



Learn Beyond

**KPR Institute of
Engineering and
Technology**

(Autonomous, Affiliated to Anna University)

CURRICULUM AND SYLLABI REGULATIONS – 2025

**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)



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- PO5:** Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems (WK2 and WK6)
- PO6:** The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment (WK1, WK5, and WK7)
- PO7:** Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws (WK9)
- PO8:** Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/ multi-disciplinary teams
- PO9:** Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
- PO10:** Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments
- PO11:** Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change (WK8)

Knowledge and Attitude Profile (WK)

- WK1:** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences
- WK2:** Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline
- WK3:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline
- WK4:** Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline
- WK5:** Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area
- WK6:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline
- WK7:** Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development
- WK8:** Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues
- WK9:** Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes

V. Program Specific Outcomes (PSOs)

Graduates of the 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


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Following three levels of correlation should be used:

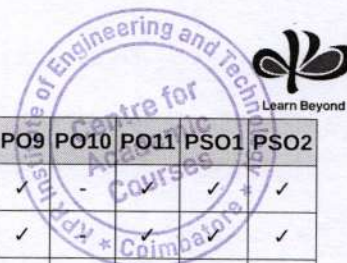
- 1: Low
2: Medium
3: High



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	English Proficiency I	-	-	-	-	-	-	-	✓	✓	-	✓	✓	✓
	Matrices and Calculus	✓	✓	-	✓	✓	-	-	-	-	-	-	✓	✓
	Engineering Physics	✓	✓	✓	✓	-	-	-	-	-	-	-	✓	✓
	Engineering Chemistry	✓	✓	✓	✓	-	-	-	✓	✓	-	✓	✓	✓
	Problem Solving using C	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓
	Digital Technologies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Elements of Mechanical Engineering	✓	✓	-	-	-	✓	-	-	-	-	-	✓	✓
	Introduction to Chemical Engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Chinese for Engineers - I	-	-	-	-	-	-	-	✓	✓	-	✓	✓	✓
	French for Engineers - I	-	-	-	-	-	-	-	✓	✓	-	✓	✓	✓
	Japanese for Engineers - I	-	-	-	-	-	-	-	✓	✓	-	✓	✓	✓
	Hindi for Engineers - I	-	-	-	-	-	-	-	✓	✓	-	✓	✓	✓
	German for Engineers - I	-	-	-	-	-	-	-	✓	✓	-	✓	✓	✓
	Induction Program - Universal Human Values I	-	-	-	-	-	✓	✓	✓	-	-	✓	✓	✓
	Heritage of Tamils	-	-	-	-	-	-	✓	✓	-	✓	-	✓	✓
	Design Thinking	✓	✓	✓	✓	-	-	-	-	✓	✓	✓	✓	✓
	Biology for Engineers	✓	✓	✓	✓	-	-	-	✓	✓	✓	✓	✓	✓
	Computer Fundamentals and Coding Essentials	✓	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	✓
	English Proficiency II	-	-	-	-	-	-	-	✓	✓	-	✓	✓	✓
II	Mathematical Transforms	✓	✓	-	✓	✓	-	-	-	-	-	-	✓	✓
	Materials Science	✓	✓	✓	✓	-	-	-	-	-	-	-	✓	✓
	Environmental Science and Sustainability	✓	✓	✓	✓	-	-	✓	✓	✓	-	✓	✓	✓
	Python Programming	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Basics of Electrical and Electronics Engineering	✓	✓	✓	-	-	-	✓	✓	✓	-	✓	✓	✓
	Engineering Graphics	✓	✓	-	-	✓	-	✓	✓	✓	-	✓	✓	✓
	Chinese for Engineers - II	-	-	-	-	-	-	-	✓	✓	-	✓	✓	✓



Sem	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
	Hindi for Engineers - II	-	-	-	-	-	-	-	✓	✓	-	✓	✓	✓
	French for Engineers - II	-	-	-	-	-	-	-	✓	✓	-	✓	✓	✓
	Japanese for Engineers - II	-	-	-	-	-	-	-	✓	✓	-	✓	✓	✓
	German for Engineers - II	-	-	-	-	-	-	-	✓	✓	-	✓	✓	✓
	Universal Human Values II	-	-	-	-	-	-	-	✓	✓	-	✓	✓	✓
	Tamils and Technology	-	-	-	-	-	-	✓	✓	-	✓	-	✓	✓
	Design Thinking	✓	✓	✓	✓	-	-	-	-	✓	✓	✓	✓	✓
	Biology for Engineers	✓	✓	✓	✓	-	-	-	✓	✓	✓	✓	✓	✓
	Computer Fundamentals and Coding Essentials	✓	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	✓
III	Probability and Statistics	✓	✓	-	-	✓	-	-	-	-	-	-	✓	✓
	Process Calculations	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Engineering Materials	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Mechanical Operations	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Fluid Mechanics for Chemical Engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Artificial Intelligence for Process Engineers	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓
	Technical Analysis Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Essence of Indian Traditional Knowledge	-	✓	-	✓	-	-	✓	-	-	-	-	✓	✓
	Professional Skill Development - I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
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 - II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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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	U25ENG01	English Proficiency I	HSMC	L	-	-	2	-	1
2	U25MA102	Matrices and Calculus	BSC	TwL	2	-	2	-	3
3	U25PH101	Engineering Physics	BSC	TwL	2	-	2	-	3
4	U25CY103	Engineering Chemistry	BSC	TwL	2	-	2	-	3
5	U25CSG02	Problem Solving using C	ESC	TwL	2	-	2	-	3
6	U25CSG03	Digital Technologies	ESC	T	1	-	-	-	1
7	U25MEG01	Elements of Mechanical Engineering	ESC	TwL	1	-	2	-	2
8	U25CH101	Introduction to Chemical Engineering	PCC	TwL	2	-	2	-	3
9	U25LEG01	German for Engineers - I	HSMC	TwL	1	-	2	-	2
	U25LEG02	Japanese for Engineers - I							
	U25LEG03	French for Engineers - I							
	U25LEG04	Hindi for Engineers - I							
	U25LEG09	Chinese for Engineers - I							
Total									21
MANDATORY CREDIT COURSES (MCC - Non CGPA) / MANDATORY NON-CREDIT COURSES (MNC)									
10	U25MCC01	Induction Program - Universal Human Values I	MCC	MCC	2	1	-	-	3
11	U25MCC02	Heritage of Tamils	MCC	Tamil Courses	1	-	-	-	1
12	U25MCC03	Design Thinking	MCC	MCC	1	-	2	-	2
	U25MCC04	Computer Fundamentals and Coding Essentials @							
	U25MCC05	Biology for Engineers \$							
Total									6

\$ - For Non-Biology Students, @ - For Biology Students

SEMESTER II

No	Course Code	Title	Category	Type	L	T	P	J	C
1	U25ENG02	English Proficiency II	HSMC	L	-	-	2	-	1
2	U25MA204	Mathematical Transforms	BSC	TwL	2	-	2	-	3
3	U25PH204	Materials Science	BSC	TwP	2	-	-	2	3
4	U25CY201	Environmental Science and Sustainability	BSC	TwL	1	-	2	-	2
5	U25CH201	Python Programming	PCC	TwL	2	-	4	-	4
6	U25EEG02	Basics of Electrical and Electronics Engineering	ESC	TwL	1	-	2	-	2
7	U25MEG03	Engineering Graphics	ESC	L	-	-	4	-	2



No	Course Code	Title	Category	Type	L	T	P	J	C
8	U25LEG05	German for Engineers - II	HSMC	TwL	1	-	2	-	2
	U25LEG06	Japanese for Engineers - II							
	U25LEG07	French for Engineers - II							
	U25LEG08	Hindi for Engineers - II							
	U25LEG10	Chinese for Engineers - II							
Total									19
MANDATORY CREDIT COURSES (MCC - Non CGPA) / MANDATORY NON-CREDIT COURSES (MNC)									
9	U25MCC06	Universal Human Values II	MCC	MCC	2	1	-	-	3
10	U25MCC07	Tamils and Technology	MCC	Tamil Courses	1	-	-	-	1
11	U25MCC03	Design Thinking	MCC	MCC	1	-	2	-	2
	U25MCC04	Computer Fundamentals and Coding Essentials @							
	U25MCC05	Biology for Engineers \$							
Total									6

\$ - For Non-Biology Students, @ - For Biology Students

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	U25MCC08	Professional Skill Development - I	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

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No	Course Code	Title	Category	Type	L	T	P	J	C
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	U25MCC09	Professional Skill Development - II	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

U25ENG01	English Proficiency I (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		0	0	2	0	1

QP PATTERN: A

COURSE OBJECTIVES:

- Comprehend technical vocabulary
- Apply reading strategies to understand academic and professional texts

COURSE OUTCOMES:

CO 1: Comprehend technical and professional documents using vocabulary and strategies

Remember

CO 2: Evaluate the understanding from technical reports and case studies

Understand

CO - PO MAPPING:

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

LIST OF EXPERIMENTS

1. Contextual lexicon – Discourse markers – Strategies for reading – Read aloud: stress and intonation – Interpretive Reading and narrative analysis – Critical reading of abstracts and conclusions from research articles / magazines / blogs
2. Newspaper: Opinions, Editorials and Columns – Short Story: The Bet – Anton Chekhov – Science Fiction: Never Let Me Go – Kazuo Ishiguro
3. Reading Standard Operating Procedures (SOPs) – Manuals – Case Studies (Field Work) Evaluation – Sustainability Practices in Industry: A Case Study – Biographies of Popular Engineers and Inventors – Success Stories of Start-ups and Entrepreneurs

CONTACT PERIODS:

Lecture: - Periods

Tutorial: - Periods

Practical: 30 Periods

Project: - Periods

Total: 30 Periods

TEXTBOOKS:

1. Meenakshi Raman and Sangeeta Sharma, "Technical Communication: Principles and Practice", 3rd Edition, Oxford University Press, 2015
2. Debra Daise and CharlNorloff, "Q Skills for Success: Q: Skills for Success: Reading and Writing, Level 4", 3rd Edition, Oxford University Press, 2019

REFERENCES:

1. Sudharshana N P and Savitha C, "English for Technical Communication", 1st edition, Cambridge University Press, 2016
2. Thomas L. Means, "English and Communication for Colleges", 4th Edition, Cengage India Private Limited, 2017


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SEMESTER I

U25MA102	Matrices and Calculus (Common to CE, CH, ME, MI)	Category: BSC				
		L	T	P	J	C
		2	0	2	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- To build competence in using matrices for solving systems and modeling physical systems
- To apply techniques of calculus for engineering analysis involving rates of change, motion, and area/volume estimation
- To interpret real-world problems in terms of calculus and matrix methods for design and analysis

COURSE OUTCOMES:

- CO 1:** Solve engineering problems involving systems of equations and matrix-based methods **Apply**
- CO 2:** Use differential calculus to solve and optimize engineering processes **Apply**
- CO 3:** Apply integration techniques to find areas and volumes in engineering models **Apply**
- CO 4:** Interpret physical scenarios like motion and system changes using calculus concepts **Apply**
- CO 5:** Understand and apply concepts of matrix transformations and characteristic values to engineering models such as vibrations and stability **Understand**

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: MATRIX METHODS FOR ENGINEERING PROBLEMS

6 + 6

Review of matrix operations – Determinant – based methods for inverse computation – Solving systems of equations using inverse method and Cramer's rule – Applications to circuit analysis and structural systems

UNIT II: CALCULUS FOR MAXIMA MINIMA

6 + 6

Applications of Derivative in optimization: maxima and minima – Rate of change in physical systems (e.g., flow rate, motion) – Higher – order derivatives in design and behavior analysis

UNIT III: TECHNIQUES AND APPLICATIONS OF INTEGRATION

6 + 6

Definite integrals for area under curves and between curves – Volume calculation by integration (e.g., rotating objects, storage tanks) – Techniques: Substitution and integration by parts – Engineering application-based examples

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UNIT IV: CALCULUS OF DYNAMICS AND OPTIMIZATION**6 + 6**

Motion along a line: position, velocity, acceleration – Time – rate problems in machines, piping systems – Models for Improving Engineering Efficiency – Cost and Design Criteria

UNIT V: MATRIX APPLICATIONS IN SYSTEM BEHAVIOUR**6 + 6**

Matrix-based transformations in 2D/3D systems – Characteristic values (eigenvalues) and characteristic directions (eigenvectors) – Applications: Vibrations in mechanical systems, system stability in control processes

LIST OF EXPERIMENTS

1. System Solving using Matrices – Implement and solve matrix systems arising from real applications – Visualize and interpret results
2. Rate-Based and Design Improvement Modeling – Model and solve rate-based engineering problems using derivatives (e.g., fluid flow, heat transfer) – Apply calculus to optimize designs (e.g., beam dimensions, tank volume)
3. Integration for Design Computations – Estimate areas/volumes for components – Plot 2D and 3D integrated shapes
4. Motion and System Dynamics Visualization. – Plotting and Analyzing Motion – Dynamic System Simulation
5. Characteristic Value Applications – Compute eigenvalues/eigenvectors for simple systems – Apply to stability and vibration models

CONTACT PERIODS:

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

TEXTBOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley, 10th Ed., 2018
2. Gilbert Strang, Introduction to Applied Mathematics, Wellesley-Cambridge Press, 2016

REFERENCES:

