moment methods of (i) cantilevers and (ii) simply supported beams with or without overhang (iii) fixed beams under (i) concentrated loads, (ii) uniformly distributed load and (iii) a combination of concentrated loads & uniformly distributed load (iv) varying load (v) application of moments, propped beams, sinking of prop, continuous beams.

Theories of Elastic Failure: Various theories of elastic failures with derivations and graphical representations, applications to problems of 2- dimensional stress system with (i) Combined direct loading and bending, and (ii) combined torsional and direct loading.

REFERENCES:

1. Mechanics of Solid by Muubeen Abdul, Pearson Publications, India.
2. Engineering Mechanics of Solids by Popov E.P, Prentice Hall of India Mechanics of Materials by Ferdinand P. Beer and E. Russel Johnston, Jr. Second Edition, McGraw Hill.
3. Solid Mechanics by Kazmi, Tata Mc Graw Hill.
4. Strength of Materials by G.H.Ryder, Macmillan, India.
5. Strength of Materials by D.S. Bedi, S. Chand & Co. Ltd.
6. Advanced Mechanics of Solids and Structures by N. Krishan Raju and D.R.Gururaje, Narosa Publishing House.
7. Strength of Materials by Andrew Pytel and Fredinand L. Singer, Int. Student Ed. Addison, Wesley Longman.
8. Strength of Materials by Sadhu Singh, Khanna Publishers, India.
9. Strength of Materials by Timoshenko S, East-West Press Pvt. Ltd., New Delhi.

Course Articulation Matrix:

Course/Course Code: Mechanics of Solids-II (PC/ME/9-T), Semester: IV															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	--	--	--	1	1	2	3	3	3	1
CO2	3	2	2	2	2	--	--	--	1	1	2	3	3	3	1
CO3	3	2	3	2	2	--	--	--	1	1	2	3	3	3	1
CO4	3	2	3	2	2	--	--	--	1	1	2	3	3	3	1

Correlation level: **1-** Slight /Low **2-** Moderate/ Medium **3-** Substantial/High

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

General Course Information:

Course Code: **MC/4-T** Course Credits: 0.0 Mode: Lecture (L) and Tutorial (T) Type: Program Core Teaching Schedule L T P: 3 0 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

About the Course and its Outcomes:

This course is designed to acquaint the students with Indian Knowledge traditions. It introduces the students to Vedic Period, Post-Vedic period, Sufi and Bhakti Movement in India and social reform movements of 19th Century.

Course outcomes:

Sr.No.	Course Outcomes At the end of the semester, students will be able to:	RBT* Level
CO 1	Recognize the forms and sources of Indian Traditional Knowledge	**L1**
CO 2	Identify the contribution of great ancient Indian Scientists and spiritual leaders to the World of Knowledge	**L2**
CO 3	Apply the reasoning based on the objectivity and contextual knowledge to address the social and cultural issues prevalent in the Indian Society.	**L3**
CO 4	Differentiate the myths, superstitions form the reality in context of traditional knowledge to protect the physical and social environment.	**L4**
CO 5	Suggest means of creating just a fair and social environment that is free from any prejudices and intolerance for different opinions and cultures.	**L5**

Course Content

UNIT–I

Introduction to Indian Traditional Knowledge: Definition traditional knowledge, forms, resources and dissemination of traditional knowledge.

Vedic Period: Vedas and Upnishads, Yogsutras of Patanjali.

Post Vedic Period: Budhism, Jainism and Indian Materialism, Charvak Schools of Thoughts.

UNIT-II

Sufi and Bhakti Movement (14th to 17th Century):सगुण–निर्गुण भक्ति, Sufism and Sufi Saints, Sant Kabir Ji, Guru Nanak Dev Ji and Guru Jambheshwar Ji Maharaj, composite cultural of Indian sub-continent.

UNIT- III

Jyotirao Phule and Savitri Bai Phule & Other 19th Century Social Reform Movements: India's Cultural Heritage.

UNIT–IV

India's Contribution to the World of Knowledge:प्राचीन भारत के महान विज्ञानिक, बोधायन, चरक, कोमारभरित्य, जीवन, सुश्रुत, आर्यभट्ट, बारहमिहिर,ब्रह्मगुप्त, नागार्जुन,वाग्भट्ट, Astrology and Astronomy, Myths and Realities.

