



Learn Beyond

**KPR Institute of
Engineering and
Technology**

(Autonomous, Affiliated to Anna University)

CURRICULUM AND SYLLABI REGULATIONS – 2025 (REVISED)

**Department of
Chemical Engineering**

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 centre of academic and research excellence in Chemical Engineering to cater to the diverse needs of industry, society and the global community

Mission

The mission of the department is to

- Provide quality education that integrates values and practical skills to ensure effective learning outcomes
- Promote research, innovation, and collaboration with industries and institutions of repute
- Inculcate professionalism, ethics, lifelong learning and social responsibilities

III. Program Educational Objectives (PEOs)

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

PEO1: Apply knowledge of science, and engineering to solve complex Chemical Engineering problems in diverse chemical and allied industries

PEO2: Design, develop, and optimize chemical processes and products to uphold the needs of society and environment ensuring sustainability

PEO3: Exhibit a commitment to lifelong learning, research and professional ethics

IV. Program Outcomes (POs)

Graduates of the CHEMICAL 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)

- 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 CHEMICAL ENGINEERING will be able to

PSO1: Acquire the necessary knowledge, skill and competence on the principles of Chemical Engineering

PSO2: Adopt Chemical Engineering principles with advanced and innovative practices for process and product development

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	1	2	2	-	-	-	-	-	-	3	3
PEO 2	-	-	2	1	2	3	2	-	2	2	-	3	3
PEO 3	-	-	-	-	-	2	2	3	3	2	2	3	3

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	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓
	Elements of Mechanical Engineering	✓	✓	-	-	✓	✓	-	✓	✓	-	-	✓	✓
	Makerspace	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	C Programming Laboratory	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	✓
	Induction Program													
	தமிழர் மரபு / Heritage of Tamils	-	-	-	-	-	-	✓	✓	-	✓	-	✓	✓
	Universal Human Values	-	-	-	-	-	✓	✓	✓	-	-	✓	✓	✓
	Environmental Governance and Sustainability	✓	✓	-	-	-	✓	✓	-	✓	-	✓	✓	✓
II	Professional Skill Development - I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Professional Communication - II	-	-	-	-	-	-	-	✓	✓	-	✓	✓	✓
	Mathematical Transforms in Engineering	✓	✓	✓	-	✓	-	-	-	✓	-	-	✓	✓
	Material Science	✓	✓	✓	-	✓	-	-	✓	✓	-	-	✓	✓
	Engineering Chemistry	✓	✓	✓	-	✓	-	-	✓	✓	-	✓	✓	✓
	Python Programming	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	✓
	Basics of Electrical and Electronics Engineering	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	✓
	Python Programming Laboratory	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	✓
	Engineering Graphics	✓	✓	✓	-	-	-	-	-	-	-	✓	✓	✓
	Design Thinking	✓	✓	✓	-	-	✓	✓	✓	✓	✓	✓	✓	✓
	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	-	-	-	-	-	-	✓	✓	-	✓	-	✓	✓
	Professional Skill Development - II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
III	Probability and Statistics	✓	✓	-	-	✓	-	-	-	-	-	-	✓	✓
	Process Calculations	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Engineering Materials	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Sem	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
	Mechanical Operations	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Fluid Mechanics for Chemical Engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Artificial Intelligence for Process Engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓
	Technical Analysis Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Essence of Indian Traditional Knowledge	-	✓	-	✓	-	-	✓	-	-	-	-	✓	✓
	Professional Skill Development - III	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IV	Partial Differential Equations for Process Engineering	✓	✓	-	-	✓	-	-	-	-	-	-	✓	✓
	Chemical Engineering Thermodynamics I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Mass Transfer I	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓
	Process Heat Transfer	✓	✓	✓	✓	✓	-	-	-	✓	✓	-	✓	✓
	Process Instrumentation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Mechanical Operations Laboratory	✓	✓	✓	✓	✓	-	-	-	✓	-	-	✓	✓
	Indian Constitution	-	-	-	-	-	✓	✓	✓	-	-	-	✓	✓
	Professional Skill Development - IV	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓



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CHEMICAL 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	U25RMEG02	Elements of Mechanical Engineering	ESC	TwL	2	-	2	-	3
6	U25RGE01	Makerspace	ESC	L	-	-	4	-	2
7	U25RCSG03	C Programming Laboratory	ESC	L	-	-	2	-	1
Total									19
MANDATORY CREDIT COURSES (MCC - Non CGPA) / MANDATORY NON-CREDIT COURSES (MNC)									
8	U25RMNC01	Induction Program	MNC	MNC	3 Weeks				-
9	U25RMCC02	தமிழர் மரபு / Heritage of Tamils	MCC	Tamil Courses	1	-	-	-	1
10	U25RMCC01	Universal Human Values	MCC	MCC	3	-	-	-	3
11	U25RMCC04	Environmental Governance and Sustainability	MCC	MCC	2	-	-	-	2
12	U25RMCC06	Professional Skill Development - I	MCC	MCC	15 Hours				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	U25REEG01	Basics of Electrical and Electronics Engineering	ESC	T	2	-	-	-	2
7	U25RCSG06	Python Programming Laboratory	ESC	L	-	-	2	-	1
8	U25RMEG01	Engineering Graphics	ESC	L	-	-	4	-	2
Total									21
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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No	Course Code	Title	Category	Type	L	T	P	J	C
11	U25RMCC07	Professional Skill Development - II	MCC	MCC	15 Hours				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	U25CH301	Process Calculations	PCC	T	3	1	-	-	4
3	U25CH302	Engineering Materials	PCC	T	3	-	-	-	3
4	U25CH303	Mechanical Operations	PCC	T	3	-	-	-	3
5	U25CH304	Fluid Mechanics for Chemical Engineers	PCC	TwL	3	-	2	-	4
6	U25CH305	Artificial Intelligence for Process Engineers	PCC	TwP	2	-	-	2	3
7	U25CH306	Technical Analysis Laboratory	PCC	L	-	-	2	-	1
Total									21
MANDATORY CREDIT COURSES (MCC - Non CGPA) / MANDATORY NON-CREDIT COURSES (MNC)									
8	U25MNC02	Essence of Indian Traditional Knowledge	MNC	MNC	1	-	-	-	-
9	U25RMCC08	Professional Skill Development - III	MCC	MCC	15 Hours				1
Total									1

SEMESTER IV

No	Course Code	Title	Category	Type	L	T	P	J	C
1	U25MA404	Partial Differential Equations for Process Engineering	BSC	TwL	2	-	2	-	3
2	U25CH401	Chemical Engineering Thermodynamics I	PCC	T	3	1	-	-	4
3	U25CH402	Mass Transfer I	PCC	T	3	-	-	-	3
4	U25CH403	Process Heat Transfer	PCC	TwL	3	-	2	-	4
5	U25CH404	Process Instrumentation	PCC	TwP	2	-	-	2	3
6	U25CH405	Mechanical Operations Laboratory	PCC	L	-	-	2	-	1
7	-	Open Elective I	OEC	T	1	-	4	-	3
					3	-	-	-	
					2	-	2	-	
Total									21
MANDATORY CREDIT COURSES (MCC - Non CGPA) / MANDATORY NON-CREDIT COURSES (MNC)									
8	U25MNC03	Indian Constitution	MNC	MNC	1	-	-	-	-
9	U25RMCC09	Professional Skill Development - IV	MCC	MCC	15 Hours				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	1	1
CO 2	-	-	-	-	-	-	-	2	3	-	1	1	1
CO 3	-	-	-	-	-	-	-	2	3	-	1	1	1
CO 4	-	-	-	-	-	-	-	2	3	-	1	1	1
CO 5	-	-	-	-	-	-	-	2	3	-	1	1	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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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	-	-	-	-	-	-	-	-	-	2	2
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	-	-	2	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: 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	-	-	-	-	-	-	-	-	-	1	1
CO 2	3	2	1	1	-	-	-	-	-	-	2	1	1
CO 3	3	2	1	1	-	-	-	-	-	-	2	1	1
CO 4	3	2	1	1	-	-	-	-	-	-	2	1	1
CO 5	3	2	1	1	1	-	-	-	-	-	2	1	1

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

U25RMEG02	Elements of Mechanical Engineering	Category: ESC				
		L	T	P	J	C
		2	0	2	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- To provide the fundamental knowledge of mechanical elements, actuation systems and manufacturing processes essential for engineering applications
- To impart knowledge of energy conversion, power generation systems and thermal systems for solving practical problems

COURSE OUTCOMES:

