GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3172312
Semester – VII
Subject Name: Fiber Reinforced Plastics and Composites

Type of course: Professional Core Course

Prerequisite: Thermoset materials

Rationale: The course designed here will help the students to understand the various types of molds, resins and reinforcements used in Fiber Reinforced Plastics **(**FRP). Students will be able to understand various manufacturing processes and compounding techniques used in FRP and apply this knowledge in process and material selection in designing FRP products. .

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)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**General introduction**: Introduction- Composites- Advantages of FRP –Role of resin and reinforcements -Applications of FRP. **Designing in FRP:** Selection criteria - material and process sselection	**03**
2	**Molds for FRP**: Plaster mold, wooden Mold - GRP molds- Epoxide molds, Steel molds- Aluminum alloy molds- Nickel shell molds.	**04**
3	**Polyester resins:** Introduction-polyester resins – glycols - unsaturated acids - saturated acids-monomers- inhibitors **Commercial Polyester resins resins** - Gelcoat/top coat resins- General purpose resins - Chemical resistant resins- Reduced flammability resins - Low styrene emission resins – Low shrinkage /low profile resins- Special purpose resin.	**06**
4	**Catalyst/Accelerators and Inhibitors for unsaturated polyester resins**: Curing reactions **Catalyst** -diacyl peroxides-ketone peroxides-hydro peroxides-dialkyl and diaralkyl peroxide -peroxy estersperketals. **Accelerators or promoters**-metal compounds-totality amine - accelerators-mixed metal salts-t-amine accelerators. **Inhibitors.**	**04**
5	**Epoxide Resins:** Introduction- Bisphenol A based resins- Glycidyl ester resins- Glycidyl amine resins- Glycidyl ethers of novolac resins- Brominated resins **Diluents-** Reactive diluents- Non-reactive diluents. Curing Agents for Epoxide Resins.	**04**

6	**Reinforcements:** Introduction - Surfacing tissue –Glass fiber –various forms and types, Carbon fiber- Aromatic polyamide (aramid) fibers - Polyester fibers- Polyacrylonitrile fibers – Natural fibers: Cotton – Sisal - Asbestos– Jute- Boron fibers.	**06**
7	**Molding Processes**: Introduction - Contact molding -hand layup - Spray lay-up- Vacuum bag molding - Pressure bag molding – Resin transfer or resin injection molding-pressure injection- Vacuum impregnation and injection - Hot press/matched metal molding - Filament winding- Centrifugal molding - Continuous sheet manufacture – Pultrusion - Sandwich construction.	**09**
8	**Bulk, Dough and Sheet molding Compounds and Prepregs:** Introduction- Dough and bulk molding compounds - Sheet mould compounds (SMC) - Prepregs	**03**
9	**Wood–Polymer Composites** WPC Feedstocks, Manufacture of WPC Products, Properties of WPC Products, Applications of WPC Products	**03**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	**25**	**10**	**5**	**5**	**5**

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. FRP TECHNOLOGY by Weatherhead.
2. FIBER REINFORCED COMPOSITES- Materials, Manufacturing, and Design by P.K. Mallick
3. COMPOSITES MANUFACTURING- Materials, Product, and Process Engineering by Sanjay K. Mazumdar
4. Plastics technology handbook by Manas Chanda
5. Hand book of Reinforcement for plastics – Milewski
6. M O W Richardson "Polymer Engineering Composite" – Applied Science.

Course Outcomes:

After learning the course the students should be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	List advantages, limitations, material, process selection of FRP.	10
CO-2	Discuss types of molds, catalysts and accelerators used in preparation of FRP products.	20
CO-3	Describe types of resins and reinforcements used in FRP.	25
CO-4	Explain FRP molding processes and compounding techniques.	30
CO-5	Prepare samples using FRP process.	10
CO-6	Analyze various applications of FRP and Composites.	05

List of Experiments: - As per the above syllabus topics-

Major Equipment:

List of Open Source Software/learning website:

1. **https://pslc.ws/**
2. **https://nptel.ac.in**
3. **https://www.bpf.co.uk/plastipedia/**