



UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION
OCTOBER 2025 SEMESTER SESSION

SUBJECT CODE	: LND10203
SUBJECT TITLE	: NAVAL ARCHITECTURE 1
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	: DIPLOMA OF ENGINEERING TECHNOLOGY (NAVAL ARCHITECTURE SHIPBUILDING)
TIME / DURATION	: 9.00 AM - 11.30 AM (2 HOURS 30 MINUTES)
DATE	: 29 JANUARY 2026

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.

THERE ARE 7 PAGES OF QUESTIONS, EXCLUDING THIS COVER PAGE.

SECTION A (Total: 60 marks)

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided.

Question 1

- (a) Complete the Table 1 below by using Figure A as your reference. The frigate has 6.1 m extreme beam. Use offset value at station 1 and waterline 2 for scale factor in your measurement.

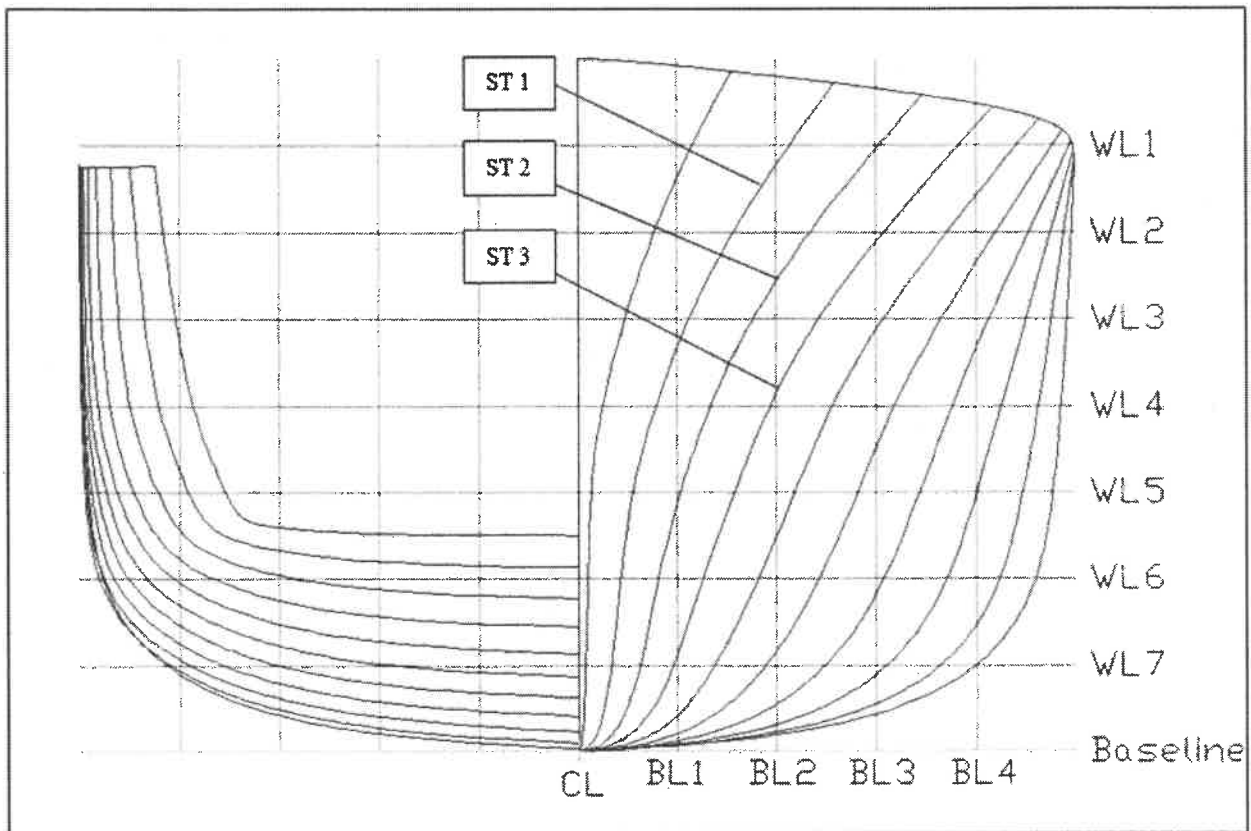


Figure A: 83m Frigate Body Plan

Table 1

Stations	1	2	3
WL 2	0.95		
WL 3			
WL 4			
WL 5			

****Units in meter.**

(11 marks)

