PLASTINDIA INTERNATIONAL UNIVERSITY

(Sponsored by Plastindia Foundation)

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

(Established under Gujarat Government Private Universities Act, 2016)

PLASTINDIA INTERNATIONAL UNIVERSITY

School of Engineering

B. Tech (Plastics and Polymer Engineering)

P-2025

Plastindia International University

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 IKH
Semester - I																
BSC	BSC101	Calculus - I	3	-	3	15	15	20	50	-	-	100	3	-	3	√
BSC	BSC102	Engineering Physics	3	-	3	15	15	20	50	-	-	100	3	-	3	√
ESC	ESC121	Materials Science and Engineering	3	-	3	15	15	20	50	-	-	100	3	-	3	
ESC	ESC122	Integrated Electrical and Electronics Engineering	3	-	3	15	15	20	50	-	-	100	3	-	3	
ESC	ESC123	Engineering Graphics and Design	3	-	3	15	15	20	50	-	-	100	3	-	3	
HSSM	HSSM131	Universal Human Values	2	-	2	-	-	-	50	-	-	50	2	-	2	
BSC	BSC141	Lab: Engineering Physics	-	2	2	-	-	-	-	-	25	25	-	1	1	
ESC	ESC142	Lab: Engineering Graphics and Design	-	2	2	-	-	-	-	25	-	25	-	1	1	
ESC	ESC143	Lab: Integrated Electrical and Electronics Engineering Laboratory	-	2	2	-	-	-	-	-	25	25	-	1	1	
VSEC	VSEC144	Lab: Design Thinking and Innovation	-	2	2	-	-	-	-	25	-	25	-	1	1	
HSSM	HSSM133	Yoga and Meditation	-	2	2	Non-Credit Mandatory Course										
		Total	17	10	27	75	75	100	300	50	50	650	17	4	21	

FY B. Tech (Plastics and Polymer Engineering),

Semester-I

Year, Program, Semester	F.Y. B. Tech in Plastics and Polymer Engineering. Semester-I						
Course Code	BSC101						
Course Category	BSC (Basic Sciences and Humanities Courses)						
Course title	**Calculus – 1**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**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)	• Basic Knowledge of Differential Equation, Algebra, Trigonometry						
Course Objectives	• To study the properties of matrix algebra and apply them to solve the system of algebraic equations. • Able to formulate and solve various engineering problems using differential and integral calculus and ability to work with advanced engineering mathematics. • Summarize concept of calculus to enhance ability of analyzing mathematical problems. • Comprehend the concept of vector space and solve problem using linear transformations						
Course Outcomes	• CO 1: Recall the concepts involved across the field of calculus and algebra. (Remember) • CO 2: Understand the conceptual variations to apply it in a various problem. (Understand) • CO 3: Apply appropriate technique to solve engineering problem. (Apply) • CO 4: Analyze engineering problems effectively with appropriate method. (Analyze)						

Unit No.	Course Content	Hours
I	**Matrix Algebra** Introduction to determinant and matrices. System of linear equations. Rank of Matrix, Eigen values, Eigen Vector, Cayley-Hamilton Theorem, Inverse of a matrix, Gauss elimination, Gauss-Jordan elimination.	6
II	**Differential Calculus** Limit. Continuity, Types of discontinuity, Successive differentiation, Rolle's Theorem, LMVT, CMVT, Maxima and Minima.	6
III	**Integral Calculus** Definite and improper integrals, Beta-Gamma function and its properties, double-triple integral, change of variables, applications.	6
IV	**Ordinary Differential Equations** First order ODEs, Formation of differential equations. Exact, Linear, and Bernoulli's equations, ODEs of higher order, Homogeneous linear ODEs of higher order. Homogeneous linear ODEs with constant coefficients. Nonhomogeneous ODEs, Rules for finding C.F. and P.I., Method of Variation of Parameters.	6
V	**Partial Differential Equations** Formation of first and second order equations. Solution of first and second order linear and non-linear equations. Homogeneous linear PDEs of higher order with constant coefficients, Heat and Wave equation. Euler's Theorem. Jacobian.	6
VI	**Vector Space and Linear Transformation** Vector Space, Subspace, Linear Combination, LI – LD Set, basis, dimension, Linear transformations (maps), range and kernel of a linear map. Dimension Theorem, Inverse of a linear transformation.	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-Hilt, New Delhi. (2007)

Reference Books

C. R. Wylie, "Advanced Engineering Mathematics", McGraw Hill Publication, New Delhi. (2003)

Shanti Narayan, "Differential Calculus" S. Chand and company, New Delhi. (1942)

	H. K. Dass, "Advanced Engineering Mathematics", S. Chand Publishing, (2007)
	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 Integral and Vector Calculus
   https://archive.nptel.ac.in/courses/111/105/111105122/

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 of advanced engineering mathematics).

- 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 for advanced engineering mathematics
- 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	First Year B. Tech in Plastics and Polymer Engineering, Semester-I						
Course Code	BSC102						
Course Category	BSC (Basic Science Course)						
Course title	Engineering Physics (Theory)						
Teaching Scheme and Credits	L	T	P	Total Contact Hours		Total Credits	
	03	-	00	03		03	
Evaluation Scheme	ISE-I		ISE-II	ESE	TA	TW	PR/OR	Total
	15		15	50	20	-	-	100
Pre-requisites (if any)	10+2 level Physics						
Course Objectives	• Understand the fundamental concepts of crystal structure and learn the properties of superconducting materials. • Understand properties of electric and magnetic fields in the presence of static charge and current distributions. • To understand principles of ultrasounds and their applications • Students will learn the concepts related to Newton's laws of mechanics and their application to many particle systems, small oscillations • Understand the fundamental concepts of waves and classical optics with reference to the phenomena of interference and diffraction • Understand key concepts in Nanotechnology						
Course Outcomes	• CO1: Recall the fundamental principles of solid-state physics, electromagnetism, quantum mechanics, ultrasound, photonics, and nanomaterials. (I Remember) • CO2: Understand the basics of semiconductors, magnetism, super conductivity, nano materials and their applications in engineering (Understand) • CO3: Apply appropriate physical laws and mathematical models to solve problems in semiconductors, electromagnetism, quantum systems, optics, and nanoscale systems. (Apply)						

	• CO4: Analyze the underlying mechanisms involved in Hall effect, electromagnetic induction, light propagation in fibres, and quantum confinement in nanomaterials (Analyze)

Unit No.	Course Content	Hours
I	**Solid State Physics** Crystal structure of solids, Cubic crystals, Semiconductor Physics, Classification of solids, Types of semiconductors, effect of doping, mobility of charge carriers, conductivity, Hall effect.	6
II	**Electromagnetism and Superconductivity** Electricity and magnetism including Coulomb's Law, Continuity Equation, electric field, Gauss' Law, electric potential, Ohm's law, magnetic field, Ampere's Law, Faraday's Law and electromagnetic waves, The Meissner effect, perfect diamagnetic behaviour of superconductors, Superconducting magnetic energy storage, electromagnets.	6
III	**Ultrasound** Introduction, Production of Ultrasonic Waves, Magnetostriction Effect, Piezoelectric Effect, Piezoelectric Oscillator, Properties, measurement of velocity & Applications of Ultrasound	6
IV	**Quantum Mechanics** Introduction to quantum physics, Wave function and its physical admissibility, normalization of wave functions, Debroglie wavelength, wave particle duality-Davisson-Germer experiment, Heisenberg uncertainty principle, Schrodinger's equation and its application to free particle, particle in one dimensional box	6
V	**Fundamentals of Photonics** **Laser:** Interaction of radiation with matter, Einstein's coefficients A & B, Pumping, population inversion with Boltzmann equation, metastable state, optical cavity, characteristics of the laser, Applications of the laser. **Fibre Optics:** Principle of light transmission in optical fibre, its types, Numerical aperture, acceptance cone, Optical fibre communication system, and advantages.	6
VI	**Physics of Nanoparticles**	6

	Nanoscale, quantum confinement, surface to volume ratio, bottom-up fabrication: sol-gel, precipitation, combustion methods, top-down fabrication: ball milling, physical vapor deposition (PVD), Properties of nanoparticles (optical, electrical, mechanical, magnetic), applications of nanotechnology: Electronics (GMR effect and its application in read-write head of HDD), automobiles, environmental & energy, medical field (targeted drug delivery). Quantum Sensors and Applications	

