ANNA UNIVERSITY, CHENNAI

UNDERGRADUATE CURRICULUM (NON-AUTONOMOUS AFFILIATED INSTITUTIONS)

Programme: B.Tech., Plastics Technology **Regulations:** 2025

Abbreviations:

HUM – Humanities (Languages, Management, Heritage, and others)

BS – Basic Science (Mathematics, Physics, Chemistry)

ES – Engineering Science (General (**G**), Programme Core (**PC**), Programme Elective (**PE**) & Emerging Technology (**ET**))

SD – Skill Development

SL – Self Learning

CDP – Capstone Design Project

OE – Open Elective

L – Laboratory Course

T – Theory

LIT – Laboratory Integrated Theory

PW – Project Work

IPW – Internship cum Project Work

DIC – Department Introductory Course

TCP – Total Contact Period(s)

Program Outcomes

1. **Engineering Knowledge**: Apply math, science, and engineering fundamentals to complex problems.
2. **Problem Analysis**: Identify and analyze complex problems using research and sustainability principles.
3. **Design Solutions**: Design systems and processes considering health, safety, cost, culture, and environment.
4. **Investigations**: Use experiments, modelling, and data analysis to reach valid conclusions.
5. **Engineering Tools**: Apply modern tools for modelling and problem-solving, recognizing their limits.
6. **Society & Environment**: Assess societal, legal, and environmental impacts of engineering solutions.
7. **Ethics**: Commit to ethics, human values, diversity, and legal compliance.
8. **Teamwork**: Work effectively as an individual and in multidisciplinary teams.
9. **Communication**: Communicate clearly in reports, presentations, and documentation across diverse groups.
10. **Management & Finance**: Apply management and economic principles in projects and teamwork.
11. **Lifelong Learning**: Engage in continuous learning, adapt to new technologies, and think critically.

Program Specific Outcomes:

PSO 1: Design and manufacture plastic products with desired properties for different applications.

PSO 2: Use modern tools and adapt sustainable practices for solving critical challenges in the fields of plastic production and recycling.

PSO 3: Acquire the skills with rapid development in Plastic Engineering, work collaborate in teams and exhibit research aptitude.

Semester – I							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T- P	**TCP**		
1.	MA25C01	Applied Calculus	T	3-1-0	4	4	BS
2.	EN25C01	English Essentials – I	T	2-0-0	2	2	HUM
3.	PT25101	Introduction to Polymer Science and Engineering	T	2-1-0	3	3	ES (PC)-DIC
4.	CY25C01	Applied Chemistry – I	LIT	2-0-2	4	3	BS
5.	PH25C01	Applied Physics – I	LIT	2-0-2	4	3	BS
6.	UC25H01	தமிழர் மரபு / Heritage of Tamils	T	1-0-0	1	1	HUM
7.	CS25C02	Computer Programming: Python	LIT	2-0-2	4	3	ES (PC)
8.	ME25C04	Makerspace	L	0-0-4	4	2	SD
9.	UC25A01	Life Skills for Engineers – I	---	1-0-2	3	1	HUM
10.	UC25A02	Physical Education – I	---	0-0-4	4	1	HUM
11.		NCC / NSS / NSO / YRC	---	---	---	---	---
Total Credits					**33**	**23**	

Semester – II							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T- P	**TCP**		
1.	MA25C02	Linear Algebra	T	3-1-0	4	4	BS
2.	CY25202	Applied Chemistry (Tech) – II	T	2-0-0	2	2	BS
3.	ME25C01	Engineering Drawing	LIT	2-0-4	6	4	ES (G)
4.	PH25C06	Applied Physics (Tech) – II	T	2-1-0	3	3	BS
5.	EE25C01	Basic Electrical and Electronics Engineering	T	3-0-0	3	3	ES (G)
6.	UC25H02	தமிழர்களும் தொழில்நுட்பமும் / Tamils and Technology	T	1-0-0	1	1	HUM
7.	ME25C05	Re-Engineering for Innovation	L	0-0-4	4	2	SD
8.	EN25C02	English Essentials – II	LIT	1-0-2	3	2	HUM
9.	UC25A03	Life Skills for Engineers – II	---	1-0-2	3	1	HUM
10.	UC25A04	Physical Education – II	---	0-0-4	4	1	HUM
11.		Foreign Language^	LIT	1-0-2	3	1	HUM
				Total Credits	**36**	**24**	

^ Deutsch / Japanese / Korean

Semester – III							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T- P	**TCP**		
1.	MA25C09	Computational Differential Equations	T	3-1-0	4	4	BS
2.	PT25301	Polymer Physics	T	3-0-0	3	3	ES (PC)
3.	PT25302	Plastics Materials I	T	3-0-0	3	3	ES (PC)
4.	PT25303	Polymer Chemistry	LIT	3-0-4	7	5	ES (PC)
5.	PT25304	Fundamentals of Chemical Engineering	LIT	3-0-2	5	4	ES (PC)
6.	PT25305	Introduction to Data Science	LIT	2-0-2	4	3	ES (PC)
7.	EN25C03	English Communication Skills Laboratory – I	L	0-0-2	2	1	HUM
8.	-	Skill Development Course – I	LIT	1-0-2	3	2	SD
				Total Credits	**31**	**25**	

Semester – IV							
S. No.	Course Code	Course Name	Course Type	Periods / Week		Credits	Category
				L-T- P	TCP		
1.	PT25401	Additives and Compounding	T	3-0-0	3	3	ES (PC)
2.	PT25402	Polymer Rheology	T	3-0-0	3	3	ES (PC)
3.	PT25403	Plastics Materials II	T	3-0-0	3	3	ES (PC)
4.	PT25404	Plastics Moulds and Dies Technology	T	3-0-0	3	3	ES (PC)
5.	PT25405	Plastics Processing - I	LIT	3-0-4	7	5	ES (PC)
6.	PT25406	Standards for Plastics Materials and products	T	1-0-0	1	1	UC
7.	PT25407	Mini Project I	L	0-0-2	2	1	SD
8.	EN25C04	English Communication Skills Laboratory – II	L	0-0-2	2	1	HUM
9.	-	Skill Development Course – II	LIT	1-0-2	3	2	SD
10.		Industry Internship*	-	-	-	-	SD
				Total Credits	**27**	**22**	

*Four weeks industrial training/internship carries two credits. Industrial training/internship during IV Semester Summer Vacation will be evaluated in V semester

Semester – V							
S. No.	Course Code	Course Name	Course Type	Periods / Week		Credits	Category
				L-T- P	TCP		
1.		Plastics Processing -II	T	3-0-0	3	3	ES (PC)
2.		Plastics Testing and Characterization	LIT	3-0-4	7	5	ES (PC)
3.		Programme Elective – I	T	3-0-0	3	3	ES (PE)
4.		AI and ML for Plastics Industries	LIT	2-0-4	6	4	ES (PC)
5.		Programme Elective – II	T	3-0-0	3	3	ES (PE)
6.		Skill Development Course – III	LIT	1-0-2	3	2	SD
7.		Industry Oriented Course - I	LIT	1-0-2	3	1	SD
8.		Plastics Processing Laboratory - II	L	0-0-4	4	2	PCC
9.		Industry Internship*	---	---	---	2	SD
				Total Credits	**32**	**25**	
For Honours Degree							
1.		Capstone Design Project – Level I	CDP	0-0-12	12	6	SD
OR							
1.		Honours Elective – I	T	3-0-0	3	3	
2.		Honours Elective – II	T	3-0-0	3	3	
For Minor Degree							

Semester – V							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T- P	**TCP**		
1.		Minor Elective – I	T	3-0-0	3	3	
2.		Minor Elective – II	T	3-0-0	3	3	

*Four weeks industrial training/internship carries two credits. Industrial training/internship during IV Semester Summer Vacation will be evaluated in V semester

Semester – VI							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.		Plastics Product Testing	LIT	3-0-4	7	5	ES (PC)
2.		Plastics Product Design	LIT	3-0-2	5	4	ETC
3.		Polymer Composites	T	3-0-0	3	3	ES (PC)
4.		Programme Elective – III	T	3-0-0	3	3	ES (PE)
5.		Open Elective	T	3-0-0	3	3	OE
6.		Self-Learning Course	---	---	-	1	--
7.		Industry Oriented Course - II	LIT	1-0-2	3	1	SD
8.		CAD/CAM/CAE Laboratory	L	0-0-4	4	2	ES (PC)
9.		Industry Internship[#]	-	-	-	-	SD
Total Credits					**28**	**22**	
For Honours Degree							
1.		Capstone Design Project – Level II	CDP	0-0-12	12	6	SD
OR							
1.		Honours Elective – III	T	3-0-0	3	3	
2.		Honours Elective – IV	T	3-0-0	3	3	
For Minor Degree							
1.		Minor Elective – III	T	3-0-0	3	3	
2.		Minor Elective – IV	T	3-0-0	3	3	

[#]Four weeks industrial training/internship carries two credits. Industrial training/Internship during VI Semester Summer Vacation will be evaluated in VII semester

Semester – VII							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.		Polymer Blends and Alloys	T	4-0-0	4	4	ES (PC)
2.		Plastics Recycling and Waste Management	T	3-0-0	3	3	ES (PC)
3.		Programme Elective – IV	T	3-0-0	3	3	ES (PE)
4.		Programme Elective – V	T	3-0-0	3	3	ES (PE)
5.		Engineering Entrepreneurship Development	T	2-0-2	4	3	HUM
6.		Climate Change and Sustainability	T	2-0-0	2	2	HUM
7.		Mini Project II	L	0-0-4	4	2	SD
8.		Project Management	T	2-0-0	2	2	---
9.		Industry Internship[#]	---	---	---	2	SD
Total Credits					**25**	**24**	
For Honours Degree							
1.		Capstone Design Project – Level III	CDP	0-0-12	12	6	SD
OR							
1.		Honours Elective – V	T	3-0-0	3	3	
2.		Honours Elective – VI	T	3-0-0	3	3	
For Minor Degree							
1.		Minor Elective – V	T	3-0-0	3	3	
2.		Minor Elective – VI	T	3-0-0	3	3	

[#]Four weeks industrial training/internship carries two credits. Industrial training/Internship during VI Semester Summer Vacation will be evaluated in VII semester

Semester – VIII							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1		Project Work / Internship cum Project Work	PW/IPW	0-0-16	16	8	SD
Total Credits					**16**	**8**	

Total No. of Credits:173

PROGRAMME ELECTIVE COURSES – STREAMS

Advanced Polymeric Materials	Design and Manufacturing	Advanced Processing Technology	Industrial Management
High Performance Polymeric Materials	Design and Manufacturing of Advanced Moulds	Advanced Extrusion Technology	Product Cost Estimation and Process Optimization
Plastics in Electronics	Additive Manufacturing	Advanced Injection Moulding Technology	Engineering Statistics and Quality Control
Bioplastics and Biodegradable Polymers	Design and Manufacturing of Plastics Machineries	Advanced Blow Moulding Process	Product Life Cycle Management and Circular Economy
Polymers in Biomedical Applications	Plastics Packaging Technology	Polyurethane Technology	Pollution, Regulatory Norms and Extended Producer Responsibility
Adhesives, Paints and Coatings	Thermoplastic Elastomers Technology	Automation in Plastics Processing	Engineering and Quality Management Systems
Sustainable Polymers and Green Composite	Polymer Nanocomposites	Advanced Foam Technology	Startup and Entrepreneurship Development
Polymer Membranes	PVC Technology	Machining and Joining of Plastics	Intellectual Property Rights (IPR)

Semester I

EN25C01	English Essentials – I	L	T	P	C
		2	0	0	2

Course Objectives:

- Enhance learners' listening and speaking skills to understand and deliver speeches effectively
- Equip students with the skills to write clear, coherent, and grammatically correct texts for various purposes.
- Strengthen the ability to comprehend, interpret, and analyse written English across diverse contexts.

Speaking Skills: Self-Introduction (Tenses, Adjectives) Expressing opinions (Subject-Verb Agreement), Participating in Conversations (Speech Acts - agreeing & disagreeing – synonyms and antonyms**)**

Suggested Activities: Self-Introduction, Just a Minute (JAM) Video recording, Situational role plays, Spell Bee, Word Substitution, Usage of Apps.

Listening Skills: Listening to Simple Conversations (Understanding tone and intent), Short Speeches / Stories, Extracting information, Pronunciation, Listening to Various Accents.

Suggested Activities: Listening and Repeating, Gap fill exercises, Note-taking

Reading Skills: Reading Strategies – (Skimming, scanning, predicting) intensive reading - short passages and long passages on suggested themes (Sentence Patterns, Prefixes and suffixes, idioms and phrases).

Activities: Reading - newspaper and digital articles, Cloze, Reading comprehension, note making and summarising,

Writing Skills: Word Substitution, Sentence Formation, Hints Development (Guided Writing), Writing Different Types of Paragraphs - (Sentence Structure) – Letter Writing / Emails (Informal)

Activities: Error Detection, Picture and poster description, Descriptive, Narrative and Comparative paragraphs, Brainstorming and Mind Mapping - Informal letters/ Emails

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Quiz (10%), Assignments (20%), Speaking Task (10%), Reading Task (10%), Writing Task (10%), Internal Examinations (40%).

References:

1. Miller, K. Q., & Wahl, S. T. (2023). *Business and Professional Communication: KEYS for Workplace Excellence* (5th ed.). SAGE Publications.
2. Kumar, Sanjay & Pushpalatha. (2018). *English Language and Communication Skills for Engineers*. India: Oxford University Press.
3. Sharma, S., & Mishra, B. (2024). *Communication Skills for Engineers and Scientists* (2nd ed.). PHI Learning.

E-resources:

1. Cambridge English – https://www.cambridgeenglish.org/learning-english/grammar-and-vocabulary/

2. Perfect English Grammar – https://www.perfect-english-grammar.com/
3. British Council – Learn English - https://learnenglish.britishcouncil.org/grammar
4. Speechling – https://speechling.com/
5. mePro by Pearson – https://mepro.pearson.com/
6. TED Talks – https://www.ted.com/

	Description of CO	**PO**	**PSO**
CO1	Listen and comprehend spoken English, take and draft notes.	---	---
CO2	Apply vocabulary and grammar appropriately to communicate in written and spoken forms.	PO1(3)	PSO1(2) PSO3(3)
CO3	Analyze texts in different contexts using appropriate reading strategies.	PO2(2)	PSO2(1)
CO4	Communicate thoughts and ideas in real life situations.	PO9(2)	PSO3(2)
CO5	Develop communication skills relevant to engineering and technology.	PO11(1)	PSO3(3)

MA25C01	Applied Calculus	L	T	P	C
		3	1	0	4

Course Objectives:

- To provide technical competence of modelling engineering problems using calculus.
- To apply the calculus concepts in solving engineering problems using analytical methods and computational tools.

Differential Calculus: Functions, graph of functions, New functions from old functions, Limit of a function, Continuity, Limits at infinity, Derivative as a function, Maxima and Minima of functions of single variable, Mean value theorem, Effect of derivatives on the shape of a graph.

Activities: Visualization of the functions, Maxima and Minima of a function using open-source software, Solving of Competitive Examination questions (Ex. GATE).

Functions of Several Variables: Partial derivatives, Chain rule, Total derivative, Maxima and minima of functions of two variables, Method of Lagrange's Multipliers, Application problems in engineering.

Activities: Partial Derivatives with two or three variables, Maxima and Minima of a function using open-source software, Solving of Competitive Examination questions (Ex. GATE).

Integral Calculus: Fundamental theorem of Calculus, Indefinite integrals and the Net Change Theorem, Improper integrals, Arc Length, Area of Region, Area of surface of revolution.

Activities: Definite and Indefinite Integrals, Determination of Area, Solving of Competitive Examination questions (Ex. GATE).

Multiple Integrals: Iterated integrals and Fubini's theorem, Evaluation of double integrals, change of order of integration, change of variables between Cartesian and polar co-ordinates, evaluation of triple integrals-change of variables between Cartesian and cylindrical and spherical co-ordinates.

Activities: Double integrals and triple integrals using open-source software, Solving of Competitive Examination questions (Ex. GATE).

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (20%), Solution to application-oriented problems using software (20%), Solving of GATE questions (20%), Internal Examinations (40%).

References:

1. Anton, H., Bivens, I. C., & Davis, S. (2021). Calculus: Early transcendentals. John Wiley & Sons.
2. Ron Larson and David C. Falvo,(2013), Calculus: an Applied Approach. Cengage Learning.
3. Stewart, J., Clegg, D., & Watson, S. (2019). *Calculus: Early transcendentals*.
4. Thomas, G. B., Jr., Weir, M. D., Hass, J., & Heil, C. (2018). *Thomas' calculus: Early transcendentals*. Pearson.

5. Singh, K. (2019). *Engineering mathematics through applications*. Bloomsbury Publishing.
6. Grewal, B. S. (2012). *Higher engineering mathematics.* Khanna Publishers.

