

**FACULTY OF ENGINEERING**

B. E. 4/4 (Mech./Prod.) I-Semester (New) (Main) Examination,  
November / December 2009

Subject : **Composite Materials** (Elective – I)

Time : 3 Hours

Max. Marks: 75

**Note:** Answer all questions of Part-A and any **Five** questions from Part-B.

**Part – A (25 Marks)**

1. Give the classification of composite materials.
2. State different materials for fibers and matrices used for polymer composites.
3. Name various methods of manufacture of composite materials.
4. What are the modes of failure in fiber reinforced polymer composition.
5. State the important properties and applications of carbon-carbon composites.
6. Compare the deformation behaviour of isotropic, generally orthotropic and Orthotropic materials.
7. Give the classification of various kinds of laminates.
8. What are interlaminar stresses? How do they occur?
9. Write the equation of Tsai-Hill theory and give its importance.
10. What is coupling effect on laminate deformation behaviour?

**Part – B (50 Marks)**

11. Describe the properties of composite materials and their applications.
12. Describe the Resin Transfer Molding process. Give its applications.
13. Describe various kinds of failure criteria in evaluating the strength of the laminate.
14. Determine the inplane shear modulus  $G_{12}$  of a glass / epoxy composite with the properties.

$$G_f = 28.3 \text{ GPa} \quad G_m = 1270 \text{ MPa} \quad V_f = 0.55$$

15. Longitudinal axis of an orthotropic lamina makes an angle of  $45^\circ$  with x-axis. It is subjected to the following stresses.

$$\sigma_x = 20 \text{ MPa} \quad \sigma_y = 0 \quad \tau_{xy} = 20 \text{ MPa}$$

Calculate the stress along the longitudinal and transverse directions.

16. Obtain the A, B matrices for the laminate with 3 layers. The top and bottom layers are of 3mm thick and oriented at  $45^\circ$  to the laminate reference axis, whereas the middle layer is 6mm thick and is oriented  $0^\circ$ .

The stiffness matrices for each lamina are

$$[Q]_1 = [Q]_3 = \begin{pmatrix} 6.55 & 5.15 & 4.5 \\ 5.15 & 6.55 & 4.5 \\ 4.5 & 4.5 & 5.15 \end{pmatrix} \quad [Q]_2 = \begin{pmatrix} 20 & 0.7 & 0 \\ 0.7 & 2.0 & 0 \\ 0 & 0 & 0.7 \end{pmatrix}$$

17. Briefly describe :
- Hygro thermal stresses in laminates
  - Thermoset matrices
  - Fracture modes in composites