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CBCS SCHEME

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18AE54

Fifth Semester B.E. Degree Examination, Feb./Mar. 2022
Introduction to Composite Materials

Time: 3 hrs. Max. Marks: 100

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

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.

Module-1

1 a. Write short note on Carbon-Carbon composites. Also write its applications. **(10 Marks)**

b. Discuss the following :
(i) Polymer Matrix Composites
(ii) Ceramic Matrix Composites
(iii) Metal Matrix Composites **(10 Marks)**

OR

2 a. Explain metal matrix composites from the Al, Mg, Ti with examples. Also write its applications. **(10 Marks)**

b. With neat sketch, explain the fabrication techniques commonly used for metal matrix composites. **(10 Marks)**

Module-2

3 a. Suggest the manufacturing process with neat sketch to produce cylindrical components. Also write its advantages and disadvantages. **(10 Marks)**

b. Explain Bag Moulding Process with its types. **(10 Marks)**

OR

4 a. With neat sketch, briefly explain about the injection molding process and write its advantages. **(10 Marks)**

b. Discuss the adhesives and cutting tools used for the composites. **(10 Marks)**

Module-3

5 a. Derive the equation for Young's modulus for isostress and isostrain conditions. **(10 Marks)**

b. Using strength of materials approach, derive the expressions for major Poisson's ratio and in plane shear modulus. **(10 Marks)**

OR

6 a. Derive the relation of Hooke's law for an anisotropic material and write its stiffness, compliance matrix. **(10 Marks)**

b. Find the compliance and stiffness matrix for a graphite / epoxy lamina. The material properties are given as

$E_1 = 181$ GPa ; $E_2 = 10.3$ GPa ; $E_3 = 10.3$ GPa
$\gamma_{12} = 0.28$; $\gamma_{23} = 0.60$; $\gamma_{13} = 0.27$
$G_{12} = 7.17$ GPa ; $G_{23} = 3.0$ GPa ; $G_{31} = 7.00$ GPa **(10 Marks)**

Module-4

7 a. Derive the Tsai-Hill Failure theory for unidirectional lamina. **(10 Marks)**

b. Write the Assumptions of Classical Plate theory and derive the expressions for it. **(10 Marks)**

OR

8 Find the three matrices [A], [B] and [D] for a three ply [0/30/-45] Graphite / Epoxy laminate as shown in Fig.Q8 below. Use the unidirectional properties of graphite/epoxy. Assume that each lamina has a thickness of 5mm.

$E_1 = 181$ GPa ; $E_2 = 10.3$ GPa ; $\gamma_{12} = 0.28$; $G_{12} = 7.17$ GPa

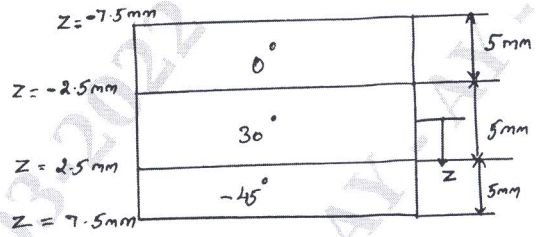

Fig.Q8 **(20 Marks)**

Module-5

9 a. Discuss the following :
(i) Shear Testing
(ii) A – B – C Scan **(10 Marks)**

b. Draw neat sketch, brief about eddy current method and Liquid Penetrant method. **(10 Marks)**

OR

10 a. Explain the use of composites in Aircraft, Space and Missiles. **(10 Marks)**

b. Briefly explain about the applications of composites in Electrical and Electronics field. **(10 Marks)**

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