	Utech
Name :	
Roll No.:	A Grant of Sandala and California
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

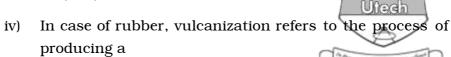
(Multiple Choice Type Questions)

1.	Choose the correct	alternatives	for any	ten of the	following:
				1	$10 \times 1 = 10$

- i) Fibre reinforced plastics are used in
 - a) Automobile tyres
- b) Lenses
- c) Aircraft
- d) Electric switch cover.
- ii) Wood is a natural composite consiting 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.

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- a) linear polymer
- branched polymer b)
- c) cross-linked polymer
- d) network polymer.
- Kevlar 49 is an example of v)
 - fibre material
 - b) matrix material
 - low strength composite material c)
 - d) high strength composite material.
- Epoxy is an example of vi)
 - fibre a)

- b) matrix
- composite
- d) none of these.
- vii) The proper form of Halpin-Tsai equation is

a)
$$\frac{E_t}{E_m} = \frac{1 + \xi \eta V_f}{1 - \eta V_f}$$

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)
$$\frac{E_t}{E_m} = \frac{1 + \xi \eta V_c}{1 - \eta V_c}$$

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?
 - Glass a)

- b) Boron carbide
- c) Graphite
- All of these. d)
- Choose the correct statement regarding composite ix) material:
 - Material is termed as advanced composite, if fibres a) are directionally oriented and continuous
 - b) Reinforced fibre glass products are strong and light weight
 - Pearlitic steels are composite material c)
 - All of these. d)



- x) 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 matrix composite material
 - d) non-metallic particles in metallic matrix composite material.
- xi) The full form of FRP is
 - a) Fibre Reinforce Plastics
 - b) Fibre Reinforced Polymer
 - c) Fully Reinforced Plastics
 - d) Form Reinforced Polymer.
- xii) For strength of the 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 criteria.
- xiii) Under longitudinal tensile load, interface matrix shear failure will occur in unidirectional composite if
 - a) $V_f < 0.40$
- b) $0.40 < V_f < 0.65$
- c) $V_f > 0.65$
- d) none of these.

GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following.

- $3 \times 5 = 15$
- 2. Write the detailed classification of composite materials.
- 3. Derive the expression of transverse modules of composite for transverse loading.
- 4. What are the assumptions of Kirchhoff's hypothesis? Show the stresses.
- 5. Write a short note on Halpin and Tsai Equation.
- 6. Mention five important general design considerations while fabricating any component with composite materials.

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(Long Answer Type Questions)

Answer any three of the following.



- 7. a) Derive the expression of transport co-efficient in the longitudinal direction for major Poisson's ratio for the unidrectional composite material.
 - b) Find the thermal conductivites 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 conductivites 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 W/m°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.

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