COURSE BOOK B. TECH. II YEAR

Mechanical Engineering

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CURRICULUM STRUCTURE & SYLLABUS

Effective from the Session: 2025-26

B.Tech (ME) 3rd Sem

S No.	Course Category (AICTE)	Course Category (UGC)	BOS	Course Code	Course Name	Type	Academic Learning (AL)			Continuous Internal Examination (CIE)			End Sem Examination (ESE)	Total Marks	Total Credits
							L	T	P	MSE	CA	TOTAL		CIE+ ESE	
1	BS	Major (Core)	ASH	MA201L	Statistics, & Numerical Analysis	L	3	0	0	60	15	75	75	150	3
2	PC	Major (Core)	ME	ME201L	Manufacturing Technology - 1	L	2	0	0	40	10	50	50	100	2
3	PC	Major (Core)	ME	ME202L	Materials Engineering & Metallurgy	L	3	0	0	60	15	75	75	150	3
4	PC	Major (Core)	ME	ME203L	Fluid Mechanics & Machinery	L	3	0	0	60	15	75	75	150	3
5	PC	Major (Core)	ME	ME204L	Engineering Thermodynamics	L	2	0	0	40	10	50	50	100	2
6	MC	Value Added	ASH	HS109L	Constitution of India	L	2	0	0	25	-	25	25	-	NC
7	HS	AEC	ASH	HS110L	Aptitude-1	L	1	0	0	-	25	25	25	50	1
8	HS	AEC	ASH	HS111L	Soft Skills Essential-1	L	1	0	0	-	25	25	25	-	NC
Blended															
9	ES	Major (Core)	ELCE	EL106B	Introduction to AI & ML	B	2	0	2	60	15	75	75	150	3
10	PE	Major (Core)/SEC	-	-	Professional Elective-I	B	3	0	2	80	20	100	100	200	4
Lab/Practical															
11	PC	Major (Core)	ME	ME201P	Manufacturing Technology - I Lab	P	0	0	2	-	25	25	25	50	1
12	PC	Major (Core)	ME	ME202P	Material Testing Lab	P	0	0	2	-	25	25	25	50	1
13	PC	Major (Core)	ME	ME203P	Fluid Mechanics & Machinery Lab	P	0	0	2	-	25	25	25	50	1
14	PW	Summer internship	CSIT	IT105P	Social Internship Assessment	P	0	0	0	-	50	50	-	50	1
Total Hours : 32 hrs.							**22**	**0**	**10**					**1250**	**25**

B. Tech (ME) 4th Sem

S No.	Course Category (AICTE)	Course Category (UGC)	BOS	Course Code	Course Name	Type	Academic Learning (AL)			Continuous Internal Examination (CIE)			End Sem Examination (ESE)	Total Marks	Total Credits
							L	T	P	MSE	CA	TOTAL		CIE+ ESE	
1	PC	Major(Core)	ME	ME205L	Applied Thermodynamics	L	3	1	0	80	20	100	100	200	4
2	PC	Major(Core)	ME	ME301L	Mechanics of Solids	L	3	1	0	80	20	100	100	200	4
3	PC	Major(Core)	ME	ME206L	Manufacturing Technology - II	L	2	0	0	40	10	50	50	100	2
4	MC	Value Added	ASH	HS112L	Universal Human Values	L	3	0	0	60	15	75	75	150	3
5	HS	AEC	ASH	HS113L	Aptitude-2	L	1	0	0	-	25	25	25	50	1
6	HS	AEC	ASH	HS114L	Soft Skills Essential 2	L	1	0	0	-	25	25	25	-	NC
Blended															
7	PE	Major (Core)/SEC	-	-	Professional Elective-II	B	3	0	2	80	20	100	100	200	4
8	PC	Minor (Core)	ME	ME201B	Machine Analytics	B	2	0	2	60	15	75	75	150	3
Lab/Practical															
9	PC	Major(Core)	ME	ME205P	Thermal Engineering Lab	P	0	0	2	-	25	25	25	50	1
10	PC	Major(Core)	ME	ME207P	CAMD Lab	P	0	0	4	-	50	50	50	100	2
11	PC	Major(Core)	ME	ME206P	Manufacturing Technology - II Lab	P	0	0	2	-	25	25	25	50	1
Total Hours : 32 hrs.							**18**	**2**	**12**					**1250**	**25**

Professional Electives (PE)

S.No.	Course Type (PE)	Basket-1 Design & Analysis	Basket-2 Automotive Product Design	Basket-3 (Intelligent Electric Vehicle) Powered by: Imperial Society of Innovative Engineers and National Skill Development Corporation (NSDC)	Basket-4 (Next-Gen Automation: IIoT & Gateways) Powered by: Usha Automation, India and Phoenix Contact, Germany
1	**BOS**	**ME**	**ME**	**EEE**	**EEE**
	PE I-(3rd Sem)	Computer Aided Design (ME208E)	Computer Aided Product Design (ME210E)	Modelling Dynamic Systems and Physical Components using MATLAB (EE205E)	Sensors & Automation Essentials (EE207E)
2	**BOS**	**ME**	**ME**	**EEE**	**EEE**
	PE II-(4th Sem)	Fundamental of Design Analysis and Simulation (ME209E)	Product Reverse Engineering (ME211E)	Integration of Systems of EVs (EE206E)	Integration of SCADA and PLC with IIOT Gateways (EE208E)

Theory Courses Detail Syllabus

Course Code: MA201L	Theory Course Name:	L	T	P	C
	Statistics & Numerical Analysis	3	0	0	3

Pre-requisite:10+2 Mathematics

Course Objectives:

1. Students will be equipped with the necessary skills to apply Statistics and probability to analyze the data
2. To develop a foundation in matrix algebra and to impart the knowledge of numerical tools from intermediate to advanced level of mathematics.

Course Outcome:

1. Apply elementary transformation to solve system of Linear equations.
2. Understand the concept of central tendency and conditional probability.
3. Apply knowledge of probability distribution in engineering problems.
4. Employ the concept of numerical analysis to solve equations and data interpolation.
5. Apply the concept of numerical analysis to solve integration and ordinary differential equations.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2					1				1
CO2	2	2	2					1				1
CO3	2	2	1					1				1
CO4	2	2	1					1				1
CO5	2	2	2					1				1

Unit 1	Matrix Algebra	9 hours

Introduction to Matrices, Elementary Transformation, Rank of a Matrix by Echelon Form, Solution of system of Linear Equations, Linear dependence and independence of vectors, Eigen Values, Eigen Vectors.

Unit 2	Statistics and Probability	9 hours

Measure of Central Tendency: Mean, Median, Mode and standard deviation, variance.
Random Variable, Probability, conditional probability, Baye's theorem.

Unit 3	Probability Distribution	9 hours

Probability Distribution, Binomial Distribution, Poisson Distribution, Normal Distribution and their applications.

Unit 4	Numerical Method-I	9 hours

Roots of transcendental and algebraic equations using Bisection method, Regula-Falsi method and Newton-Raphson method (without proof), Introduction to Interpolation, Newton's forward and backward interpolation.

Unit 5	Numerical Method-II	9 hours

Numerical integration, Trapezoidal rule, Simpson's rules, Solution of ordinary differential equations (first order, second order) by Euler's and fourth order Runge-Kutta Methods.

	Total Lecture Hours	45 hours

Textbook:

1. B. V. Ramana, Higher Engineering Mathematics, McGraw-Hill Publishing Company Ltd., 2008.
2. R K. Jain & S R K. Iyenger, Advance Engineering Mathematics, Narosa Publishing House 2002.
4. Engineering Mathematics 4 PDE & Statistics, N. P Bali.
5. S. C. Gupta & V. K. Kapoor, Fundamental of Mathematical Statistics, Sultan Chand & Sons.

Reference Books:

1. E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.
2. Seymour Lipschutz, John Schiller, Introduction to Probability and Statistics, McGraw Hill
3. Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.
4. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. Advanced Engineering Mathematics. Chandrika Prasad, Reena Garg, 2018.
6. TKV Iyenger, B. Krishna Gandhi, S. Ranganatham, MVSN Prasad, Probability and Statistics (S. Chand Publishing House).

Mode of Evaluation (Theory):

Evaluation Scheme						
MSE		CA			ESE	Total Marks
MSE 1	MSE 2	CA1	CA2	CA3 (ATT)		
30	30	6	6	3	75	150
60		15				

Course Code: ME201L	Course Name: Manufacturing Technology-1	L	T	P	C
		2	0	0	2

Pre-requisite: NA

Course Objectives:

1. This course will provide students a practical and theoretical knowledge of metal casting and forming.
2. This course will provide students understanding of rolling and sheet metal working
3. This course will provide students a practical as well as theoretical knowledge of additive manufacturing.

Course Outcome: After completion of the course, the student will be able to

1. Apply the basic concept of metal casting.
2. Apply the working of forging in manufacturing industries.
3. Apply the knowledge of rolling, wire drawing and extrusion in manufacturing industries.
4. Understand the knowledge of sheet metal cutting operations in manufacturing industries.
5. Understand the knowledge of additive manufacturing and powder metallurgy in advanced manufacturing processes.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2				2					3
CO2	3	3	2				2					3
CO3	3	3	2				2					3
CO4	2	2	2				2					3
CO5	2	2	2				2					3

Unit 1	Metal Casting & Foundry Practices	08 hours

Introduction to manufacturing processes, classification, and applications. Metal casting: steps, advantages, limitations, and applications. Patterns: types, allowances, and moulding sand properties & testing. Risers design, solidification. Casting processes: continuous casting, die casting, centrifugal casting, investment casting, stir casting. Casting defects, remedies, inspection, relevant case studies.

Unit 2	Metal Forming Processes	08 hours

Elastic & plastic deformation, yield criteria (Von Mises & Tresca). Hot vs. cold working. Forging: types, operations, die, hammers & presses, applications, and defects. Rolling: roll mill configurations, geometrical relationships, applications, and defects. Extrusion & Wire Drawing: process, type & applications, relevant case studies.

Unit 3	Sheet Metal & High Energy Rate Forming (HERF)	07 hours

Press classification, die & punch assembly, press work methods. Cutting/punching: blanking vs. piercing, compound vs. progressive dies. Punch design: load estimation. Forming process: cup/deep drawing, bending. HERF processes: explosive forming, electromagnetic forming, and electrohydraulic forming, relevant case studies.

Unit 4	Advanced Manufacturing Techniques	07 hours

Additive Manufacturing: fundamentals, differences from conventional processes, types of additive manufacturing technologies and materials. Role of additive manufacturing in Biomedical application.
Powder Metallurgy: process overview, applications, and advantages. Injection Molding: principles and applications, relevant case studies.

Total Lecture Hours	30 hours

Textbook:

1. Manufacturing Technology by P.N. Rao., MCGRAW HILL INDIA.
2. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition) Pearson India, 2014.
3. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems.

Reference Books:

1. R.K. Jain, Production Technology, Khanna Publishers, 2014.
2. Amitabha Ghosh and Ashok Kumar Mallik, Manufacturing Science, East West Press, 2010.

3. S.K. Hajra Choudhury and A.K. Hajra Choudhury, Elements of Workshop Technology: Volume I & II, Media Promoters & Publishers Pvt. Ltd., 2008.
4. Serope Kalpakjian and Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Education, 2014.

Mode of Evaluation (Theory):

Evaluation Scheme						
MSE		CA			ESE	Total Marks
MSE 1	MSE 2	CA1	CA2	CA3 (ATT)		
20	20	4	4	2	50	100
40		10				

Course Code: ME202L	Course Name: Materials Engineering and Metallurgy	L	T	P	C
		3	0	0	3

Pre-requisite:
1. Physics
2. Chemistry (bonding, metals and nonmetal).

Course Objectives:
1. To provide students with sound applied knowledge in Materials Science and Metallurgy with a foundation in basic sciences, mathematics and engineering, necessary to formulate, solve and analyze engineering problems.
2. To develop ability of selecting right material for right engineering and industrial application.
3. To develop ability in the students select and perform right heat treatment on the material to alter material properties as required.
4. To familiarize the students with advance materials.

Course Outcome: After completion of the course, the student will be able to
1. Analyse the crystal structure to relate the material properties.
2. Analyse the properties of ferrous and nonferrous materials.
3. Analyse the microstructure properties and phase diagram of engineering materials.
4. Apply heat treatment method to modify the material properties.
5. Analyse effect of different alloying elements on the properties of ferrous and nonferrous alloys.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	2	2	-	-	-	-	1
CO2	3	3	3	3	-	3	3	-	-	-	-	1
CO3	3	3	2	3	-	2		-	-	-	-	2
CO4	3	3		3	2	3	2	-	-	-	-	2
CO5	3	3	3	3	2	3	2	-	-	-	-	2

Unit 1 | **Fundamentals of Materials Science & Crystallography in Modern Applications** | **11 hours**

Classification of engineering materials, selection criteria for applications. Properties of materials in context of sustainability and eco design (Green Materials). Crystal geometry: unit cells, Bravais lattices, atomic packing, crystal planes and directions, Miller indices, polymorphism/allotropy. Crystallization mechanisms: nucleation and growth, imperfections in crystals, solute strengthening.
Influence of crystal defects in nano electronics and battery materials.

Unit 2 | **Material testing** | **09 hours**

Indentation hardness testing: Brinell, Rockwell, Meyer, Vicker and Knoop hardness testing. Meyer's law, Micro and Nano hardness testing, Tension, compression and torsion testing. Effects of specimen geometry and testing variables. Impact testing with Charpy and Izod specimens. Ductile to brittle transition behavior. Drop weight testing. Fatigue testing to determines SN. Introduction to national and international material testing standard.
NDT Methods – Visual, liquid penetrant testing, magnetic particle testing, ultrasonic testing, radiography, acoustic emission testing. Eddy current testing, thermography.
Integration of NDT with AI and IoT for predictive maintenance in smart factories (Industry 4.0).

Unit 3 | **Phase Diagram and alloy** | **10 hours**

Unary and Binary equilibrium phase diagrams, Different reactions like eutectic, eutectoid, peritectic and peritectoid; No equilibrium cooling.
Allotropy of iron; Iron carbide equilibrium diagram: Phases present and their properties, different reactions of the Iron-Iron Carbide equilibrium system; constituents, microstructures and properties of plain carbon steels.
Ferrous and nonferrous alloys:

Alloying of steel, properties of stainless steel and tool steels, maraging steels cast irons; grey, white, malleable and spheroidal cast irons copper and copper alloys; brass, bronze and cupronickel; Aluminum and AlCu – Mg alloys Nickel based super alloys and Titanium alloys.
Application of phase diagram principles in additive manufacturing and highentropy alloys for aerospace.