- CO 1: Identify the mechanical elements and actuation systems used in basic engineering applications **Understand**
- CO 2: Classify various manufacturing processes and distinguish between shaping, joining, and additive manufacturing methods **Understand**
- CO 3: Explain the working principles of power plants and renewable energy systems **Understand**
- CO 4: Describe the operating principles of internal combustion engines, refrigeration, and air conditioning systems **Understand**
- CO 5: Recall various safety requirements and software required for modelling and analysis of engineering components **Understand**

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: MECHANICAL ELEMENTS AND ACTUATION SYSTEMS

6 + 6

Mechanical elements – Gears, chains, shaft, keys, coupling, bolts, nuts, screws, spring, bearings – Actuators – Hydraulics actuators, pneumatics actuators

UNIT II: FUNDAMENTALS OF MANUFACTURING PROCESSES

6 + 6

Introduction to manufacturing – Classification of manufacturing processes – Shaping processes – Casting, molding, powder metallurgy, additive manufacturing (FDM, SLA) – Joining processes – Arc welding, brazing and soldering

UNIT III: POWER GENERATION

6 + 6

Classification of Power Plants – Working principle of Steam – Gas – Diesel – Hydroelectric and Nuclear Power Plants – Renewable Energy – Solar – Wind – Tidal – OTEC

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UNIT IV: IC ENGINES, REFRIGERATION AND AIR CONDITIONING**6 + 6**

IC Engine as power plant – Petrol and Diesel Engines – Four stroke and two stroke cycles – Working principle and Comparison – Refrigeration and Air Conditioning – Refrigerants – Vapour compression and absorption refrigeration system – Types of refrigeration and air conditioning systems – Applications

UNIT V: INDUSTRIAL AND SAFETY ENGINEERING**6 + 6**

Introduction to industrial engineering – Productivity and work study – Introduction to safety engineering – Evolution of safety – Safety organization – Safety functions – Workplace operations requiring safety – Personal Protective Equipment (PPE) – Industrial hazards – Safety benefits – Introduction to modelling and analysis software

LIST OF EXPERIMENTS

1. Determine the velocity ratio using simple and compound gear trains
2. Construct and demonstrate a basic pneumatic circuit using single-acting and double-acting cylinders
3. Perform step turning operation on a lathe machine
4. Perform drilling operation on drilling machine
5. Demonstrate the working of 3D printer by printing a simple object
6. Determination of port timing of two-stroke engine
7. Determination of valve timing of four-stroke engine
8. 3D Modeling of Mechanical Components using CAD Software

CONTACT PERIODS:**Lecture:** 30 Periods**Tutorial:** - Periods**Practical:** 30 Periods**Project:** - Periods**Total:** 60 Periods**TEXTBOOKS:**

1. Pravin Kumar, "Basic Mechanical Engineering", 4th Edition, Pearson Education India, 2022
2. P. N. Rao, "Manufacturing Technology – Volume I: Foundry, Forming and Welding", 5th Edition, McGraw Hill Education (India), 2018

REFERENCES:

1. P. K. Nag, "Power Plant Engineering", 5th Edition, McGraw Hill Education, 2021
2. S. Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", 8th Edition, Pearson Education, 2020
3. S. K. Sharma and Savita Sharma, "Industrial Engineering and Management", 3rd Edition, S. K. Kataria & Sons, 2022



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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	2
CO 3	3	2	-	-	3	-	-	3	2	-	2	2	2
CO 4	2	-	-	-	3	-	-	-	-	-	2	2	2
CO 5	3	3	2	1	3	2	2	3	3	2	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	1	1
CO 2	3	2	2	1	-	-	-	-	-	-	1	1	1
CO 3	3	2	2	1	-	-	-	-	-	-	1	1	1
CO 4	3	2	2	1	-	-	-	-	-	-	1	1	1
CO 5	3	2	2	1	-	-	-	-	-	-	1	1	1

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



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

Learn Beyond

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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 Thina 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	-	1	1
CO 2	-	-	-	-	-	-	3	3	-	2	-	1	1
CO 3	-	-	-	-	-	-	3	3	-	2	-	1	1
CO 4	-	-	-	-	-	-	3	3	-	2	-	1	1
CO 5	-	-	-	-	-	-	3	3	-	2	-	1	1

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 Bharathiyaar 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, Yash 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: THIRUVAI 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 - முனைவர். இல. சுந்தரம், விகடன் பிரசுரம், அண்ணொ சொல்ல, .சன்னை, திசம்பர் 2016
3. கீழடி - 0வக நதிக்கரையில் சங்ககொல நகர நொகரிகம், .தொல்லியல் துறை .வளையீடு, தமிழ்நொடு அரசு, .சன்னை, ஆறொம் 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

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

CO - PO MAPPING:

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

SYLLABUS:


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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:


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



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U25RMCC04	Environmental Governance and Sustainability (Common to AD, AM, BM, CB, CE, CH, CS, EC, EE, EV, IT, ME, MI, SC)	Category: MCC				
		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	1
CO 2	2	1	-	-	-	3	2	-	1	-	1	1	1
CO 3	2	1	-	-	-	3	2	-	1	-	1	1	1
CO 4	2	1	-	-	-	3	2	-	1	-	1	1	1
CO 5	3	1	-	-	-	3	2	-	1	-	1	1	1

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: ATMOSPHERE AND HYDROSPHERE

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

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	-	3	3
CO 2	3	2	2	1	2	2	-	-	1	1	-	3	3
CO 3	3	2	2	1	-	2	2	3	3	3	2	3	3

GUIDELINES:

- 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

U25REN201	Professional Communication - II (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 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	1
CO 2	-	-	-	-	-	-	-	2	3	-	1	1	1
CO 3	-	-	-	-	-	-	-	2	3	-	1	1	1
CO 4	-	-	-	-	-	-	-	2	3	-	1	1	1
CO 5	-	-	-	-	-	-	-	2	3	-	1	1	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

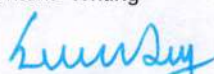
Critical Thinking Strategies - Problem-solving Communication - Case Study - Brainstorming Techniques - Collaborative Decision Making - One-word Substitutions

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,

U25RMA203	Mathematical Transforms in Engineering (Common to CE, CH, EE, ME, MI)	Category: BSC				
		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 **Understand** basic signal analysis and engineering problems
- 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	-	-	1	1
CO 2	3	2	1	-	2	-	-	-	1	-	-	1	1
CO 3	3	2	1	-	2	-	-	-	1	-	-	1	1
CO 4	3	2	1	-	2	-	-	-	1	-	-	1	1
CO 5	2	2	1	-	2	-	-	-	1	-	-	1	1

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

U25RPH03	Material Science (Common to CH, EE, ME, MI)	Category: BSC				
		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	-	-	2	1
CO 2	3	2	1	-	1	-	-	1	1	-	-	2	1
CO 3	3	2	1	-	1	-	-	1	1	-	-	2	1
CO 4	3	2	1	-	1	-	-	1	1	-	-	2	1
CO 5	3	2	1	-	1	-	-	1	1	-	-	2	1

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

REFERENCES:


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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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Head of the Department



SEMESTER I & II

U25RCY01	Engineering Chemistry (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 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	1
CO 2	3	2	1	-	1	-	-	1	1	-	1	1	1
CO 3	3	2	1	-	1	-	-	1	1	-	1	1	1
CO 4	3	2	1	-	1	-	-	1	1	-	1	1	1
CO 5	3	2	1	-	1	-	-	1	1	-	1	1	1

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 (MoS_2), 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

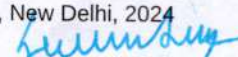
Practical: 30 Periods

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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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 **Understand** debugging techniques
- 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	-	-	-	-	-	-	-	-	-	1	1
CO 2	3	2	1	1	-	-	-	-	-	-	2	1	1
CO 3	3	2	1	1	-	-	-	-	-	-	2	1	1
CO 4	3	2	1	1	-	-	-	-	-	-	2	1	1
CO 5	3	2	1	1	-	-	-	-	-	-	2	1	1

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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SEMESTER II

U25REEG01	Basics of Electrical and Electronics Engineering (Common to CH, ME)	Category: ESC				
		L	T	P	J	C
		2	0	0	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- To provide fundamental knowledge of electric circuit elements, network laws, and circuit analysis techniques used in DC networks
- To develop understanding of the construction, operating principles, characteristics, and applications of electrical machines such as DC motors, transformers, and induction motors
- To familiarize with semiconductor devices and their applications in rectification, voltage regulation, and amplifier circuits

COURSE OUTCOMES:

