

IV B.Tech II Semester Regular Examinations, Apr/May 2006

COMPOSITE MATERIALS
(Metallurgy & Material Technology)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) An engineer has three materials A, B, and C - from which to select for an application. The selection criteria are specific strength and machineability. How would you quantify the selection process and select the best material from among these three?
(b) How can the manufacturing engineer assist design engineer in developing a manufacturable product? [10+6]
2. Define the term composites? Give the classification of composites with examples and applications. What are the major advantages of composites over conventional materials? [16]
3. What are the commonly used fibers and resins in the thermoset composite Industry? [16]
4. Write short notes on the following :
 - (a) fatigue in Metal Matrix Composites
 - (b) Laminated Metal Matrix Composites
 - (c) Creep in Metal Matrix Composites. [6+6+4]
5. Write short notes on the following:
 - (a) Aerospace applications of Metal Matrix Composites
 - (b) Thermal fatigue in Metal Matrix Composites. [8+8]
6. Describe and Differentiate the following
 - (a) Particle reinforced Ceramic Matrix Composites
 - (b) Platelet reinforced Ceramic Matrix Composites. [16]
7. (a) Why do thermoplastics have shorter processing times than thermosets?
(b) Why is it easier to process with thermosets than with thermoplastics? [8+8]
8. A Polymer Matrix composite having 45 vol % of continuous and aligned glass files. The modulus of elasticity of the matrix and the reinforcements are 15 and 89 Gpa compute the modulus of elasticity of the composite in the transverse direction.[16]

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(b) How can the manufacturing engineer assist design engineer in developing a manufacturable product? [10+6]
2. Write a note on Preparation of moulding compounds and Prepregs. [16]
3. What are cermets? Explain them in detail. [16]
4. How are the composites tested? Write in detail. [16]
5. Write short notes on the following:
 - (a) Aerospace applications of Metal Matrix Composites
 - (b) Thermal fatigue in Metal Matrix Composites. [8+8]
6. (a) Write an account of the composite materials produced from eutectic alloys.
(b) Write a note on whiskers. [10+6]
7. (a) What are the processing techniques for short fiber thermoset composites?
(b) What are the four major steps typically taken in manufacturing composite materials? [8+8]
8. A continuous and aligned glass fiber composite consists of 20 vol % of glass fibers having a modulus of elasticity of 72 GPa in a polyestetic resin, having a modulus of 28 GPa ,Calculate the following:
 - (a) Modulus of elasticity of the c composite in longitudinal direction.
 - (b) Load carried by each fiber and the matrix phases when a stress of 50 Mpa is applied on a cross sectional area of 250 mm².
 - (c) Strain Sustained by each phase when the above stress is applied. [16]

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1. (a) 'Combination of two different materials would result into a better material'
Justify the statement with suitable examples.
(b) Write a detailed note on the properties of composite materials? [10+6]
2. Discuss the manufacturing methods used for GFRP's. Give their applications. [16]
3. Explain processing of fiber reinforced composites. [16]
4. Write short notes on the following :
 - (a) fatigue in Metal Matrix Composites
 - (b) Laminated Metal Matrix Composites
 - (c) Creep in Metal Matrix Composites. [6+6+4]
5. Write short notes on the following:
 - (a) Requisites of Matrix
 - (b) Applications of Composite Materials
 - (c) Sandwich panels
 - (d) Hybrid composites. [4+4+4+4]
6. (a) Write an account of the composite materials produced from eutectic alloys.
(b) Write a note on whiskers. [10+6]
7. List different types of moulding compounds? [16]
8. A continuous and aligned glass fiber composite consists of 20 vol % of glass fibers having a modulus of elasticity of 64 GPa in a polyestetic resin, having a modulus of 43 GPa ,Calculate the following:
 - (a) Modulus of elasticity of the resultant composite in longitudinal direction.
 - (b) Load carried by each fiber and the matrix phases when a stress of 45 Mpa is applied on a cross sectional area of 125 mm².
 - (c) Strain Sustained by each phase when the above stress is applied. [4+6+6]

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(b) How can the manufacturing engineer assist design engineer in developing a manufacturable product? [10+6]
2. Discuss the following :
 - (a) Filament winding method
 - (b) Reaction injection moulding
 - (c) Cladding. [4+6+6]
3. (a) What is isostrain condition? Derive an equation for elastic modulus of a laminar continuous Fiber plastic matrix composite for isostrain conditions.
(b) Discuss different types of particulates. [10+6]
4. Explain in detail the characteristics and applications of Carbon fibers. [16]
5. What are Directionally Solidified Eutectics? Discuss their production, properties and applications with an example. [6+6+4]
6. Describe the Strength and Toughness relationship for Ceramics. [16]
7. Why is higher processing temperatures required in thermoplastic tape winding compared to the autoclave or hot press technique? [16]
8. A Metal Matrix composite is made with 80% by volume of Al alloy 2124-T6 and 20% by volume of SIC whiskers. The density of the 2124-T6 is 2.77 g/cc and that of the whisker is 3.10 g/cc. Calculate the average density of the composite. [16]