Unit 4	**Heat Treatment and Advanced Engineering Materials**	**09 hours**

Heat treatment processes: annealing, normalizing, hardening, tempering, carburizing, nitriding, cyaniding, induction, flame hardening. TTT and CCT diagrams; transformation kinetics. Strengthening mechanisms and realworld application in components (shafts, gears, turbine blades). Advanced materials: composites (metal/polymer/ceramic matrix), smart materials, functionally graded materials, nanomaterials, and semiconductors.
Smart materials in biomedical implants and aerospace; nanomaterial's in flexible electronics and coatings.

Unit 5	**Advanced materials**	**06 hours**

Properties and applications of Composites: Metal matrix, polymer matrix and ceramic matrix composite, Smart materials, functionally graded material, super alloys, Nano materials Semiconductor materials,

	Total Lecture Hours	**45 hours**

Textbook:

- Khanna O.P., A Text book of Material science and Metallurgy, Danpat Rai Publications.
- Rajput R.K., A Text book of Material Science and Engineering, S.K Kataria & sons, Delhi

Reference Books:

1. Callister Materials Science and Engineering, by William D. Callister, Jr, (Adopted by R. Balasubramaniam), Wiley India Pvt. Ltd.
2. Elements of Material Science & Engineering by Van Vlack, Pearson
3. Material Science and Engineering by Smith, Hashemi and Prakash, McGRAW HILL INDIA

Mode of Evaluation:

MSE		**CA**			**ESE**	**Total**
MSE1	**MSE2**	**CA1**	**CA2**	**CA3(ATT)**		
30	30	6	6	3	**75**	**150**
60		**15**				

Course Code: ME203L	**Course Name: Fluid Mechanics and Machinery**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Prerequisite: NA

Course Objectives:

1. To provide basic knowledge of fluid properties, buoyancy, fluid statics, kinematics, dynamics, boundary layer theory along with hydraulic turbines, pumps and other hydraulic machines.
2. To provide essential knowledge of fluid properties, buoyancy, fluid statics, kinematics, dynamics along with boundary layer theory.
3. To impart them knowledge of various hydraulic turbines, pumps and other hydraulic machines

Course Outcome: After completion of the course, the student will be able to

1. Understand the fluid properties, manometers, buoyancy principle and fluid kinematics.
2. Apply the concepts related to the dimensional analysis, Bernoulli's equation, notches, momentum equation and flow through pipes.
3. Understand the concepts related to laminar and turbulent flow and boundary layer theory.
4. Analyze the performance of impulse and reaction turbines.
5. Analyze the performance of centrifugal and reciprocating pumps and other hydraulic machines

COPO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	-	-	-	-	-	-	1	1	-	3
CO2	3	3	-	-	-	-	-	-	1	1	-	3
CO3	2	2	-	-	-	-	-	-	1	1	-	3
CO4	3	3	-	-	-	-	-	-	1	1	-	3
CO5	3	3	-	-	-	-	-	-	1	1	-	3

Unit 1	**Fundamentals of Fluid Mechanics: Properties, Statics, and Kinematics**	**09 hours**

Fluid Properties: Fluid and continuum, Physical properties of fluids, Rheology of fluids
Fluid Statics: Pascal's Law and its application, Pressure density height relationship, Introduction to simple manometers, buoyancy, condition of equilibrium for immersed and floating Bodies, Metacenter determination of metacentric height,

Fluid Kinematics: Lagrangian and Eulerian approach, Types of fluid flows, streamlines, continuity equation for 3D and 1D flows, circulation, stream function and velocity potential.

Unit 2	**Dimensional Analysis, Flow Dynamics, and Pipe Flow**	**09 hours**

Dimensional Analysis: Dimensional analysis, Buckingham's Pi theorem, important dimensionless numbers and their significance, Similarity Laws: geometric, kinematics and dynamic similarity

Fluid Dynamics: Bernoulli's equation and its applications Pitot tube, orifice meter, venturi meter, rotameter, hot wire anemometer, notches and weirs, momentum equation and its application to pipe bends

Flow Through Pipes: Major and minor losses in pipes, pipes in series and parallel, equivalent pipe, power transmission through a pipe, siphon, water hammer

Unit 3	**Laminar and Turbulent Flow, Boundary Layers, and Computational Analysis**	**09 hours**

Laminar Flow: Equation of motion for laminar flow through pipes, Stokes' law

Turbulent Flow: turbulent flow, types of turbulent flow, velocity distribution in turbulent flow over smooth and rough surfaces,

Boundary Layer Theory: Introduction to boundary layer theory, boundary layer over a flat plate, Displacement thickness, momentum thickness, energy thickness, separation and its control,

Forces on Submerged Bodies: Introduction to Drag and lift, Magnus effect, Introduction to compressible flow.

Computational Fluid Dynamics : Introduction to Computational Fluid Dynamics

Relevant case study.

Unit 4	**Hydraulic Machines and Energy Conversion**	**09 hours**

Impact of jet : Impact of jet, Evaluation of hydrodynamic force on fixed and moving flat and curved surfaces, Layout of Hydroelectric Power Plants,

Hydraulic Turbines: Definitions of heads and efficiencies of a turbine, Turbine classification, Impulse turbines, Structural features, Velocity triangles, Efficiency and power estimation, Governing of Pelton turbine, Francis and Kaplan turbines, Structural features, Velocity diagrams, Efficiency and power estimation, Draft tube, Cavitation in turbines, Similarity concepts, Unit speed and specific speed. Relevant case study.

Unit 5	**Pumps and Hydraulic Systems**	**09 hours**

Centrifugal Pump: Introduction to centrifugal and reciprocating pumps, Main parts of a centrifugal pump, Definitions of heads and efficiencies of a centrifugal pump, Minimum speed for starting a centrifugal pump, specific speed of a centrifugal pump, Priming, Cavitation in centrifugal pump, NPSH

Reciprocating Pump: Working and main parts of a reciprocating pump, classification of reciprocating pump, indicator diagram: effect of acceleration in suction and delivery pipes, effect of friction in suction and delivery pipes, maximum speed of a reciprocating pump.

Fluid Systems: Introduction to hydraulic press, hydraulic accumulator, hydraulic ram and hydraulic lift.

Relevant case study.

Total Lecture Hours	**45 hours**

Textbook:

1. A Textbook of Fluid Mechanics and Hydraulic Machines by R.K Bansal.
2. Introduction to fluid mechanics and Fluid machines by S.K Som, Gautam Biswas, S Chakraborty
3. F. M. White, Fluid Mechanics, 6th Ed., Tata McGrawHill, 2008

Reference Books:

1. Cengel & Cimbala, "Fluid Mechanics" TMH, New Delhi.
2. Garde, R.J., " Fluid Mechanics", SciTech Publications Pvt. Ltd

Mode of Evaluation (Theory):

Evaluation Scheme						
MSE		**CA**			**ESE**	**Total Marks**
MSE 1	**MSE 2**	**CA1**	**CA2**	**CA3(ATT.)**		
30	30	6	6	3	**75**	**150**
60		**15**				

Course Code: ME204L	**Course Name: Engineering Thermodynamics**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

Prerequisite: Knowledge of work, energy, heat and temperature.

Course Objectives:

1. To understand the concepts & laws of energy conversion involving heat and work interactions.
2. To learn about the property changes occurring in substances during energy conversion processes.
3. To be able to understand the working principles of energy conversion devices.

Course Outcome: After completion of the course, the student will be able to

1. Understand basic concepts of thermodynamics and apply gas laws.

2. Apply first law of thermodynamics on non-flow processes and steady and unsteady flow processes.
3. Analyze second law of thermodynamics and apply the Principle of Increase of Entropy and the Quality of Energy.
4. Analyze the behavior of steam subjected to different processes.

CO PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	-	-	-	2	2	1	2
CO2	3	3	3	-	3	-	-	-	2	2	1	2
CO3	3	3	3	-	3	-	3	-	2	2	1	2
CO4	3	3	3	-	3	-	-	-	2	2	1	2

Unit 1	Review of Fundamental Concepts and Definitions	08 hours

Review of Fundamental Concepts and Definitions:
Introduction & Basic Concepts: Thermodynamic system, Types of Systems, Surrounding, Boundaries, Control Volume, Universe, Macroscopic and Microscopic view points, Concept of Continuum, Thermodynamic Equilibrium, State, Property of system, Classification of properties, Path, Process, Cycle, Reversible & irreversible Cycle, Exact & Inexact Differentials, Quasi – static Process, Reversibility, Irreversible Process, Causes of Irreversibility Energy and its forms, Work and heat (sign convention), Gas laws, Ideal gas, Real gas, Law of corresponding states, Property of mixture of gases.
Zeroth law of thermodynamics: Zeroth law of thermodynamics, Concept of Temperature and its' measurement, Temperature scales.

Unit 2	First law of thermodynamics	07 hours

First law of thermodynamics:
First Law of thermodynamics, Ist law applied to a process and cycle, Ist law for Flow Processes, Derivation of general energy equation for a control volume; Steady state, steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of steady and unsteady. Limitations of first law of thermodynamics, PMM-I. Steady flow systems and their analysis, Steady flow energy equation,
Application of SFEE on Boilers, Condensers, Turbine, Throttling process, Pumps etc.
Application of Engineering Equation Solver.

Unit 3	Second law of thermodynamics	08 hours

Second law of thermodynamics:
Thermal reservoirs, Energy conversion, Heat engines, Efficiency of Heat engine, Reversed heat engine, Heat pump, Refrigerator, Coefficient of Performance of Refrigerator, Kelvin-Planck and Clausius statements of second law of thermodynamics, Equivalence of the two statements. Reversible and irreversible processes, Carnot cycle and Carnot engine, Carnot theorem and its corollaries, Thermodynamic Temperature Scale, PMM-II.
Entropy: Clausius inequality, Concept of Entropy, Entropy change of pure substance in different thermodynamic processes, T-ds equation, Principle of entropy increase, T-S diagram, Statement of the third law of thermodynamics.
Concept of Availability, unavailability, exergy, anergy etc.
Application of Engineering Equation Solver.

Unit 4	Properties of steam	07 hours

Properties of steam:
Properties of pure substance in solid, liquid and vapour phases, Numerical on different processes on steam, P-V-T behavior of simple compressible system, T-S and H-S diagram, study of steam table, determination of quality of steam: throttling calorimeter, combined separating & throttling calorimeter.
Application of Engineering Equation Solver.

	Total Lecture Hours	30 hours

Textbook:

1. Basic and Applied Thermodynamics by PK Nag, MCGRAW HILL INDIA.
2. Fundamentals of Engineering Thermodynamics by Radhakrishnan, PHI.
3. Engineering Thermodynamics by Onkar Singh, New Age International.
4. Engineering Thermodynamics by CP Arora.

Reference Books:

1. Thermodynamics: An Engineering Approach by Cengel, MC GRAW HILL INDIA.
2. Engineering Thermodynamics by Rogers, Pearson.
3. Fundamentals of Engineering Thermodynamics by Moran, Shapiro, Boettner, & Bailey, John Wiley.

Mode of Evaluation (Theory):

Evaluation Scheme						
MSE		CA			ESE	Total Marks
MSE 1	MSE 2	CA1	CA2	CA3 (ATT)	50	100

20	20	4	4	2		
40		**10**				

Course Code: HS109L	Course Name: Constitution of India	L	T	P	C
		2	0	0	NC

Pre-requisite: NA

Course Objectives:

- To acquaint the students with legacies of constitutional development in India and help those to understand the most diversified legal document of India and philosophy behind it.
- To make students aware of the theoretical and functional aspects of the Indian Parliamentary System.
- To channelize students' thinking towards basic understanding of the legal concepts and its implications for engineers.
- To learn procedure and effects of emergency, composition and activities of election commission and amendment procedure.

Course Outcome: After completion of the course, the student will be able to

1. Understand basic features and modalities about Indian constitution.
2. Clarify the functioning of Indian parliamentary system at the center and state level.
3. Understand the aspects of Indian Legal System and its related bodies.
4. Apply different laws and regulations related to engineering practices.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	1	2	-	-	-	2
CO2	-	-	-	-	-	-	1	1	1	-	-	2
CO3	-	-	-	-	-	-	1	1	1	-	1	2
CO4	-	-	-	-	-	-	1	2	1	1	1	2

Unit 1	Basic Information about Indian Constitution	08 hours

Meaning of the constitution law and constitutionalism, Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947, Enforcement of the Constitution, Indian Constitution and its Salient Features, The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliamentary System, Federal System, Centre-State Relations, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency, and Local Self Government – Constitutional Scheme in India.

Unit 2	Union Executive and State Executive	08 hours

Powers of Indian Parliament Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Comparison of powers of Indian President with the United States, Powers and Functions of the Prime Minister, Judiciary – The Independence of the Supreme Court, Appointment of Judges, Judicial Review, Public Interest Litigation, Judicial Activism, Lok Pal, Lok Ayukta, The Lokpal and Lok ayuktas Act 2013, State Executives – Powers and Functions of the Governor, Powers and Functions of the Chief Minister, Functions of State Cabinet, Functions of State Legislature, Functions of High Court and Subordinate Courts.

Unit 3	Basic Information about Legal System	07 hours

The Legal System: Sources of Law and the Court Structure: Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law, Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court). Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration. Contract law, Tort, Law at workplace.

