GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute

'A' GRADE ACCREDITED BY NAAC

Scheme of Examinations & Syllabus For

Bachelor of Technology (Mechanical Engineering) 2nd Year

(Effective from the Session: 2025-26)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

1. DEFINITION OF CREDIT

1	1 Lecture (L) per week	1 Credit
2	1 Tutorial (L) per week	1 Credit
2	2 Practical (Lab) per week	1 Credit
3	2 Seminar/IT per Week	1 Credit
4	4 Project per Week	2 Credit

2. RANGE OF CREDIT

A credits of 170* for a student to be eligible to get Under Graduate degree in Mechanical Engineering.

3. STRUCTURE OF BACHELOR OF TECHNOLOGY (MECHANICAL ENGINEERING)

Sr. No.	Category	Breakup of Credits
1	Professional Core Courses	71*
2	Professional Elective Courses (Relevant to chosen specialization/branch)	18*
3	Engineering Science Courses	22*
4	Basic Science Courses	21*
5	Humanities and Social Courses including Management Courses	15*
6	Multidisciplinary Open Elective Courses	9*
7	Seminar/Industrial Training	10*
8	Project	4*
9	Mandatory Courses	0*
	Total Credits	170*

**Minor variation is allowed as per need of the respective disciplines.*

4. COURSE CODE AND DEFINITIONS

Sr. No.	Category	Course Code
1	Professional Core Courses	PCC
2	Professional Elective Courses	PEC
3	Engineering Science Courses	ESC
4	Basic Science Courses	BSC
5	Humanities and Social Courses including Management Courses	HSMC
6	Multidisciplinary Open Elective Courses	OEC
7	Seminar/Industrial Training	PT
8	Project	PR
9	Mandatory Courses	MC

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examinations

B. Tech (MECHANICALENGINEERING) - 3rd Semester

w.e.f. 2025-26

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Scheme (Marks)				Exam Duration in
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-ME-201A	Thermodynamics	3	1	0	4	4	40	60		100	3
2	Professional Core Courses	PCC-ME-203A	CAD&M	3	0	0	3	3	40	60		100	3
3	Professional Core Courses	PCC-ME-205A	Materials & Metallurgy	3	0	0	3	3	40	60		100	3
4	Engineering Science Courses	ESC-ME-207A	Engineering Mechanics	3	0	0	3	3	40	60		100	3
5	Basic Science Courses	BSC-ME-209A	Mathematics-III	3	1	0	4	4	40	60		100	3
6	Humanity Science & Management Courses	HSMC-01A	Fundamental of Management and Organizational Behaviour	3	0	0	3	3	40	60		100	3
7	Professional Core Courses	LC-ME-211A	Materials & Metallurgy Lab	0	0	2	2	1	25		25	50	
8	Professional Core Courses	LC-ME-213A	CAD&M Lab	0	0	2	2	1	25		25	50	
9	Engineering Science Courses	LC-ME-215A	Engineering Mechanics Lab	0	0	2	2	1	25		25	50	
Total Credits								**23**				**750**	

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examinations

B. Tech (MECHANICALENGINEERING) – 4th Semester

w.e.f. 2024-25

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Scheme (Marks)				Exam Duration in H
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-ME-202A	Applied Thermodynamics	3	0	0	3	3	40	60		100	3
2	Professional Core Courses	PCC-ME-204A	Strength of Materials	3	1	0	4	4	40	60		100	3
3	Professional Core Courses	PCC-ME-206A	Fluid Mechanics	3	0	0	3	3	40	60		100	3
4	Professional Core Courses	PCC-ME-208A	Kinematics of Machines	3	0	0	3	3	40	60		100	3
5	Professional Core Courses	PCC-ME-210A	Manufacturing Technology-I	3	0	0	3	3	40	60		100	3
6	Professional Elective Courses	Table-I	----------	3	0	0	3	3	40	60		100	3
7	Mandatory Audit Courses	*MC-201A	Environmental Science	2	0	1	3	0		60	40		3
8	Professional Core Courses	LC-ME-220A	Applied Thermodynamics Lab	0	0	2	2	1	25		25	50	
9	Professional Core Courses	LC-ME-222A	Strength of Materials Lab	0	0	2	2	1	25		25	50	
10	Professional Core Courses	LC-ME-224A	Fluid Mechanics Lab	0	0	2	2	1	25		25	50	
11	Professional Core Courses	LC-ME-226A	Kinematics of Machines Lab	0	0	2	2	1	25		25	50	
Total Credits								**23**				**800**	

*MC-101A is a mandatory non –credit course in which the students will be required passing marks in theory.

NOTE: At the end of 4th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training centre etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 5th Semester.

Table I (Program Elective Courses)

Courses	**Remarks**
PEC-ME-212A	Industrial Engineering
PEC-ME-214A	3D Printing
PEC-ME-216A	CNC Machining
PEC-ME-218A	Composite Materials

Course Code	**PCC-ME-201A**				
Category	Professional Core Courses				
Course Title	**Thermodynamics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	1	0	**4**	
Course Objectives	The objectives of this course are • To introduce the fundamental concepts and principles of thermodynamics. • To know thermodynamic processes involving entropy, availability, and irreversibility. • To learn thermodynamic relationships for analyzing the behavior of pure substances and real systems. • To inculcate problem-solving skills related thermal engineering practice.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the thermodynamic concepts, laws, and properties of pure substances.	Level 1: Remember
CO2	Explain the laws, entropy, thermodynamic relations and energy interactions in various processes.	Level 2: Understand
CO3	Apply thermodynamic laws and equations to solve thermodynamic systems.	Level 3: Apply
CO4	Analyze behavior and efficiency of system using thermodynamic properties and relations.	Level 4: Analyze

Note: The Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each, and the remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Basic concept:** Thermodynamic system, surrounding & boundary, thermodynamics properties – intensive & extensive, thermodynamic equilibrium, state, path, process & cycle, reversible & irreversible processes, path and point function, Quasi-static process. Zeroth law of thermodynamics, temperature scales; methods of temperature measurement. **First Law of thermodynamics:** Joules experiments, first law of thermodynamics for cyclic and non-cycle processes, internal energy and enthalpy, first law applied to non- flow process.
Unit-II	**First Law of thermodynamics for flow processes:** Derivation of general energy equation for a control volume, steady state steady flow energy equation, throttling process and free expansion process. Problems. **Second Law of Thermodynamics:** Limitations of the first law of thermodynamics, thermal reservoir, heat source & heat sink, heat engine and heat pump, Kelvin- Planck and Clausius Statements and their Equivalence, PMMSK, Carnot Cycle, Carnot heat engine and Carnot heat pump, Carnot theorem and its corollaries.

Unit-III	**Entropy:** Definition of entropy**,** demonstration that entropy is a property, Clausius inequality, principle of entropy increase, temperature entropy plot, entropy change in different processes, introduction to Third Law of Thermodynamics. Problems. **Availability& Irreversibility:** High and Low Grade Energy, Availability and Unavailable Energy, Loss of Available Energy Due to Heat Transfer Through a Finite Temperature Difference, 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-IV	**Pure Substances:** 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. **Thermodynamic Relations:** Maxwell's Equations, TdS Equations, Difference in Heat Capacities, Ratio of Heat Capacities, Energy Equation, Clausius- Clapeyron Equation, Gibbs Phase Rule, Types of Equilibrium, Third Law of Thermodynamics.

Suggested Readings

1. Thermal Science and Engineering - D.S Kumar, Laxmi Publisher, 6th Edition.
2. Thermodynamics: An Engineering Approach - Yunus A. Cengel, Michael A. Boles, McGraw Hill.
3. Fundamentals of Engineering Thermodynamics - Moran, M. J. and Shapiro, H. N, John Wiley and Sons.
4. Engineering Thermodynamics – PK Nag, Tata McGraw-Hill Publishing Co. Ltd
5. Applied Thermodynamics - R. Yadav, Central Publishing House.
6. Fundamentals of Classical Thermodynamics, Gordon J. Van Wylen and Richard E. Sonntag, WILEY.

Useful Video links

Unit No.	Topic	Link
UNIT-I	Fundamentals of thermodynamics	https://nptel.ac.in/courses/101104063
	Zeroth law of thermodynamics	https://nptel.ac.in/courses/112102255
UNIT-II	First Law of thermodynamics	https://nptel.ac.in/courses/112105220
	Second Law of Thermodynamics	https://nptel.ac.in/courses/112105266
UNIT-III	Availability & Irreversibility	https://nptel.ac.in/courses/112105266
UNIT-IV	Thermodynamic Relations, Equilibrium	https://nptel.ac.in/courses/112105123
	Pure Substances	https://nptel.ac.in/courses/101104067

Course Code	**PCC-ME-203A**				
Category	Professional Core Courses				
Course Title	**Computer Aided Design & Manufacturing**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To aware about the introduction of CAD/CAM, and CIM. • To learn the Modeling of different types of curves, surface and solid. • To know about the transformation of points and lines in CAD software. • To know the numerical control machines, FMS, GT & CAPP.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the basic concepts of CAD/CAM	Level 1: Remember
CO2	Describe CAD/CAM tools, modeling techniques, geometric transformations & process planning.	Level 2: Understand
CO3	Apply modeling and coding principles to CAD/CAM systems.	Level 3: Apply
CO4	Analyze integrated systems for productivity and automation.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	Introduction: Introduction to CAD/CAM/CAE, Design Process, Importance and Necessity of CAD, Applications of CAD, Hardware and Software requirement of CAD. Fundamentals of Additive Manufacturing (AM), Basic steps to perform AM, Classification of AM, Applications of AM: Aerospace, Biomedical, Automotive, Bio-printing, Tissue & Organ Engineering, Architectural Engineering, Surgical simulation, Art, Health care.
Unit-II	Wireframe modeling, Representation of curves, Parametric and non-parametric curves, straight lines, Hermite cubic splines, B splines curves, Bezier curves. Plane surface, ruled surface, surface of revolution, bi-cubic surface, Bezier surface, B spline surface, Solid modeling, boundary representation, sweeping, parametric solid modeling.
Unit-III	Introduction, 2D & 3D Transformation, translation, rotation, Reflection, Scaling, shearing and combined transformation, Homogeneous coordinates, Orthographic and perspective Projections. Group technology, Part families, Part classification and coding, Optiz method, product flow analysis, Machine cell Design, Advantages of GT.

