PLASTINDIA INTERNATIONAL UNIVERSITY

(Sponsored by Plastindia Foundation)

Dungra, GIDC, Vapi, Dist. Valsad - 396193,

Gujarat, India

(Established under Gujarat Government Private Universities Act, 2016)

School of Engineering

B. Tech (Plastics and Polymer Engineering)

P-2025

FY B. Tech. (Plastics and Polymer Engineering)

Course Category	Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks							Credits			
			Theory	Practical	Contact Hr/Week	ISE- I	ISE - II	TA	ESE	TW	PR/OR	TOTAL	TH	TW/PR	TOTAL	In Line With UML
Semester - II																
BSC	BSC201	Calculus - II	3	-	3	15	15	20	50	-	-	100	3	-	3	√
BSC	BSC202	Organic Chemistry	3	-	3	15	15	20	50	-	-	100	3	-	3	√
ESC	ESC211	Engineering Workshop Practices	3	-	3	15	15	20	50	-	-	100	3	-	3	
PCC	PPE231	Introduction to Plastics Engineering	3	-	3	15	15	20	50	-	-	100	3	-	3	√
PCC	PPE232	Introduction to Polymer Sustainability	3	-	3	15	15	20	50	-	-	100	3	-	3	√
HSSM	HSSM221	English Language and Communication Skills	2	-	2	-	-	-	50	-	-	50	2	-	2	
BSC	BSC241	Lab: Organic Chemistry	-	2	2	-	-	-	-	-	25	25	-	1	1	√
ESC	ESC242	Lab: Engineering Workshop Practices	-	2	2	-	-	-	-	-	25	25	-	1	1	
ESC	ESC243	Lab: Programming for problem-solving with Python	-	2	2	-	-	-	-	25	-	25	-	1	1	√
HSSM	HSSM222	Indian Knowledge System: Concepts and Applications in Engineering	2	-	2	Non-Credit Mandatory Course										
PSI	PSI235	Social Internship**	After Semester II, 15 days internship preferably in a rural area													
		Total	**19**	**6**	**25**	**75**	**75**	**100**	**300**	**25**	**50**	**625**	**17**	**3**	**20**	

F.Y. B. Tech in Plastics and Polymer Engineering,

Semester-II

Year, Program, Semester	F.Y. B. Tech in Plastics and Polymer Engineering, Semester-II						
Course Code	BSC201						
Course Category	BSC (Basic Sciences and Humanities Courses)						
Course title	**Calculus – II (Theory)**						
Teaching Scheme and Credits	**L**	**P**		**Total Contact Hours / Week**	**Total Credits**		
	03	-		03	03		
Evaluation Scheme	**ISE-I**	**ISE-II**	**ESE**	**TA**	**TW**	**PR/OR**	**Total**
	15	15	50	20	-	-	100
Pre-requisites (if any)	• Calculus - I						
Course Objectives	• Apply the concept of calculus of complex function to construct analytic function. • Able to formulate and solve various engineering problems using calculus and ability to work with advanced engineering mathematics. • To formulate and solve various engineering problems using Complex Analysis. • To study the properties of Laplace Transforms to solve ODEs.						
Course Outcomes	• CO 1: Recall the concept of sequence-series, calculus, Fourier and Laplace throughout the field. (Remember) • CO 2: Understand the conceptual variations to apply it in a various domain. (Understand) • CO 3: Apply various mathematical technique to solve engineering problems. (Apply) • CO 4: Analyze engineering problems to apply appropriate advanced mathematical technique. (Analyze)						

Unit No.	Course Content	Hours
I	**Sequence and Series - I** Convergence and Divergence, Oscillating and Infinite Series, Sandwich Theorem, p-Series, Comparison test, Integral test, Ratio test, Root test, Alternating Series, Absolute and Conditional Convergence.	6

II	**Sequence and Series – II** Power Series, Taylor and Maclurian Series, Indeterminate forms, and L'Hospital rule.	6
III	**Complex Differentiation** Limit, Continuity, Differentiability of functions of complex variable, Cauchy-Riemann equations, Cauchy-Euler equation (Cartesian and Polar coordinates), Analytic functions, Harmonic functions.	6
IV	**Complex Integration** Complex line integral, Contour Integral, Cauchy-Gaursat Theorem, Cauchy Integral Theorem (CIT), Cauchy Integral Formula (CIF), Cauchy Residue Theorem.	6
V	**Fourier Series - I** Fourier Coefficients, Convergence, Types of Fourier series, Linearity, Symmetric Property, Parseval's Theorem, Dirichlet's Condition	6
VI	**Laplace Transforms – I** Laplace Transform, Linearity, First Shifting Theorem, Existence Theorem, Second Shifting Theorem, Inverse Laplace Transform, Properties of Inverse Laplace Transforms, Convolution Theorem.	6
Text Books		
1	B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi (1965)	
2	Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons. (1962)	
3	B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi. (2007)	
Reference Books		
1	C. R. Wylie, "Advanced Engineering Mathematics", McGraw Hill Publication, New Delhi. (2003)	
2	Shanti Narayan, "Differential Calculus" S. Chand and company, New Delhi. (1942)	
3	H. K. Dass, "Advanced Engineering Mathematics", S. Chand Publishing. (2007)	
4	M. D. Greenberg, "Advanced Engineering Mathematics", Pearson Education. (1998)	
Web Links and Video Lectures (E-Resources)		
1	NPTEL Course on Basic Calculus https://archive.nptel.ac.in/courses/111/106/111106146/	

2	NPTEL Course on Advance Engineering Mathematics https://archive.nptel.ac.in/courses/111/107/111107119/

Activity Based Learning (Suggested Activities in Class)

1. Flipped Classroom
2. Online Interactive Tool
3. Collaborative and Individual Problem based learning.
4. Quizzes/Assignment

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	2
CO3	3	2	-	-	-	-	-	-	-	-	-	2
CO4	3	3	-	-	-	-	-	-	-	-	-	2
Avg	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

Mapping of Course Outcomes with Program Specific Outcomes

CO No.	PSO 1	PSO 2	PSO 3
CO 1	1	-	-
CO 2	2	-	-
CO 3	2	-	-
CO 4	3	-	-
Avg.	**2**	**-**	**-**

Correlation Level

- Slightly Low: 1
- Moderately (Medium): 2
- Substantially (Strong): 3

CO-PO-PSO Mapping Justification

- CO1 (Recall the fundamental concepts): Strongly relates to PO1 (Engineering knowledge), slightly to PO2 (problem solving), and moderately to PO12 (life-long learning). It slightly supports PSO1 (understanding fundamentals).
- CO2 and CO3 (Describe variations in methods): Strongly maps to PO1, moderately to PO2 and PO12 due to understanding the variations in the methods to apply, which moderately aligns with PSO1 as it builds foundational understanding.

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- CO4 (Observation of problems): Strongly aligns with PO1 and PO2 as it involves multiple observations to analyse and apply a particular method, and moderately with PO12 (lifelong learning) for personal growth.

