U.S.N.										

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

Autonomous Institute Affiliated to VTU

October 2024 Supplementary Examinations

Programme: B.E. **Semester: VI**
Branch: Institutional Elective **Duration: 3 hrs.**
Course Code: 22CV6OEMFC **Max Marks: 100**
Course: Mechanics of FRP Composites

Instructions:1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

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
			UNIT – I			
1	a)		Classify the composites based on reinforcement and matrix materials. Sketch and give an example for the classified material.	CO 1	PO1	**10**
	b)		Determine the weight and volume fractions of glass fiber and epoxy. Also find the density of the composite, using the following data: Density of glass fiber: 3.11 g/cm³ Density of epoxy: 2.3 g/cm³ Weight of composite (w_c): 3.56 gms Weight of fiber (w_f): 2.12 gms	CO 1	PO1	**10**
			UNIT – II			
2	a)		Using rule of mixtures, obtain an expression for ν_{12} (poisson's ratio) and ultimate tensile strength of a unidirectional lamina with a suitable sketch.	CO 1	PO1	**08**
	b)		Find the longitudinal elastic modulus of a unidirectional glass/epoxy lamina with a 70% fiber volume fraction. The Young's modulus of the fiber is Ef = 85 GPa, the Young's modulus of the matrix is Em = 3.4 GPa. Also, find the ratio of the load taken by the fibers to that of the composite.	CO 2	PO1	**04**
	c)		A graphite/epoxy lamina has E_1 = 181 GPa, E_2 = 10.3 GPa, ν_{12} = 0.28, and G_{12} = 7.17 GPa. Find the compliance matrix for the lamina. If this lamina is to be used as 60° angle-ply with strains limited to $\varepsilon_x = 55 \times 10^{-6}$, $\varepsilon_y = -310 \times 10^{-6}$ and $\gamma_{xy} = 530 \times 10^{-6}$, what are the maximum values of global stresses that can be applied?	CO 2	PO1	**08**
			UNIT - III			
3	a)		Find the Compliance matrix for an orthotropic graphite/epoxy lamina. The material properties are given as $E_1 = 181GPa$, $E_2 = 10.3GPa$, $E_3 = 10.3GPa$, $\nu_{12} = 0.28$, $\nu_{23} = 0.60$, $\nu_{13} = 0.27$, $G_{12} = 7.17GPa$, $G_{23} = 3.0GPa$, $G_{31} = 7.00GPa$.	CO 2	PO1	**10**

		b)	Explain the concepts of plane stress and plane strain conditions, and derive the engineering elastic constants of a two dimensional lamina under an orthotropic conditions [Q].	***CO*** 2	***PO1***	**10**
			OR			
	4	a)	For an angle lamina, show that $[R].[T].[R]^{-1} = [R]^{-T}$	***CO*** 2	***PO1***	**06**
		b)	A 45^o angle lamina of graphite/epoxy has E_1 = 181 GPa, E_2 = 10.3 GPa, ν_{12} = 0.28 and G_{12} = 7.17 GPa. Find the following: Transformed reduced stiffness matrix ($\left[\bar{Q}\right]$) and Transformed compliance matrix ($\left[\bar{S}\right]$)	***CO 2***	***PO1***	**10**
		c)	Mention the assumptions made in the Classical Laminate Theory.			**04**
			UNIT – IV			
	5	a)	Write the schematic representation of code given below i) $[0/-45_2/90/60_2]$, ii] $[0/-45]_{2s}$ iii] $[0/-45/60]_s$	***CO*** 2	***PO1***	**06**
		b)	Compute the in-plane [A] and coupled stiffness matrices [B] and[D] for a three-ply [0/90/0] graphite/epoxy laminate having each lamina of thickness 5 mm. Use properties, E_1 = 181 GPa, E_2 = 10.3 GPa, ν_{12} = 0.28, and G_{12} = 7.17 GPa for the materials.	***CO 2***	***PO1***	**10**
		c)	What is a laminate stacking sequence? Explain with an example.	***CO 1***	***PO1***	**04**
			OR			
	6		Starting with stress-strain relationship for a unidirectional lamina, derive the A, B and D matrices for an n-ply laminate.	***CO*** 2	***PO1***	**20**
			UNIT – V			
	7	a)	State maximum stress failure criterion and maximum strain failure criterion as applied to composite material. Express the governing equations for the same.	***CO*** 2	***PO1***	**10**
		b)	State and determine all the components of Tsai–Hill and Tsai–Wu Failure theories.	***CO*** 2	***PO1***	**10**

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