SHIV NADAR
UNIVERSITY
CHENNAI

Rajiv Gandhi Salai, Kalavakkam – 603 110

SSN School of Engineering

DEPARTMENT OF MECHANICAL ENGINEERING

B.TECH. MECHANICAL ENGINEERING

CURRICULUM & SYLLABUS

REGULATIONS 2025

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Graduates will excel as mechanical engineers in industries and research organizations leading to successful professional career or entrepreneurship.

PEO2: Graduates will pursue higher studies, research, professional development and lifelong learning to keep abreast with current technological advancements.

PEO3: Graduates will demonstrate professional standards, ethical practices and commitment to social and environmental responsibilities.

PROGRAM OUTCOMES (POs)

Program outcomes are the skills and knowledge which the students should have acquired at the time of graduation. A program outcome indicates what a student can do from course-wise knowledge acquired during the program. Students who graduate from this program shall exhibit the following:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization to develop to the solution of complex Mechanical Engineering problems (WK 1 to 4).

PO2: Problem Analysis: Identify, formulate, review research literature, and analyze complex Mechanical Engineering problems reaching substantiated conclusions with consideration for sustained development (WK 1 to 4).

PO3: Design/Development of solutions: Design creative solutions for complex Mechanical Engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required (WK5).

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex Mechanical Engineering problems using research-based knowledge including design of experiments, modelling, analysis and interpretation of data to provide valid conclusions (WK8).

PO5: Engineering Tool Usage: Create, select, and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling, recognizing their limitations to solve complex Mechanical Engineering problems (WK2 and WK6).

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex Mechanical Engineering problems for their impact on sustainability with reference to economy, health, safety, legal framework, culture and environment (WK1, WK5 and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws (WK9).

PO8: Individual and Collaborative Teamwork: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and the society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multi-disciplinary environments.

PO11: Life-long learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change (WK8).

PROGRAM SPECIFIC OBJECTIVES (PSOs)

PSO1: Graduates will be able to exhibit competence in modern manufacturing processes, automation, robotics and quality control for efficient and sustainable production in industries

PSO2: Graduates will be able to design and analyse mechanical engineering components and systems using principles of engineering mechanics and design, material science and computational methods.

PSO3: Graduates will be able to analyse and apply engineering concepts of thermodynamics, fluid mechanics and heat transfer in thermal and fluid systems applications.

CURRICULUM

SEMESTER - I

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1.	Matrices and Calculus	MD	4	3	1	0	4
2.	Engineering Chemistry	MD	4	2	0	2	3
3.	Communicative English	AEC	4	2	0	2	3
4.	Engineering Graphics	MC	4	2	0	2	3
5.	Engineering Mechanics	MC	3	3	0	0	3
6.	Professional Ethics and Human Values	VAC	2	2	0	0	2
7.	Programming in Python for Data Science	VAC	3	1	0	2	2
8.	Makers Space Laboratory	SEC	4	0	0	4	2
9.	Extra academic activity*	VAC	2	0	0	2	**1***
Total			**30**	**15**	**1**	**14**	**22+1***

SEMESTER - II

Sl. No	Course Title	Course Category	Contact Periods	L	T	P	C
1.	Differential Equations and Complex Functions	MC	3	2	1	0	3
2.	Technical Writing	AEC	4	2	0	2	3
3.	Engineering Physics	MD	5	3	0	2	4
4.	Environmental Science	VAC	2	2	0	0	2
5.	Manufacturing Processes I	MC	5	3	0	2	4
6.	Fundamentals of Mechanical Engineering and Practices	MC	6	2	0	4	4
7.	Skill Enhancement Laboratory (Drone workshop)	SEC	4	0	0	4	2
8.	Extra academic activity*	VAC	2	0	0	2	**1***
Total			**31**	**14**	**1**	**16**	**22+1***

***Note at a later page on Extra Academic Activity**

SEMESTER - III

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1.	Statistics and Numerical Methods	MS	3	2	0	2	3
2.	Fluid Mechanics and Machinery	MC	3	3	0	0	3
3.	Material Science and Engineering	MS	2	2	0	0	2
4.	Mechanics of Solids	MC	3	3	0	0	3
5.	Design Thinking, Innovation and Entrepreneurship	SEC	4	2	0	2	3
6.	Engineering Thermodynamics	MC	4	3	1	0	4
7.	Mechanics of Solids Laboratory	MC	2	0	0	2	1
8.	Fluid Mechanics Laboratory	MC	2	0	0	2	1
9.	Material Science Laboratory	SEC	2	0	0	2	1
Total			**26**	**15**	**0**	**12**	**21**

SEMESTER - IV

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1.	Manufacturing Processes II	MC	5	3	0	2	4
2.	Computer Aided Design and Manufacturing	MC	4	2	0	2	3
3.	Thermal Engineering	MC	5	3	0	2	4
4.	Kinematics of Machinery	MC	3	3	0	0	3
5.	Industry 4.0	MS	2	2	0	0	2
6.	Metrology and Measurements	MC	4	2	0	2	3
7.	Engine Assembling Workshop	SEC	2	0	0	2	1
Total			**25**	**15**	**0**	**10**	**20**

SEMESTER - V

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1.	Dynamics of Machines	MC	5	3	0	2	4
2.	Mechatronics and Automation	MC	4	2	0	2	3
3.	Fundamentals of Heat Transfer	MC	5	3	0	2	4
4.	Design of Machine Elements	MC	3	3	0	0	3
5.	Fundamentals of 3D Printing Techniques	MS	3	3	0	0	3
6.	Introduction to AI and ML	MS	3	3	0	0	3
7.	Matlab / R workshop	VAC	2	0	0	2	1
Total			**25**	**17**	**0**	**8**	**21**

SEMESTER - VI

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1.	Design of Mechanical Drives	MC	3	3	0	0	3
2.	Finite Element Analysis and Simulation	MC	5	3	0	2	4
3.	Robot Technology	MC	5	3	0	2	4
4.	Automobile Engineering	MC	2	2	0	0	2
5.	Lasers in Materials and Manufacturing	MS	3	3	0	0	3
6.	Total Quality Management	MS	3	3	0	0	3
7.	Capstone Project Phase 1	PD	8	0	0	8	4
Total			**TOTAL**	**29**	**17**	**0**	**12**

SEMESTER – VII

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1.	Industrial Practices	MC	5	3	0	2	4
2.	Optimization Techniques	MC	3	3	0	0	3
3.	Program minor 3	MS	3	3	0	0	3
4.	Program Minor 4	MS	3	3	0	0	3
5.	Program Minor 5	MS	2	2	0	0	2
6.	Ability Enhancement Course#	AEC	2	2	0	0	2
7.	Capstone Project Phase 2	PD	12	0	0	12	6
8.	Internship	SI	4	0	0	4	2
Total			**34**	**16**	**0**	**18**	**25**

#The following is a list of courses that are offered under the Ability Enhancement Course:

1. Writing for Research
2. Creative Writing
3. Psychology and Communication
4. Professional Communication

SEMESTER – VIII

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1.	Program Minor - 6	MS	2	2	0	0	2
2.	Program Minor -7	MS	3	2	0	0	3
3.	Capstone Project Phase 3	PD	4	0	0	4	2
Total			**9**	**4**	**0**	**4**	**7**

COURSE SUMMARY

The listed courses in the curriculum are broadly classified as per the recommendations from the UGC.

Sl. No	Broad Category of Course	Minimum Credit Requirement	Actual Credits
1	Major Core (MC)	80	80
2	Minor Stream (MS)	32	32
3	Multidisciplinary (MD)	09	11
4	Ability Enhancement Course (AEC)	08	08
5	Skill Enhancement Course (SEC)	09	09
6	Value Added Courses (VAC)	06-08	07+2*
7	Summer Internship (SI)	02-04	2
8	Project Dissertation (PD)	12	12
	Total	160	161+2*

The semester wise credit breakup of the Curriculum based on the above credit breakup proposed by the UGC is as follows:

Semester\Category	MC	MS	MD	AEC	SEC	VAC	SI	PD	TOTAL
1	6		7	3	2	4+1*			**22+1***
2	11		4	3	2	2+1*			**22+1***
3	12	5			4				**21**
4	17	2			1				**20**
5	14	6				1			**21**
6	13	6						4	**23**
7	7	8		2			2	6	**25**
8		5						2	**7**
Total	**80**	**32**	**11**	**8**	**9**	**7+2***	**2**	**12**	**161+2***

* The credits earned through the Extra Academic Activities in Value Added Courses (VAC) are not included in the calculation of Cumulative Grade Point Average (CGPA).

MINOR STREAM

The Department of Mechanical Engineering offers the following list of Minor streams.