Unit 4	Election provisions, Emergency provisions, Amendment of the constitution	07 hours

Election Commission of India-composition, powers and functions and electoral process. Types of emergency-grounds, procedure, duration and effects. Amendment of the constitution- meaning, procedure and limitations

	Total Lecture Hours	30 hours

Textbook:

1. Brij Kishore Sharma: *Introduction to the Indian Constitution*, 8th Edition, PHI Learning Pvt. Ltd.
2. Granville Austin: *The Indian Constitution: Cornerstone of a Nation (Classic Reissue)*, Oxford University Press.
3. S.G Subramanian: *Indian Constitution and Indian Polity*, 2nd Edition, Pearson Education 2020.
4. Subhash C. Kashyap: *Our Constitution: An Introduction to India's Constitution and constitutional Law*, NBT, 2018.
5. Madhav Khosla: *The Indian Constitution*, Oxford University Press.
6. PM Bakshi: *The Constitution of India*, Latest Edition, Universal Law Publishing.
7. V.K. Ahuja: *Law Relating to Intellectual Property Rights* (2007)

8. Suresh T. Viswanathan: *The Indian Cyber Laws, Bharat Law House*, New Delhi-88
9. P. Narayan: Intellectual Property Law, Eastern Law House, New Delhi
10. Executive programme study material Company Law, Module II, by ICSI (The Institute of Companies Secretaries of India) (Only relevant sections i.e., Study 1, 4 and 36).https://www.icsi.edu/media/webmodules/publications/Company%20Law.pdf
11. Handbook on e-Governance Project Lifecycle, Department of Electronics & Information Technology, Government of India, https://www.meity.gov.in/writereaddata/files/e- Governance_Project_Lifecycle_Participant_Handbook-5Day_CourseV1_20412.pdf
12. Companies Act, 2013 Key highlights and analysis by PWC. https://www.pwc.in/assets/pdfs/publications/2013/companies-act-2013-key-highlights- and-analysis.pdf

Reference Books:

a) Keshav Anand Bharati V. State of Kerala, AIR 1973 SC 1461.
b) Maneka Gandhi V. Union of India AIR, 1978 SC 597.
c) S.R. Bammai V. Union of India, AIR 1994 SC 1918.
d) Kuldip Nayyar V. Union of India, AIR 2006 SC312.
e) A.D.M. Jabalpur V. ShivkantShakla, AIR 1976 SC1207.
f) Remshwar Prasad V. Union of India, AIR 2006 SC980.
g) Keshav Singh in re, AIR 1965 SC 745.
h) Union of India V. Talsiram, AIR 1985 SC 1416.
i) Atiabari Tea Estate Co.V. State of Assam, AIR 1961SC232.
j) SBP & Co. Vs. Patel Engg. Ltd. 2005 (8) SCC 618.
k) Krishna Bhagya Jala Nigam Ltd. Vs. G. Arischandra Reddy (2007) 2 SCC 720.
l) Oil & Natural Gas Corporation Vs. Saw Pipes Ltd. 2003 (4) SCALE 92 – 185.
m) Contemporary Newer case studies can be developed using AI tools
n) ** (Other relevant case studies can be consulted by the teacher as per the topic). Prescribed Legislations:
o) Information Technology Act, 2000 with latest amendments. **Compare this with GDPR of Europe**
p) RTI Act 2005 with latest amendments.
q) Information Technology Rules, 2000
r) Cyber Regulation Appellate Tribunal Rules, 2000 Suggested aid for Students and Pedagogic purpose
s) RSTV debates on corporate law, IPR and patent issues
t) NPTEL lectures on IPR and patent rights

Episodes of 10 -part mini TV series "Samvidhan: The Making of Constitution of India" by RSTV.

Mode of Evaluation:

MSE		CA			ESE	Total	
MSE	MSE2	CA1	CA2	CA4 (ATT)			
-	25	-	-	-	25	NC	
25		-					

Course Code: HS110L	Course Name: Aptitude-1	L	T	P	C
		1	0	0	1

Pre-requisite: NA

Course Objectives:

1. To provide adequate exposure to the students regarding the use of aptitude tests in the recruitment process and competitive examinations.
2. To improve the logical & numerical ability of the students.

Course Outcome: After completion of the course, the student will be able to

1. Illustrate their comprehension by solving the given problems
2. Apply the learned concepts to new problems and solve them aptly.
3. Make use of their thought process to interpret and draw inferences from the given data to reach logical conclusions.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	1	-	1	-	-	-	-	-	1
CO2	1	1	-	1	-	2	-	-	-	-	-	1
CO3	1	1	-	1	-	1	-	-	-	-	-	2

Unit 1	Series, Coding and Decoding	04 hours

Importance and overview of Quantitative Aptitude and Logical Reasoning, Number Series, Letter Series, Analogies, Coding and Decoding.		
Unit 2	**Data Arrangement**	**04 hours**
Ranking and Order, Direction Sense, Linear and Circular sitting arrangement.		
Unit 3	**Blood Relation and Puzzles**	**03 hours**
Basic concepts, definition and terminology related to blood relationships, Conversation-based blood relationships, Family Tree-based problems, Coded relationships and related puzzles.		
Unit 4	**Critical and Non-Verbal Reasoning**	**04 hours**
Statement arguments, course of action, classification and grouping of images, Figure series, Mirror image, Water image, Paper cutting, Paper folding, Embedded figures.		
	Total Lecture Hours	**15 hours**

Textbook:
1. A Modern Approach to Verbal & Non-Verbal Reasoning" by R.S. Aggarwal, S. Chand Publication.

Reference Books:
1. How to Prepare for Logical Reasoning for the CAT" by Arun Sharma, TMH Publication.

Mode of Evaluation:

CA			ESE	Total
CA1	CA2	CA3(ATT)		
10	10	5	25	50
25				

Course Code: HS111L	Course Name: Soft Skills Essentials-1	L	T	P	C
		1	0	0	NC

Pre-requisite:
i. Students should have foundational knowledge of grammar, vocabulary, and sentence structure to participate effectively in tasks like extempore, scenario writing after studying Communication skills subject in first year.
ii. Prior exposure to basic communication concepts (like verbal/non-verbal communication and listening skills) helps students to enhance persuasion, negotiation, and professional etiquette.

Course Objectives:

To develop students' communication, presentation, and interpersonal skills through interactive activities, elevating confidence and professionalism for academic and workplace success

Course Outcome: After completion of the course, the student will be able to

1. Demonstrate improved self-awareness and communication skills through structured presentations and vocabulary-building activities.
2. Apply effective verbal communication techniques, including pronunciation and elevator pitch delivery, to express ideas clearly and confidently.
3. Exhibit professional behaviour, grooming, and teamwork skills in group discussions, interviews, and workplace-related role plays.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	2	3	-	1
CO2	-	-	-	-	-	-	-	-	2	3	-	2
CO3	-	-	-	-	-	-	-	-	2	3	-	2

Unit 1	**Foundation of Communication and Self-Awareness**	**05 hours**
British Council-English Score Test, Team Presentations on Change Management Models, Presentations on Personality Profiling for professional growth		
Unit 2	**Verbal Communication and Clarity**	**04 hours**
Pronunciation Drill 1 & 2, Elevator Pitch Practice Session 1 & 2		
Unit 3	**Professionalism and Workplace Readiness**	**06 hours**
Professional Grooming and Etiquette, Group Discussion (General Topics), Panel Discussion on workplace scenarios using caselets		
	Total Lecture Hours	**15 hours**

Useful Resources:
- www.mindtools.com
- https://englishonline.britishcouncil.org/
- www.toastmasters.org
- https://www.futurelearn.com/

•English Score Test •Duo Lingo Test
Mode of Evaluation

MSE		CA			ESE	Total	
MSE1	MSE2	CA1	CA2	CA3(ATT)			
-	-	10	10	5			
-		25			25	50	

Course Code: EL106B	Course Name: Introduction to AI & ML	L	T	P	C
		2	0	2	3

Pre-requisite: Knowledge of Mathematics in Secondary Education and basic Programming skills

Course Objectives:
Provide core engineering students with a foundational understanding of artificial intelligence, machine learning, and reinforcement learning, with practical implementation skills using Python.

Course Outcome: After completion of the course, the student will be able to
1. Understand fundamental concepts of AI and implement basic search algorithms
2. Apply various machine learning algorithms to solve real-world problems
3. Develop deep learning models using modern frameworks
4. Implement reinforcement learning algorithms for decision-making problems
5. Create end-to-end machine learning projects using Python.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	-	-	-	2	1	-	2
CO2	3	3	3	3	3	-	-	-	2	1	-	2
CO3	3	3	3	3	3	-	-	-	2	1	-	2
CO4	3	3	3	3	3	-	-	-	2	1	-	3
CO5	3	3	3	3	3	2	2	-	2	1	-	3

Unit 1 **Introduction to Artificial Intelligence** **12 hours**

Introduction to Artificial Intelligence, Types of AI: Weak AI vs Strong AI, Problem Solving and Search Algorithms- State Space Search, Uninformed Search Strategies (BFS, DFS), Informed Search Strategies (A*, Best First Search)

Problems:
1. Write a program to simulate a simple rule-based chatbot using if-else or pattern matching.
2. Write a program to compare Weak AI and Strong AI through Tic-Tac-Toe and a basic Turing Test interface.
3. Write a program to generate and display the state space tree for the 8-puzzle problem up to a certain depth.
4. Write a program to implement Best First Search using a heuristic function to guide the search.
5. Write a program to implement the A* algorithm for pathfinding in a weighted graph or grid.

Unit 2 **Introduction to Machine Learning** **12 hours**

Fundamentals of Machine Learning, Supervised vs Unsupervised Learning, Training, Validation, and Testing. Data Preprocessing- Data Cleaning, Feature Scaling, Feature Selection, Handling Missing Values. Linear Regression and Logistic Regression

Problems:
1. Write a program to demonstrate the difference between Supervised and Unsupervised Learning using appropriate datasets.
2. Write a program that splits a dataset into training, validation, and test sets and prints their sizes.
3. Write a program to clean a dataset by removing duplicates, handling missing values, and encoding categorical features.
4. Write a program to apply feature scaling using StandardScaler and MinMaxScaler on numerical data.
5. Write a program to perform feature selection using correlation matrix and SelectKBest method.
6. Write a program to implement Linear Regression on a dataset and evaluate its performance using RMSE and R^2 score.

Unit 3 **Advanced Machine Learning Algorithms** **10 hours**

K-Means Clustering, Support Vector Machines- Linear and Non-linear SVM, Kernel Functions, Decision Trees and Random Forests,

Problems:
1. Write a program to implement K-Means clustering on a dataset and visualize the clusters.

2. Write a program to train a Linear SVM classifier on the Iris dataset and evaluate its accuracy.
3. Write a program to implement a Non-Linear SVM classifier using a radial basis function (RBF) kernel.
4. Write a program to demonstrate the effect of different kernel functions (linear, polynomial, RBF) on SVM performance.
5. Write a program to implement a decision tree classifier and visualize the decision tree

Unit 4	**Reinforcement Learning**	**13 hours**

Fundamentals of Reinforcement Learning- Markov Decision Processes, States, Actions, and Rewards, Value Functions and Policies. Q-Learning- Q-Table and Q-Function, Exploration vs Exploitation, Epsilon-Greedy Strategy. Applications in Gaming and Robotics

Problems:

- Write a program to simulate a simple Markov Decision Process (MDP) with 3 states and 2 actions. Show state transitions and rewards using a transition probability matrix.
- Write a program to implement Q-Learning for a small grid environment (e.g., 4x4 frozen lake). Use a Q-table to learn the best actions from each state.
- Write a program to compare the effect of different exploration strategies (greedy, epsilon-greedy, and softmax) on the learning process in Q-Learning.
- Write a program where an agent learns to play a simple game (e.g., Tic-Tac-Toe or a custom maze) using Q-learning
- Write a program to visualize how Q-values evolve over time in a simple environment using Epsilon-Greedy strategy with decay

Unit 5	**Deep Learning**	**13 hours**

Neural Networks Basics- Perceptron, Activation Functions, Backpropagation, Multi-layer Neural Networks, Introduction to Convolutional Neural Networks, Introduction to Recurrent Neural Networks- RNN Architecture, LSTM and GRU, Sequence Prediction. Deep Learning Frameworks- Introduction to TensorFlow, Model Building and Training.

Problems

- Write a program to implement a single-layer Perceptron for binary classification.
- Write a program to plot and compare common activation functions (Sigmoid, Tanh, ReLU, Leaky ReLU).
- Write a program to implement backpropagation in a multi-layer feedforward neural network from scratch.
- Write a program to build and train a neural network using TensorFlow's Keras API for a classification task.

	Total Lecture Hours	**60 hours**

Textbook:

1. S. Russell and P. Norvig, *Artificial Intelligence: A Modern Approach*, 4th ed. Upper Saddle River, NJ, USA: Pearson, 2020.
2. Géron, *Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow*, 3rd ed. Sebastopol, CA, USA: O'Reilly Media, 2022.
3. R. S. Sutton and A. G. Barto, *Reinforcement Learning: An Introduction*, 2nd ed. Cambridge, MA, USA: MIT Press, 2018.

Reference Books:

1. C. M. Bishop, *Pattern Recognition and Machine Learning*. New York, NY, USA: Springer, 2006.
2. Goodfellow, Y. Bengio, and A. Courville, *Deep Learning*. Cambridge, MA, USA: MIT Press, 2016.
3. S. Raschka and V. Mirjalili, *Python Machine Learning*, 2nd ed. Birmingham, UK: Packt Publishing, 2017.
4. T. Hastie, R. Tibshirani, and J. Friedman, *The Elements of Statistical Learning: Data Mining, Inference, and Prediction*, 2nd ed. New York, NY, USA: Springer, 2009.

Mode of Evaluation:

MSE		CA			ESE	Total
MSE1	MSE2	CA1	CA2	CA3(ATT)		
30	30	6	6	3	75	150
60		15				

Course Code: EE205E	**Course Name: Modelling Dynamic Systems and Physical Components using MATLAB**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**

Pre-requisite: NA

Course Objectives:

Aim to equip the students with the skills to model, simulate, and analyze dynamic physical systems using MATLAB and Simulink, with a focus on real-world vehicle applications.

Course Outcome: After completion of the course, the student will be able to

1. Explain the fundamentals and classification of dynamic systems and models.
2. Apply MATLAB programming and plotting techniques to simulate basic dynamic systems.
3. Develop dynamic system models using bond graphs and simulate using Simulink.
4. Design and simulate vehicle subsystems such as engine, drivetrain, and braking.
5. Interpret simulation data and evaluate the behavior of vehicle dynamic systems.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	2	2	2	-	-	-	-	2
CO2	2	-	2	-	2	2	2	-	2	-	-	2
CO3	3	-	3	2	3	2	2	-	2	-	-	2
CO4	3	2	3	3	3	2	2	-	2	-	-	2
CO5	3	2	3	3	3	2	2	-	2	-	-	2

Unit 1 | Fundamentals of Dynamic System and Modelling | 15 hours

Introduction to dynamic systems and need for modeling, Classification of Models- Scaled physical model, Mathematical model, Case study of passenger vehicle suspension system depicting model theories, Principles used in Modelling, Modeling of Dynamic systems, Transfer Function Models and State-space model, First and Second order, Need for Simulation.

