CBCS Scheme

USN | | | | | | | | | | |

15AE52

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Introduction to Composite Material

Time: 3 hrs.

Max. Marks: 80

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

Module-1

1 a. Define PMC. Describe the shape of the reinforcement materials. **(06 Marks)**
   b. Write a note on following :
      i) Thermoplastic and thermosets
      ii) Carbon – carbon composites **(10 Marks)**

OR

2 a. Define MMC's. Write the type of matrix and reinforcement used their manufacture. **(08 Marks)**
   b. Explain liquid metallurgy technique used manufacturing of MMC's. **(08 Marks)**

Module-2

3 a. Describe with sketch epoxy curing cycle of PMC. **(06 Marks)**
   b. Explain with neat sketches the injection moulding and thermoforming process. **(10 Marks)**

OR

4 a. List the difficulties are faced in the machining of FRP's. Explain Cutting operation for PMC's. **(08 Marks)**
   b. Explain with neat sketch Autoclave process. **(08 Marks)**

Module-3

5 a. Evaluate E_1 by the rule of mixture. **(08 Marks)**
   b. Find E_1, E_2, V_{12} and G_{12} of a glass/epoxy lamina with 70% fiber volume fraction. The value of E_f and E_m are 85 GPa and 3.4 GPA respectively. Assume V_f and V_m are 0.2 and 0.3 respectively. **(08 Marks)**

OR

6 a. For a unidirectional lamina in a 2D plane stress state. Derive reduced stiffness matrix and express these matrix co-efficient in terms of engineering elastic constants. **(10 Marks)**
   b. Find reduced stiffness matrix for a unidirectional lamina use elastic constants $E_1 = 150$ GPa, $E_2 = 20$GPa, $V_{12} = 0.2$, $G_{12} = 5$ GPa. **(06 Marks)**

Module-4

7 a. For failure analysis of a unidirectional lamina subjected to a 2D plane stress state and expresses in equation form the maximum stress criterion, the T_{sai} – Hill criterion and the T_{sai} – Wu criterion? **(08 Marks)**
   b. Compute [A] [B] and [D] matrices for a [0/90°] laminate with the following properties thickness of each lamina is 0.125mm, $E_1 = 140$ GPa, $E_2 = 10$ GPa, $\gamma_{12} = 0.3$, $G_k = 5$ GPa. **(08 Marks)**

OR

8 a. Explain CLT and derive expression for A, B and D matrices for laminate. **(08 Marks)**

b. A tensile specimen of a unidirectional composite is prepared such that the fibers make an angle of 5° with the applied load. Determine the stress to cause failure according to

    i) The maximum stress criterion

    ii) The maximum strain criterion

The following properties may be used

$E_{11} = 76.0$ GPa, $E_{22} = 5.5$ GPa, $G_{12} = 2.35$ GPA, $V_{12} = 0.33$, $\sigma_{1T} = 1250$ Mpa, $\sigma_{2T} = 30$MPa, $\tau_{12} = 50$MPa, $\sigma_{1C} = 1000$MPA, $\sigma_{2C} = 100$MPa. **(08 Marks)**

Module-5

9 a. List the NDT methods are normally used for testing FRP. **(06 Marks)**

b. Explain following inspection and quality control methods.

    i) Hardness testing

    ii) Ultrasonic inspection **(10 Marks)**

OR

10 Write a note on application of composite materials on the following industry.

    a. Automobile

    b. Aircraft

    c. Electrical and electronics

    d. Sports. **(16 Marks**

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