Unit-IV	Numerical control, Types of NC systems, MCU & other components, Co-ordinate system, NC manual part programming, G & M codes, part program for simple parts, Computer assisted part programming. Introduction, FMS component, Types of FMS, FMS layout, planning for FMS, advantage and applications Introduction, conventional process planning, Steps in variant process planning, types of CAPP, planning for CAPP

Suggested Readings

1. CAD/CAM theory and Practice by Ibrahim Zeid, Tata McGraw Hill.
2. CAD/CAM Computer Aided Design and Manufacturing by E Zimmer M Groover, Pearson.
3. CAD/CAM/CIM by P. Radhakrishnan, New Age International Publishers.
4. Automation, Production Systems, and Computer-Integrated Manufacturing, Mikell Groover, Pearson

Useful Video links

Unit No.	Topic	Link
UNIT-I	Introduction to CAD / CAM	http://www.digimat.in/nptel/courses/video/112102101/L43.html
	Fundamentals of Additive Manufacturing	https://youtu.be/t7yv4gSnNkE?si=MbYZjlOhoRt-_4tg
UNIT-II	Parametric and non-parametric equations	https://youtu.be/_PlFbHuWFOI?si=idtfnZFN-INMjj-4
	Parametric Bezier Curve	https://youtu.be/-J2m_ugWNtc?si=qvFki6d_3LjhAFR7
UNIT-III	2D Transformations	https://youtu.be/iWxS2zpaRjk?si=8SROYKLus9Q4PfVP
	Introduction to group technology	https://youtu.be/y3-5ENFtqrQ?si=nwZ4kWVP6fVusQmW
UNIT-IV	Coordinate Systems	https://www.youtube.com/watch?v=3qd1JT7sRG8
	Computer aided manufacturing and process planning	https://www.youtube.com/watch?v=20_K7c65Swg

Course Code	**PCC-ME-205A**				
Category	Professional Core Courses				
Course Title	**Materials and Metallurgy**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce to crystal structures, defects and their effects on properties. • To know the mechanical properties and materials testing techniques. • To learn the mechanisms of material failure including fracture, fatigue, and creep. • To gain the knowledge of phase diagrams and heat treatment processes. • To explore severe plastic deformation techniques for advanced applications.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the fundamental concepts of materials and metallurgy.	Level 1: Remember
CO2	Explain the crystallography, defects, mechanical behavior, phase transformations, heat treatments and advanced methods.	Level 2: Understand
CO3	Apply appropriate principles and method to enhance the material performance.	Level 3: Apply
CO4	Analyze the effects of internal structure, mechanical behavior, and processing methods on material characteristics.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Crystallography**: Reviews of Crystal structure, Classification of Lattices - Bravais Lattice, Crystal planes, Crystal directions, Coordinate number, Atoms per unit cell, Atomic Packing Factor, Numerical related to crystallography. **Imperfection in Solids**: Point Defects; vacancy, substitutional, interstitial, Frenkel and Schottky defects; Line Defects; edge and screw dislocations, Planar Defects; grain boundaries and twin boundaries; Volume defects & effects of imperfections on metal properties.
Unit-II	**Mechanical Property Measurement:** Mechanical properties of materials, relation between true and engineering stress strain curves, generalized hook's law, yielding and yielding strength, hardness testing of materials, Tensile properties of the materials, Effect of strain rate, Impact Testing, Non-destructive testing (NDT). **Fracture of Metals** – Ductile Fracture, Brittle Fracture, Ductile to Brittle Transition Temperature (DBTT), Fatigue – Endurance limit, Fatigue test, S-N curves, factors affecting fatigue, structural changes accompanying fatigue; Creep and stress rupture– mechanism of creep – stages of creep and creep test, Mechanisms of Strengthening in Metals and alloys.

Unit-III	**Phase Diagrams and Transformations in Alloys**: 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.
Unit-IV	**Heat Treatment:** Principles of heat treatment, Annealing, Concept of Recovery, Recrystallization and Grain Growth, Normalizing, Hardening, Tempering, Quenching, Special heat treatment processes: Austempering, Martempering, Ausforming, Hardenability of steel, Microstructure changes during heat treatment. Surface hardening processes - Carburizing – Nitriding – Cyaniding and carbo-nitriding, Induction and flame hardening, Laser and Electron beam hardening. **Severe Plastic Deformation**: Introduction; its importance in producing ultrafine-grained materials; SPD techniques: Equal Channel Angular Pressing (ECAP), High Pressure Torsion (HPT), and Accumulative Roll Bonding (ARB); applications, and limitations of SPD-processed materials

Suggested Readings

1. Material Science and Engineering-An Introduction - Callister; W.D., John Wiley & Sons. Delhi.
2. A Text Book of Material Science & Metallurgy – O.P. Khanna, Dhanpat Rai & Sons
3. Material Science & Engineering –V. Raghvan, Prentice Hall of India Pvt. Ltd, New Delhi.
4. Engineering Materials and Metallurgy - U. C. Jindal, Pearson.
5. Principles of Materials Science, W.F. Smith, McGraw Hill, 3rd Revised Edition, 1990.

Useful Video links

Unit No.	Topic	Link
UNIT-I	Crystal Structure	https://www.youtube.com/watch?v=OTDVov_kw6A
	Imperfection In Solids	https://archive.nptel.ac.in/courses/113/104/113104081/
UNIT-II	Fracture, Fatigue and Failure of materials	https://archive.nptel.ac.in/courses/113/105/113105106/
UNIT-III	Phase diagram in Materials Science	https://archive.nptel.ac.in/courses/113/104/113104068/
UNIT-IV	Heat Treatment	https://archive.nptel.ac.in/courses/113/104/113104074/
	Severe Plastic Deformation	http://digimat.in/nptel/courses/video/113106105/L39.html

Course Code	**ESC-ME-207A**				
Category	Engineering Science Courses				
Course Title	**Engineering Mechanics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To know the fundamentals of mechanics. • To learn the concept of equilibrium of rigid bodies. • To find the C.G. & find M.I. of different geometrical figures. • To provide knowledge of simple machines and their applications. • To introduce to principles of kinematics &dynamics.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the basic terminologies and fundamentals of engineering mechanics.	Level 1: Remember
CO2	Describe the kinematics, dynamics, geometrical properties and simple machines.	Level 2: Understand
CO3	Apply the theorems and principles to solve the problems of engineering mechanics.	Level 3: Apply
CO4	Analyze the basic mechanical systems subjected to different loading conditions.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Fundamentals:** Definitions of Mechanics, Statics, Dynamics, Rigid Bodies, Force System, Resolution of Force. Analytical and graphical method for resultant of force, Moment of Force. Varignon's Theorem, Numerical Problems. **Equilibrium:** Definition, condition of equilibrium, types of equilibrium - stable equilibrium, unstable equilibrium, neutral equilibrium, free body diagram, method of equilibrium of coplanar forces – analytical method, graphical method, Lami's Theorem, Numerical Problems.
Unit-II	**Truss and Frames:** Truss, classification of truss, assumptions in truss analysis, perfect truss, analysis of perfect plane truss using method of joints and method of sections, Numerical Problems. **Centroid:** Centroid – Definition, Moment of an area about an axis, centroid of geometrical figures such as squares, rectangles, triangles, circles, semicircles & quarter circles, centroid of composite figures, Numerical Problems.
Unit-III	**Moment of Inertia:** Definition, Parallel axis & Perpendicular axis Theorems. M.I. of plane lamina & different engineering sections, Numerical Problems. **Kinematics**: Concept of rigid body, velocity and acceleration, relative velocity, translation and rotation of rigid bodies, equations of motion for translation and rotation, Numerical Problems.

Unit-IV	**Dynamics:** Newton's Laws of Motion, Motion of Particle acted upon by a constant force, Equations of motion, DE Alembert's Principle, Work, Power, Energy- Kinetic & Potential energy, Momentum & impulse, Laws of conservation of energy & linear momentum, collision of elastic bodies, Numerical Problems. **Simple Machines:** Definition of simple machine, explain simple & compound lifting machine, define M.A, V.R. & Efficiency, State Law of Machine, Reversibility of Machine, Self-Locking Machine. Study of simple machines – simple axle & wheel, single purchase winch crab& double purchase winch crab, Worm & Worm Wheel, Screw Jack, Types of hoisting machine.

Suggested Readings

1. Text Book of Engineering Mechanics – R.S Khurmi (S. Chand).
2. Engineering Mechanics by Timoshenko S, and Young D.H, Tata McGraw Hill.
3. Engineering Mechanics – Static and Dynamics by Shames I.H, and Rao G.K.M, Pearson Education.
4. Vector Mechanics for Engineers by Beer F.P and Johnson Jr. E.R, Tata McGraw Hill.
5. Engineering Mechanics –Statics & Dynamics, R. C. Hibbeler, 11th Ed., Macmillan Publication Co.

Useful Video links

Unit No.	Topic	Link
UNIT-I	Fundamentals of Mechanics	https://nptel.ac.in/courses/112103108
	Equilibrium of forces	https://nptel.ac.in/courses/112106180
UNIT-II	Truss and Frames	https://nptel.ac.in/courses/112106286
	Centroid	https://nptel.ac.in/courses/112104526
UNIT-III	Moment of Inertia	https://nptel.ac.in/courses/112103108
	Kinematics	https://nptel.ac.in/courses/112106286
UNIT-IV	Dynamics	https://nptel.ac.in/courses/112106180
	Simple Machines	https://nptel.ac.in/courses/112104526

Course Code	**BSC-ME-209A**				
Category	Basic Science Courses				
Course Title	**Mathematics-III**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	1	0	**4**	
Course Objectives	The objectives of this course are to make the students • To provide an overview of PDE, Probability and Statistics to engineers. • To introduce the solution methodologies for PDE, Probability and Statistics with Applications in engineering.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Recall fundamental concepts and principles of differential equations, probability & statistics.	Level 1: Remember
CO2	Describe basic concepts of probability, statistics & partial differential equations.	Level 2: Understand
CO3	Apply the various methods and techniques to solve engineering problems.	Level 3: Apply
CO4	Analyse the different patterns and behavior of statistics, probability & partial differential equations.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second- order linear equations and their classification, Initial and boundary conditions, D' Alembert's solution of the wave equation.
Unit-II	Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables.
Unit-III	Measures of central tendency, Moments, Skewness and Kurtosis, Basic concepts of Probability, Conditional probability, Baye's theorem, Random variables, Discrete random variables, Expectation of discrete random variables, Variance of a sum, Binomial distribution, Poisson distribution, Continuous random variables and their properties, Distribution functions, Normal Distribution.
Unit-IV	Testing of hypothesis, Test of significance, Large sample test for single proportion, Difference of proportions, Tests for single mean, Difference of means and Difference of standard deviations, Test for ratio of variances, Chi-square test for goodness of fit and Independence of attributes.

