

GUJARAT TECHNOLOGICAL UNIVERSITY

CHEMICAL ENGINEERING (COMPUTER AIDED PROCESS DESIGN) (16)

POLYMER STRUCTURE & PROPERTY PREDICTION

SUBJECT CODE: 2731603

ME Semester: III

Type of course: Major Elective-IV

Prerequisite: Polymer Science & Synthesis of Polymers

Rationale: Able to define the Relationship between Polymer Structure, Properties and Application

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks		Practical Marks				
				ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	2	5	70	30	20	10	10	10	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; OEP-Open Ended Problem.

Content:

Sr. No.	Content	Total Hrs.	% Weightage
1	The Relationship between Structure, Properties and Application.	6	10
2	Sub molecular Structure: Chemical Composition of the Polymer Molecule, Monomeric Ingredients in the Final Polymer Composition.	8	15
3	Molecular Structure: Molecular Size & Shape: Processability, Mechanical Properties, Thermal Properties, Electrical Properties, Optical Properties, Chemical Properties, Balance of Properties.	8	15
4	Molecular Flexibility: Molecular Structure. Molecular Flexibility, Properties, Applications.	8	15
5.	Intermolecular Structure: Intermolecular Order: Amorphous State, Crystallinity, Orientation.	8	15
6	Intermolecular Bonding: London Dispersion Forces, Induced Dipoles, Permanent Dipoles, Hydrogen Bonding, Crystallinity, Ionic Bonding, Cross Linking.	8	15
7	Super molecular Structure: Multiple phases & Macrostructures: Chemically Homogeneous but Physically Heterogeneous Microstructures, Temporary Heterogeneity for Processing, Chemical Micro heterogeneity, Macrostructure : Macroscopic dimensions of Individual Structures, Complex Multicomponent Total Macrostructures.	8	15

Reference Books:

1. Polymer Structure, Properties and Applications, by R.D. Deanin.
2. Principles of Polymer Processing by Zethew Tadmor and Costas G. Gogos

Course Outcomes:

After learning the course the students should be able to:

1. Learn the relationship between structure, Properties & applications.
2. Learn about Chemical Composition of the Polymer Molecule.
3. Significance of Molecular Size & Shape on Polymer Properties.
4. Able to Identify Amorphous & Crystalline State.
5. Learn about the Intermolecular Bonding.
6. Understand the Multiple phases & Macrostructures.

List of Experiments:

Tutorials/Presentation/Practicals based on above topics.

Design based Problems (DP)/Open Ended Problem:

1. The Influence of Molecular Flexibility on the Intrinsic Viscosity, Sedimentation, and Diffusion of High Polymers.
2. Role of Chemical Structure in Fragility of Polymers
3. Semi flexible Polymers: Fundamental Theory and Applications in DNA Packaging.

Major Equipment's:

- Hardness Tester, Tensile Testing Machine, Melt Flow Index, Abrasion Tester etc.

List of Open Source Software/learning website:

- <http://scitation.aip.org/>
- <http://www.physics.emory.edu/>
- <http://stanford.edu/>

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.