1. George B. Thomas, Thomas' Calculus, Pearson, 13th Ed., 2018
2. Grewal, B.S. Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2017
3. Dennis G. Zill, Advanced Engineering Mathematics, Cengage, 2012



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SEMESTER I

U25PH101	Engineering Physics (Common to all programmes)	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:** Explain the modulus of elasticity and stress-strain behavior of materials to infer the elastic properties of **Understand** materials
- CO 2:** Examine the heat transfer in thermal systems and properties of fluids **Analyze**
- CO 3:** Apply the principles of ultrasonics in testing, imaging, and communication technologies **Apply**
- CO 4:** Estimate charge carrier transport in semiconductors and the performance of devices such as Hall effect sensors and Schottky diodes **Apply**
- CO 5:** Organise the principles of laser and fiber optics for industrial and medical applications **Apply**

CO - PO MAPPING:

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

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 in medicine – 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/noc20cy17/preview>



U25CY103	Engineering Chemistry	Category: BSC				
		L	T	P	J	C
		2	0	2	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- To describe atomic and molecular behaviour using quantum concepts and analyze organic mechanisms, functional group transformations
- To explain polymer properties, processing techniques and fundamentals of coordination chemistry
- To describe the core principles of thermodynamics, electrochemistry, kinetics and analytical techniques like spectroscopy and chromatography

COURSE OUTCOMES:

CO 1: Implement atomic and molecular principles to determine acid–base behavior and pKa values.	Apply
CO 2: Execute reaction mechanisms to determine functional group changes in organic synthesis	Apply
CO 3: Utilize polymer and coordination chemistry principles to design chemical processes and characterize materials	Apply
CO 4: Implement principles of thermodynamics, electrochemistry, and kinetics in chemical processes	Apply
CO 5: Implement surface properties, spectroscopic, and chromatographic techniques for material analysis	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: MOLECULAR STRUCTURE, BONDING AND REACTIVITY**

6 + 6

Atomic models – Wave-particle duality, deBroglie equation, Schrödinger equation (qualitative), Atomic molecular orbitals, hybridization sp , sp^2 , sp^3 , Benzene, aromaticity (Hückel's rule), Acid-base theory – Bronsted–Lowry, Lewis's acids, bases, pK_a and pK_b trends in alcohols, amines, acids, Conformational analysis – Newman, Sawhorse, Fischer projections, Stereochemistry – Chirality, optical activity, E/Z and cis/trans isomerism

UNIT II: ORGANIC CHEMISTRY AND MECHANISMS

6 + 6

Bond cleavage – Homolytic vs. heterolytic, nucleophiles and electrophiles, electrophilic (SE_1 , SE_2 , $SEAr$), nucleophilic (SN_1 , SN_2 , $SNAr$ – Nitration, Friedel Crafts, halogenation), additions, eliminations reactions, Functional group transformations (alcohol to aldehyde, aldehyde to acid, amine to diazonium, azo dye synthesis)

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UNIT III: POLYMERS AND COORDINATION CHEMISTRY**6 + 6**

Types of polymers (thermoplastics, thermosets, elastomers, tacticity, functionality, addition and condensation), properties – T_g, M_n, M_w, PDI, T_m and secondary transitions, Processing – Injection, extrusion, compression Coordination chemistry – Introduction, Crystal field theory, colour, magnetism, Organometallic complexes in catalysis (Ziegler–Natta, Wilkinson's catalyst)

UNIT IV: THERMODYNAMICS, ELECTROCHEMISTRY AND KINETICS**6 + 6**

Thermodynamics – Enthalpy, Entropy, Gibbs free energy, Clausius–Clapeyron and Maxwell relations, Electrochemistry – EMF, electrodes – Calomel and Glass electrode, fuel cells – Hydrogen–Oxygen. Phase diagrams- water system, eutectics Chemical kinetics – Rate laws, order, molecularity, steady-state approximation, Enzyme Kinetics – Michaelis-Menten Equation

UNIT V: SURFACE CHEMISTRY, SPECTROSCOPY AND CHROMATOGRAPHY**6 + 6**

Adsorption – Langmuir, Freundlich and Nernst isotherms, Colloids and micelles, zeta potential, emulsions, vesicles. contact angle, wetting / spreading. Beer- Lamberts Law, Theory and Instrumentation of UV-Vis, IR, NMR Chromatography – types, principles and applications – HPLC & GC

LIST OF EXPERIMENTS

1. Determination of pK_a of acetic acid and phenol by pH titration
2. Preparation of azo dye via diazotization coupling reaction
3. Qualitative test for acids, aldehydes, amines
4. Determination of molecular weight and degree of polymerisation of a given polymer using an Ostwald viscometer
5. Determination of rate constant of acid catalysed hydrolysis of an ester
6. EMF measurement using calomel electrode and glass electrode
7. Distribution coefficient of iodine between water and CCl₄
8. Verification of Beer-Lambert's law using UV-Vis Spectrometer/Colorimetry

CONTACT PERIODS:

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

TEXTBOOKS:

1. P. Atkins, J. de Paula and J. Keeler, "Atkins' Physical Chemistry: Thermodynamics and Kinetics", 11th edition, Oxford University Press, 2018
2. P. Y. Bruice, "Organic Chemistry", 9th edition, Pearson, 2024
3. G. Odian, "Principles of Polymerization", 4th edition, Wiley-Interscience, 2004
4. C.N. Banwell and E.M. McCash, "Fundamentals of Molecular Spectroscopy", 4th edition, McGraw-Hill, 1994

REFERENCES:

1. R.T. Morrison and R. N. Boyd, "Organic Chemistry", 7th edition, Pearson Education, 2011
2. H.H. Willard, L.L. Merritt Jr., J.A. Dean, Frank A. Settle Jr., "Instrumental Methods of Analysis", 7th edition, CBS Publishers & Distributors, 2004
3. Sunita Rattan, "Engineering Chemistry with Experiments", 8th edition, S.K. Kataria & Sons, 2023
4. J.D. Lee, "Concise Inorganic Chemistry", 5th edition, Oxford University Press, 2008

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SEMESTER I



U25CSG02	Problem Solving using C (Common to CE, CH, ME)	Category: ESC				
		L	T	P	J	C
		2	0	2	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- To provide exposure to problem-solving through programming
- To develop computational thinking perspective of one's discipline
- To write, compile and debug programs using the C language

COURSE OUTCOMES:

- CO 1:** Describe the basic organization of computers and number systems, and construct flowcharts, algorithms, Understand and pseudocode to represent solutions for real-world problems
- CO 2:** Develop C programs using variables, data types, operators, control structures, and input/output functions Apply to solve basic scientific and statistical problems
- CO 3:** Implement one-dimensional and two-dimensional arrays and perform string operations such as searching, Apply sorting, and matrix manipulations
- CO 4:** Design modular programs using functions, recursion, and pointers for efficient memory usage and Apply structured data handling
- CO 5:** Construct and manipulate programs using structures and unions to model and solve real-world problems Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: INTRODUCTION

6 + 6

Generation and Classification of Computers – Basic Organization of a Computer – Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart

UNIT II: C PROGRAMMING BASICS

6 + 6

Problem formulation – Problem Solving - Introduction to 'C' programming – Structure of a 'C' program – Compilation and linking processes – Constants, Variables – Data Types – Expressions using operators – Managing Input and Output operations – Decision Making and Branching – Looping statements – Solving simple scientific and statistical problems

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UNIT III: ARRAYS AND STRINGS**6 + 6**

Arrays – Initialization – Declaration – One-dimensional and Two-dimensional arrays. String- String operations – String Arrays.
Simple programs – sorting – searching – matrix operations

UNIT IV: FUNCTIONS AND POINTERS**6 + 6**

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers –
Definition – Initialization – Pointers arithmetic – Pointers and arrays – Example Problems

UNIT V: STRUCTURES AND UNIONS**6 + 6**

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union -
Programs using structures and Unions – Storage classes, Pre-processor directives

LIST OF EXPERIMENTS

1. Program Using Basic Input/Output and Arithmetic Expressions
2. Program to Solve a Scientific Problem using Decision Making and Looping
3. Program for Sorting Elements in a One-Dimensional Array
4. Program for Matrix Addition using Two-Dimensional Arrays
5. Program for String Manipulation using Standard String Functions
6. Program using User Defined Functions with Pass by Value and Reference
7. Program using Structures and Nested Structures
8. Program using String and Arrays for Solving Engineering Problems
9. Program using User Defined Functions for Solving Engineering Problems
10. Program using Structures for Solving Engineering Problems

CONTACT PERIODS:

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

TEXTBOOKS:

1. David D. Railey and Kenny A.Hunt , "Computational Thinking for Modern problem Solver", 1st Edition, CRC Press, 2014
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. Reema Thareja, "Programming in C", 2nd Edition, Oxford University Press, 2016
3. Paul Deitel and Harvey Deitel, "C How to Program", 7th Edition, Pearson Publication, 2015
4. Juneja, B. L and Anita Seth, "Programming in C", 1st Edition, Cengage Learning India Pvt. Ltd., 2011
5. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", 1st Edition, Oxford University Press, 2009



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SEMESTER I

U25CSG03	Digital Technologies (Common to all programmes)	Category: ESC				
		L	T	P	J	C
		1	0	0	0	1

QP PATTERN: A

COURSE OBJECTIVES:

- To explain the foundational concepts of AI, IoT, cloud, cybersecurity, and blockchain technologies
- To apply practical knowledge of OpenAI, RPA, and digital marketing strategies effectively
- To analyse interconnected smart systems, big data, and evolving digital landscapes
- To evaluate ethical implications of AI, data privacy, and societal impact of technologies

COURSE OUTCOMES:

- CO 1:** Understand the foundational concepts of AI, ML, DL, and key OpenAI generative tools Understand
- CO 2:** Explain the interplay of AI, wearables, and big data in emerging technologies like the Metaverse and Edge AI Understand
- CO 3:** Describe the key components and uses of IoT, cloud computing, and cybersecurity, including common threats Understand
- CO 4:** Interpret the core principles and practical uses of blockchain, RPA, and digital marketing strategies Understand
- CO 5:** Recognize the key concepts and applications of 3D printing, digital manufacturing, AR/VR, Metaverse, and ethical considerations in AI Understand

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

SYLLABUS:

UNIT I: MODERN ARTIFICIAL INTELLIGENCE AND OPENAI TOOLS

6

An Overview of Artificial Intelligence – Introduction to Machine Learning and Deep Learning – ChatGPT – GPT 4 – OpenAI Tools: AI Text Classifier – OpenAI Tools: Point-E – Text to Image Generator – DALL-E

UNIT II: SMART SYSTEMS AND ANALYTICS

6

Intelligent Wearables – AI and Metaverse – Edge AI / TinyML – Evolution of Big Data Analytics – Applications of Big Data Analytics


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UNIT III: IOT, CLOUD, CYBERSECURITY ESSENTIALS

6

Internet of Things – Applications of IoT – Industrial Internet of Things or IIoT – Digital Payments – Overview of Cloud Computing – Applications of Cloud Computing – Service Models in Cloud Computing – Overview of Cybersecurity – Applications of Cybersecurity – Types of Cyber Attacks – Data Privacy and User Data Control – Deepfake

UNIT IV: DIGITAL INNOVATION AND AUTOMATION

6

Evolution of Blockchain – Applications of Blockchain in Finance Industry – Impact of Blockchain on Workforce & Workplace – Getting Started with Robotic Process Automation – Applications of Robotic Process Automation in Banking & Insurance Industry – Web, Mobile Development and Marketing – 5Ds of Digital Marketing – Digital Storytelling

UNIT V: DIGITAL DESIGN AND RESPONSIBILITY

6

3D Printing Modelling – Digital Manufacturing – Augmented Reality and Virtual Reality – Pre-requisites for Augmented Reality & Virtual Reality – Metaverse – Applications of Augmented Reality – Virtual Reality in – AI Ethics – Ethical Considerations of Generative AI

CONTACT PERIODS:

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

TEXTBOOKS:

1. Faheem Syeed Masoodi, Zubair Sayeed Masoodi, Khalid Bashir Dar, "Digital and Technological Solutions: Exploring the Foundations of Digitization", 1st Edition, BPB Publications, 2024

REFERENCES:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach", 4th Edition, Pearson, 2020
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-On Approach" Universities Press, 2014
3. Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles and Practice", Addison-Wesley, 2016
4. Daniel Drescher, "Blockchain Basics: A Non-Technical Introduction in 25 Steps" Apress, 2017
5. Xiaofei Wang, Yunchuan Sun, "Edge AI: Convergence of Edge Computing and Artificial Intelligence", Wiley, 2022
6. Mark Coeckelbergh, "AI Ethics", MIT Press, 2020
7. <https://www.futureskillsprime.in/journey/digital-101-30-hours/> - Digital 101 Futureskills Prime Course by NASSCOM


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SEMESTER I

U25MEG01	Elements of Mechanical Engineering	Category: ESC				
		L	T	P	J	C
		1	0	2	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- To provide the fundamental knowledge of mechanical elements, actuation systems, and manufacturing processes essential for engineering applications
- To develop an understanding 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:** Identify the various conventional and non-conventional methods of power generation **Understand**
- CO 4:** Interpret the concepts of refrigeration and air conditioning, identify industrial safety measures, and predict CAD and simulation tools for basic engineering applications **Understand**