Year, Program, Semester	F.Y. B. Tech in Plastics and Polymer Engineering, Semester-II						
Course Code	BSC202						
Course Category	BSC (Basic Sciences and Humanities Courses)						
Course title	**Organic Chemistry (Theory)**						
Teaching Scheme and Credits	**L**	**P**		**Total Contact Hours / Week**	**Total Credits**		
	03	-		03	03		
Evaluation Scheme	**ISE-I**	**ISE-II**	**ESE**	**TA**	**TW**	**PR/OR**	**Total**
	15	15	50	20	-	-	100
Pre-requisites (if any)	Basics of Chemistry, Physics and Mathematics						
Course Objectives	• To understand the basic concepts of chemistry, atomic structure and model, periodicity and chemical bonding. • To understand laws of thermodynamics, enthalpy, entropy, Gibbs free energy, the kinetics and activation energy. • To study the state of matter, Gas laws, adsorption, water, and solutions • To know EMR interaction with matter and spectrums, hydrocarbon and green chemistry concept and 12th principles.						
Course Outcomes	• CO 1: Recall the fundamental concepts of chemistry including atomic structure, periodic trends, chemical bonding, and basic chemical calculations. (Remember) • CO 2: Explain the principles of molecular structure, intermolecular forces, states of matter, and thermodynamic laws. (Understand) • CO 3: Apply stoichiometric principles, gas laws, thermodynamic relations, and electrochemical concepts to solve numerical and conceptual problems. (Apply) • CO 4: Examine reaction kinetics, adsorption phenomena, colligative properties, and equilibrium systems to determine influencing factors. (Analyze) • CO 5: Judge spectroscopic data and electrochemical processes to determine material behaviour and chemical performance. (Evaluate)						

Unit No.	Course Content	Hours
I	**Chemical Calculation, Atomic Structure and Periodicity** Basic concepts of chemistry, Mole concept and Avogadro's number, units, Stoichiometry and chemical equations, demonstrations, atomic models, quantum numbers, Aufbau principle, Hund rule, periodic table and law, periodic properties, trends, and atomic orbital blocks.	6
II	**Chemical Bonding and Molecular Structure** Chemical bonding, Lewis's structure and Octet rule, types of bonding, VSEPR, VBT, MOT, bond and molecular polarity Intermolecular forces (dipole-dipole, and Van der Waals), hydrogen bonding, and hybridization.	6
III	**States of Matter and Solution** Properties of solids, liquids, gases, Gas laws, vapor pressure, phase rule, adsorption, absorption, surface tension, water, industrial waste water, solutions, types, various concentration terms and units, viscosity, colligative properties.	6
IV	**Thermodynamics and Chemical Kinetics** Laws of thermodynamics, enthalpy, entropy, and Gibbs free energy, spontaneous and non-spontaneous, reaction rate, orders, factors affecting, collision theory and activation energy, catalysis.	6
V	**Equilibria, Acids-Bases, and Electrochemistry** Chemical and ionic equilibrium and equilibrium constant, Le Chatelier's principle, Acid-base theories, pH, pOH, and buffer solutions, Precipitation reactions and solubility product, Basics of redox reactions and electrochemical cells.	6
VI	**Principles of Spectroscopy** Electromagnetic radiation, Interaction with matter, spectrums, Beer-Lambert Law, UV spectrum, absorbance, emission, transmittance, and reflectance. Infrared spectrum and other techniques. Applications.	6
	Text Books	
1	S. Agarwal "Text book of Engineering Chemistry" Cambridge University Press	
2	Dr. O.P. Tandon, A Text book of Inorganic Chemistry,", G.R. Bathla & Sons	
3	V K Ahluwalia, Rakesh Parashar, "Textbook of Chemistry" Viva Books, 2012.	
3	Shashi Chawla, A Text Book of Eng. Chemistry, Dhanpat Rai & Co. (P) Ltd.	

4.	Bahl and Tuli, Essentials of Physical Chemistry, S. Chand Publishing
Reference Books	
1	Jain & Jain "Engineering Chemistry" Dhanpat Rai Publishing Company
2	Baskar, Engineering Chemistry, John Wiley & Sons
3	Puri, Sharma and Pathania, Principles of Physical Chemistry" Vishal Publishing Company

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	–	–	–	–	2	-	3	–	2	–	2
CO2	3	–	–	–	–	3	3	3	–	2	–	3
CO3	2	1	–	–	–	2	3	3	3	2	–	3
CO4	2	3	–	–	–	3	3	3	2	3	1	3
Avg.	**2.25**	**2**	**-**	**-**	**-**	**2.5**	**2.25**	**3**	**2.5**	**2.25**	**1**	**2.75**

Mapping of Course Outcomes with Program Specific Outcomes

CO No.	PSO 1	PSO 2	PSO 3
CO 1	3	-	-
CO 2	3	-	-
CO 3	3	2	-
CO 4	3	1	1
Avg.	**3**	**1.5**	**1**

Correlation Level

- Slightly Low: 1
- Moderately (Medium): 2
- Substantially (Strong): 3

CO-PO-PSO Mapping Justification

- CO1: Relates to PO1, PO6, and PO8. It moderately supports PSO1.
- CO2: Maps to PO1, PO6, PO7, and PO8 due to its focus on ethical and sustainable living. Strongly aligned with PSO1 as it builds foundational understanding.
- CO3: Applies to PO6, PO7, PO8, PO9, and PO10, supporting interpersonal and ethical skills. Supports PSO1 strongly and PSO2.

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- CO4: PO6, PO7, PO8, PO9, PO10, and PO12 for professional ethics and personal growth. Weakly linked to PSO2 and PSO3 via ethical decision-making in professional environment.

Year, Program, Semester	F.Y. B. Tech in Plastics and Polymer Engineering, Semester-II						
Course Code	ESC211						
Course Category	ESC (Engineering Science Course)						
Course title	**Engineering Workshop Practices**						
Teaching Scheme and Credits	**L**	**P**		**Total Contact Hours / Week**	**Total Credits**		
	03	-		03	03		
Evaluation Scheme	**ISE-I**	**ISE-II**	**ESE**	**TA**	**TW**	**PR/OR**	**Total**
	15	15	50	20	-	-	100
Pre-requisites (if any)	Engineering Physics, Basics of Chemistry						
Course Objectives	• To provide basic workshop tools, equipment, and safety practices. • Explain fundamental procedures and techniques in various engineering workshops, including carpentry, fitting, welding, and machining. • Demonstrate correct handling and operation of standard workshop tools and machinery. • Apply practical skills to fabricate and assemble engineering components using appropriate workshop practices and tools						
Course Outcomes	• CO1: List the fundamental concepts of workshop technology including workshop layout, measuring instruments, engineering materials, machining processes, CNC systems, and joining methods used in manufacturing practice. (Remember) • CO2: Explain the principles and working of fitting operations, machining processes, material testing methods, CNC machining, additive manufacturing, and welding processes used in engineering workshops. (Understand) • CO3: Utilize appropriate measuring instruments, workshop tools, and power tools to perform basic fitting, inspection, and measurement operations in accordance with standard workshop practices. (Apply)						

	• CO4: Select suitable manufacturing and joining processes such as machining, casting, forming, CNC machining, additive manufacturing, and welding for simple engineering applications. (Apply)

Unit No.	Course Content	Hours
I	**Introduction To Workshop Technology** Workshop layout, importance of various sections, types of jobs performed in each section, safety rules and work procedures, brief overview of inspection and quality control, important terms in metrology, basic methods of measurement, standards of measurement, measuring instruments such as Vernier caliper, micrometres, slip gauges, height gauge, and dial indicator.	6
II	**Fitting Operations and Power Tools** Study and use of holding tools, marking tools, measuring tools, cutting tools, finishing tools such as reamers and files and other miscellaneous tools used in tool room practice. Fitting operations including chipping, filing, drilling, reaming, tapping, threading, scraping, deburring, and assembly. Introduction to power tools, their types and their uses in workshop practice.	6
III	**Engineering Materials** Classification of engineering material, composition of cast iron and carbon steels and their mechanical properties, Alloy steel and their applications, stress-strain diagram, Hooks law and modulus of elasticity, Tensile, shear, hardness and fatigue testing of materials	6
IV	**Machining, Casting and Forming** Machine tools and metal cutting principles, types of machining processes used in mould manufacturing, pattern, allowances of pattern ,casting process, types of casting, casting defects, moulding process and its types, forming processes such as bending, coining and embossing, types of rolling and roll mills, strain hardening, recovery, recrystallization and grain growth.	6
V	**CNC and Additive Manufacturing** Introduction to CNC machines, elements of CNC systems, block diagram of CNC, types of CNC machines, working principles of CNC machines, basics of	6

	CNC programming, G and M codes, advantages and challenges of CNC machining, and applications of CNC in mould manufacturing. Introduction to rapid prototyping, materials used in additive manufacturing.	
VI	**Welding and Joining** Introduction to joining processes and their importance in manufacturing, Types of joining such as welding, brazing, soldering, and adhesive bonding, Types of welding including arc welding, gas welding, resistance welding and TIG and MIG welding. Basic welding equipment, safety precautions and common welding defects.	6

Text Books

1	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol.-II 2010, Media promoters and publishers private limited, Mumbai.
2	Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3	Gowri P. Hari Haran and A. Suresh Babu, "Manufacturing Technology–I" Pearson Education, 2008.

