

Answer any FIVE questions

All questions carry EQUAL marks

1. a) List out the reasons, why polymers are preferred in making laminated composites.
b) Write a brief note on natural and man made composites.
c) Write a brief note on engineering applications of composites.
2. a) Derive the strain-stress relations for an orthotropic lamina in three-dimensional domain in terms of engineering constants.
b) Distinguish thermosetting plastics and thermo plastics. [8+4]
3. Compute the [A], [B], and [D] matrices for the laminate [0/90/0/90] with the following properties. Assume each lamina of thickness is 0.25mm. $E_1 = 145GPa$; $E_2 = 10.5GPa$; $G_{12} = 7.5GPa$; $\nu_{12} = 0.28$
4. a) Derive the expressions to ν_{12} , and G_{12} in terms of constituent properties using micromechanics principles.
b) Find the coefficients of thermal expansion for a 60° angle lamina of glass/epoxy whose longitudinal and transverse coefficients of thermal expansion are $8.6 \times 10^{-6} m/m/^\circ C$ and $22.1 \times 10^{-6} m/m/^\circ C$ respectively.
5. Discuss the failure mechanisms in fibre reinforced polymer matrix composites and describe a failure theory which is widely used for testing of polymer composites.
6. a) Deduce a relation between on-axis and off-axis stress transformations for a unidirectional lamina.
b) Check the failure of a unidirectional lamina with Tsai-Wu failure criterion using the following properties.
 $\sigma_1 = 800MPa$; $\sigma_2 = 300MPa$; $\sigma_{12} = 50MPa$
 $X'_{11} = 1500MPa$; $X'_{11} = -1250MPa$; $X'_{22} = 50MPa$; $X'_{22} = -200MPa$; $X'_{12} = 100MPa$
7. Derive the governing differential equations for a symmetric cross ply laminated plate.
8. Write short notes on the following:
 - a) Polymer matrix composites
 - b) Assumptions in lamination theory
 - c) Influence of coupling terms A, B and D matrices