Text Books/Reference Books:	
1.	M. N. Avadhanulu and P. G. Kshirsagar (2004), Engineering Physics, S. Chand Publication.
2.	R. K. Gaur and Gupta S. L. (2012), Engineering Physics, Dhanapat Rai and Sons Publication.
3.	V. Rajendran (2011), Engineering Physics, Tata McGraw Hill Company Ltd, New Delhi
4.	Malik and Singh (2018), Engineering Physics, Tata Mc Graw Hill Company Ltd, New Delhi
5.	C. Kittel (20050, Introduction to Solid State Physics, Wiley and Sons.
6.	N.K. Bajaj (2021). The Physics of waves and Oscillations. Tata McGraw Hill Company Ltd, New Delhi
7.	Sulabha K. Kulkarni (2015), Nanotechnology: Principles and Practices, 3rd Edition, Springer, New York

e-Books

1. Feynman Lecture series: https://www.feynmanlectures.caltech.edu/
2. Concepts of Modern Physics, Arthur Beiser:
   https://mitsri.ac.in/Department/PHYSICS/Beiser_Modern_Physics.pdf

MOOC / NPTEL/YouTube Links:

- Lectures by Walter Lewin: https://www.youtube.com/channel/UCiLIHVhvI0SBMpP75JbzJShqw
- Quantum Mechanics Lecture Series by Prof. H. C. Verma:
- https://www.youtube.com/playlist?list=PLWwcIWdB_GuISnGkAaIMpzzDBvTHg02At
- nptel.ac.in, HyperPhysics Concepts, The Physics Classroom, Virtual Labs | Physical Sciences

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	-	-	1	-	-	-	-	-	-	2
CO 2	2	2	-	-	2	-	2	-	-	-	-	2
CO 3	3	1	2	-	2	-	-	-	-	-	-	2
CO 4	3	3	2	2	3	-	2	-	-	-	-	2
Avg.	2.75	2	2	2	2.0	-	2	-	-	-	-	2

Mapping of Course Outcomes with Program Specific Outcomes

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

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, PO3 and PSO2.
- CO3 Expands on application of basic principles of physics to solve engineering problems, and PO1, PO2, 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	First Year B. Tech in Plastics and Polymer Engineering, Semester-I							
Course Code	ESC121							
Course Category	Engineering Science Course							
Course title	**Materials Science and Engineering (Theory)**							
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**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)	• Structural Mechanics, • Applied Physics I and II							
Course Objectives	• Selection of MOC for a given application, • Maintenance and corrective measures for various engineering materials.							
Course Outcomes	• CO 1: Identify various types of materials, their internal structures, and bonding mechanisms. (Remember) • CO 2: Classify the physical properties and imperfections present in solid materials. (Understand) • CO 3: Demonstrate the fundamental techniques used in the processing of engineering materials. (Apply) • CO 4: Examine the mechanisms of corrosion and degradation in materials from a scientific and engineering perspective. (Analyze)							

Unit No.	Course Content	Hours
I	**Introduction to Materials** Introduction to materials, history, glass, and ceramics, metal, bonding, ferrous and non-ferrous metals, mild-steel, alloys, composite materials, superconducting materials, polymers, applications and behaviour of materials in in various sectors.	6
II	**Structure-Property of Materials** Structure of glass, tempered and toughened glass, process, mechanical, optical, surface properties of glass, structure and properties of smart materials, conductors, semiconductors, magnetic materials, and biomaterials, factors affecting properties.	6

III	**Imperfection and Defects** Crystal systems, amorphous and crystalline, crystal-glass, degree of crystallinity in metal, alloys and polymers, defects in materials, point defects, dislocations, line defects and surface defects in glass, metal and ceramics. Impacts of defects in properties and applications.	6
IV	**Strength of Materials** Concepts of stress and strain, displacement, types of stress and strain, stress-strain curve, bending (flexural) and impact strength, elasticity and plasticity, ideal plastic flow, strain hardening, fracture: modes of fracture and toughness in materials.	6
V	**Material Processing** Introduction to solidification, metal processing, casting, sintering, diffusion, smelting, electro-deposition, nanofabrication, sputtering, atomic layer deposition (ALD), chemical vapor deposition (CVD), physical vapor deposition, Introduction to polymer processing.	6
VI	**Corrosion and Degradation of Materials** Introduction, forms of corrosion, environmental effects, corrosion prevention, oxidation, corrosion of ceramic materials, degradation of materials, swelling and dissolution, bond rupture, weathering, and ageing.	6

Text Books	
1	Materials Science and Engineering: An Introduction by William D. Callister, Jr., John Wiley & Sons, Inc., 2007, 7th Edition.
2	The Science and Engineering of Materials by Donald R. Askeland and Pradeep P. Phule, Thomson Learning, 2007, 5th Edition.
3	An Introduction to Materials Engineering and Science: For Chemical and Materials Engineers by Brian S. Mitchell, John Wiley & Sons, Inc., 2004.
4	Materials Science and Engineering – A First Course by V. Raghavan, Prentice Hall of India Private Limited, 2015, 6th Edition
5	Materials Science and Engineering by G. S. Upadhyaya and Anish Upadhyaya, Viva Books Private Limited, 2006.
6	Materials Science and Engineering by L. H. Van Vlack, Pearson Education, 2001, 6th Edition.

7	Polymer Science by V. R. Gowariker, N. V. Viswanathan, and Jayadev Sreedhar, New Age International Publishers, 2015, 2nd Edition.
8	Textbook of Polymer Science by Fred W. Billmeyer. Wiley India Pvt. Ltd., 2007. 3rd Edition.
	Reference Books
1	Energy Materials by Duncan W. Bruce, Dermot O'Hare, and Richard I. Walton, Wiley, 2011, 1st Edition.
2	Fundamentals of Solar Cells: Photovoltaic Solar Energy Conversion by A. L. Fahrenbruch and R. H. Bube, Academic Press, 1983.
3	Materials and Processes in Manufacturing by J. T. Black and Ronald A. Kohser, John Wiley & Sons, 019. 12th Edition.
4	Functional Materials by S. Banerjee and A. K. Tyagi, Elsevier (Imprint), 2013, 1st Edition.
5	Handbook of Advanced Materials: Enabling New Designs by James K. Wessel, John Wiley & Sons, 2004.
6	Energy Materials by Duncan W. Bruce, Dermot O'Hare, and Richard I. Walton, Wiley, 2011, 1st Edition.

Mapping of Course Outcomes with Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	1	-	-	-	-	-	-	-	-	2
CO 2	3	3	2	2	-	-	-	-	-	-	-	2
CO 3	3	2	3	2	1	-	1	-	-	-	-	3
CO 4	2	2	3	2	2	1	3	2	-	-	-	3
Avg	2.75	2.25	2.25	2	1.5	1	2	2	-	-	-	2.5

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	2	3
Avg.	2.5	2	3

Correlation Level

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

CO-PO-PSO Mapping Justification

- CO1 is foundational and focuses on understanding material structure and properties — it correlates well with PO1, PO2, and PSO1.
- CO2 is structure and properties of materials relevant to knowledge and problem solution mapping to PO2, PO3, PO4 and PSO1.
- CO3 involves properties, manufacturing processes and techniques — strongly mapping to design and development, problem solving, and PSO2/PSO3.
- CO4 introduces corrosion and degradation, which ties into PO7 (Environment and sustainability.

