



UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION
MARCH 2025 SEMESTER SESSION

SUBJECT CODE	: LNB10703
SUBJECT TITLE	: NAVAL ARCHITECTURE 1
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	: BET IN NAVAL ARCHITECTURE AND SHIPBUILDING (HONOURS)
TIME / DURATION	: 2.00 PM - 4.30 PM (2 HOURS 30 MINUTES)
DATE	: 21 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 B
4. Answer **ALL** question in Section A. for section B answer **THREE (3)** questions **ONLY**.
5. Please write your answers on this answer booklet provided.
6. Answer **ALL** questions in English language **ONLY**.

THERE ARE 9 PAGES OF QUESTIONS, EXCLUDING THIS PAGE

SECTION A (Total: 40 marks)**INSTRUCTION: Answer ALL questions****Please use the answer booklet provided.****Question 1**

(a) Special displacement is one of the types of ships which are supported hydrostatically while in operation. Catamaran, SWATH and Deep Displacement hull are among the vessels categorized as special displacement vessels.

- i. Sketch the front view hull form of these three vessels (as stated above), showing their special features.

(6 marks)

- ii. The ferry operator wants to build a vessel with the main function of transporting a people from port A to port B. In between these two ports, the water depth is quite limited (shallow water). He requires a higher speed which is more than 35 knots for the vessel. In order to achieve that speed, the wetted surface area of the vessel should be reduced by minimizing the underwater hull area.

As a ship designer, among those three vessels of special displacement types as stated above, which one should you consider and give reason on your answer

(3 marks)

- (b) Sketch and label the following ship terminologies.

- i. After Perpendicular (AP)
- ii. Forward Perpendicular (FP)
- iii. Amidships
- iv. Draught
- v. Freeboard

(5 marks)

- (c) Differentiate between Length of Overall (LOA), Length of Waterline (LWL) and Length between Perpendicular (LBP). Your answer must be supported with figure/ sketch.

(6 marks)

Question 2

- (a) Briefly discuss the offset table

(2 marks)

- (b) Figure 1 shows a scaled body plan of a ship. By using a scale of 1 m to 1 cm, measure the offset data for the accuracy up to 1 decimal place and error of +/-0.2. Write your answer in the answer booklet referring to the Table 1 below and fill the data in the given roman numbers only

(8 marks)

Table 1: Offset table

	ST 0	ST 1	ST 2	ST 3	ST 4	ST 8	ST 9	ST 10	TR
WL0						(v)			(vii)
WL1		(ii)			(iv)				
WL2			(iii)				(vi)		
WL3	(i)								
WL4									
WL5									(viii)