Reference Books

1	Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
2	Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw-Hill House, 2017.
3	Workshop Technology by Chapman, W.A.J. ELBS Low Price Text, Edward Donald Pub. Ltd, 2018
4	Basic Machine Shop Practice Vol. I & II By Tejwani, V.K., Tata McGraw Hill Pub. Co., 2020

Alternative NPTEL/SWAYAM Course

Sr. No.	NPTEL Course Name	Instructor	Host Institute
1.	Fundamental of Manufacturing process	Prof. D K Dwivedi	IIT Roorkee
2.	Manufacturing Processes and Technology	Dr. Sounak Choudhury	IIT Kanpur

Useful web links

1	https://archive.nptel.ac.in/courses/112/107/112107219/
2	https://onlinecourses.nptel.ac.in/noc24_me84/preview

Mapping of Course Outcomes with Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	1	2	1	-	-	-	-	-	-	-	1
CO 2	3	1	3	1	-	-	-	-	-	-	-	1
CO 3	3	1	3	2	2	-	-	-	-	-	-	1
CO 4	2	2	3	1	1	-	-	-	-	-	-	1
Avg.	**2.75**	**1.25**	**2.75**	**1.25**	**1.66**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

Mapping of Course Outcomes with Program Specific Outcomes

CO No.	PSO 1	PSO 2	PSO 3
CO 1	3	-	-
CO 2	3	-	-
CO 3	2	2	3
CO 4	2	1	3
Avg.	**2.5**	**1.5**	**3**

Correlation Level

- Slightly Low: 1
- Moderately (Medium): 2
- Substantially (Strong): 3

CO-PO-PSO Mapping Justification

- CO1 The knowledge of Physics relevant to engineering is critical for converting ideas into technology — it correlates well with PO1, PO2, PO3 and PSO1.
- CO2 An understanding of Physics also helps engineers understand new innovations and improvements — mapping to PO1, PO3, PO5 and PSO2.
- CO3 Expands on application of basic principles of physics to solve engineering problems, and PO3, PSO2/PSO3.
- CO4 Establish a strong foundation to use several materials at various technical and engineering applications., which ties into PO12 and PSO3.

Year, Program, Semester	F.Y. B. Tech in Plastics and Polymer Engineering, Semester-II						
Course Code	PPE231						
Course Category	PCC (Professional Core Course)						
Course title	**Introduction to Plastics Engineering (Theory)**						
Teaching Scheme and Credits	**L**	**P**		**Total Contact Hours / Week**	**Total Credits**		
	03	-		03	03		
Evaluation Scheme	**ISE-I**	**ISE-II**	**ESE**	**TA**	**TW**	**PR/OR**	**Total**
	15	15	50	20	-	-	100
Pre-requisites (if any)	• Fundamental knowledge of chemistry based on HSC • Basic Engineering Graphics/Design course						
Course Objectives	After the completion of the course, the student should be able to: • Have a general overview of polymers, their types, concept of molecular weight. • Have a general understanding of structure of polymers and predict polymer properties. • Develop basic competency in preparing standard 2D technical drawings with proper dimensioning.						
Course Outcomes	• CO 1: Recall fundamental concepts of polymer science, including the evolution of polymers, key definitions (monomers, oligomers, polymers), and the classification of polymers based on structure and properties. (Remember) • CO 2: Explain the relationship between polymer structures (linear, branched, crosslinked, crystalline, and amorphous) and their properties, along with the applications of different polymer types, such as rubbers, plastics, and fibers, in various industries. (Understand) • CO 3: Apply the principles of technical drawing to create accurate 2D drawings, adhering to standards and conventions, and incorporating basic dimensioning and tolerancing techniques. (Apply)						

Unit No.	Course Content	Hours
I	**Introduction to Polymers:** Historical Developments of Polymers: Overview of significant milestones in the development of polymers, Evolution of polymer science and its applications; Basic Raw Materials: Natural and synthetic sources of polymer materials, the role of monomers in polymerization; Key Concepts and Definitions: Monomers, oligomers, macromolecules, and polymers, Repeating units and degree of polymerization, Functionality concept and functional groups, Molecular weight concept	6
II	**Classification of Polymers** Basic Concepts and Definitions: Organic and inorganic polymers. Thermoplastics and thermosets, Addition and condensation polymers, Natural, semi-synthetic, and synthetic polymers, Crystalline and amorphous polymers, Homopolymers and copolymers, Homochain and heterochain polymers; Polymer Structure and Properties: Linear, branched, and crosslinked polymers, Conformation and configuration, Tacticity of polymers	6
III	**Types of Polymers and Their Applications** Rubber, Plastic, Fibers and Liquid resins: Concepts and properties of rubber, plastic, fibers and liquid resins; Commodity, Engineering and Specialty Polymers, applications of commodity and specialty polymers in various industries	6
IV	**Fundamentals of Technical Drawing and Design** Introduction to Technical Drawing: Basic principles and importance of technical drawing, Types of drawings (orthographic, isometric, section views, etc.), standards and conventions; Fundamentals of Design: Design process and problem-solving techniques, Overview of design principles (aesthetics, function, and ergonomics), Introduction to product design documentation and specifications	6

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V	**Computer-Aided Design (CAD) and Dimensioning** Introduction to Computer-Aided Design (CAD): Overview of CAD software and its applications in design, Basic CAD tools and user interface, Introduction to 2D and 3D modelling in CAD; Dimensioning and Tolerances: Importance of dimensioning in technical drawings, Types of dimensioning (linear, angular, radial, etc.), Tolerances and their role in design and manufacturing; and Geometric dimensioning and tolerancing (GD&T)	6
VI	**Manufacturing, Prototyping, and 3D Printing** Basic Concepts of Manufacturing: Overview of manufacturing processes (casting, machining, forming, etc.), Material selection and its impact on the manufacturing process, Introduction to manufacturing drawings and assembly instructions; Rapid Prototyping and 3D Printing: Introduction to rapid prototyping techniques, Overview of 3D printing technologies and their applications in design and prototyping, Practical applications of 3D printing in the industry and product development	6
	Text Books	
1	V R Gowariker, N V Viswanathan, Jayadev Sreedhar, Polymer Science, New Age International Publishers, Mumbai.	
2	V. K. Ahluwalia, Anuradha Mishra, Polymer Science: A Textbook, ANE Books, New Delhi	
3	A J Manna, Fundamentals of Polymer Science and Technology, Books and Allied Pvt Ltd. Kolkata.	
4	N. Parthasarathy, Engineering Drawing. Oxford, 2015.	
	Reference Books	
1	P. Ghosh, Polymer Science and Technology: Plastics, Rubber, Blends and Composites, Tata McGraw Hill, 2nd Edition	
2	J. A. Brydson, Plastics Materials, Butterworth Heinemann, 7th Edition	
3	George Odian, Principles of Polymerization, Wiley Interscience, 4th Edition	
4	M. Tooley, Design Engineering Manual, Elsevier, 2010.	