TEXT AND REFERENCES BOOKS:

1. A.L. Bansham, The Wonder That was India, A Survey of the culture of the, Indian Sub-Continent before, the Coming of the Muslims, Vol 1, Groove Press, New York,1959.
2. S. A.A Rizvi, Wonder That was India, A survey of the history and culture of the Indian sub-continent from the coming of the Muslims to the British conquest 1200-1700, Vol-II, Rupa and Co.2001.
3. Jambhavani Mool Sanjivini Vyakhya
4. प्रतियोगिता दर्पण अतिरिक्तांक सीरीज–5 भारतीय कला एवं संस्कृति
5. B. V. Subbarayappa, *A Historical Perspective: Science in India:*, Rupa Publications, New Delhi 2013.
6. Bishnoi, K.R. and N.R. Bishnoi (eds). Religion and Environment. Vol. II, New Delhi: Arihant Prakashan Pvt. Ltd., 2002.

Course Articulation Matrix:

Course/Course Code: Essence of Indian Traditional Knowledge (MC/4-T),										Semester: IV		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	-	-	-	-	-	-	-	-	-	1
CO2	-	2	1	-	-	-	-	-	-	-	-	1
CO3	-	3	3	2	-	3	-	-	-	-	-	3
CO4	-	2	3	3	-	3	1	-	-	-	-	3
CO5	-	3	3	3	-	3	-	-	-	-	-	3

Correlation level: **1-** Slight /Low **2-** Moderate/ Medium **3-** Substantial/High

HUMAN VALUES AND PERSONALITY DEVELOPMENT

General Course Information:

Course Code: **HSMC/2-T** Course Credits: 0.0 Mode: Lecture (L) and Tutorial (T) Type: Program Core Teaching Schedule L T P: 3 0 0 Examination Duration: **Internal Examination**	**Course Assessment Methods: Total Marks: 100** **(Internal Examination only)** The internal assessment of 30 marks will be on the minor tests, class attendance, assignments, and class performance. Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The assessment of 70 marks will be at the end of Semester through Interview/ VIVA-VOCE only by a committee of Two Faculty Members including course coordinator and a faculty member appointed by Chairperson/Head of concerned Department.

Pre-Requisites: None

About the Course and its Outcomes:

The course is designed to develop the Holistic perspective based on self-exploration and co-existence in society and nature. The focus is on to understand the harmony and being in harmony with the society and the environment around us. The students will nurture a habit of self-reflection and courage to act. This course includes the practice sessions to discuss natural acceptance in human-being as the innate acceptance for living with the responsibility (living in relationship, harmony and co-existence) rather than an arbitrariness in choice based on liking-disliking).

Course outcomes:

Sr. No.	Course Outcomes **At the end of the semester, students will be able to:**
CO 1	Exhibit awareness about oneself, one's surroundings and goals in one's life.
CO 2	Stay in harmony with society and nature.
CO 3	Develop healthy and harmonious relationships.
CO 4	Understand groups and develop team spirit
CO 5	Manage stress effectively.
CO6	Exhibit leadership qualities.
CO7	Excel in Personal and Professional Life.

Course Content

UNIT–I

Understanding the Concept of self exploration of self with JOHARI – Window. Self –Esteem, Characteristics of individuals with low and high Self- Esteem. Self Confidence, Strategies of Building Self- Confidence.

Personality: Definition, Types and Traits; Relevance and importance of nature and nurture in the development of the personality.

UNIT-II

Nature of Socialization: Socialization process, contributing to the society and nation. Importance of discipline and hard work, Ecological responsibility of Engineers. Professional Ethics: Competence in Professional values and ethics. Personal and Professional Excellence: Identifying long-term choices and goals.

UNIT- III

Meaning and nature of teams, External and internal factors affecting team building. Leadership Meaning, Nature and Functions, leadership styles in organization. Meaning and nature of stress, causes, effects and management.

UNIT–IV

Meaning and importance of human rights, Human rights awareness. Harmony in nature, understanding co-existence, harmony at all levels of existence. Understanding the concept of happiness and well – being. Role and importance of positive emotions: Gratitude, hope and optimism.

