UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY

FINAL EXAMINATION
JANUARY 2017 SEMESTER

COURSE CODE	:	LNB30503
COURSE NAME	:	SHIP STRUCTURES
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	BACHELOR OF ENGINEERING TECHNOLOGY (HONS) IN NAVAL ARCHITECTURE & SHIPBUILDING
DATE	:	08/07/2017 SAT
TIME	:	9.00 AM - 12.00 PM
DURATION	:	3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read CAREFULLY the instructions given in the question paper.
2. This question paper has information printed on both sides.
3. This question paper consists of TWO (2) sections; Section A and Section B. Answer ALL questions in Section A and THREE (3) questions from Section B.
4. Please write yours answers on the answer booklet provided.
5. Write your answers only in BLACK or BLUE ink.
6. Answer all questions in English.

THERE ARE 10 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

Question 1

(a) List four basic modes of ship failure?

(4 marks)

(b) The LBP of the ship is 195 m and the beam is 28 m and block coefficient 0.8. The weight of hull, superstructure and crane are 5050 tonnes, 750 tonnes and 50 tonnes respectively. The hull, superstructure and derrick located at LCG 25 m, 4.5 m aft and 28.5 m fwd from amidships, respectively. The mean LCB is 27.25 m from amidships. Values of the constant b are: hogging 9.795 and sagging 11.02.

By using Murray's Method, please calculate the longitudinal bending moments amidships for the ship on a standard wave with the crest amidships and the through amidships. The data for the ship are as follows:

Table 1

Item	Weight (tonnes)	LCG from amidships
Hold No. 1	1800	55.0 m aft
Hold No. 2	3200	25.5 m fwd
Hold No. 3	1200	5.5 m fwd
Hold No. 4	2200	24.0 m aft
Hold No. 5	1500	50.0 m aft
Hold No. 6	2750	75.0 m fwd
Machinery	1500	7.5 m aft
Fuel Tank	400	8.0 m aft
Fresh Water Tank	150	10.0 m fwd

(8 marks)

(c) The mass distribution and buoyancy between sections of a ship, 300m in length, balanced on a sagging wave, are given below. Hence, draw the load; shear force and bending moment diagram.

Table 2

Station	Weight	Buoyancy
1		
	0.88	0.005
2		
	1.609	0.025
3		
	2.093	0.714
4		
	3.082	3.038
5		
	2.56	5.684
6		
	3.064	6.368
7		
	3.237	4.929
8		
	3.489	2.445
9		
	2.22	0.498
10		
	1.645	0.173
11		

(8 marks)

Question 2

(a) State two principal functions of ship structure.

(2 marks)

(b) List all the structural components for the midship section below (see Figure 1).

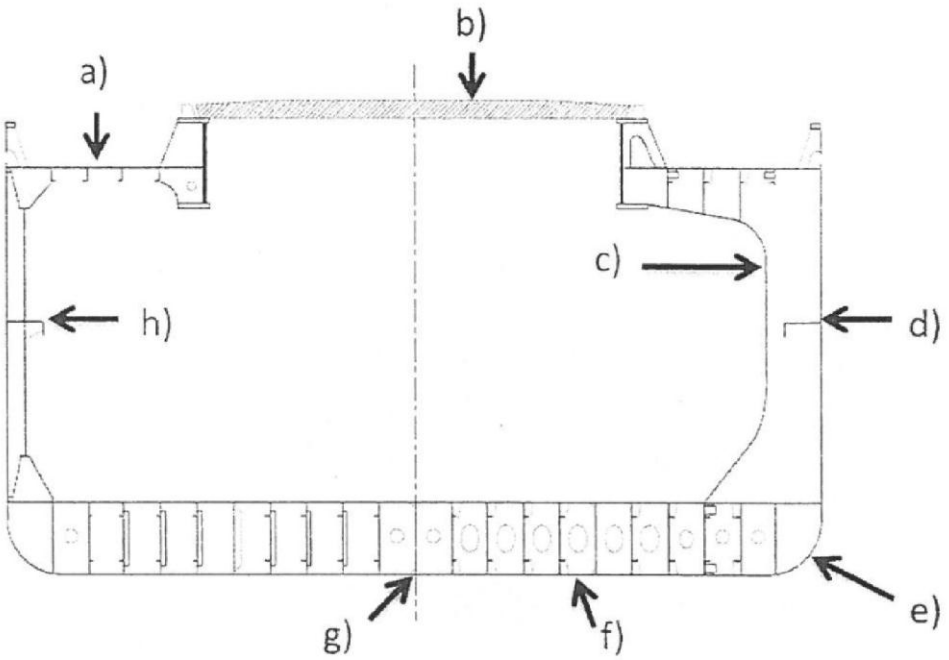

Figure 1

(4 marks)

(c)

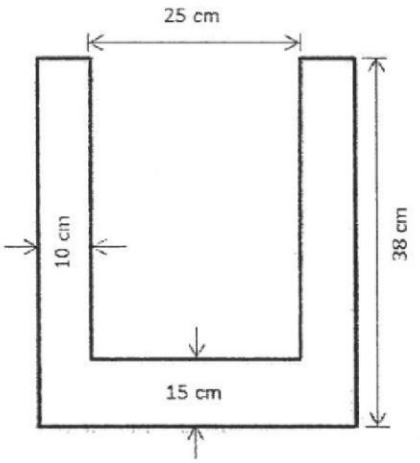

Figure 2

The channel above (Figure 2) is to be used as stiffener for bulk carrier vessel. Calculate;

i) The True Neutral Axis

ii) The Moment of Inertia about the Neutral Axis

(6 marks)

(d) The midship section of a vessel breadth 24 m and depth 15 m can be assumed as shown in Figure 3 below. If the vessel is subjected to a maximum bending moment at the neutral axis is 540 MNm, calculate the second moment of area, the position of neutral axis and the stress on the keel and the main deck. All the materials are steel and have a thickness of 15 mm.

