KPR Institute of Engineering and Technology

Learn Beyond

(Autonomous, Affiliated to Anna University)

CURRICULUM AND SYLLABI

REGULATIONS – 2025 (REVISED)

Department of Mechanical Engineering

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I. Vision and Mission of the Institute

Vision

To become a premier institute of academic excellence by imparting technical, intellectual and professional skills to students for meeting the diverse needs of industry, society, the nation and the world at large

Mission

- Commitment to offer value-based education and enhancement of practical skills
- Continuous assessment of teaching and learning processes through scholarly activities
- Enriching research and innovation activities in collaboration with industry and institutes of repute
- Ensuring the academic processes to uphold culture, ethics and social responsibilities

II. Vision and Mission of the Department

Vision

To be a transdisciplinary department for the development of academic excellence and research in the field of Mechatronics, catering to the needs of the Industry and the Society

Mission

The mission of the department is to

- Preparing graduates to suit the requirements of the Industry by offering quality education
- Providing an education ecosystem to foster R&D, innovation, creativity, and entrepreneurship
- Inculcating professionalism, ethics, human values and lifelong learning practices

III. Program Educational Objectives (PEOs)

The Program Educational Objectives (PEOs) of the MECHATRONICS ENGINEERING (MI) represent major accomplishments that the graduates are expected to achieve after three to five years of graduation.

PEO1: The graduates of Mechatronics Engineering will possess adequate knowledge and skills to succeed in their professional career

PEO2: The graduates of Mechatronics Engineering will analyze, design, and develop a transdisciplinary engineering–based products and processes for real world applications

PEO3: The graduates of Mechatronics Engineering will practice their profession with good ethics and human values

IV. Program Outcomes (POs)

Graduates of the MECHATRONICS ENGINEERING will be able to

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex 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 engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions (WK8)

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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 engineering problems (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its 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 Team work: 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 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 multidisciplinary 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)

Knowledge and Attitude Profile (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes

V. Program Specific Outcomes (PSOs)

Graduates of the MECHATRONICS ENGINEERING will be able to

PSO1: Graduates will be able to apply their gained knowledge and skills to design, develop and implement mechatronics systems in the field of engineering and sciences

PSO2: Graduates will be able to apply innovative ideas and multidisciplinary approaches to solve real world problems

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VI. PEO / PO Mapping

Following three levels of correlation should be used:

1: Low

2: Medium

3: High

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
PEO 1	3	3	2	2	3	2	2	2	2	2	3	3	3
PEO 2	3	3	3	3	3	2	2	2	2	3	3	3	3
PEO 3	1	2	2	2	2	3	3	3	3	2	2	2	2

VII. Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Sem	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
I	Professional Communication - I	-	-	-	-	-	-	-	✓	✓	-	✓	✓	-
	Multivariable Calculus and Applications	✓	✓	-	-	-	-	-	-	-	-	-	✓	✓
	Engineering Physics	✓	✓	✓	-	✓	-	-	✓	✓	-	-	✓	✓
	C Programming	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓
	Engineering Graphics	✓	✓	✓	-	-	-	-	-	-	-	✓	✓	-
	Makerspace	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	C Programming Laboratory	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	✓
	Induction Program													
	Universal Human Values	-	-	-	-	-	✓	✓	✓	-	-	✓	✓	-
	தமிழர் மரபு / Heritage of Tamils	-	-	-	-	-	-	✓	✓	-	✓	-	-	-
	Environmental Governance and Sustainability	✓	✓	-	-	-	✓	✓	-	✓	-	✓	✓	-
	Professional Skill Development - I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
II	Professional Communication - II	-	-	-	-	-	-	-	✓	✓	-	✓	✓	-
	Mathematical Transforms in Engineering	✓	✓	✓	-	✓	-	-	-	✓	-	-	✓	✓
	Material Science	✓	✓	✓	-	✓	-	-	✓	✓	-	-	✓	✓
	Engineering Chemistry	✓	✓	✓	-	✓	-	-	✓	✓	-	✓	✓	✓
	Python Programming	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	✓
	Engineering Mechanics	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	✓
	3D Modeling and Assembly Laboratory	✓	✓	✓	✓	✓	✓	-	✓	✓	-	-	✓	✓
	Python Programming Laboratory	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	✓
	Design Thinking	✓	✓	✓	-	-	✓	✓	✓	✓	✓	✓	✓	-
	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	-	-	-	-	-	-	✓	✓	-	✓	-	✓	-
	Professional Skill Development - II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
III	Probability and Statistics	✓	✓	-	-	✓	-	-	-	-	-	-	✓	✓
	Engineering Thermodynamics	✓	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	✓
	Fluid Mechanics and Machinery	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓

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Sem	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
	Sensors and Signal Processing	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓
	Electronic Devices and Digital Circuits	✓	✓	✓	-	✓	-	-	-	✓	-	✓	✓	✓
	Electrical Drives and Control	✓	✓	✓	✓	✓	-	✓	✓	✓	-	✓	✓	✓
	Data Structures and Algorithms	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓
	Manufacturing Processes Laboratory	✓	✓	✓	✓	✓	-	-	✓	✓	✓	✓	✓	✓
	Essence of Indian Traditional Knowledge	-	✓	-	✓	-	-	✓	-	-	-	-	✓	-
	Professional Skill Development - III	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-
IV	Numerical Methods and Partial Differential Equations	✓	✓	-	-	-	-	-	-	-	-	-	✓	✓
	Microcontroller and Embedded Systems	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓
	Object Oriented Programming Using Java	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	✓
	Theory of Machines	✓	✓	✓	✓	✓	✓	-	✓	✓	-	✓	✓	✓
	Metrology and CNC	✓	✓	✓	✓	-	-	-	✓	✓	✓	✓	✓	✓
	Microcontroller and Embedded Systems Laboratory	✓	✓	✓	✓	✓	-	-	-	✓	-	✓	✓	✓
	Object Oriented Programming Using Java Laboratory	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	✓
	Indian Constitution	-	-	-	-	-	✓	✓	✓	-	-	-	✓	-
	Professional Skill Development - IV	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-

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MECHATRONICS ENGINEERING

Regulations 2025

For the students admitted from 2025 onwards

CHOICE BASED CREDIT SYSTEM

CURRICULUM FOR I - VIII SEMESTERS

SEMESTER I

No	Course Code	Title	Category	Type	L	T	P	J	C
1	U25REN101	Professional Communication - I	HSMC	TwL	2	-	2	-	3
2	U25RMA101	Multivariable Calculus and Applications	BSC	T	3	1	-	-	4
3	U25RPH01	Engineering Physics	BSC	TwL	2	-	2	-	3
4	U25RCSG01	C Programming	ESC	T	3	-	-	-	3
5	U25RMEG01	Engineering Graphics	ESC	L	-	-	4	-	2
6	U25RGE01	Makerspace	ESC	L	-	-	4	-	2
7	U25RCSG03	C Programming Laboratory	ESC	L	-	-	2	-	1
Total									**18**
MANDATORY CREDIT COURSES (MCC - Non CGPA) / MANDATORY NON-CREDIT COURSES (MNC)									
8	U25RMNC01	Induction Program	MNC	MNC	-	-	-	-	-
9	U25RMCC01	Universal Human Values	MCC	MCC	3	-	-	-	3
10	U25RMCC02	தமிழர் மரபு / Heritage of Tamils	MCC	Tamil Courses	1	-	-	-	1
11	U25RMCC04	Environmental Governance and Sustainability	MCC	MCC	2	-	-	-	2
12	U25RMCC06	Professional Skill Development - I	MCC	MCC	-	-	-	-	1
Total									**7**

SEMESTER II

No	Course Code	Title	Category	Type	L	T	P	J	C
1	U25REN201	Professional Communication - II	HSMC	TwL	2	-	2	-	3
2	U25RMA203	Mathematical Transforms in Engineering	BSC	TwL	3	-	2	-	4
3	U25RPH03	Material Science	BSC	TwP	2	-	-	2	3
4	U25RCY01	Engineering Chemistry	BSC	TwL	2	-	2	-	3
5	U25RCSG04	Python Programming	ESC	T	3	-	-	-	3
6	U25RMEG03	Engineering Mechanics	PCC	T	3	-	-	-	3
7	U25RMI201	3D Modeling and Assembly Laboratory	PCC	L	-	-	4	-	2
8	U25RCSG06	Python Programming Laboratory	ESC	L	-	-	2	-	1
Total									**22**
MANDATORY CREDIT COURSES (MCC - Non CGPA) / MANDATORY NON-CREDIT COURSES (MNC)									
9	U25RMCC03	Design Thinking	MCC	MCC	1	-	2	-	2
10	U25RMCC05	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	MCC	Tamil Courses	1	-	-	-	1

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Department of Mechatronics Engineering
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No	Course Code	Title	Category	Type	L	T	P	J	C
11	U25RMCC07	Professional Skill Development - II	MCC	MCC	-	-	-	-	1
Total									4

SEMESTER III

No	Course Code	Title	Category	Type	L	T	P	J	C
1	U25MA302	Probability and Statistics	BSC	TwL	2	-	2	-	3
2	U25MEG04	Engineering Thermodynamics	PCC	T	3	-	-	-	3
3	U25MEG05	Fluid Mechanics and Machinery	PCC	T	3	-	-	-	3
4	U25MI301	Sensors and Signal Processing	PCC	TwL	2	-	2	-	3
5	U25MI302	Electronic Devices and Digital Circuits	PCC	TwL	2	-	2	-	3
6	U25EEG04	Electrical Drives and Control	ESC	TwL	2	-	2	-	3
7	U25ADG02	Data Structures and Algorithms	PCC	TwL	3	-	2	-	4
8	U25MI303	Manufacturing Processes Laboratory	PCC	L	-	-	4	-	2
Total									24
MANDATORY CREDIT COURSES (MCC - Non CGPA) / MANDATORY NON-CREDIT COURSES (MNC)									
9	U25MNC02	Essence of Indian Traditional Knowledge	MNC	MNC	1	-	-	-	-
10	U25RMCC08	Professional Skill Development - III	MCC	MCC	-	-	-	-	1
Total									1

SEMESTER IV

No	Course Code	Title	Category	Type	L	T	P	J	C
1	U25MA403	Numerical Methods and Partial Differential Equations	BSC	T	3	-	-	-	3
2	U25MI401	Microcontroller and Embedded Systems	PCC	T	3	-	-	-	3
3	U25CSG11	Object Oriented Programming Using Java	PCC	T	3	-	-	-	3
4	U25MEG06	Theory of Machines	PCC	TwL	3	-	2	-	4
5	U25MI402	Metrology and CNC	PCC	TwL	1	-	2	-	2
6	U25MI403	Microcontroller and Embedded Systems Laboratory	PCC	LwP	-	-	2	2	2
7	U25CSG13	Object Oriented Programming Using Java Laboratory	PCC	L	-	-	2	-	1
8	-	Open Elective I	OEC	T	1	-	4	-	3
					3	-	-	-	
					2	-	2	-	
Total									21
MANDATORY CREDIT COURSES (MCC - Non CGPA) / MANDATORY NON-CREDIT COURSES (MNC)									
9	U25MNC03	Indian Constitution	MNC	MNC	1	-	-	-	-
10	U25RMCC09	Professional Skill Development - IV	MCC	MCC	-	-	-	-	1
Total									1

T - Theory, **L** - Laboratory, **TwL** - Theory with Laboratory, **TwP** - Theory with Project

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SEMESTER I

U25REN101	Professional Communication - I (Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC)	Category: HSMC				
		L	T	P	J	C
		2	0	2	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- To develop professional communication skills for academic, technical and workplace environments
- To enhance the listening skills and facilitate effective pronunciation
- To enable students to communicate confidently in individual and team-based situations

COURSE OUTCOMES:

CO 1:	Use appropriate vocabulary and grammatical structures in professional communication	Understand
CO 2:	Communicate confidently in academic, social and workplace situations	Apply
CO 3:	Develop reading and writing skills for technical and professional purposes	Apply
CO 4:	Infer and present information using appropriate communication strategies	Analyze
CO 5:	Demonstrate effective listening, presentation, and teamwork skills in professional contexts	Apply

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	-	-	-	-	-	-	-	2	3	-	1	-	-
CO 2	-	-	-	-	-	-	-	2	3	-	1	1	-
CO 3	-	-	-	-	-	-	-	2	3	-	1	1	-
CO 4	-	-	-	-	-	-	-	2	3	-	1	1	-
CO 5	-	-	-	-	-	-	-	2	3	-	1	-	-

SYLLABUS:

UNIT I: FOUNDATIONS OF PROFESSIONAL COMMUNICATION 6 + 6

Verbal, Non-verbal and Digital Communication - Word chain - Professional Etiquette - Self-Introduction and Elevator Pitch - Growth Mindset and Workplace Communication - Cross-cultural Communication - Professional Terminology - AI-assisted Communication Tools

UNIT II: PROFESSIONAL READING AND WRITING 6 + 6

Reading Technical Articles - Error correction - Manuals and SOPs - Infographics and Data - Email Etiquette - Email Writing - AI-assisted Writing Tools - Ethical Use of AI - Verbal Analogy

UNIT III: LISTENING AND INTERPERSONAL COMMUNICATION 6 + 6

Listening Barriers - Note-taking Techniques - Listening for Problem Solving - Team Communication - Conflict Resolution - Workplace Discussions - Idioms and Phrases

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UNIT IV: DIGITAL COMMUNICATION AND PRESENTATION SKILLS **6 + 6**

Storytelling Techniques - Discourse markers, linkers and cohesive devices - Data Presentation - Presentation Anxiety Management - Digital Presentation Platforms - Branding - Commonly Confused Words

UNIT V: EMPLOYABILITY AND PROFESSIONALISM **6 + 6**

Prefixes, Suffixes and Root Words - LinkedIn Profile - Interview Skills - Group Discussion Strategies - Art of Persuasion - Entrepreneurial Communication - AI in Future Workplace

LIST OF EXPERIMENTS

1. Self-Introduction
2. Group Presentation
3. Listening to TED Talks
4. Listening to Documentaries
5. Digital Profiling

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. Ashraf Rizvi, Effective Technical Communication, 3rd Edition, McGraw-Hill Education, 2023
2. Meenakshi Raman & Sangeeta Sharma, Technical Communication: Principles and Practice, 4th Edition, Oxford University Press, 2022
3. Sanjay Kumar & Pushp Lata, Communication Skills, 3rd Edition, Oxford University Press, New Delhi, 2018

REFERENCES:

1. Stephen E. Lucas, The Art of Public Speaking, 14th Edition, McGraw Hill Education, New York, 2023
2. Dale Carnegie, The Quick and Easy Way to Effective Speaking, Updated Edition, Simon & Schuster, New York, 2019
3. Matt Abrahams, Think Faster, Talk Smarter: How to Speak Successfully When You're Put on the Spot, Simon & Schuster, New York, 2024

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SEMESTER I

U25RMA101	Multivariable Calculus and Applications (Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC)	Category: BSC				
		L	T	P	J	C
		3	1	0	0	4

QP PATTERN: A

COURSE OBJECTIVES:

- To provide a comprehensive knowledge of multivariable calculus, including, partial derivatives integral calculus, and vector calculus
- For constructing more convenient for students to apply their calculus knowledge to their various fields of study
- To develop skills in solving first and second order linear differential equations for engineering applications

COURSE OUTCOMES:

CO 1:	Explain the concepts of multivariable differential calculus, estimate the extreme values and Taylor's formula of two variable functions	Understand
CO 2:	Apply integral calculus to evaluate double integrals over various regions and compute area and volume using double integration	Apply
CO 3:	Apply vector calculus to compute directional derivative, divergence, curl, Green's, Stokes' and Gauss divergence theorems	Apply
CO 4:	Solve first order ordinary differential equations, model physical phenomena, determine appropriate methods for solving them, and interpret the results	Apply
CO 5:	Formulate second-order differential equations, solve the equations, and interpret the solutions for physical models	Apply

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	2	1	-	-	-	-	-	-	-	-	-	1	1
CO 2	3	2	-	-	-	-	-	-	-	-	-	2	2
CO 3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO 4	3	2	-	-	-	-	-	-	-	-	-	2	2
CO 5	3	2	-	-	-	-	-	-	-	-	-	2	2

SYLLABUS:

UNIT I: DIFFERENTIAL CALCULUS 9 + 3

Functions of two variables – Partial derivatives – Total derivatives – Taylor's formula for functions of two variables – Extreme Values

UNIT II: INTEGRAL CALCULUS 9 + 3

UNIT II Double integrals – Over rectangles – Over general regions – Fubini's theorem (statement only), Area and Volume by double integration – Reversing the order of integration

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UNIT III: VECTOR CALCULUS **9 + 3**

Differentiation in vector field – Gradient of a scalar field – Directional derivative – Divergence of a vector field – Curl of a vector field – Integration in vector field – Line integrals – Work– circulation and flux – Path independence – Conservative fields – Green's – Gauss divergence and Stoke's theorems

UNIT IV: FIRST ORDER LINEAR ORDINARY DIFFERENTIAL EQUATIONS **9 + 3**

Basic concepts of ordinary differential equations – Separable and exact differential equations – Integrating factors and first-order linear differential equations – Mathematical modelling of real-world problems

UNIT V: SECOND ORDER LINEAR DIFFERENTIAL EQUATIONS **9 + 3**

Homogeneous linear equations of second order – linearity principle – second order homogeneous equations with constant coefficients – Euler–Cauchy equation – Non-homogeneous linear second order-solution by variation of parameters

CONTACT PERIODS:

Lecture: 45 Periods **Tutorial:** 15 Periods **Practical:** - Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. Thomas G. B. and Finney R. L., "Calculus and Analytic Geometry", Pearson Education, New Delhi, 2012
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India Pvt Ltd, New Delhi, 2012

REFERENCES:

1. Wylie C. R. and Barrett L. C., "Advanced Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2013
2. Peter V.O Neil, "Advanced Engineering Mathematics", Cengage, New Delhi, 2010
3. Michael D. G, "Foundations of Applied Mathematics", Dover Publications, INC, New York, 2013
4. Gilbert Strang, "Calculus", Wellesley Cambridge Press, USA, 2017

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SEMESTER I & II

U25RPH01	Engineering Physics (Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC)	Category: BSC				
		L	T	P	J	C
		2	0	2	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- To understand the fundamental mechanical and thermal properties of solids and fluids for real-world engineering applications
- To explore advanced concepts in ultrasonic waves and their applications in imaging, testing, and sensing technologies
- To gain insights into semiconductor physics and photonics for their role in modern electronic and optical systems

COURSE OUTCOMES:

CO 1:	Apply the stress-strain behavior concepts in engineering materials and structures	Apply
CO 2:	Apply principles of heat transfer and fluid mechanics to evaluate thermal systems and engineering applications	Apply
CO 3:	Demonstrate the operation of ultrasonic wave generation and detection techniques for industrial and biomedical applications	Apply
CO 4:	Analyze the electrical properties and carrier transport mechanisms in semiconductors and semiconductor devices	Apply
CO 5:	Demonstrate the principles of lasers and optical fibers in communication, sensing, and biomedical applications	Apply

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	1	-	1	-	-	1	1	-	-	1	1
CO 2	3	2	1	-	1	-	-	1	1	-	-	1	1
CO 3	3	2	1	-	1	-	-	1	1	-	-	2	2
CO 4	3	2	1	-	1	-	-	1	1	-	-	2	2
CO 5	3	2	1	-	1	-	-	1	1	-	-	2	2

SYLLABUS:

UNIT I: MECHANICAL PROPERTIES OF SOLIDS 6 + 6

Modulus of Elasticity – Stress-strain diagram – Poisson's ratio – Elastic and plastic deformation – Stress-strain behaviour in metals, polymers and ceramics – Bending Moment – Cantilever – Applications (GIRDERS, MEMS)

UNIT II: FUNDAMENTALS OF HEAT TRANSFER AND FLUIDS 6 + 6

Heat transfer – Thermal expansion – Heat conductivity – Lee's Disc method – Surface tension – Viscosity – Coefficient of viscosity using Poiseuille's flow experiment – Solar water heater – Microwave oven – Heat exchangers – Radiators – Cooling towers

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UNIT III: ULTRASONICS AND ITS APPLICATIONS **6 + 6**

Properties of Ultrasonic waves – Production of ultrasonic waves – Piezoelectric Oscillator – Magnetostriction Oscillator – Velocity measurement of Ultrasonic waves – SONAR – Non-Destructive Testing – Ultrasound imaging – Ultrasonic scanning methods

UNIT IV: SEMICONDUCTOR PHYSICS **6 + 6**

Properties – Direct and Indirect bandgap-semiconductor – Intrinsic and extrinsic Semiconductors – Carrier concentration in n-type semiconductor – P-type semiconductor – Carrier Transport in Semiconductor – Hall effect – Ohmic contacts – Schottky diode

