UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY

FINAL EXAMINATION
JANUARY 2016 SEMESTER

COURSE CODE	: LDD20202
COURSE NAME	: NAVAL ARCHITECTURE 2
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	: DIPLOMA OF ENGINEERING TECHNOLOGY IN MARINE ENGINEERING
DATE	: 18 MAY 2016
TIME	: 02.00 PM – 04.30 PM
DURATION	: 2 HOURS 30 MINUTES

INSTRUCTIONS TO CANDIDATES

1. Please CAREFULLY read 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 questions in Section A. For Section B, answer TWO (2) questions only.
5. Please write your answers on the answer booklet provided.
6. Answer all questions in English language ONLY.

THERE ARE 7 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

A ship 32 m long and 6.4 m beam, floats at even keel draught of 2.5 m in sea water. At this draught her waterplane area coefficient is 0.84, LCF is 17.3 m from FP and second moment of area about amidships, I_L is 2576 m^4. The centre of buoyancy is 1.56 m above the keel. Half Sectional areas up to the draught are as follows.

Station	0	½	1	1 ½	2	2 ½	3	3 ½	4
½ As (m^2)	5.9	7.5	8.2	8.5	8.6	7.8	6.2	4.1	2.8

Calculate for a draught of 2.5 m:

(a) Waterplane Area, Aw (2 marks)

(b) LCF from amidships (2 marks)

(c) Second moment of area about LCF, I_{LCF} (2 marks)

(d) Volume of displacement (6 marks)

(e) Mass of displacement (2 marks)

(f) BM_L (2 marks)

(g) KM_L (2 marks)

(h) C_P (2 marks)

Question 2

(a) If the ship arrived in port with a mean draught of 7.0 m, discharged her cargo, loaded 300 tonnes of bunkers and completed with a mean draught of 5.8 m. Refer to the hydrostatic particulars below find how much cargo she discharged.

Draught (m)	Displacement (tonnes)
8.00	14820.0
7.50	13140.0
7.00	11480.0
6.50	9870.0
6.00	8280.0
5.50	6730.0
5.00	5220.0

(5 marks)

(b) A ship has a displacement of 13500 tonne in sea water. Its centre of gravity is 5.8 m above keel and its centre of buoyancy is 2.9 m above the keel. If the second moment of area of the waterplane about centerline is 48.5×10^3 m^4, find the metacentric height, GM_T.

(5 marks)

(c) A ship of 6200 tonnes displacement has its centre of gravity 1.4 m fwd of midships and 4.6 m above the keel. 260 tonnes of cargo are then removed at 40 m fwd of midships and 7.5 m above the keel. Calculate the new position of :

i. Longitudinal centre of gravity, LCG

(5 marks)

ii. Vertical centre of gravity, KG

(5 marks)

Question 3

A cargo ship has LBP 130 m, LCF 2.8 m aft of amidships and floats at 5.5 m and 5.1 m draught at FP and AP respectively. Its TPC is 24 tonnes while MCTC is 152.5 tonnes.m.
The following items are loaded and unloaded:

UNLOADED	160 tonnes cargo from 49 m fwd of amidships
	70 tonnes cargo from 15 m aft of amidships
	90 tonnes cargo at amidships
LOADED	50 tonnes cargo at LCF
	40 tonnes fresh water at 21 m fwd of amidships

Calculate:

(a) Total change in trim (8 marks)

(b) Change in trim fwd (3 marks)

(c) Change in trim aft (3 marks)

(d) Parallel rise (2 marks)

(e) Final draught at AP (2 marks)

(f) Final draught at FP (2 marks)

SECTION B (Total: 40 marks)

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

Question 4

A ship 116 m LBP, 21 m beam is floating in sea water at a 4 m draught. At this draught her TPC is 21.5 tonnes, and Second moment of area about centerline, I_T is 47523 m^4. A ship has the following waterplane area at draught 0 to 3.5 m in sea water.

Draught(m)	0	0.5	1.0	1.5	2.0	2.5	3	3.5
Aw (m^2)	865	968	1218	1402	1625	1708	1812	1956

Calculate for a draught of 4.0 m:

(a) Waterplane Area (2 marks)

(b) Volume of displacement (6 marks)

(c) Mass of displacement (2 marks)

(d) The height of the transverse metacentre above centre of buoyancy, BM_T (2 marks)

(e) The height centre of buoyancy above the keel, KB (6 marks)

(f) The height of transverse metacentre above the keel, KM_T (2 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 KG is 5.0 m, find the KM_T.

(5 marks)

(b) A ship of 14500 tonnes displacement has KM = 8.1 m, and KG = 7.2 m was listed 7° to starboard. The following weights are then loaded and discharged:

- Discharge 300 tonnes cargo which centres of gravity is 8.4 m above the keel and 6.1 m to starboard from centre line.
- Discharge 100 tonnes cargo which centres of gravity is 8.2 m above the keel and 4.5 m to port from centre line.
- Load 115 tonnes of cargo at centreline which centre of gravity is 7.4 m above the keel.
- Load 70 tonnes of ballast which centres of gravity is 1.6 m above the keel and 5.8 m to port from centre line.

Calculate:

i. Final KG (5 marks)

ii. Final GM. (Assume no change in KM) (1 mark)

iii. Changes angle of list. (7 marks)

iv. Final angle of list. (2 marks)

Question 6

(a) A ship 150 m LBP floats in sea water has draught of 7.1 m at AP and 6.7 m at FP. TPC 25 tonnes, MCTC 180 tonnes.m and centre of flotation is 1.5 m fwd amidships. Find the minimum amount of water ballast required to be taken into the forepeak tank (centre of gravity 60 m fwd of amidships) to decrease the draught at AP to 7.0 m.

(9 marks)

(b) MV MIMET is floating at draughts of 6.85 m at AP and 7.15 m at FP with LBP 120 m. Refer to the hydrostatic particulars below; calculate her longitudinal centre of gravity, LCG at that draught.

(11 marks)

Draught (m)	Displacement (tonnes)	MCTC (tonne-m)	LCB (m from Φ)
8.00	14820.0	190.0	2.50
7.50	13140.0	183.0	2.30
7.00	11480.0	180.0	2.00
6.50	9870.0	172.0	1.80
6.00	8280.0	165.0	1.50

(Notes; for LCB –ve mean fwd of amidships and +ve mean aft of amidships)

Table 1: Hydrostatic Particulars of MV MIMET

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) $I_L = 1/3 \times h^3 \times \Sigma\ 2^{nd}\ Moment_{(L)} \times 2$

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

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

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

7) $w \times d = \Delta \times GG_1$

8) $C_W = Aw / (L \times B)$

9) $GZ = KN - KG \sin \theta$

10) LCB = $\frac{h \times \Sigma\ 1^{st}\ Moment}{\Sigma\ PV}$

11) Parallel sinkage/rise = w / TPC

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

13) $I_T = 1/9 \times h \times \Sigma\ 2^{nd}\ Moment_{(T)} \times 2$

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

15) Tan θ = $\frac{\text{listing moment}}{\Delta \times GM}$

16) $I_{LCF} = I_L - Ay^2$

17) Change in trim = $\frac{\text{trimming moment}}{MCTC}$

END OF QUESTIONS