Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (ME)/SEM-8/ME-822/2013

2013

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 the following : 10 × 1 = 10

   i) 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.

   ii) Thermoplastics are the example of

      a) cross-linked polymer b) linear polymer

      c) branched polymer d) all of these.

   iii) In random or three dimensional fibre orientation the composite material posses

      a) isotropic property b) maximum strength

      c) maximum stiffness d) none of these.

iv) Which one is the correct statement among the followings ?

a) Modulus of *E*-glass > Modulus of *S*-glass

b) Modulus of *E*-glass < Modulus of *S*-glass

c) Modulus of *E*-glass = Modulus of *S*-glass

d) None of these.

v) The principal process parameters in curing process

a) Time b) Temperature

c) Pressure d) All of these.

vi) Cermet is the example of

a) Non-metallic particles in non-metallic matrix composite material

b) Metallic particles in non-metallic matrix composite material

c) Metallic particles in metallic composite material

d) Non-metallic particles in metallic matrix composite material.

vii) For strength of composite for longitudinal loading if matrix strain is higher

a) fibre fails first

b) matrix fails first

c) they fail simultaneously

d) there is no such criterion.

viii) Aramid polymer is also known as

a) Boron epoxy b) Kevlar-49

c) Carbon fibre epoxy d) All of these.

ix) Which one of the following is not a ceramic ?

a) Alumina b) Porcelain

c) Whisker d) Pyrosil.

x) Under longitudinal tensile load, interface matrix shear failure will occur in unidirectional composite if

a) $Vf < 0{\cdot}40$ b) $0{\cdot}40 < Vf < 0{\cdot}65$

c) $Vf > 0{\cdot}65$ d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Explain "Factors influencing longitudinal strength and stiffness".

3. Derive the expression of transverse modulus of composite for transverse loading.

4. Explain different types of failure modes of composite material with necessary sketches.

5. What do you understand by Vacuum moulding process ?

6. Write a short note on Halpin and Tsai equation.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) A burnout test was performed to determine the volume fractions of constituents in a glass-fibre reinforced epoxy composite. Following observations were made

Weight of empty curcible = 47·6504 gm

Weight of crucible and small piece of composite = 50·1817 gm

Weight of crucible and glass after burnout = 49·4476 gm.

Calculate :

i) the weight fractions and

ii) volume fractions of glass fibres and epoxy resin

iii) also find the void content in the composite material.

(Assume that $\rho_f = 2{\cdot}5$ gm/cm^3 & $\rho_m = 1{\cdot}2$ gm/cm^3)

b) Explain the complete classification of composite material. 8 + 7

8. Discuss the methods of 'Filament Winding' in detail.

9. Explain the Cox Model for micromechanics.

10. a) Derive the expression of transport co-efficient in the longitudinal direction for major Poisson's ratio for the unidirectional composite material.

b) Discuss various failure modes under various loading condition of composite materials. 5 + 10