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	1	-	2
CO2	3	3	-	-	-	-	1	1	-	2	-	2
CO3	3	2	3	-	3	-	-	-	2	2	2	2
Avg.	**3**	**2.33**	**3**	**-**	**3**	**-**	**1**	**1**	**2**	**1.66**	**2**	**2**

Mapping of Course Outcomes with Program Specific Outcomes

CO No.	PSO 1	PSO 2	PSO 3
CO 1	3	1	1
CO 2	3	2	1
CO 3	2	3	2
Avg.	**2.66**	**2**	**1.33**

Correlation Level

- Slightly Low: 1
- Moderately (Medium): 2
- Substantially (Strong): 3

CO-PO-PSO Mapping Justification

- CO1 (Recall polymer basics): Aligns with PO1 and PO2 for fundamental knowledge of polymers; supports PO10 and PO12 for communication and lifelong learning. Strongly linked to PSO1 for foundational understanding.
- CO2 (Explain structure-property relationships and applications): Maps to PO1 and PO2 for understanding materials and properties; connects to PO7 and PO8 for societal and environmental relevance. Supports PSO1 and PSO2 for materials application knowledge.
- CO3 (Apply technical drawing and CAD principles): Strong with PO1–PO3 and PO5 for applying design and drawing skills; relates to PO9–PO11 for teamwork and project management. Linked to PSO2 and PSO3 for design tools and process visualization.

Year, Program, Semester	F.Y. B. Tech in Plastics and Polymer Engineering, Semester-II						
Course Code	PPE232						
Course Category	PCC (Polymer Core Course)						
Course title	**Introduction to Polymer Sustainability (Theory)**						
Teaching Scheme and Credits	**L**	**P**		**Total Contact Hours / Week**	**Total Credits**		
	03	-		03	03		
Evaluation Scheme	**ISE-I**	**ISE-II**	**ESE**	**TA**	**TW**	**PR/OR**	**Total**
	15	15	50	20	-	-	100
Pre-requisites (if any)	• Environmental Science or General Studies • English • Chemistry, Physics and Mathematics						
Course Objectives	• Students will gain foundational knowledge of environmental sustainability and its relevance to plastics and polymers. • Students will understand principles of life cycle assessment, circular economy, and waste management applied to plastics. • Students will develop skills to apply concepts of recyclability, biodegradability, and green chemistry in evaluating plastic materials. • Students will enhance their ability to analyse environmental impacts and propose sustainable solutions in polymer design and manufacturing.						
Course Outcomes	• CO1: Recall the key principles of environmental sustainability and their relevance to the plastics industry (Remember) • CO2: Describe life cycle thinking, circular economy, and waste management strategies for plastics (Understand) • CO3: Demonstrate the use of basic concepts of recyclability, biodegradability, and green chemistry in evaluating plastic materials (Apply) • CO4: Examine environmental impacts of plastics and recommend sustainable alternatives in design and production (Analyse)						

Unit No.	Course Content	Hours
I	**Introduction to Environmental Sustainability in Plastics** Principles of environmental sustainability, Environmental impact of polymers and plastics, Role of plastics in sustainable development, Overview of global plastic production and consumption trends, Environmental ethics and engineering responsibility, Introduction to UN SDGs and relevance to polymer industry	6
II	**Life Cycle Thinking and Material Flow Analysis** Life Cycle Assessment (LCA): concepts and stages, Tools and metrics for assessing environmental performance, Cradle-to-cradle vs. cradle-to-grave models, Material flow in polymer production and post-use pathways, Case studies of LCA in plastic products, Environmental hotspots in polymer supply chains	6
III	**Waste Management and Circular Economy in Polymers** Plastic waste generation and categorization, Waste management techniques: collection, sorting, landfilling, incineration, recycling, Concepts of circular economy and closed-loop systems, Design for recyclability and extended producer responsibility, Case studies on circular design in polymers, Current limitations and system inefficiencies	6
IV	**Recycling, Recyclability and Toxicity** Types of recycling: mechanical, chemical, and feedstock, Challenges in polymer recyclability: contamination, additives, multilayers, Standards and testing for recyclable plastics, Polymer degradation and reprocessing issues, Toxicity of plastics and microplastics, Leachable, additives, and human/environmental health risks	6
V	**Biobased and Biodegradable Plastics** Definitions and differences between bio-based and biodegradable plastics, Common types: PLA, PHA, starch-based polymers, Properties and limitations of biodegradable plastics, Standards and certification (e.g., ASTM D6400, EN 13432), Applications and end-of-life scenarios, Degradation pathways and composting conditions	6

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VI	**Sustainable Strategies and Future Directions in Plastics** Environmental fate of plastics: land, ocean, and air, Leakage pathways and accumulation in ecosystems, Mitigation strategies: cleanup, bans, awareness, policy interventions, Industry best practices and innovation in sustainability, Green chemistry and green engineering principles, Future trends: renewable feedstocks, sustainable product design	6
	Text Books	
1	Green Chemistry and Engineering: A Sustainable Approach to Chemicals and Processes, Mukesh Doble & Anil Kumar Kruthiventi, Academic Press, Amsterdam, 2007	
2	Andrady, Anthony. Plastics and Environmental Sustainability. Wiley, Hoboken (2014). ISBN: 978-1-118-31260-5.	
3	Introduction to Plastics Engineering, Vijay K. Stokes, Wiley, Hoboken, 2020	
4	Plastics and Sustainability: Towards a Peaceful Coexistence between Bio-based and Fossil Fuel-based Plastics, Michael Tolinski, Wiley-Scrivener, Hoboken, 2021	
5	Green Chemistry and Engineering: A Sustainable Approach to Chemicals and Processes, Mukesh Doble & Anil Kumar Kruthiventi, Academic Press, Amsterdam, 2007	
	Reference Books	
1	Sustainable Plastics: Environmental Assessments of Bio-based, Biodegradable and Recycled Plastics, David Grewell & Alper Kiziltas, Wiley, Hoboken, 2020	
2	Life Cycle Assessment Handbook: A Guide for Environmentally Sustainable Products, Mary Ann Curran, Wiley, Hoboken, 2012	
3	Circular Economy and Sustainable Plastics, Vincent Eijsink & Daniel J. Aitken, Springer, Cham, 2022	
4	The New Plastics Economy: Rethinking the Future of Plastics, Ellen MacArthur Foundation, Ellen MacArthur Foundation Publishing, Cowes (UK), 2016	

Plastindia International University

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	3	-	-	-	-	-	-	-
CO4	-	3	3	3	3	-	-	-	-	-	-	3
Avg.	**2**	**2.66**	**3**	**3**	**3**	-	-	-	-	-	-	**3**

Mapping of Course Outcomes with Program Specific Outcomes

CO No.	PSO 1	PSO 2	PSO 3
CO 1	1	-	-
CO 2	2	2	-
CO 3	3	3	-
CO 4	-	3	3
Avg.	**2**	**2.66**	**3**

Correlation Level

- Slightly Low: 1
- Moderately (Medium): 2
- Substantially (Strong): 3

CO-PO-PSO Mapping Justification

- CO1 (Recall key concepts of environmental sustainability and challenges in the context of polymers): Relates to PO1 (fundamental knowledge) and PO7 (sustainability awareness). It moderately supports PSO1 (understanding fundamentals of polymer–environment interactions).
- CO2 (Describe lifecycle thinking, material flow, and waste management in sustainable plastics): Maps to PO1, PO2 (engineering analysis), and PO7 (sustainability), as it builds understanding of environmental strategies. Strongly aligned with PSO1 and PSO2 through links to materials, design, and sustainable process flows.
- CO3 (Demonstrate the application of green chemistry, recyclability, and biodegradable materials): Applies to PO1, PO2, PO3 (design), PO5 (modern tools), and PO7 (sustainability practices). It strongly supports PSO1 and PSO2 through hands-on application in material selection and process optimization.

