

PRN No.

PAPER CODE

V314-2115-B (EJE)

(AY:2024-25) December 2024 (ENDSEM) EXAM

TY (SEMESTER - I)

COURSE NAME: COMPOSITE MATERIALS BRANCH: MECHANICAL COURSE CODE: MEUA31205B

(PATTERN 2020)

Time: [1Hr 30 Min]

[Max. Marks: 40]

(*) Instructions to candidates:

- 1) Figures to the right indicate full marks. Use of scientific calculator is allowed
- 2) Use suitable data wherever required
- 3) All questions are compulsory. Solve any two sub question each from Questions 1 and 2
- 4) Solve any one sub question (2 marks) from Questions 3 ,4 ,5 and 6 and sub question of 4 marks is compulsory from questions 3,4,5,and 6

Q. No.	Question Description	Max. Marks	CO mapped	BT Level
Q.1	a) Differentiate between alloys and fiber reinforced composite materials.	[4]	1	2
	b) Illustrate the concept of hybrid composites and explain the types of hybrid composite materials with neat sketch.	[4]	1	2
	c) Illustrate the role of the matrix in fiber-reinforced composite materials and explain the different types of polymer matrices used.	[4]	1	2
Q2	a) Demonstrate the pultrusion process, draw neat sketch and list down examples of products that can be manufactured using this technique.	[4]	2	2
	b) Identify the different types of manufacturing processes and list the types of products produced by each process.	[4]	2	2
	c) Explain with neat sketch RTM process and its applications.	[4]	2	2
Q3	a) Specify the ASTM standard, specimen dimensions, and test speed required for conducting the following quasi-static tests on UTM: i) Tensile Test, and ii) Compression Test OR	[2]	3	2
	b) Specify the ASTM standard, specimen dimensions, and test speed required for conducting the following quasi-static tests on UTM: i) Flexural Test, and ii) In-plane shear Test	[2]	3	2
	c) Compare the 3-point bending and 4-point bending tests, and state the suitability of each for specific types of composite materials, including the reasons for their suitability.	[4]	3	2

Q4	<p>a) Obtain the expression for longitudinal Young's modulus in terms of volume fraction of fiber and matrix using strength of material approach (ROM)</p> <p style="text-align: center;">OR</p> <p>b) Obtain the expression for in-plane shear modulus in terms of volume fraction of fiber and matrix using strength of material approach (ROM)</p> <p>c) In unidirectional carbon fiber reinforced epoxy composite, carbon fiber is 50% by volume. Evaluate longitudinal modulus, tensile strength and fraction of load carried by fibers in composite? Use following constituent properties. $E_f = 275 \text{ GPa}, \sigma_f = 4.6 \text{ GPa}, E_m = 2.6 \text{ GPa}, \sigma_m = 115 \text{ MPa}$</p>	[2]	4	3
Q.5	<p>a) Identify the tensor order for stress, strain, and elastic constants, and provide a justification based on their mathematical representation.</p> <p style="text-align: center;">OR</p> <p>b) Obtain the stress-strain relationships for a specially orthotropic lamina in terms of the stiffness matrix and list the values of each coefficient.</p> <p>c) Estimate the transformed compliance matrix $[\bar{S}]$ at 40° for angle ply lamina. The reduced compliance matrix is given as</p> $[S] = \begin{bmatrix} 0.5525 \times 10^{-11} & -0.1547 \times 10^{-11} & 0 \\ -0.1547 \times 10^{-11} & 0.97 \times 10^{-10} & 0 \\ 0 & 0 & 0.1395 \times 10^{-9} \end{bmatrix} \text{ GPa}$	[2]	5	3
Q.6	<p>a) Demonstrate with suitable example how laminate code designation is applied?</p> <p style="text-align: center;">OR</p> <p>b) Apply CLT to formulate the equation for cross-ply laminate and identify which coefficients in the A, B, and D matrices will be zero, explaining their significance in the context of laminate behavior.</p> <p>c) Find [A] and [B] matrix for a three-ply $[0/90]_s$ laminate. Transformed reduced stiffness matrix for 0° and 90° are given below. Each lamina is 0.004 thick.</p> $[\bar{Q}]_0 = \begin{bmatrix} 18 & 2 & 0 \\ 2 & 10 & 0 \\ 0 & 0 & 7 \end{bmatrix} \quad [\bar{Q}]_{90} = \begin{bmatrix} 10 & 2 & 0 \\ 2 & 18 & 0 \\ 0 & 0 & 7 \end{bmatrix}$	[2]	6	3

Note: [BT Level: 1- Remember; 2-Understand; 3-Apply; 4-Analyse; 5-Evaluate; 6- Create]