Code: 15A03803

R15

B.Tech IV Year II Semester (R15) Advanced Supplementary Examinations July 2019

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) Define composite materials.
(b) Write any four applications of composite materials.
(c) How is FRP made?
(d) Write the compliance matrix for orthotropic material.
(e) Define void in composite material.
(f) What is unidirectional composite?
(g) How do composite laminates behave under load?
(h) State the assumptions made in thin plate theory.
(i) What is balanced laminate?
(j) Write the equation of Tsai-Hill theory of composite material.

PART – B

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

UNIT – I

2 (a) Discuss briefly the desirable characteristics of fiber in a fiber reinforced composites.
(b) Write a brief note on engineering applications of composites.

OR

3 List and explain the properties and applications of:
(a) Glass fibers.
(b) Carbon fibers.

UNIT – II

4 With suitable sketches, explain the following methods of manufacturing PMC's:
(a) Filament Winding.
(b) Hand Lay-Up.

OR

5 Write generalized Hooke's law in matrix form. Deduce the stiffness matrix & compliance matrix for a lamina from generalized Hook's law.

UNIT – III

6 Derive the expressions to E_{11}, E_{22}, γ_{12} and G_{12} interms of constituent properties using micromechanics principles.

OR

7 (a) Mention the assumptions made in the mechanics of material approach model to determine the four elastic moduli.
(b) Find the longitudinal elastic modulus of a unidirectional glass/epoxy lamina with a 70% fiber volume fraction. Also find the ratio of the load taken by the fibers to that of the composite. Take $E_f = 85\ GPa$, $E_m = 3.4\ GPa$.

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UNIT – IV

8 Derive the constitutive relations for a multidirectional composite in a hygrothermal environment.

OR

9 What is lamination theory? Describe with a sketch of laminate stacking sequence code.

UNIT – V

10 What is Tsai-Hill criterion? Explain.

OR

11 Check the failure of a unidirectional lamina with Tsai-Wu failure criterion using the following properties:

$\sigma_1 = 800\ MPa,\ \ \sigma_2 = 300\ MPa,\ \ \sigma_{12} = 50\ MPa$
$X_{11}^t = 1500\ MPa,\ X_{11}^C = -1250\ MPa,\ X_{22}^t = 50\ MPa$
$X_{22}^C = -200\ MPa,\ X_{12} = -100\ MPa.$

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