PRATHYUSHA ENGINEERING COLLEGE

(An Autonomous Institution)

CURRICULUM (Revised)

I YEAR B.E-MECHANICAL	SEMESTER - I	REGULATIONS - 2024

S.No	Course Code	Course Title	CAT	Periods / Week				CREDITS	Internal / External %
				L	T	P	R		
Theory									
1	241LEH101T	Professional English – I	HS	3	0	0	0	3	40/60
2	241MAB101T	Matrices And Calculus	BS	3	1	0	0	4	40/60
3	241PYB101T	Engineering Physics	BS	3	0	0	0	3	40/60
4	241CYB101T	Engineering Chemistry	BS	3	0	0	0	3	40/60
5	241GES102T	Engineering Graphics ENGINEERING	ES	2	2	0	0	4	40/60
6	241LEH102T	Heritage of Tamils	HS	1	0	0	0	1	40/60
Laboratory									
7	241GEB111L	Physics & Chemistry Laboratory	BS	0	0	2	0	1	60/40
8	241LEA111L	Communication Skills Laboratory	EEC	0	0	2	0	1	60/40
9	241GEM111L	IDEA LAB	MC	0	0	2	2	2	60/40
10	241GEM112L	Induction Training*	MC	0	0	4	0	2	-
Total -30Periods				15	3	10	2	22	

*** As per AICTE Norms, Grade: Completed / Not Completed; Not Counted for CGPA**

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PRATHYUSHA ENGINEERING COLLEGE
(An Autonomous Institution)
CURRICULUM

I YEAR B.E-MECHANICAL	SEMESTER - II	REGULATIONS - 2024

S. No	Course Code	Course Title	CAT	Periods / Week				Credit	Maximum Marks		
				L	T	P	R	C	CA	FE	TOTAL
Theory											
1	241LEH203T	Professional English - II	HS	3	-	-	-	3	40	60	100
2	241MAB202T	Partial Differential equations and complex Functions	BS	3	2	-	-	4	40	60	100
3	241PYB204T	Materials Technology	BS	3	-	-	-	3	40	60	100
4	241GEB204T	Environmental Science for Mechanical Engineering	BS	2	-	-	-	2	40	60	100
5	241GES201T	Problem Solving Using Python	ES	3	-	-	-	3	40	60	100
6	241LEH202T	Tamils and Technology/தமிழரும் தொழில்நுட்பமும்	HS	1	-	-	-	1	40	60	100
Laboratory											
7	241GES211L	Basic Electrical and Electronics Engineering Laboratory	ES	-	-	3	1	2	60	40	100
8	241GES214L	Problem Solving Using Python Laboratory	ES	-	-	3	1	2	60	40	100
9	241GES212L	Visualization of Design and Drawing Laboratory	ES	-	-	3	1	2	60	40	100
Total - 29 Periods				15	2	9	3	22			

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PRATHYUSHA ENGINEERING COLLEGE
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CURRICULUM

II YEAR B.E - MECH	SEMESTER - III	REGULATIONS - 2024

S.No	Course Code	Course Title	CAT	Periods / Week				Credit	Maximum Marks		
				L	T	P	R	C	CA	FE	TOTAL
Theory											
1	241MAB304T	Statistics and numerical methods	BS	3	1	0	0	4	40	60	100
2	241MEC302T	Engineering Thermodynamics	PC	3	0	0	0	3	40	60	100
3	241MEC303T	Strength of Materials	ES	3	0	0	0	3	40	60	100
4	241GES303T	AI Essentials for Engineers	ES	3	0	0	0	3	40	60	100
5	241MEC304T	Engineering Materials and Metallurgy	ES	3	0	0	0	3	40	60	100
6	241MEC305T	Manufacturing Processes	PC	3	0	0	0	3	40	60	100
Laboratory											
7	241MEC311L	Computer Aided Machine Drawing Laboratory	PC	0	0	3	1	2	60	40	100
8	241MEC312L	Manufacturing Processes Laboratory	PC	0	0	3	0	2	60	40	100
Total - 27 Periods				18	1	6	2	23			

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PRATHYUSHA ENGINEERING COLLEGE
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CURRICULUM

II YEAR B.E - MECH	SEMESTER - IV	REGULATIONS - 2024

S.No	Course Code	Course Title	CAT	Periods / Week				Credit	Maximum Marks		
				L	T	P	R	C	CA	FE	TOTAL
Theory											
1	241MEC401T	Theory of Machines	PC	3	0	0	0	3	40	60	100
2	241MEC402T	Thermal Engineering	PC	3	0	0	1	3	40	60	100
3	241MEC403T	Fluid Mechanics and Machinery	PC	3	0	0	0	3	40	60	100
4	241MEC404T	Robotics and automation	PC	3	0	0	0	3	40	60	100
5	241GES405T	AI for Mechanical Engineers	ES	3	0	0	0	3	40	60	100
6	241GEM901T	Essence of Indian Knowledge Tradition *	MC	2	0	0	0	2	40	60	100
Laboratory											
7	241MEC411L	Strength of Materials and Fluid Machinery Laboratory	PC	0	0	3	0	2	60	40	100
8	241MEC412L	Robotics and automation Laboratory	PC	0	0	3	1	2	60	40	100
		Total - 25 Periods		17	0	6	2	21			

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PRATHYUSHA ENGINEERING COLLEGE

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CURRICULUM

III YEAR B.E - MECHANICAL	SEMESTER - V	REGULATIONS - 2024

S.No	Course Code	Course Title	CAT	Periods / Week				Credit	Maximum Marks		
				L	T	P	R	C	CA	FE	TOTAL
Theory											
1	241MEC501T	Machine Design	PC	3	0	0	0	3	40	60	100
2	241MEC502T	Metrology and Measurements	PC	3	0	0	0	3	40	60	100
3	241MEC503T	Engineering Economics And Cost analysis	PC	3	0	0	0	3	40	60	100
4		Professional Electives I[$]	PE	3	0	0	0	3	40	60	100
5		Professional Electives II[$]	PE	3	0	0	0	3	40	60	100
6		Open Electives I[$]	OE	3	0	0	0	3	40	60	100
7		Innovation Course	MC	3	0	0	0	2			
Laboratory											
7	241MEC511L	Metrology and Dynamics Laboratory	PC	0	0	3	1	2	60	40	100
8	241INM511L	Industry Supported Course	EEC	0	0	2	0	1	60	40	100
Total - 25 Periods				17	0	6	2	23			

$ Open Elective / Professional Elective courses (maximum of 3) can be dropped upon the Completion/Certification of NPTEL / SWAYAM online courses.