- CO 1:** Apply circuit laws and network analysis techniques to determine electrical quantities in DC circuits **Apply**
- CO 2:** Analyze the construction, operating principles, characteristics and speed control methods of DC motors for engineering applications **Analyze**
- CO 3:** Analyze the operating principles and characteristics of transformers and three- phase induction motors under specified conditions **Analyze**
- CO 4:** Analyze the construction, operation, and characteristics of semiconductor devices such as PN junction diodes, Zener diodes, BJTs, and FETs. **Analyze**
- CO 5:** Apply semiconductor devices to develop rectifier, voltage regulator, and transistor configuration circuits for practical 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
CO 2	3	3	2	1	-	-	-	-	-	-	1	1	1
CO 3	3	3	2	1	-	-	-	-	-	-	1	1	1
CO 4	3	3	2	1	-	-	-	-	-	-	1	1	1
CO 5	3	2	1	-	-	-	-	-	-	-	1	1	1

SYLLABUS:

UNIT I: BASIC CONCEPTS OF ELECTRIC CIRCUITS

6

Active elements – Passive elements – Sources – Elements in series and parallel connections – Star and delta conversion – Ohm's law and Kirchhoff's laws – Mesh and Nodal analysis in DC Networks

UNIT II: DC MOTOR

6

DC motor – Construction, principle of operation, types, torque equation, characteristics and applications – Starters for DC motor: Two point, Three point – Speed control – Armature and field control

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UNIT III: TRANSFORMER AND AC MOTOR

6

Single phase transformer – Three phase induction motor – Construction, principle of operation, characteristics and applications
– Starters – DOL, Star-delta

UNIT IV: SEMICONDUCTOR DEVICES

6

Construction, operation and characteristics : PN Junction , Zener Diode – BJT – FET

UNIT V: APPLICATIONS OF SEMICONDUCTOR DEVICES

6

Rectifier – Half wave – Full wave – Filters – Voltage regulator – Series and shunt – CE , CB and CC Configuration

CONTACT PERIODS:

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

TEXTBOOKS:

1. A. Sudhakar and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", 5th edition McGraw-Hill Education, 2019
2. R.K.Rajput, "Electrical Machines", 6th edition, Laxmi Publications, 2016
3. V.K Metha and Rohit Metha, "Principles of Electronics", 12th edition, S.Chand Publications, 2020

REFERENCES:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", 8th edition, , McGraw-Hill Education, 2013
2. S.K. Bhattacharya, "Electrical Machines", 4th edition, McGraw-Hill Education, 2017
3. R.Sedha, "A text book of Applied Electronics", Revised edition, S.Chand Publications, 2017



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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	-	-	-	-	-	-	-	1	1
CO 2	3	2	1	1	-	-	-	-	-	-	-	1	1
CO 3	3	2	1	1	-	-	-	-	-	-	1	1	1
CO 4	3	2	1	1	-	-	-	-	-	-	1	1	1
CO 5	3	2	1	1	-	-	-	-	-	-	1	1	1

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

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	1	1
CO 2	3	2	1	-	-	-	-	-	-	-	1	1	1
CO 3	3	2	1	-	-	-	-	-	-	-	1	1	1
CO 4	3	2	1	-	-	-	-	-	-	-	1	1	1

LIST OF EXPERIMENTS

- 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)
- Manual construction of ellipse, parabola and hyperbola by eccentricity method
- Construction of involute of square and circle by manual drafting
- Projection of points in all four quadrants by manual drafting
- Projection of lines inclined to both horizontal and vertical planes by manual drafting
- Projection of planes inclined to both horizontal and vertical planes by manual drafting
- Projection of solids inclined to one plane and parallel to other planes
- Section of solids with base resting on HP
- Development of lateral surfaces of solids with base on HP
- Construction of isometric views of simple and truncated solids
- 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

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	1
CO 2	2	1	-	-	-	1	1	-	1	1	2	1	1
CO 3	2	1	1	-	-	1	1	3	1	1	2	1	1
CO 4	3	3	2	-	-	1	1	3	1	1	2	1	1
CO 5	3	2	-	-	-	1	1	3	3	1	2	1	1

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	-	1	1
CO 2	-	-	-	-	-	-	3	3	-	2	-	1	1
CO 3	-	-	-	-	-	-	3	3	-	2	-	1	1
CO 4	-	-	-	-	-	-	3	3	-	2	-	1	1
CO 5	-	-	-	-	-	-	3	3	-	2	-	1	1

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 beads – 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	-	3	3
CO 2	2	3	3	3	2	2	-	-	1	1	-	3	3
CO 3	-	-	3	-	-	2	2	3	3	3	2	3	3

GUIDELINES:

- 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

U25MA302	Probability and Statistics (Common to BM, CE, CH, EC, EE, ME, MI)	Category: BSC				
		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	-	-	-	-	-	-	1	1
CO 5	3	2	-	-	2	-	-	-	-	-	-	1	1

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: INFERENCE 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, New Delhi 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

U25CH301	Process Calculations	Category: PCC				
		L	T	P	J	C
		3	1	0	0	4

QP PATTERN: A

COURSE OBJECTIVES:

- To introduce the fundamental principles of process calculations involving units, dimensions, process variables, mixture analysis and gas laws used in chemical engineering systems.
- To develop the ability to formulate solve material balance and humidity-related calculations for single and multiple process units, with and without chemical reactions.
- To enable the students to apply stoichiometric and thermodynamic principles for energy balance, fuel analysis and combustion calculations in chemical process systems.

COURSE OUTCOMES:

- CO 1:** Apply concepts of dimensions, units, process variables and gas laws to analyze chemical engineering systems. **Apply**
- CO 2:** Apply the concept of law of conservation of mass and solve material balance equations for systems with and without chemical reactions. **Apply**
- CO 3:** Analyze humidity parameters and perform calculations related to drying and condensation Operations. **Analyze**
- CO 4:** Perform energy balance calculations for physical and reactive processes using stoichiometric and thermodynamic relations. **Analyze**
- CO 5:** Evaluate combustion calculations and fuel characteristics by performing theoretical air requirement and flue gas analysis calculations. **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	1	1	1	1	1	2	2
CO 2	3	3	2	2	2	1	1	1	1	1	1	3	2
CO 3	2	3	1	1	2	2	1	1	1	1	1	3	2
CO 4	3	3	2	2	2	2	1	1	1	1	1	2	2
CO 5	3	3	2	2	3	2	1	1	2	1	1	2	2

SYLLABUS:

UNIT I: UNITS AND DIMENSIONS

9 + 3

Dimensions and units – Fundamental and derived quantities – Conversion of units – Process variables and properties – Analysis of mixtures – Ideal gas laws – Mole fractions and partial pressures – Application of Dalton's and Amagat's law.

UNIT II: MATERIAL BALANCES

9 + 3

Introduction to material balances: Law of conservation of mass – General mass balance equation – Material balance for single and multiple units without chemical reactions – Stoichiometry – Limiting and excess reactants – Material balance involving chemical reactions – Systems with recycle, bypass, and purge.

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UNIT III: HUMIDITY**9 + 3**

Calculation of absolute humidity, molal humidity, relative humidity and percentage humidity – Use of humidity in condensation and drying – Humidity chart, dewpoint – Humidity calculations.

UNIT IV: ENERGY BALANCES**9 + 3**

Law of conservation of energy – Heat capacity and sensible heat – Heat capacities of solid and liquids – Kopp's rule and Trouton's rule – Latent Heat – Heat capacities of gases as a function of temperature – Mean heat capacity, heat capacity of mixture of gases – Standard heat of reaction, formation and combustion – Hess's law of heat summation and its application – Energy balance for systems with and without chemical reaction.

UNIT V: COMBUSTION**9 + 3**

Fuels – Classification – Calorific values of fuels – Proximate and Ultimate analysis – Determination of flue gas composition using Orsat analysis for combustion of solid, liquid, and gaseous fuels. – Calculation of theoretical and excess air requirements – Problems on sulphur and sulphur burning compounds.

CONTACT PERIODS:

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

TEXTBOOKS:

1. Himmelblau DM, Riggs JB., "Basic principles and calculations in chemical engineering", 8th Edition, Prentice Hall International, 2012.
2. Felder, R. M., Rousseau, R. W., "Elementary Principles of Chemical processes", 4th Edition, John Wiley & Sons, 2020.
3. Narayanan, K. V., Lakshmikutty, B., "Stoichiometry and Process Calculations", 2nd Edition, Prentice Hall of India, New Delhi, 2016.