TEXT AND REFERENCES BOOKS:

1. Bates, A.P. and Julian, J.: Sociology – Understanding Social Behaviour.
2. Dressler, David and Cans, Donald: The Study of Human Interaction.
3. Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
4. Organizational Behaviour, Davis K.
5. Hoover, Judhith D. Effective small group and Team Communication, 2001, Harcourt College Publishers.
6. Dick, McCann and Margerison, Charles: Team Management , 1992 Edition, via books.
7. Pestonjee, D.M.; Stress and Coping: the Indian Experience
8. Clegg, Britain; Instant Stress Management – Bring calm to your life now.

NUMERICAL METHODS LAB

General Course Information:

Course Code: **BSC/8-P** Course Credits: 1 Mode: Practical Type: Program Core Contact Hours: 2 hours per week.	**Course Assessment Methods (Internal: 50; External: 50)** Internal continuous assessment of 50 marks by course coordinator as per the course assessment method (Annexure I). For the end semester practical examination the assessment will be done out of 50 marks by the external and internal examiners as per the course assessment method (Annexure I).

Course Outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Memorize and describe various data types and file handling functions	L1
CO2.	Translate given algorithm to a working and correct program in C language	L2
CO3.	Write, compile and debug programs in C language	L3
CO4.	Compare and contrast algorithms to solve mathematical problems	L4
CO5.	Evaluate the numerical solutions of mathematical problems using C programming language	L5
CO6.	Assemble object oriented features of C programming language in developing the programs to solve real world problems	L6

LIST OF EXPERIMENTS:

Write down and execute the following programs using C :

1. To interpolate the data using Newton's forward/ backward interpolation formula
2. To interpolate the data using Gauss's forward/ backward interpolation formula
3. To interpolate the data using Lagrange's interpolation formula
4. To compute derivatives of a tabulated function at a specified value using the Newton's interpolation approach.
5. To find the roots of non-linear equation using Bisection method.
6. To find the roots of non-linear equation using Regula-Falsi method.
7. To find the roots of non-linear equation using Newton-Raphson method.
8. To solve the system of linear equations using Gauss -elimination method.
9. To solve the system of linear equations using Gauss -Seidal iteration method.
10. To solve the system of linear equation using Gauss – Jordan method.
11. To integrate numerically using Trapezoidal rule.
12. To integrate numerically using Simpson's rules.
13. To find numerical solution of ordinary differential equations by Euler's method/ Modified Euler's method.
14. To find numerical solution of ordinary differential equations by Runge -Kutta method.
15. To find numerical solution of ordinary differential equations by Milne's method.

NOTE: The list is indicative. The teacher can alter/add more number of experiments as per the requirement.

CO-PO Articulation Matrix

Course/Course Code: Numerical Methods Lab (BSC/8-P), Semester: IV															
List of Course Outcomes	**PO1**	**PO2**	**PO 3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1. Memorize and describe various data types and file handling functions	3	2	3	2	3	--	--	--	--	--	--	--	--	2	2
CO2.Translate given algorithm to a working and correct program in C language	3	2	3	2	2	--	--	--	--	--	--	--	--	2	2
CO3. Write, compile and debug programs in C language	3	3	3	3	2	--	--	--	--	--	--	--	--	2	2
CO4. Compare and contrast algorithms to solve mathematical problems	3	3	3	3	3	--	--	--	--	--	--	--	--	2	2
CO5. Evaluate the numerical solutions of mathematical problems using C programming language	3	3	3	3	2	--	--	--	--	--	--	--	--	2	2
CO6. Assemble object oriented features of C programming language in developing the programs to solve real world problems	3	2	3	2	3	--	--	--	--	--	--	--	--	2	2
Level of Attainments:															

Correlation level: 1- slight /Low 2- Moderate/ Medium 3- Substantial/High

MATERIAL SCIENCE LAB

General Course Information:

Course Code: **PC/ME/6-P** Course Credits: 1 Mode: Practical Type: Program Course Contact Hours: 2 hours/week.	**Course Assessment Methods (Internal: 50; External: 50)** Internal continuous assessment of 50 marks by course coordinator as per the course assessment method (Annexure I). For the end semester practical examination the assessment will be done out of 50 marks by the external and internal examiners as per the course assessment method (Annexure I).