Hands-on/Case Study/ Mini-Project/ Problem solving:

- Modeling and Simulation of a DC Motor Using State-Space Representation
- Simulink-Based Simulation of Dynamic Systems for Input Disturbance Analysis
- Simulation of a Quarter Car Suspension System Using Transfer Function Approach

Unit 2 | MATLAB as a Simulation Tool | 15 hours

Comparison of Analytical and Simulation methods, Types of Simulation – Continuous and Discrete Event, MATLAB as simulation tool, Demonstration of MATLAB Environment- Basics of MATLAB Programming and execution, Function statements and Plotting, Example- Modeling of Power window actuation system, solving equation using MATLAB, Introduction to Simulink – Blocks introduction, Mass-Spring-Damper system solving in MATLAB

Hands-on/Case Study/ Mini-Project/ Problem solving:

- Analytical vs. Simulation-Based Response of a Mass-Spring-Damper System Using MATLAB
- Introduction to MATLAB Programming: Solving Differential Equations and Plotting System Response

Unit 3 | Bond Graphs and Modeling systems in MATLAB | 15 hours

Bond Graph- Requirement, Advantages and Power Variables, Causality, Basic System Elements- electrical, mechanical and thermal, Simulation of models using Simulink, Sources→systems→sinks, building a Simulink model, simulation parameters, modifying subsystems parameters, simulation output.

Hands-on/Case Study/ Mini-Project/ Problem solving:

- Modeling and Simulation of an Electro-Mechanical System Using Bond Graphs and Simulink
- Parameter Modification and Output Analysis of Bond Graph-Based Dynamic Models in Simulink

Unit 4 | Modeling and Simulation of Vehicle Subsystems Using Simulink | 15 hours

Vehicle Dynamics overview- Lateral and Longitudinal dynamics, vehicle as a multi-body dynamic system, modeling longitudinal vehicle dynamics, Simulink model for vehicle acceleration/deceleration including acting forces, Vehicle subsystem to simulate- Braking system model, Engine and drivetrain system model using Simulink.

Hands-on/Case Study/ Mini-Project/ Problem solving:

- Simulation of Engine and Drivetrain Subsystem Dynamics in a Vehicle Using Simulink
- Braking System Simulation: Force Analysis and Vehicle Response Using Simulink
- Vehicle as a Multi-Body Dynamic System: Integrated Subsystem Modeling in Simulink

Unit 5 | Interpretation of Results | 15 hours

Interpreting the results derived of various Vehicle Models simulated using Simulink, Data Logging and Analysis, Hands on Experience, Results Presentation

Hands-on/Case Study/ Mini-Project/ Problem solving:

- Data Logging and Performance Analysis of Vehicle Acceleration and Braking in Simulink
- Real-Time Data Monitoring and Logging for a Vehicle Suspension System in Simulink

Total Lecture Hours | 75 hours

Textbook:

1. W. J. Palm III, System Dynamics. New York, NY, USA: McGraw-Hill, 2005
2. D. C. Karnopp, D. L. Margolis, and R. C. Rosenberg, System Dynamics: Modeling, Simulation, and Control of Mechatronic Systems, 5th ed. Hoboken, NJ, USA: Wiley, 2012.

Reference Books:

1. W. J. Palm III, System Dynamics. New York, NY, USA: McGraw-Hill, 2005.
2. Tewari, Modern Control Design with MATLAB and Simulink. Hoboken, NJ, USA: Wiley, 2007.
3. K. Ogata, Modern Control Engineering, 5th ed. Upper Saddle River, NJ, USA: Prentice Hall, 2009.
4. H. Klee and R. Allen, Simulation of Dynamic Systems with MATLAB and Simulink, 2nd ed. Boca Raton, FL, USA: CRC Press, 2011.

Mode of Evaluation:

MSE		CA			ESE	Total
MSE1	MSE2	CA1	CA2	CA3(ATT)		
40	40	8	8	4	100	200
80		20				

Course Code: EE207E	Course Name: Sensors & Automation Essentials	L	T	P	C
		3	0	2	4

Pre-requisite: NA

Course Objectives:

Aim to give exposure to the students about Sensors & Automation which are required in industry.

Course Outcome: After completion of the course, the student will be able to

1. Understand the PLC, Communication protocol role in industrial automation and role of IIOT gateways.
2. Understand the PLC panel electrical wiring on PLC Analog and digital cards.
3. Apply the Role of industrial gateways in IIOT.
4. Develop the real time application covering of IIOT.
5. Establish Communication between two industrial devices.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	2	2	2	-	-	-	-	2
CO2	2	-	2	-	2	2	2	-	2	-	-	2
CO3	3	-	3	2	3	2	2	-	2	-	-	2
CO4	3	2	3	3	3	2	2	-	2	-	-	2
CO5	3	2	3	3	3	2	2	-	2	-	-	2

Unit 1 | Introduction Industrial Automation & IIOT | 15 hours

Types of Industrial Automation Factory & Process automation, Hierarchy involved Field to operating level, Internal structure of PLC (Internal electronics) and their IP ratings, Selection criteria of PLC, Communication protocol role in industrial automation, Role of IIOT gateways, PLC programming Languages, data types in PLC (real time application based Digital number system), practical application based on digital logic gates.

Hands-on/Case Study/ Mini-Project/ Problem solving:

- Study and Simulation of Industrial Automation Hierarchies: From Field Devices to Control Rooms
- Digital Logic Gate Implementation and Real-Time PLC Programming Using Ladder Logic

Unit 2 | Digital & Analog signal types in PLC | 15 hours

Pheonix PLC panel electrical wiring on PLC Analog and digital cards, covering how digital & analog signal processing with analog signal scaling with real time application (covering temperature & pressure transmitter). CAD and SLD drawing reading as per application.

Hands-on/Case Study/ Mini-Project/ Problem solving:

- Wiring and Testing of Phoenix PLC Digital and Analog I/O Cards for Real-Time Applications
- Analog Signal Conditioning and Processing: Interfacing with Phoenix PLC Analog Cards

Unit 3 | Communication protocols in IIOT | 15 hours

Role of industrial gateways in IIOT, discussing key protocols Modbus TCP-IP, RS-232, RS-485, Profinet Profibus, and web data sharing protocols like MQTT etc.

Hands-on/Case Study/ Mini-Project/ Problem solving:

- Experimenting with Modbus TCP/IP Communication via Industrial Gateways
- RS-485 to MQTT Data Transmission: A Hands-On Approach
- Integrating Profibus and Profinet Networks Using Industrial Gateways
- Cloud Data Sharing via MQTT: Real-Time Monitoring in IIoT
- RS-232 to Cloud Integration: Leveraging Industrial Gateways for IIoT

Unit 4 | Sensor & Instrumentation Interfacing with PLC | 15 hours

Sensor & Instrumentation Interfacing with PLCs, Sensor Signal Conditioning and Interfacing Techniques (Interfacing techniques (sink/source wiring, voltage/current input, relay outputs), Real-world applications: motor control, process automation.

Hands-on/Case Study/ Mini-Project/ Problem solving:

- Sensor and Instrumentation Interfacing with PLCs in Industrial Automation
- Signal Conditioning Techniques for Sensor Integration with PLCs
- Understanding Sink/Source Wiring and Voltage/Current Input in PLC Systems
- Motor Control Applications Using PLCs in Industrial Automation
- Real-World Process Automation: PLC-Based Control of Temperature, Pressure, and Flow

Unit 5	**Application Development**	**15 hours**

Developing real time application covering all above topics (like analog digital processing with analog signal scaling), Establishing communication between two industrial devices.

Hands-on/Case Study/ Mini-Project/ Problem solving:

- Developing a Real-Time PLC Application for Analog and Digital Signal Processing
- Establishing Communication Between Industrial Devices: A Real-Time PLC-Based System
- Analog Signal Scaling and Digital Processing in Real-Time Industrial Applications
- Designing a Real-Time Motor Control System Using PLCs and Sensor Integration
- Building a Real-Time Process Automation System with PLC Communication and Signal Conditioning

Total Lecture Hours	**75 hours**

Textbook:

1. V. Kumar, *Getting Started with S7-1200*. Siemens Automation, 2017.

Reference Books:

1. J. W. Webb and R. A. Reis, *Programmable Logic Controllers: Principles and Applications*, 5th ed. Upper Saddle River, NJ, USA: Prentice Hall, 2002.
2. R. Singh, *SCADA for Engineers*, New Delhi, India: KHANNA Publishing, 2016.
3. R. Srinivasan, *PLC and SCADA for Beginners*, Chennai, India: Technical Publications, 2020.

Mode of Evaluation:

MSE		**CA**			**ESE**	**Total**
MSE1	**MSE2**	**CA1**	**CA2**	**CA3(ATT)**		
40	40	8	8	4	**100**	**200**
80		**20**				

Course Code: HS112L	**Course Name: Universal Human Values**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Pre-requisite: NA

Course Objectives:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content, and process of value education.
2. To help students initiate a process of dialog within themselves to know what they really want to be in their life and profession
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.

Course Outcome: After completion of the course, the student will be able to

1. Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content, and process of value education, explore the meaning of happiness and prosperity, and do a correct appraisal of the current scenario in the society.
2. Distinguish between the Self and the Body, and understand the meaning of Harmony in the Self and the Co-existence of Self and Body.
3. Understand the value of harmonious relationships based on trust, respect, and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society.
4. Understand the harmony in nature and existence, and workout their mutually fulfilling participation in nature.
5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**

CO1	-	-	-	-	-	2	2	2	1	-	1	1
CO2	-	-	-	-	-	2	2	2	1	-	1	1
CO3	-	-	-	-	-	2	2	2	1	-	1	1
CO4	-	-	-	-	-	2	2	2	1	-	1	1
CO5	-	-	-	-	-	2	2	3	1	-	1	1

Unit 1	**Introduction to Value Education**	**10 hours**

Understanding the need, basic guidelines, content, and process for Value Education, Self- Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation –as the mechanism for self-exploration, Continuous Happiness, and Prosperity-A look at basic Human Aspirations, Right understanding, Relationship, and Physical Facilities-the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly – A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Unit 2	**Understanding Harmony in the Human Being**	**10 hours**

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

Unit 3	**Understanding Harmony in the Family and Society**	**10 hours**

Harmony in Human-Human Relationship Understanding harmony in the Family-the basic unit of human interaction, Understanding values in the human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect(Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in a relationship, Understanding the harmony in the society (society being an extension of the family): Samadhan, Samridhi, Abhay, Sah- astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha) – from family to world family!

Unit 4	**Understanding Harmony in Nature and Existence**	**09 hours**

Whole existence as Co-existence Understanding the harmony in Nature, Inter connectedness, and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all- pervasive space, Holistic perception of harmony at all levels of existence.

Unit 5	**Implications of the above Holistic Understanding of Harmony on Professional Ethics**	**06 hours**

Natural acceptance of human values, Definiteness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics.

	Total Lecture Hours	**45 hours**

Textbook:

1. R Gaur, R Asthana, G P Bagaria, 2019 (2nd Revised Edition), A Foundation Course in Human Values and Professional Ethics. ISBN 978-93-87034-47-1, Excel Books, New Delhi.

Reference Books:

1. Ivan Illich, Energy & Equity, The Trinity Press, Worcester and Harper Collins, USA,1974.
2. E.F. Schumacher, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain,1973.
3. A Nagraj, Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak 1998.
4. P L Dhar, RR Gaur, Science and Humanism, Commonwealth Publishers 1990.

Mode of Evaluation

MSE		**CA**			**ESE**	**Total**
MSE1	**MSE2**	**CA1**	**CA2**	**CA3 (ATT)**		
30	**30**	**6**	**6**	**3**		
60		**15**			**75**	**150**

Course Code: HS113L	**Course Name: Aptitude-2**	**L**	**T**	**P**	**C**
		1	**0**	**0**	**1**

Pre-requisite: NA

Course Objectives:

1. To provide adequate exposure to the students regarding the use of aptitude tests in the recruitment process and competitive examinations.

2. To improve the logical & numerical ability of the students.

Course Outcome: After completion of the course, the student will be able to

1. Illustrate their comprehension by solving the given problems
2. Apply the learned concepts to new problems and solve them aptly.
3. Make use of their thought process to interpret and draw inferences from the given data to reach logical conclusions.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	1	-	1	-	-	-	-	-	1
CO2	1	1	-	1	-	2	-	-	-	-	-	1
CO3	1	1	-	1	-	1	-	-	-	-	-	2

Unit 1	**Analytical Reasoning & Logical Puzzles**	**04 hours**

Definition and Introduction of Concept and Relation of Cube and Cuboids, Cut the cube in different layer and then solve questions accordingly. Problems related with open and closed dice.

Unit 2	**Syllogism**	**03 hours**

Understanding of Venn diagram, Problems related with Venn diagram, Statement and Conclusion, Syllogism and reverse syllogism.

Unit 3	**Clock and Calendar**	**04 hours**

Definition and Introduction of Concept and Relation of angle and time, Overtaking, overlapping, right-angle and straight Angle with respect to time, Error in clock (faster and slower), Correct time of clock, Mirror and Water Image of clock, Introduction of Calendar, Concept of Normal and Leap Year, Finding Odd days, Finding the day of the week of given date with and without reference.

Unit 4	**Data Interpretation and Critical Reasoning**	**04 hours**

Tables (Understand of Table, Fillers in table), **Line Graph** (Understand the graph, Percentage change, Ratio based comparison), **Bar Graph** (Type of Bar Graph, Average and Comparison, Stacked Bar Graph), **Pi Chart** (Conversion of Percentage and Degree, Fillers in Pie chart, Multiple Pie chart), **Mixed Graph (problems** related with combination of various charts**) Critical Reasoning**: Assumptions, Cause and Effect, Assertion and Reason, Statement and Inference

Total Lecture Hours	**15 hours**

Useful resources:

1. "A Modern Approach to Verbal & Non-Verbal Reasoning" by R.S. Aggarwal, S. Chand Publication.
2. https://www.geeksforgeeks.org/most-important-aptitude-topics-for-placements/

Reference Books:

1. "How to Prepare for Logical Reasoning for the CAT" by Arun Sharma, TMH Publication.
2. https://www.indiabix.com/logical-reasoning/questions-and-answers/
3. https://testbook.com/placement-aptitude/test-series

Mode of Evaluation

MSE		CA			ESE	Total
MSE1	MSE2	CA1	CA2	CA3 (ATT)		
-	-	10	10	5		
-		25			25	50

Course Code: HS114L	Course Name: Soft Skills Essentials 2	L	T	P	C
		1	0	0	NC

Pre-requisite:

- Successful completion of the subject 'Soft Skills Essentials-1' of the third semester.