1. Robotics and Automation Engineering (Foundation Minor)
2. Industrial Design, Automation and Manufacturing

Each Minor Stream has seven courses worth 19 credits. The student must enroll in any one of the above two Minor Streams. Minor Streams tagged with Foundations must not be enrolled by students whose Major Core courses overlap with the listed courses in the Minor Stream.

MINOR STREAM 1: Robotics and Automation Engineering

S. No.	COURSE TITLE	Semester	Contact Periods	L	T	P	C
1	Analytical Robotics	6	3	3	0	0	3
2	Machine Vision	6	3	3	0	0	3
3	Mobile Robots	7	3	3	0	0	3
4	MINOR STREAM BASKET 1	7	3	3	0	0	3
5	MINOR STREAM BASKET 2	7	2	3	0	0	2
6	MINOR STREAM BASKET 3	8	2	3	0	0	2
7	MINOR STREAM BASKET 4	8	3	3	0	0	3

Basket 1	Basket 2	Basket 3	Basket 4
Credit -3	**Credit - 2**	**Credit - 2**	**Credit – 3**
Collaborative Robots	Robot Operating System	Bio-inspired Robots	Adaptive Control for Robots
Assistive and Therapeutic devices	Immersive Technologies for manufacturing	Human Robot Interface	Bio-Mechatronics
Feld and Service Robots	Drone Technologies	Robot Programming and Simulation	Micro sensors, Micro actuators and Control
Material Handling and Warehouse Automation	Agricultural Automation	Intelligent Agents for Products	Lean Manufacturing

Note: Students from B.Tech. Mechanical Engineering must not opt for this Minor Stream.

MINOR STREAM 2: Industrial Design, Automation and Manufacturing

S. No.	COURSE TITLE	SEMESTER	CONTACT PERIODS	L	T	P	C
1	Lasers in Materials and Manufacturing	6	3	3	0	0	3
2	Total Quality Management	6	3	3	0	0	3
3	Electric vehicle	7	3	3	0	0	3
4	MINOR STREAM BASKET 1	7	3	3	0	0	3
5	MINOR STREAM BASKET 2	7	2	3	0	0	2
6	MINOR STREAM BASKET 3	8	2	3	0	0	2
7	MINOR STREAM BASKET 4	8	3	3	0	0	3

Basket 1	Basket 2	Basket 3	Basket 4
Credit -3	**Credit - 2**	**Credit - 2**	**Credit – 3**
Design Concepts in Engineering	Computer Integrated Manufacturing Systems	Design of Robotic System	Power Plant Engineering
Product Design and Development	Reliability Engineering	Robot Operating System for field and service robots	Renewable Sources of Energy
Noise and Vibration Control	Unconventional Machining Processes	IoT for Mechatronics	Gas Dynamics and Jet Propulsion
Geometric Dimensioning and Tolerancing	Design for Manufacturing	Intelligent Automation in Manufacturing	Hydrogen and Fuel Cells

SYLLABUS

SEMESTER - I

Course Code	Category	MATRICES AND CALCULUS (Common to EEE, ECE, VLSI, MECH, CHEM, BME, CIVIL)	L	T	P	C	Contact Hours
	MD		3	1	0	4	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES

1. To apply the concepts of eigenvalues and eigenvectors in the reduction of quadratic form.
2. To obtain Taylor's expansion of various functions and extreme values of functions.
3. To equip with the concepts of integral calculus and applying it in evaluating the integrals.
4. To apply the Green's theorem, Divergence theorem and Stokes theorem in engineering problems

UNIT- I MATRICES (12 HOURS)

Eigenvalues and Eigenvectors - Cayley-Hamilton Theorem - Diagonalization: Similarity transformation - Quadratic form – Reduction of quadratic form to canonical form using orthogonal transformation, Eigen values by Power method.

UNIT- II DIFFERENTIAL CALCULUS (12 HOURS)

Curvature, radius of curvature - Cartesian and parametric forms – Centre of curvature – Circle of curvature in Cartesian form, Evolutes, Envelopes, Evolute as envelope of normals.

UNIT- III MULTIPLE INTEGRALS (12 HOURS)

Double integrals, Triple integrals: Cartesian and polar coordinates – Change of order of integration, Change of variables, Area and volume as multiple integrals.

UNIT- IV VECTOR CALCULUS (12 HOURS)

Gradient and directional derivative – Divergence and curl – Vector identities - line integral, Surface integral, Volume integral- Green's theorem, Gauss divergence and Stoke's theorems.

UNIT- V FUNCTIONS OF SEVERAL VARIABLE (12 HOURS)

Partial derivatives – Total derivative – Jacobian – Functions of two variables: Taylor's series and Maxima and minima– Constrained optimization using Lagrange's method.

TEXTBOOKS

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publishers, 45th Edition, 2020.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, Inc., 10th Edition, 2020.

REFERENCE BOOKS

1. Bali, N.P., Goyal, M., Watkins, C., Advanced Engineering Mathematics, Laxmi Publications Pvt. Limited, 2007.
2. Boyce, W.E., and DiPrima, R.C., Elementary Differential Equations and Boundary Value Problems, Wiley India, 2012.
3. George B. Thomas Jr., Maurice D. Weir, Joel R. Hass, Thomas' Calculus: Early Transcendental, 13th Edition, Pearson Education, 2013.
4. O'Neil. P. V., Advanced Engineering Mathematics, 7th Edition, Cengage Learning India Pvt., Ltd, New Delhi, 2011.
5. Howard Anton, Irl C. Bivens, Stephen Davis, Calculus Early Transcendentals, 11th Edition, John Wiley & Sons, Inc., 2016.

COURSE OUTCOMES

	Course Outcomes	**Knowledge Level**
CO1	Analyze and diagonalize matrices using eigenvalues, eigenvectors, and similarity transformations.	KL3
CO2	Compute curvature, radius and centre of curvature, and find evolutes and envelopes of plane curves.	KL3
CO3	Evaluate double and triple integrals in Cartesian and polar coordinates, change the order of integration, and compute areas and volumes using multiple integrals.	KL3
CO4	Evaluate vector integrals using gradient, divergence, curl, and theorems like Green's, Gauss, and Stokes	KL3
CO5	Evaluate partial derivatives, total derivatives, Jacobians, and use Taylor series and Lagrange's method to solve maxima, minima, and constrained optimization problems.	KL3

Course Code	Category	ENGINEERING CHEMISTRY	L	T	P	C	Contact Hours
	MD		2	0	2	3	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

This course aims to:

1. To acquire knowledge on water chemistry and treatment methods relevant to industrial and engineering applications.
2. To apply electrochemical principles in energy storage systems, fuel cells, batteries, and supercapacitors.
3. To understand and analyze corrosion mechanisms and protection techniques for engineering materials under various environments.
4. To understand the properties, processing, and applications of polymers and composite materials.
5. To acquire knowledge on various material characterization techniques and apply the skills in laboratory analysis using modern analytical techniques.

UNIT-I WATER AND ITS TREATMENT (12 HOURS)

Theory: Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – Boiler feed water chemistry: scale formation, sludge, carryover, priming & foaming Boiler corrosion: oxygen corrosion, acidic corrosion, caustic corrosion., Caustic embrittlement in boiler materials. Cooling water chemistry for heat exchangers, condensers, and IC engines. Anti-corrosion, anti-scaling, and antifreeze additives.

Practical

Exp.1: Estimation of hardness of water

Exp.2: Estimation of alkalinity

Laboratory Demonstration:

- Ion Exchange process

UNIT-II ELECTROCHEMISTRY (12 HOURS)

Theory: Electrochemistry- redox reaction- Ion selective electrodes –Glass electrodes-measurement of pH-potentiometry; Energy systems for electric vehicles – Principles & electrochemistry of: H_2–O_2 fuel cell, Li-ion battery & Na-ion battery, Battery degradation mechanisms and thermal runaway relevance to EV and hybrid vehicles, Green Hydrogen, Supercapacitors: working principles and applications in regenerative braking.

Practical:

Exp.4: Estimation of strong acid-pH

Exp.5: Estimation of ferrous ion by potentiometry

UNIT-III CORROSION (12 HOURS)

Theory: Corrosion- Types of corrosion – Dry corrosion, wet corrosion; Types of wet Corrosion-galvanic corrosion, differential aeration -simplified Pourbaix diagram interpretation- Rate of corrosion; Corrosion in Machine Parts: Stress Corrosion Cracking (SCC), Hydrogen Embrittlement, High-temperature corrosion, Fretting corrosion and erosion; Protective coatings for mechanical assemblies-anodizing, ceramic coatings, diffusion coatings Microbiologically induced corrosion and concrete deterioration: biodeterioration of stone monuments. Microbial induced calcite precipitation: preparation and mechanism and utilization in biocementation, concrete repair and environmental remediation.

