Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2170103 **Date: 04/05/2017**

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.**

Q.1	(a)	Write in detail classification of laminates	07
	(b)	Define constitutive equation. Describe the constitutive relationships of different kinds of materials and their independent constants.	07
Q.2	(a)	Explain micromechanics and macro mechanics. Derive longitudinal strength and stiffness	07
	(b)	Define reduced stiffness and reduced compliance matrices for a thin lamina	07
		OR	
	(b)	Discuss, justify, sketch and derive the stress-strain behavior over a laminate. Also explain the need of tailoring FRPs?	07
Q.3	(a)	Derive the strain-displacement relations of a laminate	07
	(b)	Define reduced stiffness and reduced compliance matrices for a thin lamina.	07
		OR	
Q.3	(a)	Determine Poisson's ratio υ_{xy} at an angle $\theta = 30^0$ with the fibre direction for a material with the following properties. E1 is thrice E2. E6 is half of E2 and is $\upsilon_{12} = 0.25$	07
	(b)	Describe the stress resultants and their significance along with a neat sketch and derive equilibrium equations.	07
Q.4	(a)	Derive in-plane shear modulus and transverse ratio	07
	(b)	Determine the [A], [B] and [D] matrices for a [0|45|-45|90], laminate with thickness of each ply as 0.2 mm. The material properties are E1=150 GPa, E2=10GPa, E6=5GPa and υ_{12}=0.3	07
		OR	
Q.4	(a)	A cross-ply laminate $[0\|90]_s$, made from carbon/epoxy unidirectional plies and subjected to a tensile membrane longitudinal force of Nx=130N/mm. Each ply is 0.3 mm. E1= 150 GPa, E2=11 GPa, E6=5.5GPa and υ_{12}=0.3	07
	(b)	Write a short note on [A], [B] and [D] matrices in detail.	07
Q.5	(a)	Explain in detail the advantages and disadvantages of FRPs.	07
	(b)	Describe the behavior of Young's modulus Ex, Ey and Shear modulus Es with orientation angle	07
		OR	
Q.5	(a)	Define off-axis and on-axis lamina. What is the need of transformation? What would happen if transformation is not done?	07
	(b)	Give two examples of symmetric laminate, anti-symmetric and asymmetric laminates.	07

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