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: MECHANICAL ELEMENTS AND ACTUATION SYSTEMS

3 + 6

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

UNIT II: FUNDAMENTALS OF MANUFACTURING PROCESSES

4 + 9

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: ENERGY CONVERSION SYSTEMS

4 + 6

Engines – IC engines – Petrol and diesel engines, two stroke and four stroke engines – General layout of electric vehicle – Power plant – Working – Thermal power plant, nuclear power plant, gas power plant – Renewable energy – Solar, wind, tidal, OTEC


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UNIT IV: THERMAL SYSTEMS AND INDUSTRIAL SAFETY

4 + 9

Refrigeration and air conditioning – Types of refrigeration and air conditioning – Industrial safety – Personal protective equipment, safety signs, fire safety, LOTO – Introduction to CAD and simulation softwares

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. Determination of COP of a refrigeration system
9. 2D Sketching of Mechanical Components using CAD Software
10. 3D Modeling of Mechanical Components using CAD Software

CONTACT PERIODS:

Lecture: 15 Periods

Tutorial: - Periods

Practical: 30 Periods

Project: - Periods

Total: 45 Periods

TEXTBOOKS:

1. Pravin Kumar, "Basic Mechanical Engineering", 3rd Edition, Pearson Education India, 2018
2. H. S. Bawa, "Manufacturing Processes", Latest Edition, Tata McGraw-Hill Education, 2004

REFERENCES:

1. Godfrey C. Onwubolu, "Mechatronics: Principles and Applications", 1st Edition, Elsevier, 2006
2. 3. P. K. Nag, "Power Plant Engineering", 4th Edition, McGraw Hill Education, 2017


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SEMESTER I

U25CH101	Introduction to Chemical Engineering	Category: PCC				
		L	T	P	J	C
		2	0	2	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- To provide a comprehensive overview of the history, evolution, and fundamentals of Chemical Engineering
- To develop understanding of key unit operations, unit processes, design, and process control principles
- To introduce computational tools and their applications in Chemical Engineering along with industry exposure

COURSE OUTCOMES:

CO 1:	Explain the history, evolution, and scope of Chemical Engineering	Understand
CO 2:	Describe the fundamental principles of unit operations in fluid mechanics and mechanical operations	Remember
CO 3:	Describe the principles of unit operations in heat transfer and mass transfer processes	Remember
CO 4:	Describe the unit process in reaction kinetics and thermodynamics relevant to chemical engineering	Remember
CO 5:	Understand the basics of process control concepts, flow sheets development and use of computational tools/software for process industries	Understand

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

SYLLABUS:

UNIT I: INTRODUCTION

6 + 6

History of Chemical Engineering – Great Personalities of Chemical Engineering – Chemist and Chemical Engineer – Role of Chemical Engineering in this world – Major Achievements – Chemical Engineering applications in Food, Water, Agriculture, Health Care, Energy, and Environment

UNIT II: FLUID DYNAMICS AND MECHANICAL OPERATIONS

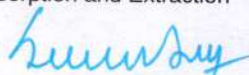
6 + 6

Units and Dimensions, Unit Conversions, Process Variables – Fluid Flow – Newton's law of Viscosity – Classification of Fluids – Transportation of Fluids – Working of Centrifugal and Piston Pumps – Mechanical Operations – Size Separation (Sieves, cyclone separator and centrifuge) and Size Reduction (laws and types)

UNIT III: HEAT TRANSFER AND MASS TRANSFER OPERATIONS

6 + 6

Heat Transfer – Modes – Conduction, Convection and Radiation – Heat Exchangers – Classifications – Basic Concepts of Mass Transfer Operations and Equipment's – Distillation, Evaporation, Absorption and Extraction


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UNIT IV: FUNDAMENTALS OF UNIT PROCESSES**6 + 6**

Classification of Chemical Reactions – Basics of Order of a Reaction, Rate Equation, and Various types of Industrial Reactors – Thermodynamics – Basics laws – Importance of Scales in Chemical Process Development: Lab, Pilot and Industrial Scales – Anatomy of Chemical Process Industries

UNIT V: BASICS OF PROCESS CONTROL, PROCESS FLOW SHEETS AND COMPUTATIONAL TOOLS**6 + 6**

Process, Instrumentation, Dynamics and Control – Basic terms, Importance, General Process Control System: Control of Temperature in Hot Water Tank System –Types of Controllers – Flow sheet development for a simple chemical process industry – Case studies on Sulfuric Acid and Soda Ash production – Use of Computational tools – MATLAB, ASPEN Plus, ANSYS CFD, SCILAB, and DWSIM

LIST OF EXPERIMENTS

1. Visit to a typical Chemical Industry
2. Visit to a typical Process Industry
3. Visit to a Typical Process Industry

CONTACT PERIODS:

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

TEXTBOOKS:

1. Badger W.L. and Banchero J.T., "Introduction to Chemical Engineering", 6th Edition, Tata McGraw Hill, 1997
2. Pushpavanam S., "Introduction to Chemical Engineering", 2nd Edition, PHI Learning, 2012
3. Ghosal S.K., Sanyal S.K., and Dutta S., "Introduction to Chemical Engineering", 4th Edition, TMH, 1998

REFERENCES:

1. McCabe W.L., Smith J.C., and Harriot P., "Unit Operations in Chemical Engineering", 7th Edition, McGraw Hill, 2001
2. Solen K.A. and Harb J.N., "Introduction to Chemical Engineering: Tools for Today and Tomorrow", 5th Edition, Wiley, 2011
3. Finlayson B.A., "Introduction to Chemical Engineering Computing", John Wiley & Sons, 5th Edition, 2006
4. Randolph Norris Shreve, George T. Austin, "Shreve's Chemical Process Industries", 5th Edition, McGraw Hill, 1984
5. Bhatt B.I. and Vora S.M., "Stoichiometry", 4th Edition, McGraw Hill, 2004



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SEMESTER I

U25LEG01	German for Engineers - I (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- Gain basic proficiency in listening, speaking, reading, and writing - understanding everyday conversations, speaking in survival situations, reading short texts, and writing simple sentences
- Acquire essential knowledge of German grammatical structures to support communication and comprehension
- Gain introductory insights into German cultural norms, practices, and everyday life

COURSE OUTCOMES:

CO 1: Acquire familiarity in the German alphabet & basic vocabulary	Understand
CO 2: Listen and identify individual sounds of German	Understand
CO 3: Use basic sounds and words while speaking	Apply
CO 4: Read and understand simple advertisements, brochures and invitations	Understand
CO 5: Use basic grammar and appropriate vocabulary in completing language tasks	Remember

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: INTRODUCTION TO GERMAN LANGUAGE AND SOUNDS

6 + 3

Alphabet and pronunciation (phonetics and name spelling) – Basic greetings and farewells – Asking for and giving personal information – Countries – Languages – Professions – Numbers (0–100) – Cultural focus: German-speaking countries

UNIT II: GRAMMAR FOUNDATIONS AND SENTENCE BUILDING

6 + 3

Formal vs. informal register: Sie vs. du – Personal pronouns: ich - du - Sie - er - sie - es – Verb conjugation in Präsens (regular and irregular) – Verbs: sein - haben (to be - to have) – Questions: wo - wer - wie - was - etc – Yes/No questions (Ja-/Nein-Fragen) – Cultural focus: Formal vs. informal speech

UNIT III: DAILY LIFE AND ROUTINES

6 + 3

Describing daily activities and routines – Talking about time – Days – Routine verbs and nouns – Grammar: Separable verbs (aufstehen - mitkommen) – Modal verbs (intro): können - müssen – Negation: nicht - kein – Cultural focus: Typical German daily schedules

UNIT IV: GRAMMAR – CASES AND STRUCTURE

6 + 3

Accusative case: articles and pronouns – Dative case: definite and indefinite articles – Grammar focus: Prepositions with dative (in, auf, bei, mit, zu) – Cultural focus: Office hours and punctuality in German culture

UNIT V: NAVIGATION AND PUBLIC INTERACTION

6 + 3

Asking for/giving directions – Describing locations and surroundings – Places in the city: Supermarkt, Bahnhof – Post – Kino – Reading and understanding public signs – Maps – Timetables – Grammar: Imperative (basic usage for giving directions) – Cultural focus: Public transportation – City services in German-speaking countries

LIST OF EXPERIMENTS

1. Prepare a family tree chart
2. Record a self-intro video
3. Describe your college
4. Presentation related to culture
5. Dialogue roleplay
6. Mock interview

CONTACT PERIODS:

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

TEXTBOOKS:

1. Buscha- A & Szita, S-Begegnungen Deutsch als Fremdsprache A1+: Integriertes Kurs- und Arbeitsbuch- 1st Edition, 2021
2. Brüseke, R., "Grammatik leicht A1," 1st Edition-2019

REFERENCES:

1. Netzwerk Deutsch als Fremdsprache A1, 1st Edition: BlueNBells, 2012
2. Huber, K., & Keller, F., "DaF kompakt A1: Deutsch als Fremdsprache," 3rd Edition, Langenscheidt, 2018



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SEMESTER I

U25LEG02	Japanese for Engineers - I (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- Gain basic proficiency in listening, speaking, reading, and writing - understanding everyday conversations, speaking in survival situations, reading short texts, and writing simple sentences
- Acquire essential knowledge of Japanese grammatical structures to support communication and comprehension
- Gain introductory insights into Japanese cultural norms, practices, and everyday life

COURSE OUTCOMES:

CO 1: Acquire familiarity in the Japanese alphabet and basic vocabulary	Understand
CO 2: Listen and identify individual sounds of Japanese	Understand
CO 3: Use basic sounds and words while speaking	Apply
CO 4: Read and understand simple advertisements, brochures and invitations	Understand
CO 5: Use basic grammar and appropriate vocabulary in completing language tasks	Remember

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: INTRODUCTION TO JAPANESE WRITING AND GREETINGS

6 + 3

Hiragana Mastery – Basic greetings & expressions – Desu (～です) – Particles: は (wa), の (no), か (ka) – Basic vocabulary: Professions, countries, school related terms – Cultural note: Bowing – Formal vs. informal speech

UNIT II: KATAKANA AND BASIC COMMUNICATION

6 + 3

Katakana Mastery – Numbers -time - and age expressions – Vocabulary: Objects, locations and daily expressions – Particles: を (wo), に (ni) - で (de) – Grammar: Arimasu / Imasu (existence) – Negation: じゃありません / ではありません – Cultural note: Japanese use of numbers and time in daily life

UNIT III: VERB BASICS AND SENTENCE STRUCTURE

6 + 3

Verb sentence structure – Verb conjugation basics: Non-past affirmative/negative – Asking about objects – Time and location expressions – Vocabulary: Places - classroom items - basic actions – Cultural note: School and work environments in Japan

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UNIT IV: DAILY ACTIVITIES AND VOCABULARY EXPANSION**6 + 3**

Daily routine verbs: おきます, たべます, ねます, etc., – Days of the week – Frequency expressions – Vocabulary: Food - drink - daily routine – Common locations: Library - school - station – Particles: は, を, に, で, も, へ – Cultural note: Japanese daily life and food habits

UNIT V: INTRODUCTION TO KANJI AND PRACTICAL USE**6 + 3**

Kanji: Recognition (~50), Writing (~30) – Practical reading and writing exercises using learned Kanji – Review of particles in context – Integration of all skills through short dialogues and written practice – Cultural note: Importance of Kanji in Japanese society and signage

LIST OF EXPERIMENTS

1. Prepare a family tree chart
2. Record a self-intro video
3. Describe your college
4. Presentation related to culture
5. Dialogue roleplay
6. Mock interview

CONTACT PERIODS:

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

TEXTBOOKS:

1. 3A Corporation, "Minna no Nihongo Shokyū I: Main Textbook," 2nd Indian Edition, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2018
2. Banno, Eri, Yutaka Ohno, Yoko Sakane, Chikako Shinagawa, and Kyoko Tokashiki, "Genki I: An Integrated Course in Elementary Japanese," 3rd Edition, The Japan Times Publishing, Tokyo, 2020

REFERENCES:

1. Yamada, M., & Fujita, T., "Japanese for Beginners: A Practical Approach," 1st Edition, Tuttle Publishing, 2019
2. Takahashi, A., & Sato, M., "Nihongo Pro: Japanese for N5 Level," 1st Edition, KADOKAWA, 2018



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SEMESTER I

U25LEG03	French for Engineers - I (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- Gain basic proficiency in listening, speaking, reading, and writing - understanding everyday conversations, speaking in survival situations, reading short texts, and writing simple sentences
- Acquire essential knowledge of French grammatical structures to support communication and comprehension
- Gain introductory insights into French cultural norms, practices, and everyday life

COURSE OUTCOMES:

CO 1: Acquire familiarity in the French alphabet and basic vocabulary	Understand
CO 2: Listen and identify individual sounds of French	Understand
CO 3: Use basic sounds and words while speaking	Apply
CO 4: Read and understand simple advertisements, brochures and invitations	Understand
CO 5: Use basic grammar and appropriate vocabulary in completing language tasks	Remember

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: INTRODUCTION TO FRENCH LANGUAGE AND BASICS

6 + 3

Alphabet and pronunciation: French sounds – Accents – Spelling names – Greeting people and introducing yourself and others – Asking about someone: names – Nationalities, and countries – Grammar: Subject pronouns (je, tu, il, elle...) - être (to be) - s'appeler (to be called) – Articles: definite/indefinite (le, la, un, une) - Gender and number of nouns – Cultural focus: French-speaking countries – forms of address (tu vs. vous)

