QP Code:MEH43-2 **(Pages:2)**

Reg No : ..... Name : .....

MAR ATHANASIUS COLLEGE OF ENGINEERING, KOTHAMANGALAM

(Govt. Aided Autonomous Institution)

Fourth Semester B.Tech. Degree Examination, May, 2026

Course Code: B24MEH43

Course Name: ADVANCED ENGINEERING MATERIALS

Max. Marks: 100 Duration:3 Hours

PART - A: 30 Marks (10 Qns x 3 Marks)

Answer all questions

1. Explain the precipitation hardening mechanism in heat-treatable aluminium alloys with a simple diagram.
2. Classify magnesium alloys based on their processing methods and give suitable examples.
3. Describe the role of γ′ precipitates in improving creep resistance of nickel-based superalloys.
4. Discuss the effect of applied stress on creep rate and component life.
5. Define photovoltaic effect and explain its role in solar energy conversion.
6. What is training in shape memory alloys? Explain its purpose.
7. Define Chemical Vapour Deposition (CVD) and explain its role in composite manufacturing.
8. Classify manufacturing methods used for polymer matrix composites based on thermoset and thermoplastic matrices.
9. Describe the role of bioactive materials in bone repair and regeneration.
10. Classify biomaterials based on material type with examples.

PART - B: 70 Marks (5 Qns x 14 Marks)

Answer any One full question from each module.

Module 1

11. Explain the Copper–Tin (Cu–Sn) phase diagram in detail.

OR

12. Compare heat-treatable and non-heat treatable aluminium alloys in terms of composition, strengthening mechanisms, and engineering applications.

Module 2

13. Explain the microstructure and properties of α, β, and α–β titanium alloys and discuss their applications in aerospace and high-temperature environments.

OR

14. Explain the classification of superalloys. Describe the composition, properties, and applications of iron-base superalloys used in high-temperature environments.

Module 3

15. Discuss the mechanism of electron transfer in photochemical and photoelectrochemical systems. Explain the factors affecting electron transfer.

OR

16. Explain the effect of deviation from equiatomic stoichiometry and additive alloying elements on the transformation characteristics of SMAs.

Module 4

17. Explain the working principle, processing steps, advantages, and limitations of Hot Isostatic Pressing (HIP) in the fabrication of metal matrix composites.

OR

18. Explain the structure, properties, and applications of metal matrix composites (MMCs) and ceramic matrix composites (CMCs).

Module 5

19. Explain the various surface modification techniques used in biomaterials to improve their performance in biomedical applications.

OR

20. Explain the concept of tissue compatibility of biomaterials and discuss the importance of evaluating it before biomedical use.

****