B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

August 2024 Supplementary Examinations

Programme: B.E.   Semester: VI

Branch: Institutional Elective   Duration: 3 hrs.

Course Code: 20CV6OEMFC   Max Marks: 100

Course: Mechanics of FRP composites

Instructions: Answer any **Five** full questions out of **six** questions.

				CO	PO	Marks
1	a)	Briefly explain FRP composites and its constituents. Write the merits and demerits of composite materials over conventional material.		CO1	PO1	**10**
	b)	How does the orientation and arrangement of fibers in a FRP Composite affect its mechanical properties? What are the different types of fiber reinforcement used in FRP composites?		CO1	PO1	**10**
2	a)	Derive an expression for Young's modulus of laminae along its longitudinal and lateral directions. Also state the assumptions made in deriving these properties.		CO1	PO1	**10**
	b)	Determine the longitudinal elastic modulus, ultimate tensile strength and major as well as minor Poisson's ratios for a glass/epoxy lamina with a 70% fiber volume fraction by using the data given below.		CO2	PO2	**10**
3	a)	Find the following for a 60° angle lamina of graphite/epoxy, if applied stresses are σx = 2 Mpa, σy = -3 MPa, τxy = 4 MPa.		CO2	PO2	**12**

For question 2 b), the data table:

Property	Glass	Epoxy
Young's Modulus	85 GPa	3.4 GPa
(σ)Ult	1550 MPa	72 MPa
ν	0.2	0.3

For question 3 a):

    i. Transformed reduced stiffness matrix $[\bar{Q}]$

    ii. Global strains

    iii. Local strains

    iv. Local stresses

Use the properties of unidirectional graphite/epoxy lamina as, longitudinal elastic modulus is 181 GPa, Transverse elastic modulus is 10.3 GPa, Major Poisson's ratio is 0.28, shear modulus 7.17 GPa.

				CO2	PO2	08
	b)	Derive the transformed reduced stiffness matrix for a lamina with arbitrary orientation (derivation of transformation matrix (T) is not required).		CO2	PO2	08
4		A four layered anti-symmetric graphite/epoxy laminate has (0/90/45/-45) scheme, each of 1mm thickness. Given E_1 = 181 GPa, E_2 = 10.3 GPa, ν_{12} = 0.28 and G_{12} = 7.17 GPa for the material combination of lamina, compute the [A], [B], and [D] matrices.		CO3	PO2	20
5		Establish the Force and Moment Resultants Related to Midplane Strains and curvatures (ABD Matrix) from the basic principles.		CO3	PO2	20
6	a)	A 30° fibre oriented lamina is subjected to the stresses, σ_x = 12MPa, σ_y = 30MPa and τ_{xy} = 3.5MPa. Check for safety of the lamina by maximum stress theory and Tsai-Hill failure theory by considering the following ultimate permissible stresses, X_T = 250MPa, Y_T = 0.5MPa, X_C = 200MPa, and Y_C = 10MPa and S = 8MPa.		CO3	PO2	10
	b)	What are the different failure theories and explain them with the relations.		CO1	PO1	10

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