REFERENCES:

1. Hougen, O. A., Watson & Ragatz, "Chemical Process Principles", Part I, 1st Edition, CBS publishers, 1973.
2. Reklaitis GV, Schneider DR. Introduction to material and energy balances. 1983. John Wiley and Sons
3. Bhatt, B. L., Vora, S. M., "Stoichiometry", 4th Edition, Tata McGraw-Hill, 2004.



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SEMESTER III

U25CH302	Engineering Materials	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- To provide fundamental knowledge of engineering materials, their properties, and criteria for selecting suitable materials for chemical process applications.
- To develop an understanding of the structure, processing, and performance relationships of metals, alloys, polymers, ceramics, composites, and new-generation materials.
- To enable students to analyse and evaluate the applicability, behaviour, and limitations of different materials under various operating conditions in chemical industries.

COURSE OUTCOMES:

- CO 1:** Identify the physical, chemical, thermal, mechanical, and electrical properties of engineering materials **Understand**
- CO 2:** Interpret phase diagrams, heat treatment processes, and microstructural transformations of metals and alloys and various processes associated with metals and their alloys **Apply**
- CO 3:** Classify and compare natural and synthetic polymers, elastomers, and fibres based on their properties and applications **Analyze**
- CO 4:** Explain the manufacture, characteristics, and uses of ceramics, refractories, and cementitious materials. (**Understand**
- CO 5:** Analyze various novel materials including shape memory alloys and explain the reason for their novelty **Analyze**

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: PROPERTIES AND SELECTION OF MATERIALS

9

Introduction to engineering materials – Properties of materials: physical, chemical, thermal, mechanical and electrical properties – Methods to choose process materials relevant for a chemical plants.

UNIT II: METALS AND ALLOYS

9

Phase diagrams: principles and types of phase diagrams – iron carbon equilibrium phase diagram –TTT and CCT diagrams: pearlitic, martensitic, and bainitic transformations. Various heat treatment processes and hardenability of steels – Hot working and cold working of metals – Recovery, recrystallization and grain growth phenomenon. Metals: Making, shaping and treating processes associated with Iron, steel, Aluminum, Aluminum alloys, Copper, Copper alloys, Nickel alloys, Chromium alloys and Titanium alloys – Case study.



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UNIT III: POLYMERS: NATURAL AND SYNTHETIC

9

Polymers – Rubber and other natural elastomers – Properties and uses of synthetic polymers such as poly vinyl chloride (PVC), polyesters, nylon, teflon – Properties and uses of natural fibers like silk, jute, cotton and other synthetic fibers.

UNIT IV: CERAMICS AND REFRACTORIES

9

Introduction – Classification, manufacture and properties of refractive materials – Constituents and applications of silica, alumina, tar-dolomite and other special refractories such as glasses – Constituents of cement.

UNIT V: NEW MATERIALS

9

Composites: Classification, types of matrix and reinforcement materials – Processing methods. Smart materials: piezoelectric, electrostrictive, fibre optics and shape memory alloys – Applications of New Materials.

CONTACT PERIODS:

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

TEXTBOOKS:

1. O.P. Khanna, "A Textbook of Material Science and Metallurgy", 2nd Edition, Dhanpat Rai Publications, New Delhi, 2014.
2. W.D. Callister Jr., "Materials Science and Engineering", 10th Edition, John Wiley & Sons, 2020.
3. V. Raghavan, "Physical Metallurgy: Principles and Practice", 3rd Edition, PHI Learning, 2015.

REFERENCES:

1. Sidney Avner, "Introduction to Physical Metallurgy", 2nd Edition, McGraw Hill Education, 2017
2. W.C. Richards, "Engineering Materials Science", 1st Edition, Literary Licensing, LLC, 2012.

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SEMESTER III

U25CH303	Mechanical Operations	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- Introduce the fundamental principles governing the behavior and mechanical handling of solid particles in chemical engineering operations.
- Develop an understanding of particle characterization methods, size analysis, and screening techniques used in process industries
- Incorporate exposure to modern, automated, and advanced mechanical operation technologies used in chemical, mineral and pharma industries.

COURSE OUTCOMES:

- CO 1:** Particle characterization methods and screening principles to determine the properties and size distribution of solid particles. **Apply**
- CO 2:** Size reduction laws and equipment selection principles to estimate energy requirements for crushing, grinding, and size enlargement operations. **Apply**
- CO 3:** Settling, sedimentation, and separation principles to evaluate the performance of solid-fluid separation processes. **Apply**
- CO 4:** Filtration mechanisms and operating parameters affecting the performance of filtration and other mechanical separation systems. **Analyze**
- CO 5:** Mixing, agitation, and solid handling systems for the selection and optimization of industrial processing operations. **Analyze**

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	1	1	1	1	1	2	2
CO 2	3	2	2	2	2	1	1	1	1	1	1	2	2
CO 3	3	2	2	2	2	1	1	1	1	1	1	2	2
CO 4	3	2	2	2	2	1	1	1	1	1	1	2	2
CO 5	3	3	3	3	3	1	1	1	1	1	1	2	2

SYLLABUS:

UNIT I: CHARACTERISTICS OF SOLIDS

9

Particle shape, size, sphericity, surface area – Particle size analysis – Screening principles, screen types, capacity and efficiency – Powder flowability – Laser diffraction, dynamic image analysis, AI-assisted particle classification, digital PSD analysis.

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UNIT II: SIZE REDUCTION AND SIZE ENLARGEMENT

9

Laws of size reduction: Kick, Rittinger, Bond – Energy and power relationships – Crushers, grinders, ball mills, ultrafine mills – Principles of granulation, pelletization, flocculation – Cryogenic grinding, jet milling, nano-size reduction, high-pressure homogenization.

UNIT III: SETTLING AND SEPARATION PROCESSES

9

Settling of particles – Free and hindered settling – Sedimentation and thickening – Elutriation – Centrifugal separation – Cyclones and hydrocyclones – Electrostatic and magnetic separation – Flotation and jigging- CFD-based separation design.

UNIT IV: FILTRATION AND OTHER MECHANICAL SEPARATIONS

9

Filtration theory – Flow through filter cake and filter medium – Compressible and incompressible cakes – Batch and continuous filtration – Filtration equipments – Filter aids – Clarifiers, thickeners, membrane filtration, ultrafiltration and nano filtration – PLC-controlled automatic filters, high-solids filtration technologies.

UNIT V: MIXING, AGITATION AND SOLID HANDLING SYSTEMS

9

Mixing of liquids and solids – Types of mixers and agitators – Selection criteria – Power requirement and impeller types – Storage of solids – CFD-based mixing analysis – smart conveying systems

CONTACT PERIODS:

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

TEXTBOOKS:

1. McCabe, W.L., Smith, J.C. & Harriott, P. Unit Operations in Chemical Engineering, 7th Edition, McGraw-Hill, 2005
2. Coulson, J.M. & Richardson, J.F. Chemical Engineering – Volume 2: Particle Technology & Separation Processes, 6th Edition, Butterworth-Heinemann, 2020.
3. Brown, T.M. Powder Handling and Processing, Chapman & Hall, 1998.

REFERENCES:

1. Foust, A. S., Wenzel, L.A., Clump, C.W., Naus, L., and Anderson, L.B., "Principles of Unit Operations", 2nd Edition, Wiley (Reprint), 2017
2. Hiroaki Masuda, Kohigashitani and Hideto Yoshida, Powder Technology Handbook, 3rd Edition, CRC Press, 2013



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SEMESTER III

U25CH304	Fluid Mechanics for Chemical Engineers	Category: PCC				
		L	T	P	J	C
		3	0	2	0	4

QP PATTERN: A

COURSE OBJECTIVES:

- To develop a strong foundation in fluid properties, fluid statics, and fluid flow phenomena, enabling the analysis and solution of complex fluid mechanics problems encountered in chemical process industries.
- To apply principles of flow measurement, fluid transportation, and fluid machinery using analytical methods and modern simulation tools for process design and performance evaluation.
- To investigate internal and external fluid flow systems, including pipe networks and multiphase flow operations, through computational techniques, and engineering problem solving approaches.