Course Objectives:

To strengthen students' professional communication, cultural intelligence, and emotional awareness through advanced speaking activities, scenario-based discussions, and digital literacy tasks, equipping them for diverse workplace interactions.

Course Outcome: After completion of the course, the student will be able to

1. Apply advanced communication strategies that include vocabulary enhancement, storytelling to improve their cultural sensitivity (DEI).
2. Demonstrate prompt writing for AI-based tools and create effective elevator pitches to convey ideas with clarity and impact.
3. Exhibit interpersonal effectiveness by navigating negotiation, persuasion, and emotional intelligence in professional contexts

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	-	-	1	3	-	2
CO2	-	-	-	-	-	-	-	-	1	3	-	2

CO3	-	-	-	-	-	1	-	-	1	3	-	2

Unit 1	**Advanced Communication and Cultural Sensitivity**	**7 hours**
Vocabulary Enhancement through Gamification, Story Coining and Presentations Understanding Cross-Cultural, Communication (DEI) using Case Studies, Duo Lingo English Proficiency Tests		
Unit 2	**Professional Expression and Digital Literacy**	**4 hours**
TMAY through Driver's test, Writing Effective Prompts on Various LLMs, Duo Lingo English Proficiency Tests		
Unit 3	**Interpersonal Effectiveness and Emotional Intelligence**	**4 hours**
Negotiation & Persuasion Role Plays, Developing Emotional Intelligence via Scenario-Based Discussions		
	Total Lecture Hours	**15 hours**

Useful Resources:

1. https://youtu.be/5Wr-uaGzY7c
2. https://youtu.be/NcCwlqBapHo
3. https://youtu.be/SKNmQPIBPIg
4. RAISEC - B. Tech. MCA - Introduction
5. RAISEC - B. Tech. MCA - Social Personality Type
6. RAISEC - B. Tech. MCA - Enterprising Personality Type
7. RAISEC - B. Tech. MCA - Conventional Personality Type

Mode of Evaluation

MSE		CA			ESE	Total	
MSE1	**MSE2**	**CA1**	**CA2**	**CA3**			
-	-	**10**	**10**	**5**			
-		**25**			**25**	-	

Course Code: EE206E	**Course Name: Integration of Systems of EVs**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**

Pre-requisite: NA

Course Objectives:

Aim to equip the students with the skills to understand the system level architecture and integration of EV systems

Course Outcome: After completion of the course, the student will be able to

1. Identify key components and subsystems of an Electric Vehicle (EV), including the battery, motor, inverter, VCU, and charger.
2. Explain the functional role and interaction of EV subsystems such as battery packs, motors, controllers, and communication protocols.
3. Analyze EV powertrain performance and control architecture using software tools like ADVISOR, MATLAB, and CANalyzer.
4. Evaluate trade-offs in battery chemistry, BMS topologies, and subsystem integration choices based on functional and efficiency criteria.
5. Design a simplified EV subsystem integration framework using hardware-software interfacing, communication protocols, and control logic.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	2	2	2	-	-	-	-	2
CO2	2	-	2	-	2	2	2	-	2	-	-	2
CO3	3	-	3	2	3	2	2	-	2	-	-	2
CO4	3	2	3	3	3	2	2	-	2	-	-	2
CO5	3	2	3	3	3	2	2	-	2	-	-	2

Unit 1	**EV Systems Architecture and Requirements**	**15 hours**

Overview of EV systems and subsystems, Electric Vehicles in India, Forces acting when a vehicle move, Power and Torque calculations, Concept of Drive Cycle- Indian Drive Cycle and associated calculations, EV subsystem – Design of EV drive train.

Hands-on/Case Study/ Mini-Project/ Problem solving:

- Case Study of Forces acting on a Nissan Magnite
- Indian Drive Cycle – Excel Sheet Calculation to various drive scenarios.

Unit 2	Battery and Powertrain Subsystems Integration	15 hours

Introduction to batteries parameters, Cells and Batteries, Lithium-ion battery and Sodium Ion battery- Terminologies and Working, Parameters for selecting the cell chemistry, cell form factors, Parameters for designing battery pack configuration, Battery Management System, BMS Topology – Centralized, Master and Slave, Modular and Distributed, Introduction to Electric Powertrain.

Hands-on/Case Study/ Mini-Project/ Problem solving:

- ADVISOR Tool Demonstration and conclusion.
- Case Study of White Paper – How Cells are Manufactured.
- Understanding Cell Data Sheet
- EV Database Website Demonstration

Unit 3	Electric Powertrain	15 hours

Components of an Electric Powertrain: Electric motors, Power electronics, Battery systems, Understanding Requirements from EV powertrain- Vehicle Load forces, Power, Energy and Speed relationships, Aerodynamic Drag, Rolling Resistance and Gradeability, Example- Tesla Model S (2013) and E-Rickshaw power demand Calculations, Battery Electric Vehicle Range at Constant Speed, Vehicle Acceleration- Traction Motor Characteristics, 2015 Nissan Leaf Rated Speed, Simplified Traction Machine Torque-Speed Characteristic (MATLAB Script Code)

Hands-on/Case Study/ Mini-Project/ Problem solving:

- Case Study of Force calculations of Nissan Micra
- Simplified Machine Torque-Speed Characteristics of a Motor (MatLaB Script Code Demonstration)

Unit 4	Fundamental of Control System Integration	15 hours

Microprocessor Architecture: Internal architecture of microprocessors, Key components: ALU, registers, control unit, Memory Interfacing: Addressing schemes and memory organization, Interfacing with RAM and ROM in automotive applications, Input/Output Interfacing: Basics of I/O interfacing, 8086 and 8087 microprocessors

Hands-on/Case Study/ Mini-Project/ Problem solving:

- CANalyzer – Case Study

Unit 5	Communication Protocols	15 hours

Controller Area Network (CAN) Protocol: Basics of the CAN protocol, Message format, Bus Arbitration, CAN in-vehicle networking for communication between ECUs, LIN (Local Interconnect Network) and Flex Ray-Overview of LIN and Flex Ray protocols, Applications and advantages in automotive systems-LIN in Interior Lighting control, FlexRay in Advanced Driver Assistance Systems (ADAS)

Hands-on/Case Study/ Mini-Project/ Problem solving:

- CAN Cable Demonstration

	Total Lecture Hours	75 hours

Textbook:

1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles by Mehrdad Ehsani, Yimin Gao, Ali Emadi, Crc Press
2. The 8051 Microcontrollers: Architecture, Programming and Applications By Kenneth J Ayala, Cengage India Private Limited

Reference Books:

1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles by Mehrdad Ehsani, Yimin Gao, Ali Emadi, Crc Press

Mode of Evaluation:

MSE		CA			ESE	Total
MSE1	MSE2	CA1	CA2	CA3(ATT)		
40	40	8	8	4	100	200
80		20				

Course Code: EE208E	Course Name: Integration of SCADA and PLC with IIOT Gateways	L	T	P	C
		3	0	2	4

Pre-requisite: NA

Course Objectives:

Aim to give exposure to the students about Sensors & Automation which are required in industry.

Course Outcome: After completion of the course, the student will be able to

1. Understand the types of SCADA and Data sharing between PLC.
2. Understand the Real-time Data Analytics in SCADA Systems using IIoT Edge Devices.
3. Apply the IIoT-Enabled Data Interfacing for ERP Systems.
4. Apply the data types involved in PLC & IIOT Gateway
5. Develop the real time application covering of IIOT.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	2	2	2	-	-	-	-	2
CO2	2	-	2	-	2	2	2	-	2	-	-	2
CO3	3	-	3	2	3	2	2	-	2	-	-	2
CO4	3	2	3	3	3	2	2	-	2	-	-	2
CO5	3	2	3	3	3	2	2	-	2	-	-	2

Unit 1	Introduction SCADA	15 hours

Introduction to SCADA, SCADA software types, Tags concepts of SCADA, SCADA programming along with report generation using VB scripting. Data sharing between PLC and SCADA software.

Hands-on/Case Study/ Mini-Project/ Problem solving:

- SCADA Programming and Simulated Report Generation using VB Scripting
- Simulated Data Exchange Between Virtual PLC and SCADA

Unit 2	Real-time Data Analytics in SCADA Systems using IIoT Edge Devices	15 hours

Designing a hybrid SCADA-IIOT architecture, Real-time Data Analytics Techniques, how edge devices communicate with SCADA and cloud., Data formats (JSON, XML).

Hands-on/Case Study/ Mini-Project/ Problem solving:

- Design and Simulation of a Hybrid SCADA-IIoT Architecture
- Implementation of Cloud Connectivity in SCADA via IoT Gateways
- Data Format Handling and Parsing: JSON vs XML in IIoT Applications
- Edge Device Communication with SCADA and Cloud via MQTT Protocol

Unit 3	IIoT-Enabled Data Interfacing for ERP Systems	15 hours

Architecture overview: Edge device → Gateway → ERP system (How data moves from sensors/machines to ERP via IIoT gateways), Types of data shared (e.g., machine status, production metrics, energy consumption)., Benefits of energy monitoring system.

Hands-on/Case Study/ Mini-Project/ Problem solving:

1. Simulating Edge-to-ERP Data Flow in a SCADA-IIoT Architecture
2. Role and Simulation of IIoT Gateways in Industrial Communication
3. Design and Simulation of an Energy Monitoring System

Unit 4	Data Types involved in PLC & IIOT Gateway	15 hours

Boolean (Binary Data), Integer, Float / Real, String (Device names, status messages, error codes, configuration parameters), Date Time / Timestamp.

Hands-on/Case Study/ Mini-Project/ Problem solving:

1. Handling Boolean (Binary) Data for Machine Status and Control
2. Transmission and Logging of Integer and Float Data in SCADA-IIoT
3. Using Strings in SCADA for Device Identification and Messaging

Unit 5	Application Development	15 hours

Developing real time application covering all above topics (Edge device → Gateway → ERP system)

Hands-on/Case Study/ Mini-Project/ Problem solving:

1. Real-Time Data Analytics and Visualization using Dashboards
2. Simulation of Edge Device Data Generation Using Multiple Data Types
3. Simulating Data Exchange from Gateway to ERP System

Total Lecture Hours	75 hours

Textbook:

1. S. K. Singh, *Industrial Automation and Control*. New Delhi, India: McGraw Hill, 2016.
2. S. Jeschke, C. Brecher, H. Song, and D. B. Rawat, *Industrial Internet of Things: Cyber manufacturing Systems*. Cham, Switzerland: Springer, 2017.

Reference Books:

1. S. G. McCrady, *Designing SCADA Application with VB and Database*. Oxford, UK: Elsevier, 2006.
2. R. Buyya and A. V. Dastjerdi, *Internet of Things: Principles and Paradigms*. Cambridge, MA, USA: Morgan Kaufmann, 2016.
3. S. A. Boyer, *SCADA: Supervisory Control and Data Acquisition*, 4th ed. Durham, NC, USA: ISA, 2009.
4. T. Winters, *Practical Industrial Internet of Things (IIoT): A Guide to Smart Manufacturing and Industry 4.0*. Birmingham, UK: Packt Publishing, 2020.

Mode of Evaluation:

MSE		CA			ESE	Total
MSE1	MSE2	CA1	CA2	CA3(ATT)		

	40	40	8	8	4	**100**	**200**	
	80		**20**					

Course Code: ME205L	**Course Name: Applied Thermodynamics**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

Prerequisite:
Student should have the understanding of basics of thermodynamics including laws, processes, heat and work, entropy, steam and its properties, etc.

Course Objectives:

1. This course aims to provide a good platform to mechanical engineering students to understand, model and appreciate concept of dynamics involved in thermal energy transformation.
2. To prepare them to carry out experimental investigation and analysis on thermal devices.

Course Outcome: After completion of the course, the student will be able to

1. Analyze the process of combustion of fuel and formation of flue gases.
2. Analyze the vapor power cycles and understand the working of steam turbines.
3. Understand the working and performance of boiler, draught and condenser.
4. Analyze the design and working of steam nozzles and compressors.
5. Understand the principle, working & performance of gas turbines and jet propulsion.

COPO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	1	-	-	1	-	2
CO2	3	3	2	2	-	-	1	-	-	1	-	2
CO3	2	2	1	2	-	-	-	-	-	1	-	2
CO4	3	3	-	1	-	-	-	-	-	1	-	2
CO5	2	2	-	-	3	-	-	-	-	1	-	2

Unit 1	**Fuel and Combustion**	**09 hours**

Introduction to solid, liquid and gaseous fuels– Calorific Value, Stoichiometry, Combustion Equation for Hydrocarbon Fuel, Determination of Excess Air Supplied, Adiabatic flame temperature, Bomb Calorimeter and Orsat Apparatus.
Exhaust gas analysis First law analysis of combustion reactions Heat calculations using enthalpy tables, Conversion of Volumetric Analysis to Mass Analysis, Determination of Percentage Carbon in Fuel Burning to CO And CO2.

Unit 2	**Vapour Power Cycles & Steam Turbines**	**09 hours**

Vapour Power cycles: Vapor power cycles Rankine cycle with superheat, reheat and regeneration, exergy analysis. Effect of pressure and temperature on Rankine cycle, Reheat cycle, Regenerative cycle, Feed water heaters, Binary vapour cycle, Combined cycles, Cogeneration.
Steam Turbines: Classification of steam turbine, Impulse and Reaction turbines, Staging, Stage and Overall efficiency, reheat factor, Bleeding, Velocity diagram of simple and compound multistage impulse and reaction turbines and related calculations, work done, efficiencies of reaction, Impulse reaction turbines, state point locus, Losses in steam turbines, Governing of turbines, Comparison with steam engine.

Unit 3	**Boilers and Condensers**	**09 hours**

Boilers: Classification of boilers, boiler mountings and accessories; draft systems, circulation system; combustion and its calculations, and boiler performance. Condenser: Classification of condenser, air leakage, condenser performance parameters, Cooling Towers and Applications. Case Study on prevention of scales and corrosion in a power plant.

Unit 4	**Steam Nozzles and Compressors**	**09 hours**

Steam and Gas Nozzles: Types of nozzles, flow of steam through nozzles; condition for maximum discharge through nozzle; nozzle efficiency, effect of friction and supersaturated flow through nozzle.
Compressors: Compression Processes, Work of Compression, SingleStage Reciprocating Air Compressor, Volumetric Efficiency, MultiStage Compression, Rotary Compressors.