Course Outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Understand the basic concepts of crystalline materials, phase & phase diagram, heat treatment process & types	L1
CO2.	Select the materials accordance to their structure and properties	L2
CO3.	Analyze the structure of materials at different levels	L3
CO4.	Examine crystals imperfections	L4

LIST OF EXPERIMENTS:

1. To study crystal structures of a given specimen.
2. To study crystal imperfections in a given specimen.
3. To study microstructures of metals/ alloys.
4. To prepare solidification curve for a given specimen.
5. To study heat treatment processes (hardening and tempering) of steel specimen.
6. To study microstructure of heat-treated steel.
7. To study thermo-setting of plastics.
8. To study the creep behavior of a given specimen.
9. To study the mechanism of chemical corrosion and its protection.
10. To study the properties of various types of plastics.
11. To study Bravais lattices with the help of models.
12. To study crystal structures and crystals imperfections using ball models.

NOTE: The list is indicative. The teacher can alter/add more number of experiments as per the requirement.

CO-PO Articulation Matrix

Course/Course Code: Material Science Lab (PC/ME/6-P), Semester: IV															
List of Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1.Understand the basic concepts of crystalline materials, phase & phase diagram, heat treatment process & types	3	2	2	1	--	--	1	1	--	1	--	3	3	3	2
CO2. Select the materials accordance to their structure and properties	3	1	2	1	--	--	1	1	--	1	1	3	3	3	2
CO3. Analyze the structure of materials at different levels	3	3	3	2	3	--	1	1	2	2	1	3	3	3	2
CO4. Examine crystals imperfections	3	3	3	2	3	--	1	1	2	2	2	3	3	3	2
Level of Attainments:															

Correlation level: **1**- slight /Low **2-** Moderate/ Medium **3**- Substantial/High

FLUID MECHANICS LAB

General Course Information:

Course Code: **PC/ME/7-P** Course Credits: 1 Mode: Practical Type: Program Core Contact Hours: 2 hours per week.	**Course Assessment Methods (Internal: 50; External: 50)** Internal continuous assessment of 50 marks by course coordinator as per the course assessment method (Annexure I). For the end semester practical examination the assessment will be done out of 50 marks by the external and internal examiners as per the course assessment method (Annexure I).

Course Outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Describe the fundamentals involved in measuring various performance parameters.	L1
CO2.	Understand the working of various flow meters.	L2
CO3.	Operate flow discharge measuring device used in pipes channels.	L3
CO4.	Examine types of flow and major and minor losses during fluid flow.	L4
CO5.	Evaluate the error between theoretical and experimental results.	L5

LIST OF EXPERIMENTS:

1. To verify the Bernoullis Theorem.
2. To determine the coefficient of discharge of an orifice meter.
3. To determine the coefficient of discharge of venturimeter.
4. To determine the coefficient of discharge of Notch (V and Rectangular types).
5. To determine the major loss due to friction in pipe flow.
6. To determine the coefficient of discharge, contraction & velocity of an orifice.
7. To find critical Reynolds number for a pipe flow.
8. To determine the meta-centric height of a floating body.
9. To determine the minor losses due to pipe fittings in pipes
10. To determine the density and viscosity of any three fluids.

NOTE: The list is indicative. The teacher can alter/add more number of experiments as per the requirement.

CO-PO Articulation Matrix

Course/Course Code: Fluid Mechanics Lab(PC/ME/7-P), Semester: IV															
List of Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1. Describe the fundamentals involved in measuring various performance parameters.	3	1	-	-	-	-	-	-	3	-	-	2	3	2	1
CO2. Understand the working of various flow meters.	3	2	-	2	-	-	-	-	-	-	-	1	3	-	-
CO3.Operate flow discharge measuring device used in pipes channels.	3	-	1	-	-	-	-	-	-	-	-	1	3	-	-
CO4. Examine types of flow and major and minor losses during fluid flow.	3	2	2	1	-	-	-	-	-	-	-	1	3	2	-
CO5. Evaluate the error between theoretical and experimental results.	-	-	-	-	-	-	-	-	-	3	-	-	-	-	2
Level of Attainments:															

