GOVERNMENT OF TAMILNADU

DIRECTORATE OF TECHNICAL EDUCATION,CHENNAI

STATE PROJECT COORDINATION UNIT

(Established under Canada India Institutional Cooperation Project)

CURRICULUM

Course Name	**FUNDAMENTALS OF POLYMER COMPOSITES AND APPLICATIONS**
Course Code	CHE/2020/004
Course Duration	40 Hours
Minimum Eligibility Criteria and Pre-requisites(if any)	10th Std & above
Course Objectives	The objectives of this course are: • To explore the various applications of polymer composites • To know about the function of compounding ingredients • To understand the various processing techniques • To know the relevant testing methods
Course Outcomes	On completion of training, the learner will be able to • Select a suitable polymer composite for a given application • Carry out compounding as per the customer requirement • Choose the required processing technique to fabricate the polymer composite product • Execute the necessary testing as per the application requirement • Compare and contrast of the behaviour of polymer composite with convention materials
Expected Job Roles	Polymer Composite Fabricator / Raw Material Supplier / Quality Control Technician / R & D Manager / Customer Support Executive / Technical Consultant

TEACHING AND SCHEME OF EXAMINATION						
Course Code	**Course Name**	**Hours**		**Assessment Marks**		**Duration of Examination (Hours)**
				Min	Max	
CHE/2020/004	Fundamentals of Polymer Composites and Applications	Theory	20	10	20	**3 Hours**
		Practical	20	40	80	
		Total	**40**	**50**	**100**	

CHE/2020/004- FUNDAMENTALS OF POLYMER COMPOSITES AND APPLICATIONS

DETAILED SYLLABUS

Unit No.	Modules	No. of Hours	
		Theory	Practical
I	**Introduction to Polymer Composites and Applications**	2 Hours	
1.1	Introduction to Polymer Composite - Characteristics - Merits	2	-
1.2	Various Classifications - Functional requirements of matrix ad reinforcement		
1.3	Applications of polymer composite		
II	**Matrix, Reinforcement and Compounding Ingredients**	6 Hours	
2.1	Matrix – Thermoplastic matrix – Thermoset matrix	6	-
2.2	Reinforcement - Types of fibre – Properties and application		
2.3	Particulate reinforcement – Whisker reinforcement		
2.4	Fillers – Wetting agents		
III	**Processing and Fabrication of Composite**	6 Hours	
3.1	DMC – SMC – Prepreg	6	-
3.2	Hand Lay-up Technique		
3.3	Vacuum Bag Moulding		
3.4	Filament Winding		
3.5	Compression Moulding		
3.6	Reaction Injection Moulding (RIM)		
3.7	Resin Transfer Moulding (RTM)		
3.8	Transfer Moulding		
3.9	Injection Moulding		

IV	**Mechanics and Testing of Composites**	6 Hours	
4.1	Isotropic – Anisotropic – Behaviour of laminates to mechanical force	6	-
4.2	Composite density calculation		
4.3	Gel time – Peak Exothermic Temperature (PET)		
4.4	Mechanical properties - Tensile Strength – Compression Strength – Flexural Strength – Impact Strength – Fatigue Strength		
V	**Practical Session**	20 Hours	
5.1	Gel time – Peak Exothermic Temperature (PET) of Epoxy and UPE resin	-	20
5.2	Epoxy Resin based FRP laminate by Hand lay-up technique		
5.3	UPE Resin based FRP laminate by Hand lay-up technique		
5.4	Epoxy Resin based particulate filled laminate		
5.5	UPE Resin based particulate filled laminate		
5.6	Polymer composite fabrication industry visit		
5.7	Testing Industry visit		
	Total Theory and Practical Hours	**20**	**20**
	Total Hours	**40**	

TOOLS/EQUIPMENT / CHEMICALS / GLASSWARES / CONSUMABLES REQUIREMENT

TOOLS/EQUIPMENT REQUIREMENT
(For a maximum of 30 participants)

S.NO	LIST OF TOOLS /EQUIPMENTS
1.	Tensile slab mould - 2 Nos.
2.	Porcelain Roller - 2 Nos.
3.	Laminate Cutter - 2 Nos.
4.	Digital weighing machine (upto 2 decimal point) - 1 No.
5.	Hot air oven (upto 300°C) - 1 No.
6.	SS Metal plate (20x20x5 mm) – 4 Nos.
7.	Stopwatch – 2 Nos.

