Indian Maritime University

(A Central University, Govt of India)

End Semester Examinations – December 2025

Programme Name: B Tech (Marine Engineering)

Semester: III

Subject Code: UG11T5304

Subject Name: Engineering Materials

Date: 13.12.2025	Max Marks: 70
Duration: 03 Hrs	Pass Marks: 35

General Instructions

(i) All Sections (A, B & C) are to be attempted.
(ii) Options, if any, are specified in respective section.

Section A

Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable.

1. Which of the following bond(s) is (are) non-directional
   a. Ionic
   b. Metallic
   c. Covalent
   d. Both (a) and (b)

2. Gibbs phase rule is given by:
   a. $F = C + P$
   b. $F = C - P + 2$
   c. $F = C + P - 2$
   d. $F = C - P - 2$

3. What does the eutectic point in a phase diagram represent?
   a. A point where a single phase exists.
   b. The point at which two solids coexist.
   c. The temperature at which liquid transforms into two solid phases.
   d. The temperature where complete melting occurs.

4. Pitting resistance of stainless steels in marine environment is primarily contributed to the presence of
   a. Molybdenum
   b. Chromium
   c. Copper
   d. Nickel

5. Gaskets can be synthesized using PTFE primarily attributing to
   a. Strength
   b. Ductility
   c. Cost effectiveness
   d. Low coefficient of friction

6. Which of the following is/are the problems experienced by the rudder
   a. Biofouling
   b. Corrosion
   c. Cavitation
   d. All of the above

7. When selecting materials for steam turbine blades in marine applications, which factor is most critical to ensure efficient performance and longevity?
   a. Low cost and availability
   b. High thermal conductivity and ductility
   c. High creep resistance and fatigue strength at elevated temperatures
   d. High electrical resistance and low density

8. Eutectoid reaction occurs at:
   a. 114 °C
   b. 600 °C
   c. 727 °C
   d. 1493 °C

9. Machines tool guide-ways are usually hardness by:
   a. Mar-tempering
   b. Flame hardening
   c. Vacuum hardening
   d. Induction hardening

10. What is the TTT diagram used for?
   a. It shows the relationship between time, temperature, and toughness.
   b. It explains the heat treatment cycle for alloys.
   c. It represents isothermal transformations in steel.
   d. It defines the rate of cooling in non-ferrous metals.

Section B

Five Questions of 02 Marks each

11. State Hume-Rothery rules?

12. What is meant by "heat treatment"?

13. Explain how chromium is contributing to the corrosion resistance of stainless steels?

14. What are the key considerations in selecting a material for pumping machinery and piping?

15. Briefly describe the advantage and disadvantages with the usage of ceramics in marine applications.

Section C

Seven Questions of 10 Marks each of which any 05 questions to be answered.

16. Explain the major materials used in marine components (diesel engine, gas turbine, etc.) and relate their selection to their properties.

(10 marks)

17. What do you understand by the term "crystal defects". Describe in detail line defects, edge and screw dislocations with the help of diagram.

(10 marks)

18. Explain the following alloying materials:

a. Chromium b. Molybdenum c. Vanadium

(4+3+3 marks)

19. Calculate the atomic packing factor for FCC and BCC crystal structures.

(5+5 marks)

20. Explain the Iron-Iron Carbide phase diagram highlighting the important reactions.

(10 marks)

21. Illustrate and discuss TTT diagram of eutectoid steel.

(10 marks)

22. Briefly discuss the following processes:

a. Annealing
b. Normalizing,
c. Hardening
d. Tempering

(2.5+2.5+2.5+2.5 marks)