UNIT II: DESCRIBING PEOPLE AND BACKGROUND

6 + 3

Describing yourself and others: nationality – profession – Age – Asking and answering personal questions – Numbers: 0–69 – Talking about languages spoken – Grammar: Verbs avoir (to have) parler (to speak) – Negation: ne...pas – Cultural focus: Francophone diversity – naming conventions (nom, prénom)


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UNIT III: GRAMMAR AND AGREEMENT IN DESCRIPTIONS**6 + 3**

Gender agreement of adjectives and professions – Asking questions: Interrogative expressions (Où, Quoi, Qui, Quel(le)) – Practice with personal descriptions – More on sentence structure and simple dialogues – Cultural focus: Intercultural identity – Polite introductions and small talk

UNIT IV: TALKING ABOUT DAILY LIFE**6 + 3**

Describing a typical day – Talking about daily activities and frequency – Saying what you like/don't like doing – Talking about schedules and routines – Cultural focus: A typical day in France – school/work life in Francophone countries

UNIT V: TIME, VERBS, AND DAILY EXPRESSIONS**6 + 3**

Telling time – grammar: Regular -er verbs in present tense – The verb aller (to go) and expressions with faire – Prepositions: à -chez - en - au -Cultural focus: French meal times – Weekend habits – Transportation

LIST OF EXPERIMENTS

1. Prepare a family tree chart
2. Record a self-intro video
3. Describe your college
4. Presentation related to culture
5. Dialogue roleplay
6. Mock interview

CONTACT PERIODS:

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

TEXTBOOKS:

1. Marie-José Lopes & Jean-Thierry Bougnec, "Inspire 2 A1-A2 Méthode de français," 1st Edition, Hachette Français Langue Etrangère, 2020
2. Gibbe, C., Berthet, A., & Hugot, C., "Édito A2: Méthode de français," 1st Edition, Didier, 2024

REFERENCES:

1. Chantal Fougères & Marc de la Harpe, "Le Nouveau Sans Frontières 2: Méthode de français A2," 1st Edition, Hachette FLE, 2020
2. Xavier Maingueneau, "Le Français pour les Nuls: A2-B1," 3rd Edition, Wiley, 2021



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U25LEG04	Hindi for Engineers - I (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- Gain basic proficiency in listening, speaking, reading, and writing - understanding everyday conversations, speaking in survival situations, reading short texts, and writing simple sentences
- Acquire essential knowledge of Hindi grammatical structures to support communication and comprehension
- Gain introductory insights into Hindi cultural norms, practices, and everyday life

COURSE OUTCOMES:

CO 1: Acquire familiarity in the Hindi alphabet and basic vocabulary	Understand
CO 2: Listen and identify individual sounds of Hindi	Understand
CO 3: Use basic sounds and words while speaking	Apply
CO 4: Read and understand simple advertisements, brochures and invitations	Understand
CO 5: Use basic grammar and appropriate vocabulary in completing language tasks	Remember

CO - PO MAPPING:

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

SYLLABUS:**UNIT I: UNIT I INTRODUCTION TO HINDI SCRIPT AND CULTURE**

6 + 3

Devanagari script basics (vowels and consonants) – Hindi sound system (aspirated/unaspirated, retroflex sounds) – Basic greetings and self-introduction – Sentence ending with है (hai) – Vocabulary: Professions – Nationalities – Countries – Family members – Grammar: Personal pronouns (मैं, तुम, आप, वह, यह) – Use of है and क्या (kya) for yes/no questions – Simple nominal sentences – Cultural note: Indian naming conventions – Forms of address (तुम vs. आप) – Gestures like namaste and head nods – Sociolinguistic formality

UNIT II: SENTENCE STRUCTURE AND EVERYDAY CONTEXTS

6 + 3

Introducing others – Talking about objects and places – Yes/no and WH- questions – Negation using नहीं – Use of यह (yeh) – वह (voh) – Vocabulary: Everyday objects – Common locations – Classroom and household terms – Grammar: Postpositions में (mein), से (se), का/की/के (possessives) – Verb basics with है and नहीं है, Subject-object-verb (SOV) structure – Cultural note: Spatial metaphors in Hindi, gestures with demonstratives, plural forms, and respect levels

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UNIT III: DESCRIBING DAILY LIFE AND HABITS**6 + 3**

Describing daily routines like waking – Eating – Going – Returning – Sleeping – Vocabulary: Daily activities – Time expressions – Common verbs – Talking about routines in present tense – Adverbs of frequency: हमेशा - कभी-कभी - कभी नहीं – Grammar: Present tense of जाना - खाना - करना - उठना - सोना – Verb agreement by gender and number – Use of को (ko) as object marker – Cultural note: Time perception – Daily routines in Indian homes – Lifestyle differences – Typical student/professional day

UNIT IV: EXPANSION OF VERB USE AND QUESTIONS**6 + 3**

Extended verb usage in different contexts – Asking and answering questions with Wh-words – Expressing possession – Giving simple commands and requests – Vocabulary: Verbs of movement – Expression – Need – Grammar: Imperatives – Compound verbs – Continued use of postpositions – Sentence expansion using connectors – Cultural note: Politeness in commands – Body language in communication – Informal/formal tone shift

UNIT V: PRACTICAL COMMUNICATION AND REVIEW**6 + 3**

Role-plays: shopping – Traveling, introducing family – Speaking about preferences and opinions – Listening to simple dialogues and identifying key points – Vocabulary: Common nouns – Adjectives – Survival phrases – Grammar: Review of present tense – Pronouns – Postpositions – Negation – Cultural note: Real-life communication scenarios – Marketplace culture – Indian transportation and hospitality norms

LIST OF EXPERIMENTS

1. Prepare a family tree chart
2. Record a self-intro video
3. Describe your college
4. Presentation related to culture
5. Dialogue roleplay
6. Mock interview

CONTACT PERIODS:

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

TEXTBOOKS:

1. Pavithra Publications, "Spoken Hindi: Through Tamil," 2nd Edition, Pavithra Publications, Chennai, 2015
2. Dakshina Bharat Hindi Prachar Sabha, "Prathamik Text Book: New Syllabus," 1st Edition, Dakshina Bharat Hindi Prachar Sabha, Madras, 2023

REFERENCES:

1. Ganga, K., & Ramesh, V., "Learn Hindi in 30 Days: A Beginner's Guide," 3rd Edition, Hindi Academy, 2020
2. Vyas, S., "Spoken Hindi for Beginners," 1st Edition, Orient BlackSwan, 2018



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SEMESTER I

U25LEG09	Chinese for Engineers - I (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- Gain basic proficiency in listening, speaking, reading, and writing - understanding everyday conversations, speaking in survival situations, reading short texts, and writing simple sentences
- Acquire essential knowledge of Chinese grammatical structures to support communication and comprehension
- Gain introductory insights into Chinese cultural norms, practices, and everyday life

COURSE OUTCOMES:

CO 1: Acquire familiarity in the Chinese alphabet & basic vocabulary	Understand
CO 2: Listen and identify individual sounds of Chinese	Understand
CO 3: Use basic sounds and words while speaking	Apply
CO 4: Read and understand simple advertisements, brochures and invitations	Understand
CO 5: Use basic grammar and appropriate vocabulary in completing language tasks	Remember

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: FUNDAMENTAL CHINESE FOR BEGINNERS

6 + 3

Introduction to Mandarin Chinese, daily greetings – Learning Mandarin alphabet initials, finals, 4 tones and tone change rules (Pinyin 拼音) – Learning numbers 0–20 – Learning basic in-class vocabulary and phrases

UNIT II: NUMBERS AND VOCABULARY EXPANSION

6 + 3

Learning numbers up to 999 – Learning country names and nationalities – Learning personal pronouns and Subject-Verb-Object (SVO) sentence structure – Practice with short dialogues and self-introductions

UNIT III: THE NEW CLASSMATE

6 + 3

Learning vocabulary related to names and introductions – Learning the differences among 是 (to be), 叫 (to be called), 姓 (to have a surname) – Learning how to form questions with 吗 – Learning abbreviated questions with 呢 – Practice dialogues: exchanging names and personal details

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UNIT IV: TIME AND POSSESSION**6 + 3**

What time do you go to the university? – Learning vocabulary for time, dates, and days of the week – Learning grammar: placement of time words (S + Time word + V) – Learning to express possession with 有 / 沒有 – Learning the usage of 的 as a possessive particle – Practice with daily schedules and activities

UNIT V: COMMUNICATION AND REVIEW**6 + 3**

Grammar consolidation: auxiliary verbs and sentence order – Forming positive-negative questions (e.g., 是不是, 有沒有) – Conversational practice: greetings, introductions, time, possession – Role-play in real-life scenarios – Cultural notes: politeness and forms of address – Final review and integrated practice of Units I–IV

LIST OF EXPERIMENTS

1. Prepare a family tree chart
2. Record a self-intro video
3. Describe your college
4. Presentation related to culture
5. Dialogue roleplay
6. Mock interview

CONTACT PERIODS:

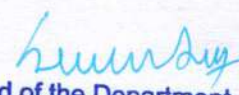
Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 15 Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. Mandarin Training Centre, National Taiwan Normal University, Modern Chinese I 時代華語 I, Edited by Chih-Ping Chou, Taipei: Cheng Chung Book Company Ltd., 2019
2. Huayu101 / 華語101, Taiwan Ministry of Education, Taiwan Mandarin Educational Resources Centre, 2018

REFERENCES:

1. Cheng Chung Book Company Ltd, 時代華語 I 教師手冊 [Modern Chinese I Teacher's Manual, 2019
2. www.lmit.edu.tw/bag


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SEMESTER I

U25MCC01	Induction Program - Universal Human Values I (Common to all programmes)	Category: MCC				
		L	T	P	J	C
		2	1	0	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human beings), family, society, and nature/existence
- Understanding (or developing clarity) of the harmony in the human being, family, society, and nature/existence
- Strengthening of self-reflection
- Development of commitment and courage to act

COURSE OUTCOMES:

CO 1: Recognize the essentials of human values and skills	Understand
CO 2: Analyse connection between profession and happiness	Understand
CO 3: Develop appropriate technologies and management patterns to create harmony in family and society	Understand
CO 4: Evaluate the significance of trust, mutually satisfying human behaviour, and enriching interaction with nature	Understand
CO 5: Demonstrate professional and ethical responsibility	Understand

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:

UNIT I: INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT, AND PROCESS FOR VALUE EDUCATION 6 + 3

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

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UNIT II: HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF**6 + 3**

Understanding human beings as a co-existence of the sentient 'I' and the material 'Body' – Understanding the needs of Self ('I') and 'Body' – Happiness and Convenience – Understanding the Body as an instrument of 'I' (I being the doer, seer, and enjoyer) – Understanding the harmony of I with the Body: Self-control and Welfare; correct appraisal of Physical needs – Meaning of Prosperity in detail – Programs to ensure Self-control and Welfare

UNIT III: HARMONY IN THE FAMILY AND SOCIETY**6 + 3**

Understanding values in human – Human relationships; the meaning of Justice (nine universal values in relationships) and the program for its fulfillment to ensure satisfaction – Trust and Respect as the foundational values of relationship – Understanding the meaning of Trust – Difference between intention and competence – Understanding the meaning of Respect – The Difference between respect and differentiation; and the other salient values in relationship – Understanding the harmony in the society (society being an extension of the family): Peace, Prosperity, Courage, and Coexistence as comprehensive Human Goals – Visualizing a universal harmonious order in society – Undivided Society – Universal Order from family to world family

UNIT IV: HARMONY IN THE NATURE AND EXISTENCE**6 + 3**

Understanding the harmony in Nature, Interconnectedness, and mutual fulfillment among the four orders of nature – Recyclability and self-regulation in nature – Understanding Existence as a Co-existence of mutually interacting units in an all-pervasive space – Holistic perception of harmony at all levels of existence – Practice sessions to discuss human beings as the cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology, etc

UNIT V: HARMONY ON PROFESSIONAL ETHICS**6 + 3**

Natural acceptance of human values – Definitiveness of Ethical Human Conduct – Basic for Humanistic Education – Humanistic Constitution, and Humanistic Universal Order – Competence in professional ethics – Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people, friendly and eco-friendly production systems, and Ability to identify and develop appropriate technologies and management patterns for the above production systems – Case studies of typical holistic technologies, management models, and production systems – Strategy for a transition from the present state to Universal Human Order – At the level of the individual: as socially and ecologically responsible engineers, technologists, and managers – At the level of society: as mutually enriching institutions and organizations

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** 15 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
2. Prof. K. V. Subba Raju, Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition, 2013

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

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SEMESTER I

U25MCC02	Heritage of Tamils (Common to all programmes)	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 Bharathiyar and Bharathidhasan

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

3

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

UNIT III: FOLK AND MARTIAL ARTS

3

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

UNIT IV: THINAI CONCEPT OF TAMILS

3

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

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

3

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

CONTACT PERIODS:

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

TEXTBOOKS:

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

REFERENCES:

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை, International Institute of Tamil Studies, C.P.T Campus, Chennai
2. கணினித் தமிழ் - முனைவர். இல. சுந்தரம், விகடன் பிரசுரம், அண்ணா சாலை, சென்னை, திசம்பர் 2016
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம், தொல்லியல் துறை வெளியீடு, தமிழ்நாடு அரசு, சென்னை, ஆறாம் பதிப்பு 2020
4. Social Life of Tamils, Dr. K. K. Pillay, A joint publication of TNTB & ESC and RMRL (in print) University of Madras, Chennai, Second Edition 1975
5. The Contributions of the Tamils to Indian Culture, Dr.M.Valarmathi, International Institute of Tamil Studies, C.I.T Campus, Tharamani, Chennai, First Edition 1995



