

PRN No.	
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PAPER CODE	U315-2114B (RE)
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(AY:2025-26) December 2025 (ENDSEM) EXAM

TY (SEMESTER - I)

COURSE NAME: COMPOSITE MATERIALS BRANCH: MECHANICAL COURSE CODE: ME31234B

T.Y.B.Tech (PATTERN 2023)

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) List types of synthetic and natural fibers; and thermoset and thermoplastic resins. Comment on their applications.	[4]	1	2
	b) Illustrate the types, applications, advantages, and limitations of Ceramic Matrix Composites (CMC).	[4]	1	2
	c) Explain the role of matrix in fiber reinforced polymer matrix composite.	[4]	1	2
Q2	a) Differentiate between polar winding and helical winding (type of the filament winding) process, draw neat sketch and list down examples of products manufactured using filament winding 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 the different types of mandrels used in the filament winding process and discuss their importance in achieving desired product quality and manufacturing efficiency.	[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) In-plane shear 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) Compression Test & ii) Flexural shear Test	[2]	3	2
	c) Discuss with neat sketches the tensile and compression testing of composite specimens. Explain the different failure modes observed in each test, highlighting the accepted and rejected failure modes as per standard testing procedures	[4]	3	2

Q4	a) Obtain the expression for in-plane shear modulus in terms of volume fraction of fiber and matrix using strength of material approach.	[2]	4	3
	OR			
	b) Obtain the expression for density in terms of volume fraction of fiber and matrix using strength of material approach.	[2]	4	3
	c) In unidirectional carbon fiber reinforced epoxy composite, carbon fiber is 65% by volume. Estimate longitudinal modulus, tensile strength and fraction of load carried by fibers in composite? Use following constituent properties. $E_f = 295 \text{ GPa}, \sigma_f = 5.5 \text{ GPa}, E_m = 3.5 \text{ GPa}, \sigma_m = 105 \text{ MPa}$	[4]	4	3
Q.5	a) Identify the tensor order for stress, strain, and elastic constants, and provide a justification based on their mathematical representation.	[2]	5	3
	OR			
	b) Obtain the relationships for coefficients of transformed compliance matrix $[\bar{S}]$ for angle ply lamina in terms of coefficients of $[S]$ .	[2]	5	3
	c) Estimate the stiffness matrix $[Q]$ for an orthotropic lamina, engineering constants along the principal material axes are $E_1=150\text{GPa}, E_2=20\text{GPa}, G_{12}=5 \text{ GPa}, \nu_{12} =0.2$ .	[4]	5	3
Q.6	a) Formulate the laminate codes for different cases (at least two) with suitable example.	[2]	6	3
	OR			
	b) Apply CLT to formulate the equation for symmetric laminate and identify which coefficients in the A, B, and D matrices will be zero, explaining their significance in the context of laminate behavior.	[2]	6	3
	c) Evaluate matrix $[A]$ for a three-ply $[0/90]_s$ laminate . Transformed reduced stiffness matrix $[\bar{Q}]$ for $0^\circ$ and $90^\circ$ are given below. Each lamina is 0.001 thick.	[4]	6	3
	$[\bar{Q}]_0 = \begin{bmatrix} 24 & 4 & 0 \\ 4 & 15 & 0 \\ 0 & 0 & 9 \end{bmatrix} \quad [\bar{Q}]_{90} = \begin{bmatrix} 15 & 4 & 0 \\ 4 & 24 & 0 \\ 0 & 0 & 9 \end{bmatrix}$			

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