UNIT V: PHOTONICS **6 + 6**

Interaction of Radiation with Matter – Laser Characteristics – Population Inversion – CO2 laser – Semiconductor Diode Laser – Laser applications – Total Internal Reflection – Structure and working principle of Optical fibre – Fiber optic Endoscopy – Fiber optic sensors

LIST OF EXPERIMENTS

1. Determine the moduli of elasticity of the given beams and evaluate them for different structural applications. (High/ Medium/Low modulus)
2. Evaluate the shear moduli of the different materials and rank them for suitable applications with reference to their strength
3. Select the most effective thermal insulation material from mica, cardboard, and glass for optimal heat protection
4. Determine the Viscosity of Liquids Using Poiseuille's Method and Identify the Fastest-Flowing Liquid
5. Measure the speed of ultrasound in liquids and calculate their compressibility for different hydraulic purposes
6. Categorize the specified semiconducting materials according to their energy bandgap values
7. Determine a semiconducting material's Hall coefficient and identify its type
8. Determination of wavelength of given laser and the particle size of the given samples using diffraction method
9. Use an optical fiber to measure its light-gathering capacity and calculate the propagation angle
10. Calculate the surface tension of different liquids and examine how surfactants affect it
11. Determination of wavelength of various spectral lines by using spectrometer and grating
12. Determination of velocity of light passing through glass medium using spectrometer

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. M.N. Avadhanulu, P.G. Kshirsagar, and T.V.S. Arun Murthy, "A Textbook of Engineering Physics", 11th edition, S. Chand Publishing, New Delhi, 2022
2. R.K. Gaur and S.L. Gupta, "Engineering Physics", 8th edition, Dhanpat Rai Publications, New Delhi, 2017

REFERENCES:

1. Harald Ibach and Hans Luth, "Solid State Physics: An Introduction", 4th edition, Springer Publications, 2020
2. Charles Kittel, revised by David Pines (Editor) "Introduction to Solid State Physics", 9th edition, Wiley & Sons, US, 2020
3. H.K. Malik and A.K. Singh "Engineering Physics" Publisher: McGraw Hill Education India, 2022
4. https://onlinecourses.nptel.ac.in/noc20_cy17/preview

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SEMESTER I

U25RCSG01	C Programming (Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC)	Category: ESC					
		L	T	P	J	C	
		3	0	0	0	3	

QP PATTERN: A

COURSE OBJECTIVES:

- To enable students to understand the fundamentals of problem-solving and C programming, including algorithms, flowcharts, pseudocode, and the structure of a C program
- To develop programming skills using input/output operations, control structures, arrays, strings, functions, pointers, and dynamic memory allocation
- To introduce user-defined data types such as structures and unions for handling complex data effectively
- To familiarize students with file handling concepts and develop C-based solutions for real-world applications

COURSE OUTCOMES:

CO 1:	Explain fundamental programming concepts, problem-solving techniques, and the basic structure of C programs	Understand
CO 2:	Develop C programs using input/output functions, operators, decision-making, and iterative control structures	Apply
CO 3:	Implement arrays and string handling concepts to solve data processing and real-world applications	Apply
CO 4:	Develop modular and efficient programs using functions, recursion, pointers, and dynamic memory allocation techniques	Apply
CO 5:	Apply user-defined data types and file handling operations to manage and process data effectively	Apply

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	2	2	-	-	-	-	-	-	-	-	-	2	2
CO 2	3	2	1	1	-	-	-	-	-	-	2	2	2
CO 3	3	2	1	1	-	-	-	-	-	-	2	2	2
CO 4	3	2	1	1	-	-	-	-	-	-	2	3	3
CO 5	3	2	1	1	1	-	-	-	-	-	2	3	3

SYLLABUS:

UNIT I: PROBLEM SOLVING APPROACHES AND C PROGRAMMING BASICS 10

Problem Solving Techniques: Problem Statement and Analysis – Problem Modelling – Identifying Input and Output Requirements – Algorithms – Flowcharts – Pseudocode for Solving Basic Scientific and Business Problems. Introduction to C: Characteristics of C – Structure of a C Program – Compiling and Executing C Program – Pre-processor Directives – Tokens – Character Set – Keywords – Identifiers – Constants – Variables – Operators – Data Types – Typecasting – Input/Output Statements in C

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UNIT II: DECISION CONTROL AND LOOPING STATEMENTS 8

Conditional Statements: if Statement – if-else Statement – Nested if Statements – else-if Ladder – switch Statement. Looping Statements: while Loop – do-while Loop – for Loop – Nested Loops. Jump Statements: break Statement – continue Statement – goto Statement

UNIT III: ARRAYS AND STRINGS 9

Arrays: Declaration and Initialization – Accessing and Manipulating Array Elements – One-Dimensional Arrays – Two-Dimensional Arrays – Applications of Arrays. Strings: Declaration and Initialization of Strings – String Handling Functions – String Arrays

UNIT IV: FUNCTIONS AND POINTERS 9

Functions: Definition – Function Call – Function Prototype – Return Statement – Types of Functions – Recursive Functions – Command Line Arguments. Pointers: Declaration and Initialization – Pointer Arithmetic – Passing Arguments by Value and by Reference – Pointer to Pointer – Pointers and Arrays. Dynamic Memory Allocation: malloc(), calloc(), realloc(), free()

UNIT V: USER-DEFINED DATA TYPES AND FILE MANAGEMENT 9

Structures: Declaration and Initialization – Accessing Structure Members – Arrays of Structures – Nested Structures – Pointer to Structures. Unions – Storage Classes. Files: File Access Methods – File Modes – File Operations – File Pointers – Binary File Operations

CONTACT PERIODS:

Lecture: 45 Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. Reema Thareja, "Computer Fundamentals and Programming in C", 3rd Edition, Oxford University Press, 2023
2. Brian W. Kernighan and Dennis Ritchie, "The C Programming Language", 2nd Edition, Pearson,2015

REFERENCES:

1. Paolo Ferragina and Fabrizio Luccio, "Computational Thinking First Algorithms", Then Code",1st Edition, Springer International Publishing, 2018
2. Paul Deitel and Harvey Deitel, "C How to Program", 7th Edition, Pearson Publication
3. Juneja, B. L and Anita Seth, "Programming in C",1st Edition, Cengage Learning India Pvt. Ltd.,2011
4. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", 1st Edition, Oxford University Press, 2009

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SEMESTER I & II

U25RMEG01	Engineering Graphics (Common to BM, CE, CH, EE, ME, MI)	Category: ESC				
		L	T	P	J	C
		0	0	4	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- To impart knowledge of BIS standards and conventions in engineering graphics for the accurate construction of curves, projections and developments
- To develop the ability to visualize and represent 3D objects in 2D space through orthographic projections, sectional views and development of surfaces
- To enhance the drafting skills to interconvert between isometric and orthographic views for practical engineering

COURSE OUTCOMES:

CO 1: Illustrate engineering curves with BIS standards for effective engineering communication — Understand

CO 2: Apply the principles of orthographic projection to represent points, straight lines, plane surfaces, and solids on engineering drawing sheets — Apply

CO 3: Construct projections of truncated and frustums solids and develop the lateral surfaces of solids — Apply

CO 4: Convert the isometric views of simple objects to orthographic views and vice versa — Apply

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	1	-	-	-	-	-	-	-	-	1	3	-
CO 2	3	2	1	-	-	-	-	-	-	-	1	2	-
CO 3	3	2	1	-	-	-	-	-	-	-	1	2	-
CO 4	3	2	1	-	-	-	-	-	-	-	1	2	-

LIST OF EXPERIMENTS

1. Introduction, drawing instruments and its uses, sheet layout, BIS conventions, lines, lettering and dimensioning practices lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints, parallelism, inclination and perpendicularity (Not for Exam)
2. Manual construction of ellipse, parabola and hyperbola by eccentricity method
3. Construction of involute of square and circle by manual drafting
4. Projection of points in all four quadrants by manual drafting
5. Projection of lines inclined to both horizontal and vertical planes by manual drafting
6. Projection of planes inclined to both horizontal and vertical planes by manual drafting
7. Projection of solids inclined to one plane and parallel to other planes
8. Section of solids with base resting on HP
9. Development of lateral surfaces of solids with base on HP
10. Construction of isometric views of simple and truncated solids
11. Sketching orthographic views from pictorial representation of 3D objects

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12. Sketching simple components using modelling software

CONTACT PERIODS:

Lecture: - Periods **Tutorial:** - Periods **Practical:** 60 Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. N.D. Bhatt and V.M. Panchal, "Engineering Drawing", Charotar Publishing House, Gujarat, 55th edition, 2025
2. K. Venugopal and V. Prabhu Raja, "Engineering Graphics", New Age International (P) Limited, 2022
3. D.M.Kulkarni, A.P.Rastogi and A.K.Sarkar, "Engineering Graphics with AutoCAD", PHI Learning Private Limited, New Delhi, Revised Edition, 2021

REFERENCES:

1. K. V. Natrajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2017
2. Sam Tickoo, "AutoCAD 2024 for Engineers and Designers", Dreamtech Press, 2024

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SEMESTER I & II

U25RGE01	Makerspace (Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC)	Category: ESC					
		L	T	P	J	C	
		0	0	4	0	2	

QP PATTERN: A

COURSE OBJECTIVES:

- Apply fundamental fabrication, electrical, electronics, programming, and digital manufacturing techniques for engineering applications
- Develop practical skills in prototyping, automation, robotics, and emerging technologies through experiential learning activities
- Design and construct interdisciplinary engineering prototypes by integrating concepts from multiple engineering domains

COURSE OUTCOMES:

CO 1:	Fabricate simple components using basic mechanical engineering tools and additive manufacturing	**Apply**
CO 2:	Carry out electrical wiring installations applying safety measures in domestic applications	**Apply**
CO 3:	Interface electronic devices to develop functional engineering solutions	**Apply**
CO 4:	Illustrate the role of automation and artificial intelligence in engineering applications	**Apply**
CO 5:	Develop interdisciplinary engineering prototype addressing specific problems through teamwork and innovation	**Create**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	-	-	3	-	-	3	2	-	2	2	2
CO 2	3	2	-	-	3	-	-	3	2	-	2	2	-
CO 3	3	2	-	-	3	-	-	3	2	-	2	2	-
CO 4	2	-	-	-	3	-	-	-	-	-	2	2	-
CO 5	3	3	2	1	3	2	2	3	3	2	2	2	-

LIST OF EXPERIMENTS

MODULE 1: FABRICATION AND MAKING SKILLS (10 Hours)

1. Welding procedure, selection & safety Measures - Hands-on session for preparing base material and joining of steel materials using arc welding
2. Study on basic pipe connections with different joining components.
3. Demo on laser cutting of acrylic boards and wire arc welding

MODULE 2: DIGITAL DESIGN AND RAPID PROTOTYPING (10 Hours)

4. 3D Modelling of simple components using software's
5. Fabrication of simple components / parts using 3D printers
6. Demonstration of assembly modelling of components

MODULE 3: AUTOMATION AND ROBOTICS (8 Hours)

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7. Demonstration on mechatronics components/systems
8. Demonstration on basic robotics system
9. Demonstration on automobiles, performance measures
10. Demonstration on programmable logic control circuit

MODULE 4: ELECTRICAL PRACTICES (10 Hours)

11. Study on basic electrical installation tools, equipment and safety measures
12. Basic electrical wiring and connections such as soldering, fuses, earthing, miniature circuit breakers and switch wiring
13. Hands-on session of electrical connections for lightings, fans, calling bells etc
14. Hands-on session of electrical connections for motors and uninterruptible power supply

MODULE 5: ELECTRONICS AND EMBEDDED SYSTEMS (8 Hours)

15. Electronic components, equipment and safety measures
16. Interfacing of sensors and actuator with microcontrollers (Arduino)
17. Integration of electronic circuits with IoT system
18. Interfacing of components with printed circuit board

MODULE 6: ARTIFICIAL INTELLIGENCE (4 Hours)

19. Demonstration on artificial intelligence technologies
20. Demonstration on AR/VR technologies

MODULE 7: INTERDISCIPLINARY PROTOTYPE CHALLENGE (10 Hours)

21. Students work in teams to develop and demonstrate an interdisciplinary product/prototype for the problem identified

CONTACT PERIODS:

Lecture: - Periods **Tutorial:** - Periods **Practical:** 60 Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. Mikell P. Groover, "Fundamentals of Modern Manufacturing: Materials, Processes and Systems", 7th Edition, Wiley, 2020
2. Simon Monk, "Programming Arduino: Getting Started with Sketches", 3rd Edition, McGraw-Hill Education, 2022
3. Richard H. Barnett, "Introduction to Mechatronics and Measurement Systems", 6th Edition, McGraw-Hill Education, 2023
4. Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things", Apress, 2016

REFERENCES:

1. Arduino Documentation – https://www.arduino.cc
2. Tinkercad Learning Portal – https://www.tinkercad.com
3. FreeCAD Documentation – https://www.freecad.org
4. Ultimaker Cura Resources – https://ultimaker.com/software/ultimaker-cura
5. ESP32 Documentation – https://docs.espressif.com

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SEMESTER I

U25RCSG03	C Programming Laboratory (Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC)	Category: ESC				
		L	T	P	J	C
		0	0	2	0	1

QP PATTERN: A

COURSE OBJECTIVES:

- To provide hands-on experience in problem solving and structured programming using the C programming language
- To develop programming skills using control structures, arrays, strings, functions, pointers, and dynamic memory management techniques
- To enable students to design and implement applications using user-defined data types and file handling concepts for real-world problems

COURSE OUTCOMES:

CO 1:	Demonstrate problem-solving techniques, algorithms, flowcharts, and basic C programming constructs in program development	**Apply**
CO 2:	Develop C programs using input/output operations, decision-making statements, and iterative constructs	**Apply**
CO 3:	Demonstrate the use of arrays and strings for data processing and manipulation	**Apply**
CO 4:	Develop modular applications using functions, recursion, pointers, and dynamic memory management techniques	**Apply**
CO 5:	Develop applications using structures, unions, storage classes, and file handling operations for data management	**Apply**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	2	1	-	-	-	-	-	-	1	3	2
CO 2	3	2	2	1	-	-	-	-	-	-	1	2	2
CO 3	3	2	2	1	-	-	-	-	-	-	1	2	2
CO 4	3	2	2	1	-	-	-	-	-	-	1	2	2
CO 5	3	2	2	1	-	-	-	-	-	-	1	2	3

LIST OF EXPERIMENTS

1. Design and implementation of algorithms, flowcharts, and pseudo code for basic problem-solving applications
2. Development of C programs demonstrating data types, operators, and formatted input/output operations
3. Implementation of decision-making applications using conditional statements and switch-case constructs
4. Development of iterative applications using looping and loop control statements
5. Design and implementation of console-based applications for real-world mathematical and logical problem solving
6. Implementation of one-dimensional array operations for searching, sorting, and statistical analysis
7. Development of matrix manipulation applications using two-dimensional arrays
8. Design and implementation of string processing applications using standard string handling functions
9. Development of modular applications using user-defined functions and recursive techniques

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10. Implementation of applications demonstrating parameter passing mechanisms using call by value and call by reference
11. Development of applications using pointers, pointer arithmetic, and array-pointer relationships
12. Implementation of dynamic memory management applications using malloc(), calloc(), realloc(), and free()
13. Design and implementation of applications using structures, nested structures, unions, and storage classes
14. Development of file processing applications using text and binary file operations in C
15. Implementation of command-line and console-based applications integrating functions, pointers, structures, and file management concepts for real-world use cases

CONTACT PERIODS:

Lecture: - Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 30 Periods

REFERENCES:

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Pearson Education, 2015
2. Reema Thareja, "Computer Fundamentals and Programming in C", 3rd Edition, Oxford University Press, 2023
3. Yashavant Kanetkar, "Let Us C", 17th Edition, BPB Publications, 2023
4. Byron Gottfried, "Programming with C", 4th Edition, Schaum's Outline Series, McGraw Hill Education

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SEMESTER I

U25RMNC01	Induction Program (Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC)	Category: MNC				
		L	T	P	J	C
		3 Weeks				0

GUIDELINES:

Students come with diverse thoughts, backgrounds and preparations. It is important to assist them adjust in the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Keeping the above thought in mind AICTE proposes a 3-week induction program for the UG students entering the institution before the commencement of normal classes which will start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, set a healthy daily routine, create bonding in the batch as well as between faculty, develop awareness, sensitivity and understanding of the self, society at large, and nature The following are the activities under the induction program in which the student should be fully and actively engaged throughout the entire duration of the program. Physical Activity: To inculcate team spirit, competitiveness, group cohesion and bonding as well as physical & mental health, physical activities like team sports, yoga, physical exercises should be conducted daily during early morning & evening. Activities like gardening may also be encouraged. Creative Arts: Every student should choose one skill related to arts /visual arts/ performing arts like painting, sculpture, pottery, music, dance etc. to develop a sense of aesthetics and also to enhance creativity The student should pursue it daily for the duration of the program. Universal Human Values: Universal Human Values module will help the student to explore oneself and experience the joy of learning, stand up to peer pressure, take decisions with courage, create awareness about the relationship with colleagues and supporting staff in the hostel and department, etc. Literary: Literary activity would encompass reading, writing and possibly, debating, enacting a play etc. Proficiency Modules: To establish the command over skills like English, a computer familiarity etc. these modules can be taught earlier so that when norm

CONTACT PERIODS:

Lecture: - Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** - Periods **Total:** 0 Periods

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SEMESTER I

U25RMCC01	Universal Human Values (Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC)	Category: MCC					
		L	T	P	J	C	
		3	0	0	0	3	

QP PATTERN: A

COURSE OBJECTIVES:

- To understand the significance of universal human values and their role in complementing technical, intellectual, and professional skills for holistic development.
- To apply a holistic perspective in addressing personal, societal, professional, and environmental challenges through ethical and value-based approaches.
- To demonstrate responsible citizenship, professional ethics, mutual respect, and sustainable practices that contribute positively to society, industry, and the environment.

COURSE OUTCOMES:

CO 1:	Explain the significance of Universal Human Values and self-exploration in developing a holistic perspective, enabling students to harmonize technical competence with ethical responsibility and value-based living.	**Understand**
CO 2:	Differentiate the needs of the Self and the Body, and apply self-exploration to develop healthy habits, value-based decision-making, and holistic well-being.	**Understand**
CO 3:	Explain the concepts of natural acceptance, competence, and respect, and apply them to foster harmonious relationships, resolve social conflicts, promote value education for children, and develop holistic perspectives for societal development.	**Understand**
CO 4:	Demonstrate an understanding of the interconnectedness of existence and integrate holistic perspectives into academic, professional, and societal contexts.	**Apply**
CO 5:	Apply human values and professional knowledge to promote sustainable development, family harmony, societal well-being, and responsible participation in nature.	**Apply**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	-	-	-	-	-	3	3	-	-	-	3	-	-
CO 2	-	-	-	-	-	3	3	3	-	-	3	-	-
CO 3	-	-	-	-	-	3	3	-	-	-	3	1	-
CO 4	-	-	-	-	-	3	3	-	-	-	3	1	-
CO 5	-	-	-	-	-	3	3	3	-	-	3	-	-

SYLLABUS:

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Centre for Academic Courses

UNIT I: INTRODUCTION TO VALUE EDUCATION 9

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) – Understanding Value Education – Self-exploration as the Process for Value Education – Continuous Happiness and Prosperity – the Basic Human Aspirations – Happiness and Prosperity: Current Scenario – Method to Fulfil the Basic Human Aspirations. Self-Exploration Activity Topics: Sharing about Oneself – Exploring Human Consciousness

UNIT II: HARMONY IN THE HUMAN BEING 9

Understanding Human being as the Co-existence of the Self and the Body – Distinguishing between the Needs of the Self and the Body – The Body as an Instrument of the Self – Understanding Harmony in the Self – Harmony of the Self with the Body – Programme to ensure self-regulation and Health. Self-Exploration Activity Topics: Exploring the difference of Needs of Self and Body – Exploring Sources of Imagination in the Self – Exploring Harmony of Self with the Body

UNIT III: HARMONY IN THE FAMILY AND SOCIETY 9

Harmony in the Family – the Basic Unit of Human Interaction – 'Trust': the Foundational Value in Relationship – 'Respect': as the Right Evaluation – Other Feelings, Justice in Human-to-Human Relationship – Understanding Harmony in the Society – Vision for the Universal Human Order. Self-Exploration Activity Topics: Exploring the Feeling of Trust – Exploring the Feeling of Respect – Exploring Systems to fulfil Human Goal

UNIT IV: HARMONY IN THE NATURE/EXISTENCE 9

Understanding Harmony in the Nature – Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders – Realizing Existence as Co-existence at All Levels – The Holistic Perception of Harmony in Existence. Self-Exploration Activity Topics: Exploring the Four Orders of Nature – Exploring Co-existence in Existence

UNIT V: HARMONY ON PROFESSIONAL ETHICS : HOLISTIC UNDERSTANDING 9

Natural Acceptance of Human Values – Definitiveness of (Ethical) Human Conduct – A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order – Competence in Professional Ethics – Holistic Technologies, Production Systems and Management Models: Typical Case Studies – Strategies for Transition towards Value-based Life and Profession. Self-Exploration Activity Topics: Exploring Natural Acceptance – Exploring Ethical Human Conduct – Exploring Humanistic Models in Education – Exploring Steps of Transition towards Universal Human Order

CONTACT PERIODS:

Lecture: 45 Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. R R Gaur, R. Asthana, G P Bagaria, "A Foundation course in Human Values and Professional Ethics", 3rd Edition, Excel Books, New Delhi, 2024. ISBN 978-93-87034- 47-1
2. Prof. K. V. Subba Raju, "Success Secrets for Engineering Students", Smart Student Publications, 3rd Edition, 2013.
3. R R Gaur, R Asthana, G P Bagaria, "Teachers Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

REFERENCES:

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1. Ivan Illich, "Energy & Equity", The Trinity Press, Worcester, and HarperCollins, USA, 1974.
2. E. F. Schumancher, "Small is Beautiful: a study of economics as if people mattered.", Blond & Briggs, Britain, 1973.
3. A Nagraj, "Jeevan Vidya ek Parichay", Divya Path Sansthan, Amarkantak, 1998.