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SEMESTER I & II

U25MCC03	Design Thinking (Common to all programmes)	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, create prototypes, 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: Define the identified problem elaborately and clearly	Apply
CO 4: Develop prototypes for conceptual solutions	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	1	2	3	2	-	-	-	-	1	1	1	1	1
CO 2	1	2	3	2	-	-	-	-	1	1	1	1	1
CO 3	1	2	3	2	-	-	-	-	1	1	1	1	1
CO 4	1	2	3	2	-	-	-	-	1	1	1	1	1
CO 5	1	2	3	2	-	-	-	-	1	1	1	1	1

SYLLABUS:

UNIT I: FUNDAMENTALS OF DESIGN THINKING

3 + 6

Introduction to Design Thinking: Definition, relevance, and applications – Contexts and situations where Design Thinking is most effective – Core process of implementing Design Thinking – Stakeholders involved in a Design Thinking approach – 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 EMPATHIZE STAGE

3 + 6

Understanding Stakeholders – Role of Empathy in Design Thinking – Tools: Persona, Journey Mapping, Stakeholder Mapping, CATWOE, Cartographic Perspective (L0), Empathy Map – Case Study

UNIT III: THE DEFINE STAGE

3 + 6

Problem Framing and Reframing – Role of a Design Thinker – Tools: Five Whys, Anti-Pattern, Problem Paraphrasing, Challenge Mapping – Introduction to LORD Skillset – Case Study

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UNIT IV: THE DIVERGENCE AND CONVERGENCE STAGE**3 + 6**

Ideation through Divergent and Convergent Thinking – Tools: Brainstorming, Metaphor, Random Association, End-State Visualization, 10gm–100gm–1000gm – Prototyping Basics – Wire framing – Case Study – Communicating for Effective Outcome

UNIT V: THE COMMUNICATION STAGE**3 + 6**

Presenting and Packaging Design Outcomes – Tools: 4Cs Framework, Naming, Packaging, Storyboarding, Presentation Techniques, Distribution Methods

LIST OF EXPERIMENTS

1. Personal Visualization
2. 3 Laws of Design Thinking®
3. Persona
4. Journey Mapping
5. Cartographic Perspective
6. Anti-Pattern, Problem Paraphrasing
7. Brainstorming
8. 10gm–100gm–1000gm
9. Prototyping Basics
10. Storyboarding
11. Presentation Techniques

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, HarperCollins Publishers Ltd., 2018
2. Idris Mootee, Design Thinking for Strategic Innovation, John Wiley & Sons Inc, 2013
3. Arun Jain, UnMukt: Science & Art of Design Thinking, School of Design Thinking, 2020

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 I & II

U25MCC04	Computer Fundamentals and Coding Essentials (Common to all programmes)	Category: MCC				
		L	T	P	J	C
		1	0	2	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- To develop an understanding of fundamental computing concepts such as data types, variables, operators and algorithmic problem-solving.
- To enable students to write, debug, and execute simple programs in C using control structures, arrays and strings for solving basic scientific and engineering problems.
- To introduce the basic structure and functioning of computer systems, including hardware, software, operating systems and file management.

COURSE OUTCOMES:

- CO 1:** Build basic computational concepts such as data types, variables, operators, algorithms to solve simple problems **Apply**
- CO 2:** Develop simple programs using input/output operations, control structures, arrays, and strings in C language **Apply**
- CO 3:** Describe the fundamental components of a computer system and explain the role of operating systems and file management in computing **Understand**

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

SYLLABUS:

UNIT I: FUNDAMENTALS OF COMPUTING

3 + 5

Introduction to algorithms and flowcharts –Data types, variables, and operators

UNIT II: INTRODUCTION TO PROGRAMMING

6 + 5

Programming languages overview - Input/output, conditional statements, loops - Basic data structures: arrays and strings - Overview of Logic gates and basic digital circuits - System software

UNIT III: INTRODUCTION TO COMPUTERS

6 + 5

Evolution of Computers - Overview of computer hardware and software - Number Systems - Understanding input/output devices, memory, storage – Basics of operating systems and file management

LIST OF EXPERIMENTS

1. Identifying computer components
2. Installation and debugging of Operating System

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3. Programs using variables and data types
4. Programs using Conditional Statements
5. Programs using Loops and Iterations
6. Program using Nested Loops & Pattern Printing

CONTACT PERIODS:

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

TEXTBOOKS:

1. Glenn Brookshear J and Dennis Brylow, "Computer Science: An Overview", 13th Edition, Perarson, 2020
2. Rajaraman V and Neeharika Adabala "Fundamentals of Computers", 6th Edition PHI Learning Private Limited, 2015
3. Yashavant Kanetkar, "Let Us C", 17th Edition, BPB Publications, 2020

REFERENCES:

1. Reema Thareja, "Programming in C", 2nd Edition, Oxford University Press, 2016
2. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", 1st Edition, Oxford University Press, 2009



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SEMESTER I & II

U25MCC05	Biology for Engineers (Common to all programmes)	Category: MCC				
		L	T	P	J	C
		1	0	2	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- To understand the biological concepts from an engineering perspective
- To understand the importance of human physiology and sensing techniques
- To perform the various laboratory tests with the relevant instruments / equipment

COURSE OUTCOMES:

CO 1:	Interpret the biological concepts of cell and its structure	Understand
CO 2:	Describe the importance of human physiology	Understand
CO 3:	Summarize the various sensing techniques and assistive devices	Understand
CO 4:	Utilize the instruments / equipment to perform the microbial growth and laboratory tests	Precision
CO 5:	Apply the principles to demonstrate the microbial growth and laboratory test	Precision

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

SYLLABUS:

UNIT I: BASICS OF CELL

5

Cell structure and function – Cell division – Mitosis – Meiosis – Cell Membrane potential

UNIT II: HUMAN PHYSIOLOGY

5

Circulatory system – Respiratory system – Digestive system – Neurology system Carbohydrates – Proteins and amino acid – Nucleic acid (DNA and RNA)

UNIT III: SENSING TECHNIQUES AND ASSISTIVE DEVICES

5

Sensory organs: Eyes and ears – Visual aids – Hearing aids – Electronic nose – Electronic tongue – Electronic skin

UNIT IV: BIOINSPIRATION

15

Demonstration on bionic principles in nature-inspired design – Exploration of biomimetic materials and their engineering applications – Identification of natural structures mimicked in robotics and sensors – Observation and analysis of bioinspired prototypes (e.g., soft actuators, lotus-effect surfaces)

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UNIT V: BASIC LABORATORY TESTS

15

Separation of serum – Identification of blood groups – Estimation of blood pressure – Measurement of pH – Acquisition of ECG signals – Introduction to bioinformatics for biomedical data interpretation: visualization of gene/protein sequences, exploration of databases such as NCBI and UniProt, and understanding their applications in clinical diagnostics and personalized medicine

CONTACT PERIODS:

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

TEXTBOOKS:

1. Campbell N.A., Reece J.B., Urry L., Cain M.L. and Wasserman S.A., "Biology: A global approach", 12th edition, Pearson Education Ltd, 2020
2. Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., "Biology for Engineers", 1st edition, Tata McGraw-Hill, 2018
3. Elaine N. Marieb and Suzanne. M. Keller, "Essential of Human Anatomy and Physiology", 12th edition, Pearson Education, 2017

REFERENCES:

1. Leslie Cromwell, Erich A. Pfeiffer, Fred J. Weibell, "Biomedical Instrumentation", 2nd Edition, Prentice Hall, 2011
2. Arthur T Johnson, "Biology for Engineers", 1st edition, CRC press, 2011
3. David. L. Nelson, Michael. M. Cox, "Lehninger Principles of Biochemistry", 7th edition, WH Freeman, 2017
4. John Enderle and Joseph Bronzino, "Introduction to Biomedical Engineering", 3rd edition, Academic Press, 2012



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SEMESTER II

U25ENG02	English Proficiency II (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		0	0	2	0	1

QP PATTERN: A

COURSE OBJECTIVES:

- Be an active listener for better comprehension and retention
- Identify main points in spoken materials such as lectures, podcasts, and conversations

COURSE OUTCOMES:

CO 1: Deploy effective listening strategies in academic, technical and everyday situations

Remember

CO 2: Engage in discussions expressing opinions and responding to ideas and arguments

Understand

CO - PO MAPPING:

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

LIST OF EXPERIMENTS

1. Listening to Lectures: Structure and Emphasis – Note-making Techniques: capturing main ideas and details – Conversations, Dialogues and Identifying Opinions – Podcasts and Interviews – Active Listening Skills: Overcoming Barriers and Improving Focus
2. Listening for Specific Information: Facts, Figures, and Sequences – Global Accents: British, American, Australian – Following Instructions and Procedures: Task-based listening – Listening to Technical Explanations: Engineering Concepts – Short Writing Task: Summary or outline from technical input
3. Listening to Workplace Conversations: Meetings, Calls and Voice Notes – Listening to News & Current Events: Identifying Main Ideas and Recognizing – Colloquial Expressions and Idioms in Context: Enhancing comprehension of informal speech

CONTACT PERIODS:

Lecture: - Periods

Tutorial: - Periods

Practical: 30 Periods

Project: - Periods

Total: 30 Periods

TEXTBOOKS:

1. Rob Freire and Tamara Jones, "Q: Skills for Success: Listening & Speaking", Level 4, 3rd edition, Oxford University Press, 2019
2. Ashraf M. Rizvi and Priyadarshi Patnaik, "Effective Technical Communication", 3rd Edition, McGraw Hill, 2024

REFERENCES:

1. Nixaly Leonardo, "Active Listening Techniques: 30 Practical Tools to Hone Your Communication Skills", Embassy Books, 2022
2. Heather R. Younger, "The Art of Active Listening: How People at Work Feel Heard, Valued, and Understood", Berrett-Koehler Publishers, 2023

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SEMESTER II

U25MA204	Mathematical Transforms (Common to CE, CH, EE, ME, MI)	Category: BSC				
		L	T	P	J	C
		2	0	2	0	3

QP PATTERN: A

COURSE OBJECTIVES:

- To understand Fourier analysis for periodic and aperiodic signals
- To apply Laplace transforms for solving linear ODEs with initial conditions
- To use 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 of standard functions and use them to model and analyze engineering systems involving differential equations **Apply**
- CO 4:** Use inverse Laplace transforms and convolution theorem to solve ordinary differential equations with initial conditions 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	1
CO 2	3	2	-	-	-	-	-	-	-	-	-	1	1
CO 3	3	2	-	-	-	-	-	-	-	-	-	1	1
CO 4	3	2	-	-	-	-	-	-	-	-	-	1	1
CO 5	2	2	-	2	1	-	-	-	-	-	-	1	1

SYLLABUS:

UNIT I: FOURIER SERIES

6 + 6

Dirichlet's conditions – General Fourier series – Even and odd functions – Half-range sine and cosine series – Parseval's identity

UNIT II: FOURIER TRANSFORM

6 + 6

Fourier transform pair – Sine and cosine transforms – Basic properties – Transforms of standard functions – Convolution theorem

UNIT III: LAPLACE TRANSFORM

6 + 6

Standard functions – Unit step and delta functions – Derivatives and integrals – Transform of periodic functions

UNIT IV: INVERSE LAPLACE TRANSFORM

6 + 6

Inverse Laplace methods – Convolution theorem – Solution of linear ODEs with constant coefficients

UNIT V: Z-TRANSFORM

6 + 6

Z-transforms – Properties – Inverse Z-transform – Initial/final value theorems – Solution of difference equations

LIST OF EXPERIMENTS

1. Fourier Series – Fourier Series Approximation – Even/Odd Functions and Half-Range Expansions
2. Fourier Transforms – FFT and Spectral Analysis. – Convolution Theorem
3. Laplace Transforms – Laplace of Basic Functions – System Response Using Laplace
4. Inverse Laplace and ODE Solving – Inverse Laplace Transform – ODE Solving Using Laplace
5. Z-Transform Applications – Z-Transform and Sequence Analysis – Digital Filter Design and Stability

CONTACT PERIODS:

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

TEXTBOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th ed., Wiley India, 2018
2. Wylie C. R. & Barrett L. C., Advanced Engineering Mathematics, Tata McGraw-Hill, 2016
3. Grewal B. S., Higher Engineering Mathematics, 44th ed., Khanna Publishers, 2017

REFERENCES:

1. Andrews, L.C & Shivamoggi, B., Integral Transforms for Engineers, SPIE Press, 2016
2. Bali N. P. & Manish Goyal, Engineering Mathematics, 12th ed., Laxmi Publications, 2016
3. Peter V. O'Neil, Advanced Engineering Mathematics, Cengage, 2016
4. James G., Advanced Modern Engineering Mathematics, 3rd ed., Pearson, 2013



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SEMESTER II

U25PH204	Materials Science (Common to CH, ME)	Category: BSC				
		L	T	P	J	C
		2	0	0	2	3

QP PATTERN: A

COURSE OBJECTIVES:

- To understand the fundamental principles of magnetic ,dielectric , superconducting and phase change materials and their technological applications
- To explore the characteristics and uses of emerging engineering materials such as metallic glasses, shape memory alloys, and nanomaterials
- To develop skills in microstructural analysis using various characterization techniques

