



UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION
FEBRUARY 2025 SEMESTER SESSION

SUBJECT CODE : LMD26603 / LMD25003

SUBJECT TITLE : NAVAL ARCHITECTURE

PROGRAMME NAME : DIPLOMA OF ENGINEERING TECHNOLOGY IN
(FOR MPU: PROGRAMME LEVEL) MARINE ENGINEERING

TIME / DURATION : 09.00 AM - 11.30 AM
(2 HOURS 30 MINUTES)

DATE : 4 JULY 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. Formula has been appended for your reference.
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THERE ARE 8 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

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

Question 1

With reference to the ship hull structure.

(a) Identify the structural component in Figure 1(a) below.

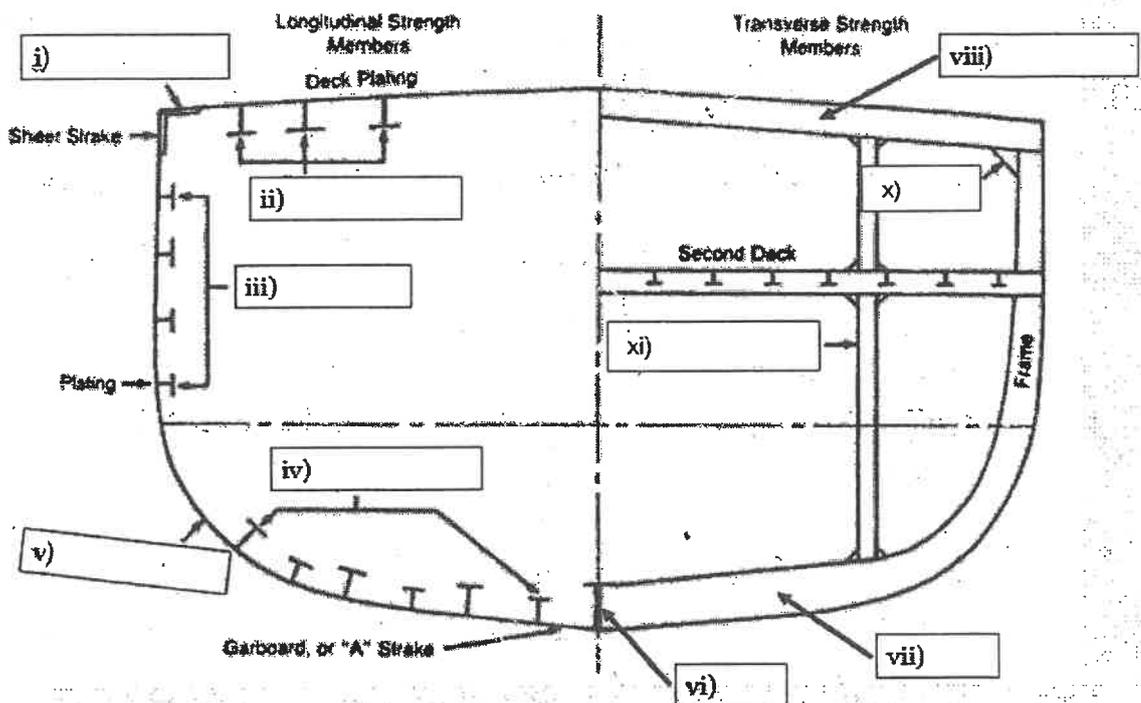


Figure 1(a): Typical Transverse and Longitudinal Strength Members

(10 marks)

- (b) Identify the structural components of Single Bottom (transversely framed) in Figure 1(b) below.