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SEMESTER I

U25RMCC02	தமிழர் மரபு / Heritage of Tamils (Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC)	Category: MCC				
		L	T	P	J	C
		1	0	0	0	1

QP PATTERN: A

COURSE OBJECTIVES:

- Learn the extensive literature of classical Tamil
- Review the fine arts heritage of Tamil culture
- Realize the contribution of Tamils in Indian freedom struggle

COURSE OUTCOMES:

CO 1:	Understand the extensive literature of Tamil and its classical nature	**Understand**
CO 2:	Understand the heritage of sculpture, painting and musical instruments of ancient people	**Understand**
CO 3:	Review on folk and martial arts of Tamil people	**Understand**
CO 4:	Realization of Thinai concepts, trade and victory of Chozha dynasty	**Understand**
CO 5:	Understand the contribution of Tamils in Indian freedom struggle, Self-esteem movement and siddha medicine	**Understand**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	-	-	-	-	-	-	3	3	-	2	-	-	-
CO 2	-	-	-	-	-	-	3	3	-	2	-	-	-
CO 3	-	-	-	-	-	-	3	3	-	2	-	-	-
CO 4	-	-	-	-	-	-	3	3	-	2	-	-	-
CO 5	-	-	-	-	-	-	3	3	-	2	-	-	-

SYLLABUS:

UNIT I: LANGUAGE AND LITERATURE 3

Language Families in India - Dravidian Languages – Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature – Management Principles in Thirukural – Tamil Epics and Impact of Buddhism & Jainism in Tamil Land – Bakthi Literature Azhwars and Nayanmars – Forms of minor Poetry – Development of Modern literature in Tamil – Contribution of Bharathiyar and Bharathidhasan

UNIT II: HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3

Hero stone to modern sculpture – Bronze icons – Tribes and their handicrafts – Art of temple car making – Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments – Mridhangam, Parai, Veenai, Yazh and Nadhaswaram – Role of Temples in Social and Economic Life of Tamils

UNIT III: FOLK AND MARTIAL ARTS 3

Tattooing, basket weaving,Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance – Sports and Games of Tamils

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UNIT IV: THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature – Aram Concept of Tamils – Education and Literacy during Sangam Age – Ancient Cities and Ports of Sangam Age – Export and Import during Sangam Age – Overseas Conquest of Cholas

UNIT V: CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3

Contribution of Tamils to Indian Freedom Struggle – The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement – Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books

CONTACT PERIODS:

Lecture: 15 Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** - Periods **Total:** 15 Periods

TEXTBOOKS:

1. Jayanthi Ravikrishna K, Heritage of Tamils, Sri Krishna publications, First Edition, 2023
2. S. Priyadharshini, Heritage of Tamils, V. K. Publications

REFERENCES:

1. தமிழக வரலாறும் மக்களும் பண்பாடும் - கே. கே. பிள்ளை, உலகத் தமிழாராய்ச்சி நிறுவனம் (International Institute of Tamil Studies), C.P.T கேம்பஸ், சென்னை.
2. கணினித் தமிழ் - மு0னவர். இல. சுந்தரம், விகடன் பிரசுரம், அண்ணொ சொ0ல, .சன்0ன, திசம்பர் 2016
3. கீழடி - 0வ0க நதிக்க0ரயில் சங்ககொல நகர நொகரிகம், .தொல்லியல் து0றை .வளியீடு, தமிழ்நொடு அரசு, .சன்0ன, ஆறைொம் பதிப்பு 2020
4. Social Life of Tamils, Dr. K. K. Pillay, A joint publication of TNTB & ESC and RMRL (in print) University of Madras, Chennai, Second Edition 1975
5. The Contributions of the Tamils to Indian Culture, Dr.M.Valarmathi, International Institute of Tamil Studies, C.I.T Campus, Tharamani, Chennai, First Edition 1995

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SEMESTER I & II

		Category: MCC				
U25RMCC04	Environmental Governance and Sustainability (Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC)	L	T	P	J	C
		2	0	0	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- To provide basic concepts of ecosystem, biodiversity, atmospheric and hydrological processes
- To inculcate knowledge on the lithosphere, waste management practices, environmental laws and disaster management strategies
- To apply the principles of sustainable living and green technologies in alignment with the UN Sustainable Development Goals

COURSE OUTCOMES:

CO 1: Explain the role of biodiversity conservation and wildlife protection in addressing environmental issues — **Understand**

CO 2: Apply pollution control methods, environmental laws, and water management practices for environmental protection — **Apply**

CO 3: Implement sustainable waste management practices for efficient resource utilization — **Apply**

CO 4: Explain the role of disaster management, governance, and IT tools in environmental and health sustainability — **Understand**

CO 5: Employ sustainable practices and national environmental initiatives for sustainable development — **Apply**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	2	1	-	-	-	3	2	-	1	-	1	1	-
CO 2	2	1	-	-	-	3	2	-	1	-	1	2	-
CO 3	2	1	-	-	-	3	2	-	1	-	1	2	-
CO 4	2	1	-	-	-	3	2	-	1	-	1	2	-
CO 5	3	1	-	-	-	3	2	-	1	-	1	2	-

SYLLABUS:

UNIT I: ENVIRONMENT AND BIODIVERSITY 6

Scope of Environmental Science – Ecology – Ecosystem – Classification, structure, productivity – Energy flow and nutrient cycles – Nitrogen cycle – Ecological succession – Biodiversity – Types and values of biodiversity – Biodiversity at Global, National and Local Levels – Bio-geographical Classification of India – India as a Mega-diversity Nation – Red Data Book – Hotspots of Indian Biodiversity – Endangered and endemic species – Conservation of biodiversity

Self - Learning & Case Studies – Species conservation projects in India – Species Reintroduction – National Biodiversity Action Plan 2015 – Role of International Union for Conservation of Nature (IUCN)

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UNIT II: ATOMSPHERE AND HYDROSPEHERE 6

Atmosphere – Structure and composition – Earth's Albedo – Carbon cycle and oxygen cycle – Air Quality Standards – Air Pollution – Sources, effects and control measures – Indian Environmental Laws – Air Act 1981. Hydrosphere – Hydrosphere – Hydrological Cycle, Water Quality Parameters, Water Pollution – Sources, effects, and control measures - Water conservation – Rainwater harvesting, Dams, and watershed Management – Wastewater treatment, Ocean acidification, Blue economy, Water Act, 1974 and Environment Protection Act, 1986

Self - Learning & Case Studies – Clean Development Mechanism (CDM) – Greenhouse Gas Protocol – ISO 14064 – Jal Shakti Abhiyan – Implementation of CNG in NCT of Delhi – Taj Trapezium Case – Narmada River – Sardar Sarovar Project

UNIT III: LITHOSPHERE AND SOLID WASTE MANAGEMENT 6

Lithosphere – Structure of the lithosphere – Continental drift – Forest resources – Deforestation – Causes and effects – Agriculture – Effects of modern agriculture – Soil Pollution – Causes, effects and control measures. Solid Waste Management – Solid Waste – Sources, classification, and effects , Waste reduction strategies – Circular Economy and 5R Principles, Solid waste treatment, Disposal techniques, Refuse-Derived Fuel and Waste-to-Energy technologies,Biomedical, E-Waste and Hazardous waste management, Resource recovery – Environmental Standards and Waste Management Regulations (ISO 14001 and Waste Rules)

Self - Learning & Case Studies – Solid Waste Management rules, 2024 – Plastic Waste Management Rules (PWMR) – Degradation of Soil in Rajasthan – Indore's Waste Management System

UNIT IV: GLOBAL ISSUES, HUMAN WELFARE AND ROLE OF TECHNOLOGY 6

EIA- Concepts, stages – Land clearing projects – Environmental and social Impacts, Resettlement and Rehabilitation – Concepts and challenges – Disaster management – Floods, Landslides, Disaster management cycle and mitigation – Environmental Governance, Global Governance and Fundamental Human Rights – Importance. Human Population – Population growth, explosion and its challenges – Trends and variation among nations – Role of IT – Remote sensing, GIS and Google earth engine – Disease tracking and prediction using big data and AI (e.g., COVID-19 apps)

Self - Learning & Case Studies – Mission Amrit Sarovar – Beti Bachao Beti Padhao mission – Kerala Flood (2018) – Sterlite Copper Plant Case – Thoothukudi

UNIT V: SUSTAINABLE DEVELOPMENT AND GREEN PRACTICES 6

Sustainable Development – Concept, significance of sustainability – UN Sustainable Development Goals (UN SDGs) – Sustainability assessment – Carbon footprint, accounting, Carbon Neutrality – Net Zero Emissions – Carrying Capacity of the Earth – Carbon Sequestration and Carbon Capture – Blue Carbon and Green Carbon. Green Practices – Sustainable Agriculture – Green Energy – Biofuels, Green Hydrogen, Solar, wind and biomass Energy – Sustainable Transport – Electric Vehicles (EVs)

Self - Learning & Case Studies – National Solar Mission, Green India Mission – Ambikapur, Chhattisgarh – Zero Waste Model – Delhi Metro – Energy Efficiency and Sustainable Transport

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** - Periods **Total:** 30 Periods

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TEXTBOOKS:

1. E. Bharucha, "Environmental Studies for Undergraduate Courses", 2nd edition, Hyderabad, University Press (India) Pvt. Ltd, 2005
2. R. Rajagopalan, "Environmental Studies: From Crisis to Cure", 3rd edition, New Delhi, Oxford University Press, 2016
3. R. R. Hiremath, "Sustainable Development", 1st edition, New Delhi, Himalaya Publishing House, 2008

REFERENCES:

1. Anubha Kaushik and C.P. Kaushik, "Environmental Studies" 6th edition, New Age International Publishers, New Delhi, 2018
2. Benny Joseph, "Environmental Studies", 3rd edition, New Delhi, McGraw Hill Education, 2017
3. M. Anji Reddy, "Textbook of Environmental Science and Technology", 3rd edition,BS Publications, 2019
4. R. B. Singh, "Disaster Management", 1st edition, New Delhi, Rawat Publications, 2006
5. .V. Desai, "Environment and Sustainable Development" 1st edition, Mumbai, Himalaya Publishing House, 2009

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SEMESTER I

U25RMCC06	Professional Skill Development - I (Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC)	Category: MCC					
		L	T	P	J	C	
		15 Hours				1	

COURSE OUTCOMES:

CO 1: Demonstrate technical skill competency through attainment of industry-relevant certifications, participation in competitions, internships, and project-based learning activities — **Apply**

CO 2: Apply research, innovation, and problem-solving skills to develop impactful solutions through projects, publications, patents, and higher education preparation — **Apply**

CO 3: Exhibit leadership, ethical responsibility, community engagement, and professional digital presence to enhance career readiness and lifelong learning — **Apply**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	2	1	3	1	-	-	2	2	-	2	2
CO 2	3	2	2	1	2	2	-	-	1	1	-	-	-
CO 3	3	2	2	1	-	2	2	3	3	3	2	-	-

GUIDLINES:

- Certifications and Skill Credentials - Free awareness certs, NPTEL/Coursera, Associate-level, Professional-level, Expert-level
- Competitions, Hackathons, and Technical Challenges - Online, institution, state, national, international competitions and hackathons, Kaggle medals
- GATE Preparation and Performance - Study plan, mock tests, registration, appearing, score percentile
- Academic, Industry, and Innovation Projects - Mini-projects, intermediate projects, industry-grade deployed projects, funded or published projects
- Internships and Industrial Training - Virtual, on-site short, core role, CoE on-campus, PPO, PPO converted to offer
- Research Publications, Patents, Intellectual Property - Reading journals, survey papers, conference papers, Scopus/WoS, Q1/Q2 journals, patents from provisional to granted
- Leadership, Community, Digital Presence - Club membership, event roles, office bearer, president, outreach, LinkedIn, GitHub, portfolio, Google Scholar

CONTACT PERIODS:

Lecture: - Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** - Periods **Total:** 0 Periods

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SEMESTER II

		Category: HSMC				
U25REN201	Professional Communication - II (Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC)	L	T	P	J	C
		2	0	2	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- To strengthen advanced communication and interpersonal skills required for academic and professional success
- To integrate AI-enabled communication tools for content creation, presentations and professional documentation
- To prepare students for modern workplace communication in global and digital environments

COURSE OUTCOMES:

CO 1:	Apply advanced verbal, written and digital communication strategies in professional contexts	Apply
CO 2:	Analyze technical information and produce effective workplace documents	Analyze
CO 3:	Demonstrate negotiation, leadership and collaborative communication skills	Understand
CO 4:	Deliver impactful technical presentations and communicate innovative ideas effectively	Apply
CO 5:	Utilize AI-assisted communication tools ethically for professional growth and workplace productivity	Apply

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	-	-	-	-	-	-	-	2	3	-	1	1	-
CO 2	-	-	-	-	-	-	-	2	3	-	1	1	-
CO 3	-	-	-	-	-	-	-	2	3	-	1	1	-
CO 4	-	-	-	-	-	-	-	2	3	-	1	-	-
CO 5	-	-	-	-	-	-	-	2	3	-	1	-	-

SYLLABUS:

UNIT I: TECHNICAL WRITING AND DOCUMENTATION **6 + 6**

Technical Reports - Proposal Writing - Meeting Agenda and Minutes - Technical Instructions and Process Description - AI-assisted Technical Documentation - Technical Vocabulary

UNIT II: COGNITIVE PROFESSIONALISM **6 + 6**

Critical Thinking Strategies - Problem-solving Communication - Case Study - Brainstorming Techniques - Collaborative Decision Making - One-word Substitutions

UNIT III: CAREER PLANNING **6 + 6**

Self-Assessment Techniques - SWOT Analysis - Goal Setting - AI-assisted Documentation - Digital Content Writing - Collocations

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UNIT IV: CORPORATE COMMUNICATION AND NETWORKING **6 + 6**

Public Speaking - Welcome Address - Vote of Thanks - Anchoring and Event Hosting - Audience Engagement - Cloze tests - Discourse markers - linkers and cohesive devices

UNIT V: CRITICAL THINKING AND COLLABORATIVE PROBLEM SOLVING **6 + 6**

Problem-solving Techniques - Mind Mapping - Negotiation Skills - Book Review / Film Review - Podcast and Media Analysis - Critical Reading - Group Discussion

LIST OF EXPERIMENTS

1. Public Speaking
2. Group Discussion
3. Case Study
4. Blog Writing
5. Mind Mapping

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. Ashraf Rizvi, Effective Technical Communication, 3rd Edition, McGraw Hill Education, 2023
2. Meenakshi Raman & Sangeeta Sharma, Technical Communication: Principles and Practice, 4th Edition, Oxford University Press, 2023
3. Sanjay Kumar & Pushp Lata, Communication Skills, 3rd Edition, Oxford University Press, New Delhi, 2018

REFERENCES:

1. Stephen E. Lucas, The Art of Public Speaking, 14th Edition, McGraw Hill Education, New York, 2023
2. Dale Carnegie, The Quick and Easy Way to Effective Speaking, Updated Edition, Simon & Schuster, New York, 2019
3. Matt Abrahams, Think Faster, Talk Smarter: How to Speak Successfully When You're Put on the Spot, Simon & Schuster, New York, 2024

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SEMESTER II

		Category: BSC				
U25RMA203	Mathematical Transforms in Engineering (Common to CE, CH, EE, ME, MI)	L	T	P	J	C
		3	0	2	0	4

QP PATTERN: A

PRE-REQUISITES:

- U25MA101 - Calculus and Differential Equations / U25RMA101 - Multivariable Calculus and Applications

COURSE OBJECTIVES:

- To impart the knowledge on continuous transforms: Fourier analysis and Laplace transform
- For constructing more convenient for students to apply their transforms knowledge to their various fields of study
- To provide students with a good understanding the concepts of Z-transforms for analyzing discrete-time systems

COURSE OUTCOMES:

CO 1:	Understand and construct Fourier series representations of periodic functions, and apply them to solve basic signal analysis and engineering problems	Understand
CO 2:	Apply Fourier transform techniques to analyze and interpret continuous-time signals in the frequency domain	Apply
CO 3:	Compute Laplace transforms and its inverse of standard functions and use them to model and analyze engineering systems	Apply
CO 4:	Use Laplace transforms and convolution technique to solve ordinary differential equations and system of differential equations in engineering applications	Apply
CO 5:	Apply discrete-time systems using Z-transforms, and solve difference equations relevant to digital signal processing and control systems	Apply

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	2	2	1	-	2	-	-	-	1	-	-	2	2
CO 2	3	2	1	-	2	-	-	-	1	-	-	2	2
CO 3	3	2	1	-	2	-	-	-	1	-	-	2	2
CO 4	3	2	1	-	2	-	-	-	1	-	-	2	2
CO 5	2	2	1	-	2	-	-	-	1	-	-	2	2

SYLLABUS:

UNIT I: FOURIER SERIES 9 + 6

Fourier Series – π and arbitrary period – Even and odd functions – Half-range expansions – Convergence and sum of a Fourier series

UNIT II: FOURIER TRANSFORMS 9 + 6

Fourier transform – Basic properties – Fourier Cosine and Sine transforms – Convolution theorem – Discrete Fourier transform – Fast Fourier transform – DIT algorithm.

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UNIT III: LAPLACE TRANSFORMS **9 + 6**

Laplace transform – Inverse transform – Linearity, s-shifting, transforms of derivatives and integrals – Unit step function – Dirac's delta functions – Transform of periodic functions – Differentiation and integration of transforms

UNIT IV: APPLICATION OF LAPLACE TRANSFORMS **9 + 6**

Solving linear ODEs with constant coefficients – System of ODEs – Convolution theorem – Solving integral equations – Modelling- damped vibrating system and hammer blow responses of a mass spring system

UNIT V: Z–TRANSFORM **9 + 6**

Z–transform – Standard functions and properties – Formation of difference equation – Inverse Z-transform – Initial and final value theorems – Application of Z-transform to solve difference equations.