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PRATHYUSHA ENGINEERING COLLEGE
(An Autonomous Institution)
CURRICULUM

III YEAR B.E - MECHANICAL	SEMESTER - VI	REGULATIONS - 2024

S.No	Course Code	Course Title	CAT	Periods / Week				Credit	Maximum Marks		
				L	T	P	R	C	CA	FE	TOTAL
Theory											
1	241MEC601T	Heat and Mass Transfer	PC	3	0	0	0	3	40	60	100
2	241MEC602T	Finite Element Analysis	PC	3	1	0	0	4	40	60	100
3	241MEC603T	Product design and development	PC	3	0	0	0	3	40	60	100
4		Professional Elective III $	PE	3	0	0	0	3	40	60	100
5		Professional Elective IV $	PE	3	0	0	0	3	40	60	100
6		Open Elective II $	OE	3	0	2	0	3	40	60	100
Laboratory											
7	241MEC611L	Industry Supported Course	EEC	0	0	2	0	1	60	40	100
8	241MEC612L	Product Design and Development Laboratory	PC	0	0	3	1	2	60	40	100
9	241MEC613L	Thermal Engineering and Heat Transfer Laboratory	PC	0	0	4	0	2	60	40	100
		Total - 31 Periods		18	1	11	1	24			

$ Open Elective / Professional Elective courses (maximum of 3) can be dropped upon the Completion/Certification of NPTEL / SWAYAM online courses.

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PRATHYUSHA ENGINEERING COLLEGE
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CURRICULUM

IV YEAR B.E - MECHANICAL	SEMESTER - VII	REGULATIONS - 2024

S.No	Course Code	Course Title	CAT	Periods / Week				Credit	Maximum Marks		
				L	T	P	R	C	CA	FE	TOTAL
Theory											
1	241MEC701T	Computer Integrated Manufacturing	PC	2	0	2	0	3	40	60	100
2	241MBH701T	Total Quality Management	HS	3	0	2	0	3	40	60	100
3		Professional Elective V$	PE	3	0	0	0	3	40	60	100
4		Professional Elective VI$	PE	3	0	0	0	3	40	60	100
5		Open Elective III$	OE	3	0	0	0	3	40	60	100
Laboratory											
6	241MEC711L	Industry Supported Course	EEC	0	0	2	0	1	60/40	40	100
7	241MEC712L	**Internship***	**EEC**	**0**	**0**	**4**	**0**	**2**	60/40	40	100
8	241MEC713L	**Mini project**	**EEC**	**0**	**0**	**2**	**2**	**2**	60/40	40	100
Total - 31 Periods											

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PRATHYUSHA ENGINEERING COLLEGE
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CURRICULUM

IV YEAR B.E - MECHANICAL	SEMESTER - VIII	REGULATIONS - 2024

S.No	Course Code	Course Title	Periods / Week				Credit	Maximum Marks			CAT
			Lecture	Tutorial	Practical	Research		CA	FE	TOTAL	
SEMESTER - VIII											
Laboratory											
1.	241MEP811L	PROJECT/STARTUP	0	0	0	24	**12**	60	40	100	EEC
		Total 24 Periods	0	0	0	24	**12**				

L – Lecture, T – Tutorial, P – Practical, R – Research, CA – Continuous Assessment, FE – Final Examination, CAT – Category ; BS – Basic Sciences; HS – Humanities and Social Sciences; ES – Engineering Sciences ; PC -Professional Core ; PE – Professional Electives; OE – Open Electives; EEC – Employability Enhancement Courses; MC – Mandatory Courses.

241MAB304T STATISTICS AND NUMERICAL METHODS L T P R C
3 1 0 0 4

COURSE OBJECTIVES:

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS 9+3

Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS 9+3

One way and two-way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9+3

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3

Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1 : Apply the concept of testing of hypothesis for small and large samples in real life problems.
CO2: Apply the basic concepts of classifications of design of experiments in the field of agriculture.
CO3: Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
CO4: Understand the knowledge of various techniques and methods for solving first and second order ordinary

differential equations.
CO5: Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXT BOOKS:

Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

REFERENCES:

Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.
Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 4th Edition, 2012.
Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2010.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	1	1	1	0	0	0	2	0	2	-	-
CO2	3	3	1	1	1	0	0	0	2	0	2	-	-
CO3	3	3	1	1	1	0	0	0	2	0	2	-	-
CO4	3	3	1	1	1	0	0	0	2	0	2	-	-
CO5	3	3	1	1	1	0	0	0	2	0	2	-	-
Avg	3	3	1	1	1	0	0	0	2	0	2	-	-

241MEC302T ENGINEERING THERMODYNAMICS L T P R C
3 0 0 0 3

COURSE OBJECTIVES:

- Impart knowledge on the basics and application of zeroth and first law of thermodynamics.
- Impart knowledge on the second law of thermodynamics in analyzing the performance of thermal devices.
- Impart knowledge on availability and applications of second law of thermodynamics
- Teach the various properties of steam through steam tables and Mollier chart.
- Impart knowledge on the macroscopic properties of ideal and real gases.

UNIT I BASICS, ZEROTH AND FIRST LAW 9

Review of Basics – Thermodynamic systems, Properties and processes Thermodynamic Equilibrium - Displacement work - P-V diagram. Thermal equilibrium - Zeroth law – Concept of temperature and Temperature Scales. First law – application to closed and open systems – steady and unsteady flow processes.

UNIT II SECOND LAW AND ENTROPY 9

Heat Engine – Refrigerator - Heat pump. Statements of second law and their equivalence & corollaries. Carnot cycle - Reversed Carnot cycle - Performance - Clausius inequality. Concept of entropy - T-s diagram - Tds Equations - Entropy change for a pure substance.

UNIT III AVAILABILITY AND APPLICATIONS OF II LAW 9

Ideal gases undergoing different processes - principle of increase in entropy. Applications of II Law. High- and low-grade energy. Availability and Irreversibility for open and closed system processes - I and II law Efficiency

UNIT IV PROPERTIES OF PURE SUBSTANCES 9

Steam - formation and its thermodynamic properties - p-v, p-T, T-v, T-s, h-s diagrams. PVT surface. Determination of dryness fraction. Calculation of work done and heat transfer in non-flow and flow processes using Steam Table and Mollier Chart.

UNIT V GAS MIXTURES AND THERMODYNAMIC RELATIONS 9

Properties of Ideal gas, real gas - comparison. Equations of state for ideal and real gases. vander Waal's relation - Reduced properties - Compressibility factor - Principle of Corresponding states - Generalized Compressibility Chart. Maxwell relations - TdS Equations - heat capacities relations - Energy equation, Joule-Thomson experiment - Clausius-Clapeyron equation.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students would be able to

CO1: Apply the zeroth and first law of thermodynamics by formulating temperature scales and calculating the property changes in closed and open engineering systems.

CO2: Apply the second law of thermodynamics in analysing the performance of thermal devices through energy and entropy calculations.

CO3: Apply the second law of thermodynamics in evaluating the various properties of steam through steam tables and Mollier chart

CO4: Apply the properties of pure substance in computing the macroscopic properties of ideal and real gases using gas laws and appropriate thermodynamic relations.

CO5: Apply the properties of gas mixtures in calculating the properties of gas mixtures and applying various thermodynamic relations to calculate property changes.

TEXTBOOKS:

1.Nag.P.K., “Engineering Thermodynamics”, 6th Edition, Tata McGraw Hill (2017), New Delhi.

2. Natarajan, E., “Engineering Thermodynamics: Fundamentals and Applications”, 2nd Edition (2014), Anuragam Publications, Chennai.

