



CBCS SCHEME

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18MDE332

Third Semester M.Tech. Degree Examination, Jan./Feb. 2021 Composite Material Technology

Time: 3 hrs.

Max. Marks: 100

*Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of Data Handbook is allowed.*

Module-1

- a. What are composites? Explain the classification of composites based on reinforcements and matrix. (10 Marks)
- b. Define metal matrix composites. List their merits over metals and polymer based composites. (10 Marks)

OR

- a. What is a particulate composite? With an example, explain various combinations of particulate composites. (10 Marks)
- b. For a graphite/epoxy unidirectional lamina, find the compliance and stiffness matrix (Given $E_1 = 181\text{GPa}$, $E_2 = 10.3\text{GPa}$, $E_3 = 10.3\text{GPa}$, $\gamma_{12} = 0.28$, $\gamma_{23} = 0.6$, $\gamma_{13} = 0.27$, $G_{12} = 7.17\text{GPa}$, $G_{31} = 7.00\text{GPa}$). (10 Marks)

Module-2

- a. Derive the expression for longitudinal Young's modulus of a unidirectional lamina using strength of materials approach. (10 Marks)
- b. Write the mathematical statements for maximum stress failure theory and maximum strain failure theory. (10 Marks)

OR

- a. Find the major and minor Poisson's ratio of a glass/epoxy lamina with fiber volume fraction of 70%. (Given $\gamma_f = 0.2$, $\gamma_m = 0.3$, $E_1 = 60.52\text{GPa}$, $E_2 = 10.37\text{GPa}$). (05 Marks)
- b. Find the transverse Young's modulus of a uniaxial fiber composite with matrix volume fraction of 30%. The fiber and matrix moduli are $E_f = 85\text{GPa}$ and $E_m = 3.4\text{GPa}$. (05 Marks)
- c. Starting from Hill's yield criterion for orthotropic materials, derive the Tsai-Hill failure criterion. (10 Marks)

Module-3

- Using the classical lamination theory, derive the expression for [A], [B], [B] matrices for a laminate. (20 Marks)

OR

- Write brief notes on: i) Symmetric laminates ii) Cross ply laminates iii) Angle ply laminates iv) Antisymmetric laminates v) Balanced laminates. (20 Marks)

Module-4

- Obtain the optimality conditions for a laminated composite panel using the method of Lagrange multipliers. (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. List out the components where composites are used in Aerospace and Automobile Industries. (10 Marks)
b. What are the applications of composites in Marine and sports industries? (10 Marks)

Module-5

- 9 a. What is Hand-layup technique? And what are its advantages and disadvantages? (10 Marks)
b. Explain the adhesive bonding with respect to composites. List out the merits and demerits of it. (10 Marks)

OR

- 10 a. With a rough sketch, explain radiographic inspection method of testing composites. (10 Marks)
b. How is ultrasonic inspection done for the non destructive evaluation of composites? (10 Marks)