COURSE OUTCOMES:

- CO 1:** Explain and evaluate fundamental fluid mechanics concepts, fluid properties, and flow behavior relevant to **Understand** chemical engineering applications and complex engineering systems.
- CO 2:** Apply fluid statics and fluid dynamics principles to analyze pressure distribution, fluid forces, and flow characteristics in compressible and incompressible fluid systems using analytical and computational approaches. **Apply**
- CO 3:** Formulate and solve complex internal and external viscous flow problems involving pipe flow, boundary layers, and pressure losses through computational techniques **Apply**
- CO 4:** Analyze the performance of flow measurement devices, pumps, compressors, and fluid transportation systems using engineering calculations and modern process simulation tools. **Analyze**
- CO 5:** Integrate dimensional analysis, similarity principles, and computational modeling techniques to design, scale-up, and optimize fluid flow systems for chemical process applications. (Ana **Analyze**

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	1	1	1	1	1	3	3
CO 2	3	3	3	3	3	1	1	1	1	1	1	3	3
CO 3	3	3	3	3	3	1	1	1	1	1	1	3	3
CO 4	3	3	3	3	3	1	1	1	1	1	1	3	3
CO 5	3	3	3	3	3	1	1	1	1	1	1	3	3

SYLLABUS:

UNIT I: INTRODUCTION

9 + 6

Introduction: Nature of fluids – Thermodynamic properties of a fluid – Types of fluids – Newton's law of viscosity – Newtonian and Non-Newtonian fluids – Basic elements of fluid flow: streamline – Streakline and pathline – Laminar and turbulent flows. Introduction to units and dimensions – CFD visualization of Flow Patterns.



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UNIT II: FLUID STATICS AND FLUID FLOW**9 + 6**

Fluid Statics – Equilibrium of a fluid element – Pressure variation in a static fluid – Manometers – Fluid Flow – Differential analysis of fluid motion – Continuity equation – Bernoulli equation – Computational verification of Bernoulli equation through Google spreadsheet.

UNIT III: FLUID FLOW: INTERNAL AND EXTERNAL**9 + 6**

Internal viscous flow through pipes: Reynolds number regimes – Boundary layer growth into a fully developed flow – Pressure drop under laminar and turbulent condition – Hagen-Poiseuille relation – Friction factor – Major and minor losses due to pipe fittings. Boundary layer thickness in laminar and turbulent flow – Drag and drag coefficient – Pressure loss estimation in a chemical plant piping network using MATLAB.

UNIT IV: FLOW MEASUREMENT AND TRANSPORTATION**9 + 6**

Flow measurement – Ergun Equation – Minimum fluidization velocity – Fluidization types and pneumatic conveyors – Valves – Pumps – Suction – Cavitation – Net positive suction head – Compressors and fans – Pump System Optimization.

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

Dimensional analysis – Principle of dimensional homogeneity – Rayleigh method – Buckingham pi theorem – Similarity analysis – Types of similarities and use of dimensional analysis for scale-up studies – Scale-up of mixing tanks from laboratory to industrial scale.

LIST OF EXPERIMENTS

1. Drag studies on falling spherical particle
2. Calibration of constant head flow meters
3. Calibration of variable head flow meters
4. Calibration of weirs and notches
5. Pressure drop for flow through straight pipe
6. Pressure drop for flow through helical and spiral coil
7. Losses in pipe fittings and valves
8. Characteristic curves of pumps (centrifugal / gear / reciprocating)
9. Pressure drop in packed bed column
10. Pressure drop in fluidized bed

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

1. Noel de Nevers, "Fluid Mechanics for Chemical Engineers", 4th Edition, McGraw Hill, 2019.
2. McCabe, Smith and Harriot, "Unit Operations in Chemical Engineering", 7th Edition, McGraw Hill, 2022..

REFERENCES:

1. White F.M., "Fluid Mechanics", 9th Edition, McGraw Hill, 2021
2. Munson, Young, Okiishi, "Fundamentals of Fluid Mechanics", 9th Edition, Wiley, 2021.
3. James Wilkes and Stacy G Bike, "Fluid Mechanics for Chemical Engineers", 2nd Edition, Prentice Hall 1999.

SEMESTER III

U25CH305	Artificial Intelligence for Process Engineers	Category: PCC				
		L	T	P	J	C
		2	0	0	2	3

QP PATTERN: A

PRE-REQUISITES:

- U25CH201 - Python Programming

COURSE OBJECTIVES:

- To provide a brief overview of foundation aspects of data analysis, Artificial Intelligence (AI) and Machine Learning in chemical engineering
- To educate the students about utilization of AI, ML and DL in process engineering
- To provide an exposure to real-life use cases where data analysis, machine learning and artificial intelligence are utilized in chemical engineering

COURSE OUTCOMES:

CO 1: Discuss the evolution of AI and types of AI

Understand

CO 2: Apply the principles of data analysis for deriving insights from data

Apply

CO 3: Apply the algorithms for classification, regression and optimization problems

Apply

CO 4: Describe the foundation aspects of supervised and unsupervised learning

Understand

CO 5: Utilize the concepts of AI for elementary chemical engineering problems

Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: INTRODUCTION

6 + 6

Definition of AI, Difference between AI, ML and DL, Comparison of AI and traditional software tools, Evolution of AI, Types and categories of AI, Need for Natural Language Processing and Large Language Models, Future of AI – Gen AI and Agentic AI

UNIT II: DATA ANALYSIS FOR AI

6 + 6

Data types – Structured, Unstructured, semi-structured data, Process of Data Analysis – Data collection, cleaning, exploration, visualization, Feature extraction, Feature engineering, Principal Component Analysis



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UNIT III: ALGORITHMS IN AI

6 + 6

Classification Algorithms – Logistic Regression, Decision Trees, Support Vector Mechanism, k-Nearest Neighbors, Regression Algorithms – Linear, Polynomial, Ridge, Random Forest. Optimization Algorithms – Loss function, Gradient Descent, Adam Algorithms

UNIT IV: LEARNING AND TRAINING IN AI

6 + 6

Definition and classification of Supervised and Unsupervised learning, Model evaluation metrics for supervised learning in classification and regression, Model evaluation metrics for unsupervised learning – cluster metrics, dimensionality reduction

UNIT V: AI IN CHEMICAL ENGINEERING

6 + 6

Applications in various fields of Chemical Engineering – Predictive maintenance for equipment, Optimization of equipment, Quality control, Anomaly detection in Process industries

CONTACT PERIODS:

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

TEXTBOOKS:

1. Stuart Russell and Peter Norvig - Artificial Intelligence a Modern Approach, Prentice Hall, 2010
2. Farooq Sher, 'Artificial Intelligence in Chemical Engineering', Elsevier 2025

REFERENCES:

1. Thomas E Quantrille, Artificial Intelligence in Chemical Engineering, Academic Press, 1991
2. Michael Mavrovouniotis, Artificial Intelligence in Process Engineering, Academic Press, 2012



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SEMESTER III

U25CH306	Technical Analysis Laboratory	Category: PCC				
		L	T	P	J	C
		0	0	2	0	1

QP PATTERN: A

COURSE OBJECTIVES:

- To train students in practical skills related to wet chemical and instrumental analytical methods.
- To familiarize students with the qualitative and quantitative analysis of various categories of chemicals such as coal, ore, phenol, oil, soap, and drugs.
- To instruct students in the quantitative analysis of heavy metals (such as iron and Manganese) and environmental pollutants, including water pollutants and the determination of Chemical Oxygen Demand (COD) in water.

COURSE OUTCOMES:

- CO 1:** Perform analytical instruments such as UV-Visible spectrophotometer, viscometers, nephelometer, and bomb calorimeter for experimental measurements **Apply**
- CO 2:** Determine the composition of chemicals such as ore, drugs, oil, coal, and soap using appropriate analytical techniques **Apply**
- CO 3:** Perform qualitative and quantitative analysis for different categories of chemicals using standard laboratory procedures **Apply**
- CO 4:** Conduct calorimetric experiments to evaluate concentration and composition of substances **Apply**
- CO 5:** Apply suitable analytical methods to measure and evaluate water pollutants **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	3	1	1	2	2
CO 2	3	2	1	1	1	2	2	1	3	1	1	2	2
CO 3	3	2	1	1	1	2	2	1	3	1	1	2	2
CO 4	3	2	1	1	1	2	2	1	3	1	1	2	2
CO 5	3	2	1	1	1	2	2	1	3	1	1	2	2

LIST OF EXPERIMENTS

1. Determination of kinematic viscosity and viscosity index of Lubricating oils by using Redwood viscometer.
2. Determination of kinematic viscosity and viscosity index of Lubricating oils by using Saybolt viscometer.
3. Analysis of water (pH, turbidity, conductivity, suspended particles, COD, BOD, iron, sulphate and Residual Chlorine).
4. Determination of acid value and iodine value of oils.
5. Proximate analysis of coal.
6. Soap Analysis a. Estimation of total fatty acid b. Estimation of percentage alkali content.
7. Estimation of phenol.
8. Determination of calorific value using bomb calorimeter.
9. Estimation of Naproxen drug in tablets using pH meter.