COURSE OUTCOMES:

CO 1:	Understand the fundamental concepts of magnetic and di-electric materials.	Understand
CO 2:	Illustrate the physical phenomena of superconductors and their technological applications	Understand
CO 3:	Analyze the properties and applications of new engineering materials like SMAs and nanomaterials	Analyze
CO 4:	Examine the basic phenomena and properties of phase change materials for energy related applications	Analyze
CO 5:	Apply various characterization techniques for microstructural analysis of materials	Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: MAGNETIC AND DIELECTRIC MATERIALS

6 + 6

Classification of magnetic materials – Domain theory – Hysteresis – Hard and soft magnetic materials – Dielectric materials – Types of polarization – Langevin-Debye equation – Dielectric breakdown – Ferroelectricity

UNIT II: 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 – Josephson Effect – SQUID – Magnetic levitation

UNIT III: NEW ENGINEERING MATERIALS

6 + 6

Metallic glasses – Types, melt spinning process, applications – Shape memory alloys – Phases, shape memory effect, pseudo elastic effect – NiTi alloy – Applications – Nanomaterials: ball milling, chemical vapour deposition, properties and applications – Carbon nanotubes: types and applications

UNIT IV: PHASE CHANGE MATERIALS**6 + 6**

Classification of phase change materials – Fabrication methods: Encapsulation and Electro spinning Techniques – Thermophysical properties – Phase change material composites – Applications – Building and Construction – Thermal storage in Solar water heater

UNIT V: MATERIALS CHARACTERIZATION TECHNIQUES**6 + 6**

UV Visible spectroscopy – FTIR – X Ray Diffraction – Optical microscopes for surface studies – Rayleigh criterion – resolving power – Atomic force microscope – Scanning electron microscope – Transmission electron microscope

LIST OF PROJECTS

1. Comparative Study of Hard vs. Soft Magnetic Materials
2. Design of a Magnetic Storage Demonstration
3. Demonstrating Polarization in Dielectric Materials
4. Research Poster: Ferroelectric Materials and Their Uses
5. Magnetic Levitation Demo Using a Superconducting Kit
6. Simulation/Poster: Type I vs. Type II Superconductors
7. SQUID Applications in Medicine and Geophysics
8. Study of Critical Temperature of YBCO Superconductor
9. Fabrication of a Metallic Glass Ribbon via Melt Spinning (Simulation/Model)
10. NiTi Shape Memory Alloy Demonstration
11. Synthesis of Nanoparticles Using Ball Milling (Review or Lab Study)
12. Carbon Nanotubes: Properties and Application Review
13. Thermal Storage Using Phase Change Material (PCM)
14. Fabrication of PCM Capsules (Model/Simulation)
15. Comparison of Thermal Response in PCM vs Non-PCM Insulated Boxes

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:

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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SEMESTER II



U25CY201	Environmental Science and Sustainability (Common to all programmes)	Category: BSC				
		L	T	P	J	C
		1	0	2	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- To provide the basic concepts of ecosystems, biodiversity, air and water systems and how to protect them
- To analyze the effects of human activities on the lithosphere, waste generation, and environmental health, and evaluate disaster management and technological solutions
- To apply the principles of sustainable living and green technologies in alignment with the UN Sustainable Development Goals

COURSE OUTCOMES:

- CO 1:** Utilize the ecosystem and biodiversity conservation concepts to address environmental issues Apply
- CO 2:** Implement atmospheric and hydrospheric concepts for water quality parameter determination. Apply
- CO 3:** Develop effective strategies to manage land-use challenges, agricultural issues, and waste management practices Apply
- CO 4:** Utilize technological tools to monitor environmental issues, resource recovery, and pollution control processes Apply
- CO 5:** Implement sustainable development strategies for green practices and waste management Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: ENVIRONMENTAL SCIENCE AND BIODIVERSITY

3 + 6

Ecosystems – Classification, Structure, Energy Flow, Ecological Succession – Biodiversity – Importance, Values and Levels – India as a Mega-diversity Nation – Red Data Book, Hotspots and Conservation of Biodiversity Self-Learning and Case Studies – Wildlife Crime in India (Poaching) – Man and Wildlife Conflict (e.g., Elephant-Human conflict in Odisha or Assam)

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UNIT II: ATMOSPHERE AND HYDROSPHERE**3 + 6**

Atmosphere – Structure, Climatic Zones, Air Quality Standards (National & WHO), Air Pollution – Causes, effects, control measures, Carbon Emissions – Greenhouse Effect, Global Warming. Hydrosphere – Hydrological Cycle – Water Quality Parameters, water pollution – Causes, effects, control measures, Overutilization of Ground Water – Water Conservation Strategies, Microplastics as emerging pollutants-Causes, effects and control measures Self-Learning and Case Studies – Atmosphere – Urban air quality (Delhi, Beijing case), Hydrosphere – (National Water Mission (NAPCC), NRCP, Jal Shakti Abhiyan – Cape Town Water Crisis (2017–2018)

UNIT III: LITHOSPHERE AND SOLID WASTE MANAGEMENT**3 + 6**

Lithosphere – Composition, Plate tectonics, continental drift, Soil Nutrients, Nitrogen cycles, Soil Pollution – Causes, effects (Land degradation, desertification) and control measures, Agriculture – Problems of modern agriculture. E-waste-causes, effects and control measures. Solid Waste Management – Types & Sources of waste, waste management processes. Self-Learning and Case Studies - (Land degradation – Rajasthan - Soil erosion – Narmada River Basin, MP – Desertification – Thar Desert – Eco buddy program).

UNIT IV: GLOBAL ISSUES, HUMAN WELFARE AND ROLE OF TECHNOLOGY**3 + 6**

Disasters & Disaster management cycle – Floods, Landslides, Land Clearing Projects – Dam sites, Highways projects. Resettlement and Rehabilitation (R&R). Population – Global and national growth patterns, Population explosion, Role of information Technology (IT) in Environmental studies and human health monitoring. Self-Learning and Case Studies – Use of IT in environmental monitoring (GIS, Remote Sensing, sensors, data loggers) Pollution Monitoring – Water, Air.

UNIT V: SUSTAINABLE DEVELOPMENT AND GREEN PRACTICES**3 + 6**

Sustainable Development – Introduction, Concepts and Strategies, Sustainable Practices and Circular Economy – 5Rs, Zero Waste Lifestyle Sustainable Development – Introduction, Concepts and Strategies, Sustainable Practices and Circular Economy – 5Rs, Zero Waste Lifestyle. Sustainable Agriculture, Green Technologies – Green Chemistry and reagent in industries, Environmental Management – ISO 14001:2004, energy efficiency, sustainable transport, carbon sequestration. Self-Learning and Case Studies - Overview of United Nations SDGs (focus on SDGs 6, 7, 11, 12, 13), Role of India in implementing SDGs, Ambikapur, Chhattisgarh – Zero waste city model, Pune, Maharashtra – Integrating informal waste sector, Delhi Metro – Energy efficiency, carbon credits from regenerative braking, solar power use, Kochi, Kerala – Sustainable urban transport with water metro and public transit integration.

LIST OF EXPERIMENTS

1. Estimation of hardness (total, temporary, permanent) in water samples
2. Iodometric / Argentometric determination of available chlorine in a sample of bleaching powder.
3. Estimation of dissolved oxygen in water.
4. Determination of nitrate/ammonium estimation — colorimetric tests for nitrate/ammonium to study N availability
5. Recovery of Aluminum from waste materials.
6. Photocatalytic degradation of dye using TiO_2 .
7. Synthesis of biodiesel from vegetable oil.
8. Coir pith composting and application study.
9. Determination of conductivity, TDS and turbidity test for potable water

CONTACT PERIODS:**Lecture:** 15 Periods**Tutorial:** - Periods**Practical:** 30 Periods**Project:** - Periods**Total:** 45 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. A. Kaushik and C. P. Kaushik, "Environmental Science and Engineering" 5th edition, New Delhi: New Age International Publishers, 2019
4. R. R. Hiremath, "Sustainable Development", 1st edition, New Delhi: Himalaya Publishing House, 2008
5. P. D. Sharma, "Ecology and Environment" 13th edition, Meerut: Rastogi Publications, 2020

REFERENCES:

1. P. Meenakshi, "Elements of Environmental Science and Engineering" 1st edition, New Delhi: Prentice Hall of India, 2005
2. G. R. Chatwal and Harish Sharma, "A Textbook of Environmental Studies" 3rd edition, Mumbai: Himalaya Publishing House, 2018
3. A. Kumar, "Environmental Studies", Revised edition, Patna: Bharati Bhawan Publishers & Distributors, 2019
4. V. Desai, "Environment and Sustainable Development" 1st edition, Mumbai: Himalaya Publishing House, 2009
5. G. K. Taneja, Gopal and S. C. Sharma, "Environmental Sustainability and Development", 2nd edition, New Delhi: Deep and Deep Publications, 2010



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SEMESTER II

U25CH201	Python Programming	Category: PCC				
		L	T	P	J	C
		2	0	4	0	4

QP PATTERN: A

COURSE OBJECTIVES:

- To introduce Python programming fundamentals
- To develop problem-solving skills using Python
- To equip students with the ability to analyze and visualize data using Python

COURSE OUTCOMES:

CO 1: Understand and apply fundamental Python programming concepts	Understand
CO 2: Develop modular Python programs using functions and exception handling	Apply
CO 3: Utilize Python data structures for effective data representation	Apply
CO 4: Implement file operations and data processing techniques	Apply
CO 5: Apply Python to solve engineering problems that involves linear algebra and ordinary differential 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	-	-	-	-	-	-	2	2
CO 2	3	3	3	2	2	1	1	1	-	-	-	2	2
CO 3	3	2	2	2	1	1	-	1	-	-	-	2	2
CO 4	3	3	3	3	2	2	1	1	1	1	1	2	-
CO 5	3	3	3	3	2	2	2	2	1	1	1	2	2

SYLLABUS:

UNIT I: INTRODUCTION TO PYTHON PROGRAMMING

6 + 12

Python installation and setup. Variables, data types, and operators. Control structures: if – else, for, while loops. Functions and modular programming. Introduction to Jupyter Notebooks and Google Collaboratory for Python scripting

UNIT II: DATA STRUCTURES AND FUNCTIONS

6 + 12

String operations and formatting. Lists: creation, indexing, slicing, and methods. Tuples and dictionaries: usage and operations. Defining and calling functions. Recursion and its applications

UNIT III: FILE HANDLING AND EXCEPTION MANAGEMENT

6 + 12

File I/O operations. Exception handling mechanisms. Working with file paths and directories. Using Python's shutil module for file operations. Debugging techniques and best practices

UNIT IV: DATA ANALYSIS WITH PYTHON

6 + 12

Introduction to NumPy arrays and operations. Pandas: DataFrame creation, indexing, and manipulation. Data visualization using Matplotlib and Seaborn. Statistical functions and methods in Python. Handling missing data and data normalization

UNIT V: PYTHON APPLICATIONS**6 + 12**

Introduction to Python libraries for engineering applications, Solving Linear Equations, Simultaneous equations, and ordinary differential equations – Case studies

LIST OF EXPERIMENTS

1. Getting Started with Jupyter Notebooks and Google Collaboratory for interactive execution of code cells, and markdown for documentation
2. Perform Basic Arithmetic Operations
3. Apply Conditional Logic and Iterative Structures to Control Program Flow
4. Create and use Functions and Modular Programming
5. Python Strings – Operations and Formatting
6. Python Lists – Creation, Indexing, Slicing, and Methods
7. Python Collections – Tuples and Dictionaries
8. Working with Functions and Recursion
9. Working with File I/O
10. Advanced File Operations with Shutil Module
11. Debugging Techniques and Best Practices
12. NumPy Array Fundamentals and Operations
13. Pandas DataFrame Creation and Manipulation
14. Basic Statistical Analysis and Data Visualization using Matplotlib and Seaborn
15. Data Preprocessing: Missing Data and Normalization
16. Solving Simple Linear Equations
17. Solving Simultaneous Equations
18. Solving Ordinary Differential Equations

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 60 Periods **Project:** - Periods **Total:** 90 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

U25EEG02	Basics of Electrical and Electronics Engineering	Category: ESC				
		L	T	P	J	C
		1	0	2	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- To solve electric circuits using basic laws
- To understand DC/AC machines, renewable energy, and power utilization
- To analyze semiconductor devices and their applications

COURSE OUTCOMES:

CO 1: Apply circuit laws to solve electrical networks	Apply
CO 2: Explain working principles of motors/transformers in industrial settings	Understand
CO 3: Describe renewable energy integration in chemical processes	Understand
CO 4: Identify semiconductor devices used in instrumentation	Understand
CO 5: Design and test power supply circuits for process instrumentation	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	2	1	1	-	-	-	1	1	1	-	1	1	1
CO 3	2	1	1	-	-	-	-	-	-	-	1	1	1
CO 4	2	1	1	-	-	-	1	1	1	-	1	1	1
CO 5	3	2	1	-	-	-	1	1	1	-	1	1	1

SYLLABUS:

UNIT I: ELECTRICAL CIRCUITS

5 + 10

Active elements – Passive elements – DC Circuits: Ohm's law – Kirchhoff's laws – Series/Parallel circuits. AC fundamentals: Power factor – Single-phase vs three-phase systems