Year, Program, Semester	First Year B. Tech in Plastics and Polymer Engineering, Semester-I						
Course Code	ESC122						
Course Category	ESC (Engineering Science Course)						
Course title	Integrated Electrical and Electronics Engineering (Theory)						
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits		
	03	-	00	03	03		
Evaluation Scheme	ISE-I	ISE-II	ESE	TA	TW	PR/OR	Total
	15	15	50	20	-	-	100
Pre-requisites (if any)	Knowledge of physics and mathematics taught at higher secondary level.						
Course Objectives	• To introduce the basics of electric circuits and analysis • To impart knowledge in the basics of working principles and application of electrical machines • To introduce and familiarize yourself with diodes and transistors analog devices and their characteristics. • To educate on the fundamental concepts of digital electronics • Prepare for next-level learning in design aspect						
Course Outcomes	• CO1: Recall fundamental electrical circuit laws, energy sources, and number systems relevant to digital electronics. (Remember) • CO2: Explain the operation of AC & DC electrical machines and identify the role of various power generation systems. (Understand) • CO3. Describe the working principles and characteristics of diodes, transistors, and operational amplifiers used in analog circuits. (Understand) • CO4: Apply circuit analysis techniques and digital logic to solve problems related to AC/DC circuits and basic digital systems. (Apply)						

Unit No.	Course Content	Hours
I	**Electrical Circuit Analysis** Energy sources - Voltage and current sources, Current Division, Voltage Division. Star-Delta transformation. DC circuits analysis using mesh, Thevenin's	6

	& superposition theorem. Concept of Phase and Phase Difference. Phasor Representation, Rectangular and Polar representation of phasor. Analysis of single-phase series AC circuits consisting of RL, RC, RLC combinations. Concept of impedance, concept of active, reactive, apparent, complex power and power factor. Numerical, 3-phase balanced and unbalanced supply, star, and delta connections.	
II	**Electric Machines** Laws of electromagnetism, mmf, flux, and their relation, analysis of magnetic circuits. Single-phase transformer, basic concepts and construction features. EMF equation, transformation ratio, voltage regulation, losses, and efficiency. Constructional details of DC machine, induction machine and synchronous machine, Working principle of 3-Phase induction motor, EMF equation of 3-Phase induction motor, Concept of slip in 3-Phase induction motor. Explanation of Torque-slip characteristics of 3-Phase induction motor. Single phase AC machines - Types. Principle and working.	6
III	**Sources of Electrical Power** Introduction to Wind, Solar, Fuel cell, Tidal, Geothermal, Hydroelectric, Thermal-steam, diesel, gas, nuclear power plants, Concept of cogeneration, and distributed generation	6
IV	**Electronic Components and Circuits** Introduction to semiconductors devices, Diodes, V-I characteristics, Bipolar junction transistors (BJT) and their working, CC, CB & CE transistor configurations, modes of operation of BJT, DC biasing of BJT. Characteristics of operation amplifiers (OP-AMP) - application of Op Amps (inverting, non-inverting)	6
V	**Digital Electronics** Number systems used in digital electronics, decimal, binary, octal, hexadecimal, their complements, operation and conversion, floating point and signed numbers, Demorgan's theorem, AND, OR, NOT, NOR, NAND, EX-NOR EX-OR gates and their representation, truth table, half and full adder circuits, R-S flip flop, J-K flip flop.	6

VI	**Sensors and Communication Systems** Classification of sensors: Active /Passive Sensors, Selection Criteria/Characteristics of sensor. Motion Sensors (LVDT), Temperature Sensors (Thermocouple, RTD), Mechanical Sensors (Strain Gauge), Biosensors. Block diagram of IoT based Data Acquisition and Automation System.	6

Text Books

1	Nagrath I.J. and D. P. Kothari (2001), Basic Electrical Engineering, Tata McGraw Hill.
3	Smarajit Ghosh (2015) Electrical Machines, Pearson Education, New Delhi.
4	Kulshreshtha D.C. (2009), Basic Electrical Engineering, Tata McGraw Hill.
5	Rajendra Prasad (2009), Fundamentals of Electrical Engineering, Prentice Hall, India
6	V. N. Mittal and Arvind Mittal (2019), Basic Electrical Engineering" McGraw Hill
7	Vincent DelToro (2011) Electrical engineering Fundamentals, PHI
8	R.P. Jain (2010), Modern Digital Electronics, 4th Edition, Tata McGraw Hill.
9	Thomas. L. Floyd (2015). Electronics Devices, 9th Edition. Pearson

NPTEL/SWAYAM Course

Sr. No.	NPTEL Course Name	Instructor	Host Institute
1	Basic Electric Circuits	Prof. Ankush Sharma	IIT Kanpur
2	Basic Electrical Circuits	Prof. Nagendra Krishnapura	IITM, Chennai
3	Fundamentals of Electrical Engineering	Prof Debapriya Das	IIT, Kharagpur

1. https://nptel.ac.in/courses/117103063
2. https://nptel.ac.in/courses/117103064
3. https://archive.nptel.ac.in/courses/106/105/106105166/

Web Links and Video Lectures (E-Resources)

1. https://nptel.ac.in/courses/108108076
2. https://archive.nptel.ac.in/courses/108/105/108105155/
3. https://nptel.ac.in/courses/108/101/108101091/
4. http://www.youtube.com/watch?v=Kp-JS6NIIsB8
5. E-Book: . https://www.pearson.com/en-us/subject-catalog/p/electronic-devices-electron-flow version/P200000001048

Activity Based Learning (Suggested Activities in Class):

Year, Program, Semester	First Year B. Tech in Plastics and Polymer Engineering, Semester-I						
Course Code	ESC123						
Course Category	Engineering Science Course						
Course title	**Engineering Graphics and Design (Theory)**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**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)	Knowledge of plane geometry and solid geometry						
Course Objectives	• To develop basic graphic skills. • To learn the engineering graphics standards. • To develop skills in reading and interpretation of engineering drawings. • To introduce Computer-Aided drafting tools						
Course Outcomes	• CO1: Identify basic concepts of BIS conventions and their application. (Remember) • CO2. Interpret first angle and third angle projection system. (Understand) • CO3: Construct orthographic projections of points, lines and planes. (Apply) • CO4: Apply principles of projection and construct orthographic and isometric views of an object. (Apply) • CO5: Develop a skill of visualization to understand and read the drawing. (Analyze)						

Unit No.	Course Content	Hours
1	**Introduction to Engineering Graphics** Scope of Engineering Drawing in all Branches of Engineering. Introduction to Drawing Standards BIS-SP-46, Representative Fraction, Engineering Scales. Dimensioning Terms and Notations, Types of Lines used in Eng. Practice recommended by BIS (Bureau of Indian Standards) Principles of Engineering Graphics and their significance, usage of Drawing instruments, Conic sections, Cycloid, Involutes.	6

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	–	1
CO2	3	2	–	–	–	1	1	–	–	1	–	2
CO3	2	2	3	–	2	–	–	–	1	2	1	2
CO4	3	2	3	–	3	1	1	–	–	1	–	2
Avg.	**2.75**	**2.0**	**3.0**	**–**	**2.5**	**1.0**	**1.0**	**–**	**1.0**	**1.25**	**0.25**	**1.75**

Mapping of Course Outcomes with Program Specific Outcomes

CO	PSO1	PSO2	PSO3
CO1	3	–	–
CO2	3	2	–
CO3	–	3	2
CO4	3	2	3
Avg.	**3.0**	**2.33**	**2.5**

Correlation Level

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

CO-PO-PSO Mapping Justification

- CO1 Builds foundational understanding of polymer science concepts — it correlates well with PO1, PO10. PO12 and PSO1.
- CO2 Develops classification and analytical skills for polymers, promoting environmental and contextual awareness — mapping to PO1, PO2. PO6. PO7. PO10. PO12 and PSO1. PSO2, PSO3.
- CO3 Enhances visualization and application skills using drawing tools and standards — linked to PO1, PO2, PO3. PO5. PO9, PO10. PO11, PO12 and PSO2, PSO3.
- CO4 Applies design thinking and CAD tools to prototype polymer products tying into PO1, PO2, PO3, PO5, PO10. PO12 and PSO1, PSO2, PSO3.

2.	Engineering Drawing and Graphics by K. Venugopal, New Age International Publishers, 2010, 5th Edition.
3.	Engineering Drawing by P. S. Gill, S. K. Kataria & Sons Publishers, 2013. Revised Edition.
	Reference Books
1	Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
2	Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, SciTech Publishers
3	Agrawal B. & Agrawal C M (2012), Engineering Graphics, TMH Publication
4	Jain, Maheshwari, Gautam (2021), Engineering Graphics & Design, Khanna Book Publishing.

