



UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION
JULY 2025 SEMESTER SESSION

SUBJECT CODE : LMB22703

SUBJECT TITLE : NAVAL ARCHITECTURE 1

PROGRAMME NAME : BACHELOR OF MARINE ENGINEERING
(FOR MPU: PROGRAMME LEVEL) TECHNOLOGY WITH HONOURS

TIME / DURATION : 9.00 AM - 11.30 AM
(2 HOURS 30 MINUTES)

DATE : 15 DECEMBER 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 7 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 ship dimension and form.

- (a) Sketch profile view and labels the following ship terminologies.
- i.) After Perpendicular (AP)
 - ii.) Forward Perpendicular (FP)
 - iii.) Amidships
 - iv.) Length Between Perpendiculars (LBP)
 - v.) Length Overall (LOA)
- (7 marks)
- (b) Sketch front view and labels the following ship terminologies.
- i) Breadth
 - ii) Draught
 - iii) Freeboard
 - iv) Depth
 - v) Centreline (CL)
- (7 marks)
- (c) With the aid of sketch, labels SIX (6) motions of freedom of a ship.
- (6 marks)

Question 2

With reference to the sagging and hogging stress onboard ships that are caused by the sea state.

- (a) Describe sagging stress condition and indicate the area in a ship that will be affected by the maximum tensile and compressive stress. (5 marks)
- (b) Sketch and labels sagging stress condition. (5 marks)
- (c) Describe hogging stress condition and indicate the area in a ship that will be affected by the maximum tensile and compressive stress. (5 marks)
- (d) Sketch and labels hogging stress condition. (5 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer only THREE (3) questions.

Please use the answer booklet provided.

Question 3

With reference to ship hydrostatic calculation.

- (a) A ship LBP 80 m is floating in sea water at a draught of 4 m. The waterplane has the following offsets:

Station	0	1	2	3	4	5	6	7	8	9	10
½ B (m)	5	5	6	8	9	9	8	7	6	3	1

Calculate for draught of 5.0 m.

- i) Waterplane area, A_w (5 marks)
 - ii) LCF from amidships (5 marks)
- (b) A ship 40 m LBP is floating in sea water has the following waterplane area up to 2.4 m draught:

Draught(m)	0	0.4	0.8	1.2	1.6	2.0	2.4
A_w (m ²)	210	340	560	680	760	800	840

Calculate for draught of 2.4 m:

- i) Volume of Displacement (5 marks)
- ii) KB (5 marks)

Question 4

With reference to the ship form coefficient and dock water allowance.

- (a) A ship with 18.0 m beam and displacement of 7000 tonnes is floating at a draught of 5.8 m in seawater. Its waterplane area coefficient is 0.82, prismatic coefficient is 0.90 and TPC is 12.0 tonnes.

Calculate for a draught of 5.8 m:

- i) Waterplane Area, A_w (2 marks)
- ii) LBP of the ship (2 marks)
- iii) Volume of displacement (2 marks)
- iv) Area of immersed midship section, A_M (2 marks)
- v) Midship section area coefficient, C_M (2 marks)
- vi) Mass to be loaded to increase the draught up to 6.0 m. (3 marks)

- (b) A ship floating at 4.0 m draught in dock water of density 1010 kg/m^3 as shown in Figure 4(b) below. TPC is 10 tonnes and FWA is 120 mm. The maximum permissible draught at sea water is 4.1 m.

Determine :

- i) Dock Water Allowance, DWA (2 marks)
- ii) Maximum permissible draught at dock water (1 mark)
- iii) Increase draught to the maximum permissible in dock water (2 marks)
- iv) Load weight to reach maximum permissible draught in dock water (2 marks)

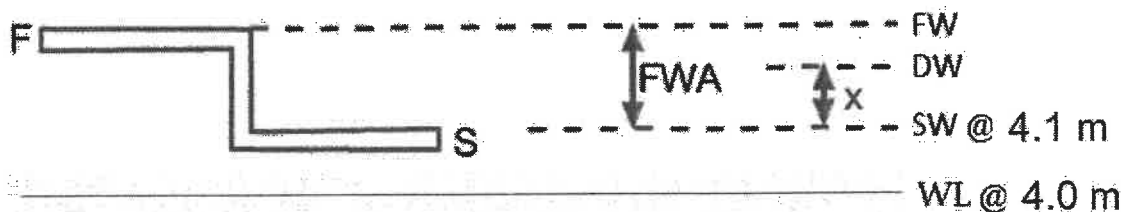


Figure 4(b)

Question 5

With reference to the ship angle of list calculation.

