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: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 20AE6DCCMT **Max Marks: 100**
Course: Composite Materials **Date: 12.07.2023**

Instructions:

1. Draw figures wherever necessary.
2. Assume suitable data wherever necessary.

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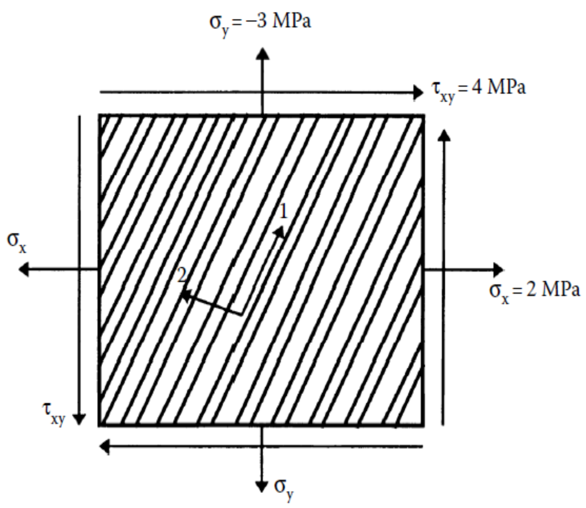
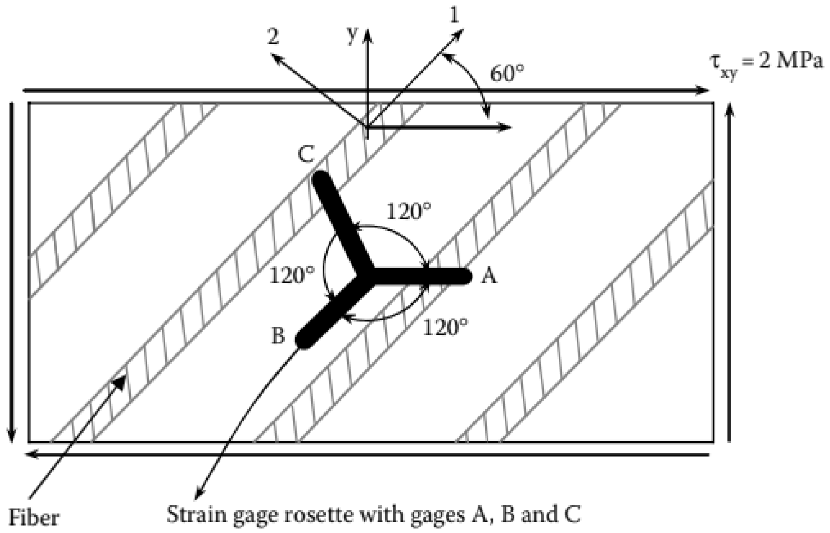
		UNIT - I	*CO*	*PO*	Marks
1	a)	Explain the classification of composite materials with examples.	*CO1*	*PO1*	**10**
	b)	Illustrate the application of composite in aerospace & also explain about the future potential of composite.	*CO1*	*PO1*	**10**
		OR			
2	a)	With a neat diagram explain about the pultrusion process along with its advantages & disadvantage.	*CO1*	*PO1*	**10**
	b)	Sketch & explain about the injection moulding process with its advantages & disadvantages.	*CO1*	*PO1*	**10**
		UNIT - II			
3	a)	Derive longitudinal young's modulus (Rule of mixture) of a unidirectional lamina.	*CO2*	*PO1* *PO2*	**08**
	b)	A composite material is made by using 10% by volume of kelvar fibre and 90% epoxy matrix. If the elastic moduli of kelvar is 130 GN/m^2 and epoxy is 4 GN/m^2, ν_f =0.2, ν_m =0.3. Calculate the following i) Young's modulus of the composite material in the fibre direction. ii) Young's modulus of the composite material in the transverse direction iii) Fraction of load carried by the fibres. iv) Major Poisson's ratio v) Minor Poisson's ratio	*CO2*	*PO1* *PO2*	**12**

			OR			
	4	a)	Show the reduction of anisotropic material stress–strain Equation to those of a monoclinic material stress–strain Equation	*CO2*	*PO1* *PO2*	**08**
		b)	Calculate the compliance and stiffness matrix for a graphite/epoxy lamina. The material properties are given as E_1 = 181MPa, E_2 = 10.3GPa, E_3 = 10.3GPa, υ_{12} = 0.28, υ_{23} =0.60, υ_{13} = 0.27, G_{12} = 7.17GPa, G_{23} = 3.0GPa, G_{31} = 7.00GPa.	*CO2*	*PO1* *PO2*	**12**
			UNIT - III			
	5	a)	Estimate the following for a 60° angle lamina of graphite/epoxy for the material shown in figure 5a. i) Transformed Compliance matrix ii) Transformed reduced stiffness matrix Take S_{11} = $0.5525*10^{-11}$ 1/Pa, S_{22} = $0.9709*10^{-10}$ 1/Pa, S_{12} = -$0.1547*10^{-11}$ 1/Pa & S_{66} = $0.1395*10^{-9}$ 1/Pa.  Figure 5a	*CO3*	*PO1* *PO2*	**10**
		b)	A 60° angle graphite/epoxy lamina is subjected only to a shear stress τ_{xy} = 2 MPa in the global axes as shown in Figure 5b. What would be the value of the strains measured by the strain gage rosette. Given, E_1 = 181 GPa, E_2 = 10.3 GPa, V_{12} = 0.28 and G_{12} = 7.17 GPa.	*CO3*	*PO1* *PO2*	**10**

			 Figure 5b			
			UNIT - IV			
	6	a)	Find the maximum value of S > 0 if a stress, σ_x = 2S, σ_y = -3S, & τ_{xy} = 4S is applied to the 60° lamina of graphite/epoxy. Use maximum stress failure theory and the properties of a unidirectional graphite/epoxy lamina using the table. E_1 = 38.6 GPa; E_2 = 8.27 GPa; G_{12} = 4.14 GPa; V_{12} = 0.26 (σ_1^T)ult = 1062 MPa, (σ_1^C)ult = 610 MPa, (σ_2^T)ult = 31 MPa, (σ_2^C)ult = 118 MPa, (τ_{12})ult = 72 MPa.	*CO4*	*PO1* *PO2*	**10**
		b)	Illustrate about the Tsai-Hill Failure theory.	*CO4*	*PO1* *PO2*	**10**
			UNIT - V			
	7	a)	Illustrate about Symmetric Laminates, Balanced Laminates & cross ply Laminates.	*CO5*	*PO1* *PO2*	**06**
		b)	Explain about the classical lamination theory.	*CO5*	*PO1* *PO2*	**06**
		c)	Derive the Strain – Displacement relations for a classical laminate.	*CO5*	*PO1* *PO2*	**08**

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