UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY

FINAL EXAMINATION
JANUARY 2016 SEMESTER

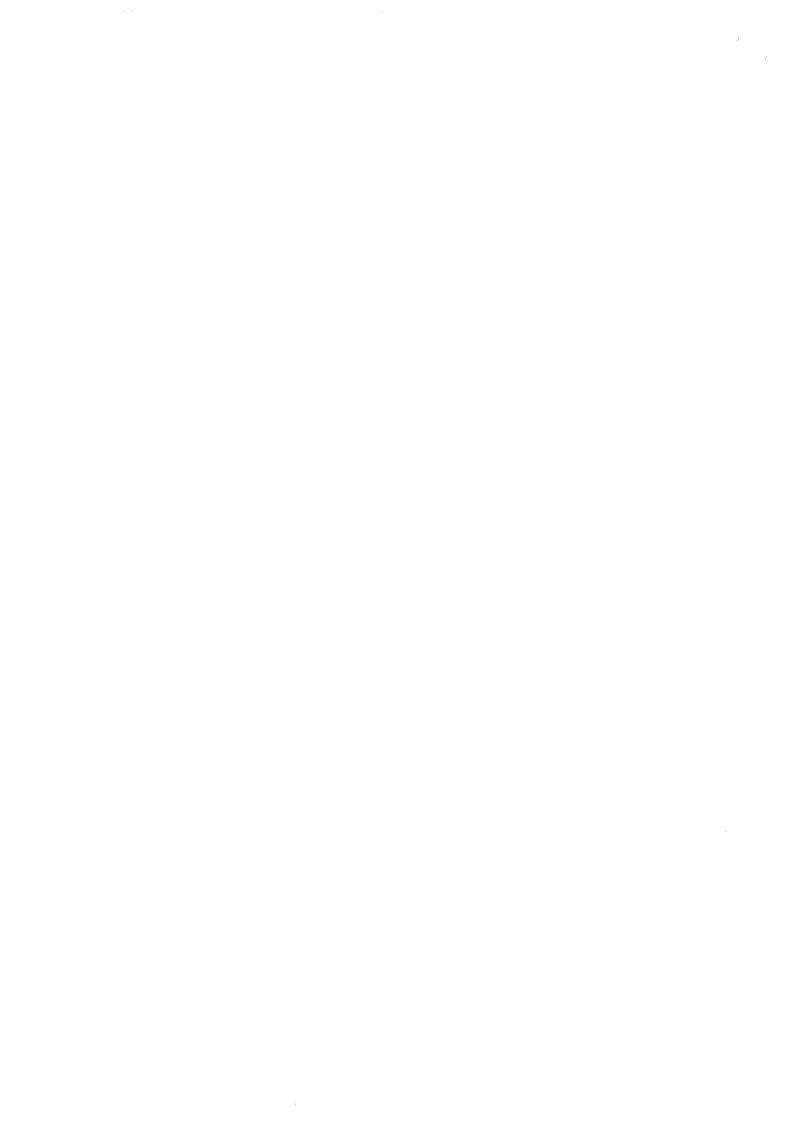|		
COURSE CODE	:	LMD22802
COURSE NAME	:	NAVAL ARCHITECTURE 2
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	DIPLOMA OF ENGINEERING TECHNOLOGY IN MARINE ENGINEERING
DATE	:	18 MAY 2016
TIME	:	02.00 PM – 04.30 PM
DURATION	:	2 HOURS 30 MINUTES

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) A bulk carrier has 185 m LBP, 32.26 m beam is floating in sea water at 11.10 m draught and has a displacement of 47965 tonnes. At this draught her waterplane area coefficient is 0.87, LCF is 90.1 m from FP and second moment of area about amidships, I_L is 3.745×10^6 m^4.

Calculate for a draught of 11.10 m:

i.	Waterplane Area, Aw	(2 marks)
ii.	LCF from amidships	(2 marks)
iii.	Second moment of area about LCF, I_{LCF}	(2 marks)
iv.	Volume of displacement	(2 marks)
v.	BM_L	(2 marks)

(b) Solve the problems below **using** the **hydrostatic particulars** given.

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

i. 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 5.7 m, find how much cargo she discharged.

(5 marks)

ii.   At a certain draught the ship discharged 2700 tonnes of cargo and loaded 130 tonnes of fresh water. The final mean draught was 6.5 m. Find the original mean draught.

(5 marks)

Question 2

A cargo ship has LBP 126 m, LCF 3.7 m forward of amidships and floats at 5.3 m and 5.8 m at FP and AP respectively. Its TPC is 22.3 tonnes while MCTC 167.3 tonnes.m.

