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***B.Tech. Degree IV Semester Supplementary Examination in  
Marine Engineering June 2023***

**MRE 1403 METALLURGY AND MATERIAL SCIENCE  
(2013 Scheme)**

Time: 3 Hours

Maximum Marks: 100

(5 × 20 = 100)

- I. What is atomic packing factor? Determine the packing efficiency of the following structure: (20)
- Simple cubic structure
  - Body centered Cubic structure
  - Face centered Cubic structure.
- OR**
- II. Describe the following terms: (20)
- Space lattice and Unit cell
  - Polymorphism and Allotropy
  - Burgers vector
  - Nucleation
  - Dendrite Growth.
- III. (a) Explain the various types of solid solutions and describe the postulates of Hume Rothery rule for solid solutions. (10)
- (b) Explain the important phases formed in Iron – Carbon phase diagram with suitable sketch. (10)
- OR**
- IV. (a) Explain the phase diagram of Isomorphous system with suitable example. (10)
- (b) Explain lever arm rule and how to predict the phase, amount of phases present and chemical composition of phases present. (10)
- V. (a) Differentiate between mar tempering and austempering with suitable sketches. (12)
- (b) Explain the functions of alloying elements of steel. (8)
- OR**
- VI. (a) Describe the following: (12)
- Flame hardening
  - Induction Hardening
  - Metal coating.
- (b) Explain the composition, properties and uses of alloys of copper. (8)
- VII. (a) Explain the mechanism of twinning with suitable sketches. (8)
- (b) Explain Griffith theory of fracture. What is stress concentration and how it affects fatigue failure? (12)
- OR**
- VIII. (a) Sketch creep curve and explain different stages of creep and also write notes on creep resistant materials. (12)
- (b) Explain the factors leading to the propagation of crack and also explain stress cycle and fatigue failure. (8)

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- IX. (a) Describe the features of fluorescent and ultrasonic test with suitable sketches. (8)
- (b) Describe the characteristics of chromium, ceramic, titanium and PTFE in ship board systems. (12)
- OR**
- X. (a) Explain any two types of destructive test with suitable sketches. (10)
- (b) Briefly explain the selection of materials in ship building and marine engineering. (10)

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