Alternative NPTEL/SWAYAM Course			
Sr. No.	**NPTEL Course Name**	**Instructor**	**Host Institute**
1.	Prof. Raja Ram Lakkaraju	IIT Kharagpur	Engineering Drawing and Computer Graphics
2	Prof. Nihar Ranjan Patra	IIT Kanpur	Engineering Graphics

Useful web links	
1	https://nptel.ac.in/courses/112103019/National Programme on Technology Enhanced Learning (NPTEL) - Phase II Course Name. Engineering Drawing
2	https://nptel.ac.in/courses/112/104/112104172/
3	http://moodle.unishivaji.ac.in/course/search.php?search=engineering+graphics Moodle Services, Sivaji University, Kolhapur
4	http://web.iitd.ac.in/~achawla/public_html/201/lectures/sp46.pdf

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

II	**Projections of Points, lines & Planes** Projection of Points and lines inclined to both planes (line in first quadrant only; Types of Projections - Oblique, Perspective, Orthographic and Isometric Projections; Projections of Points located in all four Quadrants: Projections of lines inclined to one of the Reference Plane and inclined to two Reference Planes; Projections of various planes (Polygonal, Circular and Elliptical shape inclined to one of the Reference Plane and inclined to two Reference Planes, Concept of Auxiliary Plane of Projections.	6
III	**Projections of Solids and Sections of Solids** Classifications of basic Solids. Projections of Solids - right regular prism, pyramid, cone, cylinder, tetrahedron and cube inclined to one of the reference plane and inclined to two reference planes: frustum of prism, pyramid and cone inclined to one of the reference plane; types of cutting planes - auxiliary inclined plane, auxiliary vertical plane, horizontal cutting plane, profile cutting plane; sections of solids resting on H.P./V.P. and inclined to only one of the reference planes: sectional views, true shape of the sections	6
IV	**Orthographic Projections** Different types of lines. Selection of views, spacing of views, dimensioning and sections, Conversion of pictorial view into orthographic view including sectional orthographic view.	6
V	**Isometric Projections** Principles of Isometric Projection, Isometric scale, Isometric projections and Isometric views / drawings. Circles in isometric view. Isometric views of simple solids and objects.	6
VI	**Introduction to Computer Aided Sketching** Introduction to CAD software, Graphical User interface of CAD software, Selection of Drawing size and scale, Standard Toolbars, Menus, Tabs, navigational tools. Basic Commands to draw 2D objects, Co-ordinate system and planes, Viewing Commands.	6
	Text Books	
1.	Engineering Drawing by N. D. Bhatt, V. M. Panchal, and P. R. Ingle. Charotar Publishing House, 2014, 53rd Edition.	

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	S.Y. B. Tech in Plastics and Polymer Engineering, Semester-III						
Course Code	HSSM131						
Course Category	HSSM (Humanities and Social Sciences including Management Courses)						
Course title	**Universal Human Values (Theory)**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**		
	02	-	-	02	02		
Evaluation Scheme	**ISE-I**	**ISE-II**	**ESE**	**TA**	**TW**	**PR/OR**	**Total**
	-	-	50	-	-	-	50
Pre-requisites (if any)	• Environmental Science or General Studies • English • Chemistry, Physics and Mathematics						
Course Objectives	• To introduce the need, purpose, and significance of value education for holistic human development. • To enable students to understand the harmony in the self, family, society, and nature. • To develop sensitivity towards ethical human conduct, universal human values, and sustainable living. • To encourage self-exploration and reflection as tools for personal growth and responsible decision-making. • To foster awareness of the relationship between individual well-being and societal harmony						
Course Outcomes	• CO1: Recall key concepts related to human values, harmony, and ethical living. (Remember) • CO2: Describe the fundamental human aspirations and the concept of value-based living. (Understand) • CO3: Illustrate the interdependence between self, relationships, society, and nature for achieving harmony. (Understand) • CO4: Apply self-reflection to make responsible choices in personal and						

	Text Books
1	A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition. Excel Books. New Delhi, 2019. ISBN 978-93-87034-47-1
2	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2
	Reference Books
1	Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999
2	Human Values, A.N. Tripathi, New Age Intl Publishers, New Delhi, 2004.
3	The Story of My Experiments with Truth, M.K. Gandhi, Navajivan Publishing House, Ahmedabad, 1927.
4	Small is Beautiful, E.F. Schumacher, Blond & Briggs, London, 1973.
5	Slow is Beautiful, Cecile Andrews, New Society Publishers, Gabriola Island (British Columbia), 2006.
6	The Economy of Permanence, J.C. Kumarappa, Sarva Seva Sangh Prakashan, Varanasi, 1945.
7	Bharat Mein Angreji Raj, Pandit Sunderlal, Onkar Press, Allahabad, 1929.
8	Rediscovering India, Dharampal, SIDH (Society for Integrated Development of Himalayas), Mussoorie, 2003.
9	Hind Swaraj or Indian Home Rule, M.K. Gandhi, Navajivan Publishing House, Ahmedabad, 1938.
10	India Wins Freedom, Maulana Abul Kalam Azad, Sangam Books, Hyderabad, 1959.
11	Vivekananda: A Biography, Romain Rolland, Advaita Ashrama, Kolkata, 1931.

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	–	–	–	–	2	2	3	–	1	–	1
CO2	2	–	–	–	–	3	3	3	–	2	–	2
CO3	2	–	–	–	–	3	3	3	2	2	–	3
CO4	2	2	–	–	–	3	3	3	3	3	1	3
Avg	1.75	2	-	-	-	2.75	2.75	3	2.5	2	1	2.25

	professional life. (Apply)

Unit No.	Course Content	Hours
I	**Introduction to Value Education** Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations	4
II	**Harmony in the Human Being** Understanding Human Being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to Ensure Self-regulation and Health	4
III	**Harmony in the Family and Society** Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order	4
IV	**Harmony in the Nature/Existence** Understanding Harmony in the Nature, Interconnectedness, Self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence	4
V	**Implications of the Holistic Understanding – a Look at Professional Ethics** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics	4
VI	**Holistic Technologies and Value-Based Transition** Holistic Technologies, Production Systems and Management Models – Typical Case Studies, Strategies for Transition towards Value-based Life and Profession	4

Mapping of Course Outcomes with Program Specific Outcomes

CO No.	PSO 1	PSO 2	PSO 3
CO 1	2	-	-
CO 2	3	-	-
CO 3	3	1	-
CO 4	3	2	1
Avg.	2.75	1.5	1

Correlation Level

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

CO-PO-PSO Mapping Justification

- CO1 (Recall key concepts on human values and harmony): Relates to PO1 (fundamental knowledge), PO6 (societal responsibility), and PO8 (ethics). It moderately supports PSO1 (understanding fundamentals and sustainability)
- CO2 (Describe human aspirations and value-based living): Maps to PO1, PO6, PO7 (sustainability), and PO8 due to its focus on ethical and sustainable living. Strongly aligned with PSO1 as it builds foundational understanding.
- CO3 (Illustrate interdependence in self, society, and nature): Applies to PO6, PO7, PO8, PO9 (teamwork), and PO10 (communication), supporting interpersonal and ethical skills. Supports PSO1 strongly and PSO2 weakly through system-level comprehension.
- CO4 (Apply self-reflection for responsible choices): Requires PO6, PO7, PO8, PO9, PO10, and PO12 (lifelong learning) for professional ethics and personal growth. Weakly linked to PSO2 and PSO3 via ethical decision-making in professional contexts.

Year, Program, Semester	First Year B. Tech in Plastics and Polymer Engineering, Semester-I						
Course Code	BSC141						
Course Category	BSC (Basic Science Course)						
Course title	**Engineering Physics (Lab)**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**		
	-	-	2	02	01		
Evaluation Scheme	**ISE-I**	**ISE-II**	**ESE**	**TA**	**TW**	**PR/OR**	**Total**
	-	-	-	-	-	25	25
Pre-requisites (if any)	Physics Practical at Graduation level						
Course Objectives	• Conduct experiments to measure and analyze the properties of materials using ultrasonic and dielectric techniques • Investigate the behavior and characteristics of light through laser diffraction and fiber optics experiments. • Examine the photoelectric effect and semiconductor properties using photodiodes, LEDs, and laser diodes. • Employ various methods such as the four-probe technique and B-H curve tracing to study magnetic and electrical properties.						
Course Outcomes	• CO1: Recall principles and functions of instruments used in modern physics experiments. (Remember) • CO2: Explain the physical concepts demonstrated through optical, electronic, and semiconductor experiments. (Understand) • CO3: Conduct experiments and determine key physical parameters using appropriate techniques. (Apply). • CO4: Analyze and interpret experimental data to compare device behaviour and material properties. (Analyze)						

Sr. No.	List of Experiments
1	To find velocity of sound in liquid medium using Ultrasonic Interferometer
2	To determine wavelength of the given source

