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Fifth Semester B.E. Degree Examination, June/July 2024 Introduction to Composite Materials

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define composite materials. Classify them in detail. (10 Marks)
- b. List the important characteristics of composite materials and also mention the functions of fiber and matrix in a composite materials. (10 Marks)

OR

- 2 a. With a neat sketch, explain stir casting process. (10 Marks)
- b. What is the need for production of Metal Matrix Composites (MMCs) and also mention the selection procedure for MMCs. (10 Marks)

Module-2

- 3 a. With a neat sketch, explain Filament winding process. (10 Marks)
- b. With a neat sketch, explain Hand Layup process. (10 Marks)

OR

- 4 a. With a neat sketch, explain Injection moulding process. (10 Marks)
- b. With a neat sketch explain Thermoforming process. (10 Marks)

Module-3

- 5 a. Define the term rule of mixture and obtain the expression for Young's modulus for ISO strain condition using strength of material approach. (10 Marks)
- b. A Glass/Epoxy Lamina consists of 70% fiber volume fraction. Assume the density of fiber and matrix are $\rho_f = 2500 \text{ Kg/m}^3$ and $\rho_m = 1200 \text{ Kg/m}^3$ respectively. Determine :
 - i) Density of the composite
 - ii) Volume of composite lamina if the mass of lamina is 4Kg
 - iii) Mass fractions of glass and epoxy
 - iv) Volume and mass of glass and epoxy. (10 Marks)

OR

- 6 a. Determine the Global and local stresses in an angle lamina. (10 Marks)
- b. For a Graphite/Epoxy unidirectional lamina, find the following :
 - i) Compliance matrix
 - ii) Minor Poisson's ratio
 - iii) Strains in the 1-2 coordinate system if the applied stress are $\sigma_1 = 2 \text{ Mpa}$; $\sigma_2 = -3 \text{ Mpa}$; $\tau_{12} = 4 \text{ Mpa}$ [Use : $E_1 = 181 \text{ GPa}$; $E_2 = 10.3 \text{ GPa}$; $\nu_{12} = 0.28$; $G_{12} = 7.17 \text{ Gpa}$.] (10 Marks)

Module-4

- 7 Explain the following :
 - i) Tsai – Hill failure theory (10 Marks)
 - ii) Maximum stress and maximum strain failure theory. (10 Marks)

OR

- 8 a. Derive the expression for [A] [B] and [D] matrices for a laminate using fundamentals. (10 Marks)
b. Explain Tsai- Wu failure theory. (10 Marks)

Module-5

- 9 a. List the major differences between Destructive and Non-destructive testing and also explain any one NDT testing with a neat sketch. (10 Marks)
b. Explain about Tensile and hardness testing. (10 Marks)

OR

- 10 Give the applications of composite materials in the following : (20 Marks)
i) Aircrafts ii) Marine iii) Automobile iv) Sports equipments v) Missiles.

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