

GUJARAT TECHNOLOGICAL UNIVERSITY

CHEMICAL ENGINEERING (COMPUTER AIDED PROCESS DESIGN) (16)

POLYMER MATERIALS & TESTING (PMT)

SUBJECT CODE: 2721607

SEMESTER: II

Type of course: (Major Elective-II) (M.E.CAPD)

Prerequisite: Polymer Science & Synthesis of Polymers (PSSP)

Rationale: Able to define and choose the polymer materials according to application

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	0	2#	4	70	30	20	10	10	10	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Rubbers: Rubber Materials-Introduction, Natural Rubber, Synthetic Rubbers like SBR, PBR, Silicone, Butyl, NBR, Neoprene, EPDM, Floro Elastomers etc., Thermoplastics Elastomers, Rubber Compounding, Sulphur & Non-Sulphur Vulcanization, Assessment of Processibility and State of Cure, Hard Rubber or Ebonite, Latex Technology.	6	10
2	Plastics: Plastics Materials-Introduction, Polyethylene, Linear Low Density Polyethylene, Polypropylene, Copolymers of Ethylene, Polystyrene, Acrylic Plastics, Poly(Vinyl Acetate, Vinyl Chloride), PTFE, CI Resins, Acetyl Resins, Polyamides, Polyimides, Polyesters, Polyurethane, Polycarbonates, Epoxy Resins, Cellulose Plastics, Phenolic & Amino Resins, Silicones, Additives for Plastics.	6	10
3	Fibers: Introduction, Natural Fibers, Semi Synthetic Fibers, Synthetic Fibers, Difference between Natural & Synthetic fibers, Important Requirements of a Fibre, Properties of Synthetic Fibres, Rayon or Artificial Silk, Polyamides, Polyethylene terephthalate, Orlon, Polyvinyl Alcohol, Dacron, Saran, Vinyon, Teflon, Dynel, Fabric defects-definition and principal causes, Terminology used in fibre technology.	6	10
4	Objective: To understand polymer testing related to short term as well as long term mechanical properties, thermal as well as electrical properties. To have in depth understanding of fundamental polymer processing operations.	5	10
5	Introduction: Importance of Testing, Concept of Statistics, Quality Control, Standards and Standard Organizations, Preparations of test Samples and Conditioning.	5	10

6	Identification, Testing & Evaluation of Rubbers & Plastics: Identification of Common Plastics and Rubbers, Physical Testing, Softening Temperature Tests, Melt Flow Index etc.	5	10
7	Mechanical Properties: Short term and long term mechanical properties, their Significance and importance, Determination of Short term stress-strain properties such as Tensile strength, elongation at break, tensile modulus, compression, Flexural, Tear Resistance etc. Different types of Impact tests: Determination of impact tests for different polymeric materials, Study of creep, relaxation, set and fatigue, Hardness, Abrasion Resistance etc.	6	10
8	Electrical Properties: Their importance and significance, effect of temperature and humidity on electric properties. Different types of electrical properties such as: Determination of dielectric strength, surface and volume resistance, Power factor and permittivity, Tracking resistance, arc resistance	5	10
9	Thermal Properties: Determination of heat deflection temperature (HDT) Determination of vicat softening point (VST) Determination of melting point and softening point for different polymers	5	10
10	Environmental Resistance Properties: Effect of liquids and chemicals, Study of weathering resistance, Study of weathering property, Study of fire resistance.	5	10

Reference Books:

1. Textbook of Polymer Science by FRED W. BILLMEYER
2. Handbook of Plastics Test Method, R.B. Brown, George Godwin Limited, 1981.
3. Polymer Science and Technology by Premamoy Ghosh, Second Edition.
4. Polymer Chemistry By b. K. Sharma
5. Polymer Science by P. L. Nayak.

Course Outcome:

After learning the course the students should be able to:

- Learn the classification of Polymers.
- Learn about compounding of polymer.
- Significance of Compounding ingredients in Polymer Products.
- Able to Identify Rubber, Plastics & Fibre.
- Learn the importance of mechanical properties.
- Justify the importance and significance of effect of temperature and humidity on electric properties.
- Understand the importance of Thermal Properties.
- Study about Environmental Resistance Properties

List of Experiments:

Tutorials/Presentation based on above topics.

Open Ended Problems:

1. Morphology of Polymer Molecules.
2. Importance of Thermal Transitions of Polymers.
3. Biodegradable Polymers

Major Equipment:

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

List of Open Source Software/learning website:

- http://www.ce.berkeley.edu/~paulmont/CE60New/review_final.pdf
- <authors.library.caltech.edu/25034/30/BPOCchapter29.pdf>
- www.informit.com

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.