E-resources:

1. https://math.libretexts.org/Bookshelves/Calculus/Map%3A_Calculus__Early_Transcendentals_(Stewart)/
2. https://openstax.org/books/calculus-volume-1/
3. https://tutorial.math.lamar.edu/Classes/CalcII/CalcII.aspx
4. SCILAB, https://www.scilab.org/

	Description of CO	**PO**	**PSO**
CO1	Explain the meaning of derivative, integral, and their geometric and physical interpretations.	---	---
CO2	Apply differentiation and integration techniques to compute maxima, minima, and area.	PO1(3)	PSO1(2) PSO2(2)
CO3	Analyze the behavior of single and multivariable functions using derivatives and partial derivatives.	PO2(3)	PSO1(2) PSO3(1)
CO4	Utilize modern computational software and online platforms to deepen understanding, perform complex calculations, and visualize mathematical concepts.	PO5(2) PO11(1)	PSO2(3) PSO3(1)

PT25101	Introduction to Polymer Science and Engineering	L	T	P	C
		2	1	0	3

Course Objectives:

Impart knowledge on various polymer processing techniques and Provide insights into the physical states of polymers and the significance of polymer morphology.

Foundations of Polymer Science

History of macromolecular science, structure of macromolecules. milestones in polymer science, inventions, and noble laureates in the field of polymers, classification of polymers, natural polymers, cellulose based polymers, natural rubber, and other natural polymers.

Activity: Virtual demonstration on noble laureates in the field of polymers

Monomers, Polymers, and their Classification Functionality of monomers - Synthetic polymers, types of polymers based on their synthetic route, advantages of polymer materials over conventional materials, Commodity, engineering and high-performance polymers, properties, and applications of Polymer materials.

Activity: seminar presentation on application of polymer materials.

Polymer Processing Fundamentals

Basic polymer processing techniques, introduction to injection moulding process, extrusion process, blow molding, compression moulding, thermoforming, and rotational moulding

Activity: Virtual demonstration of various moulding and extrusion process equipment.

Polymer Morphology and Physical States

Crystalline and amorphous polymers, structure and orders in polymers, polymer single crystals – lamellar and spherulites, transitions in polymers - melting transition, crystallization temperature, and glass transition.

Activity: Demonstration of glass crystallization temperature glass transition measurement.

Total: 45 Periods

References:

1. Gowariker VR, Viswanathan NV, Sreedhar J, Polymer science, New Age International, 4 th Ed., 2000.
2. Brydson A, Plastics materials, Butterworth - Heinemann – Oxford,1995
3. Billmeyer F W, Textbook of polymer science, John Wiley & Sons, 1984.
4. Odian G, Principles of polymerization, John Wiley & Sons; 4th Ed., 2004.
5. Manas Chanda, Introduction to Polymer Science and chemistry – A Problem Solving Approach- CRC Press – 2013.

	Description of CO	PO	PSO
CO1	Explain the historical evolution, major discoveries, and classification of polymers.	-	-
CO2	Differentiate between natural and synthetic polymers.	PO1(2) PO2(2)	-
CO3	Analyze and compare the polymer processing techniques.	PO2(1) PO3(3)	PSO1(1)
CO4	Demonstrate polymer crystallinity and morphology, including phase transitions like Tg and Tm.	PO11(3)	PSO3(3)

CY25C01	Applied Chemistry – I	L	T	P	C
		2	0	2	3

Course Objectives:

- To provide students with a solid understanding of the chemical principles for engineering applications.
- To introduce the chemical properties of materials and how these properties influence the selection and use of materials in engineering systems.
- To impart practical applications of chemistry in commonly used engineering devices

Water Technology: Water quality parameters and standards. Industrial feed water, Remediation. Municipal water treatment. Desalination.

Practical: Analysis of alkalinity, hardness and dissolved oxygen.

Activity: Coagulation of water sample using Alum

Nano-chemistry: Classification, Size, dependent properties. Preparation of nanomaterials, Top-down and Bottom-Up approaches, Applications (Flipped classroom).

Practical: Preparation of nanoparticles by Sol-Gel method.

Electrochemistry: Electrochemical cell, Electrode potential., Redox reaction. Conductivity of electrolytes, Factors.

Practical: Conductometric titrations

Activity: Electrochemical cell demonstration

Corrosion & Control: Chemical and electrochemical corrosions, galvanic series, factors influencing corrosion, Electrochemical protection. Organic and Inorganic coating.

Practical:

- Corrosion study by weight loss and salt spray method.
- Potentiometry/UV-visible spectrophotometer.

Activities: Case Study on Corrosion in Pipelines and Electronics, Control measures for a corroded metal

Batteries: Conventional, Contemporary and Emerging battery storage technologies, Primary & Secondary Batteries, Battery Pack, Battery Materials, Performance Parameters, Testing, Safety aspects.

Practical: Measurement of EMF, Internal Resistance, Charge and Discharge Characteristics.

Activities: Demonstration of battery pack in e-vehicles.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Quiz (5%), Assignments (20%), Flipped Class (5%), Practical (30%), Internal Examinations (40%)

References:

1. Jain, P. C., & Jain, M. (2015). Engineering Chemistry (17th ed.). Dhanpat Rai Publishing Company (P) Ltd.
2. Dara, S. S. (2004). A Textbook of Engineering Chemistry. Chand Publications.
3. Sachdeva, M. V. (2011). Basics of Nano Chemistry. Anmol Publications Pvt Ltd.
4. Friedrich, E. (2014). Engineering Chemistry. Medtech.

E-Resources:

1. Water and Wastewater Engineering (Prof. Ligy Philip, IIT Madras) – https://nptel.ac.in/courses/105106202.
2. Electrochemical Energy Systems (Prof. S. Mitra, IIT Madras) – https://nptel.ac.in/courses/113106028.
3. Corrosion (Prof. Kallol Mondal, IIT Kanpur) – https://nptel.ac.in/courses/112104088
4. Chemistry of Battery Systems (Prof. V. R. Marathe, IIT Madras) – https://nptel.ac.in/courses/115106130
5. Resource on all battery types, testing, and safety – https://batteryuniversity.com/articles

	Description of CO	**PO**	**PSO**
CO1	Understand the importance of chemistry applications with underlying mechanisms.	---	
CO2	Apply the chemistry concepts in widely used devices.	PO1(3)	PSO1(2) PSO2(2)
CO3	Analyse the effect of various chemical parameters on performance of engineering systems.	PO2(2)	PSO1(2) PSO2(1)
CO4	Perform experimentations as a group and interpret the results.	PO4(3) PO8(1)	PSO2(2) PSO3(2)
CO5	Communicate findings through case studies and reports	PO9(1)	PSO2(2) PSO3(3)

PH25C01	Applied Physics – I	L	T	P	C
		2	0	2	3

Course Objective(s):

- To impart knowledge and expose the essentials of physics in various engineering applications.

Properties of Matter: Elasticity, Cantilever, Young's modulus (non-uniform bending), Girders: Bridges and buildings, Viscosity: Stokes method, Surface tension: drop weight method, Thermal expansion, Thermal stress, Bimetallic strips, Expansion joints

Practical: Non-Uniform bending, Young's modulus of the material, Torsional pendulum, Rigidity modulus of the wire and moment of inertia of the disc.

Activities: Virtual demonstration of thermal stress.

Oscillations: Simple Harmonic motion, Torsional pendulum, Couple per unit twist, Damped and Forced Oscillation

Waves: Waves on a stretched string, Energy and Power, standing waves, Ultrasonics, piezo, electric method, Acoustic grating, Electromagnetic waves: Maxwell equation, Production of EM waves by dipole antenna, Propagation of EM waves in free space, wave equation, Cell phone reception

Practical: Melde's string experiment – Frequency of an electrically vibrating metal tip.

Activities: Virtual demonstration of propagation of EM waves

Quantum Mechanics: Black body radiation, Photoelectric effect, de Broglie hypothesis, Schrodinger Wave equation, Particle in a box (infinite potential well - three-dimensional box), Barrier penetration and quantum tunnelling.

Practical: Photo-electric effect, Determination of Planck's constant.

Activities: Virtual demonstration of Scanning Transmission Electron Microscope

Applied Optics: Interference: Air wedge, Michelson's Interferometer, Fiber optics: Structure of a fiber, Fiber Optic Communication System, Fiber Sensors (Virtual demo), Displacement, pressure sensor and Temperature sensor, Einstein Co-efficient, Nd:YAG laser, CO_2 laser (construction, functioning and applications), dye laser

Practical: Ruling width of Compact disc using Laser, Thickness of a thin sheet/wire using Air wedge Method.

Activities: Demonstration of sensors and applications of Lasers

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Quiz (5%), Assignments (20%), Flipped Class (5%), Practical (30%), Internal Examinations (40%)

References:

1. Young, H. D., & Freedman, R. A. (2020). University physics with modern physics. Pearson.
2. Gaur, R. K., & Gupta, S. L. (2022). Engineering physics. Dhanpat Rai Publications.
3. Mathur, D. S. (2010). Elements of properties of matter. S. Chand Publishing.
4. Griffiths, D. J. (2018). Introduction to quantum mechanics. Cambridge University Press.
5. Silfvast, W. T. (2008). Laser fundamentals (2nd ed.). Cambridge University Press.

E-Resources:

1. Barrier penetration problem and Quantum tunnelling: https://archive.nptel.ac.in/courses/115/104/115104096/
2. EM waves and wireless channelling: https://onlinecourses.nptel.ac.in/noc24_ee31/preview
3. CO2 Laser: https://onlinecourses.nptel.ac.in/noc25_ph03/preview
4. Bimetallic Strips _ https://www.youtube.com/watch?v=WZQ8lvxdzDk
5. Cell phone Reception_ https://www.youtube.com/watch?v=1JZG9x_VOwA
6. Dipole Antenna_ https://www.youtube.com/watch?v=4xF1Fq2wB1I
7. Optical Sensors_ https://auece.digimat.in/nptel/courses/video/108106173/L02.html
8. Scanning Tunnelling Electron Microscope_ https://www.youtube.com/watch?v=XNYZYbXNWQA

	Description of CO	**PO**	**PSO**
CO1	Explain the physics concepts in various applications.	---	---
CO2	Apply the principles of wave optics and laser physics in practical systems.	PO1(3)	PSO1(2) PSO2(2)
CO3	Analyse the behaviour of materials under different conditions.	PO2(2)	PSO1(2) PSO3(1)
CO4	Conduct experiments in groups and interpret the data.	PO4(3) PO8(1)	PSO1(2) PSO2(2)

UC25H01	தமிழர் மரபு	L	T	P	C
		1	0	0	1

மொழி மற்றும் இலக்கியம்: இந்திய மொழிக் குடும்பங்கள், திராவிட மொழிகள், தமிழ் ஒரு செம்மொழி, தமிழ் செவ்விலக்கியங்கள், சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை, சங்க இலக்கியத்தில் பகிர்தல் அறம், திருக்குறளில் மேலாண்மைக் கருத்துக்கள், தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம், பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள், சிற்றிலக்கியங்கள், தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி, தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக்
கலை:நடுகல் முதல் நவீன சிற்பங்கள் வரை, ஐம்பொன் சிலைகள், பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் , தேர் செய்யும் கலை, சுடுமண் சிற்பங்கள், நாட்டுப்புறத் தெய்வங்கள், குமரிமுனையில் திருவள்ளுவர் சிலை, இசைக் கருவிகள், மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம், தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

தமிழர்களின் திணைக் கோட்பாடுகள்: தமிழகத்தின் தாவரங்களும், விலங்குகளும், தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள், தமிழர்கள் போற்றிய அறக்கோட்பாடு, சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும், சங்ககால நகரங்களும் துறை முகங்களும், சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி, கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு, இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் , சுயமரியாதை இயக்கம் இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு, கல்வெட்டுகள், கையெழுத்துப்படிகள், தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

References:

1. தமிழக வரலாறு, மக்களும் பண்பாடும், கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ், முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி, வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை, ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: InternationalInstitute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

UC25H01	Heritage of Tamils	L	T	P	C
		1	0	0	1

Language and Literature: 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.

Heritage - Rock Art Paintings to Modern Art – Sculpture: 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.

Folk and Martial Arts: Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance, Sports and Games of Tamils.

Thinai Concept of Tamils: 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.

Contribution of Tamils to Indian National Movement and Indian Culture:

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

References:

1. தமிழக வரலாறு, மக்களும் பண்பாடும், கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும், கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ், முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி, வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை, ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils, The Classical Period (Dr.S.Singaravelu) (Published by: InternationalInstitute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi, 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL), Reference Book.

CS25C02	Computer Programming: Python	L	T	P	C
		2	0	2	3

Course Objectives:

- To equip engineering students with the foundational knowledge and practical skills in Python programming to analyse and solve computational problems effectively.
- To foster problem-solving, critical thinking, and modular programming skills essential for engineering domains.

Introduction to Python: Problem Solving, Problem Analysis Chart, Developing an Algorithm, Flowchart and Pseudocode, Interactive and Script Mode, Indentation, Comments, Error messages, Variables, Reserved Words, Data Types, Arithmetic operators and expressions, Built-in Functions, Importing from Packages.

Practical: Problem Analysis Chart, Flowchart and Pseudocode Practices. (Minimum three)

Control Structures: if, if-else, nested if, multi-way if-elif statements, while loop, for loop, nested loops, pass statements.

Practical: Usage of conditional logics in programs. (Minimum three)

Functions: Hiding redundancy, complexity; Parameters, arguments and return values; formal vs actual arguments, named arguments, Recursive & Lambda Functions.

Practical: Usage of functions in programs. (Minimum three)

Strings & Collections: String Comparison, Formatting, Slicing, Splitting, Stripping, Lists, tuples, and dictionaries, basic list operators, searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values.

Practical: String manipulations and operations on lists, tuples, sets, and dictionaries. (Minimum three)

File Operations: Create, Open, Read, Write, Append and Close files. Manipulating directories, OS and Sys modules, reading/writing text and numbers, from/to a file; creating and reading a formatted file (csv, tab-separated, etc.).

Practical: Opening, closing, reading and writing in formatted file format and sort data. (Minimum three)

Packages: Built-in modules, User-Defined modules, Numpy, SciPy, Pandas, Scikit-learn**.**

Practical: Usage of modules and packages to solve problems. (Minimum three), Project (Minimum Two)

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Quiz (5%), Project (15%), Assignment Programs (25%), Practical (25%), Internal Examinations (30%)

References:

1. Matthes, E. (2019). *Python crash course: A hands-on, project-based introduction to programming* (2nd ed.). No Starch Press.

2. Brown, M. C. (2018). *Python: The complete reference* (4th ed.). McGraw Hill Publishers.
3. Guttag, J. V. (2016). *Introduction to computation and programming using Python: With applications to understanding data* (2nd ed.). MIT Press.
4. McKinney, W. (2017). *Python for data analysis: Data wrangling with pandas, NumPy, and IPython*. Shroff/O'Reilly.

E-Resources:

1. Official Python Documentation – https://docs.python.org/3/
2. Python Tutorials – https://www.w3schools.com/python/
3. NumPy – https://numpy.org/doc/
4. SciPy – https://scipy.org/
5. Google's Python class – https://developers.google.com/edu/python/

	Description of CO	**PO**	**PSO**
CO1	Explain the potential usage of Python in engineering applications	---	---
CO2	To apply the concepts of Python in solving engineering problems and formulate new projects.	PO1 (2) PO5 (2)	PSO2(2) PSO3(1)
CO3	To interpret the data and effectively communicate in groups.	PO2 (3) PO8 (1) PO9 (1)	PSO3(1) PSO3(2)
CO4	Adapt new programming concepts and technologies in the profession.	PO11 (1)	PSO2(2)

ME25C04	Makerspace	L	T	P	C
		0	0	4	2

Course Objectives:

1. To impart practical skills in the assembly, disassembly, and welding of components using appropriate tools and techniques.
2. To provide hands-on training in electrical wiring practices, and the use of electronic components, sensors, and actuators.

List of Activities

(A). Dis-assembly & Assembly Practices

i. Tools and its handling techniques.
ii. Dis-assembly and assembly of home appliances – Grinder Mixer Grinder, Ceiling Fan, Table Fan & Washing Machine.
iii. Dis-assembly and assembly of Air-Conditioners & Refrigerators.
iv. Dis-assembly and assembly of a Bicycle.

(B). Welding Practices

i. Welding Procedure, Selection & Safety Measures.
ii. Power source of Arc Welding – Gas Metal Arc Welding & Gas Tungsten Arc Welding processes.
iii. Hands-on session of preparing base material & Joint groove for welding.
iv. Hands-on session of MAW, GMAW, GTAW, on Carbon Steel & Stainless Stell plates / pipes, for fabrication of a simple part.