UNIT II: INDUSTRIAL ELECTRICAL SYSTEMS

5 + 10

DC Motor: Industrial applications – Transformers in power distribution – Induction motors for pumps/compressors – Electrical safety in hazardous areas – Renewable energy for chemical plants (Solar/Wind) – Energy efficiency – Electrical Tariff calculation

UNIT III: ELECTRONICS FOR PROCESS CONTROL AND APPLICATIONS

5 + 10

PN diode – Zener diode – BJT as switch – SCR in power control – Sensors for pressure / temperature – Rectifiers for instrumentation power – Voltage regulators – Motor speed control circuits

LIST OF EXPERIMENTS

- Load Test on DC shunt motor


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2. Load Test on single phase transformer
3. Load Test on three phase Induction Motor
4. VI Characteristics of PN Junction diode
5. VI characteristics of SCR
6. Halfwave and Fullwave Rectifiers
7. Voltage regulator using Zener diode

CONTACT PERIODS:

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

TEXTBOOKS:

1. R.K. Rajput, Electrical Machines, 6th edition, Laxmi Publications, New Delhi, 2016
2. V.K. Mehta and Rohit Mehta, Principles of Electronics, 12th edition, S.Chand Publications, New Delhi, 2020

REFERENCES:

1. Muhammad H. Rashid, Power Electronics: Circuits, Devices and Applications, 4th edition, Pearson Education, New Delhi, 2013
2. John Bird, Electrical Circuit Theory and Technology, 7th edition, Routledge, London, 2021
3. Tony R. Kuphaldt, Lessons in Industrial Instrumentation, 2nd edition, Open Educational Resource, 2022
4. NPTEL Online Certification Course, "Renewable Energy Systems", IIT Madras, 2023
5. IEEE Transactions on Industrial Electronics, ISSN: 0278-0046. [Journal]



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SEMESTER II

U25MEG03	Engineering Graphics (Common to CE, CH, EC, EE, ME)	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 application using CAD Software

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 Understand
on engineering drawing sheets
- CO 3:** Construct projections of truncated and frustums solids and develop the lateral surfaces of solids Understand
- CO 4:** Convert the isometric views of simple objects to orthographic views and vice versa Understand

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	-	-	-	-	2	1	2	-	2	1	1
CO 2	3	1	-	-	-	-	1	1	2	-	-	1	1
CO 3	3	1	-	-	2	-	-	1	2	-	-	1	1
CO 4	3	2	-	-	2	-	2	1	2	-	2	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 viz. agency, 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 using AUTOCAD
- Section of solids with base resting on HP using AUTOCAD
- Development of lateral surfaces of solids with base on HP using AutoCAD
- Construction of isometric views of simple and truncated solids using AutoCAD

11. Sketching orthographic views from pictorial representation of 3D objects using AutoCAD

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 II

U25LEG05	German for Engineers - II (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- To improve comprehension of real-life conversations in familiar everyday situations (shopping, dining, describing spaces, etc.)
- To develop fluency in expressing preferences, describing people, homes, and daily routines using basic sentence structures
- To build competence in writing short, structured texts such as messages, descriptions, and informal communications

COURSE OUTCOMES:

- CO 1:** Engage in simple conversations while shopping, dining, or asking for information using appropriate vocabulary and phrases **Remember**
- CO 2:** Describe people, homes, weather, and daily routines using structured sentences with correct grammar **Understand**
- CO 3:** Read and interpret simple texts such as product labels, menus, signs, and weather updates **Understand**
- CO 4:** Write short messages or descriptions related to everyday topics like hobbies, weather, or family **Understand**
- CO 5:** Apply core grammatical rules such as adjective endings, possessive pronouns, and prepositions of place with improved accuracy **Apply**

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: EVERYDAY SHOPPING AND DINING

6 + 3

Shopping for groceries and clothes – Ordering food and drinks at a restaurant – Talking about prices and quantities – Expressing preferences – Reading menus, labels, and receipts – Grammar: Accusative case review with articles and adjectives, Plural forms of nouns, Adjective endings in nominative and accusative – Cultural Focus: Eating habits in Germany, Austria, and Switzerland – Supermarket etiquette – Restaurant culture – Tipping practices

UNIT II: PEOPLE AND PERSONAL INTERESTS

6 + 3

Talking about family and relationships – Describing people's appearance and personality – Hobbies and free time activities – Likes and dislikes – Grammar: Possessive pronouns - Adjective endings with possessive pronouns – Word order in main clauses – Cultural Focus: Family structures – Popular hobbies and sports – Work-life balance in German-speaking countries

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UNIT III: HOME AND LIVING**6 + 3**

Describing your home and rooms – Furniture and household items – Talking about home layout and comfort – Grammar: Two-way prepositions with accusative/dative – Use of es gibt – Describing location vs. movement – Cultural Focus: Typical German homes – Living arrangements – Interior design norms

UNIT IV: SEASONS AND WEATHER**6 + 3**

Talking about weather and seasons – Seasonal activities – Preferences for seasons – Grammar: Temporal phrases – Review of present tense verb usage with seasonal context – Use of weil (because) – Cultural Focus: Seasonal festivals like Weihnachten and Oktoberfest – Weather patterns in German speaking countries

UNIT V: PUTTING IT TOGETHER – DAILY LIFE**6 + 3**

Combining shopping – Personal life – Home, and seasonal activities into daily routines – Conversational practice across units – Grammar: Practice of main and subordinate clauses – Sentence structure review – Verb position with weil and prepositions – Cultural Focus: Daily routines in Germany – Overview of regional variations in culture and habits

LIST OF EXPERIMENTS

1. Prepare a city map
2. Video: Talk about your daily routine
3. Describe your school (using past tense)
4. Presentation related to culture
5. Dialogue roleplay
6. Mock interview

CONTACT PERIODS:

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

TEXTBOOKS:

1. Buscha, A., & Szita, S., "Begegnungen Deutsch als Fremdsprache A1+: Integriertes Kurs- und Arbeitsbuch," 1st Edition, 2021
2. Brüseke, R., "Grammatik leicht A1," 1st Edition, 2019

REFERENCES:

1. Netzwerk Deutsch als Fremdsprache A1, 1st Edition: BlueNBells, 2012
2. Huber, K., & Keller, F., "DaF kompakt A1: Deutsch als Fremdsprache," 3rd Edition, Langenscheidt, 2018



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SEMESTER II

U25LEG06	Japanese for Engineers - II (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- To improve comprehension of real-life conversations in familiar everyday situations (shopping, dining, describing spaces, etc.)
- To develop fluency in expressing preferences, describing people, homes, and daily routines using basic sentence structures
- To build competence in writing short, structured texts such as messages, descriptions, and informal communications

COURSE OUTCOMES:

- CO 1:** Engage in simple conversations while shopping, dining, or asking for information using appropriate vocabulary and phrases **Remember**
- CO 2:** Describe people, homes, weather, and daily routines using structured sentences with correct grammar **Understand**
- CO 3:** Read and interpret simple texts such as product labels, menus, signs, and weather updates **Understand**
- CO 4:** Write short messages or descriptions related to everyday topics like hobbies, weather, or family **Understand**
- CO 5:** Apply core grammatical rules such as adjective endings, possessive pronouns, and prepositions of place with improved accuracy **Apply**

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: SHOPPING AND QUANTITIES

6 + 3

Shopping-related expressions – Asking prices and quantities – Counting objects with counters: ～つ, ～人, ～枚, ～本 – Describing wants using ～がほしいです – Offering and requesting using ～をください – Grammar: Verbs in -masu form (かいます, かります, あげます, もらいます) – Particles: と, や, から, まで – Sentence structures: ～があります / ～がいます, ～は～にあります – Vocabulary: Money, items, colors, shops – Kanji: Numbers (一～十), Days (日, 月, 火) – Basic shopping terms – Cultural note: Japanese currency – Store etiquette – Giving/receiving customs


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UNIT II: DAILY LIFE AND TIME EXPRESSIONS**6 + 3**

Talking about schedules and habits – Expressing future plans using time expressions and verb tense – Grammar: Verb conjugation (non-past affirmative/negative) – Introduction to te-form: ～てください, ～てもいいです – Sequence with ～てから – Frequency expressions: ～まいにち, ～ときどき, ～よく – Vocabulary: School/work schedule, leisure activities, public places, transportation – Kanji: Days of the week (月, 火, 水, 木, 金, 土, 日) – Time-related (時, 分, 半) – Motion verbs (行く, 来る, 帰る) – Cultural note: Japanese daily routines – Work-life balance, punctuality

UNIT III: MAKING REQUESTS AND SEQUENCING ACTIONS**6 + 3**

Talking about likes and dislikes: ～が大好きです / ～がきらいです – Describing abilities: ～がじょうずです / ～がへたです – Vocabulary: Hobbies, sports, entertainment terms – Inviting someone using ～ませんか – Accepting or declining invitations: そうですね / ちょっと – Grammar: Verb forms for expressing preference and intention – Particle: が for subject in expressions of ability and preference – Kanji: Verbs related to hobbies (見, 聞, 読, 書, 食) – Nouns related to interests – Cultural note: Popular hobbies in Japan – Seasonal pastimes – Communication norms in social invitations

UNIT IV: HOBBIES AND PREFERENCES**6 + 3**

Asking and giving directions – Describing locations of people and things – Using maps and signs – Grammar: Particles に and で for location and direction – Expressions: ～のまえに, ～のとなりに, ～のなかに – Vocabulary: Places in town – Transportation terms – Directional phrases – Kanji: Location and place words (駅, 右, 左, 上, 下, 中) – Common public signs – Cultural note: Navigating Japanese cities – Polite phrases for asking directions – Public transport norms

UNIT V: ABILITIES AND SOCIAL INTERACTIONS**6 + 3**

Review of shopping – Preferences, routines, and directions – Roleplays: at the store, planning a weekend – Inviting a friend – Asking for help and giving opinions – Grammar: Integrated use of learned verb forms and particles – Vocabulary: Reinforcement through conversation – Kanji: Mixed use in real-life contexts – Cultural note: Everyday conversation etiquette – Blending formal and informal speech – Real-life scenarios in Japan

LIST OF EXPERIMENTS

1. Prepare a city map
2. Video: Talk about your daily routine
3. Describe your school (using past tense)
4. Presentation related to culture
5. Dialogue roleplay
6. Mock interview

CONTACT PERIODS:

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

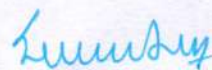
TEXTBOOKS:

1. 3A Corporation, "Minna no Nihongo Shokyū I: Main Textbook," 2nd Indian Edition, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2018
2. Banno, Eri, Yutaka Ohno, Yoko Sakane, Chikako Shinagawa, and Kyoko Tokashiki, "Genki I: An Integrated Course in Elementary Japanese," 3rd Edition, The Japan Times Publishing, Tokyo, 2020

REFERENCES:

1. Yamada, M., & Fujita, T., "Japanese for Beginners: A Practical Approach," 1st Edition, Tuttle Publishing, 2019

2. Takahashi, A., & Sato, M., "Nihongo Pro: Japanese for N5 Level," 1st Edition, KADOKAWA, 2018



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SEMESTER II



U25LEG07	French for Engineers - II (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- To improve comprehension of real-life conversations in familiar everyday situations (shopping, dining, describing spaces, etc.)
- To develop fluency in expressing preferences, describing people, homes, and daily routines using basic sentence structures
- To build competence in writing short, structured texts such as messages, descriptions, and informal communications

COURSE OUTCOMES:

- CO 1:** Engage in simple conversations while shopping, dining, or asking for information using appropriate vocabulary and phrases **Remember**
- CO 2:** Describe people, homes, weather, and daily routines using structured sentences with correct grammar **Understand**
- CO 3:** Read and interpret simple texts such as product labels, menus, signs, and weather updates **Understand**
- CO 4:** Write short messages or descriptions related to everyday topics like hobbies, weather, or family **Understand**
- CO 5:** Apply core grammatical rules such as adjective endings, possessive pronouns, and prepositions of place with improved accuracy **Apply**

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: FOOD AND SHOPPING ESSENTIALS

6 + 3

Food items – Quantities – Packaging – Prices – Navigating markets and stores – Asking for prices and quantities – Expressing preferences and choices – Grammar: Partitive articles (du - de la - des) – Expressions of quantity (un kilo de - beaucoup de - etc.) – Use of il y a – Verb prendre (to take) – Vouloir (to want) – Acheter (to buy) in the present tense – Cultural Focus: French culinary culture – Market etiquette – Typical meals and menus

UNIT II: DINING OUT AND CAFÉ CULTURE

6 + 3

Ordering in a café or restaurant – Understanding menus – Making polite requests – Expressing likes and dislikes – Talking about meals – Grammar: Adjective placement and agreement with nouns – Review of present tense verbs – Questions and polite forms – Cultural Focus: Café culture in France and Francophone regions – Dining customs – Tipping practices

UNIT III: DESCRIBING HOME AND SURROUNDINGS**6 + 3**

Talking about where you live – Describing your home and rooms – Locating objects in a room – Discussing furniture and appliances – Grammar: Prepositions of place (sur - sous - devant - derrière - entre) – Demonstrative adjectives (ce - cette - ces) – Verb habiter and other -er verbs – Cultural Focus: Types of housing in France – Apartment etiquette – Real estate ads in Francophone cities