Year, Program, Semester	F.Y. B. Tech in Plastics and Polymer Engineering, Semester-II						
Course Code	HSSM 221						
Course Category	HSSM (Humanities and Social Sciences including Management Courses)						
Course title	**English Language and Communication Skills (Theory)**						
Teaching Scheme and Credits	**L**		**P**	**Total Contact Hours / Week**	**Total Credits**		
	02		-	02	02		
Evaluation Scheme	**ISE-I**	**ISE-II**	**ESE**	**TA**	**TW**	**PR/OR**	**Total**
	-	-	50	-	-	-	50
Pre-requisites (if any)	• Basic knowledge of English language at HSC level						
Course Objectives	After the completion of the course, the student should be able to: • Enhance pronunciation skills through the effective use of Computer-Assisted Language Learning (CALL) tools. • Improve listening skills and comprehension using interactive digital and multimedia resources. • Expand vocabulary and reinforce grammatical accuracy through technology-enabled language practice. • Strengthen spoken and written communication skills through Integrated Communication Skills (ICS)–based activities.						
Course Outcomes	• CO1: Recall basic listening and speaking skills in English for effective communication. (Remember) • CO2: Interpret grammar and vocabulary through structured laboratory activities. (Understand) • CO3: Utilize phonetic principles and pronunciation techniques to enhance spoken English. (Apply) • CO4: Examine spoken and written communication scenarios to identify errors and suggest improvements. (Analyse)						

Unit No.	Course Content	Hours
I	**Spoken English Skills & Pronunciation Practice** Practising spoken English in structured oral tasks, guided speaking drills, functional English expressions, everyday communication tasks, improving articulation and intonation through dialogue practice, stress, rhythm, pitch patterns, dialogue reading and performance, accent and clarity practice	4
II	**Grammar Reinforcement & Vocabulary Building** Reinforcing understanding and correct usage of common grammar rules, error correction, tenses, concord, active–passive, reported speech, grammar games quizzes, enhancing vocabulary knowledge and contextual application, word families, collocations, academic and technical vocabulary, contextual sentence creation	4
III	**Listening Skills & Transcription Practice** Developing attentive listening and accurate transcription skills, listening to short audio clips, note-taking, transcribing dialogues and speeches, strengthening listening and critical thinking via. multimedia analysis, short lectures, TED talks, identifying tone, intent, bias, responding through reflective notes	4
IV	**Reading Comprehension & Critical Analysis** Building critical reading and comprehension abilities, skimming, scanning, passage comprehension, identifying arguments and viewpoints, enhancing conversational skills through dialogue writing and role-play, creating real-life situations, writing situational dialogues, enacting role-plays for comprehension checking	4
V	**Written Communication Formats** Learning structured formats for professional written communication, email writing, notices, short reports, minutes of meetings, improving paragraph writing with emphasis on coherence and clarity, topic sentence development, logical ordering, editing for clarity and cohesion	4

VI	**Group Interaction & Presentation Skills** Introduction to fundamentals of group discussions and effective communication, GD etiquette, group dynamics, speaking with logic, clarity, and confidence, developing oral presentation skills on assigned grammar topics, preparing short presentations, use of visual aids, delivery, body language, feedback	4

	Text Books
1	Meenakshi Raman and Sangita Sharma's Technical Communication: Principles and Practice, 3rd Edition, Oxford University Press, 2017, replacing the 2nd Edition, 2011.
2	J.D.O Connor, "Better English Pronunciation", 2nd by Cambridge University Press, 1980
3	Wren and Martin, "High School English Grammar and Composition", S Chand and Company Ltd – 2015.
4	Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
	Reference Books
1	Gajendra Singh Chauhan and Et al, "Technical Communication", Cengage learning India Pvt Limited, 019.
2	M Ashraf Rizvi's Effective Technical Communication, 2nd Edition, McGraw Hill Education (India), 2018
3	Word Power Made Easy by Norman Lewis, Goyal Publishers, 2020.
4	Randolph Quirk and S Greenbaum," A University Grammar of English Latest", Pearson 2007
5	Sanjay Kumar and Pushpalata Communication Skills", Oxford University Press India Pvt Ltd -2019
6	Practical English Usage by Michael Swan, Oxford University Press – 2016
7	Functional English (As per AICTE 2018 Model Curriculum), Cengage Learning India Pvt Limited, Latest Revised Edition, 2020.
8	D Praveen Sam, KN Shoba, "A Course in Technical English", Cambridge University Press –2020.

Activity Based Learning (Suggested Activities in Class)
1. Flipped Classroom
2. Sanako Software
3. Collaborative and Individual Problem based learning
4. Assignments aActivities

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	-	-	-	-	-	-	-	-	3	3	-	-
CO 2	-	2	-	-	-	-	-	-	-	3	-	-
CO 3	2	-	-	-	-	-	-	-	-	3	-	-
CO 4	-	-	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	-	-	2	3	3	-	2
Avg.	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**	**-**	**2**

Mapping of Course Outcomes with Program Specific Outcomes

Cos/PSOs	PSO1	PSO2	PSO3
CO1	-	3	-
CO2	-	2	-
CO3	-	3	-
CO4	-	3	-
CO5	-	3	-
Avg.	**-**	**2.8**	**-**

Correlation Level

- Slightly Low: 1
- Moderately (Medium): 2
- Substantially (Strong): 3

CO-PO-PSO Mapping Justification

- CO1: Aligns with PO9 and PO10 by developing students' teamwork and oral communication through discussions and presentations. It supports PSO2 by enhancing spoken fluency and interactive communication.
- CO2: Maps to PO2 and PO10 as it builds analytical listening and comprehension of professional content. It contributes to PSO2 by training students to evaluate tone, intent, and meaning in communication.

- CO3: Supports PO1 and PO10 through correct grammar usage and writing clarity. It strengthens PSO2 by improving the accuracy of professional written and visual communication.
- CO4: Contributes to PO10 by enabling students to understand and structure workplace documents. It links with PSO2 through familiarity with formal formats and language.
- CO5: Connects with PO9, PO10, and PO12 by building professional etiquette, interpersonal skills, and readiness for lifelong learning. It supports PSO2 by preparing students for real-world team and interview scenarios.

Year, Program, Semester	F.Y. B. Tech in Plastics and Polymer Engineering, Semester-II						
Course Code	BSC241						
Course Category	BSC (Basic Science Course)						
Course title	**Organic Chemistry (Laboratory)**						
Teaching Scheme and Credits	**L**	**P**	**Total Contact Hours / Week**		**Total Credits**		
	-	2	02		01		
Evaluation Scheme	**ISE-I**	**ISE-II**	**ESE**	**TA**	**TW**	**PR/OR**	**Total**
	-	-	-	-	-	25	25
Pre-requisites (if any)	• Basic Chemistry at HSC level						
Course Objectives	After the completion of the course, the student should be able to: • Understand chemistry laboratory guidelines, safety practices, and the use of glassware, apparatus, chemicals, and equipment. • Gain knowledge of physical properties, chemical reactions, and qualitative behavior of inorganic and organic acids, bases, salts, and functional groups. • Develop experimental skills in quantitative analysis, chemical synthesis, and separation techniques. • Understand fundamental chemical principles related to kinetics, equilibrium, thermochemistry, buffers, and analytical identification methods.						
Course Outcomes	• CO1: Identify laboratory safety norms, chemical handling practices, and commonly used laboratory glassware, apparatus, and reagents. (Remember) • CO2: Perform qualitative analysis of acids, bases, salts, functional groups, and metal ions using standard chemical tests and observations. (Understand) • CO3: Carry out quantitative experiments such as titrations, crystallization, and separation techniques to determine concentration, strength, and purity of chemical substances. (Apply)						

	• CO4: Analyze experimental results related to reaction rates, chemical equilibrium, buffer action, and heat of reaction to interpret fundamental chemical behavior. (Analyze)

Sr. No.	List of Experiments
1	To understand the Chemistry laboratory guidelines and know about glassware, accessories, apparatus, chemicals, and equipment used in Chemistry laboratory.
2	To study the melting point, boiling point, solubility and reactions of inorganic and organic acid, base, and salt.
3	Qualitative analysis of acid, base and functional groups.
4	To determine the concentration and strength of unknown sodium hydroxide solution by *titrating* it with standard oxalic acid solution
5	To synthesize pure copper sulphate crystals by controlled chemical reaction and crystallization.
6	To separate components of a salt mixture using differences in solubility and crystallization techniques.
7	To determine the concentration of an unknown acid or base by titration with a standard solution.
8	To measure the heat evolved during the neutralization of acid and base and calculate enthalpy change.
9	To study the influence of reactant concentration on the rate of the reaction between sodium thiosulfate and hydrochloric acid.
10	To prepare buffer solutions and measure their pH to understand buffer action.
11	To observe the effect of temperature on the equilibrium position of cobalt chloride solution.
12	To identify metal ions based on characteristic flame colors using flame test.