Practical

Exp.5: Estimation of dissolved oxygen

Exp. 6: Estimation of rate of corrosion

UNIT IV ENGINEERING PLASTICS (12 HOURS)

Theory: Polymers – Properties: Crystallinity, Glass Transition temperature (Tg), Viscosity Average Molecular weight-viscosity method &PDI, tacticity; Fiber reinforced polymeric materials: Key properties of FRP materials and its application in construction industries; Polymer concrete: Polymer Impregnated concrete, polymer cement concrete, Fiber reinforced concrete; Elastomers & rubber chemistry: vulcanization and mechanical behavior; Polymer degradation mechanisms: thermal, oxidative, UV degradation relevance to mechanical design and durability.

Practical:

Exp.7: Molecular weight of water-soluble polymer by viscosity method

Exp.8: Finding the Tg point of different polymer.

UNIT V MATERIAL CHARACTERISATION (12 HOURS)

Theory: Scanning Electron Microscopy (SEM): fracture analysis, wear analysis, microstructure; X-Ray Diffraction (XRD): phase identification in metals and alloys; Thermal analysis techniques: DSC Differential Scanning Calorimetry (DSC): Thermogravimetric Analysis (TGA); Material Hardness testing methods: Vickers, Rockwell, Brinell

Practical:

Exp.9: Estimation of Cu in Brass

Ex 10: Interpretation of TGA curves-Demo

TEXT BOOKS:

1. Jain P.C. and Monika Jain, 'Engineering Chemistry' 17th edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2023.
2. S.S.Dara, 'The Text Book of Engineering Chemistry, S.Chand & Co.Ltd,New Delhi, 2011.

REFERENCE BOOKS

1. N. F. Gray, Water Technology – An Introduction for Environmental Scientists and Engineers, 3rd ed., USA: Taylor & Francis, 2010.
2. S. Glasstone, An Introduction to Electrochemistry, New Delhi: East-West Press Pvt. Ltd., 2007.
3. B. Sundén, Hydrogen, Batteries and Fuel Cells, USA: Academic Press Inc., 2019.
4. R. Gowariker, N. V. Viswanathan, and J. Sreedhar, Polymer Science, New Delhi: New Age International (P) Ltd., Reprint, 2005.
5. B.Viswanath, B, P.S. Raghavan, 'Practical Physical Chemistry'.ViVa Books PVT. Ltd, New Delhi, 2012

COURSE OUTCOMES:

	Course Outcomes	Knowledge Level
CO1	Apply standard analytical techniques to identify impurities in water samples and select appropriate treatment methods for domestic and industrial applications.	KL3
CO2	Analyze electrochemical systems to identify existing challenges and evaluate strategies for improving fuel cell and battery technologies for zero-emission mobility.	KL3
CO3	Identify the type of corrosion and analyze different preventive methods of corrosion in various industries.	KL3
CO4	Evaluate the mechanical and thermal performance of engineering polymers, elastomers, and rubbers to determine their durability and suitability for material design applications.	KL3
CO5	Apply SEM, XRD, thermal analysis, and hardness testing techniques to characterize materials and relate results to material chemistry.	KL3

Course Code	Category	COMMUNICATIVE ENGLISH	L	T	P	C	Contact Hours
	AEC		2	0	2	3	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

The learners will be able to:

1. Enhance conversation fluency and networking skills in English.
2. Contribute efficiently to meetings and group discussions.
3. Deliver well-structured presentations and participate in interviews.
4. Learn the language and strategies of successful negotiations.
5. Communicate effectively during conflict-resolving situations.

UNIT 1: CONVERSATION AND NETWORKING SKILLS (12 HOURS)

Introducing yourself, peers and others. Conversation skills: starting a conversation; keeping the conversation going; closing the conversation; giving directions and instructions; learning functional language needed for everyday interactions. Imparting the basic language skills and techniques for telephonic conversations. Role-plays as a technique for practicing conversation. Writing professional emails.

UNIT 2: MEETING AND GROUP DISCUSSION SKILLS (12 HOURS)

Setting up and holding meetings; organizing and conducting effective meetings; learning the language used to lead a meeting; practicing how to agree and disagree with ideas and people politely. Research and pre-meeting preparation and mock meetings. Making notes, summarizing, and reporting in meetings. Group discussion skills: Basic skills required for a GD; strategies for improving discussion skills; learning the language used for a GD; voicing an opinion and arguing a point effectively, leading a discussion; chairing a discussion; discussing to arrive at a consensus. Research and pre-GD preparation, and mock GDs for practice.

UNIT 3: PRESENTATION AND INTERVIEW SKILLS (12 HOURS)

Making effective presentations: structure of a presentation; referring to visual data; describing visuals; non-verbal communication skills; examples of model presentations; and learning the language used to deliver effective and persuasive presentations. Advance topic research and mock presentations for practice. Applying for jobs; writing resumes; and cover letters. Participating in job interviews and other interviews. Strategies for effective interviewing: preparing for the interview, during-the-interview and after-the-interview etiquette. Common interview questions and learning interviewing language skills. Mock interviews for practice.

UNIT 4: NEGOTIATION SKILLS AND ASSERTIVENESS (12 HOURS)

Negotiation strategies; negotiating effectively; exchanging and comparing information; building rapport with people; practicing the language used in negotiations; considering and respecting cultural differences while negotiating; making compromises. Communication styles: passive, aggressive and assertive. Reading case studies and mock negotiation role plays.

UNIT 5: CONFLICT RESOLUTION AND DECISION-MAKING SKILLS (12 HOURS)

Resolving conflicts: listening actively to ideas; handling people smoothly; dealing with and attempting to solve conflicting problems. Making a decision: thinking about various possibilities before decision-making; communicating the pros and cons of a decision; presenting a mutually beneficial solution. Reading case studies and mock conflict resolution role plays. Developing cross-cultural communication skills.

TEXTBOOKS:

1. Bovee, C. L.& Thill, J. V. (2016). *Business Communication Today*, 15/e. Pearson Education India.
2. Beebe, S. A., & Mottet, T. P. (2021). *Business and Professional Communication* (3rd ed). Pearson Higher Education AU.
3. Herbert Hirsch. (2007*). Essential Communication Strategies: For Scientists, Engineers, and Technology Professionals*, 2nd edition. Wiley-IEEE Press.

REFERENCES:

1. Dodd, C. H. (2012). *Managing business and professional communication* (3rd ed). Allyn & Bacon/Pearson.
2. Dwyer, J. (2012). *Communication for Business and the Professions: Strategies and Skills* (7th ed). Pearson Higher Education AU.
3. Gill Hasson. (2012). *Brilliant Communication Skills: What the Best Communicators Know, Do and Say*. Ft Pr.
4. Jones, L., & Alexander, R. (2011). *New international business English updated edition student's book: Communication skills in English for business purposes* (Vol. 3). Cambridge university press.
5. Kerry Patterson, Joseph Grenny, Ron McMillan and Al Switzler. (2013). *Crucial Conversations: Tools for Talking When Stakes Are High*. Brilliance Audio.

COURSE OUTCOMES

	Course Outcomes	**Knowledge Level**
CO1	Develop conversation skills and networking skills in English	KL3
CO2	Communicate effectively in meetings and group discussions	KL4
CO3	Deliver engaging presentations and professional interviews	KL5
CO4	Speak and negotiate strategically in formal and informal settings	KL4
CO5	Present effectively during conflict resolving situations	KL5

Course Code	Category	ENGINEERING GRAPHICS	L	T	P	C	Contact Hours
	MC		2	0	2	3	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

1. To introduce the use of drawing instruments and CAD tools for professional practice.
2. To enable clear and precise communication of engineering ideas through standard drawings
3. To establish a fundamental basis for design and drafting for engineering applications

UNIT I FREEHAND SKETCHING AND PROJECTION OF POINTS AND LINES (9 HOURS)

Visualization concepts and Free Hand sketching: Visualization principles–Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects. – **By Conventional Method.**

Projections of points when they are situated in different quadrants. Projections of a line parallel to one of the reference planes and inclined to the other, line inclined to both the reference planes. Determination of true lengths and true inclinations by rotating line method. – **By Conventional Method.**

UNIT-II FUNDAMENTALS OF AUTOCAD - PROJECTION OF PLANES AND SOLIDS (9 HOURS)

Introduction to AutoCAD, DRAW tools, MODIFY tools, TEXT, DIMENSION. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating plane method. **Conventional and AutoCAD**

Projections of solids like prisms, pyramids, cylinder and cone, whose axis is parallel to one of the reference planes and inclined to the other by rotating object method. **Conventional and AutoCAD**

UNIT-III SECTION OF SOLIDS (9 HOURS)

Sectional planes – when the cutting plane is inclined to one of the principal planes and perpendicular to the other, Sectional views - Prism, pyramid, cylinder and cone, true shape of the section. **Conventional and AutoCAD**

UNIT-IV DEVELOPMENT OF SURFACES (9 HOURS)

Development of lateral surfaces of simple and truncated solids in vertical position– prisms, cylinders, pyramids, cones. **Conventional and AutoCAD**

UNIT-V ISOMETRIC PROJECTION (9 HOURS)

Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions **Conventional and AutoCAD**

TEXTBOOKS:

1. Venugopal, K. and Prabhu Raja, V., Engineering Drawing + AutoCAD, New Age International (P) Limited, 2022, ISBN - 13: 9788122472752.
2. Natarajan, K.V., A Textbook of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 33rd Edition, 2020. [ISBN: 9788190414089].
3. Ramesh babu. V, A Textbook on Engineering Graphics, VRB Publishers, Chennai, 2022. [ISBN - 13: 978-93-95018-55-5.]

