

GUJARAT TECHNOLOGICAL UNIVERSITY

Plastic Technology

B. E. SEMESTER: VI

Subject Name: **Plastic Structure, Property & Relationship**

Subject Code: **162302**

Teaching Scheme				Evaluation Scheme		
Theory	Tutorial	Practical	Total	University Exam (Theory) (E)	Mid Sem Exam (Theory) (M)	Practical (I)
3	0	2	5	70	30	50

Sr. No.	Course Contents	Total Hrs
1.	<p>Structure of Polymers –</p> <p>Linear, branched, cross linked, and network polymers – Homo-chain and hetero atomic chain plastics - Copolymers - Linear and cyclic arrangement - Prediction of plasticizer properties, group contribution techniques, topological techniques- Volumetric properties - molar volume, density, Van der-Waals volume - Coefficient of linear thermal expansion and volumetric thermal expansion - Pressure volume temperature (PVT) relationship</p>	12
2.	<p>Mechanical Properties –</p> <p>Stress-strain properties of plastics - Effect of plastics structure on modulus of elasticity, tensile strength, flexural strength, impact strength, yield strength, fracture toughness - Crazing in glassy polymers - Ductile brittle transition. Effect of additives on mechanical properties of polymers - Creep, stress relaxation, and fatigue.</p>	12
3.	<p>Thermodynamic and transition properties –</p> <p>Transition temperature in plastics, glass transition (T_g), melt transition (T_m), relationship between T_g and T_m - other transitions like β-transitions, upper and lower glass transition temperatures - Prediction of T_g and T_m of polymers by group contributions.</p> <p>Calorimetric properties - Heat capacity, specific heat, latent heat of crystallization and fusion, enthalpy and entropy - Calculation of heat capacities of plastics.</p>	10

4.	Electrical and Optical properties – Effect of plastic structure on dielectric constant, power factor, dissipation factor, and loss factor - effect of frequency of voltage and temperature on dielectric properties - Prediction of molar polarization and effective dipole moment. Effect of additives on electrical properties of plastics.	6
5.	Optical properties – Effect of plastics structure on optical properties - clarity, transparency, haze, transmittance, reflectance, and gloss - Prediction of refractive indices of polymers by group contributions, Static charges, volume & surface resistivity, arc resistance.	6
6.	Chemical Properties – Cohesive energy, cohesive energy density, solubility parameter, determination of solubility parameter of polymers - Prediction of solubility parameter -Effect of polymer structure on solubility in solvents and oils - Influence of structure in prediction of flame Retardancy, water repellency - Chemical resistance of plastics - Plastic toxicity.	8

Text Books:

1. Polymer Structure, Properties and Applications by R.Deanin.
2. D.W. Van Krevelen And P.J. Hoftyzen, "Properties Of Polymer, 3rd Edition Elsevier Scientific
3. Publishing Company Amsterdam – Oxford – New York. 1990.
4. J.E. Mark Ed. AIP, Physical Properties of Polymers Hand Book, Williston, Vt, 1996.

Reference Books:

1. D.A.Seanor, ed., Electrical properties of polymers, Academic press, New York, 2
2. Jozef.Bicerano, Prediction Of Polymer Properties, Second Edition, Marcel Dekker Inc. New York, 1995.J.M.Margolis (Ed.), Engineering Thermoplastics Properties & Applications, Marcel Dekker, New York .
3. R.J.Samuels, Structured Polymer Properties, John Wiley & Sons, New York,
4. I.M.Ward & D.W.Hadley, An Introduction to the Mechanical Properties of Solid Polymers, John Wiley & Sons, Chichester, England,
5. C.C.Ku & R.Liepins, Electrical Properties of Polymers, Hanser Publications, Munich,
6. F. Bueche, Physical properties of polymers, Wiley, New York,
7. J.Mort & G.Pfister, eds., Electronic Properties of Polymers, Wiley