LIST OF EXPERIMENTS

1. Fourier Series – Fourier series approximations – Half-Range Expansions
2. Fourier Transforms – Fourier transform for non-periodic functions – Find the convolution for non-periodic functions
3. Laplace Transforms – Laplace Transform of special functions – Laplace transform of Periodic function
4. Application of Laplace Transform – System response using Laplace transform – Solving systems of ODEs using Laplace transform technique
5. Z-Transform Applications – Z-Transform of standard sequence – Solving difference equations using Z-transform technique

CONTACT PERIODS:

Lecture: 45 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 75 Periods

TEXTBOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics",Wiley India Pvt Ltd, New Delhi, 2018
2. Dennis G. Z, "Advanced Engineering Mathematics", Jones and Bartlett Pvt Ltd, New Delhi, 2017

REFERENCES:

1. Andrews, L.C & Shivamoggi, B., "Integral Transforms for Engineers", SPIE Press, 2016
2. Peter V. O'Neil, Advanced Engineering Mathematics, Cengage, 2016
3. Wylie C. R. & Barrett L. C., Advanced Engineering Mathematics, Tata McGraw-Hill, 2016
4. Grewal B. S., Higher Engineering Mathematics, 44th ed., Khanna Publishers, 2017

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SEMESTER II

		Category: BSC				
U25RPH03	Material Science (Common to CH, EE, ME, MI)	L	T	P	J	C
		2	0	0	2	3

QP PATTERN: A

COURSE OBJECTIVES:

- To provide fundamental knowledge of advanced engineering materials including superconducting, thermoelectric, and energy storage materials for modern technological applications
- To introduce the operating principles and applications of functional materials used in sensors, electronic devices, and smart systems
- To familiarize students with emerging engineering materials such as metallic glasses, shape memory alloys, nanomaterials, and carbon nanotubes for advanced engineering applications

COURSE OUTCOMES:

CO 1:	Make use of the properties and applications of superconducting materials and superconducting devices	**Apply**
CO 2:	Determine the thermoelectric effects, thermoelectric materials, and their applications in energy conversion technologies	**Apply**
CO 3:	Develop the solid state electrolyte and calculate the battery performance of the materials	**Apply**
CO 4:	Apply characterization techniques for microstructural analysis of materials	**Apply**
CO 5:	Apply the concepts of advanced engineering materials including metallic glasses, shape memory alloys, and nanomaterials for engineering applications	**Apply**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	1	-	1	-	-	1	1	-	-	3	2
CO 2	3	2	1	-	1	-	-	1	1	-	-	2	2
CO 3	3	2	1	-	1	-	-	1	1	-	-	2	2
CO 4	3	2	1	-	1	-	-	1	1	-	-	2	2
CO 5	3	2	1	-	1	-	-	1	1	-	-	2	2

SYLLABUS:

UNIT I: SUPERCONDUCTING MATERIALS **6 + 6**

Superconductors – Meissner effect – Persistent current – Critical temperature – Critical magnetic field - Isotope effect – Type I, Type II superconductors – BCS theory of Superconductivity – High temperature superconductors – SQUID – Magnetic levitation

UNIT II: MATERIALS FOR THERMOELECTRICITY **6 + 6**

Thermoelectric effects (Seebeck, Peltier, Thomson) – Thermoelectric figure of merit (ZT), and material properties (σ, S, κ) – Thermoelectric materials (Bi_2Te_3, PbTe, oxides) Applications – Waste heat recovery, cooling technologies – Hybrid vehicles

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UNIT III: ENERGY STORAGE MATERIALS **6 + 6**

Energy storage systems for portable electronics and electric vehicles – Li ion Batteries – Sodium ion – Potassium ion – Magnesium ion – Multivalent batteries – Solid-state batteries (ceramic & polymer electrolytes) – Supercapacitor materials (carbon-based, transition metal oxides, conducting polymers)

UNIT IV: MATERIALS FOR SENSORS AND APPLICATIONS **6 + 6**

Inductance, capacitance, and resistance in sensor operation – Piezoelectric materials – pyroelectric materials – electroactive polymers – magneto-resistive and shape memory alloys – Applications of sensors in temperature, pressure, motion, and light detection

UNIT V: NEW ENGINEERING MATERIALS **6 + 6**

Metallic glasses – Types, glass forming ability of alloys – Melt spinning process – applications – Shape memory alloys – Phases, shape memory effect – pseudoelastic effect – NiTi alloy – Applications – Nanomaterials: ball milling – chemical vapour deposition – properties and applications – Carbon nanotubes: types and applications

LIST OF PROJECTS

1. Magnetic Levitation Demo Using a Superconducting Kit
2. Simulation/Poster: Type I vs. Type II Superconductors
3. SQUID Applications in Medicine and Geophysics
4. Fabrication of a Simple Thermoelectric Generator (TEG)
5. ZT Calculation of a Thermoelectric Material
6. Waste Heat Recovery System for Industrial Exhaust
7. Comparison of Li-ion and Na-ion Battery Performance
8. Development of a Solid-State Electrolyte
9. High-Capacitance Supercapacitor Using Carbon Nanomaterials
10. Multifunctional Sensor Using Piezoelectric Material
11. Smart Glove with Embedded Sensors
12. Design of a Pyroelectric Motion Detector
13. Study of Critical Temperature of YBCO Superconductor
14. Fabrication of a Metallic Glass Ribbon via Melt Spinning (Simulation/Model)
15. NiTi Shape Memory Alloy Demonstration

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** 30 Periods **Total:** 60 Periods

TEXTBOOKS:

1. Serway, R.A. & Jewett, J.W., "Physics for Scientists and Engineers", 10th Edition, Cengage Learning, 2018
2. Budinski, K.G. & Budinski, M.K., "Engineering Materials: Properties and Selection", 10th Edition, Pearson Education, 2020

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1. Kasap, S.O., "Principles of Electronic Materials and Devices", 4th Edition, McGraw Hill Education, 2018
2. Kittel, C., "Introduction to Solid State Physics", 8th Edition, Wiley, 2004
3. Cabeza, L.F. (Ed.), "Phase Change Materials and Their Applications", Springer, 2020
4. https://archive.nptel.ac.in/courses/115/103/115103030/

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Learn Beyond

SEMESTER I & II

		Category: BSC				
U25RCY01	Engineering Chemistry (Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC)	L	T	P	J	C
		2	0	2	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- To introduce the fundamentals, properties, industrial applications of polymeric materials and advanced energy storage devices
- To impart knowledge about corrosion prevention, surface treatment methods and nanomaterials
- To provide a basic understanding of semiconductor materials, microelectronics, quantum, computational chemistry and their applications

COURSE OUTCOMES:

CO 1:	Apply the concepts of polymer materials and their properties in solving industrial and technological challenges	**Apply**
CO 2:	Interpret the performance of batteries, solar cells, and supercapacitors for their effective energy storage applications	**Apply**
CO 3:	Utilize suitable corrosion prevention methods, surface treatment techniques and nanomaterials for industrial requirements	**Apply**
CO 4:	Apply suitable semiconductor materials, microfabrication processes and display technologies for specific applications	**Apply**
CO 5:	Utilize quantum chemistry principles and AI-assisted techniques to model, visualize, and predict material properties	**Apply**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	1	-	1	-	-	1	1	-	1	1	-
CO 2	3	2	1	-	1	-	-	1	1	-	1	2	-
CO 3	3	2	1	-	1	-	-	1	1	-	1	2	2
CO 4	3	2	1	-	1	-	-	1	1	-	1	2	2
CO 5	3	2	1	-	1	-	-	1	1	-	1	2	2

SYLLABUS:

UNIT I: POLYMERIC MATERIALS **6 + 6**

Polymers – Introduction – Compounding – Compression, Injection – Smart Polymers – Temperature responsive (PNIPAM), pH responsive (PAA), Light responsive (Azobenzene), 3D Printable (PLA), flexible and wearable polymers (PDMS – E-skin, RFID) – Conductive Polymers (PEDOT) – Synthesis, working and applications – Biopolymers – Classification, PEG, Alginate Hydrogel – Synthesis and applications

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UNIT II: ENERGY CONVERSION AND STORAGE **6 + 6**

Batteries – Classification, $LiFePO_4$ – Construction, working and applications – Fuel Cells – Proton Exchange Membrane(PEM), Solid Oxide Fuel Cells (SOFC) – Green Hydrogen – Classification, production method, electrolysis – Organic photovoltaics – P3HT and PCBM – Working and applications – Solar Cells – Dye-Sensitized Solar Cells (DSSC), Supercapacitors – Electrostatic Double Layer– Working and application

UNIT III: CORROSION AND NANO SCIENCE **6 + 6**

Types of corrosion – Factors influencing corrosion – Cathodic protection, Coatings – Galvanization, Epoxy, Polyurethane, Enamel, Superhydrophobic coatings – Process and applications. Surface treatments – Carburizing, Nitriding, Cyaniding – Process and applications. Nanomaterials – Introduction, 0D (Quantum dots), 1D (nanowire, nanorods and carbon nanotubes) 2D nanomaterials (MoS2), Size effects and quantum confinement, Synthesis – Laser ablation and Chemical Vapour Deposition (CVD), Various applications of nanomaterials

UNIT IV: SEMICONDUCTOR AND DISPLAY TECHNOLOGY **6 + 6**

Semiconductors – Perfluoropentacene, GaN – Characteristics and applications, Neuromorphic Materials – Phase-Change Memory and Memristors – Working and applications – Liquid Crystal Displays, OLED, QLED – Working and applications – Wafer Manufacturing – Purification – Czochralski and Float Zone methods – Photolithography and microfabrication

UNIT V: QUANTUM AND COMPUTATIONAL CHEMISTRY **6 + 6**

Quantum Chemistry – Basics, quantum numbers, shapes of atomic orbitals, Molecular Orbital Theory – (H_2, O_2, N_2), Schrödinger equation (Derivation) – Qubits and Quantum Memory, Computational Chemistry – Molecular modeling – Basic Computational Methods – Software tools – iGemdock, Chem draw, Molview, Jmol – Introduction to AI and its role in the field of Chemistry

LIST OF EXPERIMENTS

1. Estimate the viscosity of a given polymer solution using an Ostwald viscometer and determine molecular weight of the given polymer
2. Synthesis of a polymer (Bakelite / polyaniline (PANI) and assess the physical properties of the polymer
3. Potentiometric determination and comparative study of EMF in different solutions
4. Determine maximum wavelength of absorption of a given solution to verify Beer's Law and to find unknown concentration of the given sample by Spectrophotometry / Colorimetry
5. Determination of corrosion rate of Iron and its prevention by electroplating / electroless plating
6. Synthesis of ZnO / TiO_2 / Ag nanoparticles and study of their photocatalytic degradation of Methylene Blue dye
7. Recovery of Copper from waste Printed Circuit Boards (PCBs) and quantitative determination of copper content
8. Measurement of electrical conductivity of solutions using a conductometric Sensor
9. Perform molecular docking using freely available online software to investigate the binding affinity a ligand with the protein
10. Construct the 2D structure of a given compound and generate its 3D molecular model using computational tools for visualization and structural analysis

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. Wiley India Pvt. Ltd., "Engineering Chemistry", 2nd edition, Wiley India Pvt. Ltd., New Delhi, 2013
2. S.S. Dara and S.S. Umare, "A Textbook of Engineering Chemistry", 12th edition, Chand Publishing, New Delhi, 2024

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3. R.V. Gadag and A. Nityananda Shetty, "Engineering Chemistry", 3rd edition, I.K. International Publishing House, New Delhi, 2014

REFERENCES:

1. Fred W Billmeyer, "Textbook of Polymer Science", 4th edition, John Wiley & Sons, New York, 1999
2. Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen and Jack E. Lemons, "Biomaterials Science: An Introduction to Materials in Medicine", 4th edition, Academic Press, London, 2020
3. Kirby W Beard, Linden's "Handbook of Batteries", 5th edition, McGraw Hill, New York, 2019
4. John Larminie and Andrew Dicks, "Fuel Cell Systems Explained", 3rd edition, John Wiley & Sons, Chichester, 2012
5. Fontana M. G., "Corrosion Engineering", 3rd edition, McGraw-Hill Book Company, New York, 1986
6. V. Raghavan, "Materials Science and Engineering: A First Course", 6th edition, Prentice Hall of India, New Delhi, 2015
7. M.F. Ashby and D.R.H. Jones, "Engineering Materials" 2: An Introduction to Microstructures, Processing and Design, 4th edition, Elsevier, UK, 2012
8. Ira N Levine, "Quantum Chemistry", 7th edition, Pearson, Boston, 2013

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Learn Beyond

SEMESTER II

U25RCSG04	Python Programming (Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC)	Category: ESC				
		L	T	P	J	C
		3	0	0	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- To introduce the fundamental concepts of Python programming, including syntax, data types, operators, and input/output operations
- To develop problem-solving skills through the use of control structures, functions, recursion, and modular programming techniques
- To provide proficiency in Python collections, file handling, exception handling, and program organization using modules and packages
- To familiarize students with basic object-oriented programming concepts and the use of Python libraries for data analysis applications

COURSE OUTCOMES:

CO 1: Explain Python programming fundamentals, including data types, operators, input/output operations, and debugging techniques — **Understand**

CO 2: Develop Python programs using decision-making statements, iterative constructs, functions, recursion, and variable scope concepts — **Apply**

CO 3: Implement string processing and Python collections such as lists, tuples, sets, and dictionaries to solve computational problems — **Apply**

CO 4: Develop modular Python programs using file handling, exception handling, modules, and packages — **Apply**

CO 5: Develop simple object-oriented programs and apply NumPy and Pandas libraries for basic data analysis applications — **Apply**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	2	2	-	-	-	-	-	-	-	-	-	2	1
CO 2	3	2	1	1	-	-	-	-	-	-	2	2	2
CO 3	3	2	1	1	-	-	-	-	-	-	2	2	2
CO 4	3	2	1	1	-	-	-	-	-	-	2	2	3
CO 5	3	2	1	1	-	-	-	-	-	-	2	2	3

SYLLABUS:

UNIT I: PYTHON FUNDAMENTALS — 9

Introduction to Python – Features and Applications of Python – Installing Python – Python Interpreter – Script and Interactive Modes – Identifiers and Keywords – Variables – Data Types – Type Conversion – Operators and Expressions – Input and Output Operations – Comments and Documentation – Error Types – Testing and Debugging Basics

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UNIT II: CONTROL STRUCTURES AND FUNCTIONS 9'

Conditional Statements – Nested Conditional Statements – Iterative Statements: while Loop and for Loop – Loop Control Statements – Functions – Function Definition and Invocation – Function Arguments and Return Values – Scope of Variables – Recursive Functions – Applications of Functions in Problem Solving

UNIT III: STRINGS AND PYTHON COLLECTIONS 9

Strings and String Operations – Lists and List Operations – List Comprehensions – Tuples and Tuple Operations – Sets and Set Operations – Dictionaries and Dictionary Operations – Packing and Unpacking

UNIT IV: FILE HANDLING, MODULES AND EXCEPTION HANDLING 9

Modules and Packages – Importing Modules – Built-in Functions – File Handling – Opening and Closing Files – Reading and Writing Files – File Methods – Exception Handling – try, except, else and finally Blocks – User Defined Exceptions

UNIT V: OBJECT-ORIENTED PROGRAMMING AND DATA ANALYSIS 9

Classes and Objects – Creating Classes and Objects – Constructors – Instance Variables and Methods – Introduction to NumPy – Creating Arrays – Array Operations – Indexing and Slicing – Introduction to Pandas – Series and DataFrames – Reading and Displaying Data – Simple Data Analysis Applications.

CONTACT PERIODS:

Lecture: 45 Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. Reema Thareja, "Python programming: Using problem solving approach", 1st Edition, Oxford Press, 2017
2. William McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, 2nd Edition, Shroff/O'Reilly Publication, 2017

REFERENCES:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016
2. Ashok Namdev Kamthane and Amit Ashok Kamthane, "Programming and Problem Solving with Python", 2nd Edition, McGrawHill Education, 2018
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", 1st Edition, Pearson India Education Services Pvt. Ltd., 2016

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Learn Beyond

SEMESTER II

U25RMEG03	Engineering Mechanics (Common to CE, ME, MI)	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- To expose various laws of force for equilibrium of rigid bodies
- To introduce the concepts of properties of surfaces and solids
- To impart knowledge on the fundamentals of dynamics of particles and friction

COURSE OUTCOMES:

CO 1:	Apply the principles of force systems, moments and equilibrium to analyze coplanar engineering systems	Apply
CO 2:	Analyze the equilibrium of rigid bodies by determining support reactions using free-body diagrams and equilibrium equations	Apply
CO 3:	Determine the centroid, centre of mass, centre of area and mass moments of inertia of simple and composite engineering sections	Analyze
CO 4:	Solve engineering problems involving kinematics, kinetics, work-energy, impulse and momentum of particles	Apply
CO 5:	Analyze engineering systems involving sliding friction and the planar motion of rigid bodies under translation and rotation	Analyze

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	1	1	-	-	-	-	-	-	2	2	3
CO 2	3	2	1	1	-	-	-	-	-	-	2	2	3
CO 3	3	3	2	2	-	-	-	-	-	-	2	2	3
CO 4	3	2	1	1	-	-	-	-	-	-	2	2	3
CO 5	3	3	2	2	-	-	-	-	-	-	2	2	3

SYLLABUS:

UNIT I: EQUILIBRIUM OF FORCES 9

Types of force systems – Coplanar concurrent forces – Resultant – Moment of a force and its application – Couples and resultant of a force system – Equations of equilibrium of coplanar concurrent and non – concurrent force systems – Lami's theorem – Polygon law of forces for resultant

UNIT II: EQUILIBRIUM OF RIGID BODIES 9

Free body diagram – Types of supports – Support reactions – Moment of a force about a point – Moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force – Equilibrium of rigid bodies in two dimensions

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UNIT III: PROPERTIES OF SURFACES AND SOLIDS 9

Centroids and centre of mass – Centroids of lines and areas – Rectangular, circular, triangular areas by integration – T section, I section and Hollow section by using standard formula – Theorems of Pappus – Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Mass moment of inertia for prismatic and cylindrical solids

UNIT IV: DYNAMICS OF PARTICLES 9

Displacements, velocity and acceleration – Rectilinear motion – Curvilinear motion – Newton's laws of motion – D'Alembert's principle– Work energy equation – Impulse and momentum – Impact of elastic bodies

UNIT V: FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 9

Friction force – Laws of sliding friction – Equilibrium analysis of simple systems with sliding friction – Wedge friction – Rolling resistance (Basics) – Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc and sphere

CONTACT PERIODS:

Lecture: 45 Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. R.C. Hibbeler, "Engineering Mechanics: Statics", Pearson Education, 15th Edition, 2023
2. K. L. Kumar, "Engineering Mechanics", McGraw Hill Education, New Delhi, 5th Edition, 2021

REFERENCES:

1. S. S. Bhavikatti and K. G. Rajashekarappa, "Engineering Mechanics", New Age International Publishers, New Delhi, 5th Edition, 2021
2. Irving H. Shames, "Engineering Mechanics: Statics and Dynamics", Pearson Education, Noida, 4th Edition, 2007
3. Ferdinand P. Beer, E. Russell Johnston Jr., David F. Mazurek and Phillip J. Cornwell, "Vector Mechanics for Engineers: Statics and Dynamics", McGraw Hill Education, New York, 13th Edition, 2021

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SEMESTER II

U25RMI201	3D Modeling and Assembly Laboratory	Category: PCC				
		L	T	P	J	C
		0	0	4	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- To introduce the fundamentals of sketching, drafting, and 3D modelling for mechatronic components
- To develop skills in parametric modelling using features, patterns, and configurations
- To enable simulation of assemblies and mechanisms with proper documentation, dimensioning, and BOM generation

COURSE OUTCOMES:

CO 1: Demonstrate competency with multiple drawing and modification commands — **Apply**

CO 2: Create three-dimensional solid models and Apply industry standards in the preparation of technical mechanical drawings — **Apply**

CO 3: Apply advanced modeling tools like multibody design, shell/rib features, and configuration table to create parametric models — **Apply**

CO 4: Assemble mechanical and robotic systems using appropriate mating techniques and simulate kinematic motions — **Apply**

CO 5: Create detailed 2D engineering drawings with annotations, GD & T, and develop a BOM for assemblies — **Apply**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	-	-	3	-	-	-	-	-	-	1	2
CO 2	3	2	2	-	3	2	-	-	-	-	-	2	2
CO 3	3	2	3	-	3	-	-	-	-	-	-	1	2
CO 4	3	2	3	2	3	-	-	2	-	-	-	1	2
CO 5	3	1	2	-	3	-	-	-	3	-	-	1	2

LIST OF EXPERIMENTS

1. SKETCHING AND DRAFTING: Sketch entities – lines, rectangles, circles, polygons, splines, arcs, ellipses, centerlines; Sketch tools –offset, convert, trim; Sketch relations; Reference geometry – planes, axis, mate; references; Drawing views; Annotations. Lab Exercises: A. Individual part modelling of a bearing and a valve B. Individual part modelling of various couplings (rigid, flexible etc.)
2. 2. 3D MODELING AND EVALUATIONS: Boss and cut features – extrudes, revolves, sweeps, lofts; Fillets and chamfers; Linear, circular and fill patterns; Dimensions; Feature conditions – start and end; Mass properties; Materials. Lab Exercises: C. 3D Modelling of machine building components (gears, shafts, brackets) D. 3D Modelling of robotic accessories (grippers, mounts, end-effectors)
3. 3. ADVANCED MODELLING TOOLS AND CONFIGURATIONS: Multibody Part Design – Shell and Rib Features, Draft and Mirror Features; Design Tables and Configurations, Import/Export File Handling. Lab Exercises: E. Multi–configuration modelling of actuators F. Parametric modelling of a servo bracket with varying dimensions

