Teaching Scheme					Polymer Science (22PCM202T)					
					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	1	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

- Analyze fundamental concept along with classification of polymer and explaining the reaction mechanism.
- Evaluate analysis and morphological study with the help of various analytical techniques e.g. XRD, microscopy (optical and electronic as well) TGA, DSC and IR.
- Analyze the glass transition temperature and the factors which affects the glass transition temperature.
- Analyze and justify synthesis and engineering of various types of thermoplastics.
- Explain the rheological characteristic of polymer and plastic along with their polymer processing operation and testing.
- Formulate the concept of a polymer industrial setup.

UNIT I: Fundamentals of polymers & characterization **7 Hr.**

Monomers, functionality, degree of polymerizations, classification of polymers, glass & melting transition, polymerization methods: addition and condensation; their kinetics, metallocene polymers and other newer techniques of polymerization, copolymerization, monomer reactivity ratios and its significance, kinetics, different copolymers, random, alternating, block and graft copolymers, concept of average molecular weight, determination of number average, weight average, viscosity average and Z-average molecular weights; Polymer crystallinity; Analysis using IR, XRD, thermal (DSC, DMTA, TGA), microscopic (optical and electronic) techniques.

UNIT II: Polymer synthesis, properties, blends & composites **7 Hr.**

Commodity and general purpose thermoplastics: PE, PP, PS, PVC, Polyesters. Engineering Plastics: Nylon, PC, PBT, PSU, PPO; Thermosetting polymers: PF, UF, epoxy, unsaturated polyester; Natural and synthetic rubbers: Recovery of NR hydrocarbon from latex, SBR, nitrile, CR, CSM, EPDM, IIR, BR, Silicone, TPE; Difference between blends and composites, their significance, choice of polymers for blending, blend miscibility-miscible and immiscible blends, polymer alloys, polymer eutectics, plastic-plastic, rubber-plastic and rubber-rubber blends, FRP, particulate, long and short fibre reinforced composites.

UNIT III: Polymer rheology & technology **7 Hr.**

Polymer compounding-need and significance, different compounding ingredients for rubber and plastics, cross linking and vulcanization; Aspects of polymer rheology, measurements of rheological parameters, different flow equations, dependence of shear modulus on temperature, molecular/segmental deformations at different zones and transitions.

UNIT IV: Polymer processing and testing **7 Hr.**

Compression moulding, transfer moulding, injection moulding, blow moulding, reaction injection moulding, extrusion, pultrusion, calendaring, rotational moulding, thermoforming, rubber processing in two-roll mill and internal mixer; Mechanical-static and dynamic tensile, flexural, compressive, abrasion, endurance, fatigue, hardness, tear, resilience, impact and toughness.

Max. 28 Hr.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: The fundamental concept of polymer science and technology is required to petrochemical engineering students

CO2: Rheological study and the characterization of polymers with analytical instrument would be useful to solve some complex problem.

CO3: The understanding of glass transition temperature and its determination is useful to design and solve some industrial problem.

CO4: The synthesis of polymers and its reaction mechanism is useful to solve complex problem in petrochemical industry.

CO5: The knowledge of different types of polymer processing operations is useful to formulate a polymer industry

CO6: By formulating the polymer industrial setup the students could become entrepreneur.

TEXT/REFERENCE BOOKS

1. Freid, J.R., "Polymer Science and Technology", 3rd Edition, Prentice Hall (2014).
2. Billmeyer, F.W., "Textbook of Polymer Science", 3rd Edition, Wiley-Interscience (1994).
3. Maiti, S., "Analysis and Characterization of Polymer", Polymer science (2003).

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hr.**
Part A: 10 Questions each carrying 5 marks	50 Marks
Part B: 5 Questions each carrying 10 marks	50 Marks