

<b>Reg. No.</b>																			
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<b>Question Paper Code</b>	<b>13990</b>
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**M.E. / M.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025**

Third Semester

**M.E. - CAD/CAM**

**24PCDEL316 - MECHANICS OF COMPOSITES AND SMART MATERIALS**

Regulations - 2024

Duration: 3 Hours

Max. Marks: 100

**PART - A (MCQ) (10 × 1 = 10 Marks)**

Answer ALL Questions

	<i>Marks</i>	<i>K- Level</i>	<i>CO</i>
1. The main objective of using composites is to: (a) Increase weight (b) Improve mechanical properties (c) Reduce stiffness (d) Increase corrosion	1	K1	CO1
2. The process suitable for continuous fibre-reinforced composites is: (a) Pultrusion (b) Hand lay-up (c) Compression moulding (d) Blow moulding	1	K1	CO1
3. Which law relates stress and strain in the elastic region? (a) Pascal's law (b) Newton's law (c) Hooke's law (d) Poisson's law	1	K1	CO2
4. _____ are the principal directions in an orthotropic lamina? (a) 0°, 45°, 90° (b) x, y, z directions (c) Random (d) Circumferential	1	K2	CO2
5. The stiffness matrix [Q] in lamina analysis is used to relate: (a) Stress and strain (b) Force and displacement (c) Stress and displacement (d) None	1	K1	CO3
6. Interlaminar stresses mainly occur _____ (a) Along fibre direction (b) At laminate interfaces (c) In matrix alone (d) None	1	K2	CO3
7. Crack propagation rate is governed by _____ (a) Young's modulus (b) Stress intensity factor (c) Poisson's ratio (d) Fibre volume fraction	1	K2	CO4
8. Smart materials respond to: (a) Environmental stimuli (b) Static loads (c) Constant temperature only (d) None	1	K1	CO4
9. Shape-memory effect is reversible under: (a) Heating and cooling cycles (b) Magnetic field (c) Pressure variation (d) Mechanical loading	1	K1	CO5
10. The term piezoelectricity refers to generation of: (a) Electric charge due to mechanical stress (b) Magnetism due to stress (c) Heat due to strain (d) Sound due to vibration	1	K1	CO5

**PART - B (12 × 2 = 24 Marks)**

Answer ALL Questions

11. List the four main types of materials used in design.	2	K1	CO1
12. Define matrix and its function.	2	K1	CO1
13. List two important applications of composites.	2	K1	CO1
14. Define elastic modulus and Poisson's ratio.	2	K1	CO2
15. What are orthotropic materials?	2	K1	CO2
16. Differentiate between lamina and laminate.	2	K2	CO3
17. Define interlaminar stress.	2	K1	CO3
18. List two toughening mechanisms in composites.	2	K1	CO4
19. Define fatigue life.	2	K1	CO4
20. Differentiate bonded and bolted joints.	2	K2	CO5
21. Define smart material.	2	K1	CO5

22. Name two examples of shape-memory alloys. 2 K1 CO5

**PART - C (6 × 11 = 66 Marks)**

Answer ALL Questions

23. a) Explain open and closed mould processes used for the manufacture of composite components. 11 K2 CO1

**OR**

b) Differentiate MMC and CMC processing techniques with suitable examples. 11 K2 CO1

24. a) Derive expressions for strength of unidirectional lamina and discuss the assumptions made. 11 K3 CO2

**OR**

b) Build the engineering constants for orthotropic materials and their significance. 11 K3 CO2

25. a) Derive the laminate stiffness matrix and explain its importance. 11 K3 CO3

**OR**

b) Choose types of laminates and their mechanical response under loading. 11 K3 CO3

26. a) Explain fracture initiation and crack growth modes in composite materials. 11 K2 CO4

**OR**

b) Explain fatigue behaviour and environmental effects on composites. 11 K2 CO4

27. a) Compare the characteristics of piezoelectric and magnetostrictive materials. 11 K2 CO5

**OR**

b) Explain the applications of smart materials in aerospace and biomedical fields. 11 K2 CO5

28. a) Outline on toughening mechanisms **and** failure modes in composites. 11 K2 CO4

**OR**

b) Compare composite materials in terms of fatigue life and other mechanical properties. 11 K2 CO4