SET A

UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION

SEPTEMBER 2016 SESSION

SUBJECT CODE	:	LNB 20403
SUBJECT TITLE	:	NAVAL ARCHITECTURE 2
LEVEL	:	BACHELOR
TIME / DURATION	:	(3 HOURS)
DATE	:	13th JANUARY, 2017

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. Please write your answers on the answer booklet provided.
3. Answer should be written in blue or black ink except for sketching, graphic and illustration.
4. Answer five (5) questions only.
5. Answer all questions in English.

THERE ARE 3 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

INSTRUCTION: Answer FIVE (5) questions only.
Please use the answer booklet provided.

Question 1

(a) Discuss the FIVE (5) factors which affect the initial stability of a floating body, e.g. a ship.

(10 marks)

(b) On departure from the fishing grounds for home a trawler is found to have 30 t of fish in the fish hold at a height of 2.4 m above the keel. Since leaving port the trawler had consumed 13 t of fuel (CG 0.9 m above keel), 8 t of fresh water (CG 1.8 m above keel), 2t of stores (CG 3 m above keel) and lost 3 t of nets and fishing gear (CG 4.3 m above keel). Before leaving port the trawler had a displacement of 500 t and the height of its centre of gravity above the keel KG was 2.1 m. Calculate the new position of G above the keel. If in this condition the height of M (metacenter), i.e. KM is 2.7 m, determine the GM (metacentric height) on leaving the fishing grounds and the value of GZ (righting lever) at 10 degrees of inclination.

Given: Righting lever GZ = GM sin θ. (10 marks)

Question 2

(a) Explain angle of loll for a ship. You may illustrate your answer with sketches, where applicable.

(10marks)

(b) A ship of 10,000 t displacement has a rectangular double bottom tank 8 m long and 12 m wide. Calculate the free surface effect if this tank is partly full of liquid of density 0.85 t/m^3. Determine the reduction in free surface effect if a longitudinal centerline division is fitted in the tank.

Given: Moment of inertia of free surface about centerline of tank $I_{xx} = lb^3/12$

$$GG_2 = \frac{\text{(density of liquid)} \times I_{xx}}{\text{psw} \blacktriangledown}$$

(10 marks)

Question 3

(a) Describe the determination of BM_T, i.e. the height of the transverse metacenter M_T above the centre of buoyancy B of ship in terms of transverse moment of inertia and volume of displacement. You may use sketch to illustrate your answer.

(10 marks)

(b) A ship of 9,000 t displacement and height of metacenter KM of 7 m was inclined by moving 4 t through 18 m across the deck. The deflection of a 10 m pendulum was seen to be 125 mm. The following items were on board at the time of the inclining experiment and do not form part of the lightweight:

Item	Mass (tonnes)	Vertical centre of gravity (VCG) (m)
Inclining masses	16	12.2
Fuel oil	100	9.4
Fresh water	70	10.7
Water ballast	180	6.1
Miscellaneous	40	11.6

Calculate the lightweight of the ship and its VCG or KG.

Given: $GM \text{ as inclined} = \frac{(\text{Inclining mass}) \times (\text{Distance moved})}{\text{Displacement} \times \tan\theta}$

(10 marks)

Question 4

(a) Flooding occurs when there is damage between two watertight bulkheads and the compartment is open to the ocean. Explain the effect of flooding on stability of a ship and the means adopted to reduce the amount of flooding.

(10 marks)

(b) A ship of 10,000 t displacement and 100 m long, floats at drafts of 8.60 m forward and 9.30 m aft. The TPC is 12.1 t/cm, GM_L is 110 m and the centre of flotation F is 2.5 m aft of amidships. Calculate the MCT 1 cm and the new end drafts when 92 t are added 30 m aft of amidships.

Given: $\text{MCT 1 cm} = \frac{\Delta \times GM_L}{100L}$; $\text{Bodily sinkage} = \frac{\text{Mass added}}{\text{TPC}}$ (10 marks)

Question 5

(a) Describe the damage stability criteria for naval ships. Are naval ships required to comply with IMO (International Maritime Organization) standards?

(10 marks)

(b) Just before touching down in a drydock, a ship of 5,000 t displacement mass floats at drafts of 2.7 m forward and 4.2 m aft. The length between perpendiculars is 150 m and the water density 1.025 t/m^3. Using the given hydrostatic data, which may be considered constant over the variation in drafts considered, determine:

(i) The thrust on the heel of the sternframe, which is at the aft perpendicular, when the ship is just about to settle on the docking blocks, and,

(ii) The metacentric height GM at the instant of settling on the blocks.

Hydrostatic data: KG = 8.5 m, KM = 9.3 m, MCT 1 cm = 107,034 t-m, LCF = 2.7 m aft of amidships.

Given: Loss of GM on touching down = (P/Δ) x KM.

(10 marks)

Question 6

(a) Explain both methods of solving damage stability problem i.e. by means of lost buoyancy and added mass methods.

(10 marks)

(b) A box barge 60 m long and 10 m wide floats at a level keel draft of 3 m. Its centre of gravity is 2.5 m above the keel. Determine the forward and aft drafts if an empty, fore end compartment 9 m long is laid open to the ocean, i.e. bilged/flooded.

Given: $BM_L = \frac{I_L}{\blacktriangledown}$ where BM_L is the distance between centre of buoyancy and longitudinal metacenter, I_L is the longitudinal moment of inertia and $\blacktriangledown$ volume of displacement of the barge.

$I_L = \frac{BL^3}{12}$ where B is the width or beam and L is the length of the barge.

(10 marks)

END OF QUESTIONS