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10. Estimation of manganese in the given sample of ore.

CONTACT PERIODS:

Lecture: - Periods

Tutorial: - Periods

Practical: 30 Periods

Project: - Periods

Total: 30 Periods

TEXTBOOKS:

1. S.M.Khopkar, "Environmental pollution analysis", 1st Edition, New age international. 2011
2. N.C Aery, "Manual of environmental analysis", 2nd Edition, Ane books. 2010

REFERENCES:

1. J.Mendham, "Text book of quantitative chemical analysis", 1st Edition, Pearson education 2008



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SEMESTER III

U25MNC02	Essence of Indian Traditional Knowledge (Common to all programmes)	Category: MNC				
		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	1
CO 2	-	2	-	1	-	-	3	-	-	-	-	1	1
CO 3	-	2	-	1	-	-	3	-	-	-	-	1	1
CO 4	-	2	-	-	-	-	-	-	-	-	-	1	1
CO 5	-	2	-	1	-	-	3	-	-	-	-	1	1

SYLLABUS:

UNIT I: INTRODUCTION TO CULTURE

5

Culture, Civilization, Culture and heritage, General characteristics of culture, Importance of culture in human 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:

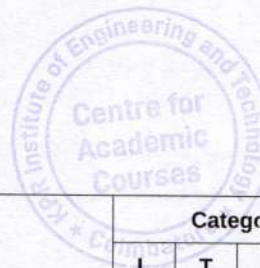
1. Kapil Kapoor, "Text and Interpretation: The India Tradition", ISBN: 81246033375, 2005.
2. "Science in Samskrit", Samskrita Bharti Publisher, ISBN: 978-8187276333, 2007.

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	-	3	3
CO 2	2	3	3	2	2	2	-	-	1	1	-	3	3
CO 3	-	-	3	-	-	2	2	3	3	3	2	3	3

GUIDELINES:

- 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

U25MA404	Partial Differential Equations for Process Engineering	Category: BSC				
		L	T	P	J	C
		2	0	2	0	3

QP PATTERN: A

PRE-REQUISITES:

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

COURSE OBJECTIVES:

- To develop analytical skills in solving boundary value problems arising in one-dimensional and two-dimensional systems using classical methods
- To introduce numerical methods for solving partial differential equations using finite difference techniques
- To enable students to apply mathematical concepts using MATLAB for simulation and visualization of physical phenomena such as heat flow and wave propagation

COURSE OUTCOMES:

CO 1:	Apply methods to form and classify partial differential equations and solve first-order partial differential equations	Apply
CO 2:	Apply analytical methods such as Lagrange's and Charpit's techniques to solve partial differential equations	Apply
CO 3:	Apply Fourier series methods to solve one-dimensional boundary value problems such as heat and wave equations	Apply
CO 4:	Apply separation of variables to solve two-dimensional heat conduction problems	Apply
CO 5:	Apply numerical methods such as finite difference techniques to solve heat and wave equations	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
CO 2	3	2	-	-	2	-	-	-	-	-	-	1	1
CO 3	3	2	-	-	2	-	-	-	-	-	-	1	1
CO 4	3	2	-	-	2	-	-	-	-	-	-	1	1
CO 5	3	2	-	-	2	-	-	-	-	-	-	1	1

SYLLABUS:

UNIT I: INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS

6 + 6

Formation of partial differential equations – Standard forms of first-order partial differential equations, singular integrals and their solutions

UNIT II: SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS

6 + 6

Lagrange's linear equation and Charpit's method – Solution of second-order homogeneous partial differential equations with constant coefficients



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UNIT III: ONE-DIMENSIONAL BOUNDARY VALUE PROBLEMS

6 + 6

Fourier series solutions – Vibration of strings, one-dimensional wave equation – One-dimensional heat flow equation

UNIT IV: TWO-DIMENSIONAL BOUNDARY VALUE PROBLEMS

6 + 6

Fourier series solutions -Two-dimensional heat flow equation (steady state, Cartesian coordinates only) – Method of separation of variables

UNIT V: NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS

6 + 6

Numerical solution of one-dimensional heat equation by Schmidt explicit and Crank–Nicolson methods–Numerical solution of one-dimensional wave equation

LIST OF EXPERIMENTS

1. Formulation of Partial Differential Equations – Formation of PDEs by eliminating arbitrary constants – Solution of first-order partial differential equations
2. Solution of Partial Differential Equations – Solution of Lagrange's linear equation – Solution of second-order homogeneous PDEs with constant coefficients (basic cases)
3. One-dimensional boundary value problems – Simulation of one-dimensional wave equation – Numerical solution of one-dimensional heat equation
4. Two-dimensional boundary value problems – Numerical solution of two-dimensional heat equation – Visualization of temperature distribution over a rectangular plate
5. Numerical solution of Partial Differential Equations – Solution of heat equation using Schmidt method – Solution of heat equation using Crank–Nicolson method

CONTACT PERIODS:**Lecture:** 30 Periods**Tutorial:** - Periods**Practical:** 30 Periods**Project:** - Periods**Total:** 60 Periods**TEXTBOOKS:**

1. Grewal, B.S., "Higher engineering Mathematics", Khanna Publishers, 2017
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India Pvt Ltd, New Delhi, 2018

REFERENCES:

1. Steven C Chapra and Raymond P Canale, "Numerical Methods for Engineers", Tata McGraw Hill, New Delhi, 2021
2. B. S. Grewal., "Numerical Methods in engineering and Science- With Programs in C, C++ and MATLAB", Khanna Publishers, 2013
3. Jain, R.K., Iyengar, S.R.K., "Advanced Engineering Mathematics", Narosa Publishing, 2019
4. Ian Sneddon, "Elements of Partial Differential Equations", Dover Publications, 2013



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SEMESTER IV

U25CH401	Chemical Engineering Thermodynamics I	Category: PCC				
		L	T	P	J	C
		3	1	0	0	4

QP PATTERN: A

COURSE OBJECTIVES:

- To illustrate zeroth law, first law and second law of thermodynamics
- To explain the thermodynamics property relations.
- To demonstrate the thermodynamic concepts to solve the problems in real time applications.

COURSE OUTCOMES:

- CO 1:** Understand the basic definitions and zeroth law of thermodynamics and apply it for suitable application Apply
- CO 2:** Apply the first law and second law of thermodynamics to perform energy balances for various closed and open chemical engineering processes Apply
- CO 3:** Predict PVT behavior and calculate thermodynamic properties of ideal and real gases using equations of state Apply
- CO 4:** Apply the thermodynamics property relations to solve the heat flow problems Apply
- CO 5:** Analyze the performance and efficiency of multi-stage compressors, refrigeration cycles, and power cycles Analyze

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: INTRODUCTION AND ZEROth LAW

9 + 3

Scope, limitations and applications of thermodynamics - Concepts of system and surroundings, control volume, state and path function, open system and closed system, equilibrium and steady state, reversibility - Energy, Heat and Work - Zeroth law and Temperature scales - Problem solving using Excel spreadsheet / C Programming / Python Programming

UNIT II: FIRST LAW AND SECOND LAW OF THERMODYNAMICS

9 + 3

Internal energy and Enthalpy - Joule's experiment and first law - First law for cyclic process, non-flow process and flow process - Concept of Entropy and relations - Entropy and heat. Entropy and temperature - Entropy and nature of process - Statements of the second law of thermodynamics - Concept of heat engine, heat pump and refrigerator - Carnot cycle and theorem - Problem solving using Excel spreadsheet / C Programming / Python Programming


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UNIT III: PVT BEHAVIOUR OF IDEAL AND REAL GASES**9 + 3**

Phase rule - Phase change of pure substance. PVT behavior of gases - mathematical and graphical representation - Polytropic process: constant volume process, constant pressure process, constant temperature process and adiabatic process - Compressibility factor and compressibility chart - Equations of state for ideal and real gases - Problem solving using C Programming or Python Programming - Problem solving using Excel spreadsheet / C Programming / Python Programming

UNIT IV: THERMODYNAMIC PROPERTY RELATIONS**9 + 3**

Helmholtz free energy, Gibbs free energy - Thermodynamic property relations - Maxwell relations - Mnemonic diagram - Clapeyron equation – Clausius-Clapeyron equation - Entropy and heat capacity Relationship - Joule-Thomson Coefficient - Gibbs-Helmholtz Equation - Problem solving using Excel spreadsheet / C Programming / Python Programming