Unit 5	**Gas Turbines & Jet Propulsion**	**09 hours**

Gas Turbine: Gas turbine classification, Brayton cycle, Principles of gas turbine, Gas turbine cycles with intercooling, reheat and regeneration and their combinations, Fundamentals of gas dynamics, energy equation, stagnation properties, isentropic flow through nozzle and diffusers, Introduction to shock waves
Jet Propulsion: Introduction to the principles of jet propulsion, Turbojet and turboprop engines and their processes, Principle of rocket propulsion, Introduction to Rocket Engine, case studies related to jet engine.

	Total Lecture Hours	**45 hours**

Textbook:

1. Basic and Applied Thermodynamics by P.K. Nag, McGraw Hill India.
2. Applied Thermodynamics by Onkar Singh, New Age International.
3. Applied Thermodynamics for Engineering Technologists by Eastop, Pearson Education.
4. Applied Thermodynamics by Venkanna and Swati, PHI.

Reference Books:

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.
2. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice Hall of India.
3. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.
4. Theory of Steam Turbine by W. J. Kearton.

Mode of Evaluation (Theory):

Evaluation Scheme						
MSE		CA			ESE	Total Marks
MSE 1	MSE 2	CA1	CA2	CA3 (ATT.)		
40	40	8	8	4	100	200
80		20				

Course Code:ME301L	Course Name: Mechanics of Solids	L	T	P	C
		3	1	0	4

Pre-requisite: 1. Engineering Mechanics
2. Engineering Mathematics

Course Objectives:

1. Understand fundamental principles of solid mechanics.
2. Analyze stress, strain, and deformation in solid materials.
3. Evaluate structural elements under various loading conditions.
4. Study factors affecting structural stability and failure.
5. Apply solid mechanics concepts to real-world engineering problems.

Course Outcome: After completion of the course, the student will be able to

1. Apply principles to analyze material behavior under axial loads, temperature variations, and complex stress systems.
2. Analyze and design beams and shafts under pure bending and torsion, considering cross-sectional geometry and material properties.
3. Analyze beam deflection and slope, and assess the stability of columns and struts under different loading conditions.
4. Calculate deflection and stress in helical and leaf springs; analyze stresses and strains in thin/thick cylinders under internal pressure.
5. Analyze stresses in curved beams and crane hooks; assess deflection and shear center in unsymmetrical bending.

CO-PO Mapping(Scale1:Low,2:Medium,3:High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	-	-	-	-	-	1	-	3
CO2	3	2	3	3	-	-	-	-	-	1	-	3
CO3	3	2	2	3	-	-	-	-	-	1	-	3
CO4	3	2	3	3	-	-	-	-	-	1	-	3
CO5	3	3	3	3	-	-	-	-	-	1	-	3

Unit1	Introduction to Mechanics of Materials and Stress Analysis	09 hours

Simple Stresses & Strains - Stress and Strain and their types, Hook's law, longitudinal and lateral strain, Poisson's ratio, stress-strain diagram for ductile and brittle materials, elasticity and plasticity, working stress, factor of safety, relation between elastic constants, Young's modulus of elasticity, modulus of rigidity and bulk modulus, temperature stress and strain calculations due to axial load and variation of temperature in single and compound bars, concept of strain gauges and rosettes, strain energy and impact strength

Case Study: *"Stress and Strain Analysis of an Axle Under different Loading Conditions"*

Compound Stresses & Strains - Two-dimensional stress system, principal stresses and principal planes, Mohr's circle of stress. Generalized Hook's law, principal stresses related to principal strains, Theories of failures their significance, comparison and application

Case Study:*"Analysis of a Pressure Vessel Using Mohr's Circle "*		
Unit 2	**Bending and Torsion of Beams and Shafts**	**09 hours**
Theory of pure bending* –** Assumptions in the simple bending theory, derivation of pure bending formula, its application to beams of rectangular, circular and channel sections, Section modulus, flexural rigidity, shear stresses in beams due to transverse and axial loads, Shear stress distribution in rectangular, circular, I section, Composite/flitched beams ***Case Study:*"Structural Analysis of a Beam Under Bending and Shear Loads"* ***Theory of pure torsion*** – Derivation of Torsion equations, Assumptions made in the theory of pure torsion, Torsion moment of resistance, Polar section modulus, Power transmitted by shafts, combined bending & torsion of solid & hollow shafts. ***Case Study:*** *"Design and Stress Analysis of a Transmission Shaft"*		
Unit 3	**Structural Analysis and Stability**	**09 hours**
Slope and deflection –Relationship between moment, slope and deflection, Moment area method, Macaulay's method, application of these methods to calculate slope and deflection for determinant beams ***Case Study:*** *"Deflection Analysis of Beams Using Macaulay's Methods"* ***Columns and Struts* –** Eccentric loading, combined direct and bending stresses, long and short columns, ideal strut, Euler's formula for crippling load for columns of different ends, concept of equivalent length, buckling of Columns, slenderness Ratio end conditions, Rankine formulae and other empirical relations ***Case Study:*** *"Buckling Analysis of Columns"*		
Unit 4	**Spring Analysis and Cylinder Stresses**	**09 hours**
Springs - Analysis of helical springs under axial load and under axial twist simultaneously both for open and closed coiled springs, Leaf spring deflection and bending stresses. ***Case Study****: "Stress Analysis of Helical Springs used in Automotive Suspension Systems"* **Thin and Thick Cylinders -** Derivation of formulae and calculations of hoop stress, longitudinal stress in a thin cylinder and thin sphere subjected to internal pressure, maximum shear stress, circumferential and longitudinal strains, Derivation of Lame's equations, calculation of radial longitudinal and hoop stresses and strains due to internal pressure in thick cylinders, compound cylinders ***Case Study:*** *"Stress Analysis of Thin-Walled Pressure Vessels"*		
Unit 5	**Curved Beams and Unsymmetrical Bending Analysis**	**09 hours**
Curved Beams* -** Bending of beams with large initial curvature, position of neutral axis for rectangular, trapezoidal and circular cross sections, stress in rectangular, trapezoidal and circular cross sections subjected to tension or compression ***Case Study: *"Stress Analysis in circular cross sections Using Curved Beam Theory"* ***Unsymmetrical Bending*** - Properties of beam cross-section, slope of neutral axis, stress and deflection in unsymmetrical bending for beam subjected to inclined loads having symmetrical sections, shear center and its importance ***Case Study:*** *"Unsymmetrical Bending Analysis of beam with Inclined Loading"*		
	Total Lecture Hours	**45 hours**

Textbook:

1. Mechanics of Materials by Ferdinand P. Beer, E. Russell Johnston Jr., John T. DeWolf, and David F. Mazurek
2. Strength of Materials by R.S. Khurmi and S. Chand
3. Strength of Materials: Mechanics of Solids by S.S. Bhavikatti
4. Strength of Materials" by Andrew Pytel and Ferdinand L. Singer

Reference Books:

1. Mechanics of Materials: An Introduction to the Mechanics of Elastic and Plastic Deformation of Solids and Structural Materials by E.J. Hearn
2. Strength of Materials: A Unified Theory by Albert C.J. Luo
3. Mechanics of Materials: An Integrated Approach by Timothy A. Philpot
4. Strength of Materials: A Unified Theory by Albert C.J. Luo

Mode of Evaluation (Theory):

Evaluation Scheme						
MSE		**CA**			**ESE**	**Total Marks**
MSE 1	**MSE 2**	**CA1**	**CA2**	**CA3 (ATT)**		
40	40	8	8	4	**100**	**200**
80		**20**				

Course Code: ME206L	**Course Name: Manufacturing Technology II**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

Prerequisite: NA

Course Objectives:

1. This course will provide students a practical and theoretical knowledge of machine tools and metal cutting.
2. This course will provide students understanding of Metal joining Processes.

3. This course will provide students a practical as well as theoretical knowledge of nontraditional machining processes

Course Outcome: After completion of the course, the student will be able to

1. Apply the basic concept of metal cutting and tooling.
2. Understand the working of machine tools in manufacturing industries.
3. Apply the knowledge of finishing operations in manufacturing industries.
4. Apply the knowledge of joining operations in manufacturing industries.
5. Understand the knowledge of nontraditional machining in advanced manufacturing processes

COPO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	-	1	-	-	-	-	3
CO2	2	1	1	-	-	-	1	-	-	-	-	3
CO3	3	3	2	-	-	-	1	-	-	-	-	3
CO4	3	3	2	-	-	-	1	-	-	-	-	3
CO5	2	1	1	-	-	-	1	-	-	-	-	3

Unit 1	**Metal Cutting and Tooling**	**08 hours**

Mechanics of metal cutting: Orthogonal vs. oblique cutting, mechanics of chip formation, shear angle relationship, and Merchant's force circle diagram. Cutting forces, power requirements, heat generation, and tool temperature. Tool geometry and nomenclature (ASA system). Tool materials, wear, tool life, and machinability. Cutting fluids: Types, applications, and lubrication mechanisms.

Unit 2	**Machine Tools and Machining Operations**	**08 hours**

Lathe Machine: Principle, construction, types, operations, and CNC lathe basics. Reciprocating Machine Tools: Shaper, Planer, and Milling: Types, operations, milling cutters, up & down milling, indexing. Drilling: Types, twist drill geometry, operations (boring, reaming), and drilling time estimation.

Unit 3	**Finishing and Metal Joining Processes**	**07 hours**

Grinding: Principles, grinding wheel specifications, attrition/fracture wear, dressing & truing. Honing, lapping, superfinishing techniques.
Welding: Classification, gas welding, arc welding (GTAW, GMAW, EBW, and LBW). Resistance welding, Friction Welding, soldering, and brazing. Metallurgical aspects of welding: Weld solidification, heat affected zones, and defects.

Unit 4	**Non-Traditional Machining (NTM) Processes**	**07 hours**

Abrasive Jet Machining (AJM), Water Jet Machining (WJM), Abrasive Water Jet Machining (AWJM). Ultrasonic Machining (USM): Principles, process parameters, material removal rate (MRR). Electrical Discharge Machining (EDM): Principle, parameters, tool wear, wire EDM. Electrochemical Machining (ECM): Process parameters, MRR, applications. Plasma Arc Machining (PAM). Case studies : Industrial applications of NTM Processes.

	Total Lecture Hours	**30 hours**

Textbook:

1. Manufacturing Technology by P.N. Rao., MCGRAW HILL INDIA.
2. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition) Pearson India, 2014.
3. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems

Reference Books:

1. Amitabha Ghosh and Ashok Kumar Mallik, *Manufacturing Science*, East West Press, 2010.
2. S. K. Hajra Choudhury, A. K. Hajra Choudhury and Nirjhar Roy, *Elements of Workshop Technology: Volume II – Machine Tools*, Media Promoters & Publishers Pvt. Ltd., 2008.
3. Serope Kalpakjian and Steven R. Schmid, *Manufacturing Engineering and Technology*, Pearson Education, 2014.
4. Mikell P. Groover, *Fundamentals of Modern Manufacturing: Materials, Processes, and Systems*, Wiley India Pvt. Ltd., 2012.
5. G. Boothroyd and W.A. Knight, *Fundamentals of Machining and Machine Tools*, CRC Press, 2005.

Mode of Evaluation (Theory):

Evaluation Scheme						
MSE		**CA**			**ESE**	**Total Marks**
MSE 1	**MSE 2**	**CA1**	**CA2**	**CA3 (ATT**	**50**	**100**
20	20	4	4	2		
40		**10**				

Course Code: ME201B	**Course Name: Machine Analytics**	**L**	**T**	**P**	**C**

	2	0	2	3

Prerequisite:

1. Basic Probability and Statistics, Linear Algebra (matrix operations, eigenvalues), Calculus (for optimization concepts)
2. Basics of Machine Elements & Mechanical Systems, Knowledge of sensors and transducers
3. Basic programming skills (preferably Python or MATLAB), Understanding of data structures and file handling.

Course Objectives:

1. To introduce the fundamentals of machine analytics and its role in modern industrial systems, including data driven decision making in the context of Industry 4.0.
2. To familiarize students with machine learning algorithms and their application in machine data analysis, including techniques for classification, regression, clustering, and anomaly detection.
3. To provide knowledge on condition monitoring and fault detection, focusing on sensor based diagnostics like vibration, temperature, and acoustic monitoring.
4. To equip students with predictive and prescriptive analytics tools, including failure prediction, remaining useful life (RUL) estimation, and optimization techniques for maintenance planning.

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

1. Demonstrate knowledge of data acquisition, storage, and preprocessing in machine analytics.
2. Apply statistical methods and machine learning models to analyze machine data.
3. Perform condition monitoring and fault detection using sensor data.
4. Implement predictive maintenance models using machine learning algorithms.
5. Integrate IoT and digital twin technologies for real time machine analytics.

COPO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2		2							1
CO2	3	3	3	2	2							2
CO3	3	3	3	2	2				1			2
CO4	3	2	3	3	3							2

Unit 1	**Fundamentals of Machine Analytics**	**15 hours**

Introduction to Machine Analytics, Industrial Applications, Data Driven Decision Making in Industry 4.0, Types of Machine Analytics, Machine Data Sources, Data Acquisition and Storage, Data Preprocessing, Statistical Methods, Probability Models.

Unit 2	**Machine Learning for Machine Analytics**	**15 hours**

Machine Learning in Industrial Systems, Supervised Learning, Regression and Classification, Unsupervised Learning, Clustering and Anomaly Detection, Time Series Analysis, Feature Engineering, Predictive Maintenance, Case Studies.

Unit 3	**Predictive & Prescriptive Analytics**	**15 hours**

Predictive Maintenance, Data Driven Approaches, Failure Prediction Algorithms, Remaining Useful Life (RUL) Estimation, Prescriptive Analytics, Optimization Models, Decision Making Techniques, Cloud Computing, Edge Processing, IoT and AI Integration, Case Study.

Unit 4	**Industrial Applications**	**15 hours**

Real Time Machine Analytics, IoT and Cloud Computing, Industry 4.0, Digital Twins, Manufacturing Applications, Energy Sector Applications, Healthcare Applications, Predictive Maintenance System Development, Industry Expert Lectures, Future Trends.

