CBCS Scheme

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16/17MST21

Second Semester M.Tech. Degree Examination, June/July 2018
Composite Materials Technology

Time: 3 hrs. Max. Marks: 80

Note: *Answer FIVE full questions, choosing one full question from each module.*

Module-1

1 a. Differentiate between Thermosets and thermoplastics. Give examples. **(05 Marks)**

b. Explain with a schematic sketch, the manufacturing of glass fiber. **(06 Marks)**

c. Discuss the classification of Metal Matrix Composites based on the type reinforcement. **(05 Marks)**

OR

2 a. For a CFRD angle Lamina shown in Fig Q2(a), Calculate the stresses and strains in local (material) axes. Take for CFRP, $E_1 = 138GPa$, $E_2 = 8.96$ GPa, $G_{12} = 7.1$ GPa, $\nu_{12} = 0.3$. **(08 Marks)**

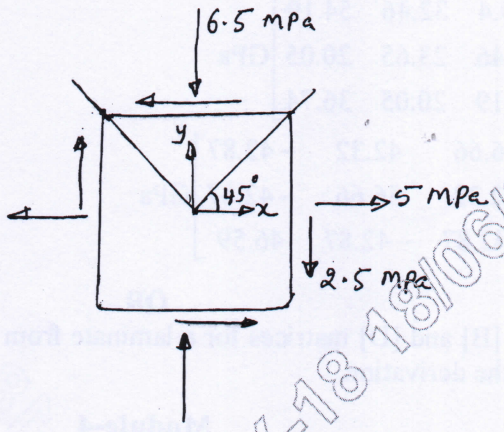

Fig Q2(a)

b. Derive compliance matrix in terms of engineering constants of an angle Lamina. **(08 Marks)**

Module-2

3 a. Derive rule of mixture for in-plane shear modulus of a Lamina. State the assumptions in the deviations. Also sketch the variation of in-plane shear module with fiber volume fraction. **(08 Marks)**

b. A unidirectional glass/epoxy lamina with a fibre volume fraction of 70% is replaced by graphite/epoxy. Lamina with the same longitudinal Young's modulus. Find the fibre-volume fraction required in the graphite/epoxy Lamina. Also compare their densities. **(08 Marks)**

Property	Glass	Graphite	Epoxy
Axial Modulus, GPa	85	230	3.4
Specific Gravity	2.5	1.8	1.2

OR

4 a. Write a note on Modified Tsai-Hill failure Theory. How it is different from Tsai-Hill Failure theory. **(06 Marks)**

b. An angle Lamina made of S-glass/epoxy has the following properties in the principal fibre direction.

$(\sigma_1^T)_{ult} = 1200\,MPA$, $(\sigma_1^C)_{ult} = 622\,MPA$

$(\sigma_2^T)_{ult} = 49\,MPA$, $(\sigma_2^C)_{ult} = 245\,MPA$

$E_1 = 35$ GPA, $E_2 = 7$ GPA, $\nu_{12} = 0.3$, $G_{12} = 3$GPa,

A tensile stress of $\sigma_x = 2$MPA is applied at an angle of 60° to the principal fibre direction. Check the safety of the Lamina as per maximum strain failure theory. **(10 Marks)**

Module-3

5 a. Explain the special cases of laminates with stiffness matrices. **(08 Marks)**

b. Find [A] and [D] stiffness matrices for a three ply [0/30/-45] graphite/epoxy laminate. Each ply has a thickness of 5mm. Take the transformed reduced stiffness matrix $[\overline{Q}]$ for each of the three plies as

$$[\overline{Q}]_0 = \begin{bmatrix} 181.8 & 2.897 & 0 \\ 2.897 & 10.35 & 0 \\ 0 & 0 & 7.17 \end{bmatrix} GPa$$

$$[\overline{Q}]_{30} = \begin{bmatrix} 109.4 & 32.46 & 54.19 \\ 32.46 & 23.65 & 20.05 \\ 54.19 & 20.05 & 36.74 \end{bmatrix} GPa$$

$$[\overline{Q}]_{-45} = \begin{bmatrix} 56.66 & 42.32 & -42.87 \\ 42.32 & 56.66 & -42.87 \\ -42.87 & -42.87 & 46.59 \end{bmatrix} GPa$$ **(08 Marks)**

OR

6 Derive [A], [B] and [D] matrices for a laminate from fundamentals. State the assumption to be made in the derivation. **(16 Marks)**

Module-4

7 Discuss the application of polymer matrix composites in (i) Aircraft (ii) Marine (iii) Automotive and (iv) Sports sectors. **(16 Marks)**

OR

8 a. Unlike metal plates, the design process of a laminated plate is indeterminate or non-deterministic Discuss. **(12 Marks)**

b. Write a brief note on pressure vessel with fiber reinforced composite wrapped around a metal linear. **(04 Marks)**

Module-5

9 Explain the following manufacturing processes with neat sketches.
(i) Filament winding (ii) Pultrusion. **(16 Marks)**

OR

10 Write short notes on

a. Types of defects and their causes **(05 Marks)**

b. Ultrasonic inspection **(06 Marks)**

c. Acoustic Emission. **(05 Marks)**