REFERENCES:

1. Cengel, Y and M. Boles, Thermodynamics - An Engineering Approach, Tata McGraw Hill,9th Edition, 2019.
2. Chattopadhyay, P, “Engineering Thermodynamics”, 2nd Edition Oxford University Press, 2016.
3. Rathakrishnan, E., “Fundamentals of Engineering Thermodynamics”, 2nd Edition, Prentice Hall of India Pvt. Ltd, 2006.
4. Claus Borgnakke and Richard E. Sonntag, “Fundamentals of Thermodynamics”, 10th Edition, Wiley Eastern, 2019.
5. Venkatesh. A, “Basic Engineering Thermodynamics”, Universities Press (India) Limited, 2007

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11		1	2
1	3	3	2	1										
2	3	3	2	1										
3	3	3	2	1					1		1		3	
4	3	3	2	1		1			2		1		3	2
5	3	3	2	1		1			2		1		3	2
Low (1) Medium (2) ; High (3)														

241MEC303T STRENGTH OF MATERIALS L T P R C
3 0 0 0 3

COURSE OBJECTIVES:

- To understand the concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion.
- To compute slopes and deflections in determinate beams by various methods.
- To study the stresses and deformations induced in thin and thick shells.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses - Deformation of simple and compound bars – Thermal stresses – Elastic constants - Volumertric strains – Stresses on inclined planes – Principal stresses and principal planes – Mohr's circle of stress.

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9

Beams – Types - Transverse loading on beams – Shear force and Bending moment in beams – Cantilever, Simply supported and over hanging beams. Theory of simple bending – Bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

UNIT III TORSION 9

Theory of Torsion – Stresses and Deformations in Solid and Hollow Circular Shafts – Combined bending moment and torsion of shafts - Power transmitted to shaft – Shaft in series and parallel – Closed and Open Coiled helical springs – springs in series and parallel.

UNIT IV DEFLECTION OF BEAMS 9

Elastic curve – Governing differential equation - Double integration method - Macaulay's method - Area moment method - Conjugate beam method for computation of slope and deflection of determinant beams.

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9

Stresses in thin cylindrical shell due to internal pressure - circumferential and longitudinal stresses - Deformation in thin cylinders – Spherical shells subjected to internal pressure – Deformation in spherical shells – Thick cylinders - Lame's theory.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students would be able to

CO1: Apply basic equation of stress and strain in simple and compound bars, the important of principal stresses and principal planes.

CO2: Understand the load transferring mechanism in beams and stress distribution due shearing force and bending moment.

CO3: Apply basic equation of torsion in designing of shafts and helical springs

CO4: Calculate slope and deflection in beams using different methods.

CO5: Analyze thin and thick shells for applied pressures.

TEXT BOOK

1.Rajput R.K. “Strength of Materials (Mechanics of Solids)", S.Chand & company Ltd., New Delhi, 7th edition, 2018.

2.Rattan S.S., “Strength of Materials", Tata McGraw Hill Education Pvt .Ltd., New Delhi, 2017.

REFERENCES:

1.Singh. D.K., “Strength of Materials”, Ane Books Pvt Ltd., New Delhi, 2021.

2.Egor P Popov, “Engineering Mechanics of Solids”, 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2015.

3.Beer. F.P. & Johnston. E.R. “Mechanics of Materials”, Tata McGraw Hill, 8th Edition, New Delhi 2019.

4.Vazirani. V.N, Ratwani. M.M, Duggal .S.K “Analysis of Structures: Analysis, Design and Detailing of Structures-Vol.1”, Khanna Publishers, New Delhi 2014.

CO	PO											PSO	
	1	2	3	4	5	6	7	8	9	10	11	1	2
1	3	3	3	3	2	3	1	3	2	3	1	3	2
2	3	3	3	3	2	3	1	3	2	3	1	3	2
3	3	3	3	3	2	3	1	3	2	3	1	3	2
4	3	3	3	3	2	3	1	3	2	3	1	3	2
5	3	3	3	3	2	3	1	3	2	3	1	3	2

241GES303T AI ESSENTIALS FOR ENGINEERS

L	T	P	R	C
3	0	0	0	3

COURSE OBJECTIVES

- To introduce fundamental concepts and significance of Artificial Intelligence (AI).
- To expose students to basic problem-solving and search techniques in AI.
- To explore knowledge representation techniques and reasoning methods in AI systems.
- To introduce fundamental concepts of Machine Learning.
- To familiarize students with domain-specific AI applications.

UNIT 1 INTRODUCTION TO ARTIFICIAL INTELLIGENCE **9**

History and Evolution of AI - Definition and Characteristics of AI – Goals and Scope in Engineering - Types of AI: Narrow AI, General AI, Super AI- Interdisciplinary nature of AI – AI vs Human Intelligence – Key Milestones in AI – Overview of AI Technologies: (Machine Learning, Deep Learning, Expert Systems, Computer Vision, NLP, Robotics)

UNIT 2 INTELLIGENT AGENTS AND PROBLEM SOLVING 9

Intelligent Agent: Architecture and Types – PEAS Framework - Problem Solving as Search – Uninformed Search Strategies: Breadth-First Search (BFS), Depth-First Search (DFS) - Informed Search Strategies: Greedy Best First Search, A* Algorithm – Heuristics and Evaluation Function – Game Playing and Adversarial Search – Case Study: Pathfinding in Robotics.

UNIT 3 KNOWLEDGE REPRESENTATION AND REASONING 9

What is Knowledge in AI? - Types: Declarative, Procedural - Knowledge Representation Techniques: Propositional Logic, First-Order Logic, Semantic Networks, Ontologies – Reasoning: Deductive and Inductive – Rule Based and Expert System.

UNIT 4 MACHINE LEARNING FUNDAMENTALS 9

Overview of Machine Learning: Definitions, Difference between AI, ML and Data Science – Categories: Supervised, Unsupervised, Reinforcement Learning, Basic Algorithms - Linear Regression, Decision Trees, KNN, Dataset basics and Evaluation Metrics, Simple application using Teachable Machine Tool.

UNIT 5 AI APPLICATIONS AND ETHICS 9

AI in Everyday Life: Smart Assistance, Face Recognition, Chat bots – AI in Engineering Domains: Electronics: AI in Signal Processing, Autonomous System, Civil: Smart Cities, Mechanical: Smart Manufacturing, Predictive Maintenance in Manufacturing, Electrical: Smart Grids, Biotech: Diagnostic Systems in Healthcare, CSE: Intelligent Software Systems, Business Intelligence – Societal & Ethical Considerations: Bias, Privacy, Safety – AI Governance and Regulation.

Course Outcomes

Upon completion of the course, the students will be able to:

CO1: Explain the fundamentals of Artificial Intelligence.
CO2: Identify and Apply problem-solving techniques, search strategies to AI problems.
CO3: Apply knowledge representation techniques and reasoning methods to model intelligent behavior in AI systems.
CO4: Analyze machine learning models and evaluate their performance.
CO5: Analyze domain-specific applications of AI in Engineering fields.

TEXTBOOK:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 4th Edition, 2022, Pearson.
2. Elaine Rich & Kevin Knight, “Artificial intelligence”, Tata McGraw-Hill.
3. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press.

