U.S.N.										

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

Autonomous Institute Affiliated to VTU

July 2023 Semester End Main Examinations

Programme: B.E. **Semester: VI**
Branch: Institutional Elective **Duration: 3 hrs.**
Course Code: 20CV6OEMFC **Max Marks: 100**
Course: Mechanics of FRP composites **Date: 07.07.2023**

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

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			CO	***PO***	**Marks**
1	a)	How are composites classified? Briefly explain each type of composites with their merits and demerits.	*CO1*	*PO1*	**12**
	b)	Differentiate between micro and macro mechanics. What are the basic assumptions in determining E_{11} and E_{22} using rule of mixture?	*CO1*	*PO1*	**08**
2	a)	Derive the expressions for major poisson's ratio and rigidity modulus of a composite material.	*CO1*	*PO1*	**14**
	b)	A glass/epoxy lamina with 60% fiber volume fraction has ultimate strength of fiber and matrix 1440 MPa and 70 MPa respectively. Compute the ultimate tensile strength of composite, if Young's modulus of fiber and matrix are E_f = 82 GPa and E_m = 3.1 GPa respectively.	*CO2*	*PO2*	**06**
3	a)	Explain plane stress condition and derive the stress-strain relation for an orthotropic material under plane stress condition. Also write the number of independent elastic constants for 3D anisotropic, Monoclinic, orthotropic, transversely-isotropic and isotropic materials.	*CO1*	*PO1*	**15**
	b)	For a 60^o angle lamina of graphite/epoxy, obtain the transformed reduced stiffness matrix ($\left[\bar{Q}\right]$) if E_1 = 181 GPa, E_2 = 10.3 GPa, ν_{12} = 0.28 and G_{12} = 7.17 GPa.	*CO2*	*PO2*	**05**
4	a)	A three layered symmetric graphite/epoxy laminate has (0/90/0) scheme, each of 2mm 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.	*CO2*	*PO2*	**14**

		b)	Write the significance of [A], [B], and [D] matrices in the resultant stress-strain relation.	*CO3*	*PO2*	**06**
	5		Establish the Force and Moment Resultants Related to Midplane Strains and curvatures (ABD Matrix) from the basic principles.	*CO3*	*PO2*	**20**
	6	a)	What are the different failure theories and explain them with the relations.	*CO1*	*PO1*	**10**
		b)	A 30^o 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**

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