	Total Lecture Hours	**60 hours**

Textbook:

1. "Predictive Analytics: The Future of Machine Learning" Author**: Eric Siegel** Publisher**: Wiley** ISBN**: 9781118356852**
2. "Data Science for Business" Authors**: Foster Provost, Tom Fawcett** Publisher**: O'Reilly Media** ISBN**: 9781449361327**
3. "Machine Learning: A Probabilistic Perspective" Author**: Kevin P. Murphy** Publisher**: MIT Press** ISBN**: 9780262018029**

Reference Books:

1. "Industrial Internet of Things: Cyber manufacturing Systems" Authors: Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat Publisher: Springer ISBN: 9783319425597
2. "Condition Monitoring with Vibration Signals: Compressive Sampling and Learning Algorithms for Rotating Machines" Author: Hosameldin Ahmed and Asoke K. Nandi Publisher: Wiley ISBN: 9781119382744

Mode of Evaluation :

Evaluation Scheme

MSE		CA			ESE	Total Marks
MSE 1	MSE 2	CA1	CA2	CA3 (ATT)		
30	30	6	6	3	75	150
60		15				

Course Code : ME208E	Course Name: Computer Aided Design	L	T	P	C
		3	0	2	4

Pre-requisite: NA

Course Objectives

1. To introduce students to the fundamentals of computer-aided design (CAD).
2. To develop 2D sketching and 3D modeling skills using CAD software.
3. To understand and apply geometric modeling techniques.
4. To familiarize students with assembly modeling and drafting.
5. To enhance visualization and design skills through practical assignments.

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

1. Understand basic CAD concepts and commands.
2. Create 2D sketches and constrain them appropriately.
3. Create 3D solid models using various modelling techniques.
4. Understand assembly modelling and create detailed drawings.
5. Apply CAD skills to basic design and project work.

Co-PO Mapping (scale 1: low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3		3	-	-	-	-	-	-	1
CO2	3	3	3		3	-	-	-	-	-	-	1
CO3	3	3	3		3	-	-	-	-	-	-	1
CO4	2	2	3		3	-	-	-	-	-	-	1
CO5	3	3	3		3	-	-	-	-	-	-	2

Unit 1	Introduction to CAD and Sketching Fundamentals	15 hours

Overview of Autodesk Inventor interface, File management: Part, Assembly, Drawing, 2D Sketching Tools: Lines, Arcs, Splines, Constraints and Dimensions: Parametric modeling concepts, Hands-on Practice: Creating and constraining 2D sketches

Unit 2	3D Part Modeling Techniques	15 hours

3D Modeling Features: Extrude, Revolve, Sweep Advanced Modeling: Fillet, Chamfer, Shell, Pattern Hands-on Practice: Creating 3D models from sketches

Unit 3	Assembly Modeling and Motion Basics	15 hours

Introduction to Assemblies Placing and Constraining Components Joint Types: Rigid, Rotational, Sliding Motion Simulation Basics Hands-on Practice: Mechanical Component Assembly

Unit 4	Drawing Generation and Basic Stress Analysis	15 hours

Generating 2D Drawings from 3D Models Dimensioning, Annotations, GD&T Symbols Section Views, Exploded Views, Bill of Materials (BOM)
Introduction to FEA and Stress Analysis using Autodesk Inventor and ANSYS, Application of Material Properties, Boundary Conditions, Static Stress Simulations

Unit 5	Advanced Applications in CAD and Simulation	15 hours

Introduction to Advanced Assemblies and Kinematic Simulation Introduction to Dynamic Analysis in CAD Overview of Topology Optimization Basics Introduction to Advanced FEA Concepts (Non-linear Analysis Overview), Case Study: Complete Mechanical Component Design and Validation

Total Lecture hours	75 hours

Textbook

1. Sham Tickoo, 'Learning Autodesk Inventor 2025,' CADCIM Technologies.
2. Saeed Moaveni, 'Finite Element Analysis: Theory and Application with ANSYS,' Pearson Education.

Reference Book

1. **N.D. Bhatt**, *Engineering Drawing*, Charotar Publishing House, 2018.
2. **Siddeshwar, Kanheya and Sastri**, *Machine Drawing*, Tata McGraw-Hill Publishing Company, 2000.

E-Resource:
https://www.autodesk.com/learn/ondemand/collection/self-paced-learning-for-fusion

Mode of Evaluation (Theory)

Evaluation Scheme						
MSE		CA			ESE	Total Marks
MSE 1	MSE 2	CA1	CA2	CA3 (Attd.)		
40	40	8	8	4	100	200
80		20				

Course Code: ME209E	Course Name: Fundamental of Design Analysis and Simulation	L	T	P	C
		3	0	2	4

Pre-requisite: NA

Course Objectives

1. To understand the fundamentals of simulation and numerical analysis.
2. To gain hands-on experience with FEA, CFD, CAM, and 3D scanning.
3. To develop skills in modeling, analysis, validation, and manufacturing simulation.
4. To foster industry-ready expertise using commercial tools like Autodesk Fusion 360.
5. To cultivate the ability to design, validate, and optimize engineering components and systems.

Course Outcome

1. Understand the fundamentals of engineering analysis and simulation methods.
2. Apply numerical methods and simulation tools for modeling mechanical systems and processes.
3. Demonstrate hands-on skills in CAM operations using Autodesk Fusion 360.
4. Apply reverse engineering and 3D scanning techniques to reconstruct digital models.
5. Analyse and optimize mechanical systems through simulation, design validation, and project-based applications.

CO-PO Mapping (scale 1: low, 2: Medium, 3: High)

CO \ PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	3	-	-	-	1	-	-	2
CO2	3	3	3	3	3	-	-	-	1	-	-	2
CO3	3	2	3	2	3	-	-	-	1	-	-	2
CO4	3	2	3	3	3	-	-	-	2	-	-	2
CO5	3	3	3	3	3	-	-	-	2	-	-	3

Unit 1:	Introduction of Analysis and Simulation	15 hours

Introduction to modeling and simulation in mechanical engineering, Types of analysis: Analytical, Numerical, Experimental, Role of simulation in design and manufacturing, Overview of finite element method (FEM), Introduction to simulation workflow: geometry, meshing, boundary conditions, solver

Unit 2:	Finite Element Analysis and CFD Fundamentals	15 hours

1D and 2D element formulation, stiffness matrix, Static structural analysis: truss, beam, and plane stress/strain problems, Basics of Computational Fluid Dynamics (CFD): governing equations, boundary conditions, Comparison of FEM, FDM, FVM methods
Case studies using ANSYS or equivalent software

Unit 3:	CAM using Autodesk Fusion 360	15 hours

Introduction to CAM and Digital Manufacturing, Interface, toolpath generation, tool libraries, CNC milling operations: facing, pocketing, drilling, Simulation and verification of toolpaths, Post-processing and G-code generation, Project: CAM setup for a mechanical component in Fusion 360

Unit 4:	Reverse Engineering and 3D Scanning	15 hours

Fundamentals of reverse engineering and digitization, Working principle of 3D scanners: structured light, laser, photogrammetry, Data acquisition and point cloud processing, Surface reconstruction: mesh creation and optimization, Case study: Reverse engineering a mechanical part using 3D scan data

Unit 5:	Applied Simulation and Optimization	15 hours

Multiphysics simulation overview: thermal-structural coupling, Introduction to topology optimization and generative design, Design validation: comparing experimental vs simulation data, Project-based learning: simulate, optimize, and present a mechanical system, Ethical aspects and best practices in simulation

Total Lecture hours	75 hours

Textbook

1. S.S. Rao, *Engineering Optimization*, Wiley
2. Belegundu & Chandrupatla, *Finite Element Methods*, Pearson
3. Autodesk Learning Hub – Fusion 360 Tutorials
4. Versteeg & Malalasekera, *Computational Fluid Dynamics*, Pearson
5. Yonghuai Liu, *3D Scanning Technologies for Reverse Engineering*, Springer
6. ANSYS, Fusion 360, and 3D Scanner User Manuals

Reference Book

1. Versteeg & Malalasekera, *Computational Fluid Dynamics*, Pearson
2. Yonghuai Liu, *3D Scanning Technologies for Reverse Engineering*, Springer
3. ANSYS, Fusion 360, and 3D Scanner User Manuals

Mode of Evaluation (Theory):

Evaluation Scheme						
MSE		**CA**			**ESE**	**Total Marks**
MSE 1	**MSE 2**	**CA1**	**CA2**	**CA3 (ATT)**	**100**	**200**
40	40	8	8	4		
80		**20**				

Course Code: ME210E	Course Name: Computer Aided Product Design	L	T	P	C
		3	0	2	4

Prerequisite: NA

Course Objectives:

1. To familiarize students with various CAD software tools like CATIA, AutoCAD, and Unigraphics.
2. To impart knowledge of CAD designing standards, drafting techniques, and procedures followed in the industry.
3. To develop skills in creating 2D and 3D engineering drawings, interpreting design specifications, and selecting appropriate design software.
4. To enable students to create 3D models and 2D drawings of products using CAD software while understanding tolerance analysis and manufacturing specifications.
5. To train students in documentation, tagging, storage of drawings, and addressing issues encountered during the design process, following industry best practices.

Course Outcome: After completion of the course, the student will be able to

1. Apply CAD software, design standards, and drafting techniques used in industry.
2. Understand engineering drawings, requirements, specifications, and select appropriate CAD tools.
3. Create 2D and 3D CAD models using industry standard CAD techniques and test models for feasibility.
4. Create technical drawings including dimensions, tolerances, manufacturing specifications, and documentation.
5. Apply ethical practices in finalizing designs, storing documentation, and modifying designs based on feedback.

COPO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO \ PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	2							
CO2	2	2	3	1	2							
CO3	3	3	3	2	3							
CO4	3	3	2	2	3	1						1
CO5	3	3	3	2	2	1			2	2		2

Unit 1	Introduction to the CAD Software	15 hours

Theory: List various designing software like CATIA, AutoCAD, Unigraphics etc. required during the designing process. Discuss the CAD designing standards and procedures involved in industry. Elaborate draughting standards and techniques e.g. ANSI series IS/ ISO.

Practical: Show comparison between various designing software. Demonstrate the use of designing software.

Unit 2	Predesigning activities	20 hours

Theory: Describe drawings and modelling techniques like 2D and 3D. Elaborate different type of views generated in engineering drawings. Describe limits, fits, GD&T etc. Discuss the information such as requirements, specifications and instructions received from design team or supervisor related to product design. List the design requirement in terms of material used for making the component, packaging and other requirements to decide the dimensions, measurements and tolerances of the aggregate/ component. List technical drawing practices as per the company standards.
Practical: Prepare sample 2D and 3D engineering drawings. Demonstrate how to interpret the vehicle component design requirements and specifications, instructions etc. Show how to select the designing software like CATIA, AutoCAD, Unigraphics etc. for creating the designs and models based on the requirement.

Unit 3	Products and parts on CAD software	20 hours

Theory: Describe CAD sketching and drafting. List the steps to be performed for creating 3D model of product in CAD software. Describe various CAD techniques available in the CAD software and required or designing of product 3D model. Describe Tolerance Analysis sheet and how to interpret it. List the steps to be performed for testing the feasibility of product with the customer requirements by conducting simulation/ packaging study. List the steps to be performed for creating 2D drawing of product in CAD software. Describe overall dimensions or other manufacturing specifications like assembly sequence, surface texture etc. of design in the drawing. Discuss the records, documents, files and reports to be maintained related to the product design.
Practical: Apply appropriate procedure of setting required specifications and dimension parameters of product design in a CAD file. Demonstrate how to insert sketches, scanned images, diagrams,
signs or symbols etc. in a CAD file. Prepare a sample 3D model of product by applying appropriate CAD techniques. Demonstrate how to draw layouts and various views of drawing in CAD software as per the relationship between components and assemblies. Apply appropriate way of filling colours symbols etc. to highlight areas in the drawing. Perform steps to test the 3D model through simulation/ packaging study and check the feasibility of product with the customer requirements. Prepare a sample 2D drawing of product in CAD software.

Unit 4	Post designing activities	20 hours

Theory: Discuss the records, documents, files and reports to be maintained related to the product design. Discuss the process of tagging and storing the drawings properly. Discuss problems and issues faced during the designing of product.
Practical: Follow ethical practices for finalising and submitting the prepared design. Apply appropriate ways to submit the product design for review and feedback to appropriate person. Show how to modify the 2D drawings of design according to the feedback received. Show how to tag and store the drawings properly as per the organisational guidelines. Prepare project on designing of 3D model of a vehicle component by using CAD software.

	Total Lecture Hours	75 hours

Textbook:
1. "Computer Aided Product Design," based on ASC/N8114, Version 1.0.
2. "Engineering Drawing and Design" by David A. Madsen and David P. Madsen
3. "CAD/CAM: Principles and Applications" by P.N. Rao
4. "Engineering Graphics with AutoCAD 2020" by James D. Bethune

Reference Books:
1. "Engineering Drawing and Design" by David A. Madsen and David P. Madsen
2. "Engineering Graphics with AutoCAD 2020" by James D. Bethune

Mode of Evaluation (Theory):

Evaluation Scheme						
MSE		CA			ESE	Total Marks
MSE 1	MSE 2	CA1	CA2	CA3 (ATT)		
40	40	8	8	4	100	200
80		20				

Course Code: ME211E	Course Name: Product Reverse Engineering	L	T	P	C
		3	0	2	4

Pre-requisite: 1. Design & Realization
2. Manufacturing Technology-I

Course Objectives:
1. Understand design requirements and prepare components for 3D scanning.
2. Operate high-accuracy 3D scanners and create mesh files.
3. Utilize CAD software to develop editable solid models from scanned data.
4. Perform reverse engineering and generate detailed drawings and blueprints.
5. Operate 3D printer to develop prototypes.

Course Outcome: After completion of the course, the student will be able to

1. **Identify** the design requirements and preparation techniques essential for 3D scanning.
2. **Operate** 3D scanning equipment to produce accurate mesh models.
3. **Construct** solid models from scanned mesh data using CAD software and appropriate surfacing techniques.
4. **Evaluate** scanned models to detect defects and ensure readiness for blueprint and technical drawing development.
5. **Inspect** 3D printed prototypes to verify compliance with dimensional and functional design specifications.

CO-PO Mapping(Scale1:Low, 2:Medium, 3:High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	2	1	1	2	3	-	-	1	1	1	-	2
CO2	2	1	1	2	3	-	-	-	1	1	-	2
CO3	2	1	1	2	3	-	-	-	1	1	-	2
CO4	2	1	1	2	3	-	-	1	2	1	-	2
CO5	2	2	3	2	3	-	-	-	2	1	2	2

Unit1	**Introduction to Design Requirements and Preparation for Scanning**	**15 hours**

Fundamentals of design requirements and specifications, such as material selection, packaging needs, dimensional tolerances, and measurements essential for preparing a component for reverse engineering. Surface preparation techniques like applying a matte coating to enhance scan accuracy, overview of various types of 3D scanning technologies and their industrial applications.