Suggested Readings:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers
2. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited
3. N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications
4. Business Statistics by T.R. Jain and S.C. Aggarwal, VK Global Publications Pvt. Ltd.
5. S. Ross, A First Course in Probability,6th Ed., Pearson Education India.

Useful Video links:

Unit No.	Topics	Links
Unit I	Partial Differential Equations.	https://www.youtube.com/watch?v=KlZqe4UC1jk
	Solution to PDE of second order.	https://www.youtube.com/watch?v=5eZbgxmpK3Q&t=520s
	Initial and boundary conditions of PDE.	https://www.youtube.com/watch?v=PVUfuiuWaZQ
Unit II	Duhamel's principle.	https://youtu.be/qu2kuCFCqbM?si=kcSK59hh5XoQrRdA
	Separation of variables method.	https://www.youtube.com/watch?v=DgvQzfLpaTY&t=92s
	Laplacian in coordinate systems.	https://youtu.be/1wxhLYiHFaE?si=GApUpW3_VTOD8q-b
Unit III	Introduction of Probability.	https://youtu.be/60vHy2lA4o4
	Discrete random variable.	https://youtu.be/Sv9UYnp9tbs?si=eHqwSJETA5SO3NFI
	Continuous Probability distribution.	https://youtu.be/o2LB3KQME3U?si=NWaP0TY_K8tPaAfu
Unit IV	Testing of Hypothesis.	https://youtu.be/14PQawp_rjk
	Large Sample Test.	https://auece.digimat.in/nptel/courses/video/111105090/L72.html
	Chi-Square Test.	https://youtu.be/SlCsNb-VXds?feature=shared

Course Code	**HSMC-01A**				
Category	Humanities and Social Science including Management Courses				
Course Title	**Fundamental of Management and Organizational Behaviour**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	3	
Course Objectives	The objectives of this course are • Introduce students to foundational management theories, functions, and organizational concepts to build a strong conceptual framework. • Develop understanding of individual and group behavior, motivation, communication, and leadership in organizational settings. • Equip students with practical skills to manage interpersonal processes, conflicts, and team dynamics effectively. • Foster critical analysis of organizational structures, cultures, and change mechanisms to enhance adaptability and effectiveness in organizations.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define fundamental management concepts, functions, organizational processes, and organizational behavior elements.	Level 1: Remember
CO2	Explain the roles, skills, and interrelationships in management, individual behaviors, group dynamics, and communication processes within organizations.	Level 2: Understand
CO3	Apply principles of management, motivation techniques, leadership styles, and conflict management strategies to solve organizational behavior challenges.	Level 3: Apply
CO4	Analyze organizational structure, culture, change processes, and behavioral dynamics to support effective decision-making and organizational development.	Level 4: Analyse

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Introduction of Management:** Meaning, Definitions, Nature of Management; Managerial Levels, Skills and Roles in an Organization. **Functions of Management:** Planning, Organizing, Staffing, Directing & Controlling, Interrelationship of Managerial Functions, Scope of Management, Importance of Management, Difference between Management and Administration.
Unit-II	**Introduction of Organization:** Meaning and Process of Organization, Management v/s Organization. **Fundamentals of Organizational Behavior:** Concepts, Evolution, Importance and Relationship with other Fields, Contemporary Challenges and Opportunities of OB**.**

	Individual Processes and Behavior: Personality, Concept, Determinants and Applications. **Perception:** Concept, Process and Applications **Learning:** Brief Introduction **Motivation:** Concept, Techniques and Importance
Unit-III	**Interpersonal Processes**: Teams and Groups, Definition of Group, Stages of Group Development, Types of Groups, Meaning of Team, Merits and Demerits of Team, Difference between Team and Group, Conflict- Concept, Sources, Types, Management of Conflict. **Leadership:** Concept, Function, Styles, Qualities of Leadership. **Communication**: Meaning, Process, Channels of Communication, Importance and Barriers of Communication.
Unit-IV	**Organizational Processes:** Organizational Structure, Meaning and Types of Organizational Structure and their effect on Human Behavior. **Organizational Culture**: Elements, Types and Factors affecting Organizational Culture. **Organizational Change:** Concept, Types and Factors affecting Organizational Change, Resistance to Change.

Suggested Readings:

1. Fundamentals of Management by Robbins, S.P. and Decenzo, Pearson Education, New Delhi.
2. Organizational Behaviour by Robbins, S.P. & Judge, T.A., Prentice Hall of India, New Delhi.
3. Management concept practice and cases by Ghuman Karminder, Aswathappa K., Tata McGraw Hill, New Delhi
4. Fundamental of Management by Chhabra T. N., Sun India Publications, New Delhi.
5. Organizational Behaviour by Stephen P Robin, Pearson Education.
6. Organizational Behaviour by McShane, Steven L, Tata McGraw Hill, New Delhi.
7. Organizational Behaviour by FC Sharma, Shree Mahavir Publications.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Nature and Scope of Management	https://nptel.ac.in/courses/110105146
Unit-II	Perception and Personality	https://nptel.ac.in/courses/110103433
Unit-III	Group Dynamics	https://archive.nptel.ac.in/courses/110/106/110106145/
Unit-IV	Organizational Change, Resistance to Change.	https://nptel.ac.in/courses/110105146

Course code	**LC-ME-211A**				
Category	Professional Core Courses				
Course title	**Materials & Metallurgy Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives	The objectives of this course are • To study crystallography and imperfections in materials through models. • To learn how to prepare specimen for microstructure analysis. • To familiarise with heat treatment processes and their effects om materials properties and microstructure. • To enhance the skills in using microscopy and other testing equipments.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Explain the crystallography, imperfections, and the working principles of metallurgical equipments.	Level 2: Understand
CO2	Apply specimen preparation and etching techniques for metallographic examination of metals.	Level 3 : Apply
CO3	Analyze the effect of heat treatment processes on material properties & microstructure.	Level 4: Analyze
CO4	Analyze the microstructures of different nonferrous materials.	Level 4: Analyze

List of Experiments

Sr. No.	Content	COs
1	To study various crystal structures through ball models.	**CO1**
2	To study of crystal imperfections through ball models.	**CO1**
3	To study the components and functions of metallurgical microscope.	**CO1**
4	To study of Muffle furnace and policing machine.	**CO1**
5	To study modern characterization (microscopy) techniques.	**CO1**
6	To prepare chemical etchant for ferrous and non-ferrous alloys.	**CO2**
7	To prepare a specimen for metallographic examination.	**CO2**
8	To analyze the changes in hardness of steel / iron after heat treatment processes.	**CO3**
9	To analyze the changes in microstructure of steel / iron after annealing.	**CO3**

10	To analyze the changes in microstructure of steel / iron after normalizing.	**CO3**
11	To analyze the changes in microstructure of steel / iron after quenching.	**CO3**
12	To analyze the microstructure of non-ferrous metal (Aluminum).	**CO4**
13	To analyze the microstructure of non-ferrous metal (Copper).	**CO4**
14	To analyze the microstructure of non-ferrous metal (Brass).	**CO4**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
Metallurgical Microscope	https://mrmsmtbs-iitk.vlabs.ac.in/exp/nucleus-cellsproliferation/simulation.html
Hardness Measurement	https://mrmsmtbs-iitk.vlabs.ac.in/exp/hardness-modulus/simulation.html
Crystal Structures	https://www.youtube.com/watch?v=OTDVov_kw6A
Techniques of materials characterization	https://archive.nptel.ac.in/courses/113/105/113105101/

Course code	**LC-ME-213A**				
Category	Professional Core Courses				
Course title	**Computer Aided Design & Manufacturing Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives	The objectives of this course are • To introduce students to the fundamentals and key features of CAD software used for part modelling and assembly design. • To provide hands-on experience in generating 3D models, part drawings, and assemblies using modern CAD tools. • To familiarize students with CNC programming for basic machining operations. • To expose students to classification systems and emerging technologies in manufacturing.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Explain the essential features and tools of CAD software and NC programming.	Level 2: Understand
CO2	Use drawing and modification tools to create 2D sketches and part models.	Level 3: Apply
CO3	Use CAD software for 3D models and assembly of mechanical components.	Level 3: Apply
CO4	Use G & M codes to write NC part programs for manufacturing operations.	Level 3: Apply

List of Experiments

Sr. No.	Content	COs
1	To Introduction to the different features of CAD softwares.	**CO1**
2	To Work with the draw and modify tools like pattern, copy, rotate, move, mirror etc.	**CO2**
3	To Draw the 2D part drawing of product 1 using software.	**CO2**
4	To Draw the 2D part drawing of product 2 using software.	**CO2**
5	To Work with creating 3D features like extrude revolve etc.	**CO3**
6	To Work with tools like hole, round, chamfer etc.	**CO3**
7	To Draw 3D models by extruding simple 2D objects.	**CO3**
8	To make an assembly drawing using different parts.	**CO3**
9	To study the G codes and M codes.	**CO1**
10	To Write a NC program for milling operation.	**CO4**

11	To Write a NC program for drilling operation.	**CO4**
12	To Write a NC program for turning operation	**CO4**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
Computer Aided Design Tools	https://youtu.be/UvP3fSGye-Y
Program using G & M Codes	https://youtu.be/ImtSsDLgAaI
Introduction To CNC Machines	https://youtu.be/B7MM5M7DzpM?si=SxDdSNolcFlwN4A9
CNC Programming	https://youtu.be/_5r2XR1h1aQ

