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***B.Tech. Degree IV Semester Regular Examination in  
Marine Engineering April 2021***

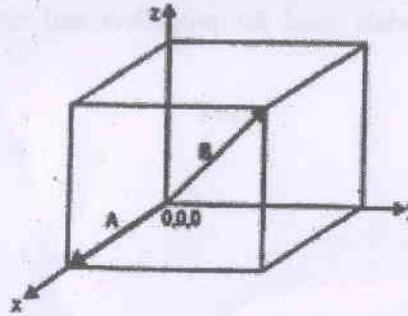
**19-208-0403 METALLURGY AND MATERIAL SCIENCE  
(2019 Scheme)**

Time: 3 Hours

Maximum Marks: 60

(5 × 15 = 75)

- I. (a) What is 'Miller indices' of crystal planes? Determine the Miller indices of directions A and B shown in the cubic unit cells. (9)



- (b) Write a note on atomic packing factor. Calculate it for FCC crystal. (6)

OR

- II. (a) Describe the processes of solidification of metals. (6)  
(b) What are dislocations? Explain different types. (9)

- III. Explain Iron carbon equilibrium diagram with a neat sketch and describe all the invariant reactions that occur, stating their names. (15)

OR

- IV. (a) What is the Hume-Rothery rules? (3)  
(b) Explain various types of solid solutions. (6)  
(c) Explain various corrosion resistance materials for propellers, hulls and heat exchangers. (6)

- V. (a) What is heat treatment process? What are the objectives of heat treatment? (4)  
(b) Compare the various simple heat treatments such as normalizing and annealing. (4)  
(c) Describe the preparation of TTT diagram and its use. (7)

OR

- VI. (a) Write notes on: (6)  
(i) Nitriding  
(ii) Cyaniding  
(iii) Carburising  
(b) What are the different types of cast irons? Mention properties and uses of each. (9)

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- VII. (a) Explain the various stages of ductile fracture with neat sketch. (7)  
(b) What is creep? Explain creep curve. (8)  
**OR**
- VIII. (a) Explain recovery, recrystallisation and grain growth. (7)  
(b) Compare the plastic deformation by slip and twinning. (8)
- IX. (a) What is non destructive test? Explain any two in detail. (9)  
(b) Explain the application of chromium and ceramic in shipboard. (6)  
**OR**
- X. (a) Explain: (8)  
(i) Tensile test.  
(ii) Hardness test.  
(b) What are the materials used for propellers and rudders? Explain their compositions. (7)

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