CBCS SCHEME

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15ME652

Sixth Semester B.E. Degree Examination, June/July 2018
Mechanics of Composite Materials

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Classify the composite material based on the geometry of the reinforcement and explain briefly any two of them. **(10 Marks)**

b. List the advantages and limitations of composite material. **(06 Marks)**

OR

2 a. With the help of a neat sketch explain "Filament winding process". Mention the applications of it. **(10 Marks)**

b. Differentiate between thermosets and thermoplastics. **(06 Marks)**

Module-2

3 a. Determine the modulus of elasticity of a FRP on the fiber direction (E_1) and in the transverse direction (E_2) with proper representative sketches. (Use strength of material approach). **(12 Marks)**

b. Find the longitudinal elastic modulus of a unidirectional glass/Epoxy lamina with a 70% fiber volume fraction. Also find the ratio of the load taken by the fibers to that of the composite.
Take $E_f = 85$ GPa and $E_m = 3.4$ GPa. (Young's modulus of fiber and matrix) **(04 Marks)**

OR

4 a. Mention the assumptions made in co-efficient of thermal expansion of composite. **(04 Marks)**

b. Derive an expression for longitudinal thermal expansion co-efficient and transnsverse thermal expansion coefficient. **(12 Marks)**

Module-3

5 a. State the assumptions made in classical laminate theory. **(04 Marks)**

b. Derive [A], [B] and [D] matrices for laminate from fundamentals. **(12 Marks)**

OR

6 a. Discuss the interlaminar stresses and edge effects in laminate. **(10 Marks)**

b. What is laminate? Describe in brief. **(06 Marks)**

Module-4

7 a. Explain the following :
(i) Maximum strain criterion
(ii) Tsai – Hill criterion **(08 Marks)**

b. Find the maximum value of $S > 0$ if a stress of $\sigma_x = 2S$, $\sigma_y = -3S$, $\tau_{xy} = 4S$ is applied to the 60° lamina of graphite/epoxy. Use maximum stress failure theory. Take the properties as $(\sigma_1^T)_{ult} = 1500$ MPa, $(\sigma_1^C)_{ult} = 1500$ MPa, $(\sigma_2)_{ult}^T = 40$ MPa, $(\sigma_2^C)_{ult} = 246$ MPa, $(\tau_{12})_{ult} = 68$ MPa. **(08 Marks)**

OR

8 a. Explain the fatigue of particle and whisker reinforced composite with sketch. **(08 Marks)**

b. Explain the creep behaviour of composite. **(08 Marks)**

Module-5

9 a. Briefly describe the Symmetric laminate and Cross-ply laminate. **(08 Marks)**

b. Show that the extensional stiffness matrix for a general 'N'-ply quasi-isotropic laminate is

$$[A] = \begin{bmatrix} u_1 & u_4 & 0 \\ u_4 & u_1 & 0 \\ 0 & 0 & \frac{u_1 - u_4}{2} \end{bmatrix} h$$ **(08 Marks)**

OR

10 a. Explain the failure criteria for laminate based on failure of individual lamina in a laminate. **(10 Marks)**

b. List the optimizing and constraining factors in the design of laminated composites. **(06 Marks)**

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