Hall Ticket Number:

Code No. : 22866

VASAVI COLLEGE OF ENGINEERING *(AUTONOMOUS)*, HYDERABAD

Accredited by NAAC with A++ Grade

M.E. (Mech. Engg.) II-Semester Main Examinations, August-2023

Mechanics of Composite Materials (PE-IV)

(Advanced Design & Manufacturing)

Time: **3 hours** Max. Marks: **60**

*Note: Answer all questions from **Part-A** and any **FIVE** from **Part-B***

Part-A (10× 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	Classify the composite material based on matrix.	2	1	1	1
2.	Identify the applications of composites.	2	2	1	1
3.	List the number of Independent elastic constants in matrix form to indicate the stress strain relationship in an orthotropic material.	2	1	2	2
4.	Write the Hapin and Tsai semi empirical relationship for the evaluation of E_2.	2	1	2	3
5.	An isotropic lamina has E=100KN/mm^2 and poissons ratio μ =0.25. Calculate shear modulus G of the material.	2	3	3	2
6.	Write the transformation matrix [T] for the transformation of stress in off - axis system.	2	1	3	1
7.	List the Failure theories in the analysis of lamina.	2	1	4	1
8.	Define maximum stress theory of a lamina.	2	2	4	1
9.	List the different types of stress acting on a thin cyilindrical shell subjected to internal pressure ' p'.	2	1	5	1
10.	Sketch the bending of composite plates subjected to bending perpendicular to the plane.	2	1	5	2
	Part-B (5×8 = 40 Marks)				
11. a)	Describe the properties of metal matrix composites with their applications.	4	2	1	1
b)	Discuss briefly the following types of Fibre reinforced polymer matrix composites (i) Glass fibre (ii) carbon fibre based on their properties and applications.	4	2	1	1
12. a)	Derive the expression for finding Longitudinal modulusE_1, for a unidirectional lamina subjected to Longitudinal stress.	4	4	2	4
b)	Calculate the Longitudinal modulus E_1 of a unidirectional composite containing 60 percent by volume of carbon fibres ($E_{1f} = 294\ Gpa$ and $\sigma_{1fu} = 5.6Gpa$) in a toughened epoxy matrix ($E_m = 3.6\ Gpa$ and $\sigma_{mu} = 105Mpa$).	4	3	2	3

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13. a)	Explain the stress strain relations of a thin lamina and derive the expression for the relationship between stress and strain in terms of reduced stiffness matrix $[Q]_{1,2}$.	4	2	3	2
b)	For an orthotropic lamina , engineering constants along the principal material axes are E_1=150 Gpa, E_2= 20 GPa, v_{12}=0.2. Determine the reduced stiffness matrix.	4	3	3	4
14. a)	Explain briefly the Tsai - Hill failure theory of a unidirectional lamina for a 2 Dimensional problem.	5	3	4	2
b)	Describe the Longitudinal Tensile strength of a unidirectional fibre composite.	3	2	4	1
15. a)	Explain the assumptions in the Levy and Navier solutions for plates of composite material.	4	1	5	3
b)	Discuss in brief the procedure involved in the analysis of a composite cylindrical shell under axially symmetric loads.	4	3	5	4
16. a)	Discuss the functions of Matrix material and Reinforcing phase in a composite material.	4	2	1	2
b)	Derive the expression for finding poisons ratio v_{12} for inplane loading of a composite subjected to longitudinal stress.	4	3	2	4
17.	Answer any ***two*** of the following:				
a)	Determine the equivalent stress system along the material axis 1-2 for a lamina with ply angle $\theta = 45^0$ if stresses along the reference axis are $\sigma_x = 200Gpa$, $\sigma_y = 50Gpa$, $\sigma_s = 70Gpa$. m=$\cos 45^0 = 0.707$, n= $\sin 45^0$=0.707.	4	4	3	3
b)	Explain the maximum strain theory of a composite subjected to in plane loading.	4	2	4	2
c)	Discuss the plate equilibrium equations.	4	2	5	2

M : Marks; L: Bloom's Taxonomy Level; CO; Course Outcome; PO: Programme Outcome

i)	Blooms Taxonomy Level – 1	23.6%
ii)	Blooms Taxonomy Level – 2	40%
iii)	Blooms Taxonomy Level – 3 & 4	36.4%

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