AHMEDABAD UNIVERSITY
School of Engineering and Applied Science
2025-2026 Monsoon

CMP613 Basics of Composites
End-Term Examination
Thursday 11 December 2025. 08:00 - 10:00

Name:	Roll no.	A	U	2							Marks /50

Attempt all questions. Ensure clarity in your explanations.

Diagrams and logical reasoning will be rewarded.

1. Differentiate between metals and FRP composites based on their stress–strain characteristics, with emphasis on elasticity, yield behaviour, fracture pattern, and toughness. Mention practical applications where their respective mechanical responses are advantageous. (10)

2. A carbon-fiber reinforced polymer (CFRP) aerospace component with complex geometry must achieve high dimensional accuracy, minimal voids, and excellent mechanical performance under extreme temperature and pressure conditions. Identify the most appropriate manufacturing process for such a CFRP part. Briefly justify why this process is superior to other composite manufacturing methods and state what is unique about the raw material used in this process. (10)

3. Among FRP, MMC, and CMC composites, determine the most appropriate material choice for each of the following advanced engineering applications. For every case, justify your selection by critically evaluating mechanical performance, thermal tolerance, environmental durability, and operational reliability. Additionally, explain why the remaining two composite classes are inferior or unsuitable for that specific application. (10)

   a. Primary aerospace/defence load-bearing structure operating under stringent weight limitations and high stresses.

   b. Automotive brake rotor systems requiring exceptional wear resistance, thermal shock stability, and sustained performance under continuously varying dynamic loads.

   c. High-precision industrial cutting tools used for machining hard alloys, where extreme hardness, creep resistance, and thermal integrity at elevated temperatures are essential.

   d. Large offshore wind turbine blades subjected to corrosive marine environments, long-term cyclic fatigue, and varying aerodynamic loads.

4. A unidirectional FRP tensile specimen is subjected to a uniaxial tensile load of 150 kN. The specimen has a rectangular cross-section of 50 mm × 4 mm and an initial gauge length of 120 mm. The fiber modulus is 200 GPa, and the epoxy matrix modulus is 3 GPa. The fiber volume fraction is 60%. The tensile strength of the FRP composite is 320 MPa. (10)

   Assuming the applied tensile load remains 150 kN, calculate:

   a. The stress induced in the specimen.

   b. The effective modulus of elasticity of the composite.

   c. The strain produced in the specimen under load.

   d. Revised cross-sectional dimensions so that the induced stress does not exceed the tensile strength of the composite.

e. Briefly discuss how increasing or decreasing fiber volume fraction influences the composite's performance.

5. Write a short note on any five: (10)

a. Process of hand lay-up and its limitations
b. How sandwich composites are advantageous over monolithic composites
c. Manufacturing process of Carbon fibre
d. How filament winding differs from pultrusion
e. How prepregs differ from sheet moulding compound
f. Advantages and limitations of FRP composites
g. Differentiate thermoset vs. thermoplastic matrices