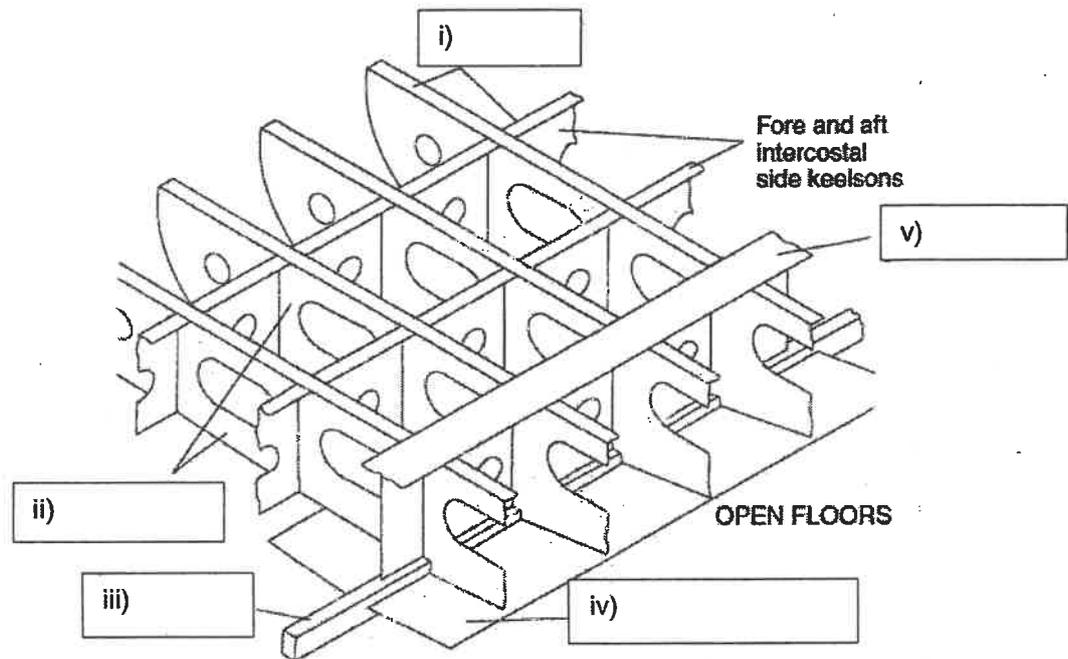


Figure 1(b)

(5 marks)

- (c) Identify the structural components of fore end structure in Figure 1(c) below.

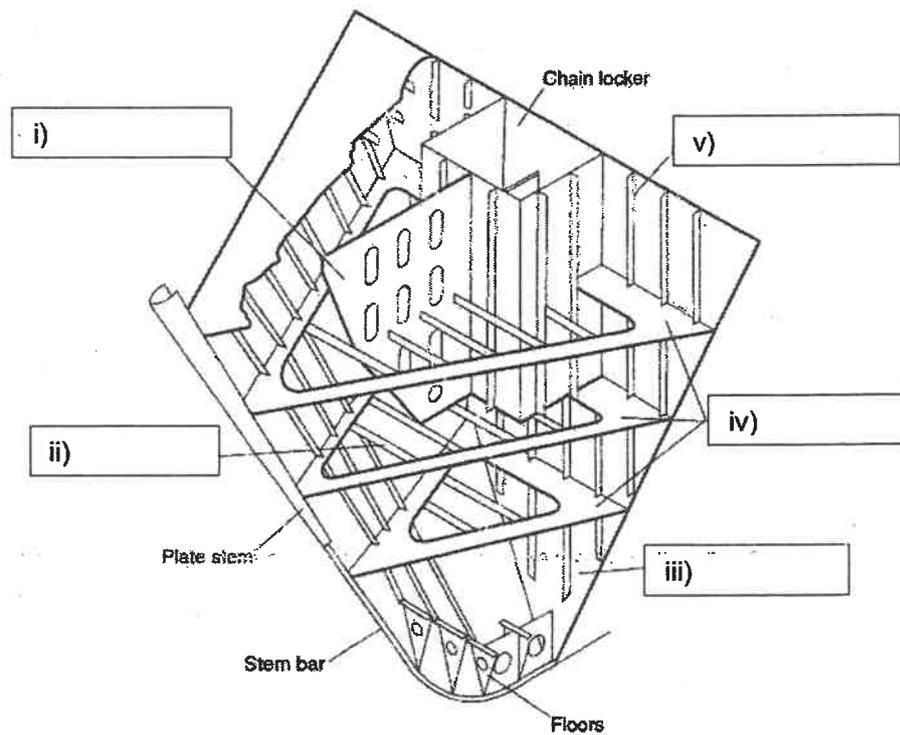


Figure 1(c)

(5 marks)

Question 2

With reference to initial stability of a ship floating freely on water.

