

Code: 9A03807

B.Tech IV Year II Semester (R09) Advanced Supplementary Examinations, July 2013

COMPOSITE MATERIALS

(Mechanical Engineering)

Time: 3 hours

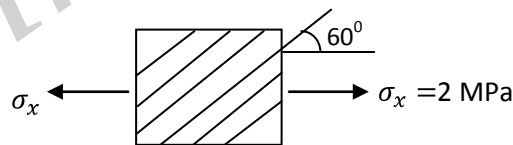
Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

- 1 (a) What is the role of matrix and reinforcement? Explain.
(b) Define a composite material. Give the complete classification of composite materials.
- 2 (a) Distinguish between thermoplastic and thermoset polymers.
(b) Explain the role and selection of fibres, in fibre reinforced composites.
- 3 Explain with the neat sketch, resin transfer mouldings.
- 4 The reduced stiffness matrix is given by:

$$\begin{bmatrix} 181.8 & 2.897 & 0 \\ 2.897 & 10.34 & 0 \\ 0 & 0 & 7.17 \end{bmatrix} \text{ GPa.}$$
Determine the engineering constants of the lamina.
- 5 An angle-ply lamina made of S-glass/epoxy has the following properties in the principal fibre directions. $F_{1T} = 1280 \text{ MPa}$, $F_{1c} = 622 \text{ MPa}$, $F_{2T} = 49 \text{ MPa}$, $F_{2c} = 245 \text{ MPa}$, $F_{12} = 69 \text{ MPa}$, $E_1 = 35 \text{ GPa}$, $E_2 = 7 \text{ GPa}$, $G_{12} = 3 \text{ GPa}$, $\nu_{12} = 0.3$. The lamina is subjected to a tensile load of 2 MPa as shown in figure below. Check the safety of the lamina by:
(i) Maximum stress theory. (ii) Maximum strain theory. (iii) Tsai-Hill theory.



- 6 (a) Derive an expression for transverse modulus ' E_2 ' of UD composite using MOM approach.
(b) Calculate ' E_2 ' of a carbon/epoxy composite with the following properties. $E_{2f} = 14.8 \text{ GPa}$, $E_m = 3.45 \text{ GPa}$, $\nu_m = 0.36$ and $V_f = 0.65$.
- 7 Compute A, B, D matrices for a $[0/\pm 45]$ laminate with the following properties. $E_1 = 145 \text{ GPa}$, $E_2 = 10.5 \text{ GPa}$, $G_{12} = 7.5 \text{ GPa}$, $\nu_{12} = 0.28$, thickness of each lamina is 0.3 mm.
- 8 (a) Discuss the phenomenon of 'Warping' in laminates.
(b) Write the applications of ceramic matrix composites. What are the advantages of CMC's over MMC's?
