Code: 13A03803 R13/SS

B.Tech IV Year II Semester (R13) Regular Examinations April 2017

COMPOSITE MATERIALS

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Differentiate between an alloy and a composite.
(b) What are the advantages of composites over conventional materials?
(c) What is the difference between isotropic and anisotropic materials?
(d) State the generalized Hooke's law.
(e) What is the difference between minimum volume fraction and critical volume fraction in FRP composites?
(f) Clearly explain angle ply laminates.
(g) What is meant by off axis and on axis stiffness?
(h) Explain extension bending coupling in a FRP laminate.
(i) What is first ply failure?
(j) State the factors that inference the properties of FRP compositor.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 Classify the different types of composite materials and discuss their applications.

OR

3 Explain various reinforcement fibres used in polymer matrix composites and their relative advantages.

UNIT – II

4 With a neat sketch, explain how FRP composites are produced in RTM.

OR

5 (a) A unidirectional composite is subjected to the following stresses: Longitudinal stress σ_L = 3.0 MPa, Transverse Stress σ_T = 6.5 MPa, Shear stress (in plane) τ_{LT} = 3.5 MPa. Find normal and shear strains if E_L = 140 GPa; E_T = 3.5 GPa and G_{LT} = 4.2 GPa. $\Upsilon_{LT} = 0.4$ & $\Upsilon_{TL} = 0.1$ (Υ is poissions ratio).

(b) How the stiffness matrix is transformed from on-axis to off-axis?

UNIT – III

6 Deduce an expression for evaluating transverse stiffness using constant stress approach. Make your comments on the predicted values.

OR

7 Calculate the ratios of transverse modulus of composite to the matrix modulus for the glass epoxy and carbon epoxy composites with 10% and 50% by volume fraction. Take E_G = 70 GPa, E_C = 350 GPa; E_{epoxy} = 3.5 GPa using Halpin-Tsai equations.

UNIT – IV

8 Deduce A, B, D matrices for a laminate from the first principles.

OR

9 A three ply laminate has top and bottom layers of each 3 mm thick and oriented at 45^0 to the laminate reference axis. The thickness of the middle layer is 6 mm and oriented at 0^o. Obtain A, B, D matrices if each lamina has same properties and on-axis stiffness matrix is: $Q = \begin{bmatrix} 20 & 0.7 & 0 \\ 0.7 & 20 & 0 \\ 0 & 0 & 0.7 \end{bmatrix} GPa$

UNIT – V

10 Briefly discuss symmetric laminates, angle ply laminates and express their force and moment resultants relations with mid plane strains and curvatures.

OR

11 A $[0/\pm 60]$graphite epoxy laminate is quasi isotropic. Find and prove:

(i) $A_{11} = A_{22}$; $A_{16} = A_{26} = 0$ and $A_{66} = \frac{A_{11} - A_{12}}{2}$.

(ii) B matrix = 0.

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