GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3162603
Semester – VI
Subject Name: Rubber Equipment Design

Type of course: Professional Core Course

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	4	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Design of Mixing Equipments: - Mixing mill & internal mixer, Design aspects of mixing mills & internal mixers, automation controls, dispersion requirements & characteristics, Safety-human aspects, machine aspects, Mixing equipments lay-out, organization & capabilities, Capital & running costs of various systems, Design Development of the Internal Mixer, Developments in Processing.	**8**
2	Design of Calendaring Machines: Applications of calender, Types of calender, Constructional components of calender, Temp. Controls by use of cold water, hot water, steam etc, centrally & peripherical drilled rolls, control of product thickness, non-Newtonian behaviors of rubber comp. methods used for thickness control, Roll design, Calculation of roll separating force, Calculation of roll deflection, Specification of calender machine.	**7**
3	Design of Hydraulic Press: Classification of Press, Hydraulic principle, Major components, Process design & Mechanical design, part design.	**6**
4	Mould Design: Introduction, Materials for mold, Chrome Plating, Part design, Factors affecting design of mold, Properties need for Mold Design, Cavity and core design, Shrinkage, Strength of cavity ,Guide system design, Ejection System design, Sprue, Runner and Gate Design	**6**
5	Design of Extruder & Die Basic requirements for Die Design, Practical aspects of Die Design, Streamlining of Extruder Dies, Classification of Dies, Material of Construction of Die, Hot Feed Extruder, Cold feed Extruder , The Single Screw Extruder, Vented Extruders, The Multiscrew Extruder, Disk Extruders, Ram Extruders, Liner, Feed Roller, Extension Barrel, Action of the Screw, Effects of the Screw and Barrel Temperatures, Iddon High Intensity Mixing Screw, , Extruder Hardware	**7**

6	Design of Injection Molding Machine: Introduction, Classification of injection mold, Parts of Conventional injection mold, Bolster, Guide Pillar, Types of injection Unit, Variations in injection molding techniques, Machine control and Process variables, Selection of machine, Effect of injection molding machine processing variables, Other machine Controls, FIFO, FILO	**6**
7	Compression Molding Introduction, Working principal , Working Process, Molding Cycle, Fundamental of molding, Parts of molding tool, Types of Compression press, Crosslinking factors, Anisotropy, Mold release, Preforms, Thermal Consideration, Cryogenic deflashing, Overflows.	**7**
8	Transfer Molding Introduction, Working principal , Working Process, Molding Cycle, Fundamental of molding, Transfer pot, Crosslinking factors, Anisotropy, Mold release, Preforms, Thermal Consideration, Pressure consideration	**7**

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
10	**10**	**15**	**15**	**10**	**10**

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:-

- Elastomer molding technology by John G Sommer
- Rubber Processing & Production Organization. By: Philip K. Freakley
- Calendering & Extrusion Technology By: Arun V. Apte.
- Rubber Products Manufacturing Technology By: Anil K. Bhowmick
- Polymer Extrusion by Chris Rauwendaal, Paul J. Gramann, Bruce A. Davis, and Tim A. Osswald
- Injection molding of Rubber By : M. A. Wheelay

Course Outcome:

After learning this course students will be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Compare different mixing equipment	15

CO-2	Analyze constructional features, role and application of different equipment used in rubber industries.	10
CO-3	Identify and Solve process, machine and product related problems in rubber industries.	15
CO-4	Design the different parts of mold according to product.	15
CO-5	Solve the problems related molding process	15

List of Experiments:

Tutorials/Presentation/Practicals based on above topics.

Major Equipments:

Mixing Mill, Calender Machine , Vulcaniser, Semi Hydraulic Press, Extruder, different molds and dies etc.

List of Open Source Software/learning website:

- http://www.chicagorubbergroup.org/
- http://facts-inc.com/
- http://www.polydynamics.com/
- http://www.smithassoc.com/
- http://www.robinsonrubber.com/