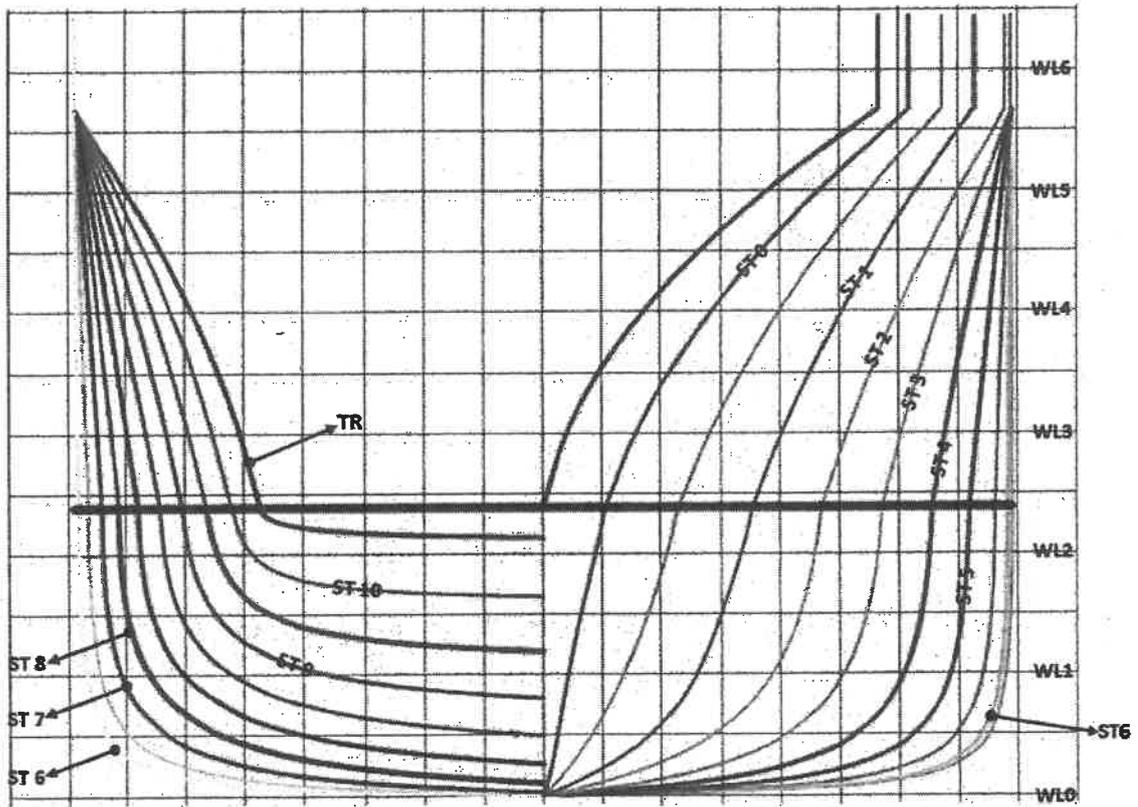


Figure 1: Scaled body plan of a ship

(c) Figure 2 shows the profile and body plan view of the ship. Using these two views as your reference, at waterline 1, 2 and 3, measure and fill in the values of offsets for station 1, station 2, station 7, and station 9 only. Fill up your offset as per Table 2 below. Standardize your measurement in mm unit.

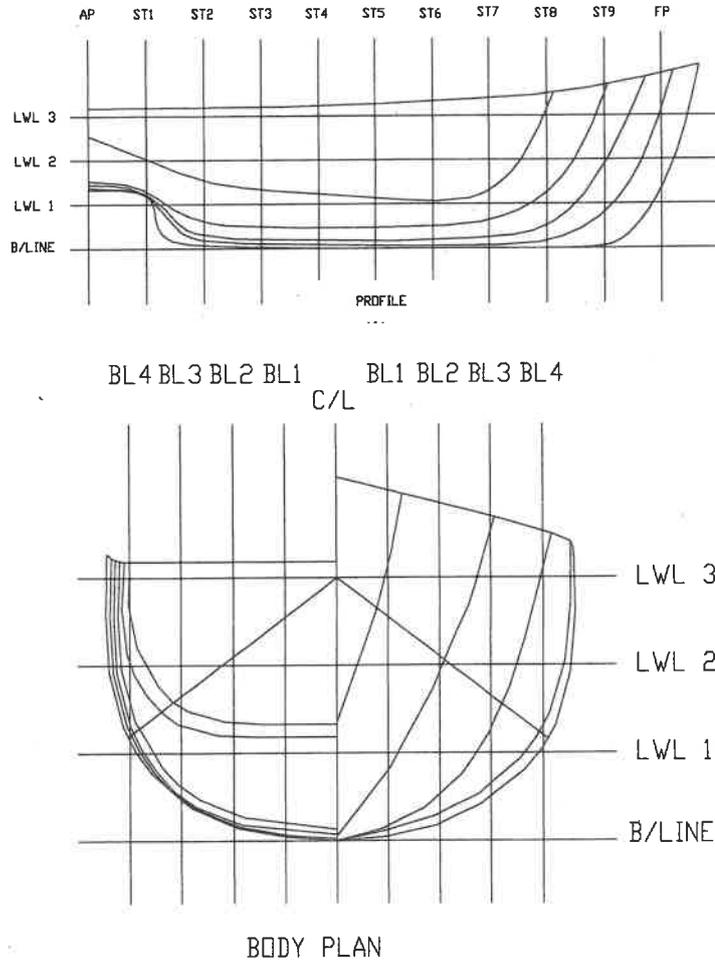


Figure 2: Profile and body plan of the ship

Table 2: Offset Table

St\WL	WL 1	WL 2	WL 3
1			
2	22.3 mm		
7			
9			17 mm

(10 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer only THREE (3) questions.