REFERENCES:

1. Bhatt, N.D., Engineering Drawing, Charotar Publishing House, 2025. [ISBN: 9789385039805].
2. Prof. Sham Tickoo, *AutoCAD 2017 for Engineers & Designers*, 23ed, Dreamtech Press [ISBN: 9789351199465]
3. Basant Agarwal, and Agarwal, C.M., Engineering Drawing, McGraw Hill, 3rd Edition, 2019. [ISBN: 9789353167448]
4. Parthasarathy, N. S. and Vela Murali, "Engineering Drawing", Oxford University Press,2015. [ISBN: 9780199455393]

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Construct orthographic views of an object and projection of points and lines.	KL3
CO2	Construct the Projection of Planes and Solids in conventional and CAD environment	KL3
CO3	Construct the details of an object through sectional views, in conventional and CAD environment	KL3
CO4	Develop the lateral surface of the solids in conventional and CAD environment	KL4
CO5	Construct the three-dimensional isometric view in conventional and CAD environment	KL4
CO6	Analyze the internal details of the industrial component through sectional and isometric views.	KL4

Course Code	Category	ENGINEERING MECHANICS	L	T	P	C	Contact Hours
	MC		3	0	0	3	3
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

1. To understand the fundamentals of statics and dynamics.
2. To apply laws of mechanics to engineering problems.
3. To develop analytical skills for solving force, motion, friction and energy problems.

To prepare students for advanced subjects like Strength of Materials, Machine Design, and Robotics

UNIT-I STATICS: FORCE & MOMENTS (11 HOURS)

Why Engineering mechanics: using case studies, Types of forces & bodies, Representation of forces, Free body diagram, Vector representation of forces, Vector mathematical operations & Physical meaning, Fundamental laws of Physics, resolution of forces, Resultant & Equilibrant for 2D & 3D engineering problems, Moment of a force, Varignon's theorem, Couples and equivalent force-couple systems, Equilibrium of rigid bodies (2D & 3D)

UNIT-II STRUCTURES AND FRICTION (9 HOURS)

Frames and machines, Types of supports and reactions, Applications of static equilibrium for plane rigid body (structures), Friction: Dry friction, Laws of friction, Angle of friction and angle of repose, Wedge friction, Belt friction, Ladder problems

UNIT-III KINEMATICS OF PARTICLES AND RIGID BODIES (9 HOURS)

Rectilinear and curvilinear motion, Displacement, velocity and acceleration, Motion under gravity, Projectile motion, Relative velocity and acceleration, Introduction to rigid body kinematics, Angular velocity and angular acceleration, Usage of simulation tools for motion representation

UNIT-IV KINETICS OF PARTICLES AND RIGID BODIES (9 HOURS)

Newton's laws of motion, D'Alembert's principle, Work-energy principle, Impulse-momentum principle, Conservation of energy and momentum, Impact (direct central impact), Rotation of rigid bodies (basic introduction), General plane motion of simple rigid bodies (disc, cylinder, sphere)

UNIT V CENTROID AND MOMENT OF INERTIA OF SURFACES & SOLIDS (7 HOURS)

Centroid of lines, areas and composite sections, Pappus-Guldinus theorems, Area moment of inertia, Parallel and perpendicular axis theorems, Mass moment of inertia, Radius of gyration, Product of inertia (introductory), Principal moment of inertia

TEXTBOOKS:

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
1. Bansal, R. K., and Sanjay Bansal. A Textbook of Engineering Mechanics. 5th ed., Laxmi Publications, 2008. ISBN 978-8131804094.

REFERENCES:

1. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
2. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education 2006.
3. Meriam J.L. and Kraige L.G., "Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", 3rd Edition, John Wiley & Sons,1993.
4. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.
5. S. S. Bhavikatti and K. G. Rajashekarappa, Engineering Mechanics, 1st ed., New Delhi: New Age International (P) Limited, 1998.
6. Kumar, K.L., "Engineering Mechanics", 3rd Revised Edition, Tata McGraw-Hill Publishing company, New Delhi 2008.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Apply equilibrium principles to engineering systems.	KL2
CO2	Analyze structures and friction problems.	KL2
CO3	Apply the concepts of design to temporary and permanent joint.	KL3
CO4	Solve motion problems using kinematics principles.	KL2
CO5	Apply energy and momentum methods in dynamics problems.	KL3
CO6	Analyze force, motion, friction and energy through a term work assignment involving literature review, numerical calculation, analysis and solution reporting.	KL4

Course Code	Category	PROFESSIONAL ETHICS AND HUMAN VALUES	L	T	P	C	Contact Hours
	VAC		2	0	0	2	2
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

1. To provide students with a foundation in ethics and human values for personal, social, and professional life.
2. To enable students to understand and apply ethical principles in decision-making and workplace conduct.
3. To develop awareness of social responsibility, civic virtues, and sustainable practices in professional and personal contexts.

UNIT-I INTRODUCTION TO ETHICS AND VALUES (6 HOURS)

Meaning and scope of ethics, morals, and values, Life skills and emotional intelligence, Personal versus professional ethics, Stakeholders and their influence on decisions, Ethical dilemmas and methods of resolution, Case studies highlighting basic ethical issues

UNIT-II RESPONSIBILITY, SOCIAL IMPACT, AND WORKPLACE CONDUCT (6 HOURS)

Attributes of a profession, roles, duties, and responsibilities, Professional obligations and social impact of decisions, Corporate Social Responsibility (CSR) and sustainable practices, Legal and social responsibilities, Workplace safety and rights, Case studies on societal and organizational ethical issues

UNIT-III THEORIES AND DECISION-MAKING FRAMEWORKS (6 HOURS)

Major ethical theories: Utilitarianism, Deontology, Virtue Ethics, Rights-based approaches, Application of theories in professional scenarios, Decision-making frameworks for dilemmas, Responsibility for safety, health, and well-being, Risk assessment and accountability, Case studies illustrating applied concepts.

UNIT- IV RIGHTS, GLOBAL ISSUES, AND ETHICAL CODES (6 HOURS)

Rights and duties in workplace, Professional standards and codes of conduct, Ethics audit: implementation and evaluation, Global challenges: environmental ethics, media ethics, bioethics, research ethics, Cross-cultural considerations and international case studies

UNIT-V HUMAN VALUES AND PROFESSIONAL DEVELOPMENT (6 HOURS)

Nature, classification, and significance of human values, Value-based decision-making in personal and professional life, Integration of human values in daily life, Harmony with self, family, society, and environment, Developing positive attitudes, moral courage, and integrity, Strategies for internalizing and applying values, Practical exercises and case studies on character building and ethical living.

TEXTBOOKS:

1. Professional Ethics Includes Human Values, R. Subramanian, Oxford University Press, 2nd Edition, 2017.
2. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 3rd revised edition, 2023.

REFERENCES:

1. A Textbook on Professional Ethics and Human Values by R.S. Naagarazan, New Age Intl. Publishers, 2006.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. Human Values and Professional Ethics, by Vaishali R Khosla & Kavita Bhagat, Technical Publications, First Edition, 2009.

COURSE OUTCOMES

	Course Outcomes	**Knowledge Level**
CO1	Explain the basic concepts of ethics, morals, and values, and differentiate between personal and professional ethics.	KL2
CO2	Describe the responsibilities of professionals and the social and legal impact of their decisions, including CSR and workplace safety.	KL2
CO3	Discuss major ethical theories and their role in resolving ethical dilemmas in professional situations.	KL2
CO4	Identify rights, professional standards, ethical codes, and global challenges relevant to workplace and international practices.	KL2
CO5	Illustrate human values in personal and professional life to foster integrity, positive attitudes, and responsible behavior.	KL3

Course Code	Category	PROGRAMMING IN PYTHON FOR DATA SCIENCE	L	T	P	C	Contact Hours
	VAC		1	0	2	2	3
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

1. To learn Python fundamentals and modularity in problem solving.
2. To learn data types in Python and file handling.
3. To learn numerical computations using NumPy.
4. To learn data manipulations using Pandas.
5. To perform visualization and statistical analysis using Python libraries.