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4. 4. 3D ASSEMBLY AND SIMULATIONS: Inserting components; Standard mates – coincident, parallel, perpendicular, tangent, concentric, distance, angle; Reference geometry – planes, axis, mate references. Lab Exercises: G. Assembly and Simulation of four bar and slider crank mechanisms H. Assembly and Simulation of a 4-axis robotic arm
5. 5. TECHNICAL DRAWING AND DOCUMENTATION: Detailing and Drawing Generation from 3D to 2D, Assembly Drawings with BOM, GD & T (Geometric Dimensioning & Tolerancing), Title Blocks, Revision Tables and Tolerances. Lab Exercises: Create Engineering drawings for modeled parts J. BOM generation for assemblies and exploded views

CONTACT PERIODS:

Lecture: - Periods **Tutorial:** - Periods **Practical:** 60 Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. Matt Lombard, "SolidWorks 2013 Bible", Wiley Publishing Inc, Canada, 2013
2. Paul Tran, "SolidWorks 2023: A Power Guide for Beginners and Intermediate Users", CAD Artifex, 2023

REFERENCES:

1. David C. Planchard and Marie P. Planchard, "Engineering Design with SolidWorks 2022 and Video Instruction", SDC Publications, 2022
2. Sham Tickoo, "SolidWorks 2022 for Designers", CADCIM Technologies, 2022
3. https://www.solidworks.com/support/training/classroom–training–courses

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SEMESTER II

U25RCSG06	Python Programming Laboratory (Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC)	Category: ESC					
		L	T	P	J	C	
		0	0	2	0	1	

QP PATTERN: A

COURSE OBJECTIVES:

- To understand the fundamental concepts of Python programming and problem-solving using Python language constructs
- To apply control structures, functions, strings, and Python collections for developing efficient applications
- To develop modular applications using file handling, exception handling, modules, and packages.
- To implement basic object-oriented programming concepts and utilize Python libraries for data analysis applications

COURSE OUTCOMES:

CO 1:	Implement Python programs using basic language constructs, data types, operators, and input/output operations	**Apply**
CO 2:	Develop Python programs using decision-making statements, looping constructs, functions, and recursion	**Apply**
CO 3:	Implement applications using strings, lists, tuples, sets, and dictionaries for data processing and problem solving	**Apply**
CO 4:	Develop modular applications using file handling, exception handling, modules, and packages	**Apply**
CO 5:	Design applications using basic object-oriented programming concepts and Python libraries such as NumPy and Pandas	**Apply**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	1	1	-	-	-	-	-	-	-	2	2
CO 2	3	2	1	1	-	-	-	-	-	-	-	2	2
CO 3	3	2	1	1	-	-	-	-	-	-	1	2	-
CO 4	3	2	1	1	-	-	-	-	-	-	1	3	-
CO 5	3	2	1	1	-	-	-	-	-	-	1	3	-

LIST OF EXPERIMENTS

1. Development of Python programs demonstrating variables, data types, operators, and input/output operations
2. Implementation of applications using conditional statements and nested conditional constructs
3. Development of iterative applications using for loops, while loops, and loop control statements
4. Design and implementation of console-based applications for mathematical and logical problem solving
5. Development of applications using user-defined functions and recursive functions
6. Implementation of string processing applications using Python string operations and methods
7. Development of applications using lists, tuples, sets, and dictionaries
8. Implementation of applications using list comprehensions and collection-based problem solving
9. Development of modular applications using built-in and user-defined modules
10. Implementation of file handling applications for reading, writing, and appending data

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11. Development of robust applications using exception handling and user-defined exceptions
12. Design and implementation of applications using classes, objects, constructors, and instance methods
13. Development of applications demonstrating inheritance and method overriding
14. Implementation of numerical computing applications using NumPy arrays and array operations
15. Development of simple data analysis applications using Pandas Series and DataFrames

CONTACT PERIODS:

Lecture: - Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 30 Periods

REFERENCES:

1. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2nd Edition, O'Reilly Media, 2016
2. Ashok Namdev Kamthane and Amit Ashok Kamthane, Programming and Problem Solving with Python, 2nd Edition, McGraw Hill Education, 2018

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SEMESTER I & II

U25RMCC03	Design Thinking (Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC)	Category: MCC				
		L	T	P	J	C
		1	0	2	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- To Understand the basics of Design Thinking, its principles, processes, and tools used
- To empathize with stakeholders and frame problems using structured tools and techniques
- To generate ideas and present solutions effectively using design tools

COURSE OUTCOMES:

CO 1:	Explain purpose and features of design thinking process	Understand
CO 2:	Use required tools to empathize with the stockholders to identify the problem	Apply
CO 3:	Comment the identified problem elaborately and clearly	Apply
CO 4:	Develop a conceptual solution for a societal problem	Apply
CO 5:	Present the identified solution to all the stakeholders	Apply

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	2	1	-	-	-	1	1	-	1	1	2	1	-
CO 2	2	1	-	-	-	1	1	-	1	1	2	1	-
CO 3	2	1	1	-	-	1	1	3	1	1	2	1	-
CO 4	3	3	2	-	-	1	1	3	1	1	2	2	-
CO 5	3	2	-	-	-	1	1	3	3	1	2	2	-

SYLLABUS:

UNIT I: FUNDAMENTALS OF DESIGN THINKING **5 + 10**

Introduction to Design Thinking: Definition, relevance, and applications – Design The Thinking – Personal Visualization, The Wheel of Life, and Balancing Priorities – Understanding and appreciating the concept of 'Design' – The 3 Laws of Design Thinking

UNIT II: THE EMPHATHIZE AND DEFINE STAGE **5 + 10**

Understanding Stakeholders – Role of Empathy in Design Thinking – Tools: Persona, Journey Mapping, Stakeholder Mapping, CATWOE, Cartographic Perspective (L0), and Empathy Map – Case Study. Problem Framing and Reframing – Role of a Design Thinker – Tools: Five Whys, Anti-Pattern, Problem Paraphrasing, Introduction to LORD Skillset – Case Study

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UNIT III: THE DIVERGENCE AND CONVERGENCE AND COMMUNICATION STAGE **5 + 10**

Ideation through Divergent and Convergent Thinking – Tools: Brainstorming, 10gm – 100gm–1000gm. Presenting Design Outcomes – Tools: 4Cs Framework – Case Study

LIST OF EXPERIMENTS

1. Design a solution for a societal problem that can be in line with sustainable development, thrust areas, industrial problems etc. under various themes like Health & Wellness: MedTech, Biotech, and HealthTech Agriculture & Rural: Agriculture, FoodTech, and Rural Development Green Energy: Renewable/Sustainable Energy and Clean and Green Technology Advanced Tech: Blockchain and Cyber Security, Robotics and Drones, and Space Technology Smart Infrastructure: Smart Automation, Smart Education, Smart Vehicles, Transportation and Logistics Daily Utility & Leisure: Fitness and Sports, Tourism, Disaster Management, Games, and Toys Sustainability & Smart Cities: waste-to-wealth, disaster management, or digital twin models for resource management

CONTACT PERIODS:

Lecture: 15 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", 1st edition, New York, HarperCollins Publishers Ltd, New York, 2018
2. Idris Mootee, "Design Thinking for Strategic Innovation", 1st edition, John Wiley & Sons Inc, 2013

REFERENCES:

1. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009
2. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011
3. Liedtka , Andrew King, Kevin Bennett , Book – "Solving Problems with Design Thinking – Ten Stories of What Works", Columbia Business School Publishing, 2013
4. Maurício Vianna, Ysmar Vianna, Isabel K. Adler, Brenda Lucena, Beatriz Russo, "Design thinking: Business Innovation", MJV Press, 2011
5. Burgelman, Christensen, and Wheelwright, "Strategic Management of Technology and Innovation", 5th Edition, McGraw Hill Publications, 2017

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SEMESTER II

U25RMCC05	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology (Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC)	Category: MCC				
		L	T	P	J	C
		1	0	0	0	1

QP PATTERN: A

COURSE OBJECTIVES:

- To learn weaving, ceramic and construction technology of Tamils
- To understand the agriculture, irrigation and manufacturing technology of Tamils
- To realize the development of scientific Tamil and Tamil computing

COURSE OUTCOMES:

CO 1:	Understand the weaving and ceramic technology of ancient Tamil people nature	Understand
CO 2:	Understand the construction technology, building materials in Sangam period and case studies	Understand
CO 3:	Infer the metal process, coin and beads manufacturing with relevant archeological evidence	Understand
CO 4:	Realize the agriculture methods, irrigation technology and pearl diving	Understand
CO 5:	Apply the knowledge of scientific Tamil and Tamil computing	Understand

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	-	-	-	-	-	-	3	3	-	2	-	-	-
CO 2	-	-	-	-	-	-	3	3	-	2	-	-	-
CO 3	-	-	-	-	-	-	3	3	-	2	-	-	-
CO 4	-	-	-	-	-	-	3	3	-	2	-	2	-
CO 5	-	-	-	-	-	-	3	3	-	2	-	2	-

SYLLABUS:

UNIT I: WEAVING AND CERAMIC TECHNOLOGY 3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries

UNIT II: DESIGN AND CONSTRUCTION TECHNOLOGY 3

Designing and Structural construction House & Designs in household materials during Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram – Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places – Temples of Nayaka Period – Type study (Madurai Meenakshi Temple) – Thirumalai Nayakar Mahal – Chetti Nadu Houses, Indo-Saracenic architecture at Madras during British Period

UNIT III: MANUFACTURING TECHNOLOGY 3

Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel, Copper and gold – Coins as source of history – Minting of Coins – Bead-making industries – Stone beads – Glass beads – Terracotta beads – Shell beads/ bone beats – Archeological evidences – Gem stone types described in Silappathikaram

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'UNIT IV: AGRICULTURE AND IRRIGATION TECHNOLOGY 3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry – Wells designed for cattle use – Agriculture and Agro Processing – Knowledge of Sea – Fisheries – Pearl – Conche diving – Ancient Knowledge of Ocean – Knowledge Specific Society

UNIT V: SCIENTIFIC TAMIL & TAMIL COMPUTING 3

Development of Scientific Tamil – The role of journals in the development of scientific Tamil – Scientific Tamil vocabulary – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project

CONTACT PERIODS:

Lecture: 15 Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** - Periods **Total:** 15 Periods

TEXTBOOKS:

1. Tamils and Technology, K. Jayanthi Ravikrishna, Sri Krishna publications, Mahalakshmi Nagar, Velappanchavadi, First Edition 2023
2. Tamils and Technology, S. Priyadharshini, V. K. Publications

REFERENCES:

1. The Contributions of the Tamils to Indian Culture, Dr. M. Valarmathi, International Institute of Tamil Studies, C.I.T Campus, Tharamani, Chennai, First Edition 1995
2. Studies in the History of India with Special Reference to Tamil Nadu, Dr. K. K. Pillay, 1979

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SEMESTER II

U25RMCC07	Professional Skill Development - II (Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC)	Category: MCC				
		L	T	P	J	C
		15 Hours				1

COURSE OUTCOMES:

CO 1: Demonstrate technical skill competency through attainment of industry-relevant certifications, participation in competitions, internships, and project-based learning activities — **Apply**

CO 2: Apply research, innovation, and problem-solving skills to develop impactful solutions through projects, publications, patents, and higher education preparation — **Apply**

CO 3: Exhibit leadership, ethical responsibility, community engagement, and professional digital presence to enhance career readiness and lifelong learning — **Apply**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	2	-	3	1	-	-	2	2	-	2	2
CO 2	2	3	3	3	2	2	-	-	1	1	-	-	-
CO 3	-	-	3	-	-	2	2	3	3	3	2	-	-

GUIDLINES:

- Certifications and Skill Credentials - Free awareness certs, NPTEL/Coursera, Associate-level, Professional-level, Expert-level
- Competitions, Hackathons, and Technical Challenges - Online, institution, state, national, international competitions and hackathons, Kaggle medals
- GATE Preparation and Performance - Study plan, mock tests, registration, appearing, score percentile
- Academic, Industry, and Innovation Projects - Mini-projects, intermediate projects, industry-grade deployed projects, funded or published projects
- Internships and Industrial Training - Virtual, on-site short, core role, CoE on-campus, PPO, PPO converted to offer
- Research Publications, Patents, Intellectual Property - Reading journals, survey papers, conference papers, Scopus/WoS, Q1/Q2 journals, patents from provisional to granted
- Leadership, Community, Digital Presence - Club membership, event roles, office bearer, president, outreach, LinkedIn, GitHub, portfolio, Google Scholar

CONTACT PERIODS:

Lecture: - Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** - Periods **Total:** 0 Periods

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SEMESTER III

		Category: BSC				
U25MA302	Probability and Statistics (Common to BM, CE, CH, EC, EE, ME, MI)	L	T	P	J	C
		2	0	2	0	3

QP PATTERN: A

PRE-REQUISITES:

- U25MA101 - Calculus and Differential Equations / U25RMA101 - Multivariable Calculus and Applications

COURSE OBJECTIVES:

- To introduce the fundamental concepts of probability and statistics relevant to engineering
- To facilitate with students, use their understanding of statistical methods for data analysis and inference in their areas of study
- To develop probabilistic models to handle uncertainty and charts to check for quality control in engineering systems

COURSE OUTCOMES:

CO 1: Explain the fundamental concepts of probability and examine discrete probability distributions — **Understand**

CO 2: Apply suitable continuous distributions, such as uniform, exponential and normal to interpret and analyse statistical data — **Apply**

CO 3: Calculate and evaluate covariance and correlation to examine the relationship between two random variables using pairs of random variables — **Apply**

CO 4: Determine the estimation theory of parameters, testing of hypotheses for means and apply the Chi-square test for attribute independence — **Apply**

CO 5: Perform analysis of variances to compare the means of multiple samples and apply control charts to check for quality control — **Apply**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	2	1	-	-	1	-	-	-	-	-	-	1	1
CO 2	3	2	-	-	2	-	-	-	-	-	-	1	1
CO 3	3	2	-	-	2	-	-	-	-	-	-	1	1
CO 4	3	2	-	-	2	-	-	-	-	-	-	2	2
CO 5	3	2	-	-	2	-	-	-	-	-	-	2	2

SYLLABUS:

UNIT I: ONE-DIMENSIONAL DISCRETE RANDOM VARIABLES — **6 + 6**

Probability – Conditional probability, independence – Baye's theorem – Discrete random variables, probability mass functions – Cumulative distribution functions – Mean and variance – Binomial, Poisson and geometric distributions

UNIT II: ONE-DIMENSIONAL CONTINUOUS RANDOM VARIABLES — **6 + 6**

Continuous random variables – Probability density functions – Cumulative distribution functions – Mean and variance – Uniform, exponential, normal distributions

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UNIT III: TWO-DIMENSIONAL PROBABILITY DISTRIBUTIONS **6 + 6**

Two dimensional discrete and continuous random variables – Marginal probability distributions – Independence – Covariance – Correlation

UNIT IV: INFERENTIAL STATISTICS **6 + 6**

Estimation - Point estimation – Interval estimation – Hypothesis testing – Hypotheses concerning means – Large, small samples - Chi square test for independence of attributes

UNIT V: ANOVA AND STATISTICAL QUALITY CONTROL **6 + 6**

Analysis of variance – Completely randomized designs – Randomized block designs – Control charts for measurements ($\bar{X}$, R charts) – Control charts for attributes (p, np)

LIST OF EXPERIMENTS

1. One-Dimensional Discrete Random Variables – Mean and Variance of discrete RVs. – Discrete Probability distributions
2. One-Dimensional Continuous Random Variables – Mean and Variance of Continuous RVs. – Continuous Probability distributions
3. Two- Dimensional Probability Distributions – Marginal Probability distributions – Covariance and Correlation
4. Inferential Statistics – Estimation theory – Testing of hypotheses
5. ANOVA and SQC – Analysis of Variance. – Control charts ($\bar{X}$, R, p, np)

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. Douglas C. Montgomery and George C. Runger, "Applied Statistics and Probability for Engineers", Wiley, 2018
2. Richard A. Johnson, "Miller & Freund's Probability and Statistics for Engineers", Pearson Education, New Delhi, 2017

REFERENCES:

1. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, "Probability & Statistics for Engineers & Scientists, Pearson Education, New Delhi, 2016
2. Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", Cengage Learning, NewDelhi 2020
3. Sheldon M Ross, "Introduction to Probability and Statistics for Engineers and Scientists", Academic press, USA, 2020
4. Robert V. Hogg, Elliot Tanis and Dale Zimmerman, "Probability and Statistical Inference", Pearson Education, USA, 2014

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SEMESTER III

U25MEG04	Engineering Thermodynamics (Common to ME, MI)	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- To comprehend fundamental thermodynamic principles and laws relevant to modern engineering applications
- To analyze energy systems and evaluate their efficiency and sustainability
- To apply thermodynamic concepts in real-world systems including HVAC, renewable energy, and electric vehicle applications

COURSE OUTCOMES:

CO 1:	Demonstrate the fundamental thermodynamic concepts and the application of the first law in engineering systems	**Apply**
CO 2:	Apply the second law of thermodynamics to evaluate the performance of thermal systems and identify sources of irreversibility	**Apply**
CO 3:	Interpret the thermodynamic properties of pure substances and mixtures using standard tables and charts	**Apply**
CO 4:	Analyze thermodynamic relations and simulate system performance using simulation software for various thermodynamic cycles	**Analyze**
CO 5:	Infer psychrometric processes and propose efficient HVAC and modern thermal management solutions	**Analyze**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	1	1	-	1	-	-	-	-	-	2	1
CO 2	3	2	1	1	-	1	-	-	-	-	-	2	1
CO 3	3	2	1	1	-	2	-	-	-	-	1	2	2
CO 4	3	3	2	2	1	-	-	-	-	-	1	2	2
CO 5	3	3	2	2	-	2	-	-	-	-	1	2	2

SYLLABUS:

UNIT I: FUNDAMENTAL AND FIRST LAW 9

Basic concepts – System, control volume, properties, state, process, equilibrium and cycle – Zeroth law and temperature scales – First law for closed systems (energy balance) and open systems (Steady Flow Energy Equation) – Applications to engineering devices: Turbines, compressors, pumps, nozzles, boilers, and condensers – Simulation – Introduction to energy conversion – Efficiency – Sustainability perspective

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UNIT II: SECOND LAW AND ENTROPY 9

Limitations of the first law – Kelvin–Planck and Clausius statements – Reversibility and the Carnot cycle – Entropy as a property – The principle of entropy increase – Entropy generation – Introduction to Exergy (Availability) and irreversibility – Second law efficiency for thermal systems – Applications: Performance evaluation of heat engines – Refrigerators – Heat pumps

UNIT III: PROPERTIES OF PURE SUBSTANCE AND GAS MIXTURES 9

Properties of pure substances – P-V-T surfaces – Phase diagrams – Thermodynamic property tables – T-S and Mollier (h-s) diagrams for steam – Ideal Gas Model and Equations of State for real gases (e.g., Van der Waals) – Thermodynamic properties of gas mixtures: Dalton's and Amagat's Laws – Introduction to modern and eco-friendly working fluids (low-GWP refrigerants)

UNIT IV: THERMODYNAMICS RELATIONS AND APPLICATIONS 9

Fundamental thermodynamic relations: Maxwell relations – T-ds equations – Clapeyron equation – Application to property estimation and specific heats – Performance analysis of gas power cycles and vapor power cycles – Simulation

UNIT V: PHYCHROMETRY AND MODERN APPLICATIONS 9

Psychrometric properties – Psychrometric chart – Analysis of psychrometric processes using simulation – Sensible heating and cooling – Humidification and dehumidification – Adiabatic saturation – Evaporative cooling – Air conditioning load calculations – Applications in modern thermal management systems: Electric Vehicle cabin cooling/heating – Data center cooling – Sustainable HVAC design

CONTACT PERIODS:

Lecture: 45 Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. P. K. Nag, "Engineering Thermodynamics", 7th Edition, McGraw Hill Education, 2025
2. Yunus A. Çengel, Michael A. Boles, "Thermodynamics: An Engineering Approach", 10th Edition, McGraw Hill, 2023
3. R. K. Rajput, "Engineering Thermodynamics", 6th Edition, Laxmi Publications, 2023

REFERENCES:

1. Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner, Margaret B. Bailey, "Fundamentals of Engineering Thermodynamics", 9th Edition, Wiley India, 2020
2. Adrian Bejan, J. A. Jones, "Advanced Engineering Thermodynamics", 4th Edition, Wiley, 2016
3. P. Chattopadhyay, "Engineering Thermodynamics", 2nd Edition, Oxford University Press, 2016

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SEMESTER III

		Category: PCC				
U25MEG05	Fluid Mechanics and Machinery (Common to ME, MI)	L	T	P	J	C
		3	0	0	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- To learn the fluid properties and their flow dynamics
- To solve the fluid flow problems and analyze the performance of the hydraulic machines
- To impart knowledge of dimensional analysis in fluid flow

