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18ME645/18SM642

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

Composite Materials Technology

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. What are composites? Explain the classification of composite based on reinforcement and matrix. (10 Marks)
- b. Define the following: i) Reinforcement ii) Matrix iii) Coupling agents (10 Marks)
iv) Coatings v) Fillers.

OR

- 2 a. List the different types of reinforcements. Explain any five. (10 Marks)
- b. Explain with a neat sketch different types of bonding at the interface. (10 Marks)

Module-2

- 3 a. Differentiate between thermoset and thermoplastic. (10 Marks)
- b. Explain the following methods of processing of PMC's:
i) Filament winding process
ii) Pultrusion process. (10 Marks)

OR

- 4 a. Explain with a neat sketch hand lay-up and autoclave bag moulding process. (10 Marks)
- b. Enumerate the applications of composite in the field of
i) Electronics and electricals
ii) Recreational and sports equipments
iii) Aerospace industries. (10 Marks)

Module-3

- 5 a. Explain the processing of CMC's using following methods:
i) Hot processing ii) Infiltration. (10 Marks)
- b. Explain self-propagation high temperature synthesis. (10 Marks)

OR

- 6 a. Explain with a flow chart processing of carbon-carbon composite. (10 Marks)
- b. Explain the oxide powder in the tube method for making high-temperature superconducting composite. (10 Marks)

Module-4

- 7 Explain the following:
a. Nanocomposite
b. Self-heating composite
c. Bio-composites
d. Hybrid composite. (20 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

OR

- 8 a. Explain the following characterization methods of composites:
 i) Tensile ii) Compressive iii) Flexural iv) Inter laminar shear strength. (10 Marks)
 b. Explain the following impact properties: i) Izod ii) Charpy iii) Drop-weight. (10 Marks)

Module-5

- 9 a. Derive an expression for Young's modulus of FRP composite in iso-stress condition. (10 Marks)
 b. Consider a unidirectionally reinforced glass fiber/epoxy composite. The fibers are continuous and 60% by volume. The tensile strength of glass fiber is 1GPa and the Young's modulus is 70GPa. The tensile strength of epoxy matrix is 60MPa and its Young's modulus is 3GPa. Compute the Young's modulus and the tensile strength of the composite in the longitudinal direction. (10 Marks)

OR

- 10 a. Derive relationship between engineering constants and reduced stiffness and compliances. (10 Marks)
 b. For a unidirectional glass/epoxy lamina, the constituent material properties are as follows:
 $E_f = 76\text{GPa}$, $\gamma_f = 0.2$, $G_f = 35\text{GPa}$, $E_m = 3.6\text{GPa}$, $\gamma_m = 0.3$, $G_m = 1.4\text{GPa}$.
 Consider zero void content and fiber volume fraction of 0.6.
 i) Determine the composite longitudinal modulus, transverse modulus, major Poisson's ratio and in-plane shear modulus.
 ii) Apply a longitudinal force on the lamina and determine the ratio of axial forces shared by fibers and matrix. (10 Marks)

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