Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER– VII EXAMINATION – SUMMER 2026

Subject Code:2170107 Date:05-06-2026

Subject Name:Mechanics of Composite Materials

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Define composite materials and give its classification.	**03**
	(b)	Discuss the various applications of composite materials.	**04**
	(c)	Explain in detail different types of matrix and reinforcements used in composite materials.	**07**
Q.2	**(a)**	What are Prepegs? Explain.	**03**
	(b)	For an E-glass polyester sample, the following are the data for a resin burnt-off test: i. Weight of an empty crucible = 10.1528 gm. ii. Weight of crucible + sample before burnt-off = 10.5219 gm. iii. Weight of crucible + sample after burnt-off = 10.3221 gm. Calculate the fiber weight fraction, fiber volume fraction and density of the composite sample, if ρ_f = 2.50 gm/ml and ρ_m = 1.20 gm/ml.	**04**
	(c)	Determine the inplane shear modulus G_{12} of a glass/epoxy composite with properties G_{12f} = 28 GPa, G_m = 1300MPa, V_f = 0.6 using the strength of materials approach and the Halpin-Tsai relationship with ξ_2 = 1.	**07**
		OR	
	(c)	What are the type of laminates given below? 1. [±45 | ±45] 2. [30 | − 45 | − 30 | 45] 3. [± θ] 4. [0 | 90 | 0 | 90] 5. [0 | 45 | 90 | 45] 6. [20 | 45 | − 20 | − 45] 7. $[0 \mid 90]_S$	**07**
Q.3	**(a)**	Define Anisotropic, Isotropic and Orthotropic materials.	**03**
	(b)	For an orthotropic lamina, engineering constants along the principal material axis are: E_1 = 150 GPa, E_2 = 20 GPa, G_{12} = 5 GPa, ν_{12} = 0.2. Determine the reduced stiffness matrix [Q].	**04**
	(c)	Explain the various steps involved in reducing independent elastic constants of an Anisotropic material from 81 to 21.	**07**

OR

Q.3 **(a)** Explain the relationship between compliance and stiffness components. **03**

(b) Explain the role of fillers and additives in composite materials. **04**

(c) An isotropic lamina has E = 100 kN / mm^2 and ν = 0.25. Determine the reduced stiffness matrix and reduced compliance matrix. **07**

Q.4 **(a)** What are the basic assumptions of micromechanical analysis of composite materials. **03**

(b) Derive the rule of mixtures relation for major Poisson's ratio and write expression for minor Poisson's ratio. **04**

(c) Derive and explain the transverse modulus of a lamina and also plot the variation of the transverse modulus with the fiber content. **07**

OR

Q.4 **(a)** What is Poisson's mismatch effect? **03**

(b) The E-glass fibers in a polyester resin is 35% by weight. Given ρ_f = 2.50 g/ml and ρ_m = 1 g/ml. Calculate V_f and ρ_c for the lamina. **04**

(c) Derive an expression for conversion between weight and volume fractions. **07**

Q.5 **(a)** What is balanced Laminate? **03**

(b) Which terms of [A], [B] and [D] matrices are zero for the following laminates: **04**

a. $[\alpha \mid -\alpha \mid \alpha \mid -\alpha \mid \alpha]$

b. $[\alpha \mid -\alpha \mid -\alpha \mid \alpha]$

c. $[\alpha \mid -\alpha \mid \alpha \mid -\alpha]$

(c) Discuss in detail symmetric and anti-symmetric laminates. **07**

OR

Q.5 **(a)** What are the different types of laminate configurations? **03**

(b) Reduced stiffness matrix [Q] is given by, **04**

$$\begin{bmatrix} 181.8 & 2.897 & 0 \\ 2.897 & 10.34 & 0 \\ 0 & 0 & 7.17 \end{bmatrix} \text{GPa}$$

Determine E_1, E_2, G_{12} and ν_{12} of the orthotropic lamina.

(c) Derive Strain – Displacement relationship of a laminate with the help of a neat sketch. **07**

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