(C). Electrical Wiring Practices

i. Electrical Installation tools, equipment & safety measures.
ii. Hands-on session of basic electrical connections for Fuses, Miniature Circuit Breakers and Distribution Box.
iii. Hands-on session of electrical connections for Lightings, Fans, Calling Bells.
iv. Hands-on session of electrical connections for Motors & Uninterruptible Power Supply.

(D). Electronics Components / Equipment Practices

i. Electronic components, equipment & safety measures.
ii. Dis-assembly and assembly of Computers.
iii. Hands-on session of Soldering Practices in a Printed Circuit Board.
iv. Hands-on session of Bridge Rectifier, Op-Amp and Transimpedance amplifier.
v. Hands-on session of integration of sensors and actuators with a Microcontroller.
vi. Demonstration of Programmable Logic Control Circuit.

(E). Contemporary Systems

i. Demonstration of Solid Modelling of components.
ii. Demonstration of Assembly Modelling of components.
iii. Fabrication of simple components / parts using 3D Printers.
iv. Demonstration of cutting of wood / metal in different complex shapes using Laser Cutting Machine.

References:

1. Stephen Christena, Learn to Weld: Beginning MIG Welding and Metal Fabrication Basics, Crestline Books, 2014.
2. H. Lipson, Fabricated - The New World of 3D Printing, Wiley, 1st edition, 2013.
3. Code of Practice for Electrical Wiring Installations (IS 732:2019)

	Description of CO	**PO**	**PSO**
CO1	Demonstrate proper use and handling of basic hand and power tools.	---	---
CO2	Carry out electrical wiring installations and repairs, applying safety measures in domestic applications.	PO1(3)	PSO2(1)
CO3	Develop solid innovative models through software.	PO5(2)	PSO2(2)
CO4	Adapt and follow safety protocols in the work environment.	PO11(2)	PSO3(2)

UC25A01	Life Skills for Engineers – I	L	T	P	C
		1	0	2	1

Course Objectives

- To equip engineering students with essential life skills encompassing personal and emotional development, effective management of time and stress, financial literacy, digital safety, and civic responsibility.
- To enhance self-awareness, interpersonal skills, and resilience to prepare students for the professional and personal challenges of engineering careers and life beyond academics**.**

Personal and Emotional Development: Self-Awareness & Personality, Emotional Intelligence & Empathy, Positive thinking, Right attitude, Stress & Anger Management, Goal-Setting & Time Management, Growth Mindset & Resilience.

Activities: Personality tests (MBTI, DISC), reflection journals, Empathy circle, role-playing difficult conversations, Guided mindfulness sessions, stress relief toolkit creation, Vision board creation, weekly time audit and planner, Group challenge scenarios, resilience journal.

Management Skills: Financial Literacy: Budgeting & Saving, Nutrition, Health, and Hygiene, Digital Literacy & Online Safety, Civic Responsibility & Ethics

Activities: Create a monthly budget, financial simulation game, Meal planning workshop, physical wellness challenge, Social media audit, privacy and safety scenarios, Community service, values debate.

Weightage: Continuous Assessment: 100%

Assessment Methodology: Assignments (20%), Flipped Class & Worksheets (10%), Practical (30%), Internal Examinations (40%)

References:

1. Khera, S. (2003). *You can win*. Macmillan.
2. Levesque, H. (n.d.). *Life skills 101: A practical guide to leaving home and living on your own*. (Publication year not specified)
3. Mitra, B. K. (2017). *Personality development & soft skills* (3rd impression). Oxford University Press.
4. ICT Academy of Kerala. (2016). *Life skills for engineers*. McGraw Hill Education (India) Private Ltd.

	Description of CO	PO	PSO
CO1	Understand personality traits and emotional intelligence, in interpersonal interactions.	---	---
CO2	To work and execute as a team through successful implementation of set goals.	PO7 (1) PO8 (2) PO9 (2)	PSO3(2)
CO3	Develop and implement best practices in day-to-day life, in terms of planning and execution.	PO11 (3)	PSO3(2)

UC25A02	Physical Education - I	L	T	P	C
		0	0	4	1

Course Objectives:

- To impart the fundamentals of physical education for development of students' physical, mental, and social well-being.
- To instill a lifelong appreciation for physical activity towards the development of positive attitude and fostering values of team work and sportsmanship.

Introduction to physical education: Exercise for Good Posture – Conditioning and Calisthenics for Before start, Jogging, Bending, Twisting, Standing, Sitting and Relaxation, Training on First Aid Practices.

Participation of athletic events: Rules and regulations of important athletic events, Sprint, Jumps, Throws and Hurdles.

Skill development in any one of the following outdoor games: Basket Ball, Volley Ball, Ball Badminton, Football, Hockey, Kho-Kho, Kabaddi, Cricket, Hand ball and Tennis.

Skill development in any one of the following indoor games: Shuttle Badminton, Chess and Table Tennis.

Weightage: Continuous Assessment: 100%

Assessment Methodology: Attendance (60%), Quiz (10%), Participation in Sports and Games (20%) and Viva Voce (10%)

References:

1. Singh, A. (2008). Essentials of physical education. Kalyani Publishers.
2. Kamlesh, M. L. (2006). Psychology in physical education and sport (3rd ed.). Metropolitan Book Co.
3. Mangal, S. K. (2009). *Psychology of sports performance*. Sports Publication.

E-resources:

https://www.who.int/health-topics/physical-activity

	CO Description	PO	PSO
CO1	Understand and explain the importance of physical activity for mental and physical health.	---	---
CO2	Apply basic principles of exercise science in the routine life.	PO1(3)	PSO1(1)
CO3	Develop teamwork, discipline, and leadership through sports and group activities and collaborate effectively.	PO8(3)	PSO3(2)
CO4	Demonstrate independent learning in health, nutrition, and fitness-related topics.	PO11(2)	PSO3(2)

Semester II

MA25C02	**Linear Algebra**	L	T	P	C
		3	1	0	4

Course Objectives:

- To impart foundational knowledge in linear algebra essential for analysing and solving problems in engineering applications.
- To provide the knowledge on computation using software and interpret key linear algebra concepts using software.

Vector Spaces Introduction to Vector Spaces, Examples, Subspaces, Linear Combinations, Span, Generating Sets, Linear Dependence and Independence, Basis and Dimension, Dimension of Subspaces.

Activities: Open-Source software, exercises to test linear dependence and independence using rank, compute span and basis of a set of vectors, determine the dimension of subspaces, and illustrate the concept of subspace and basis in $\boldsymbol{R^2}/\boldsymbol{R^3}$ with visualization.

Linear Transformations and Diagonalization: Null space, Range, Dimension Theorem (statement only), Matrix representation of a linear transformation, Eigenvalues & Eigenvectors, Diagonalizability.

Activities: Open-Source software, exercises to compute the matrix representation of a linear transformation, find the null space and range of a matrix, and compute eigenvalues and eigenvectors of a matrix.

Inner Product Spaces: Inner product, Norms, Cauchy, Schwarz inequality, Gram, Schmidt orthogonalization, Simple problems (up to $\boldsymbol{R^3}$).

Activities: Open-Source software, exercises to compute inner products and vector norms.

Matrix Decomposition: Orthogonal transformation of a symmetric matrix to diagonal form - Positive definite matrices, QR decomposition, Singular Value Decomposition (SVD), Least squares solutions- simple problems (up to $3 \times 3\ matrices$).

Activities: Open-Source software, exercises to check if a matrix is positive definite, perform QR decomposition and SVD using built-in functions.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignment (20%), Software activity (20%), Quiz (20%), Internal Examinations (40%).

References:

1. Friedberg, S. H., Insel, A. J., & Spence, L. E. (2022). *Linear algebra*. Pearson.
2. Lay, D. C., Lay, S. R., & McDonald, J. J. (2020). *Linear algebra and its applications with MATLAB*. Pearson.

3. Bronson, R. (2011). *Schaum's outline of matrix operations*. McGraw-Hill Education.
4. Strang, G., & Thomson, R. (2005). *Linear algebra and its applications*. Brooks/Cole.
5. Lipschutz, S., & Lipson, M. (2009). *Schaum's outline of linear algebra*. McGraw-Hill.
6. Kreyszig, E. (2018). *Advanced engineering mathematics*. Wiley India.

	Description of CO	PO	PSO
CO1	Explain the fundamental concepts of Linear Algebra.	---	
CO2	Compute and interpret eigenvalues and eigenvectors.	PO1(3)	PSO1(2)
CO3	Apply inner product concepts and perform orthogonalization.	PO1 (3)	PSO1(1)
CO4	Compute least squares solutions of linear system of equations.	PO1 (2) PO2 (2)	PSO3(1)
CO5	Use MATLAB to implement and validate key linear algebra concepts	PO5 (1) PO11 (1)	PSO2(2)

CY25202	Applied Chemistry (Tech) – II	L	T	P	C
		2	0	0	2

Course Objectives:

- To provide comprehensive understanding of polymerization mechanisms, including kinetics and chain transfer processes.

Polymerization Mechanisms and Kinetics:

Polymerization mechanisms, kinetics of polymerization reactions, chain transfer reactions and their effect on molecular weight and polymer structure.

Activities: Case Study on biodegradable plastics: their properties, synthesis methods, and environmental applications.

Copolymerization and Molecular Weight Determination:

Reactivity ratios and their significance, Determination of molecular weight, Factors influencing copolymer composition and kinetics

Activities: Interactive Quiz on Identification of polymer types from structural formulas, Relation to copolymer formation and properties.

Structure–Property Relationships:

Correlation between molecular structure and physical properties, Polymer morphology and its effect on mechanical, thermal, and electrical properties.

Activities: Group Project on plastic product selection, Material modifications for improved mechanical or electrical performance.

Characterization:

Thermal stability, glass transition, and melting behaviour, Mechanical properties: tensile strength, elasticity, toughness.

Activities: Problem-solving sessions on reaction rates and predict yields, Simulation of mechanical testing for the given polymer properties.

Analytical Methods:

UV-Vis, IR spectroscopy interpretation, Thermodynamics of polymer dissolution and solubility parameters, Modification techniques for property enhancement.

Activities: Hands-on interpretation of real spectra (IR, UV-Vis), Demonstration on solubility / analytical methods.

Degradation and Waste Management:

Chemical degradation, aging, and environmental wear, Biodegradable and photodegradable polymers, Plastic waste management and circular economy.

Activities: Project on waste management protocol for separating plastics from municipal waste.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Quiz (5%), Assignments (20%), Case Study (5%), Project (10%), Virtual Practice (10%), Internal Examinations (50%)

References:

1. Rumble, J. R. (Ed.). (2024). CRC handbook of chemistry and physics (105th ed.). CRC Press.
2. Matyjaszewski, K., Gnanou, Y., Hadjichristidis, N., & Muthukumar, M. (Eds.). (2022). Macromolecular engineering (2nd ed.). Wiley-VCH.
3. Gnanou, Y. (Ed.). (2022). Macromolecular engineering: From precise synthesis to macroscopic materials and applications. Wiley-VCH.
4. Ghosh, P. (n.d.). Polymer science and technology: Plastics, rubbers, blends and composites (3rd ed.). McGraw Hill Education (India) Private Limited.
5. Koltzenburg, S., & Maskos, M. (2023). Polymer analysis: Molar mass determination. In Polymer analysis. Springer. https://doi.org/10.1007/978-3-662-64929-9_3

E-resource(s):

1. Polymer Reaction Engineering, https://archive.nptel.ac.in/noc/courses/noc22/SEM1/noc22-ch34

	Description of CO	PO	PSO
CO1	Explain the applications of chemistry in polymer engineering stream.	---	
CO2	Apply chemistry concepts to select appropriate materials.	PO1(3)	PSO1(2)
CO3	Analyse the systems and interpret data from the virtual studies in the field of polymer engineering.	PO2(2)	PSO2(2) PSO3(1)

ME25C01	Engineering Drawing	L	T	P	C
		2	0	4	4

Course Objectives:

- To impart knowledge on dimensions and drawing standards.
- To explore the orthographic projection of lines and solids.
- To provide the understanding of orthographic, isometric and perspective views.

Fundamentals: Drawing instruments, Drawing standards (BIS), Lettering in engineering, Sheet layout, elements of dimensioning, Systems of dimensioning. Free hand sketching of 2D & 3D objects, Conics – Ellipse, Parabola and Hyperbola.

Activities: Virtual Demonstration of Conics and Cycloids.

Orthographic Projection: First angle projection, Projection of points, straight lines and planes.

Projection of Solids: Simple Solids, Section of Solids, Development of Surfaces

Activities: Development of models of various solids and virtual demonstration of sectioning, CAD modelling of 2D objects.

Isometric Projection: Isometric Scale, Projection of Simple solids.

Activities: Conversion of 3D into 2D orthographic views, CAD modelling of 3D objects.

Perspective Projection: Simple solids projection

Activities: Virtual demonstration of perspective views.

Project: Development of 2D objects and 3D objects using CAD tools.

Weightage:
Continuous Assessment: 50%
End Semester Examinations: 50%

Assessment Methodology:
Project – 10%, Models - 5%, Assignments - 35% and Internal Examinations - 50%

References:

1. Natarajan, K. V. (2025). A Text Book of Engineering Graphics. Dhanalakshmi Publisher.
2. Venugopal, K., & Prabhu Raja, V. (2022). Engineering Drawing + AutoCAD. New Age International Publishers.

E-Resources:

1. CAD Software – https://www.freecadweb.org/
2. Engineering Drawing and Computer Graphics, Prof. Rajaram Lakkaraju (IIT Kharagpur) – https://onlinecourses.nptel.ac.in/noc22_me105/preview
3. MIT Design Handbook: Engineering Drawing and Sketching – https://ocw.mit.edu/courses/2-007-design-and-manufacturing-i-spring-2009/pages/related-resources/drawing_and_sketching/

	CO Description	PO	PSO1
CO1	Explain the advantages of engineering drawing in engineering applications	---	
CO2	Apply the concepts of projections in formulating various solid parts in engineering systems.	PO1(3)	PSO1(2)
CO3	Analyse the various view and interpret the engineering drawings.	PO2(3)	PSO1(2)
CO4	Use CAD tools for creation of various models.	PO3(1)	PSO2(2)
CO5	Critically think and develop innovative models.	PO11(1)	PSO3(1)

PH25C06	Applied Physics (Tech) – II	L	T	P	C
		2	1	0	3

Course Objectives:

- To impart knowledge on physics concepts and explore the potential applications in the fields of engineering and technology.

Thermal Physics: Thermal Expansion- Thermal stress- Thermal resistance - Heat transfer- Thermal conductivity (Virtual demo) - Lee's disc method - Forbe's method - conduction through compound media –thermo-electric power.

Activities: Measurement of thermal conductivity of bad conductors.

Dielectric Properties: Dielectric- ferroelectric materials - Internal field – Clausius Mosotti equation – dielectric loss – Piezo, Pyro electric materials – Applications

Activities: Virtual demonstration of Piezoelectric sensor.

Optical Properties: Classification of optical materials – Luminescence-Phosphors - Polarization – Optical anisotropy - Optical processes in semiconductors – LED characteristics (Virtual demo)

Activities: Virtual demonstration of LED Characteristics

New Engineering Materials: Ceramics –Composites - fibre reinforced plastics -fibre reinforced metals – Shape memory alloys (Virtual Demo) – Biomaterials – hydroxyapatite – Bio-sensors – Polymer semiconductors – CNT (Carbon Nano Tubes)

Activities: Virtual demonstration of 3D structure of CNTs.-

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Quiz (10%), Assignments (30%), Flipped Class (10%), Internal Examinations (50%)

References:

1. Raghavan, V. (2007). *Materials science and engineering*. Prentice Hall of India.
2. Brijlal, & Subramaniyan, N. (2018). *Heat, thermodynamics and statistical physics*. S. Chand.
3. Askeland, D. R. (2010). *Materials science and engineering*. Brooks/Cole.
4. Kasap, S. O. (2007). *Principles of electronic materials and devices*. McGraw-Hill Education.

E-resources:

1. Thermal conductivity -Understanding Thermal Conductivity in Solids - https://youtu.be/VcFqqdGcwrw-
2. Applications of Piezo and pyro electric materials -NDLI: Lecture 40- Applications of Piezoelectric and Pyroelectric Materials
3. White LED_ https://archive.nptel.ac.in/courses/108/108/108108122/
4. Shape memory alloys: https://nescacademy.nasa.gov/video/00a31561480547248033a1c2df6f87831d

	Description of CO	PO	PSO
CO1	Explain the concepts of physics in technology stream.	---	
CO2	Apply appropriate techniques in physics to solve engineering problems.	PO1(3)	PSO1(3)
CO3	Analyse physical systems and interpret data from the virtual studies in the core branches in technology streams.	PO2(2)	PSO1(2)

EE25C01	Basic Electrical and Electronics Engineering	L	T	P	C
		3	0	0	3

Course Objectives:

- To impart foundational knowledge in principles and applications of electrical and electronics engineering.