Course code	**LC-ME-215A**				
Category	Basic Science Courses				
Course title	**Engineering Mechanics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To understand force laws using triangle law, polygon law, and parallel force experiments. ● To learn how to calculate mechanical advantage, velocity ratio, and efficiency of simple machines. ● To study the moment of inertia using a flywheel. ● To measure the deflections in a pin-jointed truss.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Determine the forces in members by applying laws of forces.	Level 3: Apply
CO2	Calculate mechanical advantage, velocity ratio, and efficiency of lifting devices.	Level 3: Apply
CO3	Analyze the internal forces and deflections in various structural elements.	Level 4: Analyze
CO4	Evaluate the moment of inertia and verify beam deflection principles including reciprocal and parallel force theorems.	Level 5: Evaluate

List of Experiments

Sr. No.	Content	COs
1	To determine the resultant force by applying law of polygon of forces.	**CO1**
2	To determine the resultant force by applying law of triangle of forces.	**CO1**
3	To calculate the mechanical advantage, velocity ratio and Mechanical efficiency of winch crab.	**CO1**
4	To calculate the mechanical advantage, velocity ratio and mechanical efficiency of a screw jack.	**CO2**
5	To calculate the mechanical advantage, velocity ratio and mechanical efficiency of single start worm and worm wheel.	**CO2**
6	To calculate the mechanical advantage, velocity ratio and mechanical efficiency of double & triple start worm and worm wheel.	**CO2**
7	To analyse the internal forces acting on various members of a jib crane using experimental methods.	**CO2**
8	To analyse the horizontal and vertical deflections at various joints of a pin-jointed truss using experimental data..	**CO3**
9	To analyse the behaviour of a 3-bar pin-jointed truss by comparing experimental results with analytical calculations.	**CO3**

10	To evaluate the moment of inertia of a given fly-wheel.	**CO4**
11	To verify the reciprocal theorem of deflection using a simply supported beam.	**CO4**
12	To verify the principle of forces in beam of parallel forces apparatus.	**CO4**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
Moment of inertia of a given fly-wheel.	http://phy-sc22-au.vlabs.ac.in/mechanics/Moment_of_Inertia_of_Flywheel/
Trusses	https://virtual-labs.github.io/exp-trusses-iiith/index.html
Parallelogram Law of Vectors	https://amrita.olabs.edu.in/?sub=1&brch=5&sim=20&cnt=4

Course Code	**PCC-ME-202A**				
Category	Professional Core Courses				
Course Title	**Applied Thermodynamics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To learn about dynamics involved in thermal energy transformation. • To know thermal system components for improving efficiency and effectiveness. • To provide a knowledge of steam generation systems, fuels, and combustion processes used in power generation. • To introduce about gas and vapour power cycles.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define fundamental concepts of steam generation, fuels, power cycles, and related equipment.	Level 1: Remember
CO2	Describe principles and functions involved in thermodynamic cycles and devices.	Level 2: Understand
CO3	Apply thermodynamic principles and equations to solve energy and flow problems.	Level 3: Apply
CO4	Analyze the effects of operating parameters on the performance of thermal systems and machinery.	Level 4: Analyze

Note: The Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each, and the remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Steam Generators**: Introduction, classification of boilers, comparison of fire tube and water tube boilers, description of boilers; Lancashire, Babcock Wilcox, Cochran etc. boiler's mountings and accessories, design of natural draught chimney, artificial draught, mechanical draught, efficiency of boiler and heat balance. **Fuel and Combustion:** Classification of fuels – solid, liquid and gaseous fuels, calorific values of fuels, stoichiometric air fuel ratio, excess air requirement, efficiency of boiler and heat balance. Problems.
Unit-II	**Vapor power cycles:** Carnot vapour power cycle, Simple and modified Rankine cycle, p-v, h-s and T-s diagram for Rankine and Modified Rankine Cycle, effect of operating parameters on Rankine cycle performance. Effect of maximum pressure, effect of exhaust pressure, reheating and regenerative Rankine cycle. **Gas power cycles:** Air standard Otto, Diesel and Dual Cycles-Air standard Brayton cycle, effect of reheat, regeneration and inter cooling- Combined gas and vapor power cycles. Problems

Unit-III	**Steam Nozzles**: Function of steam nozzles, shape of nozzles for subsonic and supersonic flow of steam, steady state energy equation, continuity equation, nozzle efficiency, critical pressure ratio for max. discharge, design of steam nozzle, problems. **Steam Condensers**: Classification of condensers, sources of air leakage in condensers, effect of air leakage in condenser, vacuum efficiency, condenser efficiency, air pumps, calculation of cooling water requirement, and problem.
Unit-IV	**Reciprocating compressors:** Staging of reciprocating compressors, optimal stage pressure ratio, effect of inter cooling, isothermal efficiency, volumetric efficiency, minimum work for multistage reciprocating compressors. Problems. **Steam Turbine:** Classification of steam turbine, impulse turbine, working principle, compounding of impulse turbine, velocity diagram, power output and efficiency of a single stage impulse turbine, reaction turbine, working principle, degree of reaction, velocity diagram, power output, efficiency, condition for max. Efficiency, governing of steam turbines, problem.

Suggested Readings

1. Engineering Thermodynamics - Nag, P.K, Tata McGraw-Hill Publishing Co. Ltd
2. Thermal Engineering - P.L. Ballaney Khanna Publisher.
3. Engineering Thermodynamics - Jones, J. B. and Duggan, R. E., Prentice Hall of India.
4. Thermodynamics and Heat Engines Vol II - R. Yadav, Central Publishing House.
5. I.C. Engines - M.L. Mathur and Sharma Dhanpat Rai & Sons.
6. Thermodynamics- An Engineering Approach, Y. Cengel and M. Boles, McGraw Hill Education; Eighth Edition, 2017

Useful Video links

Unit No.	Topic	Link
UNIT-I	Introduction to fuels	https://nptel.ac.in/courses/112103421
	Fuel and their properties	https://youtu.be/fscJadXHhTU?feature=shared
UNIT-II	Vapor power cycles	https://youtu.be/4-BI22Wx4Pc?feature=shared
	Gas power cycles	https://youtu.be/G02aeguJBwc?feature=shared
UNIT-III	Steam Nozzle	https://youtu.be/t-Kucwi3SDI?feature=shared
	Condenser	https://nptel.ac.in/courses/112103307
UNIT-IV	Reciprocating compressors	https://youtu.be/xFHWR99U3Q?feature=shared
	Analysis of steam turbines	https://nptel.ac.in/courses/112107291

Course Code	**PCC-ME-204A**				
Category	Professional Core Courses				
Course Title	**Strength of Materials**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	1	0	**4**	
Course Objectives	The objectives of this course are • To familiarize with stress, strain and deformation of solids under different loading conditions. • To equip students with ability to think critically and solve problems related to the strength and stability of structures. • To learn how materials, behave under different types of forces and conditions. • To develop an ability to analyze the real engineering problems and design engineering systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the fundamental concepts of strength of materials.	Level 1: Remember
CO2	Explain the expression and behavior of structural elements under various loading and support conditions.	Level 2: Understand
CO3	Solve problems related to internal forces, stresses, and deformations in structural members.	Level 3: Apply
CO4	Analyze the structural components for performance under different loading conditions.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Stress & Strain:** Concept & types of Stresses and Strains, Poisson's ratio, Hooks law, Stress Strain diagrams, stresses and strains in simple and compound bars under axial loading, elastic constants & their relationships, temperature stresses and strains in simple and compound bars under axial loading, Problems. **Principle Stresses& Strains:** Two-dimensional stress system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stresses, Problems.
Unit-II	**Shear Force & Bending Moment:** Definitions, Beams and types transverse loading on beams, types of beam support, SF& BM diagram for cantilevers, simply supported and over-hanging beams, calculation of maximum BM & SF and Point of contra flexure, Problems. **Bending & Shear Stresses in Beams:** Bending stresses in Beam, Theory of bending of beams, bending stress distribution and neutral axis, shear stresses in beam, shear stress distribution Problems.

Unit-III	**Torsion of Circular Members:** Torsion, stresses and deformation in circular solid and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, Problems. **Columns & Struts:** Introduction**,** Column under axial load, concept of instability and buckling, slenderness ratio, derivation of Euler's formulae for the elastic buckling load, Euler's, Rankine, Gordon's formulae Johnson's empirical formula for axial loading columns and their applications, eccentric compression of a short strut of rectangular & circular sections, Problems.
Unit-IV	**Slope & Deflection:** Relationship between bending moment, slope & deflection, Mohr's theorem, moment area method, method of integration, Macaulay's method, calculations for slope and deflection of (i) cantilevers and (ii) simply supported beams with or without overhang under concentrated load, Uniformly distributed loads or combination of concentrated & uniformly distributed loads and Maxwell's reciprocal theorem, Problems.

