R.No. 2

Total No. of Printed Pages: 2

PRN No.	

PAPER CODE	U313-2115 B(R)

December 2023 (REEXAM)

T.Y.B.TECH (SEMESTER - I)

COURSE NAME: COMPOSITE MATERIALS **Branch: Mechanical** **COURSE CODE: MEUA31205B**

(PATTERN 2020)

Time: [2 Hrs] **[Max. Marks: 60]**

(*) Instructions to candidates:

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

Q. No.	Question Description	Max. Marks	CO mapped	BT Level
Q.1	a) Classify the Composite Materials with suitable examples	[5]	1	Understand
	b) Illustrate the role of matrix and fibers in fiber reinforced composite materials	[5]	1	Understand
	c) Discuss the applications of composite materials in various industries	[5]	1	Understand
Q.2	a) Illustrate the spray layup process of composite material manufacturing with neat sketch along with its advantages, limitations, and applications.	[5]	2	Understand
	b) Illustrate the filament winding process of composite material manufacturing with neat sketch along with its advantages, limitations, and applications.	[5]	2	Understand
	c) Describe the pultrusion process of composite material manufacturing with neat sketch along with its advantages, limitations, and applications.	[5]	2	Understand
Q.3	a) Illustrate flexural test as per ASTM standard with neat sketch with respect to ASTM standards used, specimen dimensions with sketch, failure modes and acceptable failure patterns.	[5]	3	Understand
	b) Illustrate tensile test as per ASTM standard with neat sketch with respect to ASTM standards used, specimen dimensions with sketch, failure modes and acceptable failure patterns.	[5]	3	Understand
	c) Describe compression test as per ASTM standard with neat sketch with respect to ASTM standards used, specimen dimensions with sketch, failure modes and acceptable failure patterns.	[5]	3	Understand

Q.4	a) Proove the expression $E_c = E_f V_f + E_m V_m$ for Youngs Modulus of composite laminate in terms of volume fraction and modulus of fiber and matrix based on strength of material approach (ROM).	[5]	4	Apply
	b) Estimate longitudinal modulus and tensile strength of UD composite containing 60% carbon fibers by volume in epoxy resin. Given: Modulus and strength of carbon fiber is 294 GPa and 5.6 Gpa respectively. Modulus and strength of epoxy based matrix is 3.6 Gpa and 105 Mpa respectively.	[5]	4	Apply
	c) Longitudinal modulus of glass reinforced lamina is to be doubled by substituting some of the glass fibers with kevlar fibers. The total fiber volume (kevlar+glass) remains unchanged at 0.5 Calculate volume fraction of kevlar fibers. Given E_{kevlar} = 220 Gpa , E_{glass} = 75 Gpa , E_{matrix} = 5.5 Gpa	[5]	4	Apply
Q.5	a) Formualte the stress-strain relation for two-dimensional orthotropic lamina in terms of both stiffness and compliance matrix. Also state the relations for each constant of stiffness and compliance matrix.	[5]	5	Apply
	b) Reduced stiffness matrix $[Q]$ an orthotropic lamina is given below. Determine E_1, E_2, G_{12} and ν_{12} of orthotropic lamina. $$[Q] = \begin{bmatrix} 132.00 & 5.04 & 0 \\ 5.04 & 25.19 & 0 \\ 0 & 0 & 7 \end{bmatrix} GPa$$	[5]	5	Apply
	c) For a given reduced stiffness matrix [Q] , calculate the transformed reduced stiffness matrix $[\bar{Q}]$ at 60° $$[Q] = \begin{bmatrix} 30 & 1.4 & 0 \\ 1.4 & 5 & 0 \\ 0 & 0 & 0.7 \end{bmatrix} GPa$$	[5]	5	Apply
Q.6	a) Proove the expression for the Classical Lamination Theory (CLT) and formulate the matrices A, B , C and D.	[5]	6	Apply
	b) A [+45/-45/-45/+45] symmetric laminate subjected to N_y =1 and with extensional stiffness matrix $[A]$ given as $$[A] = \begin{bmatrix} 187 & 4.34 & 0 \\ 4.34 & 101 & 0 \\ 0 & 0 & 10.7 \end{bmatrix}$$ Estimate the midplane strains.	[5]	6	Apply
	c) Determine extensional stiffness matrix [A] matrix for a three-ply $[0/\overline{90}]s$ laminate . Transformed reduced stiffness matrix $[\bar{Q}]$ for 0° and 90° are given below. Each lamina is 0.004 thick. $$[\bar{Q}]_0 = \begin{bmatrix} 18 & 2 & 0 \\ 2 & 10 & 0 \\ 0 & 0 & 7 \end{bmatrix} \qquad [\bar{Q}]_{90} = \begin{bmatrix} 10 & 2 & 0 \\ 2 & 18 & 0 \\ 0 & 0 & 7 \end{bmatrix}$$	[5]	6	Apply