- (a) Sketch and labels stable equilibrium (5 marks)
- (b) Explain stable equilibrium (5 marks)
- (c) Sketch and labels unstable equilibrium (5 marks)
- (d) Explain unstable equilibrium (5 marks)

Question 3

With reference to the movement of ship centre of gravity:

- (a) A ship arrives in port with displacement of 5000 tonnes, KG 8 m and LCG 1 m aft of amidships. The following weights are then loaded and unloaded:

Changes	Mass(t)	KG(m)	LCG from amidships
Loaded	5000	8	2 m aft
Loaded	3000	1	3 m fwd
Unloaded	1000	8	5 m fwd
Unloaded	2000	1	12 m aft

Calculate:

- i) Final KG (6 marks)
 - ii) Final LCG from amidships (6 marks)
- (b) Refer Figure 3(b). A ship of 5000 tonnes displacement has its centre of gravity 2 m aft of midships and 5 m above the keel. 250 tonne of cargo at 10 m fwd of midships and 2 m above the keel at the lower hold are then moved to main deck. Given the final position of the cargo is 50 m fwd of midships and 9 m above the keel, calculate the new position of the following:
- (i) Longitudinal centre of gravity, LCG (4 marks)
 - (ii) Vertical centre of gravity, KG (4 marks)

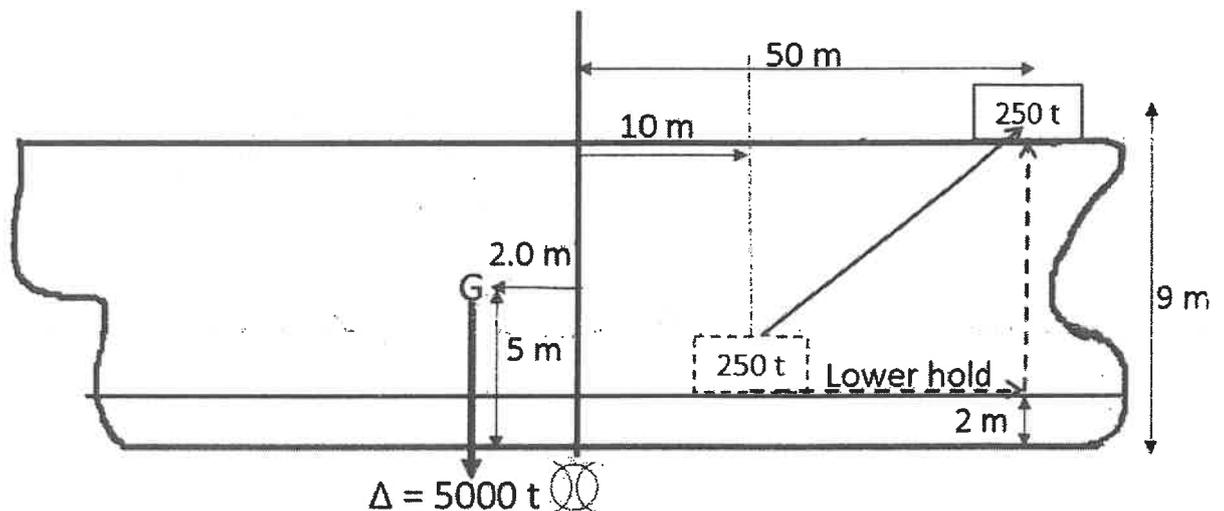


Figure 3(b)

SECTION B (Total: 40 marks)**INSTRUCTION: Answer only TWO (2) questions.****Please use the answer booklet provided.****Question 4**

With reference to ship hydrostatic calculation.

A ship is 80 m long, 19 m beam, floats at even keel draught of 9 m in sea water. Sectional areas are as follows:

Station	0	2	4	6	8	10	12	14	16	18	20
As(m ²)	90	102	115	126	150	160	150	130	101	98	72

Calculate:

- i) Volume of displacement (6 marks)
- ii) Mass of displacement (2 marks)
- iii) LCB from amidships (6 marks)
- iv) Block Coefficient (2 marks)
- v) Midship Section Area Coefficient (2 marks)
- vi) Prismatic Coefficient (2 marks)

Question 5

With reference to ship angle of list calculation.