Suggested Readings

1. Strength of Materials – G.H. Ryder - Macmillan, India.
2. Strength of materials, RK Bansal, Laxmi Publication.
3. Engineering Mechanics of Solids - EGOR. P. POPOV, Prentice Hall of India.
4. Strength of Materials - R. Subramanian, Oxford University Press.
5. Mechanics of Materials, F.P. Beer, E.R. Johnston (Jr.) and J.T. DeWolf, Tata McGraw Hill

Useful Video links

Unit No.	Topic	Link
UNIT-I	Stress & Strain	https://nptel.ac.in/courses/112106319
	Principle Stresses	https://youtu.be/vC8h1RFKYs?feature=shared
UNIT-II	Shear Force & Bending Moment	https://nptel.ac.in/courses/112107147
	Bending & Shear Stresses in Beams	https://youtu.be/sP34uzn7diA?feature=shared
UNIT-III	Columns & Struts	https://youtu.be/ZSQ_5lRj5gI?feature=shared
	Torsion of Circular Members	https://youtu.be/IQB0bJRCRxo?feature=shared
UNIT-IV	Slope & Deflection	https://nptel.ac.in/courses/105105108

Course Code	**PCC-ME-206A**				
Category	Professional Core Courses				
Course Title	**Fluid Mechanics**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce the fundamental concepts and properties of fluids. • To learn the fluid behavior under various flow conditions. • To learn applications involving compressible flow, viscous effects, boundary layers, and turbulence. • To understand flow measurement devices and solve problems pertaining to flow through pipes.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define fundamental concepts and basics of fluid mechanics.	Level 1: Remember
CO2	Explain the fluid properties &principles governing fluid motion and behavior.	Level 2: Understand
CO3	Apply fluid mechanics laws and equations to solve flow problems.	Level 3: Apply
CO4	Analyze performance characteristics and behavior of fluid under various conditions.	Level 4: Analyze

Note: The Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each, and the remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Fluid Properties and Fluid Statics:** Concept of fluid and flow, ideal and real fluids, continuum concept, and properties of fluids, Newtonian and non-Newtonian fluids. Pascal's law, hydrostatic equation, hydrostatic forces on plane and curved surfaces, stability of floating and submerged bodies, relative equilibrium, Problems. **Fluid Kinematics:** Eulerian and Lagrangian description of fluid flow; stream, streak and path lines; types of flows, flow rate and continuity equation, differential equation of continuity in cylindrical and polar coordinates, rotation, vorticity and circulation, stream and potential functions, flow net, Problems.
Unit-II	**Fluid Dynamics:** Concept of system and control volume, Euler's equation, Bernoulli's equation, venturimeter, orifices, orifice meter, mouthpieces, kinetic and momentum correction factors, Impulse momentum relationship and its applications, Problems. **Compressible Fluid Flow:** Introduction, continuity momentum and energy equation, sonic velocity, propagation of elastic waves due to compression of fluid, propagation of elastic waves due to disturbance in fluid, stagnation properties, isentropic flow, effect of area variation on flow properties, isentropic flow through nozzles, diffusers, injectors, Problems.

Unit-III	**Viscous Flow:** Flow regimes and Reynolds's number, Relationship between shear stress and pressure gradient, uni-directional flow between stationary and moving parallel plates, movement of piston in a dashpot, power absorbed in bearings. Problems. **Flow Through Pipes:** Major and minor losses in pipes, Hagen- Poiseuilli law, hydraulic gradient and total energy lines, series and parallel connection of pipes, branched pipes; equivalent pipe, power transmission through pipes, Problems.
Unit-IV	**Boundary Layer Flow:** Boundary layer concept, displacement, momentum and energy thickness, Von-Karman momentum integral equation, laminar and turbulent boundary layer flows, drag on a flat plate, boundary layer separation and control. Streamlined and bluff bodies lift and drag on a cylinder and an airfoil, Problems**.** **Turbulent Flow:** Shear stress in turbulent flow, Prandtl mixing length hypothesis, hydraulically smooth and rough pipes, velocity distribution in pipes, friction coefficients for smooth and rough pipes, Problems.

Suggested Readings

1. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar, S.K. Kataria and Sons.
2. Fluid Mechanics – Streeter V L and Wylie E B, Mc Graw Hill.
3. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas, TMH.
4. Mechanics of Fluids – I H Shames, Mc Graw Hill.
5. Fluid Mechanics – Streeter, Wylie and Bedford, TMH.

Useful Video links

Unit No.	Topic	Link
UNIT-I	Ideal fluids, Velocity potential, Potential flows	https://youtu.be/mKROgeUc_Ow?feature=shared
	Eulerian and Lagrangian description of fluid flow	https://youtu.be/H38vI93exns?feature=shared
UNIT-II	Euler's equation	https://youtu.be/nftfzCxQKfk?feature=shared
	Effects of Area Variation on Properties in an Isentropic Flow	https://youtu.be/cVmK3dLeCZ4?feature=shared
UNIT-III	Flow regimes and Reynolds's number	https://youtu.be/p7-oAAAszHc?feature=shared
	Flow in Pipes: Minor Losses	https://youtu.be/CzrQxXK0CKk?feature=shared
UNIT-IV	Boundary layer concept	https://youtu.be/zw2F4utGoVQ?feature=shared _
	Shear stress in turbulent flow	https://youtu.be/OsCTaeh_rBc?feature=shared

Course Code	**PCC-ME-208A**				
Category	Professional Core Courses				
Course Title	**Kinematics of Machines**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To learn the fundamentals of mechanisms and motion transmission. • To develop students for generation of cam profile • To equip students with tools for kinematic analysis and synthesis. • To know the friction and belt drive systems used in machines.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the basic terminologies related to kinematics of machines.	Level 1: Remember
CO2	Explain the principles of kinematics, motion and function of mechanical systems and components.	Level 2: Understand
CO3	Apply graphical and analytical methods to solve the kinematics related problems.	Level 3: Apply
CO4	Analyze the performance and motion characteristics of mechanisms and power transmission systems.	Level 4: Analyze

Note: The Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each, and the remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction**: Mechanism and machines, kinematics links, kinematics pairs, kinematics chains, degree of freedom, Grumbler's rule, kinematics inversion, equivalent linkages, four link planar mechanisms, straight line mechanisms, steering mechanisms, pantograph, problems. **Kinematics Analysis of Plane Mechanisms:** displacement analysis, velocity diagram, velocity determination, relative velocity method, instantaneous center of velocity, Kennedy's theorem, graphical and analytical methods of velocity and acceleration analysis, problems.
Unit-II	**Cams:** Classification of cams and followers, disc cam nomenclature, construction of displacement, velocity and acceleration diagrams for different types of follower motions, analysis of follower motions, determination of basic dimension, synthesis of cam profile by graphical methods, cams with specified contours, problems. **Gears: F**undamental law of gearing, involute spur gears, characteristics of involute and cycloidal action, interference and undercutting, center distance variation, path of contact, arc of contact, non-standard gear teeth, helical, spiral bevel and worm gears, problems.

Unit-III	**Gear Trains**: Synthesis of simple, compound and reverted gear trains, analysis of epicyclic gear trains, problems. **Kinematics synthesis of Mechanisms:** Function generation, path generation, Freudenstein's equation, two and three position synthesis of four bar and slider crank mechanisms by graphical and analytical methods, precision positions, structural error; Chebychev spacing, transmission angle, problems.
Unit-IV	**Friction**: Types of friction, laws of friction, motion along inclined plane, screw threads, efficiency on inclined plane, friction in journal bearing, friction circle and friction axis, pivots and collar friction, uniform pressure and uniform wear. **Belts and pulleys**: Open and cross belt drive, velocity ratio, slip, material for belts, crowning of pulleys, law of belting, types of pulleys, length of belts, ratio of tension, centrifugal tension, power transmitted by belts and ropes, initial tension, creep, chain drives, chain length, classification of chains.

Suggested Readings

1. Theory and Machines - S.S. Rattan, Tata McGraw Hill.
2. Theory of Machines - Bevan, Pearson Indian Education Service Pvt. Ltd. India.
3. Mechanism and Machine Theory - J.S. Rao and R.V. Dukkipati, New Age International.
4. Theory of Mechanisms and Machines - Amitabha Ghosh and Ashok Kumar Malik, East-West Press.
5. Theory of Machines and Mechanisms, J. J. Uicker, G. R. Pennock, J. E. Shigley, Oxford Education, Fourth Edition, 2011.

Useful Video links

Unit No.	Topic	Link
UNIT-I	Introduction to mechanism and machines Kinematics Analysis of Plane Mechanisms	https://archive.nptel.ac.in/courses/112/104/112104121/ https://archive.nptel.ac.in/courses/112/106/112106270/# https://archive.nptel.ac.in/courses/112/105/112105268/
UNIT-II	Cams Gears	https://archive.nptel.ac.in/courses/112/104/112104121/ https://archive.nptel.ac.in/courses/112/106/112106270/# https://archive.nptel.ac.in/courses/112/105/112105268/
UNIT-III	Gear Trains Kinematics synthesis of Mechanisms	https://archive.nptel.ac.in/courses/112/104/112104121/ https://archive.nptel.ac.in/courses/112/106/112106270/# https://archive.nptel.ac.in/courses/112/105/112105268/
UNIT-IV	Friction Belts and pulleys	https://nptel.ac.in/courses/112103108 https://nptel.ac.in/courses/112106286 https://nptel.ac.in/courses/112105124

Course Code	**PCC-ME-210A**				
Category	Professional Core Courses				
Course Title	**Manufacturing Technology -I**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To know how cutting tools work, how chips are formed, and what affects the life of a cutting tool. • To learn how to calculate machining costs and choose the best cutting conditions to save time and money. • To know how jigs and fixtures help in holding work-pieces and how measuring tools are used to check sizes and surface finish. • To understand how gears are made, how machines are specified, and how milling and drilling operations are done.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define the fundamental concepts of Manufacturing Technology.	Level 1: Remember
CO2	Explain principles of cutting, forming, metrology, and machine tools.	Level 2: Understand
CO3	Apply suitable tools, conditions, and setups for machining operations.	Level 3: Apply
CO4	Analyze the effects of process parameters and tool specifications on performance.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Metal Cutting & Tool Life:** Introduction, basic tool geometry, single point tool nomenclature, chips types and their characteristics, mechanics of chips formation, theoretical and experimental determination of shear angle, orthogonal and oblique metal cutting, metal cutting theories, relationship of velocity, forces, and power consumption, cutting speed, feed and depth of cut, coolant, temperature profile in cutting, tool life relationship, tailor equation of tool life, tool material and mechanism. **Economics of Metal Machining:** Cost considerations in manufacturing, elements of machining cost, minimum cost per piece, maximum production rate, optimum cutting speed and optimum tool life for minimum cost of production and maximum production rate.
Unit-II	**Jigs and Fixtures:** Introduction to jigs and fixtures, principles of locations, locating and clamping devices, jigs bushes, drilling jigs, milling fixtures, turning fixtures, boring and broaching fixtures, welding fixtures, different materials for jigs and fixtures, economics of jigs and fixtures. **Metrology:** Measurement, linear and angular simple measuring instruments, various clampers, screw gauge, sine bar, auto-collimator, comparator- mechanical, electrical, optical, surface finish

	and its measurements, micro and macro deviation, factors influencing surface finish and evaluation of surface finish.
Unit-III	**Gear manufacturing and finishing:** Introduction, Classification of gear production method, Gear generation processes: gear hobbing, gear shaping, Gear finishing methods: shaving, roll finishing, burnishing, grinding, lapping, honing. **Specification of Machine Tools:** Introduction, purpose of machine tool specifications, Methods of specification of conventional machine tools: specification of lathes, specification of drilling and boring machines, specification of shaper, planer and slotter machines, specification of milling machine, specification of gear teeth generating machines, specification of grinding machines.
Unit-IV	**Milling Process:** Milling Machine Operations performed on Milling machine, Parts of Milling Machine, Types of Milling machines, fundamentals of Milling process, Milling Cutters, Elements of Plain Milling cutter, Cutter Holing devices, Indexing, Methods of Indexing. **Drilling Machine:** Types of Drills, Drilling machine Types, Drilling machine operations, Size of Drilling machine, Main parts of drilling machine, Cutting speed, Feed and Depth of cut in drilling, MRR in drilling.