REFERENCE BOOKS:

1. David L. Poole and Alan Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press.
2. Oliver Theobald, "Machine Learning for Absolute Beginners", 3rd Edition, 2021.
3. NPTEL Courses: IIT Delhi &"Introduction to Artificial Intelligence" – Prof. Sudarshan Iyengar, IIT Ropar.
4. Coursera : "AI for Everyone" – Prof.Andrew

Program Outcomes (PO) Mapping

CO → PO	PO1	PO2	PO3	PO4	PO5		PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1				2							
CO2	3	3	2	2						2	2			
CO3	3	2	2										2	
CO4	2	3	3	2	2					2				
CO5	2	3	2		2		2		2				2	

241MEC304T ENGINEERING MATERIALS AND METALLURGY L T P R C
3 0 0 0 3

COURSE OBJECTIVES:

- To learn the constructing the phase diagram and using of iron-iron carbide phase diagram for
- microstructure formation.
- To learn selecting and applying various heat treatment processes and its microstructure formation.
- To illustrate the different types of ferrous and non-ferrous alloys and their uses in engineering field.
- To illustrate the different polymer, ceramics and composites and their uses in engineering field.
- To learn the various testing procedures and failure mechanism in engineering field.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron – Iron carbide equilibrium diagram. Classification of steel and cast-Iron microstructure, properties and application.

UNIT II HEAT TREATMENT 9

Definition – Full annealing, stress relief, recrystallisation and spheroidising –normalizing, hardening and tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram – continuous cooling Transformation (CCT) diagram – Austempering, Martempering – Hardenability, Jominy end quench test -case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening – Thermo-mechanical treatments- elementary ideas on sintering.

UNIT III FERROUS AND NON-FERROUS METALS 9

Effect of alloying additions on steel (Mn, Si, Cr, Mo, Ni, V,Ti& W) – stainless and tool steels – HSLA - Maraging steels – Grey, white, malleable, spheroidal – alloy cast irons, Copper and its alloys – Brass, Bronze and Cupronickel – Aluminium and its alloys; Al-Cu – precipitation strengthening treatment – Titanium alloys, Mg-alloys, Ni-based super alloys – shape memory alloys- Properties and Applications- overview of materials standards

UNIT IV NON-METALLIC MATERIALS 9

Polymers – types of polymers, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PAI, PPO, PPS, PEEK, PTFE, Thermoset polymers –
Urea and Phenol formaldehydes –Nylon, Engineering Ceramics – Properties and applications of Al2O3, SiC, Si3N4, PSZ and SIALON – intermetallic- Composites- Matrix and reinforcement Materials- applications of Composites - Nano composites.

UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS 9

Mechanisms of plastic deformation, slip and twinning – Types of fracture – fracture mechanics- Griffith's theory- Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Micro and nano-hardness tests, Impact test lzod and charpy, fatigue and creep failure mechanisms.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course the students would be able to
CO1: Explain alloys and phase diagram, Iron-Iron carbon diagram and steel classification.
CO 2: Explain isothermal transformation, continuous cooling diagrams and different heat treatment processes.
CO3: Clarify the effect of alloying elements on ferrous and non-ferrous metals.
CO4: Summarize the properties and applications of non-metallic materials.
CO5: Explain the testing of mechanical properties.

TEXT BOOKS:
1.Kenneth G.Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 9th edition ,2018.
2.Sydney H.Avner, "Introduction to Physical Metallurgy", McGraw Hill Book Company, 1994

REFERENCES:
1.A. Alavudeen, N. Venkateshwaran, and J. T.WinowlinJappes, A Textbook of Engineering Materials and Metallurgy, Laxmi Publications, 2006.
2.Amandeep Singh Wadhwa, andHarvinder Singh Dhaliwal, A Textbook of Engineering Material and Metallurgy, University Sciences Press, 2008.
3.G.S. Upadhyay and Anish Upadhyay, "Materials Science and Engineering", Viva Books Pvt.Ltd, New Delhi, 2020.
4.Raghavan.V, "Materials Science and Engineering", Prentice Hall of India Pvt.Ltd. 6th edition, 20195.

CO	PO											PSO	
	1	2	3	4	5	6	7	8	9	10	11	1	2
1	3	1	3	2							2	2	1
2	3	1	3	1		2		1			2	2	1
3	3	1	3								2	2	1
4	3	1	3				2				2	2	1
5	3	1	3	2	2						2	2	1

241MEC305T MANUFACTURING PROCESSES L T P R C
3 0 0 0 3

COURSE OBJECTIVES:

- To illustrate the working principles of various metal casting processes.
- To learn and apply the working principles of various metal joining processes.
- To analyses the working principles of bulk deformation of metals.
- To learn the working principles of sheet metal forming process.
- To study and practice the working principles of plastics molding.

UNIT – I METAL CASTING PROCESSES 9

Sand Casting – Sand Mould – Type of patterns - Pattern Materials – Pattern allowances – Molding sand Properties and testing – Cores –Types and applications – Molding machines – Types and applications– Melting furnaces – Principle of special casting processes- Shell, investment – Ceramic mold – Pressure die casting – low pressure, gravity- Tilt pouring, high pressure die casting- Centrifugal Casting – CO2 casting –- Defects in Sand casting process-remedies

UNIT II METAL JOINING PROCESSES 9

Fusion welding processes – Oxy fuel welding – Filler and Flux materials-–Arc welding, Electrodes, Coating and specifications – Gas Tungsten arc welding –Gas metal arc welding - Submerged arc welding – Electro slag welding– Plasma arc welding — Resistance welding Processes -Electron beam welding –Laser beam Welding Friction welding – Friction stir welding – Diffusion welding – Thermit Welding, Weld defects – inspection &remedies – Brazing - soldering – Adhesive bonding.

UNIT III BULK DEFORMATION PROCESSES & MECHANICS OF METAL CUTTING 9

Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – cold forging- Characteristics of the processes – Typical forging operations – rolling of metals – Types of Rolling – Flat strip rolling – shape rolling operations – Defects in rolled parts – Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion. Introduction to shaping operations.

Mechanics of chip formation, forces in machining, Types of chip, cutting tools – single point cutting tool nomenclature, orthogonal and oblique metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability

UNIT – IV RECIPROCATING MACHINE TOOLS 9

Reciprocating machine tools: shaper, planer, slotter: Types and operations- Hole making: Drilling, reaming, boring, tapping, type of milling operations-attachments- types of milling cutters– machining time calculation - Gear cutting, gear hobbing and gear shaping – gear finishing methods Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centerless grinding, internal grinding - micro finishing methods.

UNIT – V CNC MACHINE AND PROGRAMMING 9

Computer Numerical Control (CNC) machine tools, constructional details, special features – Drives, Recirculating ball screws, tool changers; CNC Control systems – Open/closed, point-to-point/continuous - Turning and machining centers – Work holding methods in Turning and machining centers, Coolant systems, Safety features.

Coordinates, axis and motion, Absolute vs Incremental, Interpolators, Polar coordinates, Program planning, G and M

codes, Manual part programming for CNC machining centers and Turning centers – Fixed cycles, Loops and subroutines, Setting up a CNC machine for machining.

TOTAL :45 PERIODS

OUTCOMES:

At the end of the course the students would be able to

CO1: Explain the principle of different metal casting processes.

CO2: Describe the various metal joining processes.

CO3: Apply the mechanism of metal removal process and to identify the factors involved in improving machinability.