UNIT-II PYTHON FUNDAMENTALS (4 HOURS)

Introduction to Python – Expressions and operators - Variables and Assignment - conditional and Iterative statement; Functions: Local and global scope, Methods of passing arguments, Recursion.

UNIT-II DATA TYPES AND FILE HANDLING (3 HOURS)

Compound Data Types: Strings - Lists - Tuples - Dictionaries; File handling.

UNIT-III NUMPY FOR NUMERICAL COMPUTATION (2 HOURS)

Arrays in Python – Array creation in NumPy – Indexing and slicing operations – Arithmetic operations – Statistical operations using NumPy.

UNIT-IV PANDAS FOR DATA MANIPULATION (3 HOURS)

Series and Data frames in Pandas – Data Loading - Indexing – Data cleaning and preprocessing - Data Manipulation: Sorting, grouping, handling missing values - statistical operations in data frames.

UNIT-V DATA VISUALIZATION AND STATISTICS (3 HOURS)

Data visualization using Matplotlib: line, bar, scatter, pie, histogram, multiplots; Descriptive Statistics - Correlation Analysis.

SUGGESTED EXPERIMENTS:

1. Develop a program to classify students as Excellent, Good, Average, or At Risk using conditional statements.
2. Develop a program to count the number of days with sales above the average using iterative statements.
3. Develop a recursive function to normalize a dataset using Min–Max normalization.

4. Develop a program using strings to count the number of valid and invalid emails.
5. Develop a program to remove duplicate values from a list and sort the cleaned data in ascending order.
6. Develop a program using tuples to store the customer transaction data and compute the total transaction amount.
7. Develop a program to store account number as key and customer details (name, balance, account type) as values using dictionaries and update account balance after deposit or withdrawal.
8. Develop a program to read transaction details from a CSV file and write suspicious transactions to a separate file.
9. A dataset contains monthly sales figures stored in a NumPy array. Develop a program to extract sales data for a specific range of months and access rows and columns using slicing.
10. A dataset of customer balances is stored in a NumPy array. Develop a program to compute quartiles (Q1, Q2, Q3) and interquartile range (IQR).
11. Loan applicant data includes income, age, and credit score is stored in a CSV file. Filter applicants satisfying multiple conditions (e.g., income > ₹50,000 and credit score > 700) using Pandas.
12. A bank wants to visually analyze customer, transaction, and revenue data to support decision-making. Develop a Python application that uses different Matplotlib plots to represent various types of data.
13. Mini Project on Exploratory Data Analysis.

TEXTBOOKS:

1. S Sridhar, J Indumathi, V M Hariharan, "Python Programming", Pearson, 2023. (UNIT I, II).
2. Allen B. Downey, “Think Stats: Exploratory Data Analysis” 3rd edition, O'Reilly, 2025 (UNIT III, IV, V).

REFERENCE BOOKS:

1. Wes McKinney, "Python for Data Analysis", O'Reilly, 2022 (Unit V)
2. Allen B. Downey, ``Think Python", 3rd edition, O'Reilly Media, 2024, Online Version: https://allendowney.github.io/ThinkPython/
3. Ron S. Kenett, Shelemyahu Zacks, Peter Gedeck, "Modern Statistics: A Computer-Based Approach with Python", Springer, 2022.
4. Karl Beecher, ``Computational Thinking – A beginner's Guide to Problem Solving and Programming", British Computer Society (BCS), 2017.
5. John V Guttag, ``Introduction to Computation and Programming Using Python", 3rd edition, MIT Press, 2021.
6. Alan Agresti and Maria Kateri, ``Foundations of Statistics for Data Scientists With R and Python ", First Edition, CRC Press, 2022.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Apply sequential, alternate, and iterative approaches for solving problems.	K3
CO2	Solve problems by using different datatypes and files.	K3
CO3	Develop Python programs for numerical computations using NumPy.	K3
CO4	Develop Python programs for data manipulation using Pandas.	K3
CO5	Select appropriate Matplotlib visualization techniques to accurately represent data trends, patterns, and analytical outcomes.	K5

Course Code	Category	MAKERS SPACE LABORATORY	L	T	P	C	Contact Hours
	SEC		0	0	4	2	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

1. To provide hands-on experience to the students in various basic engineering practices in Mechanical and Civil Engineering
2. To provide hands-on training to the students in electrical wiring practices and the use of electronic components.

LIST OF EXPERIMENTS

Mechanical & Civil Engineering Practice

1. **Makers Lab Safety & Tool Handling:** Lab orientation, workflow, PPE, power tool safety, material handling, measurement and marking, Outcome*:* Safe operation of makers lab tools.
2. **Power Tool Carpentry – Utility Product Fabrication:** Cutting, drilling, sanding, joint preparation. *Fabrication:* **Pen stand/utility box,** *Outcome:* Confidence in real carpentry operations.
3. **Carpentry Joints & Building Components:** Fabrication using lap and mortise–tenon joints. *Fabrication:* **Mini door/window frame or wall shelf,** *Outcome:* Understanding structural wood joints used on site.
4. **Plumbing Practice – Domestic Water Supply:** Pipe cutting, joining, and fitting (PVC & GI). *Fabrication:* **Wash basin plumbing system,** *Outcome:* Knowledge of household plumbing installation.
5. **Plumbing System Layout & Drainage:** Assembly of supply and drainage lines. *Fabrication:* **Mini water distribution / sanitary line model,** *Outcome:* Understanding real building plumbing layouts.
6. **Machining Practice – Functional Metal Component:** Drilling, tapping, countersinking, and work holding. *Fabrication:* **Fixture plate/tool holder,** *Outcome:* Exposure to workshop machining operations.
7. **Sheet Metal Fabrication – Industrial Product:** Cutting, bending, folding, riveting. *Fabrication:* **Mobile stand / small enclosure/duct prototype:** *Outcome:* Sheet metal fabrication skills.
8. **Mechanical Mechanism Models:** Assembly and study of motion systems. *Models:* **Gear train, belt-pulley, slider-crank, scissor mechanism.** *Outcome:* Practical understanding of motion transmission.
9. **Real-Life Mechanical Systems Study:** Hands-on observation and disassembly. *Systems:* **Hand pump, flush tank, pedestal fan mechanism.** *Outcome:* Linking theory with real engineering products.

10. **3D Printing – Engineering Prototyping:** Design and fabrication using additive manufacturing. *Fabrication:* **Mechanical bracket / civil pipe or truss model,** *Outcome:* Exposure to modern manufacturing practices.
11. **Laser Cutting & Hybrid Fabrication:** Laser cutting of wood/acrylic and integration with other materials. *Fabrication:* **Building layout plate/phone stand,** *Outcome:* Understanding digital fabrication workflows.

Electrical & Electronics Engineering Practice

1. **Domestic Electrical Wiring Practice:** Assemble a single-phase domestic wiring circuit for operating household appliances using fuse, switch, lamp, energy meter and test its operation. *Outcome***:** Demonstrate domestic electrical wiring practices.
2. **Electrical Measurements in RLC Circuit**: Assemble a single-phase RLC circuit and measure electrical quantities-voltage, current, power, and power factor. *Outcome*: Understand the practical measurement of electrical quantities in RLC circuit.
3. **Electrical Fault Simulation and Protection:** Identifying and analyzing common electrical faults. *Outcome:* Understand electrical faults, working of protective devices, and earthing systems for electrical safety.
4. **Soldering Practice**: Assembly and testing of mobile phone charging circuit. *Outcome:* Hands-on skill in soldering, component identification, and testing.
5. **Relay Control Circuit Using Logic Gates:** Assembly and testing of a relay-based control circuit using logic gates. *Outcome:* Understand the operation of a relay control circuit using logic gates.
6. **AC signal Parameters Measurement and Analysis**: Measurement of amplitude and frequency in a rectifier circuit using a CRO. *Outcome:* Understand the usage of CRO and measurement of AC signal parameters.
7. **Sensor and Actuator Interfacing:** Integration of sensors and actuators with a microcontroller. *Outcome:* Understand the programming of embedded controller for interfacing sensors and actuators.
8. **Dis-assembly and assembly of electrical home appliances**: Grinder Mixer, Ceiling Fan. *Outcome:* Hands-on skill in disassembling, assembling of domestic electrical appliances.