A ship of 8500 tonnes displacement has $KM = 7.6$ m, and $KG = 6.5$ m was listed 5.0° to starboard.

The following weights are then loaded and unloaded:

- Unload 500 tonnes cargo which centre of gravity is 7.5 m above the keel and 5 m to starboard from centre line.
- Unload 300 tonnes cargo which centre of gravity is 8.5 m above the keel and 6.5 m to port from centre line.
- Load 100 tonnes of cargo at centreline which centre of gravity is 7 m above the keel.
- Load 200 tonnes of ballast which centre of gravity is 1.5 m above the keel and 2 m to port from centre line.

Calculate:

- a) Final KG (7 marks)
- b) Final GM . (Assume no change in KM) (2 marks)
- c) Changes angle of list. (9 marks)
- d) Final angle of list. (2 marks)

Question 6

With reference to the effect of small changes of mass on the ship trim.

A cargo ship has LBP 120 m, LCF 3 m forward of amidships and floats at 5.3 m and 5.8 m at FP and AP respectively. Its TPC is 20 tonnes while MCTC 150 tonnes.m.

If the following item are loaded and unloaded:

UNLOADED	105 tonnes cargo from 34 m aft of amidships
	43 tonnes cargo from 13 m fwd of amidships
	96 tonnes cargo at amidships
LOADED	38 tonnes cargo at LCF
	84 tonnes fresh water at 28 m fwd of amidships

Calculate:

- (a) Parallel rise (2 marks)
- (b) Total change in trim (8 marks)
- (c) Change in trim Fwd, δT_F (3 marks)
- (d) Change in trim Aft, δT_A (3 marks)
- (e) Final draught at FP (2 marks)
- (f) Final draught at AP (2 marks)

LIST OF FORMULAE

- 1) $A_w = (1/3 \times h \times \sum PA) \times 2$
- 2) $\delta T = \text{trim} \times \left[\frac{\text{LBP}/2 \pm \text{LCF}}{\text{LBP}} \right]$
- 3) $C_w = A_w / (L \times B)$
- 4) $\text{Change in trim(m)} = \frac{\Delta \times \rho}{\text{MCTC} \times 100}$
- 5) $\text{Volume} = (1/3 \times h @ w \times \sum PV)$
- 6) $\text{Final KG} = \frac{\text{Final Moment about Keel}}{\text{Final Displacement}}$
- 7) $C_p = \text{Volume} / (A_M \times L)$
- 8) $\text{FWA(mm)} = \Delta / (4 \times \text{TPC})$
- 9) $\text{GG}_1 = (w \times d) / \Delta$
- 10) $\text{BM}_L = I_{LCF} / \text{Volume}$
- 11) $\text{MCTC} = (\Delta \times G_{ML}) / 100L$
- 12) $\text{Parallel sinkage/rise} = w / \text{TPC}$
- 13) $\text{Final LCG} = \frac{\text{Final Moment about amidships}}{\text{Final Displacement}}$
- 14) $C_B = \text{Volume} / (L \times B \times T)$
- 15) $I_{LCF} = I_L - Ay^2$; $A = A_w$, $y = \text{LCF}$
- 16) $\text{KB} = \frac{w \times \sum 1^{\text{st}} \text{Moment}}{\sum PV}$
- 17) $\text{DWA(mm)} = \text{FWA} (1025 - \rho_{DW}) / 25$
- 18) $\text{TPC} = (A_w \times \rho) / 100$
- 19) $\text{Change in trim(cm)} = \frac{\text{trimming moment } (w \times d)}{\text{MCTC}}$
- 20) $C_M = A_M / (B \times T)$
- 21) $\text{LCF} = \frac{h \times \sum 1^{\text{st}} \text{Moment}}{\sum PA}$
- 22) $\text{Tan } \theta = \frac{\text{listing moment}}{\Delta \times \text{GM}}$

END OF EXAMINATION PAPER