CONFIDENTIAL

UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION
FEBRUARY 2025 SEMESTER SESSION

SUBJECT CODE	:	**LMD25703**
SUBJECT TITLE	:	**SHIP MATERIALS**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**DIPLOMA OF ENGINEERING TECHNOLOGY IN MARINE ENGINEERING**
TIME / DURATION	:	**9.00 AM - 12.00 PM (3 HOURS)**
DATE	:	**30 JUNE 2025**

INSTRUCTIONS TO CANDIDATES

1. Please read **CAREFULLY** the instructions given in the question paper.
2. This question paper has information printed on both sides of the paper.
3. This question paper consists of **TWO (2)** sections; Section A and Section B.
4. Answer **ALL** question in Section A, and **TWO (2)** questions ONLY in Section B.
5. Please write your answers on this answer booklet provided.
6. Answer **ALL** questions in English language **ONLY**.
7. Answer should be written in black or blue ink except for sketches, graphics and illustrations.
8. Appendices have been appended for your reference.

THERE ARE 4 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

With reference to material properties and testing.

(a) Differentiate between Destructive testing & Non-destructive testing.

(10 marks)

(b) Sodium Chloride (NaCl) is a common compound found in seawater. Determine the types of primary bonding that occur in NaCl.

(10 marks)

Question 2

With reference to material properties and testing.

(a) The alloying of plain carbon steels changes the physical and mechanical properties of the metal.

i. Define metal alloy.

(4 marks)

ii. State the THREE (3) important reasons for alloying elements in plain carbon steels.

(6 marks)

(b) Figure 1 shows fatigue behavior of metal A and metal B. Explain the fatigue behavior for both metals and suggest the relevant examples.

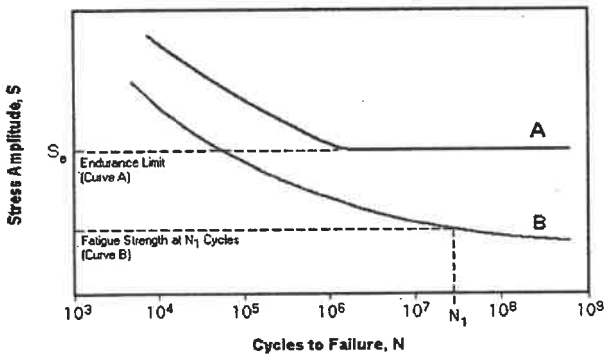

Figure 1

(10 marks)

Question 3

With reference to steel phase diagram heat treatment and material properties.

(a) Sketch and explain the following microstructures in plain carbon steel:

i. Ferrite (4 marks)

ii. Pearlite (3 marks)

iii. Cementite (3 marks)

(b) Explain the difference between thermoplastics and thermosetting. (10 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer TWO (2) questions only.
Please use the answer booklet provided.

Question 4

With reference to steel phase diagram heat treatment and material properties.

(a) Sketch the microstructure development for eutectoid steel. Show the composition, temperature and microstructure occurred. (10 marks)

(b) Suggest the corrosion minimization method that can be implemented for the submerged marine structure. (10 marks)

Question 5

With reference to material properties and corrosion.

(a) Describe FIVE (5) types of mechanical testing that are important for material selection in shipbuilding.

(10 marks)

(b) Metallic corrosion is ordinarily electrochemical, involving both oxidation reaction and reduction reaction. With the aid of diagram, discuss how oxidation and reduction take place.

(10 marks)

Question 6

With reference to material properties and corrosion.

(a) The following pairs of alloys that are coupled in seawater. Identify the alloy that will be corroded and remain protected by referring to *Appendix A*.

i. Aluminum and magnesium.
ii. Zinc and low alloy carbon steel.
iii. Cast iron and 316 stainless steels.
iv. Titanium and 304 stainless steels.
v. Low alloy carbon steel and brasses

(10 marks)

(b) Differentiate the ductile and brittle fracture of tensile test in terms of their fracture mechanism.

(10 marks)

END OF EXAMINATION PAPER

APPENDIX A

Table 1: Standard Electrode Potentials at 25° C

Oxidation (corrosion) reaction	Electrode potential (E°) (volts versus standard hydrogen electrode)
$Au \rightarrow Au^{3+} + 3e^-$	+1.498
$2H_2O \rightarrow O_2 + 4H^+ + 4e^-$	+1.229
$Pt \rightarrow Pt^{2+} + 2e^-$	+1.200
$Ag \rightarrow Ag^+ + e^-$	+0.799
$2Hg \rightarrow Hg_2^{2+} + 2e^-$	+0.788
$Fe^{2+} \rightarrow Fe^{3+} + e^-$	+0.771
$4(OH)^- \rightarrow O_2 + 2H_2O + 4e^-$	+0.401
$Cu \rightarrow Cu^{2+} + 2e^-$	+0.337
$Sn^{2+} \rightarrow Sn^{4+} + 2e^-$	+0.150
$H_2 \rightarrow 2H^+ + 2e^-$	0.000
$Pb \rightarrow Pb^{2+} + 2e^-$	−0.126
$Sn \rightarrow Sn^{2+} + 2e^-$	−0.136
$Ni \rightarrow Ni^{2+} + 2e^-$	−0.250
$Co \rightarrow Co^{2+} + 2e^-$	−0.277
$Cd \rightarrow Cd^{2+} + 2e^-$	−0.403
$Fe \rightarrow Fe^{2+} + 2e^-$	−0.440
$Cr \rightarrow Cr^{3+} + 3e^-$	−0.744
$Zn \rightarrow Zn^{2+} + 2e^-$	−0.763
$Al \rightarrow Al^{3+} + 3e^-$	−1.662
$Mg \rightarrow Mg^{2+} + 2e^-$	−2.363
$Na \rightarrow Na^+ + e^-$	−2.714