COURSE OUTCOMES:

CO 1:	Determine the properties of fluids and solve fluid dynamics problems	Apply
CO 2:	Apply concepts of boundary layer, flow through pipes, and loss estimation methods to compute and analyze performance of pipe flow systems in engineering applications	Apply
CO 3:	Use the principles of dimensional analysis and similitude to develop dimensionless parameters and predict prototype performance from model studies in fluid systems	Apply
CO 4:	Investigate the performance of pumps using velocity triangles, efficiencies and characteristic	Analyze
CO 5:	Evaluate the performance characteristics of turbines using velocity triangles, efficiencies and specific speed	Analyze

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	1	1	-	-	-	-	-	-	-	2	1
CO 2	3	2	1	1	1	-	-	-	-	-	-	2	1
CO 3	3	2	1	1	-	-	-	-	-	-	-	2	1
CO 4	3	3	2	2	1	-	-	-	-	-	-	2	1
CO 5	3	3	2	2	1	-	-	-	-	-	-	2	1

SYLLABUS:

UNIT I: FLUID PROPERTIES, STATICS AND DYNAMICS 9 + 6

Importance and applications of fluid mechanics – Units and Dimensions – Properties of fluids – Mass density – Specific weight – Specific volume – Specific gravity – Viscosity – Compressibility – Surface tension – Capillarity – Pressure and its measurement (description only) – Introduction to fluid kinematics and dynamics: types of fluid flow – Continuity equation – Euler's equation of motion – Bernoulli's equation and its applications – Momentum equation – Moment of momentum equation

UNIT II: BOUNDARY LAYER AND FLOW THROUGH PIPES 9 + 6

Boundary layer concepts – Types of boundary layer thickness – Hagen – Poiseuille equation – Losses in pipes – Loss due to friction and Darcy Weisbach equation – Moody diagram – Minor losses – Hydraulic gradient and total energy line – flow through pipes in parallel and series – Simulation of flow over a flat plate to visualize boundary layer growth using simulation software

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UNIT III: DIMENSIONAL ANALYSIS **9 + 6**

Introduction to dimensional analysis – Dimensional homogeneity – Methods of dimensional analysis – Similitude and its types – Dimensionless numbers – Model analysis and model laws – Undistorted and distorted models

UNIT IV: HYDRAULIC PUMPS **9 + 6**

Definition and classifications – Efficiencies – Centrifugal pumps – Working principle – Velocity triangles – Work done by impeller – Specific speed – Performance curves Reciprocating pumps – Working principle – Indicator diagram – Pressure vessel – Simple problems – Performance curve generation using simulation software

UNIT V: HYDRAULIC TURBINES **9 + 6**

Classification of turbines – Pelton Francis and Kaplan turbine: Working principles – Heads and efficiencies – Velocity triangles – Work done by the runner – Draft tube – Specific speed – Unit quantities – Performance curves – Simple problems – Performance curve generation using simulation software

CONTACT PERIODS:

Lecture: 45 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 75 Periods

TEXTBOOKS:

1. R. K. Bansal, "Fluid Mechanics and Hydraulic Machines", 11th Edition, Laxmi Publications, 2024
2. P. N. Modi, S. M. Seth, "Hydraulics & Fluid Mechanics including Hydraulic Machines", 23rd Edition, Standard Book House, 2022

REFERENCES:

1. A. K. Jain, "Fluid Mechanics Including Hydraulic Machine", 13th Edition, Khanna Publishers, 2021
2. Frank M. White, "Fluid Mechanics", 9th Edition, Tata McGraw Hill, 2020
3. R. K. Rajput, "A Text Book of Fluid Mechanics and Hydraulic Machines", 6th Edition, S Chand & Co Ltd, 2020

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SEMESTER III

		Category: PCC				
U25MI301	Sensors and Signal Processing	L	T	P	J	C
		2	0	2	0	3

QP PATTERN: A

PRE-REQUISITES:

- U25RPH01 - Engineering Physics

COURSE OBJECTIVES:

- To understand the concept of measurements and sensors
- To learn the different sensors used to measure various physical parameters
- To learn the fundamentals of signal processing circuits used in mechatronics system development

COURSE OUTCOMES:

CO 1:	Infer the basic concepts of measurement systems and sensors	**Understand**
CO 2:	Demonstrates the sensor's basic working principles based on the change in R, L, and C and smart sensors	**Apply**
CO 3:	Apply the working principle and applications of proximity, optical, magnetic, and heading sensors	**Apply**
CO 4:	Build the basic concepts of the signals and operational amplifier for filter applications	**Apply**
CO 5:	Choose a suitable signal conditioning system to enhance the quality of the signal	**Apply**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	2	2	-	-	-	-	-	-	-	2	1
CO 2	3	1	2	2	2	-	-	-	-	-	-	2	2
CO 3	3	1	2	2	2	-	-	-	-	-	-	2	2
CO 4	3	1	2	2	-	-	-	-	-	-	-	2	2
CO 5	3	1	2	2	-	-	-	-	-	-	-	3	2

SYLLABUS:

UNIT I: INTRODUCTION TO MEASUREMENT AND SENSORS **6 + 6**

Basics of Measurement – Classification of errors– Static and dynamic characteristics of transducers – Classification of sensors – Sensor Output Signal Types – Sensor calibration techniques

UNIT II: TRANSDUCTION PRINCIPLE- RESISTIVE, INDUCTIVE, CAPACITIVE **6 + 6**

Resistive transducers: Potentiometer, RTD, Thermistor – Thermocouple – Strain gauge, Inductive transducer: LVDT, Capacitive transducers – Introduction to Smart Sensors

UNIT III: PROXIMITY, OPTICAL, MAGNETIC AND HEADING SENSORS **6 + 6**

Accelerometer – GPS, Ultrasonic Ranging, Bio sensors, Opto-electronic sensors, Fiber optic sensor– Magnetic Sensors – Hall Effect – Current sensor Heading Sensors – Compass, gyroscope

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UNIT IV: FUNDAMENTALS OF SIGNALS AND OPERATIONAL AMPLIFIERS **6 + 6**

Standard signals – Operations on signal – Classification of signals – Periodic and aperiodic signal, odd and even signal, energy and power signal, causal and non–causal signal – Ideal op–amp– DC characteristics – Bias, offset, thermal drift – AC characteristics – Frequency response, slew rate – Case Study on Low pass and high pass filter

UNIT V: SIGNAL CONVERTERS AND PROCESSING **6 + 6**

Design of S/H circuit, D/A converter (weighted resistor and R– 2R ladder types), A/D converters (Successive approximation types), DC bridges: Classification of resistances – Wheatstone bridge. AC bridges: Maxwell's inductance bridge, Basics of Virtual Instrumentation and Data Logging.

LIST OF EXPERIMENTS

1. Determination of load, torque, and force using a strain gauge
2. Determination of the characteristics of various temperature sensors (Thermocouple, RTD & Thermistors)
3. Study the characteristics of the Hall Effect sensor and its applications
4. Measurement of water level using capacitive level sensor
5. Measurement of speed, position, and direction using encoders
6. Measurement of linear and angular displacement using potentiometer
7. Measurement of torque using torque sensor

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. Sawhney. A.K, "A Course in Electrical and Electronics Measurements and Instrumentation", 18th edition, Dhanpat Rai & Company Private Limited, New Delhi, 2015
2. Patranabis D, "Sensors and Transducers", 2nd edition, PHI, New Delhi, 2011

REFERENCES:

1. Patranabis D, "Principles of Industrial Instrumentation", Tata McGraw-Hill, Third edition, 2010
2. John G. Webster, HalitEren, "Measurement, Instrumentation, and Sensors Handbook", (2014), Second Edition, CRC Press.
3. Ramon Pallas.Amey and John G.Webster, "Sensors and Signal Conditioning", 2nd edition, John Wiley & Sons, 2012

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SEMESTER III

U25MI302	Electronic Devices and Digital Circuits	Category: PCC				
		L	T	P	J	C
		2	0	2	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- To infer the operation and characteristics of semiconductor devices
- To understand the basics of digital logic circuits
- To design the combinational and sequential logic circuits circuits

COURSE OUTCOMES:

CO 1:	Outline the operation and characteristics of semiconductor devices	Apply
CO 2:	Demonstrate the operation, input and output characteristics of BJT, JFET and MOSFET	Apply
CO 3:	Compute the Boolean functions using K-Map method	Apply
CO 4:	Design of the combinational logic circuits	Apply
CO 5:	Construct the synchronous sequential circuits and VHDL programming	Apply

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	-	-	2	-	-	-	-	-	1	2	1
CO 2	3	3	1	-	2	-	-	-	1	-	1	2	1
CO 3	3	3	1	-	1	-	-	-	1	-	1	2	1
CO 4	3	3	2	-	2	-	-	-	2	-	1	2	2
CO 5	3	3	1	-	1	-	-	-	2	-	1	2	2

SYLLABUS:

UNIT I: SEMICONDUCTOR DEVICES 6 + 6

Construction and operation of LED, LASER, LDR and Photo diode – V-I Characteristics – SiC and GaN – Rectifiers: types and analysis – Applications

UNIT II: TRANSISTOR AND APPLICATIONS 6 + 6

Transistor: Types, construction, operation and characteristics of BJT, JFET, and MOSFET – Transistor Configuration: CB, CE and CC – Applications

UNIT III: DIGITAL ELECTRONICS FUNDAMENTALS 6 + 6

Boolean postulates and laws – Minimization of Boolean expressions – Canonical forms – Karnaugh map, Tabulation Method – Don't care conditions

UNIT IV: COMBINATIONAL LOGIC CIRCUITS 6 + 6

Adder – Subtractor – Multiplexer / Demultiplexer – Encoder / Decoder – Applications

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UNIT V: SEQUENTIAL LOGIC CIRCUITS 6 + 6

Latches: SR – SR, JK, D and T Flip flops – Analysis and design of clocked sequential circuits – Design of synchronous and asynchronous counters – Introduction to VHDL programming – Applications

LIST OF EXPERIMENTS

1. Determine the volt–ampere characteristics of the LED and photodiode
2. Determine the DC output voltage of the halfwave and full wave rectifiers
3. Obtain the input and output characteristics of the common emitter transistor configuration
4. Design of the multiplexer and demultiplexer circuits using basic gates
5. Design and simulation of encoder and decoder circuits
6. Design of SR and JK flip–flops using NAND gates and verify its truth table
7. Simulation of synchronous and asynchronous counters

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. Salivahanan S, Sureshkumar N, Vallavaraj A, "Electronic Devices and Circuits", 3rd edition, Tata McGraw–Hill India, 2010.
2. Morris Mano M, Michael D Ciletti, "Digital Design", 6th edition, Pearson, 2018

REFERENCES:

1. Jacob Millman, Christos C Halkias, Satyabrata Jit, "Electronic Devices and Circuits", 4th edition, McGraw-Hill India, 2015
2. Yang, "Fundamentals of Semiconductor Devices", 1st Edition, McGraw-Hill International, 2017
3. Thomas L.Floyd, "Digital Fundamentals", 11th edition, Prentice Hall, 2015
4. Anand Kumar A, "Fundamentals of Digital Circuits", 2nd edition, PHI Learning, 2013

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SEMESTER III

U25EEG04	Electrical Drives and Control (Common to ME, MI)	Category: ESC				
		L	T	P	J	C
		2	0	2	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- To learn the basic concepts of power semiconductor devices and electric drives
- To acquire the knowledge in the characteristics and operation of DC, AC drives and servo motors
- To understand the control techniques and applications of DC and AC drives

COURSE OUTCOMES:

CO 1:	Infer the construction and operation of power semiconductor devices	Apply
CO 2:	Apply the characteristics of various types of electric drives to determine the steady state stability	Apply
CO 3:	Demonstrate the operation and control techniques of DC motor drives	Apply
CO 4:	Demonstrate the operation and control strategies of AC motor drives and servo motors	Apply
CO 5:	Select the motor drives for industrial applications	Apply

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	2	2	-	-	-	-	1	1	1	-	1	2	1
CO 2	3	2	1	-	-	-	1	1	1	-	1	2	1
CO 3	3	2	1	1	3	-	1	1	1	-	2	2	1
CO 4	3	2	1	1	3	-	1	1	1	-	2	2	2
CO 5	3	2	1	1	1	-	1	1	1	-	2	2	2

SYLLABUS:

UNIT I: POWER SEMICONDUCTOR DEVICES **6 + 6**

Basic components of electric drive system – Load characteristics – Types of electric motor drives – Power electronic switches (SCR, MOSFET, IGBT) – Selection of drives

UNIT II: DRIVE CHARACTERISTICS **6 + 6**

Electric drive – Equations governing motor load dynamics – Steady state stability – Multi quadrant Dynamics – Selection of power rating – Speed torque characteristics – Various types of loads

UNIT III: DC DRIVES **6 + 6**

Converter: Types – 2 pulse and 6 pulse converter – Speed control of DC motors using controlled rectifiers – DC choppers: Control strategies – Four quadrant operation – BLDC motors – Principle of operation – Drive schemes

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UNIT IV: AC DRIVES **6 + 6**

Inverter: types – VSI and CSI operation – Induction motor drives – Torque equation – Speed control of 3-phase induction motor – Stator voltage and frequency control – Rotor resistance control: Slip power recovery scheme – Inverter fed induction motor drive – Servo Mechanism

UNIT V: APPLICATIONS OF DRIVES **6 + 6**

Selection of motor – Digital techniques in speed control – Microcontroller based control of electric drives – Drive applications in robotic process automation

LIST OF EXPERIMENTS

1. VI characteristics of power semiconductor devices (SCR, MOSFET and IGBT)
2. Load on DC shunt motor
3. Load test on three phase induction motor
4. Single phase half controlled and fully controlled converter
5. Speed control of DC motor drive
6. Speed control of induction motor drive
7. Speed control of BLDC motor drive
8. Simulation of speed control of DC and AC drive

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. Bimbhra B.S., "Power Electronics", 5th edition, Khanna Publishers, New Delhi, 2018
2. Vedam Subrahmanyam," Electric Drives: Concepts and Applications", 2nd edition, McGraw Hill, New Delhi, 2017

REFERENCES:

1. Singh M.D. and Kanchandhani K.B., "Power Electronics", 2nd edition, McGraw Hill, New Delhi, 2017
2. Theraja B.L. and Theraja A.K., "A Text Book of Electrical Technology", Revised edition, S. Chand and Co. Ltd., New Delhi, 2015
3. Gobal K. Dubey, "Fundamentals of Electrical Drives", 2nd edition, Narosa Publishing House, New Delhi, 2022

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SEMESTER III

		Category: PCC				
U25ADG02	Data Structures and Algorithms (Common to AD, BM, EC, EE, MI)	L	T	P	J	C
		3	0	2	0	4

QP PATTERN: A

COURSE OBJECTIVES:

- To understand the fundamental concepts of ADT and data structure types
- To learn linear and non linear data structures
- To explore tree and graph data structures

COURSE OUTCOMES:

CO 1:	Implement linear data structures such as lists, stacks and queues using array-based and linked-list-based techniques	Apply
CO 2:	Apply searching and sorting techniques to solve real-time data organization problems	Apply
CO 3:	Apply tree-based data structures including binary trees, binary search trees and AVL trees to perform efficient data representation, traversal and manipulation	Apply
CO 4:	Apply graph representations and graph algorithms to solve problems involving traversal, shortest paths, topological ordering and minimum spanning trees	Apply
CO 5:	Explain the analysis of algorithms, time and space complexity	Understand

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	1	1	1	-	-	-	-	-	-	2	1
CO 2	3	2	1	1	1	-	-	-	-	-	-	2	1
CO 3	3	2	1	1	1	-	-	-	-	-	-	2	2
CO 4	3	2	1	1	1	-	-	-	-	-	-	2	2
CO 5	2	1	-	-	-	-	-	-	-	-	-	3	2

SYLLABUS:

UNIT I: LINEAR DATA STRUCTURES – LIST, STACKS, QUEUES **9 + 6**

Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list-based implementation – Singly linked lists – Circularly linked lists – Doubly-linked lists – Applications of linked list: Polynomial ADT, Radix sort, Multilist. Stack ADT – Operations – Applications – Symbol balancing - Evaluating arithmetic expressions – Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – DeQueue – Applications of queues

UNIT II: SEARCHING, SORTING AND HASHING TECHNIQUES **9 + 6**

Searching: Linear Search—Binary Search. Sorting: Bubble sort-Insertion sort-Selection sort- Merge sort - Quick sort. Hashing – Hash Functions – Separate Chaining – Open Addressing –Rehashing – Extendible Hashing

UNIT III: NON-LINEAR DATA STRUCTURES – TREES **9 + 6**

Tree ADT – Tree traversals – Binary Tree ADT – Expression trees – Binary search tree ADT –AVL Trees

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UNIT IV: NON-LINEAR DATA STRUCTURES - GRAPHS **9 + 6**

Introduction to Graph – Types of graph-Representation of graphs – Graph traversal: Breadth-first traversal – Depth-first traversal – Topological ordering –Dijkstra's algorithm- Minimum spanning tree algorithms – Prims algorithm - Kruskal's Algorithm

UNIT V: ALGORITHM ANALYSIS **9 + 6**

Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithm Efficiency – Asymptotic Notations and its properties – Mathematical analysis for Recursive and Non recursive algorithms.

LIST OF EXPERIMENTS

1. A small library stores the list of newly arrived books in an array-based structure. The librarian wants to maintain the order of arrival. Given the arrival sequence: "AI Basics", "Data Science", "Python 101", "Algorithms", "Machine Learning", Insert them into an array-based List ADT. A book "Cyber Security" arrives and must be inserted at position 3. Later, "Python 101" is removed as it's damaged. Design the array-based List ADT operations to update the list and display the final order.
2. A hospital needs to maintain a waiting list of patients dynamically as patients arrive and get treated. Insert patients: John, Priya, Abdul, Meera in order. A senior citizen "Ravi" should be added after Priya. "Abdul" leaves before consultation. Using Linked List ADT, show how the list changes after each operation.
3. An airport check-in counter processes passengers using a circular queue system. Passengers arriving in order: P1, P2, P3, P4, P5. The queue size is 4 due to staff shortage. • Enqueue all passengers in order and show how overflow occurs. Two passengers are processed (dequeued). P6 and P7 arrive. Simulate these operations using array-based circular queue and show rear/front updates.
4. A bank uses a linked-list–based queue for serving customers. Customers: A, B, C arrive. Then D arrives. B and C are served. Implement the queue operations and show the dynamic linked list changes.
5. A sports event records running times of participants. The unsorted times are 15.2, 12.8, 20.5, 11.6, 19.3. The coach wants to sort the times to shortlist top performers. Apply Bubble Sort and Insertion Sort separately to sort the timings. Show the status of the list after each pass for both algorithms.
6. An online store wants to quickly sort product prices for discount analysis. Prices are 499, 199, 999, 350, 150, 750. Use Quick Sort (first element as pivot) and show partition steps. Use Merge Sort and show the splitting and merging stages.
7. A college stores roll numbers of students in a system. For a particular exam, the roll numbers are sorted [101, 115, 130, 145, 152, 170, 185]. • Apply Binary Search and show mid calculations for each iteration. Compare it with how Linear Search would behave for the same case. A teacher wants to find whether roll number 152 is present.
8. A company stores employee IDs in a hash table of size 10. Employee IDs: [1001, 1123, 1198, 1455, 1677]. Apply open addressing and closed addressing hashing techniques and show the optimal one.
9. A university stores student scores in a BST for quick rank retrieval. Scores: [75, 60, 90, 45, 65, 85, 95]. Construct the BST. Apply inorder, preorder, and postorder traversal. Later, student scores 45, 65 and 75need removal due to correction. Show the tree after each deletion and state the rule used.
10. A delivery company wants to find the fastest delivery route between warehouses in a city. Given a weighted graph (distances between warehouses): A → B : 4 A → C : 2 B → D : 5 C → B : 1 C → D : 8 D → E : 6 Apply Dijkstra's algorithm starting from A and determine: Shortest path from A to all other warehouses. Distance table update for each step.
11. A telecom company wants to lay cables between cities at minimum cost. The network between cities is modeled as a weighted graph. Apply Prim's algorithm to find the Minimum Spanning Tree and list the edges selected at each step, growing MST, total cost.
12. A power grid network wants to connect electricity stations with minimal wiring cost. The weighted edges between stations are provided. Apply Kruskal's algorithm by sorting edges by weight.