3	To determine the value of Planck 's Constant using Light Emitting Diodes (LEDs).
4	To determine Dielectric Constant of given samples
5	To measure the Numerical aperture /Acceptance angle to measure attenuation
6	a) To Study I-V characteristics in forward bias b). To Study I-V characteristics under no illumination / different illuminations (intensities) in reverse bias
7	To determine the Energy Band Gap of a Semiconductor by using PN Junction Diode
8	To Study I-V characteristics of LED and Diode Laser. To Study P-I characteristics of LED and Diode Laser.
9	To determine the Fermi energy of copper.
10	To determine the value of Boltzmann Constant using a semiconductor diode

Reference Books	
1	Donald A. Neamen, Semiconductor Physics and Devices: Basic Principles,4th Edition. McGraw Hill, 2027
2	K K Sharma, Optics, Principles and Applications, Elsevier, Academic Press, 2006
3	by M Born and E Wolf, Principles of Optics, 7th Edition, Cambridge Press, 2013
4	Satya Prakash and Vinay Dua, Oscillations and Waves, Pragati Publishers, 2010

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	-	-	-	-	-	-	-	-	-	-	2
CO 2	3	2	-	-	-	-	-	-	-	2	-	2
CO 3	3	-	-	3	2	-	-	-	2	-	-	2
CO 4	2	3	2	3	-	-	2	-	-	-	-	3
Avg.	2.5	2.5	2	3	2	-	2	-	2	2	-	2.25

Mapping of Course Outcomes with Program Specific Outcomes

CO/PSO	PSO1	PSO2	PSO3
CO1	2	1	1
CO2	3	1	1
CO3	3	3	2
CO4	3	2	3
Avg.	2.75	1.75	1.75

Correlation Level

Slightly Low: 1

Moderately (Medium): 2

Substantially (Strong): 3

CO-PO-PSO Mapping Justification

- CO1 → PO1, PO12, PSO1: Fundamental understanding of tools and techniques in physical sciences supports polymer science learning
- CO2 → PO1, PO2, PSO1: Provides foundational physical principles important for polymer science applications.
- CO3 → PO1, PO4, PSO1, PSO2: Develops lab and practical skills relevant to processing, measurement, and analysis in polymers.
- CO4 →PO2, PO3, PSO1, PSO3: Correlates with analyzing and solving polymer-related technical challenges based on experimental observations.

Year, Program, Semester	First Year B. Tech in Plastics and Polymer Engineering, Semester-I						
Course Code	ESC142						
Course Category	Engineering Science Course						
Course title	**Engineering Graphics and Design (Lab.)**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**		
	-	-	02	02	01		
Evaluation Scheme	**ISE-I**	**ISE-II**	**ESE**	**TA**	**TW**	**PR/OR**	**Total**
	-	-	-	-	25	-	25
Pre-requisites (if any)	• Knowledge of plane geometry and solid geometry						
Course Objectives	• The course is aimed at developing Basic Graphic skills. • To learn the engineering graphics standards. • To develop Skills in Reading and Interpretation of Engineering Drawings. • To introduce Computer-Aided Drafting tools						
Course Outcomes	• Identify the basic concepts of BIS conventions and their application in engineering drawing. (Remember) • Interpret the principles of first angle and third angle projection systems used in technical graphics. (Understand) • Construct orthographic projections of points, lines, and planes using standard projection techniques. (Apply) • Develop orthographic and isometric views of objects based on projection principles. (Apply)						

List of Experiment	
1	Introduction to Engineering Graphics: Types of lines, Letterings, Drawing Symbols, Numberings, Dimensioning Terms and Notations, Title Block, Geometric Constructions etc.
2	Exercise Sheet on Engineering curves
3	Exercise Sheet on Projections of Points and lines
4	Exercise Sheet on Projections of planes
5	Exercise Sheet on Projections of solids
6	Exercise Sheet on Development of lateral surfaces of solids
7	Exercise Sheet on Orthographic projections

8	Exercise Sheet on Isometric projections
9	Demonstration of drafting software with commands

Mapping of Course Outcomes with Program Outcomes

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	–	–	–	–	–	–	–	–	2	–	2
CO2	3	2	–	–	–	–	–	–	–	2	–	–
CO3	3	–	3	–	–	–	–	–	–	2	–	–
CO4	3	–	3	–	2	–	–	–	–	2	–	–
Avg.	**3**	**2**	**1.5**	**–**	**2**	**–**	**–**	**–**	**–**	**2**	**–**	**2**

Mapping of Course Outcomes with Program Specific Outcomes

CO \ PSO	PSO1	PSO2	PSO3
CO1	3	–	–
CO2	3	–	–
CO3	–	3	–
CO4		3	3
Avg.	1.5	1.5	0.75

Correlation Level

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

CO-PO-PSO Mapping Justification

- CO1 Understanding of BIS conventions and standards is essential for correct engineering documentation — it correlates well with PO1, PO10, PO12 and PSO1.
- CO2 Knowledge of first and third angle projection systems enables accurate interpretation of engineering views — mapping to PO1, PO2, PO10 and PSO1.
- CO3 The ability to construct projections of points, lines, and planes develops core technical drawing skills — linked to PO1, PO3, PO10 and PSO2
- CO4 Applying projection principles to generate orthographic and isometric views builds a foundation for design and visualization — mapped to PO1, PO3, PO5, PO10 and PSO2, PSO3.

Year, Program, Semester	**First Year B. Tech in Plastics and Polymer Engineering, Semester-I**						
Course Code	ESC143						
Course Category	ESC (Engineering Science Course)						
Course title	**Integrated Electrical and Electronics Engineering (Lab.)**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**		
	-	-	2	02	01		
Evaluation Scheme	**ISE-I**	**ISE-II**	**ESE**	**TA**	**TW**	**PR/OR**	**Total**
	-	-	-	-	-	25	25
Pre-requisites (if any)	• Knowledge of physics and mathematics taught at higher secondary level.						
Course Objectives	• To analyse AC and DC circuits • To understand the construction and working of various electrical machines and perform load tests to find its efficiency. • To Implement analog and digital circuits.						
Course Outcomes	• CO 1: Measure electrical parameters and waveforms of machines and components using appropriate test equipment. (Understand) • CO 2: Verify fundamental circuit theorems and analyze the steady-state behavior of AC and DC electrical circuits. (Apply) • CO 3: Demonstrate the working principles of basic electronic and digital logic circuits using datasheets and truth tables. (Apply) • CO 4: Determine performance characteristics of electrical machines and transformers under varying load conditions. (Analyze)						

List of Experiment

PART-A: List of Experiments

1. To verify KVL and Superposition theorem and Thevenin's theorem
2. To measure steady state response of series RL and RC circuits on AC supply and observations of voltage and current waveforms on storage oscilloscope
3. To derive resonance frequency and analyse resonance in series RLC circuit.

4. Speed control of DC shunt motor by armature voltage and flux control method.
5. Load test on three phase induction motor.
6. Direct Load test on single phase transformer.
7. V-I characteristics of:
   a) P-N Junction Diode (Study the datasheet of typical PN junction diode 1N 400X)
   b) Zener Diode (Study the datasheet of typical Zener diode IN 4148)
8. Test and verify the truth tables of:
   a) Basic and Universal Gates (Study the data sheet of respective ICs)
   b) Half / Full Adder
   c) RS/JK/T/D flip flop

PART-B: Assignments (Any Two)

1. Assignment on Electrical circuit analysis
2. Assignment on Electric machines
3. Assignment on Electronic Components and Circuits
4. Assignment on Digital Electronics

Suggested Learning Resources (Text / Reference Books)	
1	L. S. Bobrow (2011), Fundamentals of Electrical Engineering, Oxford University Press
2	Edward Hughes (2016), Electrical Technology", ELBS, Pearson Education
3	Nagrath I.J and D. P. Kothari (2001), Basic Electrical Engineering, Tata McGraw Hill.
4	Smarajit Ghosh (2015) Electrical Machines, Pearson Education, New Delhi.
5	Kulshreshtha D.C. (2009), Basic Electrical Engineering, Tata McGraw Hill.
6	Rajendra Prasad (2009), Fundamentals of Electrical Engineering, Prentice Hall, India
7	Hayt and Kimberly, Engineering Circuit Analysis, Tata McGraw Hill.
8	Smarajit Ghosh (2015) Electrical Machines, Pearson Education, New Delhi.
9	Vincent DelToro (2011) Electrical engineering Fundamentals, PHI
10	R.P. Jain (2010), Modern Digital Electronics, 4th Edition, Tata McGraw Hill.
Web Links and Video Lectures (E-Resources)	
3.	https://nptel.ac.in/courses/108108076
4.	https://archive.nptel.ac.in/courses/108/105/108105155/

