CONFIDENTIAL

UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION
FEBRUARY 2025 SEMESTER SESSION

SUBJECT CODE	:	**LMB22703**
SUBJECT TITLE	:	**NAVAL ARCHITECTURE 1**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**BACHELOR OF MARINE ENGINEERING TECHNOLOGY WITH HONOURS**
TIME / DURATION	:	**2.00 PM - 4.30 PM (2 HOURS 30 MINUTES)**
DATE	:	**23 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 **THREE (3)** questions in Section B.
5. Please write your answers on this answer booklet provided.
6. Answer **ALL** questions in English language **ONLY**.

THERE ARE 8 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 40 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.

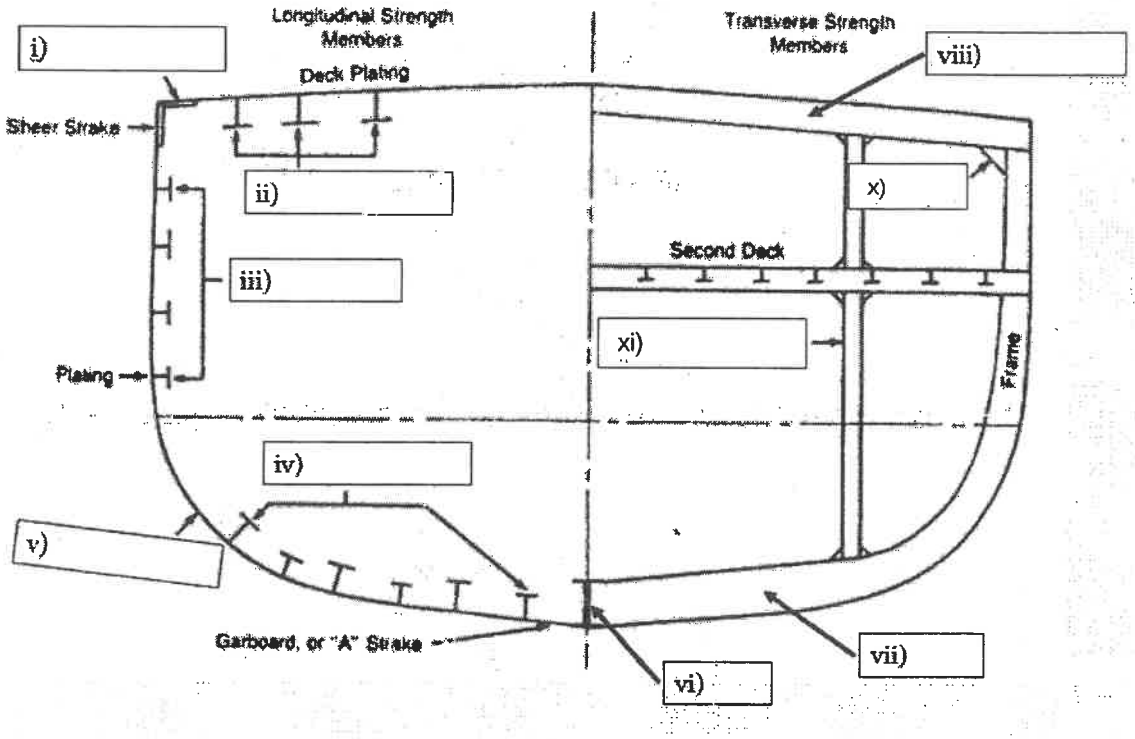

Figure 1(a): Typical Transverse and Longitudinal Strength Members

(10 marks)

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

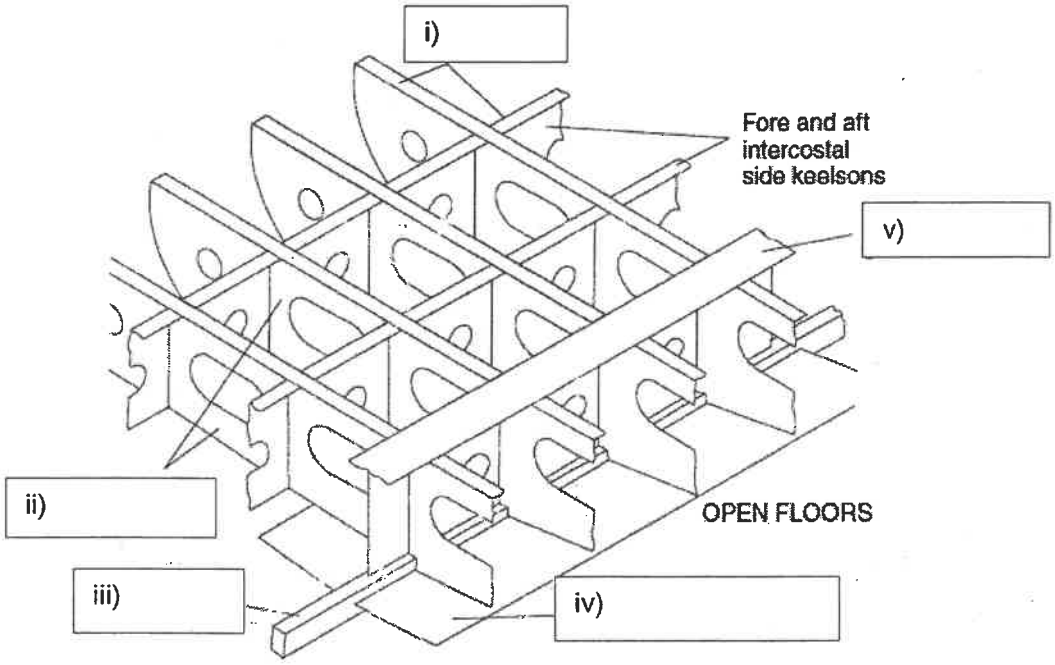

Figure 1(b)