Reference Books	
1	Shashi Chawla, Theory and Practical of Eng. Chemistry, Dhanpat Rai & Co.
2	Preeti Jain and S.L. Garg, "Engineering Chemistry Practical Book" Variety Books Publishers Distributors
3	Anupma Rajput, Laboratory Manual Engg. Chemistry, Dhanpat Rai & Co.
4	Malviya A. and Jaspal D., "Engineering Chemistry: A Practical Book", Narosa Publishing House Pvt. Ltd. - New Delhi
5	Abdul Rahman, Organic Chemistry Laboratory Manual, Caravan Book House.
6	B.S. Furniss, Vogel's textbook of Practical Organic Chemistry, Pearson India.
7	Sanjay Kumar Batra, Shikha Gulati and Shefali Shukla, Green Chemistry: Strategies, Tools & Experiments. Shree Kala Prakashan, New Delhi.

Mapping of Course Outcomes with Program Outcomes

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	1	-	-	-	-	1	-	1
CO2	3	2	-	1	-	-	-	-	-	1	-	1
CO3	3	2	2	1	2	-	-	-	-	1	-	1
CO4	3	3	-	2	1	-	1	-	-	1	-	1
Average	**3**	**2**	**2**	**1.33**	**1.33**	**-**	**1**	**-**	**-**	**1**	**-**	**1**

Mapping of Course Outcomes with Program Specific Outcomes

CO \ PSO	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	1
CO3	3	2	2
CO4	3	-	2
Average	**3**	**2**	**1.67**

Correlation Level

- Slightly Low: 1
- Moderately (Medium): 2
- Substantially (Strong): 3

CO-PO-PSO Mapping Justification

- **CO1:** Supports foundational chemical knowledge, laboratory safety, and correct use of apparatus, strengthening core engineering knowledge, professional practices, communication, and lifelong learning (PO1, PO5, PO10, PO12; PSO1).
- **CO2:** Develops understanding of qualitative chemical behavior and identification techniques, enhancing problem analysis, experimental awareness, and scientific interpretation relevant to polymer and chemical engineering contexts (PO1, PO2, PO4, PO10, PO12; PSO1, PSO3).
- **CO3:** Builds hands-on competence in quantitative chemical analysis, synthesis, and separation techniques, integrating experimental skills with engineering problem-solving and tool usage (PO1, PO2, PO3, PO5, PO10, PO12; PSO1, PSO2, PSO3).
- **CO4:** Strengthens analytical ability to interpret kinetics, equilibrium, buffer action, and thermochemical behavior, linking experimental observations with sustainability awareness and scientific reasoning (PO1, PO2, PO4, PO5, PO7, PO10, PO12; PSO1, PSO3).

Year, Program, Semester	F.Y. B. Tech Semester – II Plastics and Polymer Engineering						
Course Code	ESC242						
Course Category	Engineering Science Course						
Course title	**Engineering Workshop Practices (Laboratory)**						
Teaching Scheme and Credits	**L**	**P**	**Total Contact Hours / Week**		**Total Credits**		
	-	2	2		1		
Evaluation Scheme	**ISE-I**	**ISE-II**	**ESE**	**TA**	**TW**	**PR/OR**	**Total**
	-	-	-	-	-	25	25
Pre-requisites (if any)	• Engineering Graphics and Design • Material Science and Engineering						
Course Objectives	After the completion of the course, the student should be able to: • Develop an understanding of dimensional accuracy and tolerances and their relevance to manufacturing processes. • Acquire hands-on skills in fabricating basic mechanical components using common hand tools and workshop equipment. • Gain the ability to assemble components and develop simple functional devices with proper consideration of fit, form, and function.						
Course Outcomes	• CO 1: Relate practical knowledge of dimensional accuracy and tolerances to appropriate manufacturing processes. (Understand) • CO 2: Fabricate basic mechanical components using common hand tools and workshop equipment. (Apply) • CO 3: Design simple functional devices by assembling components with attention to fit, function, and form. (Create)						

Sr. No.	List of Experiments
1	Perform basic machining operations such as turning, milling, drilling, and grinding to create precise components.
2	Carry out fitting tasks including filing, sawing, and assembling metal parts to achieve accurate fits and tolerances.

3	Construct a wooden structure or component, applying techniques such as measuring, cutting, joining, and finishing.
4	Build and test a simple electronic circuit or electrical component, involving soldering, wiring, and troubleshooting.
5	Execute basic arc welding (4 hours) and gas welding (4 hours) tasks to join metal pieces, focusing on weld quality and safety.
6	Create a metal casting using sand casting or another suitable method, including Mold preparation, pouring, and finishing.
7	Forge a simple component using smithy techniques, such as heating, hammering, and shaping metal.
8	Produce a plastic part using injection moulding or another plastic forming process, and perform precision glass cutting to create a specified shape.
9	Demonstrations of Jobs in following machine shops: Lathe Machine, Drilling Machine, Hacksaw Machine

Text Books	
1	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol.-II 2010, Media promoters and publishers private limited, Mumbai.
2	Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3	Gowri P. Hari Haran and A. Suresh Babu, "Manufacturing Technology–I" Pearson Education, 2008.
Reference Books	
1	Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
2	Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw-Hill House, 2017.
3	Workshop Technology by Chapman, W.A.J. ELBS Low Price Text, Edward Donald Pub. Ltd, 2018

4	Basic Machine Shop Practice Vol. I & II By Tejwani, V.K., Tata McGraw Hill Pub. Co., 2020

Mapping of Course Outcomes with Program Outcomes

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	–	–	–	–	–	–	–	2	–	2
CO2	3	–	3	–	2	–	–	–	–	2	2	2
CO3	3	–	3	–	3	–	–	–	2	3	2	3
Avg.	**2.67**	2	**3**	**-**	**2.5**	**-**	**-**	**-**	**2**	**2.33**	**3**	**2.33**

Mapping of Course Outcomes with Program Specific Outcomes

CO/PSO	PSO1	PSO2	PSO3
CO1	3	–	–
CO2	2	2	2
CO3	3	–	2
CO4	2.66	2	2

Correlation Level

- Slightly Low: 1
- Moderately (Medium): 2
- Substantially (Strong): 3

CO-PO-PSO Mapping Justification

- CO1 Relating practical knowledge of manufacturing accuracy and tolerance builds foundational understanding of processes — it correlates well with PO1, PO2, PO10, PO12 and PSO1, PSO2.
- CO2 Fabricating components manually develops hands-on proficiency, process understanding, and measurement skills — mapping to PO1, PO3, PO5, PO10, PO11, PO12 and PSO2, PSO3.
- CO3 Designing simple devices through component assembly fosters innovation, system thinking, and applied technical skills — linked to PO1, PO3, PO5, PO9, PO10, PO11, PO12 and PSO2, PSO3.

