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

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

Time: 3 Hours

Maximum Marks: 60

Course Outcome

On successful completion of the course, the students will be able to:

- CO1: Understand the crystal structure of metal, defects occurring in crystals of metals and the process of solidification of metals under slow and fast cooling.
 CO2: Understand the phase rule, phase diagrams, solid solutions, examples of binary solid solutions and to understand the mechanism of corrosion and its prevention methods.
 CO3: Understand about different heat treatment methods and different metals and alloys.
 CO4: Gain knowledge about the phenomena of failures occurring in metals.
 CO5: Learn about the different destructive and non-destructive tests and the different metals used onboard and in marine applications.

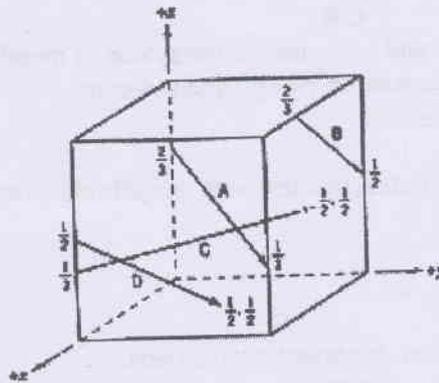
Bloom's Taxonomy Levels (BL): L1 – Remember, L2 – Understand, L3 – Apply, L4 – Analyze, L5 – Evaluate, L6 – Create

PO – Programme Indicators

Answer **ALL** questions

(5 × 15 = 75)

- | | | Marks | BL | CO | PI |
|--------|---|-------|----|----|----|
| I. (a) | Explain the various types of seven crystal system with suitable examples and sketch of the unit cell. | 7 | L2 | 1 | 1 |
| (b) | Determine the indices for the directions shown in the following cubic unit cell. | 8 | L3 | 1 | 1 |



OR

- | | | | | | |
|---------|--|----|----|---|---|
| II. (a) | With the help of suitable sketches explain the various surface imperfections found in solid crystal. | 10 | L3 | 1 | 1 |
| (b) | Explain with suitable sketch the mechanism of crystal growth in solidifications. | 5 | L1 | 1 | 1 |

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| | | Marks | BL | CO | PI |
|-----------|--|-------|----|----|----|
| III. | (a) Draw a neat labeled sketch of the Iron Carbon equilibrium diagram with all salient points. | 10 | L3 | 2 | 1 |
| | (b) Explain the mechanism and factors influencing corrosion. | 5 | L2 | 2 | 1 |
| OR | | | | | |
| IV. | (a) Explain the various classifications of solid solutions with suitable sketches. | 8 | L2 | 2 | 1 |
| | (b) Describe on various phases present on Iron Carbon phase diagram. | 7 | L3 | 2 | 1 |
| V. | (a) Explain the following: (i) Spheroidizing (ii) Austempering (iii) Martempering (iv) Normalizing (v) Annealing. | 10 | L2 | 3 | 1 |
| | (b) What are the effects on steel containing molybdenum? | 5 | L2 | 3 | 1 |
| OR | | | | | |
| VI. | (a) Explain in detail the following surface treatments: (i) Carburizing (ii) Nitriding (iii) Cyaniding (iv) Induction Hardening (v) Flame Hardening. | 10 | L2 | 3 | 1 |
| | (b) What are the important properties and application of grey cast iron? | 5 | L2 | 3 | 1 |
| VII. | (a) Explain the following strengthening mechanisms: (i) Work hardening (ii) Grain boundary hardening (iii) Precipitation hardening. | 9 | L2 | 4 | 1 |
| | (b) Draw and describe the various zones of creep curve. | 6 | L2 | 4 | 1 |
| OR | | | | | |
| VIII. | (a) Discuss on elastic, anelastic and visco elastic behaviour of metals. | 5 | L2 | 4 | 1 |
| | (b) Differentiate between the mechanism by slip and twinning. | 6 | L2 | 4 | 1 |
| | (c) Explain Griffith theory of fracture. | 4 | L1 | 4 | 1 |
| IX. | (a) Describe the following non destructive test with suitable sketches: (i) Magnetic dust test (ii) Fluorescent test (iii) Ultrasonic test (iv) Radiographic test. | 12 | L3 | 5 | 1 |
| | (b) Mention the use of materials in shipboard applications. | 3 | L1 | 5 | 1 |
| OR | | | | | |
| X. | (a) Describe the following destructive test with suitable sketches: (i) Bend test (ii) Torsion test (iii) Impact test. | 9 | L3 | 5 | 1 |
| | (b) Explain the selection of materials in ship building and marine engineering. | 6 | L2 | 5 | 1 |

Blooms's Taxonomy Levels

L1 – 8%, L2 – 54.67%, L3 – 37.33%.