Please use the answer booklet provided.

Question 3

- (a) A ship with LBP of 180 m has the half ordinates as shows in Table 3. By using Simpson's 1st Rule, calculate:
- i. Waterplane Area (WPA)
 - ii. the longitudinal centre of floatation about amidships ($LCF_{\text{amidships}}$)
 - iii. the second moment of area about amidships ($I_{\text{amidships}}$)

Table 3: Offset data of 180 m ship

Station	0 (AP)	½	1	2	3	4	5	6	7	8	9	9½	10 (FP)
Offset (m)	0	5	8	10.5	12.5	13.5	13.5	12.5	11	7.5	3	1	0

(12 marks)

- (b) A ship 72 m LBP is floating in seawater has the following waterplane area up to 2 m draught:

Draught(m)	0	0.5	1	1.5	2
A_w (m ²)	321	510	630	720	770

At draught of 2.0 m, calculate.

- i. Volume of Displacement
- ii. Vertical Centre of Buoyancy (VCB)

(8 marks)

Question 4

- (a) A barge with same transverse sections throughout its length has 20 meters in length, beam of 8 meters and design water line (DWL) of 3 meters as shown in Figure 3.

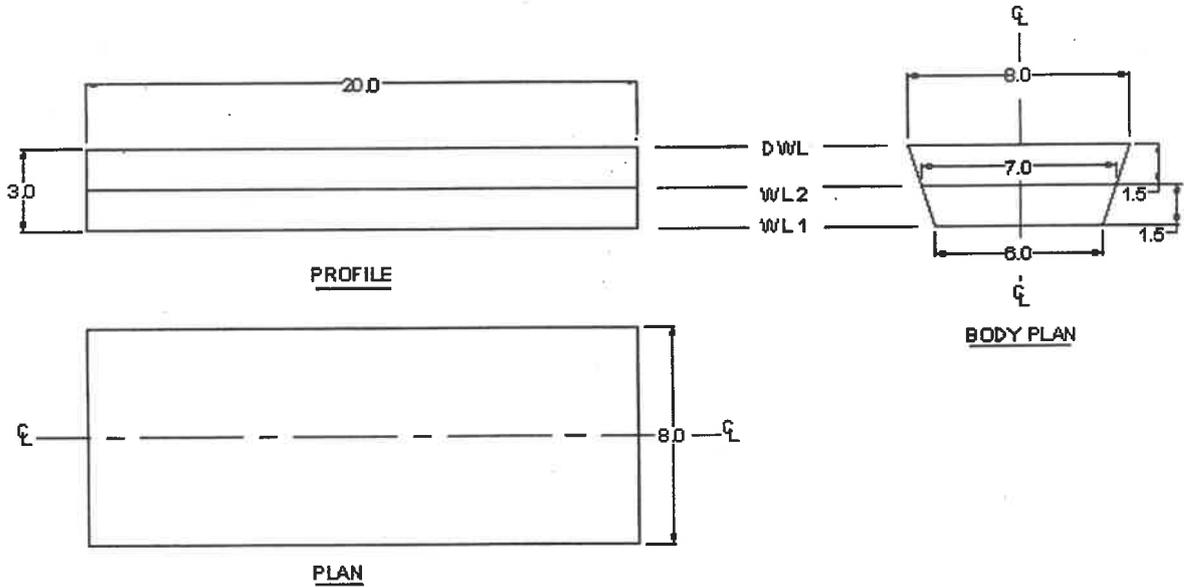


Figure 3 Lines Plan of 20m Barge

Calculate the following values for WL1 (baseline), WL 2 and DWL (Design Water Line) and organize your answers as per table shown in Table 4. Your answer must be supported with working calculation.

Table 4 Geometries Particular of 20m Barge

ITEM	WL 1 (BL)	WL 2	DWL
Waterplane Area (m ²)			
Volume Of Displacement (m ³)			420 m ³
Block Coefficient (C _B)			
Midship Coefficient (C _{Am})		0.93	

(10 marks)

- (b) Offset table for 24 m LBP crew boat as shown in Table 5 below. Calculate BM_T for waterplane area (WPA) at waterline 4 for this boat with the following half breadths. At this draught the boat has a displacement of 90.8 tonnes in sea water ($\rho_{sw} = 1.025$ tonnes/m³).