Suggested Readings

1. Manufacturing Engineering Technology, K. Jain, Pearson Education
2. Principles of Manufacturing Materials and Processes, James S. Campbell, TMH.
3. Production Engineering Sciences by P.C. Pandey and C.K. Singh, Standard Publishers Ltd.
4. Manufacturing Science by A. Ghosh and A.K. Mallik, Wiley Eastern

Useful Video links

Unit No.	Topic	Link
UNIT-I	Tool Life	https://youtu.be/-R-fySRLa9Q?si=rjouuxiO4PYAi8VL
	Economics of Machining	https://www.youtube.com/watch?v=YDSdhiMksoQ
UNIT-II	Jigs and Fixtures For Machine Shops	https://www.youtube.com/watch?v=7yzvno4AvKw
	Introduction to Metrology	https://www.youtube.com/watch?v=HpIEeBtJupY
UNIT-III	Gear Manufacturing	https://www.youtube.com/watch?v=B8w-0Oi0Yf4
	Metal Cutting and Machine Tools	https://archive.nptel.ac.in/courses/112/105/112105233/
UNIT-IV	Milling Machine- Indexing	https://youtu.be/Rf90Jbbcr3M?si=3oMLtK3cYdBA1koj
	Machining Operations: Milling & Drilling	https://www.youtube.com/watch?v=a07gtJbK9aU

Course Code	**MC-201A**				
Category	Mandatory Courses				
Course Title	**Environmental Science**				
Scheme and Credits	L	T	P	**Credits**	**Semester- IV**
	2	0	1	-	
Course Objectives	The objectives of this course are • Create awareness of the multidisciplinary nature and importance of environmental studies, including the sustainable management and conservation of natural resources. • Develop an understanding of ecosystem dynamics, biodiversity, pollution types, and their impacts on environmental and human health. • Foster critical thinking on social, ethical, and legislative aspects of environmental protection, emphasizing the role of individuals and society. • Engage students in practical learning through fieldwork and case studies to apply environmental concepts for sustainable development and responsible citizenship.				
Practical/Field Visits	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				
Remarks	The subject of Environmental Studies will be included as a qualifying paper in all UG Courses and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded. The duration of the course will be 40 lectures. The examination will be conducted along with the semester examinations. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.				

Course Outcomes: After successful completion of this course, the students will be able to

CO	**Skill Demonstrated**	**RBT Level**
CO1	Describe key concepts of environmental studies, types of natural resources, ecosystem structures, pollution types, major environmental laws, and human-environment interactions.	Level 1: Remember
CO2	Explain the interrelationships among ecosystems, biodiversity, pollution, social issues, environmental ethics, and related legislation for sustainable development.	Level 2 : Understand
CO3	Apply principles of environmental management, pollution control, disaster preparedness, and sustainable practices in real-world and field-based environmental contexts.	Level 3: Apply
CO4	Analyze environmental problems, population growth impacts, climate change, welfare programs, and the role of information technology in promoting public health and environmental sustainability.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	The Multidisciplinary nature of environmental studies. Definition scope and importance. **Natural Resources:** Renewable and non-renewable resources, Natural resources and associated problems. **a) Forest resources:** Use and over-exploitation: deforestation, case studies. Timber extraction, mining dams and their effects on forests and tribal people. **b) Water resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems. **c) Mineral resources:** Use and exploitation, environmental effects of extracting and using mineral resources, case studies. **d) Food resources:** World food problems, changes, caused by agriculture and overgrazing, effects of modern agriculture, fertilizer pesticide problems, Water logging, salinity, case studies. e) Energy resources: Growing energy needs; renewable and non- renewable energy sources, use of alternate energy sources, case studies. f) **Land resources:** Land as are source, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources, equitable use of resources for sustainable life styles
Unit-II	**Ecosystems**: Producers, Consumers and Decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, Food web sand ecological pyramids**,** Introduction, types, characteristic features, structure and function of Forest ecosystem, Grass land ecosystem, Desert ecosystem and Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). **Bio diversity and its conservation:** Introduction, Definition, Genetic, Species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot-spots of biodiversity. Threats to biodiversity, habitat loss, poaching of wild life, man-wild life conflicts, Endangered and endemic species of India, In-situ and ex-situ conservation of biodiversity.
Unit-III	**Environmental Pollution:** Definition, Causes, Effects and Control Measures of Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Hazards. **Solids Waste Management:** Causes, Effects and Control Measures of Urban and Industrial Wastes, Role of an Individual in Prevention of Pollution, Pollution Case Studies. **Disaster Management:** Floods, Earthquake, Cyclone and Landslides. **Social issues and the Environment:** From unsustainable to sustainable development, Urban problems related to energy, Water conservation, Rain Water Harvesting, Watershed Management, Resettlement and Rehabilitation of People, its problems and concerns case studies. **Environmental Ethics:** Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies, Waste land reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of pollution) Act, Water (Prevention and Control of pollution) Act, Wild life Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness.
Unit-IV	**Human population and the Environment:** Population growth, Variation among Nations, Population explosion -Family Welfare Programme, Environment and human health, Human Rights. Value Education, HIV/AIDS, Woman and Child Welfare Role of Information Technology in Environment and human health. Case Studies. **Field Work (Field work equal to10 lecture hours)-** Visit to a local area to document environmental assets- river/forest/grassland/hill/mountain, Visit to a local polluted site-urban/Rural/Industrial/ Agricultural, Study of common plants, insects, birds, Study of simple ecosystems-pond, river, hills, slopes, etc. .

Suggested Readings:

1. Environmental Biology by K.C. Agarwal, Nidi Pub. Ltd., Bikaner
2. The Biodiversity of India by Bharucha, MA Pin Publishing Pvt. Ltd., Ahmedabad.
3. Hazardous Waste Incineration by R.C. Brunner, McGraw Hill Inc.
4. Environmental Chemistry by A.K. De, Wiley Eastern Ltd.
5. Global Biodiversity Assessment by V.H. Heywood & R.T. Watson, Cambridge University Press
6. Environmental Protection and Laws by H. Jadhav & V.M. Bhosale, Himalaya Pub. House, Delhi.
7. Matter Hazardous by A.K. Mhaskar, Techno-Science Publications.
8. Waste Water Treatment by M.N. Rao & A.K. Datta, Oxford & IBH Publ. Co. Pvt. Ltd.
9. Environmental Chemistry by B.K. Sharma, Goel Publ. House, Meerut,
10. Survey of the Environment, The Hindu.
11. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II by R.K. Trivedi, Enviro Media.
12. Introduction to Air Pollution by R.K. Trivedi & P.K. Goel, Techno-Science Publications.
13. Environmental Management by K.D. Wagner, W.B. Saunders Co., Philadelphia, USA.
14. A Textbook of Environmental Education by Dr. J.P. Yadav, G.V.S. Publishers.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Environment Science: Introduction	https://www.youtube.com/watch?v=5QxxaVfgQ3k
	Natural Resources	https://www.youtube.com/watch?v=CXCT2R1K6Ts
	Ecosystem	https://www.youtube.com/watch?v=1dBU6HB8G6s
Unit-II	Biodiversity and its conservation	https://archive.nptel.ac.in/courses/102/104/102104068/
Unit-III	Sustainable Water Management In Urban Areas	http://digimat.in/nptel/courses/video/127106004/L29.ht
	Environmental Pollution	https://archive.nptel.ac.in/courses/123/105/123105001/
Unit-IV	Population and population growth	https://archive.nptel.ac.in/courses/102/104/102104068/
	National Family Welfare Programme	https://www.youtube.com/watch?v=X5F99L8ZEtc

Course code	**LC-ME-220A**				
Category	Professional Core Courses				
Course title	**Applied Thermodynamics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To introduce students to the fundamental principles and operational features of thermal equipment. ● To enable students to gain practical knowledge in analyzing and evaluating the performance of thermal systems. ● To provide hands-on experience in conducting experiments related to steam generation, heat transfer, and power generation systems.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Explain the construction details of various types of boilers, mountings and accessories.	Level 2: Understand
CO2	Demonstrate the working principle of various thermal equipments.	Level 3: Apply
CO3	Analyze the thermodynamic properties of steam and system performance.	Level 4: Analyze
CO4	Evaluate the performance of reciprocating air compressor and cooling tower.	Level 5: Evaluate

List of Experiments

Sr. No.	Content	COs
1	To study low pressure boilers and their accessories and mountings.	**CO1**
2	To study high pressure boilers and their accessories and mountings.	**CO1**
3	To study the working of impulse and reaction steam turbines.	**CO2**
4	To study principle, construction and working of Bomb Calorimeter.	**CO2**
4	To study of heat balance sheet for given boiler.	**CO2**
5	To find power output & efficiency of a steam turbine.	**CO3**
6	To find dryness fraction of steam by separating and throttling calorimeter.	**CO3**
7	To find the condenser efficiencies.	**CO3**
8	To evaluate the volumetric efficiency of a reciprocating air compressor.	**CO4**