CO4: Describe the constructional and operational features of reciprocating machine tools

CO5: Demonstrate the Program CNC machine tools through planning, writing codes and setting up CNC machine tools to manufacture a given component.

TEXT BOOKS:

1.Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India,4th Edition, 2013

2.P.N.Rao Manufacturing Technology Volume 1&2 Mc Grawhill Education 5th edition,2018.

REFERENCES:

1.Roy. A. Lindberg, Processes and materials of manufacture, PHI / Pearson education, 2006.

2.S. Gowri P. Hariharan, A.Suresh Babu, Manufacturing Technology I, Pearson Education, 2008.

3.Paul Degarma E, Black J.T and Ronald A. Kosher, Eligth Edition, Materials and Processes, in Manufacturing, Eight Edition, Prentice – Hall of India, 1997.

4.Hajra Chouldhary S.K and Hajra Choudhury. AK., Elements of workshop Technology, volume I and II, Media promoters and Publishers Private Limited, Mumbai, 1997

5.Sharma, P.C., A Text book of production Technology, S.Chand and Co. Ltd., 2004

CO	PO											PSO	
	1	2	3	4	5	6	7	8	9	10	11	1	2
1	3		2			2	3	1	1	-	-	3	1
2	3		2			2	3	1	1	-	-	3	1
3	3		2			2	2	1	1	-	-	3	1
4	3		2			2	2	1	1	-	-	3	1
5	3		2		2	2	2	1	1	-	-	3	1

241MEC311L COMPUTER AIDED MACHINE DRAWING

L	T	P	R	C
0	0	3	1	2

COURSE OBJECTIVES:

- To acquaint the skills and practical experience in handling 2D drafting and 3D modelling software
- systems, standard drawing practices using fits and tolerances.
- To prepare assembly drawings both manually and using standard CAD packages.
- To Preparing standard drawing layout for modeled parts, assemblies with BoM.

PART I DRAWING STANDARDS & FITS AND TOLERANCES 12

Code of practice for Engineering Drawing, BIS specifications – Welding symbols, riveted joints, keys, fasteners – Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc. - Limits, Fits – Tolerancing of individual dimensions IS919- Specification of Fits – Preparation of production drawings and reading

of part and assembly drawings, basic principles of Geometric Dimensioning &Tolerancing.

PART II 2D DRAFTING

Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed Drawing.

1. Bearings – Bush Bearing,
2. Valves – Safety and Non-return Valves.
3. Couplings – Flange, Oldham's, Muff, Gear couplings.
4. Joints – Universal, Knuckle, Gib& Cotter, Strap, Sleeve &Cotter joints.
5. Engine parts – Piston, Connecting Rod, Crosshead (vertical and horizontal), Stuffing box, multi-plate clutch.
6. Machine Components – Screw Jack, Machine Vice, LatheTail Stock, Lathe Chuck, Plummer Block, Vane and Gear pumps.

Total: 20% of classes for theory classes and 80% of classes for practice

Note: 25% of assembly drawings must be done manually and remaining 75% of assembly drawings must be done by using any CAD software. The above tasks can be performed manually and using standard commercial 2D CAD software.

TOTAL:60 PERIODS

OUTCOMES:

At the end of the course the students would be able to

CO1: Prepare standard drawing layout for modelled assemblies with BoM.
CO2: Model orthogonal views of machine components.
CO3: Prepare standard drawing layout for modelled parts

TEXT BOOKS:

1.Gopalakrishna K.R., "Machine Drawing", 17th Edition, Subhas Stores Books Corner, Bangalore,2003.
2.N. D. Bhatt and V.M. Panchal, "Machine Drawing", 51st Edition, Charator Publishers,2022.

REFERENCES:

1.K. L Narayana, P.Kannaiah, K.Venkata Reddy, Machine Drawing , 15 Edition , New Age International Publication
2.Goutam Pohit and Goutam Ghosh, "Machine Drawing with AutoCAD", 1st Edition,Pearson Education, 2004
3.Junnarkar, N.D., "Machine Drawing", 1st Edition, Pearson Education, 2004
4.N. Siddeshwar, P. Kanniah, V.V.S. Sastri," Machine Drawing" , published by Tata McGrawHill,2006
5.S. Trymbaka Murthy, "A Text Book of Computer Aided Machine Drawing", CBS Publishers, New Delhi, 2007

CO	PO										PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**
1	1	2			3				3	2		2	2
2	1	2			3				3	2		2	2
3	1	2			3				3	2		2	2

241MEC312L MANUFACTURING PROCESSES LABORATORY

L	**T**	**P**	**R**	**C**
0	**0**	**3**	**0**	**2**

COURSE OBJECTIVES:

- To Selecting appropriate tools, equipment's and machines to complete a given job.
- To Performing various welding process using GMAW and fabricating gears using gear making
- machines.
- To Performing various machining process such as rolling, drawing, turning, shaping, drilling, milling and analyzing the defects in the cast and machined components.

LIST OF EXPERIMENTS

1. Fabricating simple structural shapes using Gas Metal Arc Welding machine.
2. Shaping – Square Heads on circular parts using shaper machine.
3. Milling contours on plates using vertical milling machine.
4. Cutting spur and helical gear using milling machine.
5. Generating gears using gear hobbing machine.
6. Generating gears using gear shaping machine.
7. Grinding components using surface grinding machine.
8. Cutting force calculation using dynamometer in milling machine
9. Spur gear cutting in milling machine
10. Helical Gear Cutting in milling machine
11. Plain Surface grinding and cylindrical grinding
12. Tool angle grinding with tool and Cutter Grinder
13. Measurement of cutting forces in Milling /Turning Process
14. CNC Part Programming

TOTAL:60 PERIODS

OUTCOMES: At the end of the course the students would be able to

CO1: Demonstrate the safety precautions exercised in the mechanical workshop and join two metals using GMAW.

CO2: The students able to make the work piece as per given shape and size using machining process such as rolling, drawing, turning, shaping, drilling and milling.

CO3: The students become make the gears using gear making machines and analyze the defects in the cast and machined components

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**		**1**	**2**
1	3						1		2		1		1	2
2	3						1		2		1		1	2
3	3						1		2		1		1	2

241MEC401T THEORY OF MACHINES

L	**T**	**P**	**R**	**C**
3	**0**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To study the basic components of mechanisms, analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism and design cam mechanisms for specified output motions.
- To study the basic concepts of toothed gearing and kinematics of gear trains
- To Analyzing the effects of friction in machine elements
- To Analyzing the force-motion relationship in components subjected to external forces and
- analyzing of standard mechanisms.
- To Analyzing the undesirable effects of unbalances resulting from prescribed motions in mechanism and the effect of dynamics of undesirable vibrations.

UNIT – I KINEMATICS OF MECHANISMS **9**

Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain – kinematics analysis

in simple mechanisms – velocity and acceleration polygons– Analytical methods – computer approach – cams – classifications – displacement diagrams - layout of plate cam profiles – derivatives of followers motion – circular arc and tangent cams.

UNIT – II GEARS AND GEAR TRAINS 9

Spur gear – law of toothed gearing – involute gearing – Interchangeable gears – Gear tooth action interference and undercutting – nonstandard teeth – gear trains – parallel axis gears trains – epicyclic gear trains – automotive transmission gear trains.