DC Fundamentals: Current and Voltage sources, Resistance, Inductance and Capacitance; Ohm's law, Kirchhoff's law, Series parallel combination of R, L and C components, Voltage Divider and Current Divider Rules.

Activities: Virtual Demonstration of electrical laws & circuits, Hands-on Breadboarding, Solving GATE questions.

AC Fundamentals: Faraday's Laws of Electro-magnetic Induction, Definition of Self and Mutual Inductances, Generation of sinusoidal voltage, Instantaneous & RMS values of sinusoidal signals, Introduction to 3-phase systems, Electrical Safety, Fuses and Earthing.

Activities: Virtual Demonstration of electromagnetic induction, Measurement of instantaneous and RMS values of AC signals, Solving GATE questions.

Electric Machines: DC Machines, Transformers, Star and delta Connections, Three phase Induction motors, Synchronous Generators, Single Phase Induction Motors, Stepper Motor, Universal Motor and BLDC motor.

Activities: Virtual demonstration of step-up and step-down transformers, Virtual working models of Universal and BLDC motors, Solving GATE questions.

Semiconductor Devices: PN junction diodes, Zener Diode, Voltage regulator, BJT & FET Transistors, Timers, Operational Amplifiers.

Activities: Virtual demonstration of V-I characteristics of PN junction and Zener diodes using simulation, inverting/non-inverting amplifiers, Solving GATE questions.

Digital Electronics: Boolean algebra, Basic and Universal Gates, adders, multiplexers, demultiplexers and flip-flops.

Activity: Online logic gate simulators, Solving GATE questions.

Microcontrollers: Introduction, Architecture, Potential Applications.

Activities: Physical demonstration of a microcontroller and online simulation of microcontroller.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Quiz (5%), Assignments (25%), GATE Questions (20%), Internal Examinations (50%)

References:

1. Del Toro, V. (2022). *Electrical engineering fundamentals*. Pearson Education.
2. Hambley, A. R. (Year). *Electrical engineering: Principles and applications* (Edition if known). Publisher.
   (Note: Please provide the year and edition for complete citation)
3. Mehta, V. K., & Mehta, R. (2006). *Principles of electrical engineering and electronics*. S. Chand Publishing.

E-resources:

1. https://archive.nptel.ac.in/courses/108/106/108106172/
2. Circuit Simulator – https://www.falstad.com/circuit/

	Description of CO	**PO**	**PSO**
CO1	Understand and explain basic electrical and electronic concepts.	---	
CO2	Apply and analyse electrical circuits in real-time applications.	PO1 (3) PO2 (1)	PSO1(2)
CO3	Identify and utilise key electronic devices used in engineering applications	PO2 (2)	PSO1(2)

UC25H02	தமிழர்களும் தொழில்நுட்பமும் / Tamils and Technology	L	T	P	C
		1	0	0	1

நெசவு மற்றும் பானைத் தொழில்நுட்பம்: சங்க காலத்தில் நெசவுத் தொழில், பானைத் தொழில்நுட்பம், கருப்பு சிவப்பு பாண்டங்கள், பாண்டங்களில் கீறல் குறியீடுகள்.

வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு, சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள், மாமல்லபுரச் சிற்பங்களும், கோவில்களும், சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள், மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள், பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ, சாரோசெனிக் கட்டிடக் கலை.

உற்பத்தித் தொழில் நுட்பம்: கப்பல் கட்டும் கலை, உலோகவியல், இரும்புத் தொழிற்சாலை, இரும்பை உருக்குதல், எஃகு, வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள், நாணயங்கள் அச்சடித்தல், மணி உருவாக்கும் தொழிற்சாலைகள், கல்மணிகள், கண்ணாடி மணிகள், சுடுமண் மணிகள், சங்கு மணிகள், எலும்புத்துண்டுகள், தொல்லியல் சான்றுகள், சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: அணை, ஏரி, குளங்கள், மதகு, சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம், கால்நடை பராமரிப்பு, கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள், வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள், கடல்சார் அறிவு, மீன்வளம், முத்து மற்றும் முத்துக்குளித்தல், பெருங்கடல் குறித்த பண்டைய அறிவு, அறிவுசார் சமூகம்.

அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: அறிவியல் தமிழின் வளர்ச்சி, கணித்தமிழ் வளர்ச்சி, தமிழ் நூல்களை மின்பதிப்பு செய்தல், தமிழ் மென்பொருட்கள் உருவாக்கம், தமிழ் இணையக் கல்விக்கழகம், தமிழ் மின் நூலகம், இணையத்தில் தமிழ் அகராதிகள், சொற்குவைத் திட்டம்.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Quiz (20%), Assignments (30%), Internal Examinations (50%)

Text-Cum-Reference Books

1. தமிழக வரலாறு, மக்களும் பண்பாடும், கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை, ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils – The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi – 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

UC25H02	Tamils and Technology	L	T	P	C
		1	0	0	1

Weaving and Ceramic Technology: Weaving Industry during Sangam Age, Ceramic technology, Black and Red Ware Potteries (BRW), Graffiti on Potteries.

Design and Construction Technology: 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 Nayaka rMahal, Chetti Nadu Houses, Indo, Saracenic architecture at Madras during British Period.

Manufacturing Technology: 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 Stonebeads, Glass beads, Terracotta beads, Shell beads / bone beats, Archeological evidences, Gem stone types described in Silappathikaram.

Agriculture and Irrigation Technology: Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompuof 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.

Scientific Tamil & Tamil Computing: Development of Scientific Tamil, Tamil computing, Digitalization of Tamil Books, Development of Tamil Software, Tamil Virtual Academy, Tamil Digital Library, Online Tamil Dictionaries, Sorkuvai Project.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Quiz (20%), Assignments (30%), Internal Examinations (50%)

Text-Cum-Reference Books

1. தமிழக வரலாறு, மக்களும் பண்பாடும், கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ், முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி, வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை, ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils, The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi , 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

ME25C05	Re-Engineering for Innovation	L	T	P	C
		0	0	4	2

Course Objectives:

- To cultivate foundational skills in prototyping, and automation for development of prototypes with real-world applications.
- To provide a comprehensive, hands-on exposure to product development through reverse engineering concepts.

Bootcamp 1: Introduction to Product Development, Reverse Engineering, Overview of the product lifecycle, Hands-on disassembly of simple products, Practice of basic measurements and sketching, Introduction to CAD modeling of disassembled parts, Virtual assembly of parts.

Bootcamp 2: Embedded System Programming (Open-source platforms), Practice of interfacing sensors, reading data, automation in home, healthcare and agriculture.

Reverse Engineering: Sketch and prototype alternative designs, Group brainstorming sessions, Manufacture prototype parts using 3D printing and / or workshop tools, Assemble prototype product.

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%

Assessment Methodology: Project (30%), Assignment (10%), Practical (30%), Internal Examinations (30%)

References:

1. Wang, W. (2010). Reverse engineering: Mechanisms, structures, systems & materials. CRC Press.
2. Margolis, M. (2020). Arduino cookbook: Recipes to begin, expand, and enhance your projects (3rd ed.). O'Reilly Media.

E-resources:

1. GrabCAD – https://grabcad.com/
2. GitHub – https://github.com/

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

	Description of CO	PO	PSO
CO1	Understand the product development lifecycle, including stages such as concept generation, design, prototyping, and testing.	---	
CO2	Apply reverse engineering techniques to analyze and document existing products.	PO1 (3) PO2 (2)	PSO1(2)

	Description of CO	PO	PSO
CO3	Collaborate in teams to fabricate prototypes using appropriate tools.	PO5 (2) PO8 (1) PO9 (1)	PSO3(3)
CO4	Engage in independent learning and continuously adapt to emerging technologies in product design	PO11(2)	PSO2(2) PSO3(2)

EN25C02	English Essentials – II	L	T	P	C
		1	0	2	2

Course Objectives

- Enable learners to improve fluency and accuracy in spoken and written communication.
- Develop learners' ability to articulate ideas clearly and effectively in formal and informal spoken interactions.
- Help learners construct well-organised written documents relevant to academic and workplace contexts.

Oral Communication: Types (Verbal and Nonverbal), Interpersonal and group communication, Telephonic conversation.

Suggested Activities: Short presentations, Debates, Formal Speeches (Welcome, Vote of Thanks and introducing guests), Listen and respond to short podcasts.

Business Correspondence: Email Communication, Formal Letters (Types), Business Meeting.

Suggested Activities: Email and letter writing (Complaint, request, permission), Agenda, minutes of the meeting.

Academic Writing: Paraphrasing, Summarizing, Essay Writing, Instructions and Recommendations.

Suggested Activities: Essay writing (Cause and effect, argumentative, persuasive), User guides/ manuals, policy document.

Team Work: Leadership Skills (Team building, Team Leader, Team player), Negotiation and Problem solving skills

Suggested Activities: SWOT Analysis, Brainstorming and Group discussions.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Worksheets (10%), Group Activity (20%), Report Writing (20%), Internal Examinations (50%)

References:

1. Koneru Aruna. (2020). English Language Skills for Engineers. McGraw Hill Education.
2. Taylor, Shirley & Chandra .V. (2010). Communication for Business A Practical Approach. India: Pearson Longman.
3. Ian Badger, et al., (2014). Listening: B2 (Collins English for Life: Skills), Collins.
4. Raymond Murphy (2019), Grammar in Use, Cambridge University Press.

E-resources:

1. Communication for Business Success - https://open.umn.edu/opentextbooks/textbooks/8
2. TED Talks – https://www.ted.com/

	Description of CO	PO	PSO
CO1	Understand the importance of communication and drafting skills in engineering and technology.	---	
CO2	Apply listening strategies to comprehend spoken English in various contexts.	PO1(3)	PSO3(2)
CO3	Participate actively in group discussions by analysing critically from different views.	PO2(2) PO8(1)	PSO3(3)
CO4	Create written reports coherently for various purposes.	PO9(2)	PSO3(2)
CO5	Adapt communication styles to global, multicultural environments.	PO11(1)	PSO2(2)

UC25A03	Life Skills for Engineers – II	L	T	P	C
		1	0	2	1

Course Objectives:

- To impart and cultivate analytical reasoning, innovative thinking, effective collaboration, and ethical leadership to prepare students for complex challenges in professional and personal environments.

Critical Thinking: Creativity, Critical Thinking, Collaboration, Problem Solving, Decision Making, Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity, Critical thinking Vs Creative thinking, Convergent & Divergent Thinking, Critical reading & Multiple Intelligence.

Activities: Two-Brainstorm Method, “30 Circles” Challenge, “Desert Survival” Simulation, Lateral thinking riddles and puzzles, "What If?" Scenario Writing, Fast vs. Slow Thinking Game, Creativity Myth Busters

Problem Solving: Techniques, Six Thinking Hats, Mind Mapping, Forced Connections. Analytical Thinking, Numeric, symbolic, and graphic reasoning. Scientific temperament and Logical thinking.

Activities: Case study analysis, Escape Room challenge.

Leadership: Leadership Styles & Self-Assessment, Communication & Active Listening, Decision-Making & Responsibility, Teamwork & Delegation, Empathy, Integrity & Conflict Management, Vision, Motivation & Goal-Setting.

Activities: Crisis Leadership Simulation, Tower Challenge, Leadership Dilemmas Role-Play, Team Vision Board

Weightage: Continuous Assessment: 100%

Assessment Methodology: Assignments (20%), Flipped Class & Worksheets (10%), Practical (30%), Internal Examinations (40%)

References:

1. De Bono, E. (2017). Six thinking hats, Little, Brown Book Group.
2. Facione, P. A. (2015). Critical thinking: What it is and why it counts. Insight Assessment.
3. Kahneman, D. (2011). Thinking, fast and slow. Farrar, Straus and Giroux.
4. Whetten, D. A., & Cameron, K. S. (2016). Developing management skills. Pearson.

	Description of CO	PO	PSO
CO1	Explain the importance of leadership and management skills in life.	---	
CO2	Apply and demonstrate creative thinking techniques to generate innovative solutions.	PO7 (3)	PSO1(1) PSO2(1)
CO3	Exhibit effective collaboration and communication skills through teamwork, active listening, and conflict resolution strategies.	PO8 (2)	PSO3(3)
CO4	Integrate scientific temperament and logical reasoning into c problem solving in engineering and real-world contexts.	PO11 (2)	PSO2(1) PSO3(2)

UC25A04	Physical Education - II	L	T	P	C
		0	0	4	1

Course Objectives:

- To impart knowledge on gymnastic exercises and pressing needs for upskilling in a particular game.

Basic gymnastics exercises: Warming up, Suitable exercise, Lead up games, Safety education, Movement education, Balanced Walk, execution, floor exercise, tumbling/acrobatics, grip, release, swinging, parallel bar exercise, horizontal bar exercise, flic-flac-walk and pyramids.

Upskilling in any one of the athletics: Broad Jump, High Jump, Triple Jump, Relay Sprints, Javelin Throw, Discuss Throw, Shot Put, Short and Long-distance Running.

Advance skills in any one of the indoor/outdoor games, which has been opted by the student in the I semester.

Weightage: Continuous Assessment: 100%

Assessment Methodology: Attendance (60%), Quiz (10%), Participation in Sports and Games (20%) and Viva Voce (10%)

References:

1. Singh, A. (2008). Essentials of physical education. Kalyani Publishers.
2. Kamlesh, M. L. (2006). Psychology in physical education and sport (3rd ed.). Metropolitan Book Co.
3. Mangal, S. K. (2009). *Psychology of sports performance*. Sports Publication.
4. Kandappan, K. (2004). *Foundations of physical education*. Friends Publications.

E-resources:

https://www.who.int/health-topics/physical-activity

	CO Description	PO	PSO
CO1	Understand and explain the importance of physical activity for mental and physical health.	---	
CO2	Apply safety principles and methods during sports activities.	PO1(3)	PSO3(1)
CO3	Develop teamwork, discipline, and leadership through sports and group activities and collaborate effectively.	PO8 (3)	PSO3(2)
CO4	Demonstrate the advanced technical skills and strategic understanding in the game of their interest.	PO11(1)	PSO3(2)

Foreign Language^

UC25F01	Deutsch – I	L	T	P	C
		1	0	2	1

Course Objectives:

- To impart fundamentals of the Deutsch language, including reading, writing systems, pronunciation, and speaking.

Basics & Introduction: German alphabet and pronunciation, Basic greetings and farewells, Introducing yourself and others (Ich heiße…, Wer bist du?), Numbers 1–100 and days of the week, Personal pronouns (ich, du, er, sie…), Sentence structure (SVO word order).

Activities: Alphabet spelling game, short skits, Use color-coded cards for SVO sentences.

Grammar Essentials & Everyday Vocabulary: Present tense of regular verbs (spielen, arbeiten, machen…), Common irregular verbs: sein (to be), haben (to have), gehen, kommen, Articles and gender (der, die, das; ein, eine), Simple questions and negation (nicht, kein), Describing people and things: adjectives and colors, Family, school, food, and common objects vocabulary.

Activities: Conjugate regular and irregular verbs, “Question Chain” game, Create a simple family tree.

Everyday Communication in German: Asking for and giving directions, Telling the time and talking about schedules, Ordering food and drinks at a café or restaurant, Talking about hobbies, weather, and daily routines, Listening to short conversations and responding appropriately, Introduction to German culture and formal/informal language use (du vs Sie).

Activities: Ordering food and drinks, Give directions, Formal / Informal greetings, Do’s and Don’ts.

Weightage: Continuous Assessment: 100%

Assessment Methodology: Assignments (30%), Quiz (10%) and Internal Examinations 60%

References:

1. Funk, H., Kuhn, C., & Demme, S. (2015). Menschen A1: Deutsch als Fremdsprache Kursbuch. Hueber Verlag.

	CO Description	PO	PSO
CO1	Understand simple spoken Deutsch in everyday contexts.	---	
CO2	Communicate with widely used Deutsch words effectively.	PO9 (2)	PSO3(2)
CO3	Develop the skills necessary for self-directed learning and continuous improvement in Deutsch language.	PO11 (1)	PSO3(2)

UC25F02	Japanese – I	L	T	P	C
		1	0	2	1

Course Objectives:

- To impart fundamentals of the Japanese language, including reading, writing systems, pronunciation, and speaking.

Writing Systems & Basic Communication: Introduction to Hiragana: vowels, basic characters, reading & writing, Introduction to Katakana: basic characters and usage, Basic greetings and farewells (こんにちは, おはようございます, さようなら), Introducing yourself (名前、出身、年齢), Basic sentence structure: Subject–Object–Verb, Numbers 1–100, days of the week, classroom expressions.

Activities: Flashcard games and writing drills, Self-introduction, Numbers & date-matching, Greeting expressions, Listening to audio.