UNIT V: COMPRESSION AND REFRIGERATION**9 + 3**

Thermodynamic aspects of compression - Adiabatic compression and isothermal compression – Multi-stage compression - Refrigeration: Vapour Compression Refrigeration Cycle and Vapor absorption cycle - Steam power plant : Rankine cycle - IC Engines: Otto cycle and Diesel cycle - Jet ejectors - Problem solving using Excel spreadsheet / C Programming / Python Programming

CONTACT PERIODS:

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

TEXTBOOKS:

1. Narayanan, K.V. A Textbook of Chemical Engineering Thermodynamics Prentice Hall India, 2013, 2e
2. Smith, J.M., Van Ness, H.C and Abbot M.M "Introduction to Chemical Engineering Thermodynamics ", McGraw Hill Publishers, VIII edition, 2018

REFERENCES:

1. Kyle, B.G., "Chemical and Process Thermodynamics III Edition", Prentice Hall of India Pvt. Ltd., 1999
2. Elliott J.R., Lira, C.T., "Introductory chemical engineering thermodynamics", Prentice Hall, 1998
3. Rao, Y.V.C., "Chemical Engineering Thermodynamics" Universities Press, 2005


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SEMESTER IV

U25CH402	Mass Transfer I	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- To understand the fundamentals of molecular and convective mass transfer.
- To apply mass transfer principles to absorption, drying, and crystallization.
- To develop ability to design mass transfer equipments.

COURSE OUTCOMES:

CO 1:	Understand the principles of molecular diffusion, multicomponent diffusion, and diffusion in solids	Understand
CO 2:	Apply mass transfer theories and evaluate convective mass transfer coefficients for counter-current and co-current flow situations	Apply
CO 3:	Design and analyse gas absorption systems using equilibrium data, operating lines, and stage/HTU-NTU methods	Analyze
CO 4:	Interpret drying mechanisms and perform drying rate and drying time calculations for batch and continuous dryers	Analyze
CO 5:	Apply crystallization principles such as supersaturation, nucleation, and crystal growth to design crystallizers	Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: MOLECULAR DIFFUSION

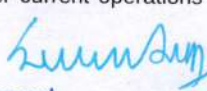
9

Overview of mass transfer operations - Diffusion velocity and fluxes - Fick's laws of diffusion -, Steady-state diffusion in gases, liquids - Multicomponent diffusion - Diffusion in solids - molecular, Knudsen, and pore diffusion - Diffusivity measurement and empirical correlations - gases - liquids

UNIT II: CONVECTIVE MASS TRANSFER & INTERPHASE TRANSFER

9

Mass transfer coefficients - local, individual, overall, Dimensionless groups and empirical correlations - Eddy diffusion and turbulent mass transfer - Theories of mass transfer - Film, penetration, surface renewal - Analogies - Interphase mass transfer and equilibrium, two film theory, overall mass transfer coefficients - Co-current and counter current operations - equilibrium and operating line concept - Stage-wise and differential contactors


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UNIT III: GAS ABSORPTION

9

Fundamentals of absorption - equilibrium curves - Operating lines from material balances - Number of equilibrium stages - Kremser Equation, Stage efficiency and column performance - Trayed and packed columns - Rate based methods for packed columns (HTU, NTU)

UNIT IV: DRYING

9

Drying – Mechanism, equilibria, rate curves, critical and falling rate periods, drying time estimation - Drying Equipment, Batch drying-material and energy balance - Process design of dryers - Material and energy balances in direct dryers

UNIT V: CRYSTALLIZATION

9

Theory of solubility and crystallization - phase diagram (temp/solubility relationship) - Crystal geometry - Solid-liquid equilibrium, Supersaturation generation - Nucleation types - Crystal growth mechanisms and laws - Heat and material balances in crystallizers - Equipment - Batch and continuous crystallizers

CONTACT PERIODS:

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

TEXTBOOKS:

1. Treybal, R. E. (1981). Mass transfer operations (3rd ed.). McGraw-Hill.
2. Geankoplis, C. J. (2003). Transport processes and separation process principles (4th ed.). Pearson Education.
3. McCabe, W. L., Smith, J. C., & Harriott, P. (2005). Unit operations of chemical engineering (7th ed.). McGraw-Hill

REFERENCES:

1. Richardson, J. F., Harker, J. H., & Backhurst, J. R. (2002). Coulson & Richardson's chemical engineering: Vol. 2. Particle technology and separation processes (5th ed.). Butterworth-Heinemann
2. Dutta, B. K. (2007). Principles of mass transfer and separation processes (1st ed.). Prentice-Hall of India.
3. Seader, J. D., Henley, E. J., & Roper, D. K. (2011). Separation process principles: Chemical and biochemical operations (3rd ed.). Wiley.



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SEMESTER IV

U25CH403	Process Heat Transfer	Category: PCC				
		L	T	P	J	C
		3	0	2	0	4

QP PATTERN: A

PRE-REQUISITES:

- U25CH301 - Process Calculations
- U25CH304 - Fluid Mechanics for Chemical Engineers

COURSE OBJECTIVES:

- To explain the fundamental mechanisms of conduction, convection, and radiation heat transfer processes
- To determine heat-transfer coefficients using empirical correlations for convection, boiling, and condensation operations
- To calculate heat transfer area and effectiveness of heat exchangers using LMTD and NTU methods
- To conduct heat-transfer experiments and interpret the resulting data to validate theoretical principles

COURSE OUTCOMES:

- CO 1:** Solve steady-state heat conduction problems for systems such as bricks, tanks, pipes and insulation layers. **Apply**
- CO 2:** Determine heat transfer coefficients for convective systems using empirical equations and analogies. **Apply**
- CO 3:** Calculate heat transfer coefficient for phase change processes such as boiling, condensation and evaporation. **Apply**
- CO 4:** Analyze the performance of double pipe and shell and tube heat exchangers using LMTD and effectiveness-NTU methods. **Analyze**
- CO 5:** Compute radiative heat transfer between surfaces using fundamental radiation laws. **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	-	3	3
CO 2	3	2	1	1	1	-	-	-	1	1	-	3	3
CO 3	3	2	1	1	1	-	-	-	1	1	-	3	3
CO 4	3	3	2	2	1	-	-	-	1	1	-	3	3
CO 5	3	2	1	1	1	-	-	-	1	1	-	3	3

SYLLABUS:

UNIT I: CONDUCTION

9 + 6

Introduction - Modes of heat transfer – Conduction – Fourier's Law – Thermal conductivity – One dimensional steady state heat conduction through plane and composite walls, hollow cylinder and spheres – Critical thickness of insulation – Fundamental concepts in extended surfaces heat transfer - Transient heat conduction.



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UNIT II: CONVECTION**9 + 6**

Types of convection - Natural and forced convection – Thermal boundary layer – Individual and Overall heat transfer coefficient – Dimensional analysis in heat transfer – Analogies between transfer of momentum and heat – Reynold's analogy – Prandtl analogy – Colburn analogy - Empirical equations for calculation of heat transfer coefficients in pipes.

UNIT III: HEAT TRANSFER WITH PHASE CHANGE**9 + 6**

Heat Transfer to fluids with phase change – Heat transfer from condensing vapours - Drop wise and film wise condensation – Heat transfer to boiling liquids – Mechanism of boiling – Nucleate and film boiling – Evaporator – Single and multiple effect operations – Material and Energy balance in evaporators – Boiling point elevation – Duhring's rule – Capacity and Economy of an evaporator.

UNIT IV: HEAT EXCHANGERS**9 + 6**

Heat Exchangers – Classification – LMTD – Fouling factor – Heat transfer area calculations for double pipe and shell and tube heat exchangers – Effectiveness NTU method.

UNIT V: RADIATION**9 + 6**

Introduction to radiation heat transfer - Black body radiation and laws - Kirchhoff's Law - Stefan-Boltzmann law - Planck's law – Radiation between surfaces - Configuration factor - Radiation shield.

LIST OF EXPERIMENTS

1. Calculation of the thermal conductivity of insulating powder
2. Study of thermal conductivity measurement using a guarded hot plate
3. Determination of the overall heat transfer coefficient using a pin-fin apparatus
4. Determination of the overall heat transfer coefficient of a helical-coil heat exchanger
5. Study of the performance of a vertical condenser
6. Study of the performance of a horizontal condenser
7. Determination of the overall heat transfer coefficient of an open-pan evaporator
8. Study of the performance of a single-effect evaporator
9. Determination of the overall heat transfer coefficient of a shell-and-tube heat exchanger
10. Study of the performance of a jacketed vessel

CONTACT PERIODS:

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

TEXTBOOKS:

1. Holman, J. P. and Souvik Bhattacharyya, "Heat Transfer", 10th Edition, McGraw-Hill Education, 2017.
2. Binay K. Dutta, "Heat Transfer Principles and Applications", 2nd Edition, PHI Learning, 2023.
3. Incropera, F. P., DeWitt, D. P., Bergman, T. L., and Lavine, A. S., Fundamentals of Heat and Mass Transfer, 8th Edition, John Wiley & Sons, 2020.