UNIT – III FRICTION IN MACHINE ELEMENTS 9

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction aspects in brakes– Friction in vehicle propulsion and braking.

UNIT – IV FORCE ANALYSIS 9

Applied and Constrained Forces – Free body diagrams – static Equilibrium conditions – Two, Three and four members – Static Force analysis in simple machine members – Dynamic Force Analysis – Inertia Forces and Inertia Torque – D'Alembert's principle – superposition principle – dynamic Force Analysis in simple machine members

UNIT – V BALANCING AND VIBRATION 9

Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing machines – free vibrations – Equations of motion – natural Frequency – Damped Vibration – bending critical speed of simple shaft – Torsional vibration – Forced vibration – harmonic Forcing – Vibration isolation. (Gyroscopic principles)

TOTAL: 45 PERIODS

OUTCOMES: At the end of the course the students would be able to
CO 1 : Discuss the basics of mechanism.
CO 2 : Solve problems on gears and gear trains.
CO 3 : Examine friction in machine elements.
CO 4 : Calculate static and dynamic forces of mechanisms.
CO 5 : Calculate the balancing masses and their locations of reciprocating and rotating masses. Computing the frequency of free vibration, forced vibration and damping coefficient.

TEXT BOOKS:

1.Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", Oxford University Press, 2017.
2.Ramamurthi. V, "Mechanics of Machines", Narosa Publishing House, 3rd edition 2019.

REFERENCES:

1.AmitabhaGhosh and Asok Kumar Mallik, "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., 1988.
2.Rao.J.S. and Dukkipati.R.V. "Mechanism and Machine Theory", New Age International Pvt. Ltd., 2nd edition,2014.
3.Rattan, S.S, "Theory of Machines", McGraw-Hill Education Pvt. Ltd., 5th edition 2019.
4.Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGraw-Hill, 2013.
5.Wilson and Sadler, Kinematics and Dynamics of Machinery, Pearson, 2008.

CO	PO											PSO	
	1	2	3	4	5	6	7	8	9	10	11	1	2
1	3	2	2		2			1			1	3	1
2	3	2	2		2			1			1	3	1
3	3	2	2		2			1			1	3	1
4	3	2	2		2			1			1	3	1
5	3	2	2		2			1			1	3	1

241MEC402T THERMAL ENGINEERING

L	T	P	R	C
4	0	0	1	3

COURSE OBJECTIVES:

- To learn the concepts and laws of thermodynamics to predict the operation of thermodynamic
- cycles and performance of Internal Combustion (IC) engines and Gas Turbines.
- To analyzing the performance of steam nozzle, calculate critical pressure ratio
- To Evaluating the performance of steam turbines through velocity triangles, understand the need
- for governing and compounding of turbines
- To analyzing the working of IC engines and various auxiliary systems present in IC engines
- To evaluating the various performance parameters of IC engines

UNIT I THERMODYNAMIC CYCLES 9

Air Standard Cycles – Carnot, Otto, Diesel, Dual, Brayton – Cycle Analysis, Performance and Comparison, Basic Rankine Cycle, modified, reheat and regenerative cycles.

UNIT II STEAM NOZZLES AND INJECTOR 9

Types and Shapes of nozzles, Flow of steam through nozzles, Critical pressure ratio, Variation of mass flow rate with pressure ratio. Effect of friction. Metastable flow.

UNIT III STEAM AND GAS TURBINES 9

Types, Impulse and reaction principles, Velocity diagrams, Work done and efficiency – optimal operating conditions. Multi-staging, compounding and governing. Gas turbine cycle analysis – open and closed cycle. Performance and its improvement - Regenerative, Intercooled, Reheated cycles and their combination.

UNIT IV INTERNAL COMBUSTION ENGINES – FEATURES AND COMBUSTION 9

IC engine – Classification, working, components and their functions. Ideal and actual : Valve and port timing diagrams, p-v diagrams- two stroke & four stroke, and SI & CI engines – comparison. Geometric, operating, and performance comparison of SI and CI engines. Desirable properties and qualities of fuels. Air-fuel ratio calculation – lean and rich mixtures. Combustion in SI & CI Engines – Knocking – phenomena and control.

UNIT V INTERNAL COMBUSTION ENGINE PERFORMANCE AND AUXILIARY SYSTEMS 9

Performance and Emission Testing, Performance parameters and calculations. Morse and Heat Balance tests. Multipoint Fuel Injection system and Common rail direct injection systems. Ignition systems – Magneto, Battery and Electronic. Lubrication and Cooling systems. Concepts of Supercharging and Turbocharging –
Emission Norms

TOTAL :45 PERIODS

OUTCOMES: At the end of the course the students would be able to

CO1: Apply thermodynamic concepts to different air standard cycles and solve problems.
CO2: To solve problems in steam nozzle and calculate critical pressure ratio.
CO3: Explain the flow in steam turbines, draw velocity diagrams, flow in Gas turbines and solve problems.
CO4: Explain the functioning and features of IC engine, components and auxiliaries.
CO5: Calculate the various performance parameters of IC engines

TEXT BOOKS:

1. Mahesh. M. Rathore, “Thermal Engineering”, 1st Edition, Tata McGraw Hill, 2010.
2. Ganesan.V, " Internal Combustion Engines" 4th Edition, Tata McGraw Hill, 2012.

REFERENCES:

1. Ballaney. P, “Thermal Engineering”, 25th Edition, Khanna Publishers, 2017.
2. Domkundwar, Kothandaraman, &Domkundwar, “A Course in Thermal Engineering”, 6th Edition, DhanpatRai& Sons, 2011.
3. Gupta H.N, “Fundamentals of Internal Combustion Engines”, 2nd Edition Prentice Hall of India, 2013.
4. Mathur M.L and Mehta F.S., “Thermal Science and Engineering”, 3rd Edition, Jain Brothers Pvt. Ltd, 2017.
5. Soman. K, “Thermal Engineering”, 2nd Edition, Prentice Hall of India, 2011.

CO	PO											PSO	
	1	2	3	4	5	6	7	8	9	10	11	1	2
1	3	2	1	1							1	2	1
2	3	2	2	1							1	2	1
3	3	2	2	1							1	2	1
4	3	2	1	1							1	2	1
5	3	2	1	1							1	2	1

241MEC403T FLUID MECHANICS AND MACHINERY L T P R C
3 0 0 0 3

COURSE OBJECTIVES:

- To introduce the students about properties of the fluids, behavior of fluids under static conditions.
- To impart basic knowledge of the dynamics of fluids and boundary layer concept.
- To expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on pipe bends.
- To exposure to the significance of boundary layer theory and its thicknesses.
- To expose the students to basic principles of working of hydraulic machineries and to design Pelton wheel, Francis and Kaplan turbine, centrifugal and reciprocating pumps.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 10

Properties of fluids – Fluid statics - Pressure Measurements - Buoyancy and floatation - Flow characteristics - Eulerian and Lagrangian approach - Concept of control volume and system - Reynold's transportation theorem - Continuity equation, energy equation and momentum equation - Applications.