5. https://nptel.ac.in/courses/108/101/108101091/
6. http://www.youtube.com/watch?v=Kp-iS6NHsB8

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 Specific Outcomes

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	–	–	–	–	–	–	–	–	2	–	–
CO2	3	2	–	–	–	–	–	–	–	2	–	1
CO3	3	–	2	–	–	–	–	–	–	2	–	–
CO4	3	2	2	–	–	–	–	–	–	2	–	2
Avg.	3	2	2	-	-	-	-	-	-	2	-	1.5

Mapping of Course Outcomes with Program Specific Outcomes

CO No.	PSO 1	PSO 2	PSO 3
CO 1	2	-	-
CO 2	3	2	-
CO 3	-	2	2
CO 4	-	3	2
Avg.	2.5	2.33	2

Correlation Level

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

CO-PO-PSO Mapping Justification

- CO1 Measuring parameters and waveforms builds instrumentation and observation skills — mapped to PO1, PO10 and PSO1.
- CO2 Verifying theorems and steady-state behavior promotes analytical reasoning and circuit understanding mapped to PO1, PO2, PO10, PO12 and PSO1, PSO2.

- CO3 Demonstrating electronic and digital logic circuits improves experimental analysis and integration skills — linked to PO1, PO3, PO10 and PSO2, PSO3.
- CO4 Determining machine performance characteristics through tests develops applied analysis and reporting abilities — mapped to PO1, PO2, PO3, PO10, PO12 and PSO2, PSO3.

Year, Program, Semester	First Year B. Tech in Plastics and Polymer Engineering, Semester-I						
Course Code	VSEC132						
Course Category	Engineering Science Course						
Course title	Design Thinking and Innovation (Lab)						
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits		
	-	-	02	02	01		
Evaluation Scheme	ISE-I	ISE-II	ESE	TA	TW	PR/OR	Total
	-	-	-	-	25	-	25
Pre-requisites (if any)	• Knowledge of Basic Science and Mathematics						
Course Objectives	• To explain the concept of design thinking for product and service development • To explain the fundamental concept of innovation and design thinking • To discuss the methods of implementing design thinking in the real world.						
Course Outcomes	• CO 1: Identify user needs, pain points, and contexts using empathy mapping and persona development. (Remember) • CO 2: Generate creative ideas and design directions using ideation, brainstorming, and mind mapping techniques. (Create) • CO 3: Develop prototypes that communicate core product concepts and address user-centered design goals. (Apply) • CO 4: Demonstrate iterative testing, analysis, and refinement by conducting user testing and journey mapping. (Analyze)						

Sr. No.	List of Experiment
1	To utilize Empathy Mapping for gaining insights into user needs and behaviours for informed, user-centred design decisions
2	To create detailed user personas that represent the target audience's characteristics, needs, and behaviours, enabling a deeper understanding of user requirements and guiding the design process effectively.

3	To explore and apply various ideation techniques for generating innovative and diverse solutions, fostering creativity, and addressing user needs effectively in the design thinking process.
4	To explore and apply collaborative brainstorming and mind mapping techniques to generate diverse ideas, encourage creative thinking, and organize complex information, fostering innovation and expanding the boundaries of solution development.
5	To develop tangible prototypes that represent initial design concepts, facilitating the exploration, communication, and validation of ideas in alignment with user needs and design objectives.
6	To understand and apply rapid prototyping techniques by creating a 3D-printed part, demonstrating the process of transforming designs into physical models quickly and efficiently.
7	To understand the process of user testing and its significance in product development by conducting user testing sessions, gathering feedback, and analyzing insights to propose actionable improvements for a given prototype or product.
8	To understand the process of Journey Mapping and its significance in analyzing user experiences by visualizing and evaluating the steps users go through while interacting with a product, service, or system.
9	Design Sprint: Rapid Problem Solving
10	Innovative Problem-Solving: Applying Design Thinking in Real-World Scenarios

Conduct of Laboratory Sessions

The following activities will be planned

a) Brain teasers (aka Puzzle Busters, to be solved individually)

b) Cartoon captions (small teams)

c) TRIZ, a systematic ideation method, reading (individual)

d) Book readings and discussions (small teams)

e) Small teams' presentations on innovation.(1) innovative individual, (2) innovative company, (3) innovative movie / game, (4) sustainable innovation, (5) innovation in business, (6) innovation in art,

(7) innovation in architecture, (8) innovative nation, (9) innovation in science, and (10) innovation in engineering.

f) Large groups hands-on projects

g) Eight-dimensional (8D) ideation method examples

h) Large teams' videos.

i) Students also will be taken to the **workshop** to experience some kind of hands-on training to make carpentry, metal or smithy job.

	Reference Books
1.	Lockwood, T., & Papke, E. (2010). Design Thinking: Integrating Innovation, Customer Experience, and Brand Value. Allworth Press.
2.	Lewrick, M., Link, P., & Leifer, L. (2018) The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems Wiley.
3.	Plattner, H., Meinel, C., & Leifer, L. (Eds.). (2020). Design Thinking Research: Building Innovation Eco-Systems (Understanding Innovation). Springer.
4.	Brown, T. (2009). Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation. Harper Business.
5.	Ramanathan, U., & Seth, R. (Eds.) (2018). Social Internship and Sustainable Community Development in India: Concepts, Strategies, and Best Practices. Springer.

	Important web links
1.	Stanford d.school - https://dschool.stanford.edu/
2	IDEO U - https://www.ideou.com/

CO-PO Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	–	–	–	1	1	2	2	2	–	2
CO2	2	2	3	–	2	–	–	–	2	2	–	2
CO3	2	–	3	–	3	–	–	–	–	2	–	2
CO4	2	2	3	2	2	–	–	–	2	3	–	3
Avg.	**2**	**1**	**3**	**2**	**2.33**	**1**	**1**	**2**	**2**	**2.25**	**-**	**2.25**

CO-PSO Mapping

CO \ PSO	PSO1	PSO2	PSO3
CO1	2	2	–
CO2	–	3	2
CO3	–	2	3
CO4	2	2	3
Avg.	1.0	2.25	2.0

Correlation Level

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

CO-PO-PSO Mapping justification

- CO1 Understanding user needs through empathy and persona creation is foundational to design thinking — it correlates well with PO1, PO2, PO6, PO7, PO8, PO9, PO10, PO12 and PSO1, PSO2.
- CO2 Generating creative ideas using ideation and mind mapping techniques fosters innovation and collaborative thinking — mapping to PO1, PO2, PO3, PO5, PO9, PO10, PO12 and PSO2, PSO3.
- CO3 Developing functional and visual prototypes helps translate abstract concepts into tangible outputs — linked to PO1, PO3, PO5, PO10, PO12 and PSO2, PSO3.
- CO4 Iterative testing and journey mapping refine design outcomes and promote user-centered innovation — mapped to PO1, PO2, PO3, PO4, PO5, PO9, PO10, PO12 and PSO1, PSO2, PSO3.

Year, Program, Semester	First Year B. Tech in Plastics and Polymer Engineering, Semester-I				
Course Code	HSSM133				
Course Category	HSSM (Humanities and Social Sciences including Management Courses)				
Course title	**Yoga and Meditation** **(Practice – Non-Credit Mandatory Course)**				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	9	-	2	02	-
Pre-requisites (if any)	Basic physical fitness and flexibility for yoga postures (asanas) and meditation practices. Open-mindedness, willingness to learn, and a commitment to regular practice and self-reflection are essential.				
Course Objectives	• Gain a comprehensive understanding of yoga and meditation principles and practices for holistic well-being. • Develop practical skills to incorporate yoga and meditation into daily life for stress reduction and emotional balance. • Explore the scientific basis and applications of yoga and meditation in diverse contexts. • Foster personal growth and self-awareness through regular practice, integrating yoga and meditation as a lifelong journey.				
Course Outcomes	• CO 1: Develop a strong foundation in yoga and meditation techniques and principles. • CO 2: Cultivate mindfulness and self-awareness through regular practice. • CO 3: Enhance physical flexibility, strength, and overall well-being. • CO 4: Apply yoga and meditation practices to reduce stress and promote mental and emotional balance.				

