GUJARAT TECHNOLOGICAL UNIVERSITY

CHEMICAL TECHNOLOGY (36)
COMPOUNDING & PROCESSING OF PLASTICS & RUBBERS-II
SUBJECT CODE: 2163606
B.E. 6th SEMESTER

Type of course: Chemical Technology

Prerequisite: **Studied** subject PR-06 (Compounding & Processing of Plastics & Rubbers- I).

Rationale: The main objective of this subject is to study the mixing of two polymers and rubbers and what is the machinery used to process them in chemical industries. This subject provides fundamental knowledge of various types of rubber & polymers and how to carry out the compounding as well as processing of rubber & polymers in chemical industries.

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)	
					PA	ALA	ESE	OEP		
4	0	3	7	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs.	% Weightage
1	**Compounding & Processing-** Rubbers. Making of compounds for products such as tires, hoses, mats & other products. Making of some common products. Processing: Rubber Mixing, Cycles time and its importance, Rubber extrusion, Rubber Calendaring, Microwave curing system, Cv curing process	13	24
2	**Blends & Alloys-** Blends of Polymers & rubbers, Compounding Polymer Blends, Fundamentals of polymer mixing, Blending methods and equipment, Type of blends: RTM DMC, SMC, and IPN. Commercial Polymer Blends.	8	16
3	**Post extrusion techniques** -Metallization, electroplating, Welding & bonding, Simple flow models for extrusion.	7	16
4	**Basic concepts of Rheology**- Viscosity of Polymers and rubbers, Power law, Melt solutions & the relevance of the same in processing & compounding.	7	14
5	**Manufacture and Characteristics Composites & Nanocomposites-** Thermoplastic and thermoset composites & nanocomposite products: Fibre reinforced composites/nanocomposites, copolymer / clay nanocomposites, latex / ZnO nanocomposites, PVC/ $CaCO_3$ nanocomposites, Rubber based composites/nanocomposite etc	8	16
6	**Applications of Composites & Nanocomposites**- Flame	7	14

	retardant textiles, Toughened plastics, Automotive bodies, Belts, Vacuum cleaners, Covers for mobile phones, Power tools.		

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
60	**10**	**10**	**10**	**10**	**00**

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

Reference Books:

1. Understanding Injection Molding Technology, Herbert Rees, Hanser Publishers, 1994.
2. Understanding Extrusion, Chris Rauwendaal, Hanser Publishers, 1998
3. Rotational Molding, Glenn L. Beau, Hanser Publishers, 1998
4. Understanding Compounding, R. H. Wildi & Maier, Hanser Publisher mc, 1998
5. Fundamentals of Polymer Processing, S. Middleman, Houghton Mifflin Company, 1997
6. Fillers & Filled Polymers, J. F. Gerard, Wiley-VCH Verlag GmbH, 2001
7. Handbook of Fillers, C. Wypych, Chem. Tech Publishing 2000
8. Handbook of Fillers & Reinforcements for Plastics, H. S. Katz & J. V. Milewski, Van
9. Rubber Compounding, Barlow, CRC Press, 2nd Ed, 1993
10. Rubber Compounding: Chemistry and Applications, Brendan Rodgers, CRC, 1st Ed, 2004
11. Introduction to Rubber Technology, Andrew Ciesielski, RAPRA Publications, 2000
12. Rubber Technology, Maurice Morton, Springer, 1st Ed, 1987

Course Outcome:

1. To get an introductory knowledge of Polymers & Rubbers Technology.
2. To know the Rapid Polymers & Rubbers concept, as well as its application
3. To be able to apply this knowledge in Polymers & Rubbers industries

List of Experiments:

1. Hot gas welding of Plastics and Rubber
2. Single screw extruder: Polymer composites
3. Single screw extruder: Polymer nanocomposites
4. Fabrication of PVC/ $CaCO_3$ nanocomposites
5. Fabrication of Rubber composites & nanocomposites
6. Single screw extruder: Polymer/Rubber blends
7. Single screw extruder: Polymer/Polymer blends
8. Mooney Viscometer- Mooney Viscosity, Mooney scarch
9. Rheometer- Test Parameter, Analysis of Rheograph
10. Determination of Viscosity of Polymer by using Ostwald Viscometer

Design based Problems (DP)/Open Ended Problem:

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. Literature survey on synthesis of new techniques in nanocomposites.
2. Lay out design of manufacturing facility of formulation of nanocomposites.
3. Product profile and its manufacturing process of nanocomposites.

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. The best three works should submit to GTU.