Hands-on/Case Study/ Mini-Project/ Problem solving:

Unit 2	**3D Scanning Techniques and Mesh File Creation**	**15hours**

3D scanners setup, calibration, capture critical sections of components, Generation of mesh files, standard operating procedures (SOPs), nuances of effective scanning strategies, ensuring data accuracy and reliability during the scanning process, and subsequent modeling tasks.

Hands-on/Case Study/ Mini-Project/ Problem solving:

Unit 3	**Reverse Engineering Using CAD Tools**	**15 hours**

Process of importing mesh data into CAD software equipped with reverse engineering tools. Different techniques for creating editable solid models, including semi-automatic surfacing, automatic surfacing, and manual redrawing methods. Identify and rectify flaws in scanned models, prepare accurate blueprints, and develop complete manufacturing drawings for further product development.

Hands-on/Case Study/ Mini-Project/ Problem solving:

Unit 4	**Drawing Management and File Preparation for 3D Printing**	**15hours**

Drawing preparation, layout creation, and assembly relationship documentation. Store, tag, and submission of drawings according to organizational standards. Conversion of solid models into suitable 3D printer file formats, such as STL and AMF, and transferring these files to 3D printers or storage devices.

Hands-on/Case Study/ Mini-Project/ Problem solving:

Unit5	**3D Printing Process and Prototype Inspection**	**15 hours**

Process of setting up and operating a 3D printer, selecting encoding formats, setting part orientations, and optimizing material usage. Hands-on experience in operating the printer, troubleshooting errors, cleaning printed prototypes for improved surface finish, and conducting quality inspections. Proper methods for storing and preserving printed prototypes.

Hands-on/Case Study/ Mini-Project/ Problem solving:

	Total Lecture Hours	**75 hours**

Textbook:

1. "Reverse Engineering: Technology of Reinvention" by Wego Wang, Publisher: CRC Press
2. "Rapid Prototyping: Principles and Applications" by **C**hua Chee Kai, Kah Fai Leong, Chu Sing Lim Publisher: World Scientific Publishing
3. "Mastering 3D Printing" by Joan Horvath Publisher: Apress

Reference Books:

1. 3D Scanning for Reverse Engineering: A Process Manual for Design Engineers and Managers" by **Belussi, Laura & Barozzi, Carlo, *Publisher:* Wiley4. Strength of Materials: A Unified Theory by Albert C.J. Luo**
2. "3D Printing and Additive Manufacturing: Principles and Applications" **by Chee Kai Chua and Kah Fai Leong**
3. "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems" **by Mikell P. Groover**

Mode of Evaluation :

Evaluation Scheme

MSE		CA			ESE	Total Marks
MSE1	MSE2	CA1	CA2	CA3 (ATT)	100	200
40	40	8	8	4		

80	20		

Practical Courses Detail Syllabus

Course Code: ME201P	Course Name: Manufacturing Technology –I Lab	L	T	P	C
		0	0	2	1

Pre-requisite: NA

Course Objectives:

1. Learn casting processes and molten metal flows and solidifies in molds.
2. Learn key metal forming and sheet metal operations used in manufacturing.
3. Explore the fundamentals of 3D printing and injection molding techniques.

Course Outcome: After completion of the course, the student will be able to

1. Understand the casting process and remember various elements of gating system.
2. Understand different operations of metal forming.
3. Understand different operations of 3D printing.
4. Understand different operations of sheet metal forming.
5. Apply the concept of injection molding in plastic industry.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2							2			3
CO2	2	2							2			3
CO3	2	2			2				2			3
CO4	2	2							2			3
CO5	3	3							2			3

List of Practical's (Indicative & not limited to)

1. Pattern Making: Preparation of patterns with different allowances (e.g., shrinkage, draft).
2. Sand testing methods (at least one, such as grain fineness number determination)
3. Mould Preparation, Metal Melting, Solidification, and Defect Analysis: Preparation of moulds, followed by metal melting, pouring, solidification, and inspection of casting defects.
4. Injection molding with plastics
5. Forging power hammer study & operation
6. Press work experiment such as blanking/piercing, washer, making etc.
7. Bending & spring back.
8. Role of AI/ML in 3D Printing
9. Jigs & Fixture experiment.
10. Presentation based on different case studies.

Total Hours	30 hours

Mode of Evaluation:

CA		ESE	Total
CA1	CA2		

	12	13	**25**	**50**

Course Code: ME202P	**Course Name: Material Testing Lab**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

Pre-requisite: NA

Course Objectives:

The objective of the course is to provide knowledge of the mechanical properties of material and the analysis of properties.

Course Outcome: After completion of the course, the student will be able to

1. Test the mechanical properties of material on Universal testing machine and also able to analyse test results.
2. Evaluate materials hardness and also able to analyse effect of different processes on hardness.
3. Evaluate the toughness of materials by izod and charpy test.
4. Analyse the effect of heat treatment on the same.
5. Evaluate the modulus rigidity through torsion test and able to analyse fatigue failure of the material using Fatigue test.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	2	-	2	-	-	-	-
CO2	3	3	-	-	-	-	-	2	-	-	-	-
CO3	3	3	-	-	-	2	-	2	-	-	-	-
CO4	3	3	-	-	-	-	-	2	-	-	-	-
	3	3	-	-	-	2	-	2	-	-	-	-

List of Practical's (Indicative & not limited to)

1. Strength test of a given mild steel specimen on UTM with full details and stress versus strain plot on the machine.
2. Other tests such as shear, bend tests on UTM.
3. Impact test on impact testing machine like Charpy, Izod or both.
4. Hardness test of given specimen using Rockwell and Vickers/Brinell testing machines.
5. Preparation for microscopic study and study of microstructure of different alloys.
6. Fatigue test on fatigue testing machine.
7. Creep test on creep testing machine.
8. Experiment on deflection of beam, comparison of actual measurement of deflection with dial gauge to the calculated one, and or evaluation of young's modulus of beam.
9. Torsion test of a rod using torsion testing machine.
10. Study of NDT (nondestructive testing) methods like magnetic flaw detector, ultrasonic flaw detector, eddy current testing machine, dye penetrant tests.
11. Study of MMC/PMC using AI/ML

Total Hours	**30 hours**

Mode of Evaluation:

CA		ESE	Total
CA1	CA2		
12	13	**25**	**50**

Course Code: ME203P	**Course Name: Fluid Mechanics & Machinery Lab**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

Pre-requisite: NA

Course Objectives:

1. Understanding buoyancy principle, momentum equation, Reynold's experiment, major, minor losses and CFD analysis.
2. Practical Application of, Bernoulli's theorem, venturi meter, orifice meter.
3. Figure out practical working and examine the efficiency of Pelton wheel turbine and centrifugal pump.

Course Outcome: After completion of the course, the student will be able to

1. Apply the concept of capillarity, Meta center and momentum equation.
2. Analyze Bernoulli's equation and its applications.
3. Analyze Reynold's experiment, major, minor losses and CFD analysis of laminar flow.

4. Analyze a Pelton wheel turbine and investigate its efficiency.
5. Analyze a centrifugal pump and examine its efficiency.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	1	-	-	-	-	3	1	2	3
CO2	3	-	-	1	-	-	-	-	3	1	2	3
CO3	3	-	-	1	-	-	-	-	3	1	2	3
CO4	3	-	-	1	-	-	-	-	3	1	2	3
CO5	3	-	-	1	-	-	-	-	3	1	2	3

List of Practical's (Indicative & not limited to)

1. Experiment on capillarity: To determine surface tension of water by using capillary tubes
2. Experiment on Meta center: To determine Metacentric height of a given ship model.
3. Experiment on Impact of Jet: To verify the momentum equation using the experimental setup on impact of jet
4. Experiments on Bernoulli's theorem: To verify the Bernoulli's theorem.

a. To calibrate a Venturi meter and study the variation of the co efficient of discharge with the Reynold's number.
b. To calibrate Orifice meter and study the variation of the co efficient of discharge with Reynold's number.

5. Experiment on Reynold's experiment: To study the transition from laminar to turbulent flow and to determine the lower critical Reynold's number
6. Experiment on Major losses in pipes: To study the variation of friction factor 'f' for turbulent flow in commercial pipes.
7. Experiment on Loss due to sudden enlargement and contraction: To determine the minor losses due to sudden enlargement and sudden contraction
8. Experiment on CFD analysis of laminar flow through pipes: Velocity and pressure contours using ANSYS.
9. Experiment on Francis turbine: To study and calculate the efficiency of a Francis Turbine.
10. Experiment on Reciprocating Pump: To study and calculate the efficiency of reciprocating pump under different heads.

Total Hours	**30 hours**

Mode of Evaluation:

CA		ESE	Total
CA1	CA2		
12	13	**25**	**50**

Course Code: ME205P	Course Name: Thermal Engineering Lab	L	T	P	C
		0	0	2	1

Pre-requisite: NA

Course Objectives:

1. Learn the basic principles of combustion and fuel calorific value determination.
2. Explore the working of steam turbines, air compressors, and their key components.
3. Familiarize with boiler systems and engine performance using mechanical measuring devices.

Course Outcome: After completion of the course, the student will be able to

1. Apply combustion concepts to determine the calorific value of fuels.
2. Analyze impulse, reaction forces, and compounding in steam turbines.
3. Explain single and multi-stage compression in air compressors.
4. Study boiler components and engine performance using dynamometers.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2					2	1	2	2
CO2	3	3	3									
CO3			2	2					2	1	2	2
CO4			2	2					3	1		2

List of Practical's (Indicative & not limited to)

1. To calculate the calorific value of fuel using bomb calorimeter
2. To study the different types of steam turbines
3. To study the phenomenon of compounding in impulse turbines
4. Investigate the principles of steam turbine performance through simulation
5. To study the boiler internals and different types of boilers.
6. To calculate the performance of single stage air compressor
7. To study the construction and working of the gas turbine engine.
8. To study the construction and working of a steam engine.
9. Investigate the principles of rocket propulsion, including thrust generation and specific impulse, through simulation
10. To calculate the different performance parameters of diesel engine.

Total Hours | **30 hours**

Mode of Evaluation:

CA		ESE	Total
CA1	CA2		
12	13	**25**	**50**

Course Code: ME207P	Course Name: CAMD Lab	L	T	P	C
		0	0	4	2

Pre-requisite: Basic knowledge of Engineering Graphics

1. Understand the fundamentals of Computer Aided Machine Drawing
2. Develop drawing skills on drawing sheet and software
3. Apply basics of machine drawing using CAD software

Course Outcome: After completion of the course, the student will be able to

1. To acquire the knowledge of CAD software and its features.
2. To familiarize the students with Indian Standards on drawing practices.
3. To impart knowledge of thread forms, fasteners, keys, joints and couplings.
4. To make the students understand and interpret drawings of machine components leading to preparation of Assembly drawings manually and using CAD packages.
5. To acquire the knowledge of limits, tolerance and fits and indicate them on machine drawings.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	-	2	-	-	2	-	-	-	2
CO2	3	3	1	-	1	-	-	2	-	-	-	2
CO3	3	3	2	-	2	-	-	2	-	-	-	2
CO4	3	3	2	-	3	-	-	2	-	-	-	2
CO5	3	3	1	-	3	-	-	1	-	-	-	3

List of Practical's (Indicative & not limited to)

1. Orthographic Projections from Pictorial Views – Conversion of pictorial to orthographic views of simple machine parts; practice of hidden lines, precedence of lines, and BIS conventions.
2. Thread Profiles and Standard Representations – Drawing 2D profiles of ISO metric, BSW, Acme, Square, and American thread forms (external/internal); using sectional views.
3. Fastener Assemblies and Threaded Joints – Creating assemblies: bolt-nut-washer, square head bolt, stud bolt with lock nut; sectional views and callouts.
4. Keys, Keyways, and Shaft Assembly – Drawing parallel, taper, feather, gib head, and Woodruff keys with their fitment in shafts.
5. Riveted and Cotter Joints – Assembly Drawing – 2D assembly drawings of lap and butt joints (chain/zigzag), socket & spigot cotter joint, and knuckle joints with conventions.
6. Limits, Fits & Geometric Dimensioning and Tolerancing (GD&T) – Applying ISO fits (hole-basis), tolerances, surface finish, and basic GD&T symbols on mechanical part drawings.
7. Plummer Block – Detailed Assembly Drawing – Drawing both individual parts and full sectional assembly of a plummer block with detailed dimensions, layers, and annotations.
8. I.C. Engine Connecting Rod – Part and Assembly – 2D part and exploded assembly drawing of a connecting rod with sectioning, GD&T, annotations, and tolerances.
9. 3D Assembly Modeling with Exploded View and BoM – Assembling components like Screw Jack or Machine Vice; generating exploded view and Bill of Materials with part numbers and quantities.

10. Advanced Mechanisms – Cam or Gear Coupling – 3D modeling and exploded assembly of cam-follower or gear coupling; include sectional views, surface finish, and GD&T annotations.

Total Hours	**60 hours**

Mode of Evaluation:

CA		ESE	Total
CA1	CA2		
25	25	50	100

Course Code: ME206P	Course Name: Manufacturing Technology - II Lab	L	T	P	C
		0	0	2	1

Pre-requisite: NA

Course Objectives:

1. To perform various machining operations using CNC, VMC, and conventional machines.
2. Familiarize with advanced manufacturing techniques like laser welding, MIG welding, and plasma arc machining.
3. Application of AI/ML tools for process parameter optimization in modern manufacturing systems.

Course Outcome: After completion of the course, the student will be able to

1. Understand the basic concepts of metal cutting
2. Understand different operations of CNC/VMC machine
3. Apply the concept of welding operations in welding lab
4. Understand different operations of non-conventional machining process like PAM.

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2							2			3
CO2	2	2							2			3
CO3	2	2							2			3
CO4	2	2							2			3

List of Practical's (Indicative & not limited to)

1. Preparation of one model on CNC/lathe involving plane turning, taper turning, step turning, facing, convex shape turning, external thread cutting and associated measurement.
2. Create a model on VMC machine involving various machining operations.
3. Cutting of spur gear teeth using milling machine/MATLAB.
4. Finishing of a surface on surface grinding machine.
5. Study of the laser welding process and effect of laser power on weld quality.
6. Study the effect of laser welding speed on weld bead formation.
7. Groove design and welding by MIG welding.
8. Drilling holes on drilling machine and study of twist drill.
9. Development of various cutting profiles by plasma arc machining.
10. Process parameters optimization on VMC using AI/ML.

Total Hours	**30 hours**

Mode of Evaluation:

CA		ESE	Total
CA1	CA2		
12	13	25	50