CHEMICALS/GLASSWARES/CONSUMABLESREQUIREMENT

S.NO	LIST OF Chemicals/ Glassware
1.	Epoxy resin - 5 kg
2.	Unsaturated Polyester resin – 5 kg
3.	TETA Hardener – 1 kg
4.	Cobalt Napthenate / Octoate – 500 ml
5.	MEKP – 500 ml
6.	Toluene – 5 litre
7.	Acetone – 5 litre
8.	Mould spray (Silicone) – 500 ml x 4 Nos.
9.	Woven glass fibre – 5 metre
10.	Beaker (250 ml) – 5 Nos.
11.	Beaker (500 ml) – 5 Nos.
12.	Thermometer (300°C) – 3 Nos.
13.	Glass rod – 5 Nos.
14.	2” Brush – 5 Nos.
15	Waste Cloth – 1 kg

REFERENCE WEBSITES

1.https://application.wiley-vch.de/books/sample/3527326243_c01.pdf

2. https://www.elsevier.com/__data/assets/pdf_file/0011/87176/Polymer-Matrix-Composites-and-Technology_Intro_Excerpt.pdf

3. https://onlinelibrary.wiley.com/journal/15480569

4. https://www.intechopen.com

5. https://www.polymerexpert.biz

6. http://compositeslab.com

7. https://www.intertek.com/polymers/composites/test-methods

REFERENCE BOOKS

S.NO	NAME OF THE BOOK	AUTHOR	PUBLISHER
1	Composite Materials	L.Holloway	Elsevier, Amsterdam
2	Composite Materials	P.S.Sampath	B.S.Publications
3	Fibre Science & Technology	P.Ghosh	Tata McGraw Hill, New Delhi
4	Fibre Glass Reinforced Plastics	R.H.Sonneborn	Reinhold, Newyork
5	Green Polymer Composites Technology- Properties and Applications	Inamuddin	CRC Press

ASSESSMENT AND CERTIFICATION

S.No	Criteria for assessment
1.	A trainee will be assessed based on the performance in End Examination for Theory and Practical conducted internally in the Project Polytechnic College for a duration of 3 hours
2.	A trainee must have 75% of attendance to appear for End examination in Theory and Practical.
3.	The assessment for theory part will be based on the marks scored in the end examination on the knowledge bank of questions (1 word/objective type questions)
4.	The assessment for practical part will be based on the marks scored in the end examination conducted by the Project Polytechnic and assessed by the Examiners approved by Strategic Plan Implementation Committee (SPIC) of the project polytechnic.
5.	The criteria for successful completion of training is every trainee should score 50% of marks in theory and practical examination.
6.	On successful completion of training , Certificate will be issued to the participants by the Directorate of Technical Education through the Project Polytechnic.

END EXAMINATION

ALLOCATION OF MARKS

S.No	Description	Max.Marks
1.	Theory Examination	20
2.	Practical Examination	
	a)Aim	5
	b)Procedure	15
	c)Observation /Calculation	15
	d)Experiment handling	15
	e)Result	10
	f)Record	20
	Total Marks	**100**

THEORY MODEL QUESTION PAPER

CHE/2020/004- FUNDAMENTALS OF POLYMER COMPOSITES AND APPLICATIONS

(Maximum Marks: 20)

(N.B: Answer any **Twenty** questions) **20x1= 20 Marks**

1. Write any two types of Polymer Composite.
2. Write any two Polymer Composite Characteristics.
3. Write any two types of Polymer Composite Merits
4. Name any two types of Functional requirements of matrix and reinforcement.
5. Write any two applications of polymer composite.
6. Write any two materials for Thermoplastic matrix.
7. Write any two materials for Thermoset matrix.
8. Write any two Types of fibre.
9. What are the properties and application of reinforcing fibre?
10. Give the advantages of Particulate reinforcement.
11. Give the advantages of Whisker reinforcement.
12. What are Fillers?
13. What are Wetting agents?
14. What is meant by dough moulding compound.
15. What is meant by bulk moulding compound.
16. What is meant by Prepreg?
17. Write about Vacuum Bag Moulding.
18. Write about Filament Winding.
19. Write about Hand Lay-up Technique.
20. Write any two Operations in Reaction Injection Moulding.
21. Write any two Operations in Resin Transfer Moulding.
22. What is Gel time?
23. What is Peak Exothermic Temperature (PET) of Epoxy and UPE resin?
24. Write about Epoxy Resin based particulate filled laminate.
25. Write about UPE Resin based particulate filled laminate.