9	To study cooling tower and evaluate its efficiency.	**CO4**
10	To evaluate the isothermal efficiency of a reciprocating air compressor.	**CO4**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
To find dryness fraction of steam by separating and throttling calorimeter.	https://vmtitg.vlabs.ac.in/Separating_and_Throttling_Calorimeter(theory).html
To study cooling tower and evaluate its efficiency.	https://vmt-iitg.vlabs.ac.in/Water_cooling_tower(procedure).html
To evaluate the volumetric efficiency of a reciprocating air compressor.	https://www.youtube.com/watch?v=AQEQl8qJgfI
To study high pressure boilers and their accessories and mountings.	https://www.youtube.com/watch?v=S1pDhYR7ZQg

Course code	**LC-ME-222A**				
Category	Professional Core Courses				
Course title	**Strength of Materials Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To learn the working principles of various material testing machines and perform tests. ● To enhance the knowledge stress, strain of materials and ability to interpret the data from the experiments. ● To evaluate the mechanical properties of materials through impact, tensile, compression, bending, and shear tests.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Apply hardness testing procedures to determine the hardness of various engineering materials.	Level 3: Apply
CO2	Use appropriate methods to determine material behavior under sudden impact & sheet deformation.	Level 3: Apply
CO3	Analyze the behavior of materials under different types of loading.	Level 4: Analyze
CO4	Evaluate torsional, spring, and fatigue behavior of materials using theoretical relationships.	Level 5: Evaluate

List of Experiments

Sr. No.	Content	COs
1	To determine the hardness of the given specimen using Brinell hardness test.	**CO1**
2	To determine the hardness of the given Specimen using Rockwell hardness test.	**CO1**
3	To determine the hardness of the given Specimen using Vickers hardness test.	**CO1**
4	To conduct sheet metal test in Erichsen sheet metal testing machine.	**CO2**
5	To determine the Impact strength of a given specimen using Izod impact test.	**CO2**
6	To determine the Impact strength of a given specimen using Charpy impact test	**CO2**
7	To perform tensile test on UTM.	**CO3**
8	To perform compression test on UTM.	**CO3**
9	To perform bending tests on UTM.	**CO3**
10	To perform the shear test on UTM.	**CO3**

11	To evaluate the torsional properties of mild steel using a torsion testing machine.	**CO4**
12	To evaluate the stiffness of a spring and the modulus of rigidity of its wire.	**CO4**
13	To evaluate a material's response to cyclic loading with a fatigue test machine.	**CO4**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
Brinell Hardness Test.	https://sm-nitk.vlabs.ac.in/exp/brinell-hardness-test/
Rockwell Hardness Test.	https://sm-nitk.vlabs.ac.in/exp/rockwell-hardness-test/
Vickers Hardness Test.	https://sm-nitk.vlabs.ac.in/exp/vickers-hardness-test/
Izod Test	https://sm-nitk.vlabs.ac.in/exp/izod-impact-test/
Charpy Test	https://sm-nitk.vlabs.ac.in/exp/charpy-impact-test/
Tensile Test	https://sm-nitk.vlabs.ac.in/exp/tensile-test-mild-steel/
Bending Test.	https://sm-nitk.vlabs.ac.in/exp/bending-test-mild-steel/
Compression Test.	https://sm-nitk.vlabs.ac.in/exp/compression-test-mild-steel/
Sheer Test	https://sm-nitk.vlabs.ac.in/exp/direct-shear-test-steel-rod/
Torsion test.	https://sm-nitk.vlabs.ac.in/exp/torsion-test-mild-steel/

Course code	**LC-ME-224A**				
Category	Professional Core Courses				
Course title	**Fluid Mechanics Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To gain knowledge of fluid flow principles and pipe flow behavior. ● To measure key flow parameters such as friction factor, Reynolds number, and viscosity. ● To know the causes and impact of energy losses in pipe systems. ● To provide hands-on experience to observe fluid flow phenomena through experiments..				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	**Skill Demonstrated**	**RBT Level**
CO1	Apply fluid flow measurement techniques to determine discharge coefficients and fluid properties.	Level 3: Apply
CO2	Calculate friction factor, Reynolds number, viscosity and flow losses in pipes.	Level 3: Apply
CO3	Analyze stability of floating bodies and fluid flow characteristics.	Level 4: Analyze
CO4	Evaluate the fundamental fluid properties and mechanics principles through experimentation.	Level 5: evaluate

List of Experiments

Sr. No.	**Content**	**COs**
1	To find out the coefficient of discharge of an orifice meter.	**CO1**
2	To find out the coefficient of discharge of venturimeter	**CO1**
3	To find out the coefficient of discharge of Notch (V and Rectangular types).	**CO1**
4	To find out the coefficient of discharge, contraction & velocity of an orifice.	**CO1**
5	To calculate the friction factor for the pipes.	**CO2**
6	To calculate the minor losses due to sudden enlargement, sudden contraction and bends.	**CO2**
7	To analyze the stability of a floating body by determining the metacentric height of a floating body.	**CO3**
8	To analyze the velocity and pressure variation with radius in a forced vertex flow.	**CO3**
9	To analyse the critical Reynolds number for a pipe flow.	**CO3**

10	To evaluate the viscosity of a fluid by Stokes' law apparatus.	**CO4**
11	To verify the Bernoulli's Theorem.	**CO4**
12	To verify the momentum equation..	**CO4**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
Friction in Pipes	https://fm-nitk.vlabs.ac.in/exp/friction-in-pipes/simulation.html
Venturimeter	https://fm-nitk.vlabs.ac.in/exp/venturimeter/
Reynolds Experiment	https://me.iitp.ac.in/Virtual-Fluid-Laboratory/reynolds/simulation.html
Bernoulli's Experiment	https://me.iitp.ac.in/Virtual-Fluid-Laboratory/bernoulli/about_setup.html
V-Notch Experiment	https://me.iitp.ac.in/Virtual-Fluid-Laboratory/notch/about_setup.html
Stability of Floating Bodies	https://me.iitp.ac.in/Virtual-Fluid-Laboratory/metacenter/about_setup.html

Course code	**LC-ME-226A**				
Category	Professional Core Courses				
Course title	**Kinematics of Machines Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To provide knowledge of the basic elements and working principles of mechanical linkages and mechanisms. ● To introduce the motion characteristics of mechanisms used in machinery and equipment. ● To equip students with skills to analyze the performance of motion transmission systems such as cams, gears, and gear trains. ● To enable hands-on experience in evaluating the behavior and efficiency of mechanical systems through laboratory experiments.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Understand various kinematic links, pairs, chains, and mechanisms, including their inversions.	Level 2: Understand
CO2	Apply graphical methods to draw displacement, velocity, and acceleration diagrams of mechanisms.	Level 3: Apply
CO3	Analyze the characteristics and profiles of cams, followers, and gears.	Level 4: Analyze
CO4	Evaluate the performance and efficiency of power transmission elements.	Level 5: Evaluate

List of Experiments

Sr. No.	Content	COs
1	To study various types of Kinematic links, pairs, chains and Mechanisms.	**CO1**
2	To study inversions of 4 Bar Mechanisms, Single and double slider crank mechanisms.	**CO1**
3	To plot slider displacement, velocity and acceleration against crank rotation for single slider-crank mechanism.	**CO2**
4	To draw velocity diagram of four bar mechanism.	**CO2**
5	To draw velocity diagram of slider crank mechanism.	**CO2**
6	To draw acceleration diagram of four bar mechanism.	**CO2**
7	To categories various type of cam and follower arrangements.	**CO3**
8	To plot follower displacement vs cam rotation for various cam follower systems.	**CO3**

9	To classify various types of gears- spur, helical, worm, bevel gear etc.	**CO3**
10	To classify various types of gear trains - simple, compound, reverted & epicyclic.	**CO3**
11	To generate spur gear involute tooth profile using simulated gear shaping process.	**CO3**
12	To evaluate the MA, V.R. and efficiency of screw jack.	**CO4**
13	To evaluate the coefficient of friction between belt and pulley.	**CO4**

Note: At least ten experiments are to be performed. Eight experiments should be from the above list and remaining two experiments may either be performed from the above list or as per the scope of the syllabus.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
Velocity analysis of Grashof four bar mechanism	https://mm-nitk.vlabs.ac.in/exp/velocity-analysis-grashof/
CAM Follower Mechanism	https://mr-iitkgp.vlabs.ac.in/exp/cam-follower-mechanism/

Course Code	**PEC-ME-212A**				
Category	Professional Elective Courses				
Course Title	**Industrial Engineering**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce to different recording charts and PPC. • To learn techniques for accurate sales forecasting and demand estimation. • To grasp inventory management principles for cost-effective control and stock optimization. • To know value analysis methods to enhance product and process value while reducing costs.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the fundamental concepts and techniques related to industrial engineering.	Level 1: Remember
CO2	Explain the principles, procedures, techniques, and tools used to improve industrial systems.	Level 2: Understand
CO3	Apply standard methods, analytical and practical tools for managing industrial operations.	Level 3: Apply
CO4	Analyze industrial processes and organizational systems for performance improvement.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	Introduction to work study; Method study; Basic procedure, Recording techniques (Charts and diagrams); Elemental breakdown; Micro-motion studies; Therbligs; SIMO- chart principles of motion- economy. Introduction; Objectives; techniques (time) information recording; methods of things, Time study allowances; work sampling technique, Performances rating and its determinant ion technique, Performance rating and its determination PMTS; M.T.M., Work factor.
Unit-II	Principle of organization; Importance and characteristics of organization; Organization theories; Classical Organization theory; Neo-Classical organization theory, modern organization theory; Types of organization. Military or line organization, Functional organization, line and staff organization, Committee objectives of PPC; Functions of PPC Preplanning and planning; Routing; Estimating; scheduling; master schedule; Daily schedule; Gantt chart; Dispatching.
Unit-III	Introduction, Objectives and importance of sales forecasting, Types of forecasting, Methods of sales forecasting, Collective opinion method, Delphi technique, economic indicator method; Regression analysis, introduction, Functions of inventory; Types of inventory; Control importance functions, Inventory costs, factors affecting inventory control, Various inventory controls models; A.B.C. analysis, lead-time calculations.