Table 5 Offset Table for 24m Crew Boat

ST \ WL	OFFSET							
	0	1	2	3	4	5	6	7
AP	0.00	0.00	0.00	0.00	0.00	2.49	2.53	2.56
0.5	0.00	0.00	0.00	0.00	2.36	2.57	2.61	2.66
1	0.00	0.00	1.38	2.60	2.63	2.66	2.69	2.71
2	0.00	2.36	2.62	2.65	2.67	2.70	2.72	2.75
3	0.26	2.40	2.62	2.65	2.67	2.70	2.73	2.75
4	0.26	2.40	2.62	2.65	2.67	2.70	2.73	2.75
5	0.26	2.40	2.62	2.65	2.67	2.70	2.73	2.75
6	0.26	2.32	2.57	2.61	2.64	2.68	2.71	2.74
7	0.26	1.63	2.01	2.21	2.31	2.41	2.51	2.61
7.5	0.00	0.43	0.87	1.15	1.37	1.58	1.79	2.00
FP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65

(10 marks)

Question 5

Referring to Table 5, the Hydrostatics Data of a typical patrol craft,

Table 6: Hydrostatic data of a patrol boat.

Draft, T	0.2	0.3	0.4	0.5	0.6	0.7	0.8
A_w	49.1	67.2	86.1	100	118.7	122	125.7
TPC	0.5	0.7	0.9	1	1.2	1.3	1.3
Δ	15.1	40.1	73	112.2	160.7	211.9	264.4
C_B	0.35	0.37	0.37	0.38	0.44	0.48	0.52
C_P	0.7	0.73	0.73	0.72	0.73	0.74	0.74
C_{WP}	0.78	0.79	0.78	0.8	0.82	0.83	0.83
C_M	0.5	0.5	0.5	0.52	0.6	0.65	0.68
LCB	2.3	2.4	2.4	2.3	1.9	1.6	1.5
KB	0.2	0.5	0.7	1	1.3	1.5	1.7
LCF	2.4	2.5	2.2	1.9	0.8	1	1.2
MCTC	0.2	0.4	0.8	1.1	1.6	1.7	1.9
I_L	774.2	1306.4	1958.4	2528.9	3435.2	3688.3	3971.1
I_{LCF}	501.2	876.7	1539.4	2179.1	3355	3566.3	3802.7
KM_L	34.2	22.9	22.4	20.9	22.7	18.8	16.5
KM_T	5.4	4.3	4	3.7	3.7	3.5	3.4

- (a) Construct (plot) the hydrostatic curve for all types of form coefficients by using graph paper. You must use appropriate scales and labels for the curves. (11 marks)
- (b) Determine its volume displacement (∇) and the transverse second moment of area (I_T) if the patrol craft is floating in sea water (density = 1.025 tonne/m³) at 0.7 m even keel draft. Given $BM_T = I_T/\nabla$ (9 marks)

Question 6

(a) A 5600 tonnes USS SIMPSON (frigate) is underway on an even keel at a draft of 4.8m, with LBP = 124m and KG = 6.2 m on the centerline and KM = 10.5m. She discharged 31 tonnes of ballast water from a tank located 3.4m port of the centerline, 4 m above the keel. Then, 10 tonnes of fuel are pumped into the service tank located 1.5m starboard of the centerline, 2.7m above the keel.

- i. Calculate the new KG_{new} of the ship
- ii. Calculate the ship's angle of list

(8 marks)

(b) A barge with Length between Perpendicular, LBP 100m floats at 3.2m and 4.4m at FP and AP respectively and has Longitudinal Centre of Floatation LCF 3m aft of amidships. Its TPC is 10 tonnes while MCTC is 100 tonnes-m. The following cargo is added and removed:

- LOAD : 20 tonnes cargo at 10 m forward of amidships
5 tonnes fuel at 10 m aft of amidships
- REMOVED : 50 tonnes cargo from 20 m forward of amidships
30 tonnes cargo from 15 m aft of amidships
10 tonnes cargo from 5m aft of amidships

Calculate the final draughts at both perpendiculars (FP and AP)

(12 marks)

END OF EXAMINATION PAPER