REFERENCE BOOKS

1. S Gowri, T Jeyapoovan, “Engineering Practices Laboratory Manual”, 5th Edition, Vikas Publishing, 2016.
2. V Ramesh Babu, “Engineering Practices Laboratory”, VRB Publications, 2006.
3. Willis H Wagner, Howard Bud Smith, Mark W Huth, “Modern Carpentry”, 12th Edition, 2015.
4. P C Sharma, “Production Technology: Manufacturing Process”, S Chand publisher, 2006.
5. David W Rongey, “A Complete Guide to Home Electrical Wiring”, 2013.
6. K Jeyachandran, S Natarajan, S Balasubramanian, “A Primer on Engineering Practices Laboratory, Anuradha Publications, 2007.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Identify and explain makers lab safety practices, PPE usage, tools, workflow, and engineering materials used in fabrication.	KL2
CO2	To perform carpentry, plumbing, machining, and sheet metal work to fabricate real-time civil engineering components, domestic water supply systems and to manufacture functional mechanical components.	KL3
CO3	Apply modern fabrication techniques such as 3D printing and laser cutting to develop mechanical and civil engineering models and prototypes to meet practical engineering requirements.	KL3
CO4	Construct electrical circuits and demonstrate their working.	KL3
CO5	Demonstrate the implementation and control of electronic circuits for practical applications.	KL2

SEMESTER - II

Course Code	Category	DIFFERENTIAL EQUATIONS AND COMPLEX FUNCTIONS (Common to ECE, VLSI, BME, CIVIL, EEE, MECH, CHEM)	L	T	P	C	Contact Hours
	MC		2	1	0	3	3
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

The objective of the course is to enable the students

1. To understand the concept of ordinary and partial differential equations and utilize it in solving engineering problems.
2. Find the Laplace Transforms of standard functions and solve second order linear ordinary differential equations with constant coefficients.
3. To construct Analytic functions and evaluate integrals using Cauchy's integral formula

UNIT-I ORDINARY DIFFERENTIAL EQUATIONS (9 HOURS)

Solution of second and higher order linear differential equations with constant coefficients (RHS functions - $e^{mx}, sinmx, cosmx, x^n, x^n f(x),\ e^{mx} f(x)$), Application to harmonic oscillation of an undamped Mass-Spring system- Method of variation of parameters - Simultaneous linear differential equations with constant coefficients of first order.

UNIT-II LAPLACE TRANSFORMS (9 HOURS)

Definition, properties – Transform of elementary functions, unit step function and unit impulse function, shifting theorems – Transforms of derivatives and integrals, Evaluation of integrals by Laplace transforms - Periodic functions – Initial and final value theorems.

UNIT-III INVERSE LAPLACE TRANSFORMS (9 HOURS)

Inverse transforms – Definition, Properties - Method of Partial Fractions, Inverse Laplace transforms of derivatives and integrals - Convolution theorem - Applications of Convolution Theorem - Ordinary Differential Equations: Solution by using Laplace Transforms.

UNIT IV ANALYTIC FUNCTIONS (9 HOURS)

Analytic functions – necessary and sufficient conditions, Cauchy-Riemann equations in Cartesian and polar form (with proof) – Properties – harmonic functions, Construction of analytic function, conformal mapping – some standard transformations w = z + c, cz, 1/z, bilinear transformation.

UNIT V COMPLEX INTEGRATION (9 HOURS)

Line integral – Cauchy's integral theorem – Cauchy's integral formula, Taylor's and Laurent's series, Singularities – Residues – Residue theorem – Application of residue theorem for evaluation

of real integrals – Use of circular contour and semicircular contour (except the poles on the real axis).

TEXTBOOKS

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publishers, 45th Edition, 2020.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, Inc., 10th Edition, 2020.

REFERENCE BOOKS

1. Bali, N.P., Goyal, M., Watkins, C., Advanced Engineering Mathematics, Laxmi Publications Pvt. Limited, 2007.
2. Boyce, W.E., and DiPrima, R.C., Elementary Differential Equations and Boundary Value Problems, Wiley India, 2012.
3. George B. Thomas Jr., Maurice D. Weir, Joel R. Hass, Thomas' Calculus: Early Transcendental, 13th Edition, Pearson Education, 2013.
4. O'Neil. P. V., Advanced Engineering Mathematics, 7th Edition, Cengage Learning India Pvt., Ltd, New Delhi, 2011.
5. Howard Anton, Irl C. Bivens, Stephen Davis, Calculus Early Transcendentals, 11th Edition, John Wiley & Sons, Inc., 2016.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Solve second- and higher-order linear ordinary differential equations with constant coefficients, handle simultaneous linear ODEs	KL4
CO2	Obtain the Laplace Transforms of standard functions.	KL4
CO3	Apply the concepts of inverse Laplace Transforms in solving differential equations	KL3
CO4	Solve problems in Analytic functions and construction of analytic functions using C-R equations	KL3
CO5	Compute line integrals, residues, and real integrals via residue theorems.	KL3

Course Code	Category	TECHNICAL WRITING	L	T	P	C	Contact Hours
	AEC		2	0	2	3	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

The learners will be able:

1. To prepare effective instructions, checklists and emails
2. To write different kinds of paragraphs and argumentative essays
3. To develop and revise effective resumes, cover letters and SOPs
4. To document and organise various kinds of reports, case studies and white papers
5. To create well-structured proposals and press releases

UNIT-I WRITING INSTRUCTIONS, CHECKLISTS AND EMAILS (12 HOURS)

Writing instructions and checklists; using bulleted lists and numbered lists. Writing professional emails: appropriate greetings, subject line, writing three-body paragraphs – introduction, body, and closing paragraph; discussion of samples. Reading sample instructional texts and professional email models. Language skills: Tenses – present and past

UNIT-II WRITING ARGUMENTATIVE PARAGRAPHS AND ESSAYS (12 HOURS)

Writing paragraphs. Structure of a paragraph: basic, compare and contrast. Product descriptions and process descriptions. Interpreting charts and graphs. Reading and writing model argumentative essays and sample analytical paragraphs; handling three types of arguments: Classical, Rogerian, Toulmin; structure of an argumentative essay: introduction, building the thesis, body paragraphs with three arguments or claims and supporting evidence, conclusion.
Sample essays. Language skills: Connectors and definitions

UNIT-III WRITING JOB APPLICATIONS AND SUMMARIES (12 HOURS)

Writing job applications, resumes, and cover letters. Writing the statement of purpose (SOP): Outline – professional narrative, previous experience, research interests, and career goals.
Writing summaries: reading the text; identifying main and supporting ideas. Writing paraphrases: step-by-step paraphrasing; text comparison; sentence analysis. Language skills: subject-verb agreements

UNIT-IV WRITING REPORTS, CASE STUDIES AND WHITE PAPERS (12 HOURS)

Writing datasheets: outline – descriptions, graphics, benefits, features, specifications, requirements, and contact information. Writing abstracts. Reading sample reports, case studies and whitepapers. Writing technical reports; practising IMRAD structure; Engineering reports & Feasibility reports. Writing case studies and white papers: main components of an issue case study – problems, search for solutions, implementation of the solution and results. Language skills: Active voice, passive voice

UNIT-V WRITING PROPOSALS AND PRESS RELEASES (12 HOURS)

Writing business proposals: format -- title page, table of contents, executive summary, project details, deliverables and milestones, budget, conclusion. Writing for Websites: Inverted pyramid style; headings and subheading; bulleted lists; short paragraphs with one idea. Writing press releases: outline – headline, date of publication, contact information, summary, intro paragraph, detail paragraphs, and about section. Language skills: Correction of errors, proofreading and editing

TEXTBOOKS:

1. Laplante, P. A. (2018). *Technical writing: A practical guide for engineers, scientists, and nontechnical professionals*. CRC Press.
2. David Bonamy. (2013) Technical English Level 2 Course Book. Pearson

REFERENCES:

1. Kmiec, D., & Longo, B. (2017). *The IEEE guide to writing in the engineering and technical fields*. John Wiley & Sons.
2. Lewis Lansford; Peter Astley. (2013). Oxford English for Careers: Engineering 1: Student's Book. Oxford University Press.
3. Mark Ibbotson. (2008). Cambridge English for Engineering, 2008, Cambridge University Press.
4. Rubens, P. (2002). *Science and technical writing: A manual of style*. Routledge.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Write instructions, checklists and emails with clarity and readability	KL3
CO2	Compose paragraphs, and structure an argumentative essay effectively	KL4
CO3	Create and edit resumes, cover letters and SOPs concisely	KL4
CO4	Document well-structured reports, case studies and white papers	KL5
CO5	Develop effective proposals and press releases	KL5

Course Code	Category	ENGINEERING PHYSICS	L	T	P	C	Contact Hours
	MD		3	0	2	4	5
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES

The objective of this course is to enable the student to

- Comprehend and identify different crystal structures and their imperfections.
- Develop an understanding of quantum mechanical phenomena and their applications.
- Explain physics of semiconductors.
- Provide an overview of the characteristics of sound, architectural acoustics and the production and applications of ultrasound.
- Understand the origin of laser action, production of laser, fibre optics and their applications.

UNIT-I CRYSTAL PHYSICS (9 HOURS)

Single crystalline, polycrystalline (common metals/alloys) and amorphous materials– single crystals - Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) - Crystal Imperfections with Examples – Point, line (Edge and Screw dislocations –Burger vectors) Surface (stacking faults) and Volume defects-Crystals in scintillation detectors (CsI, LSO, BGO and NaI).