Sr. No.	Course Content
I.	Introduction to Yoga and Meditation: a) Overview of yoga and its origins b) Introduction to meditation techniques and benefits
II.	Foundations of Yoga Practice:

	a) Understanding yoga asanas (poses) and their alignment b) Pranayama techniques for breath control and energy regulation
III.	Exploring Meditation Techniques: a) Mindfulness meditation and its practice b) Guided visualization and relaxation techniques
IV.	Yoga for Physical Health and Well-being: a) Yoga for flexibility and strength b) Yoga for stress reduction and relaxation
V.	Yoga Philosophy and Lifestyle: a) Introduction to the philosophy of yoga b) Applying yoga principles to daily life and relationships
VI.	Advanced Practices and Integration: a) Advanced yoga asanas and sequences b) Integrating yoga and meditation into a holistic lifestyle

Reference Books	
1	Iyengar, B.K.S. Light on Yoga: The Bible of Modern Yoga. HarperCollins, 2001.
2	Khalsa, Gurucharan Singh. Kundalini Yoga. The Flow of Eternal Power. TarcherPerigee, 1999.
3	Lasater, Judith Hanson. Relax and Renew: Restful Yoga for Stressful Times. Rodmell Press, 2011.
4	Saraswati. Swami Satyananda. Asana, Pranayama, Mudra, Bandha. Bihar School of Yoga, 2008.
5	Satchidananda, Swami. The Yoga Sutras of Patanjali. Integral Yoga Publications, 2012.
6	Zinn, Jon Kabat. Wherever You Go, There You Are: Mindfulness Meditation in Everyday Life. Hyperion, 2005.
Important web links	
1.	Yoga Journal. www.yogajournal.com
2.	Headspace: www.headspace.com
3.	The International Sivananda Yoga Vedanta Centres: www.sivananda.org
4.	Insight Timer: www.insighttimer.com

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**	**T**	**P**	**Total Contact Hours**	**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.
- 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	S.Y. B. Tech in Plastics and Polymer Engineering, Semester-II						
Course Code	BSC202						
Course Category	BSC (Basic Sciences and Humanities Courses)						
Course title	**Engineering Chemistry (Theory)**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**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 basic concepts of chemistry, atomic structure and model, periodicity and chemical bonding (Remember) • CO 2: To understand the laws of thermodynamics, enthalpy, Gibbs free energy, the kinetics and activation energy. (Understand) • CO 3: Student will be able to study the state of matter, gas laws, adsorption, water, and solutions (Illustrate) • CO 4: Student will be able to understand an electromagnetic radiation interaction with matter, spectrums and green chemistry (Apply)						

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 (Recall the basic concepts of chemistry, calculation, atomic structure): Relates to PO1 (fundamental knowledge), PO6 (societal responsibility), and PO8 (ethics). It moderately supports PSO1 (understanding fundamentals and sustainability).
- CO2 Illustrate the state of matter, water: Maps to PO1, PO6, PO7 (sustainability), and PO8 due to its focus on ethical and sustainable living. Strongly aligned with PSO1 as it builds foundational understanding.
- CO3 (To understand the laws of thermodynamical system, reaction rate). Applies to PO6, PO7, PO8, PO9, and PO10, supporting interpersonal and ethical skills. Supports PSO1 strongly and PSO2.
- CO4 (Apply knowledge about electro-chemistry, equilibrium and electromagnetic radiation interaction, green chemistry): PO6, PO7, PO8, PO9, PO10, and PO12 (lifelong learning) for professional ethics and personal growth. Weakly linked to PSO2 and PSO3 via ethical decision-making in professional con

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**	**T**	**P**	**Total Contact Hours**		**Total Credits**		
	03	-	00	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	• CO 1: Identify various tools, equipment, and machines used in engineering workshop practices. *(Remember)* • CO 2: Explain fundamental principles and safety guidelines associated with different workshop practices. *(Understand)* • CO 3: Demonstrate basic skills in fitting, carpentry, welding, sheet metal, and machining operations. *(Apply)* • CO 4: Perform practical tasks using proper techniques and adhering to industry-standard safety protocols. *(Apply)*							

Unit No.	Course Content	Hours
I	**Introduction:** Workshop layout, Importance of various sections/shops of workshop, Types of jobs done in each shop, General safety rules and work procedure in workshop, brief overview of inspection and quality control, Important terms in metrology, Basic methods of measurement, Standards of	6

	measurements, measuring instruments (vernier callipers, micrometers, slip gauges).	
II	**Fitting Operations and Power Tools:** Study and use of Holding tools, Marking and Measuring tools, cutting tools, Finishing tools (Reamer and Files) and some other miscellaneous tools. Fitting operations: chipping filling, Drilling and tapping. Power tools, its types and their uses, Sheet Metal work: Metals used in sheet metal work, sheet metal tools, Forging methods, power forging	6
III	**Carpentry:** Types of woods and their applications, Timber seasoning; Types, sketch, specification, material, methods and applications of carpentry tools like saws, planner, chisels, hammers, pallet, marking gauge, vice, try square, rule, etc.	6
IV	**Machining, Casting, Forming and Joining:** *Machining:* Machine tools and metal cutting Principles, Types of machining process; Pattern, Pattern materials *Casting*: Casting process, Types of casting, Casting defects, Moulding process and its types, Pattern making, allowances of pattern and Pattern types *Metal Forming:* forming processes - Bending, Coining, embossing *Rolling:* types of Rolling and Roll mills. Strain Hardening, Recovery, Recrystallization and Grain growth; *Joining process:* Introduction and types of joining (welding, brazing, soldering, adhesive bonding)	6
V	**CNC and Additive Manufacturing:** Introduction, Elements, block diagram, Types of CNC machine, Working of CNC, Programming basics, G and M code, Advantages and challenges, Introduction to Rapid Prototyping, material, applications, limitations and Techniques: Photo polymerization, Stereo lithography, Powder Bed Fusion, Selective Laser Sintering, 3D Printing, Laminated Object Manufacturing	6
VI	**Plastic Moulding and Glass Cutting:** Introduction of Plastic moulding and Types (rotational moulding, injection moulding, blow moulding, compression moulding, extrusion moulding, and	6

	thermoforming); Evaluation of Glass Cut, Cutting with Wheels, cutting with CO_2 Laser, Cutting by Ablation, Filament Cutting.	
	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	Prof. Sounak Kumar 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**	**T**	**P**	**Total Contact Hours**	**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 10th and 12th standard • Basic Engineering Graphics/Design course						
Course Objectives	• General overview of polymers, their types, concept of molecular weight. • General understanding of structure of polymers and predict polymer properties.						
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

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	S.Y. B. Tech in Plastics and Polymer Engineering, Semester-III						
Course Code	PPE232						
Course Category	PCC (Polymer Core Course)						
Course title	**Introduction to Polymer Sustainability (Theory)**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**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

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	

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	BSC241						
Course Category	BSC (Basic Science Course)						
Course title	**Engineering Chemistry (Lab.)**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**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	• To understand basic guidelines, and knowledge about glassware and apparatus used in chemistry laboratory. • To get knowledge of qualitative analysis, titration and chemical kinetics practical. • To determine the concentration of unknown solution by light interaction, waste water treatment practical. • To identify the element, present in an organic compound, simple preparation and green methods.						
Course Outcomes	• CO 1: Student will learn basic guidelines, and about glassware and apparatus used in chemistry laboratory (Remember). • CO 2: Able to get knowledge of qualitative analysis, titration and chemical kinetics practical (Understand) • CO 3: Student will be able to identify an organic compound, preparation and green methods. (Understand) • CO 4: Student will learn to find the concentration of solution by light interaction, waste water treatment (Apply)						

No.	List of Experiments
1	To understand about glassware, accessories, apparatus, chemicals, and equipment used in Chemistry laboratory.
2	Qualitative analysis of acidic radicals and basic radicals in a given unknown inorganic compound.
3	To prepare the solutions of different molarity and normality.
4	Titration: To determine the concentration and strength of unknown solution by *titrating* it with standard solution.
5	To determine the rate constant for the hydrolysis of methyl acetate in acidic medium.
6	To determine DO/BOD/COD in industrial/domestic waste water sample.
7	To determine the viscosity of given chemicals of by Ostwald Viscometer.
8	To determine the concentration of unknown solution using colorimeter based on specific wavelength.
9	To prepare buffer solutions and measure their pH to understand buffer action
10	To prepare an organic compound by one-step process.

