

# GUJARAT TECHNOLOGICAL UNIVERSITY

## CHEMICAL TECHNOLOGY (36)

**SUBJECT NAME: PRODUCT DESIGN CONCEPTS: STRUCTURE & ADDITIVES  
(DE-VIII)**

**SUBJECT CODE: 2173607**

B.E. VII<sup>th</sup> SEMESTER

**Type of Course:** Chemical Technology

**Prerequisite:** Studied subject PR-08 (**Product Design Concepts: Structures & Additives**). Basic Knowledge of Recent Trends in Polymer & Rubber Technology.

**Rationale:** The main objective of this subject is to study the product preparation how to design on the process of or with the help of additives used in chemical industries. This subject provides fundamental knowledge of a new product which is applicable in chemical industries.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		PA(V)		PA (I)		
				PA	ALA	ESE	OEP			
4	0	3	7	70	20	10	20	10	20	150

L-Lectures; T-Tutorial/TeacherGuidedStudentActivity;P-Practical;C-Credit;ESE-EndSemesterExamination; PA-Progressive Assessment, ALA- Active Learning Assignment, OEP- Open Ended project

**Content:**

Sr. No.	Topic	Teaching Hours	Module Weightage (%)
1	<b>Structures-</b> Polymers & Rubbers	7	14
2	<b>General Structural Features of Polymers-</b> Chemical & Physical structure, Thermal behaviour, Glass Transition Temperature, Chain Flexibility, Crystallinity, Spherulites, Degradation & similar effects	9	18
3	<b>Processing Parameters-</b> The influence of processing parameters on the structure & properties of polymers & rubbers.	7	14
4	<b>Product Design-</b> Importance of additives in product design	7	14
5	<b>Molecular Weight Determination-</b> Study of the respective principles, theories & application by the following techniques : Gradient elution technique, Gel permeation chromatography, Vapour pressure Osmometry, Cryoscopy & ebullioscopy	10	20
6	<b>Microscopy-</b> Testing of flexible films for food applications, Permeability, Adhesion test, Peel test, shear test, Microscopy: Scanning electron microscopy (SEM), Transmission electron microscopy (TEM) , Identification of polymers using chemical methods.	10	20

## Reference Books:

1. Polymer Structure, Properties & application, R.D. Deanin, American Chemical Society, 1974
2. Properties of Polymer; Correlations with Chemical Structures & their numerical Estimation & Predication from Additive Group Contribution Van Drevelen,, Elsevier Publication Company, 1990.
3. Relating Materials Properties to structure, D. J. David, Technical Publishing Company Inc, 1999.
4. Rubber Technology, Maurice Morton, Springer, 1st Ed, 1987
5. The Science and Technology of Rubber, Mark and Erman, Academic Press, 3rd Ed, 2005
6. Rubber Processing, Robert Johnson, Hanser Publications, 2001
7. Rubber Compounding: Chemistry and Applications, Brendan Rodgers, CRC, 1st Ed, 2004
8. Rubber Compounding 2E: Compounding and Testing for Performance, John Dick, Hanser Publications, 1st Ed., 2009

## List of Experiments:

1.	Identification of polymers using chemical methods
2.	Determination of molecular weight of polymer
3.	Morphology: TEM & SEM
4.	Gel permeation chromatography (GPC)
5.	Peel test of films
6.	Shear test of films
7.	Microscopy: Scanning electron microscopy (SEM), Transmission electron microscopy (TEM)
8.	Determination of Glass Transition Temperature and % Crystallinity: DSC

## Open Ended Project fields:-

Students are free to select any area of science and technology based on chemical technology applications to define Projects.

### Some suggested projects are listed below:

1. Industrial practices for product design
2. Polymeric materials characterization
3. Structure-property correlation and its effect on product design

## Course Outcomes:

1. To get a knowledge of Product Design and also about their structure & Recent Trends in Polymer & Rubber Technology.
2. To be able to apply this knowledge in Polymer & Rubber industries.
3. To build a bridge between theoretical and practical concept used in industry.

### List of Open Source Software/learning website:

1. Literature available on internet
2. Polymer & Rubber dictionaries
3. Delnet
4. Literature available under R&D in Polymer & Rubber industry.
5. Polymer & Rubber journals

**ACTIVE LEARNING ASSIGNMENTS:** Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The

faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide.