2028

National Institute of Technology-Hamirpur End-Term Examination B. Tech, 4th Semester, MS-223: *Composite Materials*

Duration: 180min

Max. Marks: 50

Note

• This question paper consists of 9 questions and two pages.

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- Attempt all questions.
- Wherever necessary, the diagram drawn should be neat and properly labelled.
- 1) Write a short note on followings:
 - a) Cermets
 - b) GFRP
 - c) CFRP
 - d) PIC technique
 - e) LSI technique
 - f) Diffusion bonding

2) Answer the followings:

- a) What is the HIP process?
- b) What are the benefits of hybrid composites compared to those of traditional fiber composites?
- c) Explain the difference between the strengthening mechanisms of large-particle and dispersion-strengthened particle-reinforced composites.
- d) What are the advantages of using aramid fiber reinforced composites over GFRP and CFRP composites?
- e) How does the orientation of the dispersed phase in the matrix affect the stressstrain curve?
- 3) Derive the expressions for the elastic modulus of a longitudinally and transversely loaded continuous and oriented fiber reinforced composite? (4)
- 4) Define laminar structure composites and provide the equations for their various properties.(4)

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(12)

6)

(10)



- 5) Give a brief explanation of sandwich panels and explain the role of the faces and the core? (4)
- 6) Provide a flowchart for each type of composite (MMC, CMC, and PMC) that illustrates the different manufacturing techniques employed. (4)
- 7) A continuous and aligned glass fiber-reinforced composite consists of 40 vol.% of glass fiber possess a elastic modulus of 69 GPa (10×10⁶ psi) and 60 vol.% of a polyester resin (after hardened) displays a modulus of 3.4 GPa (0.5×10⁶ psi). (6)
 - (a) Compute the modulus of elasticity of the composite in the longitudinal direction.
 - (b) If the cross-sectional area is 250 mm² (0.4 in.²) and a stress of 50 MPa (7250 psi) is applied in this longitudinal direction, compute the magnitude of the load carried by each of the fibre and matrix phases.
 - (c) Determine the strain that is sustained by each phase when the stress in *part (b)* is applied.
- 8) Describe a vapour phase method for manufacturing of MMCs and CMCs. (6)
- 9) Enumerate the different toughening mechanisms utilized in CMCs

(4)