- (b) Using the offset table given below, find;
- (i) Waterplane area at draft 3 meters (7 marks)
- (ii) Waterplane area coefficient, C_{wp} at draft 3 meters (2 marks)

<h1>MV FATEH</h1>		PRINCIPAL DIMENSION				
		LOA	75.00 m			
		LBP	72.00 m			
		BEAM	10.42 m			
		DEPTH	7.00 m			
TABLE OF OFFSETS (HALF BREADTH) in metres						
		Waterline Name and distance from Baseline in metres				
		BL	WL 0.5	WL 1	WL 2	WL 3
		0	0.5	1	2	3
Station Name	FP (0)	0	0	0	0	0
	½	0.44	0.63	0.82	0.99	1.66
	1	0.83	1.83	2.84	4.08	4.8
	2	2.89	3.89	4.94	5.2	5.21
	3	3.76	4.33	4.91	5.18	5.21
	4	3.79	4.37	4.91	5.18	5.21
	5	3.79	4.37	4.91	5.18	5.21
	6	3.4	4.16	4.86	5.17	5.21
	7	2.84	3.45	4.06	4.64	4.85
	7½	1.07	1.88	2.69	3.07	3.29
AP (8)	0	0.33	0.66	0.9	0.99	

Question 2

A ship 105m LBP, 16 m beam is floating in sea water. The waterplane has the following offsets at 5 m draught:

Station	0	½	1	2	3	4	5	6	7	8	9	9½	10
½ B (m)	5.0	5.5	6.0	6.5	7.4	7.6	8.0	7.7	6.9	6.0	3.0	2.0	0

The ship has the following waterplane area at other draughts:

Draught (m)	0	0.5	1.0	2.0	3.0	4.0
A_w (m ²)	15	490	750	1005	1210	1270

Calculate for a draught of 5.0 m;

- a) Waterplane area (6 marks)
- b) 2nd moment of area about centreline, I_T (6 marks)
- c) Volume of displacement (6 marks)
- d) BM_T (2 marks)

Question 3

- (a) With the support of sketches, discuss the differences between Sectional Area Curve and Bonjean Curve.

(8 marks)

- (b) A ship is 65m long, 13m beam, floats at even keel draught of 5m in sea water. Sectional areas are as follows:

Station	0	1	2	3	4	5	6	7	8	9	10
Area (m ²)	11	26	36	44	49	50	49	43	35	20	5

- i. Plot sectional area curve from the above table

(10 marks)

- ii. Draw LCB line in sectional area curve created in (i) if the center of buoyancy is 0.84m aft amidships

(2 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer only TWO (2) questions.

Please use the answer booklet provided.

Question 4

(a) A small weight is shifted from port to starboard as shown in Figure 3.0. Redraw the figure showing the final positions of the:

- i. Center of gravity (G),
- ii. Center of buoyancy (B),
- iii. Keel (K)
- iv. The resultant weight of the ship (Δ_S),
- v. The resultant buoyant force (F_B),
- vi. The transverse metacenter (M_T).

Be neat, clearly label, and use a straight edge where possible. Assume the angle of list is small.

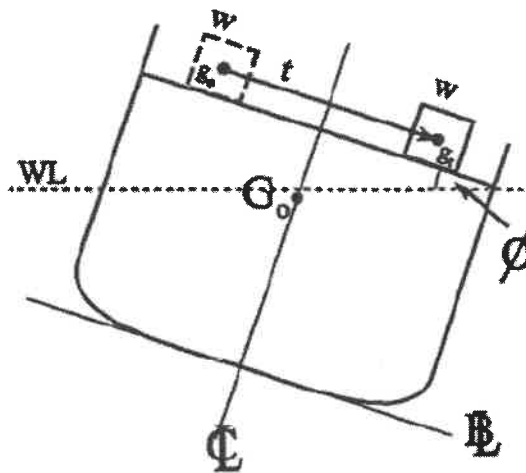


Figure 3.0

(6 marks)

- (b) An oil tanker of 15000 tonnes displacement has its centre of gravity 1m forward of amidships and has 250 tonnes of fuel oil in its forward deep tank 70m from amidships. This fuel is transferred to the after oil bunker whose centre is 40 m from amidships. After

transferring the fuel, 200 tonnes of fuel from the after bunker is now burned. Calculate the new position of the centre of gravity (LCG);

(i) After the oil has been transferred

(7 marks)

(ii) After the oil has been used.