Grammar & Everyday Vocabulary: Particles: は (wa), を (wo), の (no), へ (e), に (ni), Present tense verbs: です, ます-form conjugation (たべます、のみます), Negative forms: ではありません, ません, Describing people and objects using adjectives (い and な), Question formation: なに、どこ、だれ、いつ, Vocabulary for family, food, colors, and basic actions.

Activities: Verb conjugation drills, Guessing game, Picture description, “Shopping” with food vocab and counters

Conversation & Cultural Etiquette: Talking about routines and schedules (daily verbs, time expressions), Asking and giving simple directions (〜はどこですか？), Ordering food and making polite requests (〜をください、〜をおねがいします), Expressing likes and dislikes (すき・きらい), Listening to short conversations and identifying key phrases, Introduction to formal/informal speech and Japanese etiquette.

Activities: Skits and role-plays, daily schedule, beginner-level dialogue, Group discussion on etiquette.

Activities: Practice worksheets and flashcards for hiragana, Writing drills and reading simple katakana words, Dialogue practice for greetings and self-introduction, Sentence construction exercises with basic SOV structure, Particle usage exercises and short dialogues, Role-play scheduling, shopping, and telling time, Verb conjugation drills for common verbs, Descriptive sentence exercises using adjectives, Practice Q&A dialogues forming questions and negations, Kanji writing practice and quizzes for basic characters, Vocabulary tests and conversational practice on daily topics, Oral presentations and listening comprehension quizzes.

Weightage: Continuous Assessment: 100%

Assessment Methodology: Assignments (30%), Quiz (10%) and Internal Examinations 60%

References:

1. Banno, E., Ikeda, Y., Ohno, Y., Shinagawa, C., & Tokashiki, K. (2011). Genki I: An integrated course in elementary Japanese. The Japan Times.
2. The Japan Foundation. (2017). Marugoto Japanese language and culture starter (A1) course book for communicative language activities. Goyal Publishers.

	CO Description	PO	PSO
CO1	Understand simple spoken Japanese in everyday contexts.	---	
CO2	Communicate with widely used Japanese words effectively.	PO9 (2)	PSO3(2)
CO3	Develop the skills necessary for self-directed learning and continuous improvement in Japanese language.	PO11 (1)	PSO3(2)

UC25F03	Korean – I	L	T	P	C
		1	0	2	1

Course Objectives:

- To impart fundamentals of the Korean language, including reading, writing systems, pronunciation, and speaking.

Fundamentals of Korean: Introduction to Hangul: consonants and vowels, Basic pronunciation and syllable formation, Common greetings and self-introductions, Numbers (Sino-Korean and Native Korean basics), Basic sentence structure (Subject-Object-Verb), Simple expressions (e.g., 감사합니다, 안녕하세요).

Activities: Writing and reading Hangul practice sheets, Pronunciation drills and audio repetition, Dialogue practice for greetings and self-introduction, Counting and number exercises.

Essential Grammar and Vocabulary: Particles (은/는, 이/가, 을/를) and usage, Basic verbs and present tense conjugation, Sentence patterns: affirmative, negative, interrogative, Common adjectives and descriptive sentences, Expressing possession and location, Asking simple questions (어디, 뭐, 누구).

Activities: Verb conjugation and sentence formation drills, Role-play conversations for shopping and daily routines, Descriptive writing and speaking exercises, Question and answer practice.

Everyday Korean Communication: Polite speech levels and honorifics introduction, Talking about time, dates, and schedules, Ordering food, shopping phrases, counting objects, Simple directions and transportation vocabulary, Listening practice with short dialogues, Cultural notes on etiquette and communication.

Activities: Role-play ordering at a restaurant or buying items, Listening comprehension exercises, Giving and asking for directions practice, Group conversations and presentations.

Weightage: Continuous Assessment: 100%

Assessment Methodology: Assignments (30%), Quiz (10%) and Internal Examinations 60%

References:

1. King, R., Yeon, J., & Brown, A. (2015). Elementary Korean (2nd ed.). Tuttle Publishing.
2. Cho, Y., Lee, H., Schulz, C., Sohn, H.-M., & Sohn, S.-O. (2001). Integrated Korean: Beginning 1. University of Hawai‘i Press.

	CO Description	PO	PSO
CO1	Understand simple spoken Korean in everyday contexts.	---	
CO2	Communicate with widely used Korean words effectively.	PO9 (2)	PSO3(2)
CO3	Develop the skills necessary for self-directed learning and continuous improvement in Korean language.	PO11 (1)	PSO3(2)

SEMESTER III

MA25C09	Computational Differential Equations	L	T	P	C
		3	1	0	4

Course Objectives: The Objectives of the course are to equip students with the ability to formulate and solve various types of Ordinary and Partial Differential Equations (ODEs & PDEs) and to develop proficiency in applying numerical methods and computational tools for solving differential equations encountered in engineering problems.

First Order Ordinary Differential Equations: Basic concepts of ordinary differential equations– Formation of first order differential equations from physical problems–First order and first-degree ODE: Variables separable–Exact equations–Leibnitz's equation – Bernoulli's equation – Numerical Methods: Solving first order ODE by Euler's formula, Taylor series and Runge Kutta method of 4th order.

Activities: Application and Visualization of the first order ODE using open-source software and solving Competitive Examination questions

Higher Order Ordinary Differential Equations: Formation of second order differential equations from physical problems–Linear equations of second and higher order with constant coefficients – Euler's linear equations – Method of variation of parameters–Numerical Methods: Solving second order ODE by Runge-Kutta method of 4th order and finite difference method.

Activities: solving ordinary differential equations using open-source software and solving of Competitive Examination questions

First Order Partial Differential Equations: Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solution of PDE by variable separable method – Solution of standard types of first order partial differential equations (excluding reducible to standard types) – Lagrange's linear equation – Numerical Methods for first order PDE by Method of lines with Runge-Kutta method of order fourth.

Activities: Application and Visualization of the Partial Differential Equations using open-source software and solving Competitive Examination questions

Higher Order Partial Differential Equations: Linear homogeneous partial differential equations of second and higher order with constant coefficients. Numerical Methods: Finite difference techniques for the solution of two-dimensional Laplace's and Poisson's equations on rectangular domain—Solution of one-dimensional heat equation using Bender Schmidt and Crank Nicholson difference schemes—Solution of one-dimensional wave equation by explicit scheme.

Activities: Application of the second order PDE using open-source software of 1-D wave, 1-D heat equations, Laplace and Poisson equations and Solving Competitive Examination questions

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Assignments (20%), Solution to application-oriented problems using software (20%), Solving Competitive Examination questions (20%), Internal Examinations (40%).

References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, (11th ed.), John Wiley & Sons, USA,2025.
2. Joe D. Hoffman, Numerical *Methods for Engineers and Scientists* (3rd ed.). CRC Press (Taylor & Francis Group), 2001.
3. Steven C. Chapra and Raymond P. Canale. *Numerical Methods for Engineers* (8th ed.). McGraw-Hill Education, 2021.

4. William E. Boyce and Richard C. DiPrima. *Elementary Differential Equations and Boundary Value Problems,* (11th ed.). John Wiley & Sons, USA,2017.
5. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 45th Edition, 2026.
6. Randall J. LeVeque, Finite Difference Methods for Ordinary and Partial Differential Equations, SIAM,2007.

E-resources:

1. https://ocw.mit.edu/courses/18-03-differential-equations-spring-2010/
2. https://archive.nptel.ac.in/content/syllabus_pdf/111107063.pdf
3. https://github.com/patrickwalls/mathematicalpython

	Description of CO	**PO**	**PSO**
CO1	Explain first and higher-order ODEs using appropriate analytical and numerical techniques.	-	-
CO2	Solve higher-order PDEs using classical and finite difference methods.	PO1(3) PO5(3)	PSO1(2)
CO3	Apply various solution methods to differential equations arising in engineering contexts.	PO1 (3) PO5(3)	PSO2(1)
CO4	Interpretation of numerical solutions for partial differential equations and using open-source software.	PO2(3) PO5(3) PO11(2)	PSO2(1)

PT25301	Polymer Physics	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the Physical and conformational properties of polymeric materials.
- To study Molecular arrangement in polymers and their orientation under the influence of stress.
- To study the Solubility behavior of polymers.

Fundamentals of polymer physics: Potential energy and conformational energy of molecules - conformations and configurations, Tacticity, isomeric states and isomerism in polymers, stereoisomerism, geometric isomerism - Random coils and average end to end distance - (Derivation only).

Activities: Study different polymer conformations and configurations, including tacticity and isomerism concepts. Illustrate examples of stereoisomerism and geometric isomerism in polymer structures.

Thermodynamic properties: Laws of Thermodynamics - Freely jointed and freely rotating chain models - Entropy and enthalpy Energy driven and entropy driven elasticity - Thermo elasticity -Thermodynamic treatment - entropic and energetic contributions (Derivation only).

Activities: Review the Laws of Thermodynamics and their application in polymer systems. Understand chain models like freely jointed and freely rotating chains in polymer behavior.

Polymer Crystal Formation: Amorphous State - Transition temperatures- Glass transition temperature Theory- Factors influencing glass transition Temperature- Crystalline State - polymorphism – Polymer single crystals, lamellae, spherulites – Crystallinity -factors affecting crystallinity -X-ray diffraction (XRD).

Activities: Interpretation of thermograms and Gel Permeation Chromatography (GPC) data for molecular weight, crystallinity – XRD and Differential Scanning Calorimetry (DSC).

Chain Orientation: Chain orientation - Concept of chain orientation - orientation in amorphous and crystalline polymers - Uniaxial and biaxial orientation practical significance – Orientation processes: spinning Process – Optical Properties of polymers – Birefringence, Haze, Transparency.

Activities: Understand the concept of chain orientation in amorphous and crystalline polymers. Differentiate between uniaxial and biaxial orientation with practical examples.

Polymer Solutions: Polymer solutions - Terms and definitions, types of solutions - Hildebrand approach, Flory Huggins theory - Thermodynamic view of miscibility, upper critical solution temperature (UCST), lower critical solution temperature (LCST) - solubility parameter, determination of solubility parameter of polymers - theta conditions.

Activities: Analyze phase behavior concepts such as UCST and LCST, Relate solubility parameter and theta conditions to polymer solution behavior.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Assessment I (35%), Assessment II (35%), Activities (30%)

References:

1. Ulf W. Gedde, Polymer Physics, Springer – Science +Business Media, B.V. 1st Edition, 43 2001.
2. S. Glasstone and D. Lewis, Elements of Physical Chemistry, Textbook Publishers, 2003.
3. Michael Rubinstein, R. H. Colby, Polymer Physics – Oxford University Press, 2003.
4. David I. Bower "An Introduction to Polymer Physics" Cambridge University Press,

E-resource(s):

1. edX – University-level learning resources on polymers and statistical mechanics.

CO Mapping with PO & PSO:

	Description of CO	PO	PSO
CO1	Understand molecular arrangement in polymers.	PO1 (2),PO2 (2), PO3 (2), PO4 (2), PO5 (2), PO6 (1), PO7 (3), PO8 (1), PO10 (1), PO12 (2)	PSO1(2) PSO2(2) PSO3(2)
CO2	Demonstrate the orientation processes in polymer	PO1 (2), PO2 (2), PO3 (2), PO4 (2), PO5 (2), PO6 (1), PO7 (3), PO8 (1), PO10 (1), PO12 (2)	PSO1(2) PSO2(2) PSO3(2)
CO3	Demonstrate knowledge in solubility behavior of polymers	PO1 (2), PO2 (2), PO3 (2), PO4 (2), PO5 (2), PO6 (1), PO7 (3), PO8 (1), PO10 (1), PO12 (2)	PSO1(2) PSO2(2) PSO3(2)

PT25302	Plastics Materials I	L	T	P	C
		3	0	0	3

Course Objectives:

- To learn about the general methods of preparation of individual class of plastics Materials
- To study about the general properties, processing behavior and applications of different Class of plastics materials
- To understand about the structure- property relation of different class of plastics materials.
- To familiar about properties and end application of different plastics materials
- To gain knowledge of thermoplastics for industrial applications

Introduction: Basic chemistry of polymers-nomenclature of polymers sources for raw materials. Methods of manufacturing –properties and applications of Natural Polymers - Shellac resin and natural rubber- Cellulosics-Cellulose nitrate, cellulose acetate, cellulose acetate butyrate, Ethyl cellulose and others.

Activities: Analyze properties and applications of natural polymers such as cellulose nitrate and cellulose acetate. Compare how chemical modification changes polymer performance in real applications.

Commodity thermoplastics-I: Preparation- properties - and applications of Polyolefin-Polyethylene- LDPE -LLDPE- HDPE, HMWHDPE- UHMWHDPE–Cross-linked polyethylene- Chlorinated polyethylene –Polypropylene – Homo & Co polymer.

Activities: Analyze applications of polypropylene and cross-linked polyethylene in industrial usage. Understand how copolymerization improves material performance**.**

Commodity thermoplastics-II: Preparation - properties - and applications of Vinyl plastics - Polyvinyl chloride, C-PVC, Polyvinyl Acetate, Polyvinylidene chloride, polyvinyl alcohol. Polystyrene

Activities: Identify and compare rigid and flexible behavior of Vinyl polymers.

General purpose thermosets: Preparation - properties - and applications of: Phenol formaldehyde (PF), Amino plastics: Urea50formaldehyde (UF) - Melamine formaldehyde (MF), unsaturated polyesters, Alkyd resins.

Activities: Compare properties of unsaturated polyesters and alkyd resins. Identify industrial applications based on durability and chemical resistance**.**

Engineering plastics & its applications–I: Preparation- properties - and applications: Styrene copolymers–High Impact Polystyrene (HIPS), Acrylonitrile Butadiene Styrene (ABS), Styrene acrylonitrile (SAN), Acrylic plastics–Polymethyl Methacrylate, Polyacrylonitrile, Ethylene Vinyl Acetate (EVA).

Activities: Examine properties and applications of PMMA, SAN, PAN, and EVA materials. Relate molecular structure to transparency, strength, and flexibility.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Assessment I (35%), Assessment II (35%), Activities (30%).

References:

1. J. A. Brydson, “Plastics Materials”, Butterworth- Heinemann - Oxford, 7th Ed., 2001.
2. Feldman.D and Barbalata. A, “Synthetic Polymers”, Chapman Hall, 1996.
3. Brydson John, **“**Plastic Materials”, 7Th Edition, Elsevier Science, ISBN: 9788181475817, 2014.
4. Johannes Karl Fink “Handbook of Engineering and Specialty Thermoplastics, Wiley- Scrivener; 1st edition, ISBN-13: 978-0470625835, 2010.
5. Subrata Sengupta “Organic Chemistry” Oxford University Press; First edition, ISBN-13: 978- 0199451647, 2014.
6. Rubin Irvin I “Handbook of Plastic Materials and Technology” Wiley India, ISBN-13: 978- 8126552283, 2014

E-resource(s):

1. NPTEL – IIT lectures on polymer chemistry, synthesis, properties, and applications.
2. Coursera – Courses on polymer science, materials science, and industrial polymers.

CO Mapping with PO & PSO:

CO	Description of CO	PO Mapping	PSO Mapping
CO1	Understand the classification, properties, processing characteristics, and applications of natural polymers and plastic materials.	–	–
CO2	Apply the principles of polymer additives selection for improving the performance and processing characteristics of plastic products.	PO1 (3), PO2 (2)	PSO1 (2), PSO2 (2)
CO3	Analyze the manufacturing processes, structure-property relationships, and applications of polyolefins used in engineering and consumer products.	PO2 (2), PO3 (2), PO4 (2)	PSO1 (2), PSO2 (2)
CO4	Evaluate the properties, processing behavior, and suitability of vinyl and halogenated olefin-based plastics for specific industrial applications.	PO3 (2), PO4 (2), PO6 (1), PO7 (3)	PSO1 (2), PSO2 (2), PSO3 (2)
CO5	Design and select special-purpose plastic materials based on performance, sustainability, and application requirements.	PO4 (2), PO7 (3), PO10 (1), PO12 (2)	PSO1 (3), PSO2 (2), PSO3 (3)

PT25303	Polymer Chemistry	L	T	P	C
		3	0	4	5

Course Objectives:

- The basic concepts of polymers, classification of polymers, copolymer types and tactility.
- The kinetics & mechanism of different types addition polymerization and free radical copolymerization
- The kinetics & mechanism of two types of condensation polymerization and ring-opening polymerization
- Various types of polymerization techniques
- The molecular weight and its distribution and different methods of molecular weight determination.

Basic concepts of polymers: Basic concepts of polymers–Monomers -degree of polymerization– significance of functionality – classification of polymers based on source, structure, thermal processing behaviour, composition and structure, mechanism, intermolecular forces – nomenclature of polymers –tacticity – copolymers and its types :alternate, random, block and graft copolymers.

Practical: Identification and classification of polymer samples based on physical properties.

Activities: Analyze classification of polymers, intermolecular forces. Differentiate copolymers such as block copolymer, random, graft, and alternating structures using diagrams.

