

CBCS SCHEME

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17ME652

Sixth Semester B.E. Degree Examination, June/July 2023

Mechanics of Composite Materials

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- Define Composite Material. Give complete classification of composite materials. (10 Marks)
 - Discuss the application of polymer matrix composites in Aircraft, Automobile and Sports sectors. (10 Marks)

OR

- Explain with neat sketches:
 - Hand Layup Technique
 - Injection Moulding
 - Filament Winding(20 Marks)

Module-2

- Derive an expression for Longitudinal Young's modulus and Transverse Young's modulus for a unidirectional lamina by using Role of Mixture. (10 Marks)
 - Discuss with the expression the effects of
 - Volume fraction
 - Density fraction
 - Mass fraction(10 Marks)

OR

- The Glass/Epoxy lamina is developed with 70% fiber volume fraction. Determine
 - Longitudinal Young's modulus
 - Transverse Young's modulus
 - Inplane Shear modulusConsider the properties of glass fibers as $E_{\text{glass}} = 85 \text{ GPa}$, $\mu_{\text{glass}} = 0.2$, $G_{\text{glass}} = 35.42 \text{ GPa}$ and Epoxy is $E_{\text{epoxy}} = 3.4 \text{ GPa}$, $\mu_{\text{epoxy}} = 0.3$, $G_{\text{epoxy}} = 1.3 \text{ GPa}$ (10 Marks)
 - Explain the following :
 - Transverse stresses
 - Load transfer in particulate composite
 - Fiber elastic matrix plastic and Fiber elastic – matrix elastic. (10 Marks)

Module-3

- Derive the engineering constant for an angle lamina. (10 Marks)
 - An isotropic material has $E = 100 \text{ kN/mm}^2$ and $\mu = 0.25$. Determine reduced stiffness matrix and reduced compliance matrix. (10 Marks)

OR

- Write the reduced stiffness matrix and reduced compliance matrix for an isotropic lamina. (10 Marks)
 - Explain Interlaminar stress and Edge effects. (10 Marks)

Module-4

- 7 a. Write short notes on:
 i) Fiber Pullout ii) Debonding iii) Delamination in composites. (10 Marks)
 b. Explain Tensile Strength and Compressive strength of unidirectional fiber composites. (10 Marks)

OR

- 8 Explain the following :
 a. Maximum Stress Failure Theory
 b. Maximum Strain Failure Theory
 c. Tsai – Hill Failure Theory
 d. Tsai – Wu Failure Theory (20 Marks)

Module-5

- 9 Explain with representation the laminate codes for:
 a. Symmetric Laminate
 b. Angle-Ply Laminate
 c. Balanced Laminate
 d. Cross-Ply Laminate (20 Marks)

OR

- 10 a. Explain failure criterion for a laminate. (10 Marks)
 b. What are the types of laminate given below? Mention which elements of [A], [B], [D] are zero for each one of them:
 i) $[\pm 45^\circ / \pm 45^\circ]$
 ii) $[+30^\circ / -45^\circ / -30^\circ / +45^\circ]$
 iii) $[\pm \theta]$
 iv) $[0^\circ / 45^\circ / 90^\circ / -45^\circ]$ (10 Marks)
