

GUJARAT TECHNOLOGICAL UNIVERSITY

RUBBER TECHNOLOGY (26) POLYURETHANE TECHNOLOGY SUBJECT CODE: 2182609 B.E. 8TH SEMESTER

Type of course: BE

Prerequisite: NA

Rationale: NA

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		ESE (V)		PA (I)		
				PA	ALA	ESE	OEP			
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1.	Introduction: The development of the Polyurethanes, The Market of the Polyurethanes	4	10
2.	Chemical and Physical-Chemical Principles of Polyurethane Chemistry: Chemical Principles, Important Building blocks for Polyurethanes, Preparation methods for Polyurethanes, Recent developments, Perceptions on the physical chemistry of the structure of Polyurethanes	6	15
3.	Raw Materials: Introduction, Polyols: Polyether & Polyester, Isocyanates, Conversation Products of Raw Materials, Additives and Auxiliary Materials, Industrial Hygiene of PU Raw Materials, Additives.	8	15
4.	Polyurethane Processing: Basics, Design Principles for Polyurethane Processing Equipments, Steps of the Polyurethane Processing like Delivery and storage of the raw materials, Preparation of components, Metering, Mixing, Pouring, Process Controls.	8	10
5.	Flexible Foams: Introduction, Slab stock Foams, Carpet Backing, Flexible Polyurethane Molded Foam, Semi-rigid Polyurethane Molded Foam.	6	10

6.	PU Rigid Foam: Introduction, Chemistry and Raw Materials, Manufacturing, Properties, Relationship between Production Methods and Properties, Applications, Consolidation of Coal and surrounding Strata.	6	10
7.	Determination of the Composition and Properties of Polyurethanes: Introduction, Determination of the Chemical Composition, Determination of Material Properties, Suitability Determination through End-Product Testing, Combustibility Testing and Rating.	8	15
8.	Polyurethane and the Environment: Introduction, Industrial Hygiene in Manufacturing and Processing, Ecology of Polyurethanes, Polyurethanes as Foodstuffs-Commodities, Flammability and Flammability Risk etc.	8	15

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
14	14	14	14	14	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

- Polyurethane Handbook By: Dr. Gunter Oertel
- Handbook of Thermoplastic Elastomer, Edited by Benjamin M. Walker
- Thermoplastic Elastomers: A Comprehensive Review, Edited by N. R. Legge, G. Holden, H. E. Schroeder
- Rubber Materials & Their Compounds, by J. A. Brydson

Course Outcome:

After learning the course the students should be able to:

- Understand the Chemical and Physical-Chemical Principles of Polyurethane.
- Know about building blocks for Polyurethanes.
- Learn about Various types of foams.
- Study about determination of the chemical composition of polyurethane foam.
- Know about ecology of polyurethanes.
- Understand about the Perceptions on the physical chemistry of the structure of Polyurethanes.
- Learn about the conversation Products of raw materials.
- Know about the combustibility testing and rating.

List of Experiments:

Tutorials/Presentation/Practicals based on above topics.

Design based Problems (DP)/Open Ended Problem:

- Hydrophilic Polyurethane Foams.
- Biomedical Applications of Polyurethane.
- Agricultural Applications of Polyurethane

List of Open Source Software/learning website:

- <http://americanurethane.com/polyurethane-properties.html>
- [http:// www.crcpress.com](http://www.crcpress.com)
- <http://www.polyurethanes.covestro.com/>

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. The best three works should submit to GTU.