



Name : .....  
Roll No. : .....  
Invigilator's Signature : .....

**CS/B.TECH(ME)/SEM-8/ME-822/2012**  
**2012**  
**MECHANICS OF COMPOSITE MATERIALS**

Time Allotted : 3 Hours Full Marks : 70

*The figures in the margin indicate full marks.*  
*Candidates are required to give their answers in their own words as far as practicable.*

**GROUP – A**  
**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10
- i) Fibre reinforced plastics are used in
    - a) Automobile tyres                      b) Lenses
    - c) Aircraft                                      d) Electric switch cover.
  - ii) Wood is a natural composite consisting of which of the following ?
    - a) Lignin fibres in collagen matrix
    - b) Ligning fibres in apatite matrix
    - c) Cellulose fibres in apatite matrix
    - d) Cellulose fibres in lignin matrix.
  - iii) Which one of the following is not a ceramic ?
    - a) Alumina                                      b) Porcelain
    - c) Whisker                                      d) Pyrosil.



- iv) In case of rubber, vulcanization refers to the process of producing a
- a) linear polymer                      b) branched polymer  
 c) cross-linked polymer      d) network polymer.
- v) Kevlar 49 is an example of
- a) fibre material  
 b) matrix material  
 c) low strength composite material  
 d) high strength composite material.
- vi) Epoxy is an example of
- a) fibre                                      b) matrix  
 c) composite                              d) none of these.
- vii) The proper form of Halpin-Tsai equation is
- a)  $\frac{E_t}{E_m} = \frac{1 + \xi \eta V_f}{1 - \eta V_f}$       b)  $\frac{E_m}{E_t} = \frac{1 + \xi \eta V_f}{1 - \eta V_f}$   
 c)  $\frac{E_t}{E_m} = \frac{1 + \xi \eta V_c}{1 - \eta V_c}$       d)  $\frac{E_t}{E_m} = \frac{E_f}{\frac{E_m}{1 - \eta V_f}}$
- viii) Which of the following fibre materials are used for reinforcement in composite materials ?
- a) Glass                                      b) Boron carbide  
 c) Graphite                                  d) All of these.
- ix) Choose the correct statement regarding composite material :
- a) Material is termed as advanced composite, if fibres are directionally oriented and continuous  
 b) Reinforced fibre glass products are strong and light weight  
 c) Pearlitic steels are composite material  
 d) All of these.



- x) Cermet is the example of
- non-metallic particles in non-metallic matrix composite material
  - metallic particles in non-metallic matrix composite material
  - metallic particles in metallic matrix composite material
  - non-metallic particles in metallic matrix composite material.
- xi) The full form of FRP is
- Fibre Reinforce Plastics
  - Fibre Reinforced Polymer
  - Fully Reinforced Plastics
  - Form Reinforced Polymer.
- xii) For strength of the composite for longitudinal loading if matrix strain is higher
- fibre fails first
  - matrix fails first
  - they fail simultaneously
  - there is no such criteria.
- xiii) Under longitudinal tensile load, interface matrix shear failure will occur in unidirectional composite if
- $V_f < 0.40$
  - $0.40 < V_f < 0.65$
  - $V_f > 0.65$
  - none of these.

**GROUP – B**

**( Short Answer Type Questions )**

Answer any *three* of the following.  $3 \times 5 = 15$

- Write the detailed classification of composite materials.
- Derive the expression of transverse modulus of composite for transverse loading.
- What are the assumptions of Kirchhoff's hypothesis ? Show the stresses.
- Write a short note on Halpin and Tsai Equation.
- Mention five important general design considerations while fabricating any component with composite materials.



**GROUP – C**

**( Long Answer Type Questions )**

Answer any *three* of the following.  $3 \times 15 = 45$

7. a) Derive the expression of transport co-efficient in the longitudinal direction for major Poisson's ratio for the unidirectional composite material. 5
- b) Find the thermal conductivities of unidirectional glass fibre and carbon fibre-reinforced epoxy composite in the longitudinal and transverse directions. Fibre volume fraction is 60% in both cases. Following are the thermal conductivities for the fibre and the matrix. ( Note that the carbon fibre itself is anisotropic ).  
Epoxy matrix  $K_m = 0.25 \text{ W/m}^\circ\text{C}$   
Glass fibres  $K_f = 1.05 \text{ W/m}^\circ\text{C}$   
Carbon fibres  $(K_f)_L = 80 \text{ W/m}^\circ\text{C}$   
 $(K_f)_T = 12.5 \text{ W/m}^\circ\text{C}$ . 5
- c) Write down the speciality of composite fabrication. 5
8. What are the generally adopted procedures for manufacturing of composite materials ? Discuss three of them in detail with necessary diagrams.
9. a) What are the assumptions of Kirchhoff's hypothesis ? 2  
b) Deduce the final expression of resultant forces and moments of a laminate in matrix form and also specify the matrix elements. 9 + 4
10. Write short notes on the following : 5 + 5 + 5  
a) Pultrusion Fabrication  
b) Prepeg Moulding  
c) Layup Process.