REFERENCES:

1. Coulson, J. M. and Richardson, J. F., "Chemical Engineering", Vol I, 6th Edition, 2017.
2. Kern D. Q, "Process Heat Transfer", 2nd Edition, McGraw Hill Education, 2019.



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3. McCabe, W.L., Smith, J. C., and Harriot, P., "Unit Operations in Chemical Engineering", 7th Edition, McGraw-Hill Education, 2004.



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SEMESTER IV

U25CH404	Process Instrumentation	Category: PCC				
		L	T	P	J	C
		2	0	0	2	3

QP PATTERN: A

COURSE OBJECTIVES:

- To understand the characteristics of measurement systems for pressure, temperature, flow, level and composition analysis.
- To familiarize the principle, working and calibration, of measuring instruments.
- To introduce the analytical instruments for measurement of process parameter.

COURSE OUTCOMES:

- CO 1:** Illustrate various industrial instrumentation, instrument connection possibilities to process industry **Understand**
- CO 2:** Identify the appropriate pressure measuring devices or instrument for a specific application and understand the working principles and their operation. **Apply**
- CO 3:** Demonstrate the methods for measuring temperature, including the principles and functions of temperature sensors. **Understand**
- CO 4:** Select the appropriate measuring device for a flow and level measurements with their working principle and operations **Apply**
- CO 5:** Utilize the operating principles of various analytical instruments used for measuring pH, moisture content and composition **Apply**

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: INTRODUCTION TO INDUSTRIAL INSTRUMENTATION

6 + 6

Characteristics of Measurement System - Elements of instruments, static and dynamic characteristics, basic concepts and qualities of measurement Indicators, Recorders, Process switches, Alarms, Sensors, Transducers, Converters, amplifier signal conditioner, signal isolation, transmission, display, data acquisition modules, interfaces.

UNIT II: PRESSURE MEASUREMENT

6 + 6

Methods of pressure measurement, Manometers, Elastic pressure transducers, Measurement of vacuum, Force-balance pressure gauges, Electrical pressure transducers, Pressure switches, Calibration of pressure measuring instruments.


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UNIT III: TEMPERATURE MEASUREMENT**6 + 6**

Temperature scales, Methods of temperature measurement, Thermocouples, Bimetallic thermometers, Liquid-in-glass, Pressure thermometer, Semiconductor sensors, Digital thermometers, Pyrometers.

UNIT IV: FLOW AND LEVEL MEASUREMENT**6 + 6**

Methods of flow measurement, Inferential flow measurement, Quantity flowmeters, Mass flowmeters, Positive displacement flow meters, Calibration of flowmeters, Selection of flowmeters - Methods of liquid level measurement, Direct methods, level measurement in pressure vessels, measurement of interface level, level of dry materials.

UNIT V: COMPOSITION ANALYSIS**6 + 6**

Composition analysis - Gas analysis by thermal conductivity, analysis of moisture in gases (humidity); psychrometer method, hygrometer method, dew point method for moisture analysis in gases, measurement of moisture in solids; pH measurement; Gas analysis by thermal conductivity, polarography & chromatography; Composition analysis using spectroscopic methods.

LIST OF PROJECTS

1. Calculation of the thermal conductivity of insulating powder.
2. Study of thermal conductivity measurement using a guarded hot plate.
3. Determination of the overall heat transfer coefficient using a pin-fin apparatus.
4. Determination of the overall heat transfer coefficient of a helical-coil heat exchanger.
5. Study of the performance of a vertical condenser.
6. Study of the performance of a horizontal condenser.
7. Determination of the overall heat transfer coefficient of an open-pan evaporator.
8. Study of the performance of a single-effect evaporator.
9. Determination of the overall heat transfer coefficient of a shell-and-tube heat exchanger.
10. Study of the performance of a jacketed vessel.

CONTACT PERIODS:**Lecture:** 30 Periods**Tutorial:** - Periods**Practical:** - Periods**Project:** 30 Periods**Total:** 60 Periods**TEXTBOOKS:**

1. D.P. Eckman, Industrial Instrumentation, CBS Publishers & Distributors Pvt. Ltd., 2004.
2. Gregory S. Patience, Experimental Methods and Instrumentation for Chemical Engineers, Elsevier Science Ltd., 1st Edition, 2013.
3. D. Patranabis, Principles of Industrial Instrumentation, 2nd Edition, Tata McGraw Hill Publishing Company, New Delhi, 1999.
4. E. J. Wightman, Instrumentation in Process Control, Butterworth-Heinemann, 1st Edition, 2017.

REFERENCES:

1. William C. Dunn, Fundamentals of Industrial Instrumentation and Process Control, 1st Edition, Tata McGraw-Hill Education Private Limited, 2009.
2. Ernest O. Doebelin, "Measurements systems Application & design", McGraw Hill Publishing, 1990.



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SEMESTER IV

U25CH405	Mechanical Operations Laboratory	Category: PCC				
		L	T	P	J	C
		0	0	2	0	1

QP PATTERN: A

COURSE OBJECTIVES:

- To calibration of the units
- To determine the Elutriator Characteristics
- To find the size separation of Sub - Sieving

COURSE OUTCOMES:

CO 1:	Sieve and sub-sieving techniques to determine particle size distribution and size separation characteristics.	Apply
CO 2:	Filtration principles to evaluate the performance of leaf filters and plate-and-frame filter presses.	Apply
CO 3:	Size reduction concepts to determine the reduction ratio and operational performance of crushers and mills.	Apply
CO 4:	Compare Filtration and separation	Analyze
CO 5:	Determine characteristic of Elutriator	Evaluate

CO - PO MAPPING:

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

LIST OF EXPERIMENTS

1. Determine the particle size distribution of solid particles using sieve analysis.
2. Perform size separation of fine particles using a sub-sieving apparatus.
3. Conduct batch filtration studies using a leaf filter and evaluate filtration performance.
4. Conduct batch filtration studies using a plate-and-frame filter press and determine filtration characteristics.
5. Determine the settling characteristics of particles through batch sedimentation studies.
6. Determine the reduction ratio of solid particles using a jaw crusher.
7. Determine the reduction ratio of solid particles using a ball mill.
8. Evaluate the separation characteristics and efficiency of a cyclone separator.
9. Determine the specific surface area of particulate solids using an air permeability apparatus.
10. Determine the separation characteristics and performance of an elutriator.

CONTACT PERIODS:

Lecture: - Periods

Tutorial: - Periods

Practical: 30 Periods

Project: - Periods

Total: 30 Periods

TEXTBOOKS:

1. McCabe, W.L., Smith, J.C. & Harriott, P. Unit Operations in Chemical Engineering, 7th Edition, McGraw-Hill, 2005.
2. Coulson, J.M. & Richardson, J.F. Chemical Engineering – Volume 2: Particle Technology & Separation Processes, 6th Edition, Butterworth-Heinemann, 2020.
3. Brown, T.M. Powder Handling and Processing, Chapman & Hall, 1998.

REFERENCES:

1. Foust, A. S., Wenzel, L.A., Clump, C.W., Naus, L., and Anderson, L.B., "Principles of Unit Operations", 2nd Edition, Wiley (Reprint), 2017.
2. Hiroaki Masuda, Kohigashitani and Hideto Yoshida, Powder Technology Handbook, 3rd Edition, CRC Press, 2013
3. A. Rushton, A.S. Ward, R.G. Holdich, Solid–Liquid Filtration and Separation Technology, 2nd Edition, Wiley-VCH, 2017



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SEMESTER IV

U25MNC03	Indian Constitution (Common to all programmes)	Category: MNC				
		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	1
CO 2	-	-	-	-	-	1	2	3	-	-	-	-	-
CO 3	-	-	-	-	-	1	2	3	-	-	-	-	-
CO 4	-	-	-	-	-	1	2	3	-	-	-	-	-
CO 5	-	-	-	-	-	1	2	3	-	-	-	-	-

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 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	-	3	3
CO 2	2	3	3	3	2	2	-	-	1	1	-	3	3
CO 3	-	-	3	-	-	2	2	3	3	3	2	3	3

GUIDELINES:

- 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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