UNIT II FLOW THROUGH PIPES AND BOUNDARY LAYER 9

Reynold's Experiment - Laminar flow through circular conduits - Darcy Weisbach equation - friction factor - Moody diagram - Major and minor losses - Hydraulic and energy gradient lines - Pipes in series and parallel - Boundary layer concepts - Types of boundary layer thickness.

UNIT III DIMENSIONAL ANALYSIS AND MODEL STUDIES 8

Fundamental dimensions - Dimensional homogeneity - Rayleigh's method and Buckingham Pi theorem Dimensionless parameters - Similitude and model studies - Distorted and undistorted models.

UNIT IV TURBINES 9

Impact of jets - Velocity triangles - Theory of rotodynamic machines - Classification of turbines - Working principles - Pelton wheel - Modern Francis turbine - Kaplan turbine - Work done - Efficiencies - Draft tube Specific speed - Performance curves for turbines - Governing of turbines.

UNIT V PUMPS 9

Classification of pumps - Centrifugal pumps - Working principle - Heads and efficiencies– Velocity triangles - Work done by the impeller - Performance curves - Reciprocating pump working principle - Indicator diagram and it's variations - Work saved by fitting air vessels - Rotary pumps.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course, the student is expected to be able to

CO1: Understand the properties and behaviour in static conditions. Also, to understand the conservation laws applicable to fluids and its application through fluid kinematics and dynamics

CO2: Estimate losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel. Also, to understand the concept of boundary layer and its thickness on the flat solid surface.

CO3: Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performances of prototype by model studies

CO4: Explain the working principles of various turbines and design the various types of turbines.

CO5: Explain the working principles of centrifugal, reciprocating and rotary pumps and design the centrifugal and reciprocating pumps

TEXT BOOKS:

1.Modi P.N. and Seth, S.M. Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, 22nd edition (2019)
2.Jain A. K. Fluid Mechanics including Hydraulic Machines, Khanna Publishers, New Delhi, 2014.
3.Kumar K. L., Engineering Fluid Mechanics, Eurasia Publishing House(p) Ltd. New Delhi, 201

REFERENCES:

1.Fox W.R. and McDonald A.T., Introduction to Fluid Mechanics John-Wiley and Sons, Singapore, 2011.
2.Pani B S, Fluid Mechanics: A Concise Introduction, Prentice Hall of India Private Ltd, 2016.
3.Cengel Y A and Cimbala J M, Fluid Mechanics, McGraw Hill Education Pvt. Ltd., 2014.

4.S K Som; Gautam Biswas and S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGrw Hill Education Pvt. Ltd., 2012.
5.Streeter, V. L. and Wylie E. B., Fluid Mechanics, McGraw Hill Publishing Co., 2010.

CO	PO											PSO	
	1	2	3	4	5	6	7	8	9	10	11	1	2
1	3	3	2	2	1	2	2	1	2	1	1	3	2
2	3	3	3	2	1	2	2	1	2	1	1	3	2
3	3	3	3	3	1	2	2	1	2	1	1	3	3
4	3	3	3	3	1	2	2	1	2	1	1	3	2
5	3	3	3	3	1	2	2	1	2	1	1	3	2

241MEC404T ROBOTICS AND AUTOMATION L T P R C
3 0 0 0 3

COURSE OBJECTIVES:

- To learn about basics of robots and their classifications
- To understand the robot kinematics in various planar mechanisms
- To learn about the concepts in robot dynamics
- To understand the concepts in trajectory planning and programming
- To know about the various applications of robots

UNIT – I BASICS OF ROBOTICS 8

Introduction- Basic components of robot-Laws of robotics- classification of robot- robot architecture, work space-accuracy-resolution –repeatability of robot.

UNIT – II ROBOT KINMEATICS 11

Robot kinematics: Introduction- Matrix representation- rigid motion & homogeneous transformation- D-H, forward & inverse kinematics of 2DOF and 3 DOF planar and spatial mechanisms

UNIT – III ROBOT DYNAMICS 9

Introduction - Manipulator dynamics – Lagrange - Euler formulation- Newton - Euler formulation

UNIT – IV TRAJECTORY, PATH PLANNING AND PROGRAMMING 8

Trajectory Planning- Joint space and Cartesian space technique, Introduction to robot control, Robot programming and Languages- Introduction to ROS

UNIT – V ROBOT AND ROBOT APPLICATIONS 9

Sensors and Actuators for Robots, Power transmission systems, Rotary to rotary motion, Rotary to linear motion, Harmonics drives – gear system - belt drives. Robot end effectors & Grippers: Introduction- types & classification- Mechanical gripper- gripper force analysis- other types & special purpose grippers. Robot Applications: pick and place, manufacturing, automotive, medical, space and underwater.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon completion of this course, the students can able to

CO1: State the basic concepts and terminologies of robots

CO2: Know the Procedures for Forward and Inverse Kinematics, Dynamics for Various Robots

CO3: Derive the Forward and Inverse Kinematics, Dynamics for Various Robots

CO4: Apply the various programming techniques in industrial applications

CO5: Analyze the use of various types of robots in different applications

TEXT BOOKS:

1.John.J.Craig, " Introduction to Robotics: Mechanics & control", Pearson Publication, Fourth edition, 2018.

2.K.S.Fu, R.C.Gonzalez, C.S.G.Lee, "Robotics: Sensing, Vision & Intelligence", Tata McGraw-Hill Publication, First Edition, 1987.

REFERENCES:

1.M.P.Groover, M.Weiss ,R.N. Nagal, N.G.Odrey, "Industrial Robotics - Technology, programming and Applications" Tata , McGraw-Hill Education Pvt Limited 2ndEdition, 2012.

2. Jazar, "Theory of Applied Robotics: Kinematics, Dynamics and Control", Springer, 2ndEdition, 2010

3. S K Saha, Introduction to Robotics, Tata McGraw-Hill, ISBN: 9789332902800, Second Edition, 9789332902800

4. Sathya Ranjan Deb, "Robotics Technology & flexible Automation" Second edition, Tata McGraw-Hill Publication, 2009.

CO	PO											PSO	
	1	2	3	4	5	6	7	8	9	10	11	1	2
1	3	2	3	1	2							1	2
2	3	2	3	1	2							1	2
3	3	2	3	1	2							1	2
4	3	2	3	1	2							1	2
5	3	2	3	1	3							1	2

241GES405T ARTIFICIAL INTELLIGENCE IN MECHANICAL ENGINEERING L T P R C

3 0 0 0 3

Course Objectives

- To explore the fundamental principles of Artificial Intelligence (AI) and its role in solving complex problems in mechanical engineering systems.
- To apply AI-based search, optimization, and learning algorithms to enhance performance and decision-making in mechanical processes.
- To examine machine learning approaches and knowledge representation methods for diagnostics, fault detection, and system control in mechanical engineering.
- To design and integrate AI-driven solutions into manufacturing, design, robotics, and predictive maintenance tasks.
- To evaluate current and emerging AI applications in mechanical engineering, considering ethical, safety, and sustainability implications.