Addition polymerisation: Kinetics and mechanism of free radical polymerization: chain transfer, Inhibition and retardation– Kinetics and mechanism of cationic polymerisation and anionic polymerisation–livingpolymers–Ziegler-Nattacatalysts–coordinationpolymerisation–kinetics of free radical co polymerization.

Practical: Preparation of polystyrene (PS) by free radical polymerization, Preparation of Poly(methyl methacrylate) (PMMA)

Activities: Compare cationic polymerization and anionic polymerization with respect to kinetics. Understand living polymers and role of Ziegler–Natta catalysts in coordination polymerization**.**

Condensation polymerisation: Kinetics of poly-condensation reactions (acid catalysed and self-catalysed) – ring-opening polymerization – multi chain polymerization: branching, cross-linking–step-wise copolymerization– methods of synthesizing copolymers: statistical, alternate and block copolymers.

Practical: Synthesis of Nylon-6,6 by interfacial condensation polymerization, Preparation of Phenol-Formaldehyde Resin (Bakelite).

Activities: Explore ring-opening polymerization and step-growth copolymerization mechanisms.
Differentiate statistical, alternating, and block copolymers using structural representations**.**

Classification of polymerization Techniques: homogenous and heterogeneous polymerisation – bulk or mass polymerization – Trommsdroff effect–solution polymerisation–suspension polymerisation–emulsion polymerisation–interfacial polymerisation–melt polycondensation. Advanced Polymerization Techniques - Atom Transfer Radical Polymerization (ATRP), Group Transfer-Polymerization (GTP), Reversible Addition Fragmentation Termination (RAFT).

Practical: Comparison of bulk and solution polymerization (yield and properties study).

Activities: Study different polymerization techniques such as bulk, solution, suspension, and emulsion polymerization. Compare homogeneous and heterogeneous systems and explain the Tromms dorff effect in bulk polymerization.

Molecular weight and its distribution: Molecular weight of polymer – number, weight and viscosity average molecular weights – molecular weight distribution (problems) – molecular weight determination: end-group analysis, colligative properties, osmometry, light scattering, gel permeation chromatography and viscometry**.**

Practical: Estimation of intrinsic viscosity of polymer solution**.**

Activities: Explore experimental methods for molecular weight determination including osmometry and gel permeation chromatography. Compare techniques like viscometry, light scattering, and end-group analysis for accuracy and applicability.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Theory (30%), Practical (10%), Activities (10%)

References:

1. FredW. Bill Meyer'Text book of Polymer Science' John Wiley & Sons, 2008.
2. George Odian "Principles of Polymerization" John Wiley & Sons, Inc., ISBN: 9780471274001, 2004.
3. Ravve, Principles of PolymerChemistry, Springer-VerlagNewYork, 2012.
4. JoelR.Fried,"PolymerScienceandTechnology",PrenticeHall,2014.
5. Premamoy Ghosh'Polymer Science and Technology' Tata McGraw–Hill, 2011.
6. Charles E.Carraher Jr. Introduction to Polymer Chemistry, Fourth Edition, CRC Press, 2017.
7. HermanF.Mark,"EncyclopediaofPolymerScienceandTechnology",WileyInterscience;3rd Edition,2004.
8. R. J. Samuels, "Structured Polymer Properties", John Wiley & Sons, NewYork, 1974.
9. Premamoy Ghosh, —Polymer Science and Technology of Plastics and Rubbers‖, Tata McGraw- Hill, New Delhi, 1990.

E-resource(s):

1. ScienceDirect – Research articles on polymer molecular weight analysis and distribution.
2. SpringerLink – Books and journals on polymer physics and characterization techniques.
3. Google Scholar – Research papers and references for molecular weight determination methods.

CO Mapping with PO & PSO:

CO	Description of CO	PO	PSO
CO1	Understand the classification, nomenclature, structure, and fundamental concepts of polymers.	–	–
CO2	Apply the principles of addition polymerization to derive rate equations and solve polymerization-related problems.	PO1 (3), PO2 (2)	PSO1 (2), PSO2 (2)
CO3	Analyze condensation polymerization mechanisms and kinetic behavior to determine polymer formation characteristics.	PO2 (2), PO3 (2), PO4 (2)	PSO1 (2), PSO2 (2)
CO4	Evaluate various polymerization techniques based on process requirements, product quality, and industrial applications.	PO3 (2), PO4 (2), PO5 (2), PO7 (3)	PSO1 (2), PSO2 (2), PSO3 (2)
CO5	Design and determine suitable methods for molecular weight characterization and interpret polymer properties based on molecular weight data.	PO4 (2), PO5 (2), PO10 (1), PO12 (2)	PSO1 (2), PSO2 (2), PSO3 (3)

PT25304	Fundamentals of Chemical Engineering	L	T	P	C
		3	0	2	4

Course Objectives:

- To learn the fundamental operation involved in chemical engineering
- To attain the knowledge in the subject of fluid flow
- To gain the ideas in the field of heat transfer operation
- To learn the mass diffusion in polymers by the study or mass transfer operations
- To acquire knowledge about various unit operations

Fluid flow: Fluid Flow: Newtonian and Non-Newtonian fluid - Bernoulli's theorem-Hagen Poisuille equation, measurement of fluid flow- orifice meter, venturi meter and pitot tube.

Practical: Measurement of fluid flow using Venturi meter / Orifice meter**.**

Activities: Study the difference between Newtonian fluid and non-Newtonian fluids with real-life examples.

Mechanical operations: Properties of solids - Sieve analysis; Laws of crushing, Crushers and grinders. Principle of separation and selection and details of equipment for screening, cyclones and hydro cyclones (Basic principles and equipment description only. Mathematical consideration not required).

Practical: Sieve Analysis of Sand

Activities: Study of a Jaw Crusher

Heat transfer: Modes of heat transfer; Heat transfer by conduction - Fourier's law, conduction across composite walls. Heat transfer by natural & forced convection. Co current, counter current, shell & tube heat exchangers (Basic principles and equipment description only. Mathematical consideration not required).

Practical: Heat exchanger

Activities: Study of Shell and Tube Heat Exchanger

Mass transfer: Principles of diffusion, theory of diffusion, Two film theory and mass transfer coefficients Humidification - operation, humidity chart, equipment's - cooling towers and spray chambers Drying - Principles and definitions. Rate of batch drying- Equipment for drying (Basic principles and equipment description only. Mathematical consideration not required).

Practical: Drying of Wet Solid (Batch Drying)

Activities: Study of Cooling Tower (Humidification Equipment)

Unit operations: Absorption - Principle and equipment (packed towers and plate columns). Distillation - flash distillation, and Binary distillation. Industrial equipment for distillation Adsorption - Principle and equipment for adsorption. (Basic principles and equipment description only. Mathematical consideration not required)

Practical: Simple Distillation

Activities: Study of Packed Tower (Absorption Equipment)

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Theory (30%), Practical (10%), Activities (10%).

References:

1. W.L .Mc Cabe, J.C. Smith, “Unit Operations of Chemical Engineering”, McGraw-Hill,7th edition 2014.
2. Shri. K.A. Gavhane, “Unit Operations I & II”, NiraliPrakashan Publication, 2015.
3. Ghosal, S.K., Sanyal, S.K., Datta, S., “Introduction to Chemical Engineering”, Tata McGraw-Hill Publishing Company Ltd., New Delhi(1997).
4. Richardson and Coulson, “Chemical Engineering”, Vol. 1, Elesvier, 6th Edition 2006.
5. J. M. Smith, H. C. Van Ness, M. M. Abbott and M. T. Swihart “Introduction to Chemical Engineering Thermodynamics” McGraw-Hill Education, 2 Perm Plaza, New York, NY, 8th Edition 2018.

E-resource(s):

1. NPTEL
2. MIT Open Course Ware
3. LearnChemE

CO Mapping with PO & PSO:

CO	Description of CO	PO	PSO
CO1	Understand the principles of fluid flow behavior and mechanical separation operations used in process industries.	–	–
CO2	Apply the concepts of conduction and convection heat transfer to solve engineering problems.	PO1 (2), PO2 (2)	PSO1 (1), PSO2 (1)
CO3	Analyze the operation and performance of distillation equipment used in chemical and polymer process industries.	PO2 (2), PO3 (2), PO4 (2)	PSO1 (1), PSO2 (1)
CO4	Evaluate chemical engineering unit operations and their suitability for different industrial applications.	PO3 (2), PO4 (2), PO5 (1), PO7 (2)	PSO2 (1), PSO3 (2)
CO5	Design and select appropriate unit operations and processing systems for polymer manufacturing and processing applications.	PO4 (2), PO5 (2), PO10 (1), PO12 (2)	PSO1 (1), PSO2 (1), PSO3 (2)

PT25305	Introduction to Data Science	L	T	P	C
		2	0	2	3

Course Objectives:

- An understanding of the data operations
- An overview of simple statistical models and the basics of machine learning techniques of regression.
- An understanding good practices of data science
- Skills in the use of tools such as python, IDE
- Understanding of the basics of the Supervised learning

Introduction, Toolboxes: Python, fundamental libraries for data Scientists. Integrated development environment (IDE). Data operations: Reading, selecting, filtering, manipulating, sorting, grouping, rearranging, ranking, and plotting

Practical: Data Analysis and Visualization using Python or MATLAB

Activities: Load a dataset and perform basic data operations like filtering, sorting, and grouping using Pandas. Visualize insights using plots with Matplotlib or Seaborn.

Descriptive statistics and data preparation: Exploratory Data Analysis data summarization, data distribution, measuring asymmetry. Sample and estimated mean, variance and standard score. Statistical Inference frequency approach, variability of estimates, hypothesis testing using confidence intervals, using values.

Practical: Descriptive Statistics and Hypothesis Testing Python or MATLAB

Activities: Perform Exploratory Data Analysis on a dataset to summarize key features using mean, median, and variance. Visualize data distribution and asymmetry using histograms and box plots.

Supervised Learning: First step, learning curves, training-validation and test. Learning models generalities, support vector machines, random forest. Examples.

Practical: Supervised Learning Model Implementation and Evaluation using Python or MATLAB

Activities: Study on performance metrics to understand model generalization.

Regression analysis: Regression: simple linear regression, multiple & Polynomial regression, Sparse model. Unsupervised learning, clustering, similarity and distances, quality measures of clustering, case study.

Practical: Regression and Clustering Analysis using Python or MATLAB

Activities: Apply Simple Linear Regression, multiple, and polynomial regression models to understand relationships between variables. Compare model performance and interpret coefficients to analyze prediction accuracy.

Network Analysis: Graphs, Social Networks, centrality, drawing centrality of Graphs, PageRank, Ego-Networks, community Detection.

Practical: Graph Analysis and Community Detection using Python or MATLAB

Activities: Explore basics of Network Analysis by representing data as graphs with nodes and edges. Compute centrality measures (degree, closeness, betweenness) to identify important nodes.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Theory (30%), Practical (10%), Activities (10%).

References:

1. Introduction to Data Science a Python approach to concepts, Techniques and Applications, Igual, L;Seghi', S. Springer, ISBN:978-3-319-50016-4
2. Data Analysis with Python A Modern Approach, David Taieb, Packt Publishing, ISBN - 9781789950069
3. Python Data Analysis, Second Ed., Armando Fandango, Packt Publishing, ISBN: 9781787127487

E-resource(s):

1. Kaggle – Practice datasets, competitions, and notebooks for hands-on learning.
2. Google Colab – Run Python code online without installation.

CO Mapping with PO & PSO:

CO	Description of CO	PO	PSO
CO1	Understand the fundamentals of Data Science, data-driven decision making, and the skill sets required for data scientists.	–	–
CO2	Apply exploratory data analysis (EDA) techniques to summarize, visualize, and interpret datasets.	PO1 (2), PO2 (2), PO5 (1)	PSO2 (1)
CO3	Analyze supervised learning techniques, including classification methods and Support Vector Machines (SVM), for solving engineering problems.	PO2 (2), PO3 (2), PO4 (2)	PSO1 (1), PSO2 (1)
CO4	Evaluate the performance of machine learning models such as Linear Regression using appropriate metrics and validation techniques.	PO3 (2), PO4 (2), PO5 (2)	PSO2 (2), PSO3 (1)
CO5	Design and develop data-driven solutions using network analysis concepts and PageRank algorithms for real-world applications.	PO5 (2), PO10 (1), PO12 (2)	PSO1 (1), PSO2 (1), PSO3 (2)

EN25C03	English Communication Skills Laboratory– I	L	T	P	C
		0	0	2	1

Course Objectives:

- The objectives of the course are to foster students' confidence and fluency in professional and social communication and to bridge the gap between academic English and industry expectations.

List of Activities

A. Elements of Effective Speaking and Listening

(i) Sharing life experience/ turning point in their life – SATORI
(ii) Situational Conversation – eg. Talking to a Senior about Internship Tips
(iii) Welcoming a Guest Speaker at a Seminar
(iv) Pictography to represent data using images or symbols
(v) B2-C1 Listening exercises include lectures, interviews, and discussions.

B. Mastering Presentations

(i) Presentation Skills – Non-verbal communication
(ii) Mini-Presentations: Topics like "My Dream Project," "Engineering in 2050," 3-minute technical pitches with logical flow
(iii) Technical Presentations with PPT

C. Group Discussion Strategies:

(i) Introduction to Group Discussions - Key skills for effective participation
(ii) Phases in a GD and Conversational Phrases in GD.
(iii) Group Discussions – Abstract and Factual topics

D. Resume & LinkedIn Optimization

(i) Building LinkedIn Profile – Drafting headlines and summaries
(ii) Social Media Optimisation
(iii) Preparing Video Resume

E. Podcast-Based Language Learning:

(i) Listening to podcast (motivational, career oriented, success stories)
(ii) Podcast Preparation – Purpose – Topic – Structure – Recording Tips - Publication of the Podcast

F. Mock Interviews and Communication Strategies:

(i) Listening – Job interview
(ii) Speaking – Mock interviews

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%.

Internal Assessment: 1. Listening (20 marks)
2. Video Resume (20 marks)
3. Creating a Podcast (30 marks)
4. Mock interview (30 marks)

End Semester Assessment: 1. Presentation with PPT (50 marks)
2. Group Discussion (50 marks)

References:

1. Floyd Kory, “Interpersonal Communication”, McGraw Hill Publication, 2023.
2. Bharadwaj Apoorva, “Leadership Communication Skills for Intercultural Management: Strategies for Effective Intercultural Management (Contemporary Themes in Business and Management)”, Routledge India; 1st edition, 2024.
3. Helen Spencer-Oatey and DomnaLazidou**, “**Making Working Relationships Work: The TRIPS Toolkit for Handling Relationship Challenges and Promoting Rapport”,Castledown Publishers,2023.
4. Presentations - Cambridge
5. Speaking Extra
6. Listening Extra – Miles Craven by Cambridge University Press
7. CVs, Resumes, and LinkedIn: A Guide to Professional English – Springer International Publishing

E-resources:

1. Train your mind to perform under pressure- Simon Sinek https://curiosity.com/videos/simon-sinek-on-training-your-mind-to-perform-under-pressure-capture-your-flag/
2. Brilliant way one CEO rallied his team in the middle of layoffs https://www.inc.com/video/simon-sinek-explains-why-you-should-put-people-before-numbers.html
3. Will Smith's Top Ten rules for success https://www.youtube.com/watch?v=bBsT9omTeh0

	Description of CO	PO	PSO1
CO1	Communicate effectively in everyday professional situations with confidence		
CO2	Deliver well-organised and effective presentations	PO9(3)	PSO1(1) PSO3(2)
CO3	Participate in group discussions and express ideas clearly and confidently.	PO8(2) PO9(3)	PSO3(2)
CO4	Create professional video resumes and participate in interviews effectively.	PO9(2)	PSO3(3)
CO5	Create, record and publish motivational podcasts.	PO9(2) PO11(1)	PSO2(2) PSO3(3)

(1) = Low; (2) = Medium; (3) = High

Semester IV

PT25401	Additives and Compounding	L	T	P	C
		3	0	0	3

Course Objectives:

- Understand various draw backs of polymer materials and suitable remedies.
- understand various additives used in polymers
- understand the mechanism of degradation of polymers and chemistry of stabilizing additives
- understand various compounding methodologies for plastics materials
- Learn the housekeeping and maintenance of compounding machinery.

Fillers/ reinforcements, stabilizers, pigments: Fillers and Reinforcement–Antioxidants-Thermal Stabilisers, Ultraviolet stabilizer–Impact Modifiers/ toughening agents. Colourants-Fire retardants-Coupling agents-blowing-agents.

Activities: Studying the effect of antioxidants and thermal stabilizers on plastics sample properties.

Additives for processing: Plasticizers- Antistatic agents-Anti blocking agents-Slip and anti- slip agents-processing aids - Lubricants- mould releasing agents Additives for recycling.

