Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII(OLD) • EXAMINATION – WINTER 2016

Subject Code: 170103 Date: 23/11/2016

Subject Name: Mechanics of Composite Materials

Time: 10:30 AM to 01:00 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)**	Derive the longitudinal strength and stiffness of a laminate	**07**
	(b)	Describe 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)	Determine the Poisson's ratio υ_{xy} at an angle $\theta = 20^0$ with the fibre direction for a material with the following properties: E1/E2 = 3, E6/E2=0.5 and υ_{12}=0.25	**07**
		OR	
Q.3	**(a)**	1. Determine the equivalent stress system along the material axes, for a lamina with ply angle $\theta=45^0$ if stresses along the reference axis are 220 GPa, 60 GPa and 75 GPa, in x, y and shear directions respectively. 2. Determine the strain along the material axes for a lamina with ply orientation $\theta=30^0$, if strains along the reference axes are 0.0025, 0.0018 and 0.00009 respectively in x, y and shear directions respectively.	**07**
	(b)	Describe the stress resultants and their significance along with a neat sketch and derive equilibrium equations.	**07**
Q.4	**(a)**	Write a short note on [A], [B] and [D] matrices in detail.	**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)	Prove that [B] matrix is zero for a symmetric laminate and $[A_{is}]$ is zero for a balanced laminate	**07**
Q.5	**(a)**	List down all the advantages and disadvantages of composite materials	**07**
	(b)	Derive the transverse modulus of a laminate	**07**
		OR	
Q.5	**(a)**	Derive the inplane-modulus and Possion's ratio of a laminate	**07**
	(b)	Give two examples of symmetric laminate, anti-symmetric and asymmetric laminates.	**07**

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