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CONTACT PERIODS:

Lecture: 45 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 75 Periods

TEXTBOOKS:

1. Reema Thareja, "Data Structures and Algorithms", 1st edition, Oxford University Press, 2025
2. Ellis Horowitz, Sartaj Sahni,Susan Anderson Freed, "Fundamentals of Data Structures in C", 2nd Edition, Techno Series, 2024

REFERENCES:

1. R. Venkatesan, S. Lovelyn Rose, "Data Structures", 2nd Edition, Wiley, 2019
2. Seymour Lipschutz, "Data Structures", 2nd Edition, McGraw Hill Education, 2017
3. Alfred V. Aho, John E. Hopcroft and Jeffrey D.Ullman, "The Design and Analysis of Computer Algorithms", 1 st Edition, Pearson Education Asia, 2013

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SEMESTER III

		Category: PCC				
U25MI303	Manufacturing Processes Laboratory	L	T	P	J	C
		0	0	4	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- To provide hands-on exposure to casting, forming, machining, sheet metal, welding, finishing and advanced manufacturing processes
- To train students in selecting machines, tools, cutting parameters and process variables for common manufacturing operations
- To enable students to prepare process plans, operation sheets, CNC simulation outputs and time-cost estimates for simple components

COURSE OUTCOMES:

CO 1:	Prepare sand moulds, demonstrate basic casting practice and identify simple casting defects	Apply
CO 2:	Perform turning, drilling and milling operations by selecting suitable tools and cutting parameter	Apply
CO 3:	Perform sheet metal and welding operations and inspect common process defects	Apply
CO 4:	Select grinding wheels and demonstrate grinding or surface finishing processes for common applications	Apply
CO 5:	Prepare a complete process plan with CNC simulation, operation sheet, time estimate and cost estimate for a selected component	Apply

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	2	1	1	1	1	-	-	1	1	1	1	1	1
CO 2	3	2	1	2	1	-	-	1	2	1	1	2	1
CO 3	3	2	2	1	1	-	-	1	1	1	1	2	2
CO 4	2	1	1	1	2	-	-	1	1	1	1	2	1
CO 5	3	2	2	2	3	-	-	1	2	1	2	3	2

LIST OF EXPERIMENTS

1. Study of foundry tools, pattern allowances and preparation of a simple green sand mould
2. Preparation of a simple casting route and identification of common casting defects using sample components
3. Demonstration of rolling/drawing process for simple sections and observation of plastic deformation
4. Lathe operations: facing, plain turning and step turning with selection of speed, feed and depth of cut
5. Drilling operation: hole making, countersinking/counterboring and preparation of operation sheet
6. Milling operation: plain or slot milling with selection of cutter, work holding and machining parameters
7. CNC part programming and simulation for a simple turned or milled component using basic G/M codes
8. Sheet metal operation: shearing and bending of a simple bracket/cover with bend allowance calculation.
9. Welding practice: arc welding/GMAW/GTAW on simple joints and inspection of common weld defects
10. Resistance spot welding demonstration and evaluation of joint quality for thin sheet components

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11. Grinding operation: surface/cylindrical grinding with grinding wheel selection for a given application
12. Demonstration/study of MAF and non-traditional processes: USM, AWJM, ECM and EDM using samples or simulation

CONTACT PERIODS:

Lecture: - Periods **Tutorial:** - Periods **Practical:** 60 Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. Groover, M. P., "Fundamentals of Modern Manufacturing", John Wiley and Sons Inc., 6th edition, 2015
2. Kalpakjian, S., "Manufacturing Engineering and Technology", Pearson Education India Edition, 6th edition, 2018

REFERENCES:

1. Rao, P. N., "Manufacturing Technology, Vol. 1 & 2", Tata McGraw Hill, 2013
2. Fitzpatrick, M., "Machining and CNC Technology", McGraw-Hill Education, 4th edition, 2013
3. Mishra, P. K., "Nonconventional Machining", Narosa Publishing House, New Delhi, 2018
4. Jain, V. K., "Advanced Machining Processes", Allied Publishers, New Delhi, 12th edition, 2010

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SEMESTER III

		Category: MNC				
U25MNC02	Essence of Indian Traditional Knowledge (Common to all programmes)	L	T	P	J	C
		1	0	0	0	0

QP PATTERN: A

COURSE OBJECTIVES:

- Understand the Concept of culture in ancient, medieval and modern period.
- Know the need and importance of Indian languages and Literature.
- Understand the various religion and philosophy in various periods.

COURSE OUTCOMES:

CO 1:	Understand Philosophy of Indian culture	Understand
CO 2:	Distinguish the Indian languages and literature.	Understand
CO 3:	Learn the philosophy of ancient, medieval and modern Indian	Remember
CO 4:	Acquire the information about the fine arts in India	Apply
CO 5:	Know the contribution of scientists different eras	Understand

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	-	2	-	1	-	-	3	-	-	-	-	1	-
CO 2	-	2	-	1	-	-	3	-	-	-	-	1	-
CO 3	-	2	-	1	-	-	3	-	-	-	-	-	-
CO 4	-	2	-	-	-	-	-	-	-	-	-	-	-
CO 5	-	2	-	1	-	-	3	-	-	-	-	-	-

SYLLABUS:

UNIT I: INTRODUCTION TO CULTURE 5

Culture, Civilization, Culture and heritage, General characteristics of culture, Importance of culture inhuman literature, Indian culture, Ancient India, Medieval India, Modern India

UNIT II: INDIAN LANGUAGES AND LITERATURE 5

Indian Languages and Literature-I: The role of Sanskrit, Significance of scriptures to current society, Indian philosophies, other Sanskrit literature, Literature of south India Indian Languages and Literature-II: Northern Indian Languages & literature, Temples and Temple types, Sculptors 's specialties, Temples Individualities Festivals and hopes

UNIT III: RELIGION AND PHILOSOPHY 5

Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (Selected Movements only)

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UNIT IV: ARTS, SCIENCE, TECHNOLOGY& ENGINEERING IN INDIA 5

Indian painting, Handicrafts, Music, Divisions of Indian classical music, Modern Indian music, Dance and drama, Indian architecture (ancient, medieval and modern), Science and technology in India, Development of science in different periods, Sushruta and Charaka, sages of South India, herbal treatments, Surgery methods of healers, Yoga and pranayama practices, Herbal usages and medication-making methods.

UNIT V: EDUCATION SYSTEM IN INDIA 5

Education in ancient, Medieval and modern India, Aims of education, subjects, languages, science and scientists of Ancient India, Medieval India and Modern India

CONTACT PERIODS:

Lecture: 25 Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** - Periods **Total:** 25 Periods

TEXTBOOKS:

1. Kapil Kapoor, "Text and Interpretation: The India Tradition", ISBN: 81246033375, 2005.
2. "Science in Samskrit", Samskrita Bharti Publisher, ISBN: 978-8187276333, 2007.

REFERENCES:

1. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher, 1989.
2. M. Hiriyanna, "Essentials of Indian Philosophy", Motilal Banarsidass Publishers, ISBN: 9788120810990, 2014.
3. S. Narain, "Examinations in Ancient India", Arya Book Depot, 1993.
4. NCERT, "Position Paper on Arts, Music, Dance and Theatre", 2000.
5. B. Kumar Mohanta & Vipin Kumar Singh, "Traditional Knowledge System and Technology in India", 2012.

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SEMESTER III

U25RMCC08	Professional Skill Development - III (Common to all programmes)	Category: MCC				
		L	T	P	J	C
		15 Hours				1

COURSE OUTCOMES:

CO 1: Demonstrate technical skill competency through attainment of industry-relevant certifications, participation in competitions, internships, and project-based learning activities — **Apply**

CO 2: Apply research, innovation, and problem-solving skills to develop impactful solutions through projects, publications, patents, and higher education preparation — **Apply**

CO 3: Exhibit leadership, ethical responsibility, community engagement, and professional digital presence to enhance career readiness and lifelong learning — **Apply**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	2	-	3	1	-	-	2	2	-	2	-
CO 2	2	3	3	2	2	2	-	-	1	1	-	2	-
CO 3	-	-	3	-	-	2	2	3	3	3	2	2	-

GUIDLINES:

- Certifications and Skill Credentials - Free awareness certs, NPTEL/Coursera, Associate-level, Professional-level, Expert-level
- Competitions, Hackathons, and Technical Challenges - Online, institution, state, national, international competitions and hackathons, Kaggle medals
- GATE Preparation and Performance - Study plan, mock tests, registration, appearing, score percentile
- Academic, Industry, and Innovation Projects - Mini-projects, intermediate projects, industry-grade deployed projects, funded or published projects
- Internships and Industrial Training - Virtual, on-site short, core role, CoE on-campus, PPO, PPO converted to offer
- Research Publications, Patents, Intellectual Property - Reading journals, survey papers, conference papers, Scopus/WoS, Q1/Q2 journals, patents from provisional to granted
- Leadership, Community, Digital Presence - Club membership, event roles, office bearer, president, outreach, LinkedIn, GitHub, portfolio, Google Scholar

CONTACT PERIODS:

Lecture: - Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** - Periods **Total:** 0 Periods

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SEMESTER IV

		Category: BSC				
U25MA403	Numerical Methods and Partial Differential Equations (Common to CE, EE, ME, MI)	L	T	P	J	C
		3	0	0	0	3

QP PATTERN: A

PRE-REQUISITES:

- U25MA101 - Calculus and Differential Equations / U25RMA101 - Multivariable Calculus and Applications

COURSE OBJECTIVES:

- To provide knowledge of numerical methods for solving nonlinear equations, systems of linear equations, interpolation, differentiation, and integration problems
- To develop the ability to formulate and solve partial differential equations using standard analytical techniques
- To impart an understanding of Fourier series and boundary value problems arising in heat flow and wave propagation

COURSE OUTCOMES:

CO 1:	Apply numerical methods to solve systems of linear equations and compare the efficiency of various solution techniques	**Apply**
CO 2:	Apply interpolation techniques to estimate unknown values and analyze the accuracy of the approximations	**Apply**
CO 3:	Implement numerical differentiation and integration methods to obtain approximate solutions and evaluate their accuracy	**Apply**
CO 4:	Apply standard methods to solve partial differential equations and interpret the resulting solutions under given conditions	**Apply**
CO 5:	Apply Fourier series and partial differential equation techniques to solve heat and wave equations under different boundary conditions	**Apply**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	-	-	-	-	-	-	-	-	-	1	1
CO 2	3	2	-	-	-	-	-	-	-	-	-	1	2
CO 3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO 4	3	2	-	-	-	-	-	-	-	-	-	2	2
CO 5	3	2	-	-	-	-	-	-	-	-	-	2	2

SYLLABUS:

UNIT I: SYSTEM OF EQUATIONS 9

Solution of nonlinear equations – Newton Raphson method, Regular false – Solution of system of linear equations – Gauss elimination method, Iterative solution of linear systems by Gauss-Seidel method

UNIT II: INTERPOLATION 9

Interpolation with equal intervals – Newton's forward and backward difference formulae, Interpolation with unequal intervals – Lagrange Interpolation

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UNIT III: NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Approximation of derivatives using interpolation polynomials for an equal interval – Numerical Integration – Trapezoidal rule, Simpson's 1/3 rule,evaluation of double integrals by Trapezoidal rule

UNIT IV: PARTIAL DIFFERENTIAL EQUATIONS 9

Formation of Partial Differential Equations – Lagrange's linear equation – Solution of second-order homogeneous partial differential equations with constant coefficients

UNIT V: BOUNDARY VALUE PROBLEM 9

Fourier Series solutions – One-dimensional wave equation – One-dimensional heat flow equation (unsteady state) – Two-dimensional heat flow equation (Steady state, Cartesian form only)

CONTACT PERIODS:

Lecture: 45 Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. Steven C Chapra and Raymond P Canale, "Numerical Methods for Engineers", Tata McGraw Hill, New Delhi, 2021
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th edition, Wiley India Pvt Ltd, New Delhi, 2018

REFERENCES:

1. Curtis F Gerald and Patrick O Wheatly, "Applied Numerical Analysis", Pearson Education, New Delhi, 2017
2. Grewal, B S and Grewal J S, "Numerical Methods in Engineering and Science", , Khanna Publishers, New Delhi, 2015
3. Bali N.P., & Manish Goyal, "Engineering mathematics", 12th edition, Lakshmi Publication, 2016
4. Peter V.O`Neil, "Advanced Engineering Mathematics", Cengage, 2016

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SEMESTER IV

U25MI401	Microcontroller and Embedded Systems	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

QP PATTERN: A

PRE-REQUISITES:

- U25MI302 - Electronic Devices and Digital Circuits

COURSE OBJECTIVES:

- To familiarize the architecture and assembly language programming of microprocessor and microcontroller
- To perform embedded C programming using the PIC 18 microcontroller's architecture
- To interface peripherals and external I/o's with the microcontroller using embedded C programming

COURSE OUTCOMES:

CO 1:	Interpret the basic concepts of the 8085 microprocessor and the 8051 Microcontroller	Understand
CO 2:	Develop assembly language programming for the 8051 Microcontroller	Apply
CO 3:	Model the architecture of the PIC 18 Microcontroller	Apply
CO 4:	Perform embedded C programming using the PIC 18 microcontroller	Apply
CO 5:	Develop the embedded C program for the peripheral and external I/O's	Apply

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	1	1	1	-	-	-	-	-	2	2	1
CO 2	3	2	1	2	3	-	-	-	-	-	2	3	2
CO 3	3	2	3	3	3	-	-	-	-	-	2	3	2
CO 4	3	2	3	3	3	-	-	-	-	-	2	3	3
CO 5	3	2	3	3	3	-	-	-	-	-	2	3	3

SYLLABUS:

UNIT I: INTRODUCTION TO MICROPROCESSOR AND MICROCONTROLLER 9

8085 Microprocessor Architecture and Pin diagram – Addressing modes – Registers – ALU, Bus systems – Instruction sets – Interrupts – Microprocessor Vs Microcontroller – 8051 Microcontroller Architecture – Features and Specifications.

UNIT II: ASSEMBLY LANGUAGE PROGRAMMING 9

Fundamentals of Assembly Language Programming – Instruction to Assembler – Basic Arithmetic and Logical Programming – Interfacing and Programming of Serial Communication – Stepper motor interfacing of 8051 Microcontroller

UNIT III: PIC 18 MICROCONTROLLER 9

Architecture of PIC 18 – Pin Description – Memory organization: Program memory – Data Memory – I/O Ports – Timers – Counters – External hardware interrupts – USART – ADC.

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UNIT IV: EMBEDDED C PROGRAMMING USING PIC 18 MICROCONTROLLER 9

Introduction to Embedded C Programming – Assembly language programming Vs Embedded C programming – Programming Structure – Data types – memory models – Infinite loops and interrupts handling – I/O port programming – Timer programming – Counter programming – Serial communication.

UNIT V: PERIPHERAL INTERFACING 9

Switch keypad – LCD – LED – ADC and DAC – I/O Programming – Sensors – Relays – Solenoid Valve and Heater – Stepper Motors – PWM Programming – Closed Loop Control Programming of DC Motors – Traffic Light control

CONTACT PERIODS:

Lecture: 45 Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. Ramesh Goankar, "Microprocessor 8085 Architecture, Programming and Interfacing", 6th Edition, Penram International Publishers, Mumbai, 2013.
2. Mazidi, Muhammad Ali, McKinlay, Rolin D. & Causey, Danny, "PIC Microcontroller and Embedded Systems using Assembly and C for PIC 18", 2nd edition, Pearson Education Asia, Noida, 2021.

REFERENCES:

1. Frank Vahid and Tony Givagis, "Embedded System Design", Wiley, 2018
2. Wayne Wolf, "Computers as Components: Principles of Embedded Computer Systems Design", Elsevier, 2013
3. Muhammad Ali Mazidi, Janice Gillipse Mazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems using Assembly and C", 2nd edition, Pearson Education India, 2007.

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SEMESTER III & IV

		Category: PCC				
U25CSG11	Object Oriented Programming Using Java (Common to AD, AM, BM, CB, CS, EC, EE, IT, MI, SC)	L	T	P	J	C
		3	0	0	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- To introduce object-oriented programming concepts and Core Java programming fundamentals
- To develop Java applications using classes, inheritance, polymorphism, interfaces, and exception handling mechanisms
- To provide programming skills in multithreading, collections framework, and file handling using Java APIs
- To enable students to develop modular and reusable Java applications using standard libraries and object-oriented design principles

COURSE OUTCOMES:

CO 1:	Describe object-oriented programming concepts and Java fundamentals for developing simple applications	**Understand**
CO 2:	Develop Java applications using inheritance, polymorphism, abstract classes, interfaces, and packages	**Apply**
CO 3:	Develop Java programs incorporating exception handling and multithreading concepts	**Apply**
CO 4:	Develop Java applications using collections, generics, and related utility classes	**Apply**
CO 5:	Develop Java applications using file handling, stream processing, and object serialization techniques	**Apply**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	2	1	1	1	-	-	-	-	-	-	-	1	1
CO 2	3	2	2	2	-	-	-	-	-	-	1	1	2
CO 3	3	2	2	2	-	-	-	-	-	-	2	1	2
CO 4	3	2	2	2	-	-	-	-	-	-	2	2	2
CO 5	3	2	2	2	-	-	-	-	-	-	2	2	2

SYLLABUS:

UNIT I: INTRODUCTION TO OBJECT-ORIENTED PROGRAMMING AND JAVA BASICS 9

Procedure-Oriented vs Object-Oriented Java Features and Platform: JVM, JRE, JDK – Java Program Structure & Memory Layout – Classes and Objects – Static and non-static members, static and non-static Methods, Constructors – Access Modifiers, Abstraction and Encapsulation – Scanner and System classes

UNIT II: INHERITANCE AND POLYMORPHISM 9

Inheritance and types – Polymorphism: Method Overloading and Overriding – Abstract Classes and Methods – Interfaces. Java packages : Built in and user defined packages

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UNIT III: EXCEPTION HANDLING AND MULTITHREADING 9

Exception Handling: try, catch, throw, throws, finally – Built in exception classes and User defined Exceptions – Multithreading: Thread Lifecycle, Creating Threads, Thread Class and Runnable Interface, Thread Priorities, Synchronization – Inter-thread Communication, Deadlock prevention

UNIT IV: COLLECTIONS FRAMEWORK AND GENERICS 9

Collections Framework – Generics and Type Safety – Wrapper Classes and Autoboxing/Unboxing – Interfaces and Classes: List, Set, Map, Queue – Implementations: ArrayList, LinkedList, HashSet, TreeSet, HashMap, TreeMap – Iterators – Comparator and Comparable Interfaces

UNIT V: JAVA I/O AND FILES 9

Java I/O Framework – Input and Output Streams – Readers and Writers – File I/O using File, FileReader, FileWriter, BufferedReader, BufferedWriter and Files – Console Input using Scanner and Console – Serialization and Deserialization – Object Streams

CONTACT PERIODS:

Lecture: 45 Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, 2018
2. Cay S. Horstmann and Gary Cornell, "Core Java 2, Vol 1, Fundamentals", 11th Edition, Pearson Education, 2020

REFERENCES:

1. J. Nino and F. A. Hosch, "An Introduction to Programming and OO Design using Java", 1st Edition, John Wiley & Sons, 2018
2. Paul Deitel and Harvey Deitel, "Java SE 8 for Programmers", 3rd Edition, Pearson, 2015
3. E. Balagurusamy, "Programming with Java", 6th Edition, McGraw Hill Education, 2019

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Learn Beyond

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SEMESTER IV

		Category: PCC				
U25MEG06	Theory of Machines (Common to ME, MI)	L	T	P	J	C
		3	0	2	0	4

QP PATTERN: A

PRE-REQUISITES:

- U25MEG03 - Engineering Graphics / U25RMEG01 - Engineering Graphics
- U25ME201 - Engineering Mechanics / U25RMEG03 - Engineering Mechanics

COURSE OBJECTIVES:

- To design linkages and cams for desired output motions and analyze the speed relationships in various gear train systems
- To understand and evaluate the force–motion interactions in machine components and achieve dynamic balance in mechanical systems
- To analyze control mechanisms and vibration behaviour for stable mechanical system performance

COURSE OUTCOMES:

CO 1:	Perceive the concept mechanisms and compute the velocity and acceleration of different links in a mechanism	Apply
CO 2:	Develop cam profiles for specified follower motions and use gear train analysis methods to solve engineering problems	Apply
CO 3:	Analyze the dynamic forces acting on machine components and measure the degree of unbalance for mass systems	Analyze
CO 4:	Investigate the functional behavior of governors and gyroscopes for controlling system stability	Evaluate
CO 5:	Interpret the interdependence of vibration parameters for dynamic system analysis	Evaluate

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	1	1	2	-	-	1	1	-	1	2	1
CO 2	3	2	1	1	-	-	-	1	1	-	1	2	1
CO 3	3	3	2	2	1	1	-	1	1	-	1	2	1
CO 4	3	3	3	3	1	2	-	1	1	-	1	3	1
CO 5	3	3	3	3	-	1	-	1	1	-	2	3	1

SYLLABUS:

UNIT I: BASICS OF MECHANISMS AND KINEMATICS OF LINKAGE MECHANISMS 9 + 6

Classification of mechanisms – Kinematic concepts and definitions – Degree of freedom – Mobility – Kutzbach criterion – Gruebler's criterion – Grashof's Law – Kinematic inversions of four bar chain and slider crank chains – Straight line generators – Universal Joint – Geneva mechanism – Ratchet and Pawl mechanisms – Robot gripper mechanisms – Displacement – Velocity and acceleration analysis of simple mechanisms – Graphical method – Demonstration of linkage mechanism using simulation software

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UNIT II: KINEMATICS OF CAM MECHANISMS, GEARS AND GEAR TRAINS **9 + 6**

Classification of cams and followers – Terminology and definitions – Displacement diagrams – Uniform velocity – Parabolic – Simple harmonic – Cycloidal motions – Derivatives of follower motions – Layout of plate cam profiles – Spur Gear terminology and definitions – Law of toothed gearing – Gear trains – Speed ratio – Train value – Parallel axis gear trains – Epicyclic gear trains – Velocity ratio of epicyclic gear trains by tabular method

UNIT III: FORCE ANALYSIS AND BALANCING **9 + 6**

Dynamic force analysis – Inertia force and Inertia torque – D'Alembert's principle – Dynamic Analysis in reciprocating engines – Gas forces – Inertia effect of connecting rod – Bearing loads – Crank shaft – Static and dynamic balancing – Balancing of rotating masses

UNIT IV: MECHANISMS FOR CONTROL **9 + 6**

Governors – Types – Centrifugal governors – Gravity controlled centrifugal governors – Spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling force curves – Gyroscopes – Gyroscopic forces and torques – Gyroscopic stabilization – Gyroscopic effects in automobiles, ships and airplanes

UNIT V: VIBRATION **9 + 6**

Basic features of vibratory systems – Degrees of freedom – Single degree of freedom – Free vibration – Equations of motion – Natural frequency – Types of damping – Damped vibration – Torsional vibration of shaft – Critical speeds of shafts – Forced vibration – Harmonic disturbances – Vibration isolation

LIST OF EXPERIMENTS

1. Dynamic analysis of cam mechanism – Determination of cam profile and jump speed
2. Simple and compound gear trains – Determinations of velocity ratio and torque
3. Balancing of rotating masses and reciprocating masses
4. Experiment on motorized gyroscope – Comparison of theoretical and experimental precessional velocity
5. Universal governors (Watt, Porter, Proell and Hartnell) – Determination of centrifugal force and equilibrium speed
6. Whirling of shaft and compound pendulum – Determination of natural frequency
7. Two rotor system – Comparison of theoretical and experimental torsional frequency
8. Vibrating table – Determination of transmissibility ratio
9. Velocity and acceleration on rigid body using simulation software
10. Active force and torque on four bar mechanism using simulation software
11. Modelling of vehicle dynamics using simulation software

CONTACT PERIODS:

Lecture: 45 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 75 Periods

TEXTBOOKS:

1. Rattan S.S, "Theory of Machines", 5th Edition, Tata McGraw Hill, 2019
2. Uicker J.J, Pennock G.R and Shigley J.E, "Theory of Machines and Mechanisms", 5th Edition, Oxford University Press, 2017

REFERENCES:

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1. Ghosh A and Mallick A.K, "Theory of Mechanisms and Machines", 3rd Edition, Affiliated East-West Press Pvt. Ltd, 1998

2. Robert L. Norton, "Kinematics and Dynamics of Machinery", 3rd Edition, Tata McGraw Hill, 2020

3. Khurmi R.S and Gupta J.K, "Theory of Machines", 14th Edition, S Chand Publications, 2020

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Learn Beyond

SEMESTER IV

U25MI402	Metrology and CNC	Category: PCC				
		L	T	P	J	C
		1	0	2	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- To understand the basic operation of measuring instruments
- To provide hands-on experience in dimensional and surface finish measurement
- To provide hands-on experience in CNC manufacturing and programming

COURSE OUTCOMES:

CO 1: Explain measurement needs, metrology terms, and the use of common linear measuring instruments for dimensional inspection — **Understand**

CO 2: Demonstrate angular, optical, and surface measurement methods to measure geometric features and surface parameters — **Apply**

CO 3: Apply limits, fits, tolerances, and GO/NO-GO gauges to inspect machined parts — **Apply**

CO 4: Execute the CNC machine architecture, operation, coordinate systems, work holding devices — **Apply**

CO 5: Develop and execute CNC turning and milling programs using G- and M-codes, and validate part dimensions using metrology instruments. — **Apply**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	2	1	1	1	-	-	-	1	1	1	1	1	1
CO 2	3	2	1	3	-	-	-	1	2	1	1	2	1
CO 3	3	2	2	2	-	-	-	1	1	1	1	-	1
CO 4	2	1	1	2	-	-	-	1	1	1	1	2	1
CO 5	3	2	2	3	-	-	-	1	2	1	2	3	2

SYLLABUS:

UNIT I: LINEAR MEASUREMENT — **3 + 6**

Accuracy vs. Precision, Calibration, Construction and working of Vernier Calipers, Micrometers, and Height Gauges. Introduction to Slip Gauges. Concept of Limit Gauges (Go/No-Go).

UNIT II: ANGULAR & OPTICAL METROLOGY — **3 + 6**

Bevel Protractor and Sine Bar usage. Working principle of Profile Projector. Terminology and stylus probe measurement. Basic gear and thread measurement

UNIT III: ADVANCED METROLOGY & SENSORS — **3 + 6**

Introduction to Coordinate Measuring Machines (CMM) and probes. Working principles of Load cells (Force) and Strain gauges (Torque). Thermocouples and RTDs

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UNIT IV: CNC MACHINE ARCHITECTURE **3 + 6**

CNC vs NC, Slideways, and Ball screws. Open-loop vs. closed-loop control systems. Automatic Tool Changers (ATC). Clamping devices for Lathe and Mill.

UNIT V: CNC PROGRAMMING BASICS **3 + 6**

Absolute (G90) vs Incremental (G91) Coordinates. Common G-codes (G00, G01, G02, G03) and M-codes. Introduction to Canned Cycles for drilling and turning. Introduction to CNC simulation.

LIST OF EXPERIMENTS

1. Measurement using Vernier Caliper, Micrometer, and Height Gauge
2. Measurement of component profiles using Profile Projector
3. Dimensional measurement using Coordinate Measuring Machine
4. Measurement of surface roughness (Ra) using Surface Roughness Tester.
5. Measurement of Force, Torque, and Temperature using standard setups
6. Programming and machining for Turning and Threading operations
7. Programming and machining for Pocketing and Contouring operations

CONTACT PERIODS:

Lecture: 15 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. Venkateshan S P, "Mechanical Measurements", 2nd edition, Springer Cham, 2022.
2. Micheal Fitzpatrick, "Machining and CNC Technology", 4th edition, McGraw-Hill, 2018.
3. Peter Smid, "CNC Programming Handbook", 3rd edition, Industrial Press, Inc., 2007

REFERENCES:

1. Jain R.K., "Engineering Metrology", Special edition, Khanna Publishers, 2022.
2. Beckwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson education, 2014.
3. Rao P N, "Manufacturing Technology Metal Cutting and Machine Tools", 3rd edition, Tata McGraw-Hill, 2013.
4. GCodeTutor – CNC Program Simulator

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SEMESTER IV

		Category: PCC				
U25MI403	Microcontroller and Embedded Systems Laboratory	L	T	P	J	C
		0	0	2	2	2

QP PATTERN: A

COURSE OBJECTIVES:

- To learn about microcontroller and Embedded programming
- To develop assembly language and Embedded C programming to perform I/O interfacing
- To control the real–world application using Embedded C programming

COURSE OUTCOMES:

CO 1:	Perform the arithmetic and logical operations using microprocessors and microcontrollers by means of assembly language programming	**Apply**
CO 2:	Experiment with embedded C program for the given applications	**Apply**
CO 3:	Make use of sensors, actuators and other I/O's with microcontrollers	**Apply**
CO 4:	Design, monitor and logging the sensory data using microcontrollers	**Apply**
CO 5:	Develop the application to acquire and transfer of data using IoT platform	**Apply**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	1	1	2	-	-	-	2	-	2	3	2
CO 2	3	2	2	1	2	-	-	-	2	-	2	3	2
CO 3	3	2	2	1	2	-	-	-	2	-	2	3	2
CO 4	3	2	2	1	2	-	-	-	2	-	2	3	2
CO 5	3	2	2	1	2	-	-	-	2	-	2	3	2

LIST OF EXPERIMENTS

1. Performing Arithmetic functions using the 8085 Microprocessor using Assembly language programming
2. Sorting an array of data into ascending and descending order using the 8085 Microprocessor using assembly language programming
3. Interfacing of switch and LED with 8051 Microcontroller using assembly language programming
4. Study on editing, debugging and simulation of Embedded C programming in software platform
5. Interfacing of stepper motor to rotate in clockwise and anti–clockwise using Embedded C programming
6. Development of Embedded C Programming to Interface LCD Screen
7. Detection and counting of the object using Embedded C Programming
8. Data logging of Real time temperature data using Embedded C programming
9. Development of Embedded C Program for the actuation of pneumatic cylinders for the required sequence
10. Development of Embedded C Program to monitor the level of water and transfer the data using IoT module
11. Development of Embedded C Program for PID Controller Implementation

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12. PROJECT - Design and development of an embedded system for real-time monitoring and control applications by applying the concepts of microcontroller programming, embedded system design, and peripheral interfacing.

CONTACT PERIODS:

Lecture: - Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** 30 Periods **Total:** 60 Periods

TEXTBOOKS:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", 2nd edition, Pearson Education, 2008

REFERENCES:

1. Mazidi, Muhammad Ali, Mckinlay, Rolin D. & Causey Danny, "PIC Microcontroller and Embedded Systems using Assembly and C for PIC 18", 2nd Edition, Pearson Education Asia, Noida, 2021
2. Michael Barr, Anthony Massa, "Programming Embedded Systems: With C and GNU Development Tools", 2nd Edition, O'Reilly Media, 2006.

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SEMESTER III & IV

U25CSG13	Object Oriented Programming Using Java Laboratory (Common to AD, AM, BM, CB, CS, EC, EE, IT, MI, SC)	Category: PCC				
		L	T	P	J	C
		0	0	2	0	1

QP PATTERN: A

COURSE OBJECTIVES:

- To understand the fundamental concepts of object-oriented programming using Java for developing modular and reusable applications
- To apply inheritance, polymorphism, exception handling, and multithreading concepts in developing robust Java applications
- To develop collection-based and file-processing applications using Java I/O, generics, and collections framework for real-world problem solving

COURSE OUTCOMES:

CO 1:	Implement the fundamental concepts of object-oriented programming, Java program structure, classes, objects, and encapsulation principles	Apply
CO 2:	Develop Java applications using inheritance, polymorphism, abstract classes, interfaces, and packages	Apply
CO 3:	Implement exception handling and multithreading mechanisms for developing reliable and concurrent applications	Apply
CO 4:	Utilize collections framework, generics, and sorting mechanisms for efficient data management and processing	Apply
CO 5:	Develop file handling and object persistence applications using Java I/O streams, serialization, and deserialization techniques	Apply

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	1	1	-	-	-	-	-	-	1	-	-
CO 2	3	2	1	1	-	-	-	-	-	-	1	-	1
CO 3	3	2	1	1	-	-	-	-	-	-	1	2	1
CO 4	3	2	1	1	-	-	-	-	-	-	1	2	1
CO 5	3	2	2	2	-	-	-	-	-	-	2	2	1

LIST OF EXPERIMENTS

1. Design and implementation of Java programs demonstrating classes, objects, constructors, and methods
2. Development of applications illustrating static and non-static members, access modifiers, abstraction, and encapsulation
3. Implementation of console-based applications using Scanner and System classes for input and output processing
4. Design and implementation of applications demonstrating inheritance and its various types
5. Development of applications illustrating compile-time and runtime polymorphism using method overloading and method overriding
6. Implementation of applications using abstract classes, interfaces, and dynamic method dispatch mechanisms
7. Design and development of modular Java applications using built-in and user-defined packages
8. Implementation of robust exception handling mechanisms using built-in and user-defined exceptions

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9. Development of multithreaded applications using Thread class and Runnable interface
10. Design and implementation of synchronized multithreaded applications with inter-thread communication
11. Development of applications demonstrating thread lifecycle management and deadlock prevention techniques
12. Implementation of generic collection-based applications using List, Set, Map, and Queue interfaces
13. Design of applications utilizing Comparator and Comparable interfaces for customized sorting operations
14. Development of file processing applications using Java I/O streams, readers, writers, and buffered streams
15. Implementation of object persistence mechanisms using serialization and deserialization techniques

CONTACT PERIODS:

Lecture: - Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 30 Periods

REFERENCES:

1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, 2018
2. Cay.S.Horstmann and Gary Cornell, "Core Java 2, Vol 1, Fundamentals", 11th Edition, Pearson Education, 2020

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SEMESTER IV

		Category: MNC				
U25MNC03	Indian Constitution (Common to all programmes)	L	T	P	J	C
		1	0	0	0	0

QP PATTERN: A

COURSE OBJECTIVES:

- To understand the evolution and importance of the Constitution.
- To understand salient features of the Indian Constitution and philosophy of Fundamental Rights
- To gain the knowledge about the state government and local level administration

COURSE OUTCOMES:

CO 1: Understand the historical background of the Constitution making and its importance for building a democratic India — Understand

CO 2: Understand the value of Fundamental Rights and Duties for becoming a good citizen of India — Understand

CO 3: Analyze the powers of the Central Government — Analyze

CO 4: Understand the role and responsibilities of State and Local Administration — Understand

CO 5: Apply knowledge in strengthening constitutional institutions like Election Commission and UPSC for sustaining democracy — Apply

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	-	-	-	-	-	1	2	3	-	-	-	1	-
CO 2	-	-	-	-	-	1	2	3	-	-	-	1	-
CO 3	-	-	-	-	-	1	2	3	-	-	-	1	-
CO 4	-	-	-	-	-	1	2	3	-	-	-	1	-
CO 5	-	-	-	-	-	1	2	3	-	-	-	1	-

SYLLABUS:

UNIT I: HISTORICAL BACKGROUND OF INDIAN CONSTITUTION — 5

Introduction to Indian Constitution: Constitution Meaning of the term, History of Making of the Indian Constitution, Evolution of the Indian Constitution, Drafting Committee (Composition and Working).

UNIT II: FEATURES OF INDIAN CONSTITUTION — 5

Philosophy and salient features of the Indian Constitution, Citizenship, Fundamental Rights, Duties and their significance, Directive Principles of State Policy, Rights Protective Mechanisms in India; Right to Education Act 2009; Right to Information 2005.

UNIT III: UNION GOVERNMENT — 5

Union Legislature (Parliament), Lok Sabha and Rajya Sabha (with Powers and Functions), Union Executive, President of India (with Powers and Functions), Prime Minister and Council of Ministers (with Powers and Functions), Cabinet and Central Secretariat, Union Judiciary (Supreme Court).

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UNIT IV: STATE GOVERNMENT AND LOCAL ADMINISTRATION 5

Governor, Chief Minister and Council of Ministers, State Secretariat – Roles and Responsibilities, District Administration, Head, Municipalities – Mayor and Role of Elected Representatives, Panchayati Raj, Zila Panchayat – Roles and Responsibilities, Block Level and Village Level Organizational Hierarchy

UNIT V: CONSTITUTIONAL INSTITUTIONS 5

Election Commission of India – Powers and Functions, Electoral Process in India, Methods of Constitutional Amendments and their Limitations, Important Constitutional and gist Emergency Provisions. Case Studies.

CONTACT PERIODS:

Lecture: 25 Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** - Periods **Total:** 25 Periods

TEXTBOOKS:

1. Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India Pvt. Ltd., New Delhi.
2. Subash Kashyap, "Indian Constitution", National Book Trust.

REFERENCES:

1. M. Laxmikanth, "Indian Polity", McGraw Hill Education India, 2013.
2. M. P. Jain, "Indian Constitution Law," 7th Edition, Lexis Nexis, 2014.
3. Raj Kumar, "Ambedkar and Constitution", Commonwealth Publication Pvt. Ltd., New Delhi, 2011

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SEMESTER IV

U25RMCC09	Professional Skill Development - IV (Common to all programmes)	Category: MCC				
		L	T	P	J	C
		15 Hours				1

COURSE OUTCOMES:

CO 1: Demonstrate technical skill competency through attainment of industry-relevant certifications, participation in competitions, internships, and project-based learning activities **Apply**

CO 2: Apply research, innovation, and problem-solving skills to develop impactful solutions through projects, publications, patents, and higher education preparation **Apply**

CO 3: Exhibit leadership, ethical responsibility, community engagement, and professional digital presence to enhance career readiness and lifelong learning **Apply**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	2	-	3	1	-	-	2	2	-	2	-
CO 2	2	3	3	3	2	2	-	-	1	1	-	2	-
CO 3	-	-	3	-	-	2	2	3	3	3	2	2	-

GUIDLINES:

- Certifications and Skill Credentials - Free awareness certs, NPTEL/Coursera, Associate-level, Professional-level, Expert-level
- Competitions, Hackathons, and Technical Challenges - Online, institution, state, national, international competitions and hackathons, Kaggle medals
- GATE Preparation and Performance - Study plan, mock tests, registration, appearing, score percentile
- Academic, Industry, and Innovation Projects - Mini-projects, intermediate projects, industry-grade deployed projects, funded or published projects
- Internships and Industrial Training - Virtual, on-site short, core role, CoE on-campus, PPO, PPO converted to offer
- Research Publications, Patents, Intellectual Property - Reading journals, survey papers, conference papers, Scopus/WoS, Q1/Q2 journals, patents from provisional to granted
- Leadership, Community, Digital Presence - Club membership, event roles, office bearer, president, outreach, LinkedIn, GitHub, portfolio, Google Scholar

CONTACT PERIODS:

Lecture: - Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** - Periods **Total:** 0 Periods

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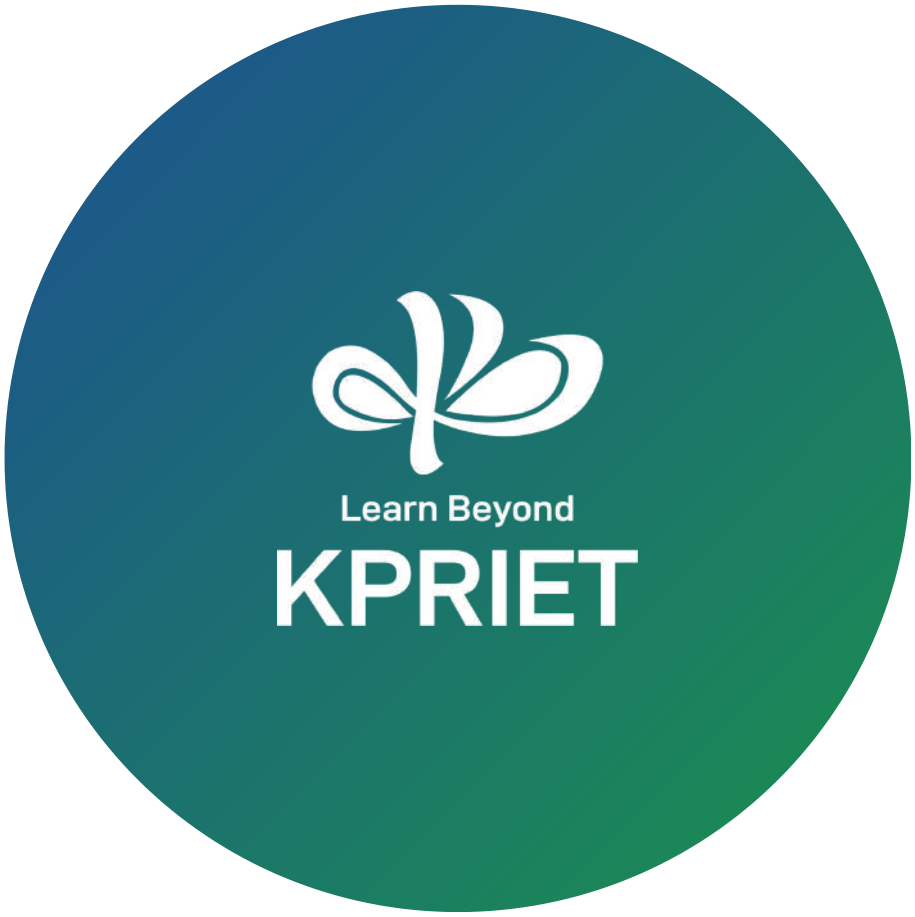
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