Year, Program, Semester	F.Y. B. Tech in Plastics and Polymer Engineering, Semester-II						
Course Code	ESC243						
Course Category	Engineering Science Course						
Course title	**Programming for problem-solving with Python (Laboratory)**						
Teaching Scheme and Credits	**L**	**P**		**Total Contact Hours / Week**	**Credits**		
	-	02		02	01		
Evaluation Scheme	**ISE-I**	**ISE-II**	**ESE**	**TA**	**TW**	**PR/OR**	**Total**
	-	-	-	-	25	-	25
Pre-requisites	• Basics of Computers and Mathematics						
Course Objectives	After completion of the course, the student will be able to: • To practice fundamental concepts of Python programming including operators and expressions, arrays, characters and string arrays, lists, tuples, dictionaries, sets, and maps, along with control flow structures. • To design programmatic solutions using file handling techniques and error and exception handling mechanisms. • To use appropriate Python libraries for data manipulation, analysis, and basic plotting applications. • To learn the basic principles of object-oriented programming and their implementation in Python.						
Course Outcomes	• CO1: To identify and use appropriate Python data structures and operators, expressions, etc., and control flow structures for a given problem (Understand) • CO2: To use file handling, error and exception handling to real-world problems (Apply) • CO3: To use appropriate Python packages for data manipulation and graph plotting. (Apply) • CO4: To design solutions using basic concepts of object-oriented programming and user-defined methods and classes. (Create)						

Sr. No.	List of Experiments
1	Write a Python program to accept a number from the user and compute the following: (a) square root of number, (b) square of number,(c) cube of number, (d) check for prime, (e) factorial of number, and e) prime factors.
2	Write a program to compute molecular distribution breadth for the polymerization reaction of trifunctional monomers, if the conversion is 90%.
3	The average rate at which energy is conducted outward through the ground surface at a place is 50.0 mW/m2, and the average thermal conductivity of the near-surface rocks is 2.00 W / m K. Assuming a surface temperature of 20.0 °C, find the temperature at a depth of 25.0 km. Next, calculate the temperature at depths 10, 11, 12, ..., 30 km.
4	Write a program to iterate through a dictionary and print all its keys and values. Write a program to count the frequency of each character in a given string and store it in a dictionary.
5	Given two sets, A and B, find their intersection (common elements) and union (all elements). Write a program to add a single item and multiple items to an existing set.
6	Write a Python function count_words (filename) that reads a text file and returns the number of words in it. The function should handle the case where the file is not found.
7	Write a Python function divide_numbers (x, y) that divides x by y and prints the outcome. The function should handle common exceptions.
8	Create a custom Python module (using Python programs implemented in Lab 7,8,9) that contains functions, classes, and variables that can be imported into another Python program. Write a Python program to use functions and classes from this module.
9	Write a Python program for the following: create two 2-D matrices using Numpy and perform matrix multiplication on these matrices. Now modify your program to perform multiplication on specific tiles.

10	Create a simple Class Student with attributes for name, age, marks (in 5 subjects), etc. Then, create an object (instance) of this class and print its attributes. Expand Class Student to include a method called Evaluate to compute the total score of a student and print the percentage.
11	Create a parent class Student (same as Lab 12). Create a child class CSE_student() that inherits from the Student class and overrides Evaluate() method, which calculates performance as grades (instead of percentage).
	Text Books
1	Kenneth A. Lambert, "Fundamentals of Python First Programs", 2nd Edition, Cengage MindTap, (2022)
2	Michael Dawson, "Python Programming for Absolute Beginners", 3rd edition, Cengage. (2023)
3	Brett Slatkin, "Effective Python", 2nd edition, Pearson. (2020)
4	Robert Sedgewick, Kevin Wayne and Robert Dondero, "Introduction to Programming in Python, Pearson. (2016)
	Useful web links
1	NPTEL Course on Python Programming https://nptel.ac.in/courses/106106145
2	NPTEL Course on Python Programming https://nptel.ac.in/courses/106106182
	Reference Books
1	Michael T. Goodrich, Robert Tamasia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", Wiley, (2013 or advanced version)
2	Reema Thareja, "Data Science and Machine Learning using Python", McGrawHill, (2023)

Mapping of Course Outcomes with Program Outcomes

O	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	3	–	–	–	–	–	–	–	–	–
CO 2	3	–	3	–	3	–	–	–	2	–	–	–
CO 3	1	1	–	2	3	–	–	–	–	–	–	–
CO 4	3	–	3	3	–	–	1	–	–	–	–	–
Avg.	**2.5**	**2**	**3**	**2.5**	**3**	–	**1**	–	**2**	–	–	–

Mapping of Course Outcomes with Program Specific Outcomes

CO/PSO	PSO1	PSO2	PSO3
CO1	3	3	2
CO2	3	–	1
CO3	–	3	2
CO4	3	1	1
Avg.	**2.25**	**2.33**	**1.5**

Correlation Level

- Slightly Low: 1
- Moderately (Medium): 2
- Substantially (Strong): 3

CO-PO-PSO Mapping Justification

- CO1 → PSO1: Provides foundational chemical knowledge essential for understanding polymer science.
- CO2 → PSO1, PSO2, PSO3: Builds lab skills and introduces tools, analysis, and chemical techniques useful in processing and technical problem-solving.
- CO3 → PSO1, PSO3: Reinforces core concepts like thermodynamics and kinetics relevant to polymer behavior and process design.
- CO4 → PSO1, PSO2, PSO3: Links organic chemistry to polymer synthesis, supporting material design, process development, and industry applications.

Year, Program, Semester	F.Y. B. Tech in Plastics and Polymer Engineering, Semester-II						
Course Code	HSSM222						
Course Category	HSSM (Humanities and Social Sciences including Management Courses)						
Course title	**Indian Knowledge System: Concepts and Applications in Engineering (Theory – Non-Credit Mandatory Course)**						
Teaching Scheme and Credits	**L**	**P**		**Total Contact Hours / Week**	**Total Credits**		
	02	-		02	-		
Evaluation Scheme	**ISE-I**	**ISE-II**	**ESE**	**TA**	**TW**	**PR/OR**	**Total**
	-	-	-	-	-	-	-
Pre-requisites (if any)	• General Science and History						
Course Objectives	After completion of the course, the students will be able to: • Develop a genuine curiosity and respect for India's rich traditional knowledge and scientific heritage. • Appreciate the interdisciplinary nature of Indian Knowledge Systems and their relevance to modern science and engineering. • Build foundational awareness that bridges ancient wisdom with contemporary technological advancements. • Engage with the course content irrespective of their prior exposure to Indian history or science. • Foster a sense of cultural pride and motivation to explore India's contributions to global knowledge.						
Course Outcomes	• CO1: Recall the key concepts, historicity, and structure of the Indian Knowledge System. (Remember) • CO2: Identify important ancient Indian technologies and their applications in daily life. (Remember) • CO3: Explain the significance of traditional Indian contributions in mathematics, astronomy, and measurement systems. (Understand) • CO4: Describe the principles behind Indian architectural and town planning practices. (Understand)						

Unit No.	Course Content	Hours
I	**Introduction to Indian Knowledge System** Introduction to Indian Knowledge System (IKS): What is IKS, why do we need IKS, Organization, Historicity and salient aspects of IKS. The Vedic Corpus: Introduction to Vedas, a Synopsis of four Vedas and their subclassification, messages in Vedas and introduction to Vedangas.	4
II	**Number Systems and Unit of Measurement** Number systems in India-Historical evidence, Salient aspects of Indian Mathematics Bhūta-Saṃkhyā system, Kaṭapayādi system, Measurements for time, distance, and weight, Piṅgala and the Binary system.	4
III	**Mathematics** Introduction to Indian Mathematics, Unique aspects of Indian Mathematics, Indian Mathematicians and their Contributions. Algebra, Geometry, Trigonometry, Magic squares in India.	4
IV	**Astronomy** Introduction to Indian astronomy, Indian contributions in astronomy, The celestial coordinate system, Elements of the Indian calendar, Notion of years and months. Panchanga- The Indian calendar system, Astronomical Instruments (Yantras), Jantar Mantar of Rājā Jai Singh Sawai.	4
V	**Town Planning and Architecture** Perspective of Arthashastra on town planning, Vastushastra- The science of architecture, Eight limbs of Vāstu, Town planning, Temples in India: marvelous stone architecture for eternity, Temple architecture in India, Irrigation and water management, Irrigation systems and practices in South India.	4
VI	**Metals and Metalworking** Wootz Steel: The rise and fall of a great Indian technology, The Indian S & T heritage, Mining and ore extraction, Metals and metalworking technology, Iron and steel in India, Lost wax casting of idols and artefacts, Apparatuses used for extraction of metallic components. Other Technologies: Dyes and painting technology, The art of making perfumes, Surgical techniques, Shipbuilding, Sixty-four art forms (64 Kalās).	4