UNIT 1: FOUNDATIONS OF AI AND ITS RELEVANCE TO MECHANICAL ENGINEERING 9

Definition, scope, and evolution of AI - AI vs. traditional computational methods - Role of AI in product lifecycle management - Review of mechanical systems suitable for AI integration - Introduction to tools: MATLAB, Python, and simulation software - Application of AI in Mechanical Engineering

UNIT 2: INTELLIGENT CONTROL SYSTEMS 9

Basics of control systems in mechanical engineering - Fuzzy logic, neural networks, and expert systems - Adaptive and predictive control using AI - Case studies: HVAC control, smart actuators, and energy optimization - Implementation using microcontrollers and PLCs

UNIT 3: AI FOR CONDITION MONITORING AND PREDICTIVE MAINTENANCE 9

Principles of machine condition monitoring - Sensor integration and data collection techniques - Vibration analysis, thermography, and acoustic monitoring - AI models for failure prediction (SVM, ANN, Decision Trees) - Case studies: CNC machines, pumps, bearings, gearboxes

UNIT 4: AI IN MECHATRONICS AND SMART SYSTEMS 9

Integration of AI in mechatronic systems, Autonomous machines and AI-driven decision making - Real-time data processing in robotic systems - Computer vision systems in mechanical inspection - AI-based human–machine interaction (HMI)

UNIT 5: EMERGING TRENDS AND PROJECT APPLICATIONS 9

Digital twins and AI - AI in additive manufacturing and topology optimization - AI-driven energy systems (thermal, fluid, hybrid) - Ethical, safety, and sustainability issues in AI systems - Mini-project: Develop a basic AI model for a mechanical system (simulation or prototype)

TOTAL: 45 PERIODS

Course Outcomes (COs)

CO1: Analyze the foundational principles of AI and examine their relevance to mechanical engineering, including intelligent systems, data acquisition, and AI tools.
CO2: Apply AI-based optimization techniques and intelligent control strategies to improve manufacturing, design processes, and energy management in mechanical systems.
CO3: Develop machine learning models and utilize data analytics for predictive maintenance, fault detection, and condition monitoring in mechanical equipment.
CO4: Design and implement AI-driven systems in robotics, mechatronics, and automation for real-time decision-making, computer vision, and smart manufacturing.
CO5: Evaluate emerging AI applications in mechanical engineering, considering ethical, safety, and sustainability implications in system design and deployment.

Text books:

1.S. Rajasekaran & G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic, and Genetic Algorithms, 1st Edition, PHI Learning Pvt. Ltd., 2003. Pages: 1–90 (Chapters on Neural Networks and Fuzzy Logic relevant to intelligent control systems).
2.M. Affonso & S. B. Gabriel, AI in Mechanical and Industrial Engineering,
1st Edition, Springer, 2021. Pages: 25–100 (Sections on AI in manufacturing, predictive maintenance, and design applications).

References:

1.J. Norberto Pires, Industrial Robots Programming: Building Applications for the Factories of the Future, 1st Edition, Springer, 2007. Pages: 101–175 (Covers robotics, automation, and control programming using AI).

2.A. Kusiak, Smart Manufacturing, 1st Edition, Elsevier, 2022. Pages: 45–130 (Relevant to AI in Industry 4.0 and data-driven manufacturing systems).

3.Zindani, Divya; Davim, J. Paulo and Kumar, Kaushik Artificial Intelligence in Mechanical and Industrial Engineering (Artificial Intelligence AI in Engineering) , 1st Edition, 2021

4.Ganesh M. Kakandikar, Dinesh G. Thakur Nature-Inspired Optimization in Advanced Manufacturing Processes and Systems, 1st Edition, 2021

Web link:

1.NPTEL Course – AI Applications in Manufacturing Offered by IITs (Free online resource), Updated 2024. https://nptel.ac.in/courses/ (Suggested modules: Week 2 – Introduction to AI in Manufacturing; Week 6 – Predictive Maintenance)

2. Coursera – AI for Engineering Applications Offered by various universities, Latest Update: 2023. https://www.coursera.org/ (Focus on real-world case studies involving AI in mechanical and civil systems)

CO	PO											PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**
1	3	2	2	1	-	-	2	2	2	-	2	-	2
2	3	2	2	1	-	1	-	2	2	-	2	-	2
3	3	2	2	1	-	1	-	2	2	-	2	-	2
4	3	2	2	1	-	1	-	2	2	-	2	-	2
5	3	2	2	1	-	1	-	2	2	-	2	-	2

241MEC411L STRENGTH OF MATERIALS AND FLUID MACHINERY LABORATORY L T P R C
0 0 3 0 2

COURSE OBJECTIVE:

To study the mechanical properties of metals, wood and spring by testing in laboratory.
To verify the principles studied in fluid mechanics and machinery theory by performing experiments in laboratory.

UNIT – I STRENGTH OF MATERIALS 30

LIST OF EXPERIMENTS

1. Tension test on mild steel rod
2. Torsion test on mild steel rod
3. Hardness test on metal (Rockwell and Brinell Hardness)
4. Compression test on helical spring
5. Deflection test on carriage spring

UNIT – II FLUID MECHANICS AND MACHINES LABORATORY **30**

LIST OF EXPERIMENTS

1. Determination of forces due to impact of jet on a fixed plate
2. Characteristics of centrifugal pumps
3. Characteristics of submersible pump
4. Characteristics of Pelton wheel turbine
5. Characteristics of Kaplon turbine
6. Characteristics of Francis turbine

TOTAL: 60 PERIODS

OUTCOMES: On completion of the course, the student is expected to be able to

CO1: Determine the tensile, torsion and hardness properties of metals by testing

CO2: Apply the conservation laws to determine the coefficient of discharge of a venturi meter and finding the friction factor of given pipe

CO3: Apply the fluid static and momentum principles to determine the metacentric height and forces due to impact of jet

CO	PO											PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**
1	3	2	1	3	3	1	1	1	3	1	1	2	2
2	3	2	1	3	3	1	1	1	3	1	1	3	2
3	3	3	2	3	2	1	1	1	3	1	1	3	2
Low (1) ; Medium (2) ; High (3)													

241MEC412L **ROBOTICS AND AUTOMATION LAB** **L T P R C**
0 0 3 0 2

COURSE OBJECTIVES:

To impart knowledge on

- Fundamentals of fluid power and Mechatronics and primary actuating systems.
- Programming skills in Programmable logic controllers.
- Principles of pneumatics and hydraulics and apply them to real life problems.

List of experiments:

1. Standard Fluid Power Symbols.
2. Pneumatic Basic Logic Circuits.
3. Pneumatic Circuit for Material Handling System.
4. Electro pneumatic circuit using Relay, Limit Switch and solenoid
5. Valves.
6. PLC controlled pneumatic Logic circuits
7. PLC controlled pneumatic circuit for Material Handling system
8. Control of Fanuc robot.
9. Robot programming for pick and place application.
10. Assembly and disassembly of PLC controlled based mobile robot.
11. Programming for interfacing of sensors.

COURSE OUTCOMES:

After completing the course, the students will be able to

CO1: Apply Boolean algebra for logic design of pneumatic circuits.

CO2: Build logic circuits for industrial applications.

CO3: Write program me for robot movements.

CO	PO											PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**
1	2	2	1	1					1		1	1	1
2	2	2	1	1					1		1	1	1
3	2	2	1	1					1		1	1	1
Low (1) ; Medium (2) ; High (3)													