(5 marks)

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

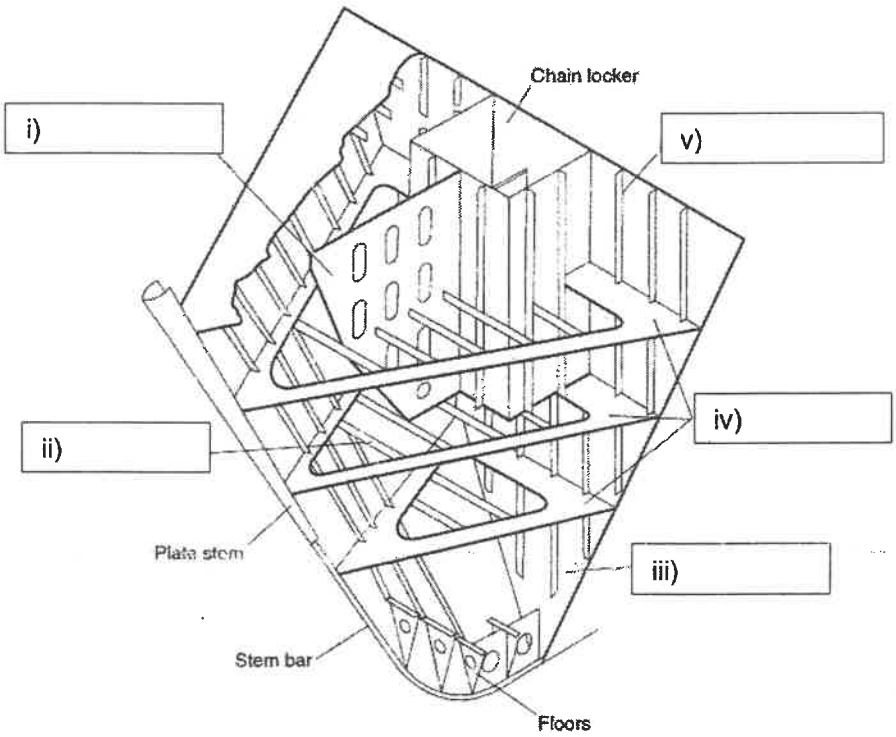

Figure 1(c)

(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)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer only THREE (3) questions.
Please use the answer booklet provided.

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)

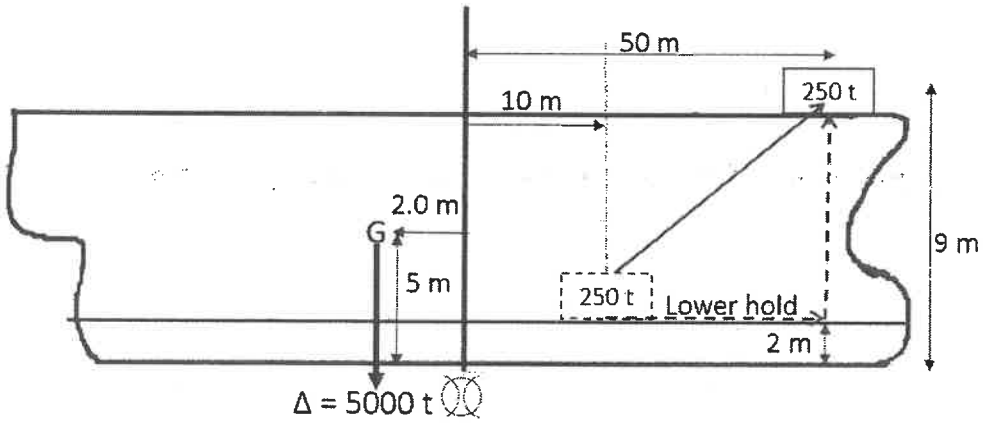

Figure 3(b)

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) $Aw = (1/3 \times h \times \sum PA) \times 2$

2) $\delta T = trim \times [\ \frac{LBP/2 \pm LCF}{LBP}\ ]$

3) $C_W = A_W / (L \times B)$

4) $\text{Change in trim(m)} = \frac{\Delta \times p}{MCTC \times 100}$

5) $Volume = (1/3 \times h@w \times \sum PV)$

6) $\text{Final KG} = \frac{\text{Final Moment about Keel}}{\text{Final Displacement}}$

7) $C_P = Volume / (A_M \times L)$

8) $FWA(mm) = \Delta / (4 \times TPC)$

9) $GG_1 = (w \times d) / \Delta$

10) $BM_L = I_{LCF} / Volume$

11) $MCTC = (\Delta \times G_{ML}) / 100L$

12) Parallel sinkage/rise = w / TPC

13) $\text{Final LCG} = \frac{\text{Final Moment about amidships}}{\text{Final Displacement}}$

14) $C_B = Volume / (L \times B \times T)$

15) $I_{LCF} = I_L - Ay^2$; *A = Aw, y = LCF*

16) $KB = \frac{w \times \Sigma\ 1^{st}\text{Moment}}{\Sigma\ PV}$

17) $DWA(mm) = FWA\ (1025 - \rho_{DW}) / 25$

18) $TPC = (Aw \times \rho) / 100$

19) $\text{Change in trim(cm)} = \frac{\text{trimming moment } (w \times d)}{MCTC}$

20) $C_M = A_M / (B \times T)$

21) $LCF = \frac{h \times \Sigma\ 1^{st}\text{Moment}}{\Sigma\ PA}$

22) $\text{Tan } \theta = \frac{\text{listing moment}}{\Delta \times GM}$

END OF EXAMINATION PAPER