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
CO 1	3	-	1	-	3	-	1	1	2	1	-	3
CO 2	2	2	-	2	-	-	2	-	2	-	-	1
CO 3	3	2	1	2	2	-	3	2	-	2	-	2
CO 4	3	2	-	2	-	-	3	1	2	1	-	2
Avg.	2.75	2	1	2	2.5	-	2.25	1.33	2	1.33	-	2

Mapping of Course Outcomes with Program Specific Outcomes

C/PSOs	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	1
CO3	3	-	2
CO4	3	-	1
Avg.	3	-	2.33

Correlation Level

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

CO-PO-PSO Mapping Justification

- CO1 → PSO1, PO-1, PO-3, PO-5, PO-7, PO-9, PO-10 and PO-12: Provides fundamental essential and basic knowledge for laboratory guidelines and apparatus.
- CO2 → PSO1, PSO3, PO-1, PO-2, PO-7, PO-9, PO-10 and PO-12: qualitative analysis of chemicals and chemical kinetics
- CO3 → PSO1, PSO3, PO-1, PO-2, PO-5, PO-7, PO-9, PO-10 and PO-12: qualitative analysis of organic compound and preparation.
- CO4 → PSO1, PSO3, PO-1, PO-3, PO-7, PO-9, PO-10 and PO-12: light interaction with chemical solution and. buffer sol^n, waste water DO analysis: sustainability

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 (Lab.)**							
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**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	Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.							
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	ESC244						
Course Category	Engineering Science Course						
Course title	**Computer Programming (Lab)**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Credits**		
	-	-	02	02	01		
Evaluation Scheme	**ISE-I**	**ISE-II**	**ESE**	**TA**	**TW**	**PR/OR**	**Total**
	-	-	-	**25**	-	-	25
Pre-requisites	• Physics and Mathematics						
Course Objectives	• Understand the basic terminology used in computer programming • To learn the syntax and semantics of the C programming language • Compile and debug programs in C and Implement data structures and algorithms in C • To be able to introduce core programming basics and various Operators of Python programming language.						
Course Outcomes	• CO 1: Recall fundamental concepts of manufacturing processes including casting, forming, machining, and joining. (Remember) • CO 2: Explain material-specific fabrication techniques for metals, polymers, ceramics, and composites. (Understand) • CO 3: Demonstrate practical skills in fabricating basic components using conventional tools and basic CNC equipment. (Understand) • CO 4: Use standard industry practices and safety protocols to solve basic problems in a manufacturing setting. (Apply)						

Sr. No.	Experiment Title
1	Programs on basic programming in C
2	Programs using Decision Controls in C
3	Programs using while, do-while and for Loop
4	Programs using Case Control Structure, odd loop
5	Programs illustrating use of function
6	Programs illustrating use of arrays
7	Python program to print "Hello Python"
8	Python program to find the area of a triangle
9	Write a program to demonstrate different number data types in Python.
10	Write a program to perform different Arithmetic Operations on numbers in Python
	Text Books
1	E Balguruswamy, "Programming with ANSI C", (TMH)
2	Kernighan and Richie, "The C Programming Language" (PHI)/Pearson Education
3	Yashwant Kanetkar, "Let us C", BPB Publications, 16th Edition 2017
4	Learning Python, Mark Lutz, Orielly, 3 Edition 2007.
5	Python Programming: A Modern Approach, Vamsi Kurama, Pearson, 2017.
6	Anil B. Chaudhuri, "Flowchart and Algorithm Basics: The Art of Programming", Mercury Learning & Information, 2020
	Useful web links
2	Problem Solving Through Programming in C:https://nptel.ac.in/courses/106/105/106105171/
3	Introduction To Programming in C. https://nptel.ac.in/courses/106/104/106104128/
4	https://www.javatpoint.com/python-programs
5	https://www.w3schools.com/python/python_reference.asp
6	https://www.python.org/doc/
	Reference Books
1	Gottfried, "Programming in C", Shattern Series
2	Herbert Schildt, "Complete 'C' Reference".

Mapping of Course Outcomes with Program Outcomes

O	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	1	-	-	-	-	-	-	-	-	-	-
CO 2	2	2	-	3	2	-	-	-	-	-	-	-
CO 3	3	2	2	2	-	-	-	-	-	-	-	-
CO 4	3	2	3	2	2	-	-	-	-	-	-	-
Avg.	2.75	1.75	2.50	2.33	2.00	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO/PSO	PSO1	PSO2	PSO3
CO1	3	–	–
CO2	2	2	2
CO3	3	–	2
CO4	3	2	3
Avg.	**2.75**	**2**	**2.33**

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	HSSM221						
Course Category	HSSM (Humanities, Social Sciences including Management Course)						
Course title	**English Language and Communication (Theory – Non-Credit Mandatory Course)**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**		
	02	-	-	02	-		
	-	-	-	-	-	-	-
Pre-requisites (if any)	• Basic knowledge of English language acquired at the foundational level						
Course Objectives	• Enhance pronunciation, listening, vocabulary, and grammar using CALL tools, and strengthen spoken and written communication through ICS-based practice						
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)						

Sr. No.	List of Experiments
1	To practice spoken English in structured oral tasks.
2	To reinforce understanding and correct usage of common grammar rules.
3	To enhance vocabulary knowledge and contextual application
4	To improve articulation and intonation through dialogue practice.
5	To develop attentive listening and accurate transcription skills.
6	To build critical reading and comprehension abilities.
7	To strengthen listening and critical thinking via multimedia analysis.
8	To learn structured formats for professional written communication.

9	To improve paragraph writing with emphasis on coherence and clarity.
10	To enhance conversational skills through dialogue writing and role-play.
11	To introduce fundamentals of group discussions and effective communication.
12	To develop oral presentation skills on assigned grammar topics.
	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

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	2	-	-	-	-	-	-	-	3	-	2
CO 2	2	2	-	-	-	-	-	-	-	3	-	2
CO 3	-	-	-	-	-	-	-	2	2	3	-	1
CO 4	2	2	-	-	-	-	-	2	2	3	-	2
Avg.	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**3**	**-**	**1.75**

Mapping of Course Outcomes with Program Specific Outcomes

CO/PSO	PSO1	PSO2	PSO 3
CO1	2	-	-
CO2	2	-	-
CO3	-	2	-
CO4	2	2	-
Avg.	**2**	**2**	**-**

Correlation Level

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

CO-PO-PSO Mapping Justification

- CO1 Moderately supports PO1 and PO2 as it builds foundational listening and speaking skills; strong alignment with PO10 (communication skills); moderate support for PO12 (lifelong learning) and PSO1.
- CO2 Similar to CO1, focusing on grammar and vocabulary; supports PO1, PO2, PO10, PO12, and PSO1.
- CO3 Applies phonetic and pronunciation skills, supporting PO8 and PO9 (practical and teamwork skills), PO10 (professional communication), and PSO2.
- CO4 Analyses communication scenarios, linking to higher-order skills in PO8, PO9, PO10, and both PSOs.

Year, Program, Semester	F.Y. B. Tech in Plastics and Polymer Engineering, Semester-II						
Course Code	IISSM222						
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**	**T**	**P**	**Total Contact Hours**	**Total Credits**		
	02	-	-	02	-		
Evaluation Scheme	**ISE-I**	**ISE-II**	**ESE**	**TA**	**TW**	**PR/OR**	**Total**
	-	-	-	-	-	-	-
Pre-requisites (if any)	• General Science • History						
Course Objectives	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, Pingala 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.
	Bag, A.K. (1979). Mathematics in Ancient and Medieval India, Chaukhamba Orientalia. New Delhi.
	Reference Books
1	atta, 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	https://onlinecourses.swayam2.ac.in/imb23_mg53/preview

Mapping of Course Outcomes with Program Outcomes

CO No.	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 No.	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	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	1. Cultivate rural awareness and empathy among students. 2. Enable students to apply engineering skills effectively in underserved areas.				
Course Outcomes	1. Increased recognition of rural challenges and dynamics. 2 Demonstrated ability to devise and implement relevant solutions.				

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.