Correlation level: **1-** slight /Low **2-** Moderate/ Medium **3-** Substantial/High

SKILLS AND INNOVATION LAB

General Course Information:

Course Code: **EEC/ME/1-P** Course Credits: 1 Mode: Practical Type: Program Core Contact Hours: 2 hours per week.	**Course Assessment Methods (Internal: 50; External: 50)** Internal continuous assessment of 50 marks by course coordinator as per the course assessment method (Annexure I). For the end semester practical examination the assessment will be done out of 50 marks by the external and internal examiners as per the course assessment method (Annexure I).

Course Outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Explore novel ideas/modified techniques on topics related to Mechanical Engineering.	L1
CO2.	Work in groups and collectively mange to present their ideas into a concept.	L2
CO3.	Identify and interpret practical problems/issues in existing mechanical systems	L3
CO4.	Employ modern design and analysis tools for carrying out their project work.	L4

Course Content

A group of 5-7 students are required to carry out a project related to current research & development in the field of Mechanical Engineering. Each group of students will try to propose a novel idea/modified technique/new interpretation after identifying an existing research work. They will work towards finding solutions to the identified problem such as cost reduction, enable new processes and/or materials, create a higher impact than the existing practices etc. using their innovative ideas and concept generation abilities.

The topic of the project will be decided by the students in consultation with the course coordinator. The project report will be submitted by a group at the end of semester. The students may use the equipments/machines/instruments available in the labs/workshops with the due permission of Chairperson on recommendation of the course coordinator.

Course Articulation Matrix:

Course/Course Code: Skill and Innovation Lab (EEC/ME/1-P), Semester: IV														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	--	--	2	--	3	--	2	2	2	2	3
CO2	3	2	2	2	--	--	2	--	3	2	2	2	2	2	3
CO3	3	3	2	2	--	--	2	--	--	2	2	2	2	2	3
CO4	3	--	2	2	3	--	2	--	--	--	2	2	2	2	3

Annexure - I

Course Assessment Methods (Internal: 50; External: 50)

The internal and external assessment is based on the level of participation in laboratory Sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed.

There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations.

The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students.

The Course Coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the Performa (attached herewith as Annexure II and III) to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Annexure - II

Chaudhary Devi Lal University
Sirsa, Haryana (India) – NAAC Accredited Univesity
(Established by the State Legislature Act 9 of 2003)

CHUADHARY DEVI LAL UNIVERSITY, SIRSA								
Internal Laboratory Course Evaluation Performa								
Minor Laboratory Course Evaluation-I (MLE-I) / Minor Laboratory Course Evaluation-II (MLE-II)								
Name of the Programme :								
Semester :								
Nomenclature of the Course :								
Course Code :								
SR. No.	Roll. No.	Conduct of Experiments and /or Written work	(VIVA-VOCE) based on laboratory Course Outcomes (CO-2 to CO-4)			Laboratory Record/ Reports/ File	Class Performance (Attendance/Ethical practices followed, Self-Learning and Team Spirit)	Total Marks
		CO-1 (15)	CO-2 (5)	CO-3 (5)	CO-4 (5)	CO-5 (10)	CO-6 (10)	50
Total No. of Students:			Present:			Absent		
Name of the Course Coordinator			Signature of the Course Coordinator					

Annexure - III

Chaudhary Devi Lal University
Sirsa, Haryana (India) - NAAC Accredited Univesity
(Established by the State Legislature Act 9 of 2003)

CHUADHARY DEVI LAL UNIVERSITY, SIRSA

External Laboratory Course Evaluation Performa

Name of the Programme:
Semester:
Nomenclature of the Course:
Course Code:

SR. No.	Roll. No.	Conduct of Experiment(s) CO1, CO6 (20)	VIVA-VOCE CO2-CO4 (15)	Written Work CO5 (15)	Total Marks (50)

Total No. of Students: Present: Absent:

Signature of the Internal Examiner

Name of the Internal Examiner

Signature of the External Examiner

Name of the External Examiner