Reg. No.																

Question Paper Code	13229

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024

Seventh Semester

Mechanical Engineering

20MEEL712 - COMPOSITE MATERIALS AND MECHANICS

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (20 × 1 = 20 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Which fiber has the best strength-to-weight ratio? (a) Glass fiber (b) Carbon fiber (c) Boron fiber (d) Ceramic fiber	1	K1	CO1
2.	Which industry primarily uses composites for thermal shields? (a) Marine (b) Automotive (c) Space (d) Sporting Goods	1	K1	CO1
3.	What process is used to fabricate carbon fibers? (a) Melting and spinning (b) Pyrolysis and carbonization (c) Electroplating (d) Molding	1	K1	CO1
4.	What is the primary advantage of thermoplastic matrix composites? (a) High-temperature resistance (b) Recyclability (c) Low strength (d) Cost-effectiveness	1	K1	CO2
5.	What process involves injecting resin into a closed mold with dry fibers? (a) Pultrusion (b) Spray-up (c) Resin Transfer Molding (d) Filament winding	1	K1	CO2
6.	What is the main reinforcement in polymer nano composites? (a) Carbon fibers (b) Nanometer-scale particles (c) Glass fibers (d) Boron fibers	1	K1	CO2
7.	What is the primary benefit of titanium-based MMCs? (a) Low strength (b) Excellent corrosion resistance (c) High density (d) Poor thermal stability	1	K1	CO3
8.	What is the primary advantage of magnesium-based MMCs? (a) Lightweight (b) High strength (c)Thermal stability (d) High corrosion resistance	1	K1	CO3
9.	What is the main reinforcement material in metal matrix nanocomposites? (a) Carbon fibers (b) Nanotubes or nano-oxides (c) Glass fibers (d) Ceramic whiskers	1	K1	CO3
10.	What type of sintering involves a liquid phase to aid densification? (a) Solid-state sintering (b) Liquid phase sintering (c) Chemical vapor impregnation (d) Hydrothermal synthesis	1	K1	CO4
11.	What is the main reinforcement in carbon-carbon composites? (a) Ceramic fibers (b) Glass fibers (c) Carbon fibers (d) Metallic whiskers	1	K1	CO4
12.	What property is critical for CMCs in high-temperature environments? (a) Low weight (b) Wear resistance (c) Thermal stability (d) Electrical conductivity	1	K1	CO4
13.	What does the β-matrix in laminated constitutive equations represent? (a) Extensional stiffness (b) Bending stiffness (c) Coupling stiffness (d) Shear stiffness	1	K1	CO5
14.	What is the property of quasi-isotropic laminates? (a) Isotropic behavior in-plane (b) No coupling between bending and extension (c) High out-of-plane stiffness (d) Zero shear stiffness	1	K1	CO5
15.	What is the stress resultant per unit width? (a) Strain field (b) Force per unit area (c) Force per unit width (d) Moment per unit width	1	K1	CO5
16.	Which test provides stiffness data for laminates? (a) Tension test (b) Laminate bending test (c) Shear test (d) Composite impact test	1	K1	CO5
17.	What property makes ceramic matrix composites suitable for high-temperature environments? (a) Electrical conductivity (b) Thermal insulation (c) High corrosion resistance (d) Thermal stability	1	K1	CO6

18.	Which composite material is commonly used in aerospace fuselages? (a) Polymer matrix composites (b) Ceramic matrix composites (c) Metal matrix composites (d) Natural composites	*1*	*K1*	*CO6*
19.	Which process uses resin impregnation followed by pyrolysis for C-C composites? (a) Hot pressing (b) Liquid impregnation (c) CVI (d) Calendaring	*1*	*K1*	*CO6*
20.	What is the main advantage of ceramic matrix nanocomposites? (a) Low cost (b) Enhanced toughness (c) Simple fabrication (d) High electrical conductivity	*1*	*K1*	*CO6*

PART - B (10 × 2 = 20 Marks)

Answer ALL Questions

21.	Why are composite materials needed in the aerospace industry?	*2*	*K1*	*CO1*
22.	List two characteristics of composite materials that make them suitable for military applications.	*2*	*K1*	*CO1*
23.	Define resin transfer molding in polymer matrix composites.	*2*	*K1*	*CO2*
24.	State the mechanical properties enhanced in polymer matrix composites compared to traditional materials.	*2*	*K1*	*CO2*
25.	Briefly explain the solid-state processing technique for MMCs.	*2*	*K1*	*CO3*
26.	Define diffusion bonding in the context of metal matrix composites.	*2*	*K1*	*CO3*
27.	List four physical methods used in the processing of CMCs.	*2*	*K1*	*CO4*
28.	State the mechanical properties of ceramic matrix composites.	*2*	*K1*	*CO4*
29.	State the basic assumption of laminated anisotropic plates.	*2*	*K1*	*CO5*
30.	Define quasi-isotropic laminates in mechanics of composites.	*2*	*K1*	*CO6*

PART - C (6 × 10 = 60 Marks)

Answer ALL Questions

31.	a)	Explain the physical and chemical properties of various plant fibers.	*10*	*K2*	*CO1*
		OR			
	b)	Explain the classification of polymers with suitable industrial applications.	*10*	*K2*	*CO1*
32.	a)	Explain the compression moulding composite fabrication process with appropriate sketches.	*10*	*K2*	*CO2*
		OR			
	b)	Explain the resin transfer moulding process with suitable industrial applications.	*10*	*K2*	*CO2*
33.	a)	Describe about processing techniques of MMCs with neat sketches.	*10*	*K3*	*CO3*
		OR			
	b)	Describe various metal matrix Nanocomposites with suitable applications.	*10*	*K3*	*CO3*
34.	a)	Explain about mechanical properties and applications of CMCs.	*10*	*K2*	*CO4*
		OR			
	b)	Discuss about processing of carbon-carbon composites and mention their industrial applications.	*10*	*K2*	*CO4*
35.	a)	Describe the evaluation process of lamina properties from laminate tests.	*10*	*K3*	*CO5*
		OR			
	b)	Derive the expression for lamina constitutive equations.	*10*	*K3*	*CO5*
36.	a)	Explain the carbon fiber reinforcements matrix systems with neat sketches.	*10*	*K2*	*CO6*
		OR			
	b)	Explain the industrial applications of CMC's with suitable examples.	*10*	*K2*	*CO6*