Code: 13A03803

R13/SS

B.Tech IV Year II Semester (R13) Advanced Supplementary Examinations July 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) Composites are tailor made materials-comment.

(b) Name different types of ceramic matrix composites.

(c) Differentiate thermoplastic and thermo setting matrix materials with examples.

(d) How vacuum assisted RTM is different from RTM?

(e) What is the difference between orthotropic and transversely isotropic?

(f) Explain monoclinic materials.

(g) Explain rule of mixtures to evaluate modulus in longitudinal direction.

(h) Explain the major difference in strength of materials approach and elasticity approach in predicting composite properties.

(i) Define the flexural modulus of a laminate.

(j) What is meant by warping of laminate?

PART - B

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

UNIT - I

2 Name and discuss common polymeric matrix materials that are using extensity in polymeric matrix composite fabrication process.

OR

3 What is the significance of metal matrix composites in engineering applications? How reinforcement of fibres is done in metal matrix composites?

UNIT - II

4 With a neat diagram, explain the fabrication of FRP composite pipes using filament winding technique.

OR

5 Discuss briefly the relations between stress and strain tensors for an anisotropic material. From that explain: (i) Specially orthotropic material. (ii) Transversely isotropic material.

UNIT - III

6 What are the various factors that influence longitudinal strength and stiffness of the composite?

OR

7 Discuss briefly the effect of fibre volume fraction on transverse strength and stiffness of the unidirectional composite.

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UNIT - IV

8 Show that for a symmetric laminate the bending extension coupling matrix is a null matrix.

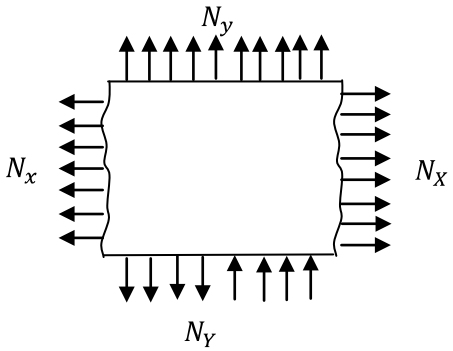
OR

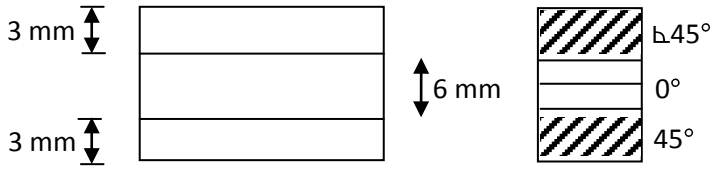
9 A three ply laminate as shown in figure below be subjected to the forces $N_x = 1000\,N/mm$, $N_y = 200\,N/mm$ and $N_{xy} = 0$. Calculate stresses and strains in the individual plies. The extensional – extension coupling matrix can be taken as

$$[A] = \begin{bmatrix} 159.3 & 35.1 & 27 \\ 35.1 & 51.3 & 27 \\ 27.0 & 27.0 & 35.1 \end{bmatrix}$$

And $[Q]$ matrix at for $0°$ fibre direction is

$$[Q] = \begin{bmatrix} 20 & 0.7 & 0 \\ 0.7 & 2.0 & 0 \\ 0 & 0 & 0.7 \end{bmatrix} GPa$$





UNIT - V

10 A 5 mm thick symmetric cross-ply laminate is constructed from 15 identical laminae having following stiffness matrix and strengths.

$$Q = \begin{bmatrix} 56 & 4.6 & 0 \\ 4.6 & 18.7 & 0 \\ 0 & 0 & 8.9 \end{bmatrix} GPa$$

$$\sigma_{LU} = 1050\,MPa$$
$$\sigma_{TU} = 28\,MPa$$
$$\tau_{LTU} = 42\,MPa$$

A uni-axial load is applied and the stacking sequence of the laminate is that nine laminae are in the load direction. Find the load at which $90°$ ply fail and load carrying capacity of the composite.

OR

11 Discuss the load-deformation behavior of a hypothetical laminate and comment on first ply failure.

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