



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3163618

Semester – VI

Subject Name: Polymer & Rubber Processing

Type of course: Chemical Technology

Prerequisite: Student should know the basics of polymer and rubber material and its properties.

Rationale: The main objective of this subject is to provide the knowledge about the different polymer and rubber processing processes.

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)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Introduction to Polymer Compounding: Raw polymeric (Plastics and Elastomers) materials, Compounding processes such as mastication and mixing, Properties & various applications of additives. Compounding machineries & parameters – different types of mixing roll mills, internal mixers, solution mixers and extruders. Curing of rubber materials, Making of Compounds for products such as tires, hoses, mats & other products.	10
2	Extrusion: Introduction basics of extrusion process, Different types of extruders, general constructional features of single screw and twin screw extruders, machine design features eg: drives, types of screw, L/D ratio, compression ratio, flight depth, pitch, helix angle and screw clearance. Rubber extrusion	8
3	Compression Moulding: Introduction and different types of moulds, the compression moulding cycles, breathing, trouble shooting, Compression moulding of thermoplastics. advantages and drawbacks of the process	7
4	Injection moulding: Construction and specifications of Injection moulding machines. Types of Injection moulding machines, types of clamping - Toggle and hydraulic clamps, clamp force requirements. Injection moulding variables for ram and screw type machines (temp., pressure, time).	6
5	Transfer moulding: Fundamental principles of transfer moulding, Different types of transfer moulding - pot, plunger and screw transfer moulding, Transfer molds: Integral moulds and auxiliary ram moulds. Advantages over other moulding techniques.	7
6	Blow moulding: Basic Principles of machines and processes for manufacture of bottles and other hollow products by extrusion blow moulding, injection blow moulding and stretch blow moulding.	5
7	Rotational moulding: Process, different types, advantages and limitations, type of materials that can be processed and moulds used.	5
8	Thermoforming and Calendaring: General constructions of the processes and its types. Rubber Calendaring	5



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Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
25	25	05	05	05	05

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:

1. A. Brent strong , 'Plastics: Materials and processing', Prentice-Hall Englewood cliffs, 2006
2. Isayev, Injection molding and compression molding fundamentals, Marcel Dekker,2010
3. Alan Griff ,Plastics Extrusion Technology, Krieger Publishing Company,1996
4. Rosato and Rosato. Injection Moulding Hand book, Hanser Publishers,2010
5. Rosato and Rosato, Blow Moulding Hand book , Hanser Publishers,2010
6. Ed.Corish ,Concise Encyclopedia of Plastics Processing and applications, , Pergamon Press,1996
7. F W Barlow. Rubber compounding: Principles, Materials and Techniques, 2nd edition, Marcel Dekker, CRC Press, New York, 1993.
8. Ica Manas-Zloczower. Mixing and Compounding of Polymers: Theory and Practice. 3rd edition, Hanser Gardner Publications, Munich, Germany, 2012.
9. Joel Fredos, Plastics Engineering Handbook, 2nd-3rd edition, Van Nostrand Reinhold , Newyork, 1976.
10. Reginald Alfred Elden and A. D. Swan, Calendaring of plastics, Plastics Institute, 1971
11. Middleman, Fundamentals of Polymer processing ,McGraw Hill, Newyork,1977
12. D.H. Morton Jones Polymer processing, Chapman & Hall, 1989
13. Understanding Injection Molding Technology, Herbert Rees, Hanser Publishers, 1994.
14. Understanding Extrusion, Chris Rauwendaal, Hanser Publishers, 1998
15. Rotational Molding, Glenn L. Beau, Hanser Publishers, 1998
16. Understanding Compounding, R. H. Wildi & Maier, Hanser Publisher mc, 1998
17. Fundamentals of Polymer Processing, S. Middleman, Houghton Mifflin Company, 1997
18. Rubber Compounding, Barlow, CRC Press, 2nd Ed, 1993
19. Rubber Compounding: Chemistry and Applications, Brendan Rodgers, CRC, 1st Ed, 2004

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	To recognize the knowledge about the basic introduction of polymer and rubber compounding.	20
CO-2	To identify the processing of polymer and rubber materials by extrusion process.	25
CO-3	To apply this knowledge the processing of materials by getting knowledge about Compression molding and apply it with real world situation.	25
CO-4	To analyze the Injection molding processes for the polymer and rubber materials.	10
CO-5	To be able to formulate polymeric materials suitable for processed in transfer and rotational molding.	10



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CO-6	To correlate between theoretical and practical concept by making final products by performing processes such as thermoforming and calendering.	10
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List of Experiments:

1. Rubber compounding with the help of two roll mill.
2. Calculation of density of compound from the rubber compound formulation.
3. Determination of density of raw compound and cured compound.
4. To study the specification of extruder available in the lab.
5. To Perform Single screw extruder practical for polymer and rubber materials.
6. Compression Moulding of polymer and rubber materials.
7. To study the mould analysis for Compression and injection moulding processes.
8. To study the effect of Additive in Polymers and rubbers.

List of Open Source Software/learning website:

1. www.iri.net.in
2. www.ipiindia.org
3. Delnet
4. Literature available under R&D in Polymer & Rubber industry.
5. Polymer & Rubber journals
6. Polymer & Rubber dictionaries