Find the final draught at the perpendiculars when the following item are loaded and unloaded:

UNLOADED	102 tonnes cargo from 34 m aft of amidships
	43 tonnes cargo from 12 m fwd of amidships
	96 tonnes cargo at amidships
LOADED	38 tonnes cargo at LCF
	84 tonnes fresh water at 28 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)

Question 3

A ship of 8300 tonnes displacement has KM = 7.6 m, and KG = 6.5 m was listed 5.6° to starboard. The following weights are then loaded and discharged:

- Load 235 tonnes cargo which centre of gravity is 6.4 m above the keel and 5.3 m to port from centre line.

- Load 156 tonnes cargo which centre of gravity is 6.4 m above the keel and 2.8 m to starboard from centre line.

- Discharge 98 tonnes of cargo at centreline which centre of gravity is 5.8 m above the keel.

- Discharge 54 tonnes of ballast which centre of gravity is 1.2 m above the keel and 6.9 m to starboard from centre line.

Calculate:

(a)	Final KG	(7 marks)
(b)	Final GM. (Assume no change in KM)	(2 marks)
(c)	Changes angle of list.	(9 marks)
(d)	Final angle of list.	(2 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer only TWO (2) questions.

Please use the answer booklet provided.

Question 4

A ship has the following waterplane area at draught 0 to 4.0 m in sea water.

Draught (m)	0	0.5	1	1.5	2	4
Waterplane Area (m²)	25	350	680	1005	1230	1380

When the ship is floating at a draught of 6 m, the waterplane has the following offsets with 110 m length, 16 m breadth and transverse second moment of area about centerline, I_T is 25574.45 m⁴.

St	0(AP)	1	2	4	6	6.5	7	7.5	8(FP)
1/2 B (m)	5.0	6.2	6.8	8.0	7.7	7.2	6.5	3.5	2.0

Calculate for a draught of 6.0 m:

(a)	Waterplane Area, Aw	(6 marks)
(b)	Volume of displacement	(5 marks)
(c)	BM_T	(2 marks)
(d)	KB	(5 marks)
(e)	KM_T	(2 marks)

Question 5

(a)   A ship has a displacement of 13000 tonne in sea water. Its centre of gravity is 5.8 m above keel and its centre of buoyancy is 3.2 m above the keel. If the second moment of area of the waterplane about centerline is $41.5 \times 10^3 \, m^4$, find the metacentric height, GM_T.

(5 marks)

(b)   A ship arrives in port trimmed 0.3 m by the bow and discharges 4200 tonnes of cargo from 4 holds. 1700 tonnes of the cargo is to be discharged from No. 1 hold and 900 tonnes from No. 4 hold. Centre of flotation is 2 m aft of amidships, MCTC 250 tonnes m.

The centre of gravity of No. 1 hold is 44 m forward of amidships.
The centre of gravity of No. 2 hold is 26 m forward of amidships.
The centre of gravity of No. 3 hold is 21 m aft of amidships.
The centre of gravity of No. 4 hold is 51 m aft of amidships.

Find the amount to be discharged from No. 2 and No. 3 holds if the ship is to complete on an even keel.

(15 marks)

Question 6

(a)   A ship 195 m LBP floats in sea water has draught of 6.7 m at FP and 7.1 m at AP. TPC 23 tonnes, MCTC 183 tonnes.m and centre of flotation is 1.6 m aft amidships. Find the minimum amount of water ballast required to be taken into the forepeak tank (centre of gravity 54 m fwd of amidships) to increase the draught forward to 7.0 m.

(8 marks)

(b)   MV MIMET is floating at draughts of 5.85 m at FP and 6.15 m at AP with LBP 120 m. Its GM was measured and found to be 0.45 m.
Calculate:

    i.   Displacement,   (3 marks)
    ii.   Longitudinal centre of gravity, LCG   (7 marks)
    iii. Vertical centre of gravity, KG.   (2 marks)

Draught (m)	Displacement (tonnes)	KB (m)	BM_T (m)	MCTC (tonne-m)	LCB (m from Φ)	LCF (m form Φ)
8.00	14820.0	4.07	3.66	190.0	2.50	2.0
7.50	13140.0	3.67	3.98	183.0	2.30	1.50
7.00	11480.0	3.26	4.46	180.0	2.00	0.70
6.50	9870.0	2.85	5.02	172.0	1.80	-0.06
6.00	8280.0	2.44	5.66	165.0	1.50	-1.00
5.50	6730.0	2.04	6.67	157.0	1.10	-2.00
5.00	5220.0	1.63	8.06	146.0	0.00	-3.00

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

Table 1: Hydrostatic Particulars of MV MIMET

END OF QUESTIONS

LIST OF FORMULAE

1) $Aw = (1/3 \times h \times \sum PA) \times 2$

2) $\delta T = trim \times \left[\dfrac{LBP/2 \pm LCF}{LBP} \right]$

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

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

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

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

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

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

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

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

11) Parallel sinkage/rise = w / TPC

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

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

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

15) $Tan\ \theta = \dfrac{listing\ moment}{\Delta \times GM}$

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

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