- (a) A ship of 6000 tonnes displacement has $KM = 7.3$ m, and $KG = 6.4$ m, is floating at 5° listed to port. If the ship is to decrease the final angle of list to 2° port by using ballast water from Water Ballast Tank No.4, determine:

- i) The required changes angle. (2 marks)
- ii) The required listing moment. (4 marks)
- iii) The weight of ballast water to be transferred given center gravity for both tank of port and starboard are 3 m out from centerline. State also movement of ballast water must take place.

(4 marks)

- (b) A ship of 5000 tonnes displacement is listed 4° to starboard and has $GM 0.80$ m. A weight of 60 tonnes, already onboard is moved 2.5 m vertically upwards and 8.0 m transversely to port.

Determine:

- i) New GM (4 marks)
- ii) Changes angle of list (4 marks)
- iii) Final angle of list (2 marks)

$$\tan \theta = \frac{w \cdot d}{\Delta \cdot GM}$$

Question 6

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

A ship LBP 120 m departed from Lumut Port with displacement 14,000 tonnes and longitudinal centre of gravity, (LCG) 1.2 m fwd of amidships.

The following items are now unloaded as shown in Table 6:

Table 6

Item	Mass (t)	LCG from amidships (m)
Cargo	8600	0.5 m Aft
Fuel oil	400	55 m Fwd
Fresh water	120	6.5 m Aft
Stores	80	50 m Fwd

Hydrostatic particulars indicate that at 4800 tonne displacement, mean draught is 4.5 m, Moment to change trim 1 cm, (MCTC) 156 tonne.m, longitudinal centre of buoyancy, (LCB) 2.1 m aft of amidships and longitudinal centre of floatation, (LCF) 1.5 m fwd of amidships.

Calculate:

- (a) New position longitudinal centre of gravity, LCG (7 marks)
- (b) Total change in trim (3 marks)
- (c) Change in trim Fwd (3 marks)
- (d) Change in trim Aft (3 marks)
- (e) Final draught at AP (2 marks)
- (f) Final draught at FP (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) $\text{LCB} = \frac{h \times \sum 1^{\text{st}} \text{Moment}}{\sum PV}$
- 11) $\text{BM}_L = I_{\text{LCF}} / \text{Volume}$
- 12) $\text{MCTC} = (\Delta \times G_{ML}) / 100L$
- 13) $\text{Parallel sinkage/rise} = w / \text{TPC}$
- 14) $\text{Final LCG} = \frac{\text{Final Moment about amidships}}{\text{Final Displacement}}$
- 15) $C_b = \text{Volume} / (L \times B \times T)$
- 16) $I_{\text{LCF}} = I_L - Ay^2$; $A = A_w$, $y = \text{LCF}$
- 17) $\text{KB} = \frac{w \times \sum 1^{\text{st}} \text{Moment}}{\sum PV}$
- 18) $\text{DWA(mm)} = \text{FWA} (1025 - \rho_{\text{DW}}) / 25$
- 19) $\text{TPC} = (A_w \times \rho) / 100$
- 20) $\text{Change in trim(cm)} = \frac{\text{trimming moment } (w \times d)}{\text{MCTC}}$
- 21) $C_m = A_m / (B \times T)$
- 22) $\text{LCF} = \frac{h \times \sum 1^{\text{st}} \text{Moment}}{\sum PA}$
- 23) $\text{Tan } \theta = \frac{\text{listing moment}}{\Delta \times \text{GM}}$

$$C_p = \frac{C_b}{C_m}$$

END OF EXAMINATION PAPER

