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18AE54

Fifth Semester B.E. Degree Examination, July/August 2022

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 a composite material and classify them in detail. (06 Marks)
- b. List the characteristics of composites material and differentiate between thermoset and thermoplastic polymers. (08 Marks)
- c. Discuss the functions of fiber and matrix in a composite material. (06 Marks)

OR

- 2 a. With a neat sketch explain stir casting technique of producing metal matrix composites. (08 Marks)
- b. Explain the selection procedure of Metal Matrix Composites (MMCS) in detail. (06 Marks)
- c. List the important characteristics of MMC's. (06 Marks)

Module-2

- 3 a. With a neat sketch illustrate autoclave process. (10 Marks)
- b. With a neat sketch outline Filament Winding Process. (10 Marks)

OR

- 4 a. With neat sketch explain injection moulding technique. (10 Marks)
- b. With neat sketch explain pultrusion technique. (10 Marks)

Module-3

- 5 a. Using rule of mixture derive the expressions for density in terms of volume fraction and mass fraction. (06 Marks)
- b. Stating the assumptions, derive the expression for Transverse Young's modulus for a unidirectional Lamina. (10 Marks)
- c. Define mass fraction and volume fraction with relevant equations. (04 Marks)

OR

- 6 a. Determine 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 Poission's ratio
 - iii) Reduced stiffness matrix
 - iv) Strains in the 1 - 2 coordinate systems.

If the stresses are $\sigma_1 = 2\text{MPa}$, $\sigma_2 = -3\text{MPa}$, $\tau_{12} = 4\text{MPa}$. Take for Graphite/epoxy $E_1 = 181\text{GPa}$, $E_2 = 10.3\text{GPa}$, $\nu_{12} = 0.28$, $G_{12} = 7.17\text{GPa}$. (10 Marks)

Module-4

- 7 a. Based on Von-Mises distortional energy theory, determine the parameters of Tsai - Hill failure criterion. (10 Marks)
- b. Explain maximum stress and maximum strain failure theory. (10 Marks)

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OR

- 8 a. State the assumptions made in classical Laminate theory. (05 Marks)
b. Using the fundamentals derive the expressions [A], [B] and [D] matrices for a Laminate. (15 Marks)

Module-5

- 9 a. Discuss the major differences between destructive and non-destructive testing. (05 Marks)
b. Explain the following :
i) Hardness test
ii) Compression test
iii) Ultrasonic A – B – C scan. (15 Marks)

OR

- 10 Applications of composite materials in :
a. Marine industry
b. Automobile industry
c. Sports equipment
d. Aerospace industry. (20 Marks)

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