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UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION
JULY 2025 SEMESTER SESSION

SUBJECT CODE	:	**LMD26603** / LMD25003
SUBJECT TITLE	:	**NAVAL ARCHITECTURE**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**DIPLOMA OF ENGINEERING TECHNOLOGY IN MARINE ENGINEERING**
TIME / DURATION	:	**09.00 AM - 11.30 AM (2 HOURS 30 MINUTES)**
DATE	:	**16 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 **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 6 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 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)

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, Aw (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
Aw (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)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer only TWO (2) questions.
Please use the answer booklet provided.

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 sea water. 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.) Draught to be increased so that it will float at maximum permissible at dock water (2 marks)
iv.) Weight can be loaded to meet the maximum permissible draught at dock water (2 marks)

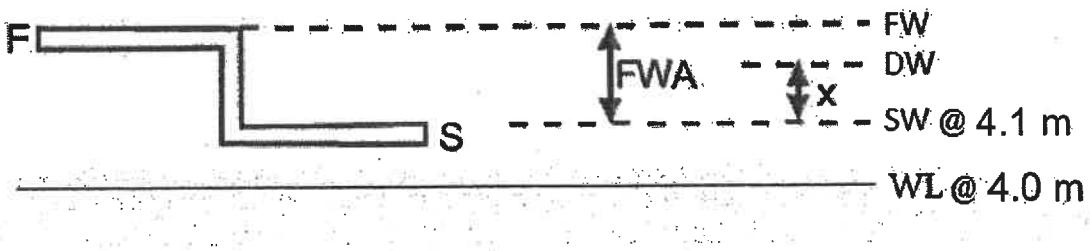

Figure 4(b)

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)

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:

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) $Aw = (1/3 \times h \times \sum PA) \times 2$
2) $\delta T = trim \times \left[\frac{LBP/2 \pm LCF}{LBP} \right]$
3) $C_W = A_W / (L \times B)$
4) Change in trim(m) $= \frac{\Delta \times p}{MCTC \times 100}$
5) $Volume = (1/3 \times h@w \times \sum PV)$
6) 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) LCB $= \frac{h \times \Sigma \text{ 1st Moment}}{\Sigma PV}$
11) $BM_L = I_{LCF} / Volume$
12) $MCTC = (\Delta \times G_{ML}) / 100L$
13) Parallel sinkage/rise = w / TPC
14) Final LCG $= \frac{\text{Final Moment about amidships}}{\text{Final Displacement}}$
15) $C_B = Volume / (L \times B \times T)$
16) $I_{LCF} = I_L - Ay^2$; *A = Aw, y = LCF*
17) KB $= \frac{w \times \Sigma \text{ 1st Moment}}{\Sigma PV}$
18) $DWA(mm) = FWA (1025 - \rho_{DW}) / 25$
19) $TPC = (Aw \times \rho) / 100$
20) Change in trim(cm) $= \frac{\text{trimming moment } (w \times d)}{MCTC}$
21) $C_M = A_M / (B \times T)$
22) LCF $= \frac{h \times \Sigma \text{ 1st Moment}}{\Sigma PA}$
23) $\tan \theta = \frac{\text{listing moment}}{\Delta \times GM}$

END OF EXAMINATION PAPER