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Question Paper Code: 42918

M.E. DEGREE EXAMINATION, NOVEMBER 2015

Elective

CAD / CAM

14PCD525 – COMPOSITE MATERIALS AND MECHANICS

(Regulation 2014)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

- Which of the following fiber has the maximum Modulus of Elasticity?
 - Glass fiber
 - Graphite fiber
 - Kevlar fiber
 - Banana fiber
- What is the material model of a composite material?
 - Isotropic
 - Anisotropic
 - Orthotropic
 - Quasi-isotropic
- Which type of laminate has the same fiber orientation angles in all laminas?
 - Unidirectional laminate
 - Angle-ply laminate
 - Cross-ply laminate
 - Symmetric laminate
- What is the admissible crack extension mode to form any crack?
 - Opening mode
 - Forward-shear mode
 - Parallel-shear mode
 - Sum of the three modes
- Which matrix material must be used in high temperature applications?
 - Alumina
 - Aluminium
 - Polyester
 - Epoxy

PART - B (5 x 3 = 15 Marks)

6. What is the significance of matrix in composite materials?
7. Write the stiffness matrix for monolithic and orthotropic materials.
8. List out the ASTM standards used to measure the mechanical properties of composites.
9. How to do the measurement of delamination in composite laminates?
10. What are the limitations of ceramic matrix composites?

PART - C (5 x 16 = 80 Marks)

11. (a) Classify the composite materials based on
 - (i) Matrix materials. (8)
 - (ii) Reinforcement materials and explain them briefly. (8)

Or

- (b) Explain the various tests for measuring interfacial strength of a composite. (16)
12. (a) (i) Calculate the longitudinal modulus and tensile strength of a UD composite containing 60% by volume of carbon fibers ($E_f = 294 \text{ GPa}$ and $\sigma_f = 5.6 \text{ GPa}$) in an epoxy matrix ($E_m = 3.6 \text{ GPa}$ and $\sigma_m = 105 \text{ MPa}$). What fraction of the load is carried by fibers in the composite? (8)
- (ii) An isotropic lamina has $E = 100 \text{ kN/mm}^2$ and $\nu = 0.25$. Determine the reduced stiffness matrix. (8)

Or

- (b) (i) Briefly explain about Hooke's law for anisotropic material. (10)
- (ii) Write short notes on residual stresses in composite materials. (6)
13. (a) (i) What are the assumptions to be made during analysis of laminated composite? (8)
- (ii) Write short notes on inter laminar stresses. (8)

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 $t = 0.25 \text{ mm}$. (16)

14. (a) (i) Explain maximum stress theory and maximum strain failure theory. (14)
(ii) Define the term strength ratio. (2)

Or

- (b) Write the significance of Sandwich constructions in composite applications. What are the applications of Sandwich composites? Mention its properties? (16)
15. (a) Explain the detail of design process for the structural application of composites. (16)

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. (6)
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