

# GBCS Scheme

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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 : (10 Marks)  
i) Thermoplastic and thermosets  
ii) Carbon – carbon composites

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  $[0/90^\circ]$  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  $5^\circ$  with the applied load. Determine the stress to cause failure according to
- The maximum stress criterion
  - The maximum strain criterion

The following properties may be used

$E_{11} = 76.0 \text{ GPa}$ ,  $E_{22} = 5.5 \text{ GPa}$ ,  $G_{12} = 2.3 \text{ GPa}$ ,  $\nu_{12} = 0.33$ ,  $\sigma_{1T} = 1250 \text{ Mpa}$ ,  $\sigma_{2T} = 30 \text{ MPa}$ ,  
 $\tau_{12} = 50 \text{ MPa}$ ,  $\sigma_{1C} = 1000 \text{ MPa}$ ,  $\sigma_{2C} = 100 \text{ MPa}$ . (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.
- Hardness testing
  - Ultrasonic inspection

OR

- 10 Write a note on application of composite materials on the following industry.
- Automobile
  - Aircraft
  - Electrical and electronics
  - Sports.

(16 Marks)

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