(7 marks)

Question 5

(a) A weight of 75 tonnes when moved transversely across the deck through a distance of 4 m causes a ship of 6100 tonnes displacement to list 3.6 degrees to starboard. If KM_T is 5.8 m, find the KG.

(5 marks)

(b) A ship of 16700 tonnes displacement has $KM = 8.1$ m, and $KG = 7.2$ m was listed 9.8° to port. The following weights are then loaded and discharged:

- Discharge 296 tonnes cargo which centre of gravity is 8.4 m above the keel and 6.1 m to port from centre line.
- Discharge 120 tonnes cargo which centre of gravity is 8.2 m above the keel and 4.5 m to starboard from centre line.
- Load 115 tonnes of cargo at centreline which centre of gravity is 7.4 m above the keel.
- Load 74 tonnes of ballast which centre of gravity is 1.6 m above the keel and 5.8 m to starboard from centre line.

Calculate the final angle of list. (Assume no change in KM)

(15 marks)

Question 6

A cargo ship has LBP 130 m, LCF 3 m aft of amidships and floats at 4.6 m and 4.2 m draught at FP and AP respectively. Its TPC is 22.6 tonnes while MCTC is 154 tonnes.m.

If the following items are loaded and unloaded:

UNLOADED	140 tonnes cargo from 50 m fwd of amidships
	90 tonnes cargo from 30 m aft of amidships
	80 tonnes cargo at amidships
LOADED	60 tonnes cargo at LCF
	70 tonnes fresh water at 25 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 AP | (2 marks) |
| (f) Final draught at FP | (2 marks) |

LIST OF FORMULAE

1. $WPA = \frac{1}{3} \times h \times \text{Sum. of } PA \times 2$
2. $\delta T = \frac{\text{trim}}{LBP} \left[\frac{LBP}{2} \pm LCF \right]$
3. $\text{Change in trim} = \frac{TM}{MCTC}$
4. $\text{Parallel rise or sinkage} = w/TPC$
5. $\text{Tan}\theta = \frac{\text{Listing moment}}{\Delta \times GM}$
6. $GG_1 = (w \times d)/\Delta$
7. $\text{Final } KG = \frac{\text{Final moment about keel}}{\text{Final displacement}}$
8. $\text{Final } LCG = \frac{\text{Final moment about amidships}}{\text{Final displacement}}$
9. $TPC = \frac{\rho \times WPA}{100}$
10. $I_L = \frac{2}{3} \times h^3 \times \text{Sum. of 2nd mmt area}$
11. $I_T = \frac{2}{9} \times h \times \text{Sum. of 2nd mmt area}$
12. $BM_T = \frac{I_T}{\nabla}$
13. $BM_L = \frac{I_{LCF}}{\nabla}$
14. $I_{LCF} = I_L - WPA(LCF^2)$
15. $LCF = h \times \frac{\text{Sum. of 1st mmt area}}{\text{Sum. of product area}}$
16. $LCB = h \times \frac{\text{Sum. of 1st mmt volume}}{\text{Sum. of product volume}}$
17. $VCB = w \times \frac{\text{Sum. of 1st mmt volume}}{\text{Sum. of product volume}}$
18. $\nabla = \frac{1}{3} \times h \times \text{Sum. of } PV$
19. $C_B = \frac{\nabla}{LBT}$
20. $C_P = \frac{\nabla}{A_M \times L}$
21. $C_M = \frac{A_M}{B \times T}$
22. $C_{WP} = \frac{A_W}{B \times L}$
23. $GZ = KN - KG \sin\theta$

END OF EXAMINATION PAPER