Unit-IV	Introduction, Objective; Concept and life cycle of a product and V.E.; Steps in V.E. Methodology and techniques, Fast diagram, Matrix method. Various concepts in industrial engineering. a) Wages and Incentives; Concept; Types, plans, Desirable characteristics. b) Supply Chain Management; Its Definition, Concept, Objectives, Applications, Benefits, some successful cases in Indian Industries. c) JIT; Its definition, concept, importance, misconception, relevance, Applications, Elements of JIT (brief description) d) Time Management; Introduction, steps of time man agreement, Ways for saving time KEY for time saving.

Suggested Readings

1. Industrial Engineering and Organization Management-S.K. Sharma & Savita Sharma, KATSONs.
2. Industrial Engineering and Production Management by M. Mahajan, Dhanpat Rai & Co.
3. Production planning and control by S. Elion.
4. Industrial Engineering and management -I P Singh, Neelam Publications.

Useful Video links

Unit No.	Topic	Link
UNIT-I	SIMO Chart	https://youtu.be/BGxW2T8lhFU?feature=shared
	Allowances in Time Study	https://youtu.be/iTBirKYQ6zw?feature=shared
UNIT-II	Gantt chart	https://youtu.be/xZs7WsNPJXY?feature=shared
	Organization Theory	https://youtu.be/6_3VHAAJddY?feature=shared
UNIT-III	Planning, Sales forecasting and Budgeting	https://youtu.be/i7uPlBLBG4I?feature=shared
	Various inventory controls models	https://youtu.be/9tJv5COGkD0?feature=shared
UNIT-IV	Supply Chain Management	https://youtu.be/PmR2SKeY9Ms?feature=shared
	JIT	https://youtu.be/HkdoR-NNEoI?feature=shared

Course Code	**PEC-ME-214A**				
Category	Professional Elective Courses				
Course Title	**3D Printing**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To aware the working principle and process parameters of additive manufacturing processes. • To learn applications of AM processes in various fields. • To know different post processing methods for AM. • To learn the basics of different tooling and its methods for AM				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Recall the basic concepts, classifications, and applications of additive manufacturing technologies.	Level 1: Remember
CO2	Explain the processes, materials, and software used in additive manufacturing and reverse engineering.	Level 2: Understand
CO3	Apply additive manufacturing principles to model development, data processing, and part fabrication.	Level 3: Apply
CO4	Analyze additive manufacturing processes and post-processing methods for suitability and efficiency in various applications.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Introduction:** Overview of Additive Manufacturing (AM); AM history; Classification of AM; Merits/de-merits and applications of AM process; Outline on AM software's. Brief information on different materials used for AM. **Reverse Engineering:** Meaning, Use, RE-The generic process, Phase of RE–scanning, Contact Scanners, Noncontact Scanners, Point Processing, Application Geometric Model, Development.
Unit-II	**CAD Data Processing for AM:** - CAD model development; Overview on Data requirements, Data formats (STL, SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP), Data interfacing, Part orientation and support generation; Design of support structure for AM; Overview on slicing methods; Tool path generation for AM.
Unit-III	**Liquid, Solid & Powder Based AM Technologies:** Stereo lithography; FDM; LOM; Multi-jet Modeling, SLS, Direct Metal Laser Sintering, 3-Dimensional Printing; Working Principles, products, materials, merits, drawbacks and applications –Case studies. **Direct Energy Deposition AM Process:** Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Electron Beam based metal deposition: working principles, products, benefits and drawbacks, applications. Overview on new & Hybrid AM technologies.

Unit-IV	**Post Processing of AM Parts:** Overview on support material removal, Surface quality and aesthetic improvement. Overview on construction of basic AM machines. **Rapid Tooling:** Rapid Tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods. **AM Applications:** Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.

Suggested Readings

1. Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Ian Gibson, David W Rosen, Brent Stucker, 2nd Edition, Springer, 2015
2. Rapid prototyping: Principles and applications, second edition, Chua C.K., Leong K.F., and Lim C.S., World Scientific Publishers, 2003
3. 3D Printing and Additive Manufacturing: Principles and Applications: Fourth Edition of Rapid Prototyping, Chee Kai Chua, Kah Fai Leong, World Scientific Publishers, 2014
4. Additive Manufacturing Technologies, Ian Gibson, David W. Rosen, Brent Stucker, Springer,2009

Useful Video links

Unit No.	Topic	Link
UNIT-I	Fundamentals of Additive Manufacturing	https://youtu.be/t7yv4gSnNkE?feature=shared
	Reverse Engineering	https://youtu.be/W2QpGdsTIJ8?feature=shared
UNIT-II	Slicing Methods	https://youtu.be/Neb9IdIctmI?feature=shared
UNIT-III	Stereo lithography	https://youtu.be/Aq6Ea8TBIbs?feature=shared
	Fused Deposition Modeling	https://youtu.be/Ua7pEn7Rsws?feature=shared
UNIT-IV	Post Processing of AM Parts	https://youtu.be/jq9Lqil6bLw?feature=shared

Course Code	**PEC-ME-216A**				
Category	Professional Elective Courses				
Course Title	**CNC Technology**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce the fundamentals and evolution of CNC technology. • To learn CNC machine structure, hardware components, and coordinate systems. • To learn manual and computer-aided part programming methods. • To enable students to gain programming skills and tooling knowledge.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Recall the key concepts & components of CNC machines and part programming..	Level 1: Remember
CO2	Explain the working principles and structure of CNC systems and tooling.	Level 2: Understand
CO3	Apply CNC programming techniques to generate part programs for various machining operations.	Level 3: Apply
CO4	Analyze CNC machine operations & programs to improve machining efficiency and accuracy.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Computer Numerical Control (CNC) Technology: Numerical Control (NC), Historical Development of CNC Machines, NC Coordinate Systems, NC Modes, Advantages and Limitations of CNC Machine Tools. CNC Hardware: Structure of CNC Machine tools, Drives used in CNC machines, Actuation Systems of CNC Machines Tools, Feedback Devices used in CNC Machine.
Unit-II	CNC Programming Fundamentals: Part Programming Steps, Axes Identification in CNC Turning and Machining Centers, Machine Zero and Home Position, ISO Standards for Coding. Manual Part Programming: Preparatory Functions, Miscellaneous Functions, Absolute and Incremental Programming, Tool Length Compensation.
Unit-III	Turning Centre Programming: Motion Commands, Tool Nose Radius Compensation, Cut Planning, Thread Cutting, Part Program Numericals. Machining Centre Programming: Canned Cycles, Cutter Radius Compensation, Part Program Numericals.
Unit-IV	Computer Aided Part Programming: APT Language, Geometry Statements, Motion Statements, Post Processor Statements, Auxiliary Statements, Part Program Numericals. CNC Tooling: Cutting Tool Material and Characteristics, Turning Tool Geometry, Tooling System for Turning, and Milling. Tool Presetting, Automatic Tool Changers, Work Holding.

Suggested Readings

1. Computer Numerical Control: Operation and Programming by Jon Stennerson, Prentice Hall.
2. CNC Programming Principles & Applications by Mattson Mike, Cengage learning.
3. Machining and CNC Technology by Fitzpatrick, McGraw-Hill Higher Education.
4. Industrial Engineering and management by I P Singh, Neelam Publications.
5. CNC Tips and Techniques: A Reader for Programmers by Peter Smid, Industrial Press Inc.

Useful Video links

Unit No.	**Topic**	**Link**
UNIT-I	Computer Numerical Control (CNC)	https://youtu.be/Gi42gKGiCl0?feature=shared
UNIT-II	Preparatory functions	https://youtu.be/Mj6VbVL4tn0?feature=shared
	Absolute and Incremental Programming	https://youtu.be/PN_tGm5Gip4?feature=shared
UNIT-III	CNC programming	https://youtu.be/_5r2XR1h1aQ?feature=shared

Course Code	**PEC-ME-218A**				
Category	Professional Elective Courses				
Course Title	**Composite Materials**				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce the fundamental concepts of composite materials. • To learn the mechanical behaviour of composite materials. • To get an overview of the methods of manufacturing composite materials.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Define the basic concepts and fundamental of composite materials.	Level 1: Remember
CO2	Describe the roles and characteristics of matrix and reinforcement materials in composite structures.	Level 2: Understand
CO3	Apply preparation and processing methods for different types of composite materials.	Level 3: Apply
CO4	Analyze the influence of composite composition & manufacturing techniques on material performance.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts of 1.5 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Content
Unit-I	**Introduction**: Definition - Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.
Unit-II	**Reinforcements**: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Iso-strain and Iso-stress conditions.
Unit-III	**Manufacturing of Metal Matrix Composites:** Casting – Solid State diffusion technique, Cladding - Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration - Liquid phase sintering. Manufacturing of Carbon - Carbon composites: Knitting, Braiding, Weaving. Properties and applications.
Unit-IV	**Manufacturing of Polymer Matrix Composites**: Preparation of moulding compounds and prepregs - hand layup method – Autoclave method – Filament winding method- Compression moulding – Reaction injection moulding. Properties and applications.

Suggested Readings

1. Hand Book of Composite Materials-George Lubin
2. Composite Materials– K.K. Chawla.
3. Composite Materials Science and Applications–Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tsai.

Useful Video links

Unit No.	Topic	Link
UNIT-I	Classification of composite materials.	https://youtu.be/0kB0G6WKhKE?feature=shared
	Effect of reinforcement on composite.	https://www.youtube.com/watch?v=_JAGKikeCSY
UNIT-II	Preparation-layup, curing, properties.	https://youtu.be/649fIwvIvRc?feature=shared
	Mechanical Behavior of composites	https://www.youtube.com/watch?v=IZXHu5IQOrM
	Iso-strain and Iso-stress conditions	https://www.youtube.com/watch?v=dj8r0M5LsnQ
UNIT-III	Manufacturing of Metal Matrix Composites	https://www.youtube.com/watch?v=aNie6dhPKZk
	Manufacturing of Ceramic Matrix Composites	https://www.youtube.com/watch?v=bdC8yySkARs
	Manufacturing of Carbon – Carbon composites	https://www.youtube.com/watch?v=zC3M51uosDc
UNIT-IV	Manufacturing of Polymer Matrix Composites	https://youtu.be/uO8EMAUh1po?feature=shared
	Filament winding method- Compression moulding	https://www.youtube.com/watch?v=qos45EwMmd0
	Reaction injection moulding	https://www.youtube.com/watch?v=T4C4m0Q8a6Q