LABORATORY EXPERIMENT

1. Determination of the Young's modulus of the given metal/alloy.

UNIT-II QUANTUM PHYSICS (9 HOURS)

Black body radiation – Planck's radiation law (Qualitative) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton Effect (Conceptual)– Photoelectric effect (conceptual)- Properties of Matter waves – wave particle duality - Schrödinger's wave equations – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box and extension to three dimensional box – Degeneracy of electron energy states – Applications-Scanning electron microscopy(SEM)-Transmission electron microscopy(TEM).

LABORATORY EXPERIMENT

2.Determination of the Planck's constant and the work function using photoelectric effect.

UNIT-III SEMICONDUCTORS (9 HOURS)

Classification of semiconductors based on doping and band gap – Intrinsic semiconductor – Concept of hole – carrier concentration derivation –Fermi level and its variation with temperature – electrical conductivity – band gap determination –Extrinsic semiconductors –

Carrier concentration derivation in n-type and p-type semiconductors – Variation of Fermi level with temperature and impurity concentration.

LABORATORY EXPERIMENTS

3. Determination of the band gap of a semiconductor.

UNIT-IV ACOUSTICS AND ULTRASONICS (9 HOURS)

Acoustics: Classification and characteristics of Sound - decibel - Weber–Fechner law– Sabine's formula (conceptual) —factors affecting the acoustics of buildings and their remedies.

Ultrasonics: Production of ultrasonics by Magnetostriction and Piezoelectric methods – acoustic grating -Non-Destructive Testing – pulse echo system through transmission and reflection modes - A, B, C and M– scan displays- Phased Array Ultrasound and Time of Flight Diffraction techniques.

LABORATORY EXPERIMENTS

4. Determination of the velocity of sound in the given liquid and compressibility of the liquid using an Ultrasonic interferometer.

UNIT-V LASERS AND FIBRE OPTICS (9 HOURS)

Lasers: Spontaneous and stimulated emission- Population inversion -Einstein's A and B coefficients –Conditions for Laser action - Types of lasers (Qualitative) – Nd: YAG, Basics of diode lasers-Industrial and Medical Applications.

Fiber optics: Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – Fibre Optical Communication system (Block diagram) - Applications- Active and passive fiber sensors - pressure and temperature-fiber optic endoscopy.

LABORATORY EXPERIMENTS

5. Determination of the grating element/wavelength, and the particle size using a laser.
6. Determination of the numerical aperture and acceptance angle of the given optical fibre.

TEXTBOOKS:

1. Gaur, R.K., and Gupta, S.L., Engineering Physics, Dhanpat Rai Publishers, 2012.
2. S. Singaravadivelu and A. Chandrasekaran, Engineering Physics, Vedha Publications, Chennai, 2022.
3. Serway, R.A., & Jewett, J.W., Physics for Scientists and Engineers, Cengage Learning, 2010.
4. Shatendra Sharma and Jyotsna Sharma, "Engineering Physics", Pearson, 2006.

REFERENCE BOOKS

1. Halliday, D., Resnick, R. & Walker, J. Principles of Physics, Wiley, 2015.
2. Tipler, P.A. & Mosca, G. Physics for Scientists and Engineers with Modern Physics, WH Freeman, 2007.
3. Avadhanulu, M. N., Kshirsagar, P. G, A textbook of Engineering Physics, S. Chand

& Co. Ltd., Ninth Revised Edition, 2012.
4. H.K. Malik and A. K. Singh, Engineering Physics, 2nd Edition, McGraw Hill, 2016.
5. Pandey B.K., Chaturvedi S. “Engineering Physics”, Cengage Learning India Pvt. Ltd, 2012.

COURSE OUTCOMES

	Course Outcomes	**Knowledge Level**
CO1	Analyze crystal structures and the influence of imperfections on their properties.	KL4
CO2	Comprehend the quantum mechanical principles to correlate with experimental results and their applications.	KL2
CO3	Analyze the physics of semiconductors.	KL4
CO4	Analyze the applications of acoustics and ultrasonics to engineering and medical disciplines.	KL4
CO5	Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommunication.	KL2

Course Code	Category	ENVIRONMENTAL SCIENCE	L	T	P	C	Contact Hours
	VAC		2	0	0	2	2
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

This course aims to:

1. To develop a better understanding of human relationship with environment.
2. To explain the importance of conservation of resources.
3. To create awareness on pollution and environmental degradation.
4. To acquire knowledge on sustainable development.
5. To apply technical skills for solving environmental problems.

UNIT-I ECOSYSTEM AND BIODIVERSITY (6 HOURS)

Structure and function of an ecosystem – energy flow- food chains, food webs and ecological pyramids – ecological succession. Introduction to biodiversity definition and types– values of biodiversity – threats to biodiversity-conservation of biodiversity: In-situ and ex-situ conservation of biodiversity; role of individuals and communities in biodiversity conservation.

UNIT-II NATURAL RESOURCES (6 HOURS)

Forest, Water, Food, Energy, Mineral and Land resources – uses and case studies on over exploitation of natural resources; Conservation of natural resources; Equitable use of resources for sustainable lifestyles

UNIT-III CURRENT ENVIRONMENTAL ISSUES (6 HOURS)

Air pollution – particulate pollution (Smog, acid rain, climate change and global warming, ozone layer depletion); Water pollution; Soil pollution and solid waste management; Noise pollution; Nuclear pollution; Role of an individual in the prevention of pollution. Disaster management; Human health and Environment: Issues with water and sanitation; Human rights, HIV/AIDS, Women and child welfare

UNIT-IV SUSTAINABLE DEVELOPMENT SUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL GOVERNANCE (6 HOURS)

Sustainable development goals (SDGs): Origin, Purpose, importance, and challenges in achieving SDG; Circular economy (4 R and 10 R); Upcycling and waste to wealth strategies; Extended Producer Responsibility; Green buildings; Electric and hybrid electric vehicles; Mission LiFE and Sustainable Lifestyle Practices; Environmental legislations: National Green Tribunal; National missions and policies towards SDGs; ESG framework and corporate sustainability

UNIT-V ENGINEERING INTERVENTION TO REDUCE ENVIRONMENTAL STRESSES (6 HOURS)

Role of technology in environmental studies – AI and IoT- Real time data collection and analysis - Environmental modelling and simulation – GIS - Remote sensing – satellite and sensors - Use of drone for aerial mapping and surveying.

TEXT BOOKS:

1. Anubha Kaushik and Kaushik, C. P. , "Environmental Science and Engineering", New Age International Publishers,14thEdition, 2014.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi,2006

REFERENCES:

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition,Pearson Education, 2004.
2. Tyler Miller G. , and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014
3. M.H. Fulekar, Bhawana Pathak and R. K. Kale, 'Environment and sustainable development' Springer Nature, 2013.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Acquire the basic concepts of ecosystems; understand the importance of biodiversity and conservation strategies.	KL2
CO2	Develop knowledge on natural resources and equitable use of natural resource.	KL2
CO3	Analyse the current environmental problems and its plausible solutions.	KL2
CO4	Explain the concept of sustainable development, its importance and key challenges in implementation of sustainable goals.	KL2
CO5	Describe the role of technology for assessment and management of environment and human health.	KL2

Course Code	Category	MANUFACTURING PROCESSES –I	L	T	P	C	Contact Hours
	MC		3	0	2	4	5
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES

1. To expose students to various manufacturing processes including, casting, joining, forming, sheet metal, and plastics, and to provide hands-on practical experience to reinforce theoretical knowledge.

To develop the ability to analyze, evaluate, and measure basic manufacturing operations, identify defects, and understand the fundamental principles and limitations of these processes.

