Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E. SEMESTER III–EXAMINATION – WINTER 2015

Subject code: 2730806 **Date: 04/12/2015**

Subject Name: Mechanics and Manufacturing of Composites

Time: 2:30 PM to 5:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	What are the important characteristics of the fibers? Discuss about boron carbide fibers.	**07**
	(b)	Describe classification of composite materials. Explain in detail various types with suitable examples	**07**
Q.2	**(a)**	Explain strength of lamina considering maximum stress-strain criteria in shear.	**07**
	(b)	Explain in detail volume and weight fractions and write a short note on derivation of transverse modulus.	**07**
		OR	
	(b)	Define "reduced" compliance and stiffness. How are Compliance and Stiffness matrix related? What is their physical significance? Write these matrices for a unidirectional lamina	**07**
Q.3	**(a)**	Explain micromechanical analysis of composite materials in general. Describe and derive volume and weight fractions for a composite material.	**07**
	(b)	Find the deflection of a thin square laminated plate of size 50 × 50 mm consisting of four layers [0/90/90/0] of equal thickness with b/h = 100 having all edges simply supported. The properties of a graphite/epoxy laminated plate are: E_{11} = 181 GPa; E_{22} = 10.30 GPa; γ_{12} = 0.28 ; G_{12} = 7.17 GPa.	**07**
		OR	
Q.3	**(a)**	Describe and derive in-plane shear modulus and Poisson's ratio for a composite material from micro-mechanical point of view in detail.	**07**
	(b)	Calculate the volume ratio of aluminium and boron composite which have the Young's modulus equal to that of iron. The Young's modulus of Al, iron and boron are 71, 210 and 440 GN/m^2 respectively.	**07**
Q.4	**(a)**	Explain the failure of unidirectional lamina under longitudinal tension.	**07**
	(b)	The stresses subjected to a unidirectional lamina are: σ_1 = 350 MPa, σ_2 = 70 MPa and σ_6 = 20 MPa, E = 100 kN/mm^2 and v = 0.25. Determine reduced stiffness, reduced compliance matrix and the strain composites.	**07**
		OR	
Q.4	**(a)**	Define anisotropic, monoclinic, orthotropic and transversely isotropic materials.	**07**
	(b)	Derive the laminate stiffness; [A], [B] and [D]. Start from in-plane forces and moments of a laminate.	**07**
Q.5	**(a)**	What is the role of shear strength and anisotropic strength in failure of composite material?	**07**
	(b)	What is hybrid composite? Give important advantage of hybrid composite over normal composite.	**07**
		OR	
Q.5	**(a)**	Derive in-plane-shear modulus and Poisson's ratio for a unidirectional composite.	**07**
	(b)	Describe following terms with sketch.	**07**

(i) Metal Matrix Composite (MMC)
(ii) Whiskers
(iii) Aligned discontinues fiber reinforced.
(iv) Laminate.
(v) Particle reinforced.

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