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**Question Paper Code: 92017**

M.E. DEGREE EXAMINATION, MAY 2014.

Elective

CAD / CAM

01PCD525 - COMPOSITE MATERIALS AND MECHANICS

(Regulation 2013)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. How composites are classified?
2. List out various natural fibers used in polymer composite.
3. Write the condition for plane stress and plane strain for 2D elasticity problems.
4. Why the residual stresses needs to be studied?
5. Explain the significance of rule of mixture.
6. List out the ASTM standards used to measure the mechanical properties of composites.
7. How to do the measurement of delamination in composite laminates?
8. Illustrate the different modes of fracture mechanics.
9. What are the fabrication methods of metal matrix composites?
10. Define the term green composites.

PART - B (5 x 14 = 70 Marks)

11. (a) (i) What are the fiber factors contribute to the mechanical performance of the composite? (10)  
(ii) Give a detailed description of the glass fiber. (4)

Or

- (b) (i) Give typical applications of polymer matrix composites (10)  
(ii) Show one process of how metal matrix composites are manufactured. (4)
12. (a) Find the compliance and stiffness matrix for a graphite/epoxy lamina. The material properties are given as:

$$E_1 = 181 \text{ GPa}, E_2 = 10.3 \text{ GPa}, E_3 = 10.3 \text{ GPa}; \nu_{12} = 0.28, \nu_{23} = 0.60, \nu_{13} = 0.27 ; \\ G_{12} = 7.17 \text{ GPa}, G_{23} = 3 \text{ GPa}, G_{13} = 7 \text{ GPa}. \quad (14)$$

Or

- (b) Explain the procedure used for finding the elastic analysis of thermal residual stresses. (14)
13. (a) (i) Prove that the  $[0/\pm 45/90]$  laminate is quasi-isotropic. (10)  
(ii) Explain the term orthotropic laminate. (4)

Or

- (b) Compute all terms of the [A], [B] and [D] matrices for a  $[0/90]$  laminate with the lamina properties.  
 $E_1 = 145 \text{ GPa}, E_2 = 10.5 \text{ GPa}, \nu_{12} = 0.28 ; G_{12} = 7.00 \text{ GPa},$  and  $t = 0.25 \text{ mm}.$  (14)
14. (a) (i) Explain Maximum stress theory and Maximum strain failure theory. (12)  
(ii) Define the term strength ratio. (2)

Or

- (b) Explain the measuring procedure of fracture toughness of composites with the aid of double cantilever beam experiment. (14)
15. (a) Explain the details of design process for the structural application of composites. (14)

Or

- (b) (i) Explain in detail about the environmental risks due to the usage of synthetic fiber reinforced polymer composites. (10)
- (ii) What are the significance of ceramic matrix composites. (4)

PART - C (1 x 10 = 10 Marks)

16. (a) Explain in detail any one of the manufacturing methods suitable for natural fiber reinforced polymer composites. (10)

Or

- (b) Explain the role of fiber reinforced composites in aerospace and automotive industries. (10)

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