UNIT I METAL CASTING PROCESSES (15 HOURS)

Theory: Casting fundamentals, types of patterns: single-piece, split-piece, loose-piece, pattern materials, pattern allowances, linear and volumetric allowances, moulding sand properties: strength, permeability, moisture content, testing of sand, solidification of metals and alloys, cooling curves, latent heat, progressive and directional solidification, risers, gating, cores, furnaces: blast, cupola, special casting processes: shell, investment, ceramic, centrifugal, CO_2 process, casting defects: types, causes, remedies

Numerical Problems: Solidification time (Chvorinov's rule), riser dimension calculation, shrinkage allowance, casting yield (%)

Practical Experiments: Green sand mould – single-piece pattern, green sand mould – split-piece and loose-piece patterns, measurement of mould dimensions and allowances, identification of defects, calculation of casting yield

Laboratory Demonstrations: Aluminium alloy casting – sand, metal, ceramic moulds, 3D printed pattern preparation for investment casting

UNIT-II JOINING PROCESSES (15 HOURS)

Theory: Fusion welding: gas welding, types of flames, SMAW, GTAW, GMAW, resistance welding: spot welding, nugget diameter, heat input, arc efficiency, weld bead geometry, weld defects: types, causes, remedies, advanced processes: friction stir, laser, electron beam, thermit, plasma, brazing, soldering

Numerical Problems: Heat input calculation (SMAW), weld bead cross-section and deposition rate, nugget diameter (spot welding), weld efficiency

Practical Experiments: SMAW of mild steel plates – bead measurement, resistance spot welding – nugget measurement, calculation of heat input and efficiency

Laboratory Demonstrations: Friction stir welding – torque measurement, brazing of thin sheets – shear strength evaluation

UNIT-III METAL FORMING PROCESSES (15 HOURS)

Theory: Stress-strain relations: engineering vs true stress-strain, elastic and plastic deformation, strain hardening, hot and cold working, recovery, recrystallization, forging processes: open die, impression die, closed die, forging load calculation, rolling: types, shape rolling, neutral point, rolling load, defects in rolled parts, rod/wire drawing, tube drawing, extrusion: hot and cold, extrusion pressure, friction factor evaluation – ring compression test
Numerical Problems: True stress-strain calculation, rolling load estimation, wire drawing stress, extrusion pressure calculation, friction factor calculation
Practical Experiments: Ring compression test – friction factor evaluation, two-high rolling of sheet metals, true stress-strain curve plotting from tensile test
Laboratory Demonstrations: Hot compression behaviour of aluminium and magnesium alloys

UNIT-IV SHEET METAL PROCESSES (15 HOURS)

Theory: Sheet metal characteristics, shearing, bending, drawing operations, stretch forming, formability, hemispherical dome test, limiting drawing ratio (LDR), formability limit diagram (FLD), hydroforming, water hammer forming, rubber pad forming, metal spinning, explosive forming, magnetic pulse forming, peen forming, superplastic forming
Numerical Problems: Minimum bend radius, spring back, drawing force for circular cup, blank size for deep drawing, LDR calculation
Practical Experiments: Hemispherical dome test – FLD construction, shearing and bending – simple component fabrication, water hammer forming – thickness and strain measurement
Laboratory Demonstrations: Metal spinning – dimensional analysis

UNIT-V MANUFACTURING OF PLASTIC COMPONENTS (15 HOURS)

Theory: Types of plastics: thermoplastics, thermosets, moulding processes: injection, compression, transfer, industrial applications, injection moulding: cycle time, cooling time, clamping force, extrusion: flow rate, die swell, thermoforming, bonding of plastics, composite fabrication
Numerical Problems: Cooling time and cycle time calculation, clamping force estimation, extrusion flow rate, fibre volume fraction, rule of mixtures for composite strength
Practical Experiments: Injection moulding – cycle and cooling time measurement, hand-layup polymer composite – fibre volume fraction estimation, tensile testing of composites
Laboratory Demonstrations: Bonding of plastics – strength evaluati

TEXT BOOKS:

1. Kalpakjian. S, Manufacturing Engineering and Technology, Pearson Education India Edition, 2013.
2. Hajra Choudhary S.K. and Hajra Choudhury. AK., Elements of workshop Technology, volume I and II, Media promoters and Publishers Private Limited, Mumbai, 2008

1. Paul Degarma E, Black J.T and Ronald A. Kosher, Materials and Processes, in Manufacturing Eight Edition, Prentice – Hall of India, 1997.
2. Rao, P.N. Manufacturing Technology Foundry, Forming and Welding, 4 th Edition, TMH2013
3. Roy. A. Lindberg, Processes and Materials of Manufacture, PHI / Pearson education, 2006
4. Sharma, P.C., A Textbook of production Technology, S.Chand and Co. Ltd., 2014.

COURSE OUTCOMES:

	Course Outcomes	**Knowledge Level**
CO1	Select materials, types, and allowances of patterns used in casting and analyze the various elements of moulds.	KL3
CO2	Make use of different metal joining processes to fabricate various weld joint configurations.	KL3
CO3	Identify metal forming processes for different real-time applications	KL3
CO4	Choose and develop appropriate manufacturing techniques/procedures to fabricate sheet metal components.	KL3
CO5	Select proper methods to manufacture plastic components and make use of injection moulding and hand lay methods to fabricate them.	KL3
CO6	Inspect and evaluate manufactured components for defects, dimensional accuracy, and quality using appropriate testing and measurement techniques.	KL3

Course Code	Category	FUNDAMENTALS OF MECHANICAL ENGINEERING AND PRACTICES	L	T	P	C	Contact Hours
			2	0	4	4	6
Course Level	100	*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

To introduce and reinforce various fundamentals of mechanical engineering concepts (i.e., manufacturing, design, thermal, and automation) via experiential learning

UNIT-I INTRODUCTION TO MECHANICAL ENGINEERING AND MACHINE ELEMENTS (15 HOURS)

Introduction, Types and applications of machine components: Bolts/Screws – Nuts - Washers - Locks (circlips) – Bearings, linear motion bearings, Timer Belts – Timer Pulleys – Couplings **–** Gears– springs

Studio sessions

Identification and measurement activities on different types of machine elements 1) Bolts 2) Bearings

UNIT-II MECHANISMS AND DRIVES IN MACHINE TOOLS (15 HOURS)

Applications of: Simple and compound gear trains – Screw and nut mechanism — Rack and pinion mechanism – Worm and wheel mechanism - Rachet and pawl mechanism – Belt and pulley systems, DC, Stepper and Servo motors, linear rail, lead and ball screws.

Studio sessions

Product dissection activity – 3) Drilling machine, 4) Tailstock, 5) Worm gear box 6) Gear Trains – Lathe: End Gear Train

UNIT-III PRACTICAL PNEUMATICS AND HYDRAULICS (15 HOURS)

Introduction to Fluid power, Pneumatic vs Hydraulics, Hydraulic Actuators: Cylinders: Types and construction, Applications - Pumping Theory – Pump Classification – Construction, Working, Applications, Control Components: Direction Control, Flow control and pressure control valves – Selection of cylinders, hydraulic power packs, pumps and valves for a given application (numerical problems) - Design of hydraulic circuits.

Studio sessions

Product dissection activity – 7) Hydraulic cylinders, 8) Hydraulic power unit 9) Internal and External pumps

UNIT-IV SENSORS AND 3D PRINTING FOR AUTOMATION (15 HOURS)

Working circuits using Sensors: Microcontrollers, IR sensors, Ultrasonic Sensors, Light Dependent Resistors, Flame Sensor, Buzzers, proximity sensors, load cell, relays, contactors and timers, rotary encoders, Programmable Logic Controllers, Variable Frequency Drives Human Machine Interface, thermocouples, heaters, Modelling of basic shapes and 3D printing practice.

Studio sessions

Different automation Projects: Demo & Hands-on (10-14)

UNIT-V CASE STUDIES AND MINI PROJECT: SELF AND PEER LEARNING (INCLASS AND EXTERNAL LEARNING). (15 HOURS)

1) Specification and Cost Assessment of machine elements for different applications.
2) Demonstrate transmission and transformation systems
3) Demonstrating the application of hydraulic power
4) Simulation of different hydraulic circuits
5) Build your own automation
6) Temperature measurement and heating elements for different applications.
   Use of 3D printed components for prototyping.

TEXT BOOKS

1. Robert O. Parmley, Machine Devices and Components Illustrated Sourcebook, Ist Edition, Tata McGraw- Hill,2005,
2. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2005.

REFERENCES

1. Majumdar S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGraw- Hill, 2001.
2. Paul Scherz, Simon Monk, Practical Electronics for Inventors, Fourth Edition 4th Edition, Tata McGraw- Hill, 2016.
3. Saeed Moaveni, Engineering Fundamentals: An introduction to Engineering, CENGAGE learning, 2010
4. Experiential Learning in the Thermal Sciences: Introducing and Reinforcing Fundamental Thermodynamics and Heat Transfer Principles to K-12 and Engineering Undergraduate Students Dr. Arden Moore, Louisiana Tech University, American Society for Engineering Education, 2016

COURSE OUTCOMES

	Course Outcomes	**Knowledge Level**
CO1	Explain the uses of basic mechanical engineering components, fabricate and demonstrate prototype models of simple fixtures/machines	KL3
CO2	Make use of various types of mechanisms to fabricate and demonstrate prototype of simple mechanical systems	KL3
CO3	Explain and demonstrate the function, working, selection and steps for installation of various components based on given hydraulic system requirements	KL3
CO4	Make use of electronic sensors and components to fabricate and demonstrate prototype of simple elecro-mechanical systems	KL3
CO5	Design, simulate, and implement mechanical and hydraulic systems, apply automation and temperature management, and utilize 3D printing for prototyping	KL4