UNIT IV: DAILY ROUTINES AND PERSONAL DESCRIPTIONS**6 + 3**

Describing people – Talking about daily routines – Introduction to reflexive verbs – Using adverbs of place (ici - là-bas) – Giving simple directions – Grammar: Reflexive verbs (s'habiller, se lever) – Adverbs of place – Review of verb placement – Cultural Focus: Urban vs. rural living – Typical neighborhood life in French cities

UNIT V: LEISURE, WEATHER, AND SOCIAL LIFE**6 + 3**

Talking about hobbies and sports – Weekend activities – Making and responding to invitations – Expressing preferences and future intentions – Grammar: Verbs faire, aimer, préférer, sortir, aller – Contractions with à and de (au, du) – Near future tense (futur proche: aller + infinitive) – Use of on – Cultural Focus: Leisure activities in Francophone countries – Popular sports and pastimes – Social norms around outings and gatherings

LIST OF EXPERIMENTS

1. Prepare a city map
2. Video: Talk about your daily routine
3. Describe your school (using past tense)
4. Presentation related to culture
5. Dialogue roleplay
6. Mock interview

CONTACT PERIODS:

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

TEXTBOOKS:

1. Marie-José Lopes & Jean-Thierry Bougnec, "Inspire 2 A1-A2 Méthode de français," 1st Edition, Hachette Français Langue Etrangère, 2020
2. Gibbe, C., Berthet, A., & Hugot, C., "Édito A2: Méthode de français," 1st Edition, Didier, 2024

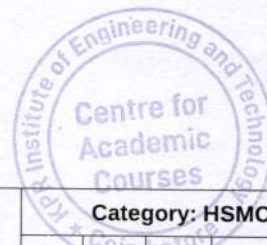
REFERENCES:

1. Chantal Fougères & Marc de la Harpe, "Le Nouveau Sans Frontières 2: Méthode de français A2," 1st Edition, Hachette FLE, 2020
2. Xavier Maingueneau, "Le Français pour les Nuls: A2-B1," 3rd Edition, Wiley, 2021



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SEMESTER II

U25LEG08	Hindi for Engineers - II (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- To improve comprehension of real-life conversations in familiar everyday situations (shopping, dining, describing spaces, etc.)
- To develop fluency in expressing preferences, describing people, homes, and daily routines using basic sentence structures
- To build competence in writing short, structured texts such as messages, descriptions, and informal communications

COURSE OUTCOMES:

- CO 1:** Engage in simple conversations while shopping, dining, or asking for information using appropriate vocabulary and phrases **Remember**
- CO 2:** Describe people, homes, weather, and daily routines using structured sentences with correct grammar **Understand**
- CO 3:** Read and interpret simple texts such as product labels, menus, signs, and weather updates **Understand**
- CO 4:** Write short messages or descriptions related to everyday topics like hobbies, weather, or family **Understand**
- CO 5:** Apply core grammatical rules such as adjective endings, possessive pronouns, and prepositions of place with improved accuracy **Apply**

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: SHOPPING LANGUAGE AND NUMBER USAGE

6 + 3

Interacting in markets and shops – Asking prices and quantities – Expressing need and preference – Vocabulary: Fruits – Vegetables – clothes – Money terms – Numbers (1–100) – Classifiers: किलो - दर्जन – Use of polite requests – Grammar: Verbs चाहना - लेना - देना in present tense – Use of कुछ and कितना – Postpositions: के लिए - के पास – Emphatic words: ही - भी – Cultural note: Indian market etiquette – Bargaining norms – Respectful phrases for shopkeepers – Currency handling

UNIT II: DESCRIBING PEOPLE AND RELATIONSHIPS

6 + 3

Talking about family and people – Describing physical appearance and personality – Expressing family relations – Vocabulary: Family members – Descriptive adjectives – Colors – Body parts – Grammar: Adjective agreement by gender and number – Possessives with का/की/के – Verb होना in past tense (था/थी/थे) – Using का रिश्ता for relationships – Honorific subject-verb agreement – Cultural note: Kinship terms – Family address norms – Formal/informal differences – Indian respect systems

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UNIT III: HOBBIES, LIKES, AND SOCIAL LANGUAGE**6 + 3**

Talking about hobbies and free time – Expressing likes and dislikes – Making suggestions and invitations – Vocabulary: Leisure activities – hobbies - entertainment words – Days of the week – Grammar: पसंद होना constructions – Compound verb use with करना (e.g., किताब पढ़ना) – Use of मुझे X पसंद है – Use of को for preferences – Future tense basics with गा/गी/गे – Cultural note: Indian leisure culture – Film and music – Inviting friends – Group social etiquette

UNIT IV: EVERYDAY CONVERSATIONS AND NEEDS**6 + 3**

Describing needs and routines in daily life – Making polite offers and requests – Talking about simple problems and solutions – Vocabulary: Basic needs – Services – Tools – simple household and health terms – Grammar: Requests with क्या आप...? – Use of चाहिए – Conditional phrases with अगर (if) – More on present vs. future tense use – Cultural note: Navigating services in India – Polite refusals – Help seeking expressions

UNIT V: RECAP AND REAL-LIFE PRACTICE**6 + 3**

Conversational roleplays: shopping – Family introductions – Hobby discussion – Describing routines and asking for help – Combining sentence structures from previous units – Vocabulary: Review and integrate all learned sets – Grammar: Review of verb tenses – Question structures – Postpositions – Honorifics – Cultural note: Integrating cultural etiquette with language use – Real-world scenarios for communication in Hindi

LIST OF EXPERIMENTS

1. Prepare a city map
2. Video: Talk about your daily routine
3. Describe your school (using past tense)
4. Presentation related to culture
5. Dialogue roleplay
6. Mock interview

CONTACT PERIODS:

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

TEXTBOOKS:

1. Pavithra Publications, "Spoken Hindi: Through Tamil," 2nd Edition, Pavithra Publications, Chennai, 2015
2. Dakshina Bharat Hindi Prachar Sabha, "Prathamik Text Book: New Syllabus," 1st Edition, Dakshina Bharat Hindi Prachar Sabha, Madras, 2023

REFERENCES:

1. Ganga, K., & Ramesh, V., "Learn Hindi in 30 Days: A Beginner's Guide," 3rd Edition, Hindi Academy, 2020
2. Vyas, S., "Spoken Hindi for Beginners," 1st Edition, Orient BlackSwan, 2018



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SEMESTER II

U25LEG10	Chinese for Engineers - II (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

QP PATTERN: A

COURSE OBJECTIVES:

- To improve comprehension of real-life conversations in familiar everyday situations (shopping, dining, describing spaces, etc.)
- To develop fluency in expressing preferences, describing people, homes, and daily routines using basic sentence structures
- To build competence in writing short, structured texts such as messages, descriptions, and informal communications

COURSE OUTCOMES:

- CO 1:** Engage in simple conversations while shopping, dining, or asking for information using appropriate vocabulary and phrases **Remember**
- CO 2:** Describe people, homes, weather, and daily routines using structured sentences with correct grammar **Understand**
- CO 3:** Read and interpret simple texts such as product labels, menus, signs, and weather updates **Understand**
- CO 4:** Write short messages or descriptions related to everyday topics like hobbies, weather, or family **Understand**
- CO 5:** Apply core grammatical rules such as adjective endings, possessive pronouns, and prepositions of place with improved accuracy **Apply**

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: WOULD YOU LIKE TO HAVE COFFEE OR TEA?

6 + 3

Learning transposed objects – Learning how to express “too”, “also” with 也 – Learning how to express “excessively” with 太.....了 – Learning numerical system in Chinese – Learning how to express “more than” with 多

UNIT II: WHERE IS MY WALLET?

6 + 3

Learning 在 as a verb with a place word – Learning location of an action (S + 在 + 處所詞 (PW) + 動作 (V)) – Learning how to express suggestion with 吧 – Learning noun + directional word as a place word – Learning existential sentences with 有

UNIT III: LET'S PLAY TENNIS THIS WEEKEND!

6 + 3

Learning how to express acquired skills with 會 (know how to) – Learning complement marker 得 – Learning 有(一)點(兒) as an adverb – Learning auxiliary verb 可以

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UNIT IV: HOW MUCH IS THIS?**6 + 3**

Learning new vocabulary for shopping – Learning measure words (個, 本, 張, 件) – Learning how to ask and answer about prices (多少錢). Using 塊, 毛, 分 for money – Practicing shopping dialogues

UNIT V: WHAT'S YOUR FAVORITE FOOD?**6 + 3**

Learning new vocabulary for food and drinks – Learning common verbs for eating and drinking (吃, 喝) – Expressing preferences with 喜歡 / 不喜歡 – Using 還是 to make choices – Role-play: ordering food in a restaurant

LIST OF EXPERIMENTS

1. Prepare a city map
2. Video: Talk about your daily routine
3. Describe your school (using past tense)
4. Presentation related to culture
5. Dialogue roleplay
6. Mock interview

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

1. Mandarin Training Centre, National Taiwan Normal University, Modern Chinese I 時代華語 I, Edited by Chih-Ping Chou, Taipei: Cheng Chung Book Company Ltd., 2019
2. Huayu101 / 華語101, Taiwan Ministry of Education, Taiwan Mandarin Educational Resources Centre, 2018

REFERENCES:

1. Cheng Chung Book Company Ltd, 時代華語 I 教師手冊 [Modern Chinese I Teacher's Manual, 2019
2. www.lmit.edu.tw/bag



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SEMESTER II

U25MCC06	Universal Human Values II (Common to all programmes)	Category: MCC				
		L	T	P	J	C
		2	1	0	0	3

QP PATTERN: A

PRE-REQUISITES:

- U25MCC01 - Universal Human Values I

COURSE OBJECTIVES:

- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature

COURSE OUTCOMES:

- CO 1:** Evaluate the significance of value inputs in formal education and start applying them in their life and **Understand** profession
- CO 2:** Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the **Understand** Body, Intention and Competence of an individual, etc
- CO 3:** Analyze the value of harmonious relationship based on trust and respect in their life and profession **Understand**
- CO 4:** Examine the role of a human being in ensuring harmony in society and nature **Understand**
- CO 5:** Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession **Understand**

CO - PO MAPPING:

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

SYLLABUS:

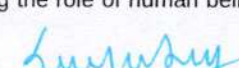
UNIT I: INTRODUCTION-BASIC HUMAN ASPIRATION, ITS FULFILLMENT THROUGH ALL ENCOMPASSING6 +
RESOLUTION 3

The basic human aspirations and their fulfillment through Right understanding and Resolution – Right understanding and Resolution as the activities of the Self-self being central to Human Existence – All encompassing Resolution for a Human Being – Its details and solution of problems in the light of Resolution

UNIT II: RIGHT UNDERSTANDING - KNOWER, KNOWN & THE PROCESS

6 + 3

The domain of right understanding starting from understanding the human being and extending up to understanding nature/ existence – its interconnectedness and co-existence – and finally understanding the role of human being in existence (human conduct)


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UNIT III: UNDERSTANDING HUMAN BEING**6 + 3**

Understanding the human being comprehensively as the first step and the core theme of this course – Human being as co-existence of the self and the body – The activities and potentialities of the self-basis for harmony/contradiction in the self

UNIT IV: UNDERSTANDING NATURE AND EXISTENCE**6 + 3**

A comprehensive understanding about the existence – Nature being included – The need and process of inner evolution – Particularly awakening to activities of the Self: Realization – Understanding and Contemplation in the Self

UNIT V: UNDERSTANDING HUMAN CONDUCT, ALL-ENCOMPASSING RESOLUTION & HOLISTIC WAY OF LIVING 6 + 3

Understanding Human Conduct – Different aspects of all encompassing Resolution – Holistic way of living for Human Being with all encompassing resolution covering all four dimensions of human endeavor viz., realization, thought, behavior and work leading to harmony at all levels from Self to Nature and entire Existence

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** 15 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, 2nd Revised Edition, Excel Books, New Delhi, 2019

REFERENCES:

1. E G Seebauer & Robert L. Berry, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press, 2000
2. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd
3. B P Banerjee, Foundations of Ethics and Management, Excel Books, 2005
4. B L Bajpai, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008



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SEMESTER II

U25MCC07	Tamil and Technology (Common to all programmes)	* Coin 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 – Beads 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 Thoombu 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, Chennai – 600 007, First Edition 2023
2. Tamils and Technology, S. Priyadharshini, V. K. Publications, 55, Gopuram Colony, Sivakasi – 626 124

REFERENCES:

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை, International Institute of Tamil Studies, C.P.T Campus, Chennai
2. கணினித் தமிழ் - முனைவர். இல. சுந்தரம், விகடன் பிரசுரம், அண்ணா சாலை, சென்னை, திசம்பர் 2016
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம், தொல்லியல் துறை வெளியீடு, தமிழ்நாடு அரசு, சென்னை, ஆறாம் பதிப்பு 2020
4. 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
5. Studies in the History of India with Special Reference to Tamil Nadu, Dr. K. K. Pillay, 1979



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.



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 Sanskrit", 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

U25MCC08	Professional Skill Development - I (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	-	1	1
CO 2	2	2	3	3	2	2	-	-	1	1	-	1	1
CO 3	-	-	3	-	-	2	2	3	3	3	2	1	1

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

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

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 – Dühring'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.

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

U25MCC09	Professional Skill Development - II (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	-	1	1
CO 2	2	3	3	3	2	2	-	-	1	1	-	1	1
CO 3	-	-	3	-	-	2	2	3	3	3	2	1	1

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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