	Text Books
1	Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. (2022), "Introduction to Indian Knowledge System: Concepts and Applications", PHI Learning Private Ltd. Delhi.
2	Pride of India: A Glimpse into India's Scientific Heritage, Samskrita Bharati, New Delhi.
3	Sampad and Vijay (2011). "The Wonder that is Sanskrit", Sri Aurobindo Society, Puducherry.
4	Bag, A.K. (1979). Mathematics in Ancient and Medieval India, Chaukhamba Orientalia,
	Reference Books
1	Datta, B. and Singh, A.N. (1962). History of Hindu Mathematics: Parts I and II, Asia Publishing House, Mumbai.
2	Kak, S.C. (1987). "On Astronomy in Ancient India", Indian Journal of History of Science, 22(3), pp. 205–221.
3	Subbarayappa, B.V. and Sarma, K.V. (1985). Indian Astronomy: A Source Book, Nehru Centre, Mumbai.
4	Bag, A.K. (1997). History of Technology in India, Vol. I, Indian National Science Academy, New Delhi.
5	Acarya, P.K. (1996). Indian Architecture, Munshiram Manoharlal Publishers, New Delhi.
6	Banerjea, P. (1916). Public Administration in Ancient India, Macmillan, London.
8	Kapoor Kapil, Singh Avadhesh (2021). "Indian Knowledge Systems Vol – I & II", Indian Institute of Advanced Study, Shimla, H.P.
9	Robert Sedgewick, Kevin Wayne and Robert Dondero, "Introduction to Programming in Python, Pearson. (2016)
	Useful web links
1	https://onlinecourses.swayam2.ac.in/imb23_mg53/preview

Mapping of Course Outcomes with Program Outcomes

CO/PO.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	1	3	-	-	-	-	-
CO2	3	2	1	1	2	1	3	-	-	-	-	-
CO3	2	3	2	1	3	1	3	-	-	-	-	-
CO4	2	3	2	1	3	1	3	-	-	-	-	-
Average	**2.50**	**2.50**	**1.50**	**1.00**	**2.50**	**1.00**	**3.00**	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO/PSO	PSO 1	PSO 2	PSO 3
CO1	2	1	1
CO2	2	1	1
CO3	3	2	1
CO4	3	2	1
Average	**2.5**	**1.5**	**1**

Correlation Level

- Slightly Low: 1
- Moderately (Medium): 2
- Substantially (Strong): 3

CO-PO-PSO Mapping Justification

- CO1 (Recall key concepts of IKS) is foundational, helping students build awareness of Indian heritage, mapping strongly to PO1 (engineering knowledge), PO7 (environment and sustainability), and PSO1 (understanding fundamental concepts in polymer science with cultural awareness). Moderate mapping to PO2 (problem analysis) and PO5 (modern tool usage) is due to cognitive understanding and some analytical skills.
- CO2 (Identify ancient technologies and their applications) supports comprehension of historical scientific developments and their relevance, thus strongly connecting to PO1, PO7, and PSO1. It also moderately supports PO2 and PO5, as it encourages critical thinking and exploration of traditional technologies.
- CO3 (Explain traditional contributions in math, astronomy) expands into application and synthesis, aligning well with PO2 (problem analysis), PO5 (tool usage), and PSO1. It also strongly maps to PO7 due to the sustainability aspect of ancient knowledge.
- CO4 (Describe architectural and planning principles) correlates with PO2 and PO5 as it involves understanding systems and structures, and strongly supports PO7 and PSO1 for environmental and cultural sustainability knowledge.

Year, Program, Semester	F.Y. B. Tech in Plastics and Polymer Engineering, Semester-II				
Course Code	PSI235				
Course Category	Project Seminar Internship				
Course title	**Social Internship (Practice – Non-Credit Mandatory Course)**				
Teaching Scheme and Credits	L	T	P	Total Contact Hours / Week	Total Credits
	After Semester-I, 15 Days Social Internship, preferably in a rural area				00
Evaluation Scheme	Not Applicable				
Pre-requisites (if any)	Design Thinking and Innovation-I and orientation by the Program before proceeding on to this internship.				
Course Objectives	• Cultivate rural awareness and empathy among students. • Enable students to apply engineering skills effectively in underserved areas.				
Course Outcomes	• Describe the objectives, scope, and significance of social internship activities in rural communities, including community engagement and ethical responsibilities. (Remember) • Explain the social, environmental, health, and infrastructure-related challenges identified during community interaction and needs assessment. (Understand) • Demonstrate the use of surveys, interviews, workshops, and teamwork skills for interacting with community members and identifying local needs. (Apply) • Apply suitable engineering, communication, and problem-solving skills to propose simple and practical solutions for community-based challenges. (Apply				

Social Internship Course Description

The class teacher jointly with the Program Head and First Year Coordinator will plan for this activity. The following tasks to be thought of before the students proceed for the said social internship and accordingly the students will be guided to complete this internship preferably in a rural part of the state.

a) Introduction to social internship projects and objectives.

b) Assignment of social internship teams and project topics.

c) Guidance on project planning and community engagement strategies

The students will undergo social internship of 10 days preferably in rural part of the country. Here are some of the potential activities that students could engage in during their 10-day social internship:

1. Community Needs Assessment:

a) Conduct surveys and interviews to understand the specific needs and challenges of the community.

b) Identify priority areas for potential engineering interventions.

2. Interactive Workshops:

a) Organize workshops to share basic engineering concepts with community members, fostering mutual learning.

b) Collaborate on simple projects, like building low-cost solar cookers or water purification systems.

3. Design Thinking Sessions:

a) Facilitate brainstorming sessions with locals to generate innovative ideas for solving local problems.

b) Prototype and refine potential solutions based on community input.

4. Infrastructure Evaluation:

a) Assess existing infrastructure (water supply, sanitation, roads, etc.) for maintenance needs or improvements.

b) Propose feasible upgrades using engineering principles.

5. Environmental Initiatives:

a) Participate in tree planting drives or waste management campaigns to promote environmental sustainability.

b) Educate the community about eco-friendly practices.

6. Skill Enhancement Workshops:

a) Teach basic technical skills, such as basic repairs, to empower locals to address minor challenges independently.

b) Provide training on digital literacy to bridge the technological gap.

7. Health and Hygiene Workshops:

a) Conduct workshops on personal hygiene, sanitation, and health awareness.

b) Collaborate with healthcare professionals to provide basic medical check-ups and guidance.

8. Documentation and Reporting:

a) Maintain a daily journal to document experiences, observations, and interactions.

b) Compile a comprehensive report outlining findings, proposed solutions, and lessons learned.

9. Cultural Exchange Activities:

a) Engage with the community through cultural activities, such as sharing traditional dances, songs, or cuisine.

b) Foster a sense of unity and understanding between students and locals.

10. Feedback and Reflection Sessions:

a) Regularly engage in discussions to reflect on the challenges faced, lessons learned, and potential improvements.

b) Gather feedback from both students and community members to enhance the internship's impact.