



B.E/B.TECH DEGREE EXAMINATIONS: NOV/DEC 2024

(Regulation 2018)

Seventh Semester

MECHANICAL ENGINEERING

U18MEE0003: Composite Materials

COURSE OUTCOMES

CO1: Explain role of matrices and reinforcements, different types of fibers, Applications of composites

CO2: Discuss the production and applications of metal matrix composites.

CO3: Enumerate the various methods for producing ceramic matrix composites.

CO4: Sketch and explain the polymer resin composite fabrication methods.

CO5: Describe the various composite testing

CO6: Select an appropriate manufacturing technique for composite materials.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

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|---|-----|-------------------|
| 1. What is the function of fibers in a composite? | CO1 | [K ₁] |
| 2. Show the equation for Reuss Model (Lower Bound) | CO1 | [K ₂] |
| 3. Contrast the recycling challenges are associated with Metal Matrix Composites? | CO2 | [K ₂] |
| 4. Interpret the primary difference in composition between alloys and Metal Matrix Composites? | CO2 | [K ₂] |
| 5. How do monolithic ceramics perform under high-temperature conditions? | CO3 | [K ₁] |
| 6. List common application of SiC(Silicon carbide)-based Ceramic Matrix Composites? | CO3 | [K ₁] |
| 7. Extend in which two categories polymers divided where both very relevant for the processing method? | CO4 | [K ₂] |
| 8. Recall this vacuum injection by relating the terms in the correct order: release agent – mould – peel ply – fibre package – vacuum film – bleeder/breather fabric. | CO4 | [K ₁] |
| 9. Show two reasons for using a multiaxial strain gauge | CO5 | [K ₂] |
| 10. Summarize about Interlaminar shear test. | CO5 | [K ₂] |

Answer any FIVE Questions:-

PART B (5 x 16 = 80 Marks)

(Answer not more than 400 words)

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|-----|----|---|----|-----|-------------------|
| 11. | a) | Compare Particle reinforced composites and Fiber reinforced composites from their definitions, mechanical properties, advantages, common applications, and any challenges associated with each type. | 8 | CO1 | [K ₃] |
| | b) | Elaborate any four types of fibres with their properties, applications and advantages? | 8 | CO1 | [K ₂] |
| 12. | a) | Explain the key stages involved in the powder metallurgy process? | 12 | CO2 | [K ₂] |
| | b) | Conclude the various types of MMCs(Metal Matrix Composites), categorized based on their matrix materials and reinforcement | 4 | CO2 | [K ₃] |
| 13. | a) | How does Cold Isostatic Pressing compared to Hot Isostatic Pressing in terms of process and application? | 8 | CO3 | [K ₂] |
| | b) | What are the key properties that define engineering ceramics and also explain their significance in applications | 8 | CO3 | [K ₂] |
| 14. | | Elaborate about Reinforced Reaction Injection Molding (RRIM), and how does it differ from traditional molding techniques? What factors influence the decision to use RRIM over other manufacturing methods for composite materials? | 16 | CO4 | [K ₃] |
| 15. | a) | What are the key parameters derived from tensile testing, and how are they calculated? | 12 | CO5 | [K ₂] |
| | b) | How do stress-strain curves help in understanding the mechanical behavior of composites | 4 | CO5 | [K ₃] |
| 16. | | A company specializing in the automotive industry is looking to reduce the weight of its vehicles without compromising strength or safety. This improvement is aimed at enhancing fuel efficiency and overall performance. The company is considering the use of carbon fiber-reinforced polymer (CFRP) composites in place of traditional steel and aluminum in certain structural components. Discuss the composite manufacturing process the company should consider, the challenges they might face, and the potential benefits of using CFRP in a real-time automotive application. Include insights on sustainability and cost implications | 16 | CO6 | [K ₄] |