Activities: Study of anti-blocking agents used to prevent sticking of plastic films.

Fundamentals of compounding: Compounding-Selection of polymers and compounding-ingredients-general objectives- Merits and demerits of additives in polymer matrices. Mixing and mixing equipments. Compounding by batch mixer-High speed mixer-Two roll mill - Banbury Mixer - Ribbon blender - Planetary mixers.

Activities: Identification and comparison of different compounding ingredients/techniques used in plastics industry.

Compounding mechanisms: Compounding Machineries specifications - temperature control system – operating characteristics and working details of continuous mixers - - Single Screw extruder - Twin Screw extruder- maintenance of compounding machines.

Activities: Study of compounding section of plastics industry.

Case studies: Case studies on preference of one plastics to other and co-relation of properties of conventional materials and blends and alloys - case studies on application of blends and alloys.

Activities: Study of real-life applications where blends and alloys are preferred over pure polymers.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Assessment I (35%), Assessment II (35%), Activities (30%).

References:

1. Al – Malaika; S. Golovoy; A and Wilkie (Eds), Chemistry and Technology of Polymer Additives, Black well Science Ltd, Oxford (1999).
2. Matthews; F.L. and Rawlings; R.D, Composite Materials, Engineering and Science Chairman and Hall, London (1994).
3. Plastics Testing Technology Hand Books by Vishu Shah, 1984.
4. Hand Book of Plastics Test Methods by Brown R.P, 1989.
5. Mascia; L., the Role of Additives in Plastics, Edward Arnold Publishers Ltd., U. K. (1974).

CO Mapping with PO & PSO:

CO	Description of CO	PO	PSO
CO1	Understand the functions, classification, advantages, and limitations of additives used in plastic materials and their influence on product performance.	–	–
CO2	Analyze various compounding techniques used for manufacturing thermoplastic and thermoset compounds and evaluate their impact on material properties and processing characteristics.	PO1 (3), PO2 (2), PO3 (2)	PSO1 (2), PSO2 (2)

PT25402	Polymer Rheology	L	T	P	C
		3	0	0	3

Course Objectives:

- To analyze the flow behavior of polymer melts
- To understand the basics of fluid mechanism and to analyze behavior of Newtonian fluids.
- To familiarize with instruments such as orifice meter, Venturi meter and Pitot tube

Fluid properties: Units and dimensions-Properties of fluids-mass density, specific weight, specific volume, specific gravity, viscosity, surface tension and capillarity-Terminologies of fluid flow Laminar and turbulent flow of Newtonian fluids-Power law-Reynolds number and its significance.

Activities: Study of Reynolds number and classification of flow regimes (laminar, transition, turbulent).

Fluid friction and flow measurement: Bernoulli 's equation–kinetic energy correction factor; head loss; friction factor; major and Minor losses- Flow measurement: Introduction; Orifice meter; Venturi meter; concept of area meters: rotameter; Local velocity measurement: Pitot tube.

Activities: Study of Venturimeter and comparison with orifice meter**.**

Polymer rheology :Introduction and Basic concepts of Rheology, classification of fluids, Newtonian and non-Newtonian fluids, shear stress, shear strain and shear rate, shear modulus, bulk modulus, Zero shear viscosity, Dependence of viscosity with temp, shear stress , Viscoelasticity -effect of rate of strain, temperature and time on mechanical behaviour of polymeric materials.

Activities: Study of viscosity variation with temperature from real world application.

Rheological models :Mechanical models - stress strain response of spring and dashpot - visco elastic models -Maxwell element - Voigt kelvin element - response to creep and stress relaxation -four parameter model - Boltzman principle - time temperature super position principle – WLF equation.

Activities: Study of mechanical models of rheology using spring and dashpot analogies.

Measurement of polymer melt viscosity: Viscosity of polymer melts – dieswell and melt fracture - Weissenberg effect – Elongational viscosity. Measurements of rheological properties - capillary rheometers – cone and plate viscometer - Oscillating disc rheometer - Mooney viscometer.

Activities: Study of Mooney viscometer and its use in polymer characterization.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Assessment I (35%), Assessment II (35%), Activities (30%).

References:

1. Cogswell, Polymer melt rheology, Woodhead Publishing Ltd, 1994.
2. R.J. Crawford, Plastics Engineering, Butterworth - Heinemann, Oxford, 2002, 3rd edition
3. Dr. R. K. Bansal, “A Textbook of Fluid mechanics and Hydraulic Machines”, 9th edition,2017
4. P.N.Cogswell, Polymer Melt Rheology, A guide for Industrial Practice, George Godwin,1981.
5. Richard C. Progelh of and James L. Throne, Polymer Engineering Principles, Hanser Publishers, New York, 1998.
6. John M. Dealy and Kurt F. Wissburn, Melt rheology and its role in plastics processing, Chapman, London, Oct 3rd, 2013.
7. R.S. Lenk, Polymer Rheology, Applied Science, London, 2012.
8. J.D. Ferry, Viscoelastic Properties of Polymers, john Wiley & Sons, New York, 1986.
9. Chang Dae Han. Rheology in Polymer Processing, Academic Press, New York, 1976

E-resource(s):

1. NPTEL
2. MIT Open Course Ware
3. Learn ChemE

CO Mapping with PO & PSO:

CO	Description of CO	PO	PSO
CO1	Understand the fundamental concepts of rheology, fluid properties, and flow behavior of polymeric materials.	–	–
CO2	Apply rheological principles to determine and interpret the mechanical behavior of polymers under different loading conditions.	PO1 (3), PO2 (2)	PSO1 (2), PSO2 (2)
CO3	Analyze rheological properties of polymers using appropriate experimental techniques and testing instruments.	PO2 (3), PO4 (2), PO5 (2)	PSO1 (2), PSO2 (3)
CO4	Evaluate the flow behavior of Newtonian and non-Newtonian fluids using principles of fluid mechanics and rheological models.	PO2 (3), PO3 (3), PO5 (2)	PSO2 (3), PSO3 (2)
CO5	Select and assess suitable flow measurement devices such as orifice meters, venturi meters, and pitot tubes for engineering applications involving fluid flow systems.	PO3 (3), PO5 (3), PO10 (1)	PSO1 (2), PSO2 (3), PSO3 (2)

PT25403	Plastics Materials II	L	T	P	C
		3	0	0	3

Course Objectives:

- Learn about the general methods of preparation of individual class of plastic materials
- Understand the general properties, processing behavior of plastics materials.
- Gain knowledge in applications of different class of plastics materials.
- Make the student familiar about specialty polymers properties and end application.
- To understand the role of polymer blends & alloys in current scenario.

Engineering plastics & its applications– II: Preparation-properties - and applications: Polyamides-Nylons 6, (6,6), (6,10), 11, 12, Polyesters– Polyethylene terephthalate, polybutylene terephthalate, Polycarbonate, Polyacetals.

Activities: Identification of product applications made from engineering plastics (automotive, electrical, packaging).

High performance plastics –Preparation -properties-and applications: Aromatic ether-Polypheneylene oxide (PPO), Aromatic thioether – Polyphenylene sulphide (PPS), Polysulfone, Aromatic polyamides.

Activities: Select product applications from the high-performance polymers.

High performance plastics–II: Preparation-properties-and applications: Polyimides (PI) Polyamideimide (PAI), Polyimidazoles, Fluoropolymers–Polyvinyl fluoride (PVF), Polyvinylidene fluoride (PVDF), Polytetrafluoroethylene (PTFE), Polychlorotrifluoroethylene (PCTFE).

Activities: Selection of high-performance plastics for chemical resistance, conductivity, self-lubrication and thermal applications.

Water soluble polymers and bio degradable polymers: Preparation - properties and applications of Biodegradable polymers-poly ξ – caprolactone-polylactic acid- Bacterial polyhydroxyalkonates – polyvinylpyrrolidone – polyacrylic acid and its homolog's – polyacrylamide –polyethylene oxide – polyethylene amine-Polyvinyl alcohol

Activities: Observation of degradation behavior of biodegradable plastics under environmental conditions.

Engineering and speciality thermosets: Preparation - properties - and applications of: Phenolic resin - Urea Formaldehyde - Melamine Formaldehyde – Unsaturated Polyesters-Epoxy resins- Polyurethane and Silicones.

Activities: Identification of phenol-formaldehyde (phenolic) resin products used in electrical and mechanical applications.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Assessment I (35%), Assessment II (35%), Activities (30%).

References:

1. Plastic Materials Ed 7 - By Brydson, J A,1999.
2. Hand Book of Plastics Materials & Technology - By Rubin, Irwin, J,1990.
3. Manas Chanda, Salil.K.Roy, “Plastics Technology Hand book”, 2nd edition, Marcel Dekker, New York, 1993.
4. Matrin.T.Goosey, “Plastics for Electronics”, Elsevier, Applied Science, 1985.
5. R.W. Dyson, “Specialty Polymers”, Chapman & Hall, 2nd edition, 1998.
6. Plastics Engineering Hand Book Ed. 5 & Society of the Plastic Industry Inc - By SPI,1994.
7. Plastics Materials and Processing - By Schwartz & Goodman,1982.
8. Plastics Materials (Properties & Application) - By Birley & Scott,1982.
9. Modern Plastics Hand Book - By Harper, 2000.
10. Birley; Arthur W. and Scott; Martyn J., Plastics Materials: Properties and Applications, Leonard Hill, Blackie and Sons Ltd., 1982.
11. Biron; Michel, Thermoplastics and Thermoplastic Composites: Technical Information for Plastics Users, Elsevier, Amsterdam, 2007.
12. DuBois; P, Plastics in Agriculture, Applied Science Publishers Ltd., London 1978
13. H.F.Mark, (Ed), “Encyclopedia of polymer Science & Engineering”, John Wiley & Sons, New York, 1989.
14. Johannes Karl Fink, ‘Handbook of Engineering and SpecialityThermoplastics’, Volume 10, Water Soluble Polymers, John Wiley & Sons, New Jersy, 2011.
15. David Kaplan, “Biopolymers from renewable resources” ,Springer,1998.

E-resource(s):

1. NPTEL
2. MIT Open Course Ware
3. LearnChemE

CO Mapping with PO & PSO:

CO	Description of CO	PO	PSO
CO1	Understand the manufacturing methods, properties and applications of special-purpose polymers used in advanced engineering applications.	-	-
CO2	Apply knowledge of manufacturing methods to correlate the structure–property relationships of high-performance polymers for specific industrial applications.	PO2(2), PO3(2)	PSO1(2), PSO2(2)
CO3	Analyze the manufacturing processes, properties and performance characteristics of ionic polymers for diverse engineering applications.	PO3(3), PO4(2)	PSO1(2), PSO2(3)
CO4	Evaluate conducting polymers and select suitable materials for electronic, industrial and functional applications based on performance requirements.	PO4(3), PO5(2)	PSO2(3), PSO3(2)
CO5	Design and develop sustainable solutions using water-soluble and biodegradable polymers for environmental and advanced engineering applications.	PO5(3), PO7(3), PO12(2)	PSO1(2), PSO2(3), PSO3(3)

PT25404	Plastics Moulds and Dies Technology	L	T	P	C
		3	0	0	3

Course Objectives:

- To impart knowledge on Various Molds types, Mold making and Material of mold selection.
- To impart knowledge on Elements of the mould and manufacturing processes.
- To impart knowledge on Application of additive manufacturing in mould development
- To impart knowledge on Advanced measuring instruments for inspection of mold

Injection Mould Design: Introduction to injection moulds- mould parts its factions and classification sprue bush – Locating ring – Guide pillar & bush – Integer & Insert bluster type core & cavity – Bolsters – Inserts – Mould Clamping Assembly of Moulds – Shrinkage consideration for Core & Cavities – Design requirement for quality moudlings plate moulds – Mould Plates - CAD/CAM applications in mould design - materials used in mould making – Requirements of mould material – Ferrous and Non ferrous materials used in injection moulds – Heat treatment requirements for mould materials. Parting line – Parting surface – type of parting surfaces – mould relieving – Mould Venting – Criteria's for selection of injection moulding machine – Clamping force – Shot Weight – Shot Capacity – Day light distance – Projected area – Injection pressure – Distance between tie bars - Calculation of no. of impressions for a mould – Standard Mould base – Advantages & Limitations – Manufacturers of standard mould bases – Standard mould parts – Selection of mould base and accessories.

Activities: Study of Injection Mould for a Plastic Component.

Design of Feed Ejection and Cooling Systems: Feed System: Sprue, runner and gates – Cross Section and Size of runner – runner types & runner efficiency – rubber layout – balancing of runners – types of gates – gate balancing – Empirical formulae for runner and gate. Ejector System: Ejection system major division – Ejector grid – its types – Ejector plate assembly – Ejector assembly return system – Stop button – types of ejection – sprue pullers- Calculation of rejection force – ejection stroke – Calculation of support pillar requirements – Mould temperature control system – Mould cooling – Cooling Integer type cavity and core plates – Cooling of bolsters – Cooling of cavity inserts – Cooling of core inserts – O ring, Heat Pipe and Heat rods – Adaptors and Plugs for cooling circuits – Calculation of Cooling efficiency – Introduction to confirmal cooling.

Activities: Study of how plastic flows, solidifies, and is ejected by designing the three critical mould systems.

Design of Compression and Transfer Moulds: Introduction to compression moulds – Open Hash, Semi Positive, Positive and Displacement moulds – Types of loading chambers – Bulk factor – Flash Thickness – Projected area – Compression Pressure – Clamping Force – No. of impressions by technological method – Heating System – Types of Heaters – Heat Requirement – Heat Loss – heater capacity – Loading Chamber design – Mould Material Transfer Mould – Its types – integral pot transfer mould, auxiliary ram – transfer pot design – Projected area – transfer pressure – Clamping force –

Pressure Pad design – Design of Sprue, runner and gate for transfer mould – Advantages and disadvantages of transfer mould – transfer Pot and Plunger Calculations – Mould material.

Activities: Study on design of Compression and Transfer Moulds.

Design of Blow Moulds & Extrusion Dies: Blow mould Design – Material for blow mould- types of blow moulds – Blow ratio – parison – Parison Programming – Blow Moulded Container Terminology – Panch off design – mould alignment – mould venting – mould cooling – Priform extrusion die design – Principles of extrusion – Extruder die geometry – Die material – Die Swell – Die Land design – sizing equipment, screen peak and breaker plates – Construction of extrusion dies – Dies for rod – Dies for Pipe – Dies for blown film – Dies for flat film – dies for profile – dies for wires cables – Die mandrel – Spider – Plastic Materials used for extrusion – Mel flow index – Co extrusion dies.

Activities: Understand and design tooling used in blow and extrusion processes by creating basic mould and die layouts for simple plastic products.

Advanced Injection Mould Design & Mould Maintenance: Introduction to Design of mould, Care and Maintenance - Working Principle and Construction – Principles and rule of design for mould – Engineering and design procedure – Dimension and mould drawings – Mould stamping – Causes of wear and damage – Preventive maintenance of moulds

Activities: Understand and Develop advanced skills in mould design (multi-cavity, hot runner, complex geometries) and understand practical maintenance techniques to improve mould life and product quality.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Assessment I (35%), Assessment II (35%), Activities (30%).

References:

1. DuBois J. Harry: Plastics Mold Engineering Handbook (English, Paperback, Springer- Verlag New York Inc.4th Edition November 2013
2. .Klus S DuBois J. Harry, Plastics Mold Engineering Handbook (English, Paperback, , Hanser Publishers, NY, 3rd Edition 2013
3. Peter Jones, “The Mould Design Guide”, Smithers Rapra Technology Ltd., 2008
4. R.G.W.Pye, Injection Mold Design, East West Press Pvt. Ltd., New Delhi.,2000.
5. Hajra Chouldhary S.K and Hajra Choudhury. AK., "Elements of workshop Technology", volume II, Media promoters and Publishers Private Limited, Mumbai, 2010.
6. Peter Jones, “The Mould Design Guide”, Smithers Rapra Technology Ltd., 2008.
7. W.A.J Chapman, Workshop Technology, Vol I & II, ELBS.
8. Herbert Rees, Mold Engineering, Hanser Publishers, NY.,2002.
9. George Menges & Paul Mohren, How To Make Injection Molds, Hanser Publishers,2001.
10. Douglas M. Bryce, Plastic Injection Molding manufacturing process fundamentals, Society of Manufacturing Engineers, Dearborn, Michigan.,1996.
11. Jain R K ,” Engineering Metrology” , 19th Edition , Khanna Publishers , 2005.
12. Gaylor, Shotbolt and Sharp, Metrology for Engineers, Publisher: O.R.Cassel, London,1993.

E-resource(s):

1. LearnChemE
2. PlasticsEurope
3. Engineering Toolbox

CO Mapping with PO & PSO:

CO	Description of CO	PO Mapping	PSO Mapping
CO1	Explain the principles of mould tools, mould materials, and mould manufacturing processes used in plastic product fabrication.	-	-
CO2	Apply the knowledge of different mould types and mould design considerations for selecting suitable moulds in plastic processing applications.	PO2(3), PO3(2), PO5(2)	PSO1(3), PSO2(2)
CO3	Analyze and evaluate mould quality using advanced measuring and inspection equipment to ensure precision, productivity, and product quality.	PO4(3), PO5(3), PO11(2)	PSO2(3), PSO3(3)

PT25405	Plastics Processing - I	L	T	P	C
		3	0	4	5

Course Objectives:

- To understand various processing techniques of plastic materials.
- To learn the fundamentals of compression molding and transfer molding of thermoset plastics.
- To learn the basic processing of thermoplastics by injection molding, extrusion and blow moulding.

Compression moulding: Basic principles of compression and transfer moulding-Meaning of terms-Bulk factor and flow properties as applied to moulding materials-The methods adopted for estimating these properties and their limitations Process variables-Inter relation between flow properties-Curing time-Mould temperature and Pressure requirements-Preforms and preheating-Techniques of preheating- Machines used-Types of compression mould-Common moulding faults and their correction- Finishing of mouldings.

Practical: Study of Hand compression M/c, Operating Principle of Hand Compression Press, mould setting procedure & parameter setting, operation practice on different compression moulds, M/c specification observations and recording

Activities: Analysis of relationship between flow properties and moulding conditions**.**

Transfer moulding: Fundamental principles of transfer moulding-advantages over compression moulding- Equipment used-Press capacity-Integral moulds and auxiliary ram moulds-Moulding cycles-Tool costs- Moulding tolerances-Materials Theoretical calculation of pressures- Line pressures- Injection ram pressure-clamping-Heating requirements-Finishing of moulded parts—Moulding faults – causes and remedies.

Practical: Technical specification of M/c, Mould clamping on M/c, Parameter setting, operation-practice on different Transfer Moulds, Cycle-time analysis, observation & Procedure of start-up & shut down of M/c.

Activities: Identification of parts used in transfer moulding operations.

Injection moulding: Principles processing outline - Process variables - Mould cycle - Machinery used – Parts and functions –Specifications - Construction and maintenance - Start-up and shut down procedures - Cylinder nozzles - Press capacity projected area - Shot weight Basic theoretical concepts and their relationship to processing - Interaction of moulding process aspect effects in quoted variables - Introduction to trouble shooting**.**

Practical: (i) Injection Moulding Semi-Automatic -Study of Semi-Automatic Injection Moulding M/cs of all types in IRO. Comparative study of Pneumatic type & Hydraulic type of M/cs, Operating Principle of M/cs. Line diagrams of M/cs with nomenclature of parts, M/cs specifications.

(ii) Injection Moulding M/c.- Automatic- Study of M/c Parts & function, Study of clamping systems in M/cs, Technical spec. of M/c, study of process sequence in Machine, Study & definitions of terms related to M/c operation e.g. M/c Day light, Locating Ring Dimensions, ejector-stroke, Tie-

Bar distance, M/c Platen sizes & mould clamping arrangements. Definitions of all Processing Parameters & study of controls in M/cs.

Activities: Study of injection moulding machine parts, functions, and specifications.

Extrusion: Basic principles of extrusion – Types of extruders, general features of extruders viz. barrel, screw, types of screws, drive mechanism, specifications, heating & cooling systems, flow mechanism, die entry effects and exit instabilities. Melt fracture & Bam- booing. Factors affecting the output of an extruder, process variables in extrusion Extrusion processes and the downstream equipments for the production of films, blown film, cast film/slot film, BO film, coextruded film. Tube/pipe-sizing take off equipment, extrusion coating, wire & cable covering –pretreatment of conductor, cooling, takeoff equipment constructional features of dies for the above processes and trouble shooting. Applications of extrusion and new developments.

Practical: (i) Study of Extruders in IRO, Free sketch of machines, their parts and parts-function, List of products manufactured by Extrusion-Process. Study of different types of extrusion process.

(ii) Operation-Practice by Trainee on setting up of Process parameter to produce Blown-Film on Film-plant, observations on extruder output, size of film produced and technical specifications of machines to be recorded.

Activities: Identification of downstream equipment used in film and pipe extrusion lines.

Blow Moulding: Basic principles and definitions- Processer – viz, Injection Blow moulding, extrusion blow moulding, Accumulation blow moulding, Merits & Demerits - Development of blow moulding industry Processing Parameters-Temperature-Pressure and cycle time Components – Materials requirements related to process and product performance- Materials used-Limitations in product design presented by process characteristics- Design guide lines for optimum product performance and appearance-Equipment used- Hand and power operated equipment. Screw and Plunger Systems-Cross head and die design-Blow moulding machine features and operation including hydraulic and electrical control systems-faults, causes and remedies. Parison programming, blow mould construction, cooling methods, mould venting, blow moulding of difficult articles like fuel tanks, odd shaped containers with handles, limitation in blow moulding, decoration of blow moulding products, hot stamping-multi colour printing-faults, causes and remedies.

Practical:

(i) Study of Hand Blow Moulding, Free-sketch of M/c with parts & study of part-function, Specification of M/c, Study of Parison-die with sketch.

(ii) Die-centering practice by Trainees, operation of Hand Blow Machines, to produce components observations, cycle time analysis Procedure of operation and observations

Activities: Study of materials used in blow moulding and their performance requirements.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Theory (30%), Practical (10%), Activities (10%)

References:

1. Allen; W. S. and Baker; P. N., Hand Book of Plastic Technology, Volume-1, Plastic Processing Operations [Injection, Compression, Transfer, Blow Molding], CBS Publishers and Distributors, New Delhi (2004).Injection Molding Theory & Practice By Rubin, Irvin.
2. Injection Molding Hand Book By Rusto,D.V &Rosato, D.V Plastic Engineering Hand Book & D–5 By Society of Plastic Industry Inc.,2000.
3. Plastics Material & Processing By Strong, A, Brent ,Blow Molding Hand Book By Rosato,
4. D.V & Rosato, D.V ,Plastic Extrusion Technology By Hensen.
5. Extrusion of Plastics By Fisher
6. Plastics Extrusion Technology By Grief
7. Plastic Engineering Hand Book By S P I,1991.
8. Plastics Extrusion Technology By Henson,1997.
9. A Guide to Injection Molding of Plastics By Bolur, P.C.,
10. Development in Injection Molding By Whelan, A & Craft, J.L.
11. Technician's Hand Book & Plastics By Grandilli, P.A.,1990.
12. Plastics Materials & Processing By Schwartz & Goodman.,1982.
13. Injection Molding By Athalye, A.S.,1997.
14. Injection Molding Technology By V.D.I.
15. Innovation in Polymer Processing By Stevenson.,1996.
16. Extrusion The definitive Processing Guide and Hand Book By Giles, H.H & Others., 2004.

E-resource(s):

1. NPTEL
2. MIT Open Course Ware
3. Learn ChemE
4. Plastics Europe
5. Engineering Toolbox

CO Mapping with PO & PSO:

CO	Description of CO	PO Mapping	PSO Mapping
CO1	Explain the principles, process parameters, equipment, and applications of plastic processing techniques such as injection moulding, extrusion, and blow moulding.	-	-
CO2	Apply and analyze compression moulding and transfer moulding processes for thermoset plastics and evaluate their suitability for different product applications.	PO2(3), PO3(2), PO5(2)	PSO1(2), PSO2(3), PSO3(2)

PT25406	Standards For Plastics Materials and Products	L	T	P	C
		1	0	0	1

Course Objectives:

- To understand the importance of standards in the plastics industry for ensuring quality, safety, and regulatory compliance.
- To familiarize students with national and international standard organizations such as ISO, ASTM, and their roles in plastics materials and product standardization.
- To develop knowledge of standard specifications for various plastic raw materials, additives, and finished products.

Standard Specifications of Commodity Plastics:

Specification for Polyethylene Material for Moulding and Extrusion as per standard, Specification for Polypropylene Materials for Moulding and Extrusion as per standard, Polystyrene Moulding and Extrusion Materials as per standard.

Activities: identify and understand the standard specifications of commodity plastics.

Standard Specifications of Engineering & Thermoset Plastics:

Polycarbonate Moulding and Extrusion Materials Specification as per standard, Ethylene Vinyl Acetate (EVA) Copolymers for Its Safe Use in Contact with Foodstuffs, Pharmaceuticals and Drinking Water as per standard and Phenolic Moulding Materials — Methods of Test as per standard.

Activities: Evaluation of Standard Specifications of Engineering & Thermoset Plastics.

Standard Specifications of Plastic Films:

Polyethylene Films and Sheets — Specification as per standard

Activities: Evaluation of Standard Specifications of Plastic Films.

Standard Specifications of Moulded Products:

Rotational Moulded Polyethylene Water Storage Tanks as per standard and High Density Polyethylene (HDPE) Crates for Milk Pouches-Specification as per standard, Plastic Bottles/Containers for Packaging of Natural Mineral Water and Packaged Drinking Water – Specification as per standard and Plastics Feeding Bottles as per standard.

Activities: Evaluation of Standard Specifications of Moulded Plastic Products.

Standard Specifications of Pipes:

Unplasticized PVC Pipes For Potable Water Supplies Specification as per standard and Polyethylene Pipes for Water Supply – Specification as per standard.

Activities: Evaluation of Standard Specifications of Plastic Pipes.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Assessment – I (35%), Assessment – II (35%), Activities (30%).

References:

1. Brown; Paul F (Ed), Hand Book of Plastics Test Methods, Longman Scientific and Technical, Harlow (1988).
2. Shah, Vishnu, Hand Book of Plastics Testing Technology, John Wiley and Sons, SPE Monograph (1984).
3. Blythe; A. R., Electrical Properties of Polymers, Cambridge University Press, Cambridge (1979).

CO Mapping with PO & PSO:

CO	Description of CO	PO Mapping	PSO Mapping
CO1	Understand the importance of standards, specifications, and regulatory requirements in the plastics industry for quality assurance, safety, and compliance.	–	–
CO2	Apply national and international standards such as BIS, ISO, and ASTM in the classification and specification of plastic materials and products.	PO1(3), PO2(2)	PSO1(2), PSO2(2)
CO3	Analyze standard specifications and testing requirements of commodity plastics, engineering plastics, and thermoset materials used in industrial applications.	PO2(3), PO3(2), PO4(2)	PSO1(2), PSO2(3)
CO4	Evaluate the performance requirements and standard specifications of plastic films, moulded products, and related plastic components.	PO3(3), PO5(2), PO7(2)	PSO2(3), PSO3(2)
CO5	Assess and select suitable plastic pipes and products based on relevant standards and application-specific engineering requirements.	PO4(3), PO5(2), PO10(2)	PSO1(2), PSO2(3), PSO3(2)

PT25407	Mini Project I	L	T	P	C
		0	0	2	1

Course Objectives:

- The main objective of Mini Project is to let the students apply the knowledge of theoretical concepts which they have learnt as a part of the curriculum of the undergraduate courses to real time problems or situations.

Course Guidelines:

- Students can choose project based on industry defined problem or user defined problem which must emulate the real-life problems.
- It is desirable that students should work on the project in group of 2 or 3 but not more than three.
- After making the group, students must decide the title of the project and they will present to the department. Also, students will prepare the proposal report of 4-5 pages and submit at the time of presentation.
- At the end, students must submit the final report of the project and the format for the same will be given by the department.
- The plagiarism check for the final report is to be done through the required software suggested by the department and the report must be having similarity less than 25%.
- The students will report to the respective guide/supervisor at every fortnight to discuss their progress.
- The final evaluation of the project will be done based on the demonstration and presentation.

	Industry Internship	L	T	P	C
		0	0	0	0

Course Objectives:

- Get connected with industry/ laboratory/research institute
- Get practical knowledge on production process in the industry and develop skills to solve related problems
- Develop skills to carry out research in the research institutes/laboratories

The students individually undergo training in reputed firms/ research institutes / laboratories for the specified duration. After the completion of training, a detailed report should be submitted within ten days from the commencement of next semester. The students will be evaluated as per the Regulations.

No. of. Weeks: 04

CO Mapping with PO & PSO:

	Description of CO	PO	PSO
CO1	Plant layout, machinery, organizational structure and production processes in the firm or research facilities in the laboratory/research institute	PO1 (2), PO2 (2), PO3 (2), PO4 (2), PO5 (2), PO6 (1), PO7 (3), PO8 (1), PO10 (1), PO12 (2)	PSO1(2) PSO2(2) PSO3(2)
CO2	Analysis of industrial / research problems and their solutions	PO1 (2), PO2 (2), PO3 (2), PO4 (2), PO5 (2), PO6 (1), PO7 (3), PO8 (1), PO10 (1), PO12 (2)	PSO1(2) PSO2(2) PSO3(2)
CO3	Documenting of material specifications, machine and process parameters, testing parameters and results	PO1 (2), PO2 (2), PO3 (2), PO4 (2), PO5 (2), PO6 (1), PO7 (3), PO8 (1), PO10 (1), PO12 (2)	PSO1(2) PSO2(2) PSO3(2)
CO4	Preparing of Technical report and presentation	PO1 (2), PO2 (2), PO3 (2), PO4 (2), PO5 (2), PO6 (1), PO7 (3), PO8 (1), PO10 (1), PO12 (2)	PSO1(2) PSO2(2) PSO3(2)

EN25C04	English Communication Skills Laboratory – II	L	T	P	C
		0	0	2	1

Course Objectives:

- The objectives of the course are to build students' advanced communication skills for workplace readiness and develop intercultural competence for effective collaboration in global and virtual teams. Prepare students for competitive exams with focused skill-building and test-oriented practice.

List of Activities

Stage Ready – Impactful Public Speaking.

(i) Simulate a formal event such as an academic conference, convocation, or awards ceremony, where students roles including Master of Ceremonies (MC), Role as a dignitary, and a Commentator
(ii) Visual Prompt Storytelling: Use random images to create spontaneous stories, focusing on plot, setting, and character,
(iii) Digital Presentation - Record a short video explaining a project or technical concept, using slides, voiceover, and visual aids (to be uploaded using google classroom or drive link)

Professional and Application-Oriented Writing

(i) Résumé Preparation: Design ATS-friendly résumés tailored to various job descriptions, using action verbs and quantifiable impact. ·
(ii) Design engaging content for poster presentation relevant to their domain.

Receptive Skills in Workplace Communication·

(i) Reading articles related to their domain and discuss in groups
(ii) Visit company websites, make inferences and present in the class
(iii) Listen to recorded mock interviews and take detailed notes. Summaries key points and action items in a professional format and make a presentation.

Intercultural Communication

(i) Assertive vs Aggressive communication
(ii) Role play activities – workplace communication in intercultural/crosscultural contexts

From Campus to Career: Industry Skills and Global Exam Preparation

(i) Participate in HR interviews using AI tools or peer interviewers, responding to behavioural questions using methods like STAR (Situation, Task, Action, Result)
(ii) Practice Verbal Ability in competitive exams like UPSC, SSC, CDS, TNPSC, etc.

Weightage: Continuous Assessment: 60%, End Semester Lab Examinations: 40%.

Internal Assessment Methodology: 1. Oral story telling using visual prompts (30 marks)

2. Poster presentation (40 marks)
3. ATS resume writing (30 marks)

End Semester Assessment:

1. Interview (50 marks)
2. Verbal Ability test (50 marks)
   (students must bring the resume but evaluation must be done based on the performance in the interview)

References:

1. Lucas, Stephen, and Paul Stob. The Art of Public Speaking. Thirteenth edition, McGraw-Hill Education, 2020.
2. Abrahams, Matt. Think Faster, Talk Smarter: How to Speak Successfully When You're Put on the Spot. Simon & Schuster, 2023.
3. Beshara, Tony. Powerful Phrases for Successful Interviews, Rev. ed., McGraw-Hill, 2023.
4. Papalia, Anna. Interviewology: The New Science of Interviewing. Harper Business, 2024.
5. Verbal Ability and Reading Comprehension by Ajay Singh McGraw Hill Education 2020

E-resources:

1. Purdue OWL – Online Writing Lab (Academic and professional writing help) https://owl.purdue.edu/
2. Canva Resume Builder (Creative, ATS-friendly resume design) https://www.canva.com/resumes/
3. BBC Learning English – Pronunciation https://www.bbc.co.uk/learningenglish/english/features/pronunciation
4. India Bix website

CO Mapping with PO & PSO:

	Description of CO	PO	PSO1
CO1	Understand basic industry-related reading materials.	-	-
CO2	Design and present a domain specific poster	PO9(3)	PSO1(2) PSO3(3)
CO3	Deliver effective digital presentations	PO9(3)	PSO2(1)
CO4	Communicate appropriately in intercultural/cross cultural contexts	PO9(3)& PO11(1)	PSO3(3)
CO5	Perform in interviews and competitive exams successfully	PO9(3)	PSO3(1)