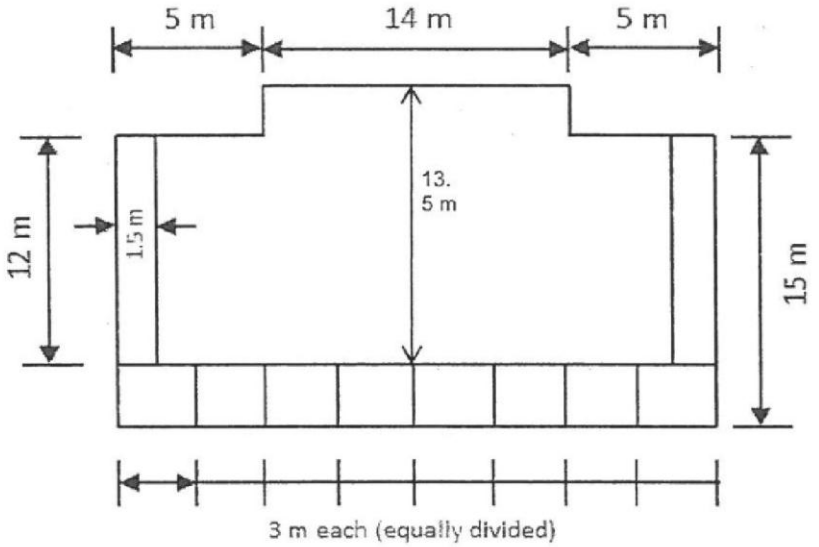

Figure 3

(8 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer only THREE (3) questions.

Question 3

(a) State three design constraints that engineer and designer need to be considered.

(3 marks)

(b) A traversing beam of an overhead crane with 17 m long has been installed onboard a vessel. Both ends of the beam are fitted with rollers and considered point supported. The weight of the beam is 1.25 $t.m^{-1}$ and lifting a load of 12 tonnes at mid span of the beam. Define;

i) The free body diagram showing the forces and moments on the beam.

(2 marks)

ii) Calculate the reactive forces at both ends.

(3 marks)

iii) Calculate the bending moment at the mid span.

(3 marks)

(c) A ship sails through a rough weather at sea is subjected to a bending moment of 100 t.m and the ship rolls to one side by Ø degrees.

i) Derive the general expression of the stress subjected to the structure at a coordinate (x,y) as the ship rolls to Ø degrees.

(4 marks)

ii) Calculate the stress subjected to the ship at a coordinate position of 10 m from the ship's centerline and 15 m from the inclined neutral axis on the midships section as the ship rolls to 30 degrees, given that the second moment of areas about the neutral axis (I_{NA}) is 350m^4 and about the ship vertical centerline (I_{CL}) is 200 m^4 and the midships bending moment is 310 MNm.

(5 marks)

Question 4

(a) Theorem of Castigliano states that the partial derivative of the total strain energy U with respect to each applied load is equal to the displacement of the structure at the point of application in the direction of the load. The theorem could be applied in solving problems on ship structures.

i) Write down the expression of the strain energy due to bending moment M for a curved beam of second moment area I and the Young's modulus E.

(4 marks)

ii) Derive the equation of the displacement from the expression in i) above.

(4 marks)

(b) A continuous beam ABC (Figure 4) of constant cross section is fixed in position and direction at point A and C, and simply supported at point B. The beam is loaded as shown below:

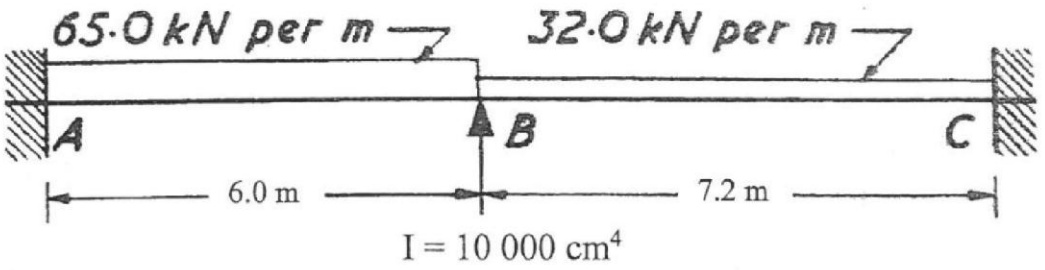

Figure 4

Please analysis and determine the final bending moments at point A, B and C by using Moment Distribution Method and sketch the Bending Moment Diagram to show the distribution of moments along the beam.

(12 marks)

Question 5

(a) A stress concentration in ships had become problematic issues to designers and ship operators and many ships and life were lost due to the effects. The problems arise mainly due to discontinuity structurally or materially.

i) Explain the two types of structural discontinuities exist in ships.

(2 marks)

ii) State two of the many eventual outcomes as a result of stress concentration.

(2 marks)

(b) i) Define an efficiency of a superstructure.

(4 marks)

ii) The midship section of a steel ship has the following particulars:
Cross-sectional area of longitudinal material = $2.3m^2$
Distance from neutral axis to upper deck = 7.6m
Second moment of area about the neutral axis = $58m^4$

A superstructure deck is to be added 2.6m above the upper deck. This deck is 13m wide, 12mm thick and is constructed of aluminum alloy. If the ship must withstand a sagging bending moment of 450MNm, calculate the superstructure efficiency if with the superstructure deck fitted, the stress in the upper deck is measured as $55MN/m^2$. (Young's modulus of aluminum as 0.322 that of steel).

(12 marks)

Question 6

(a) A combined deck plating and a transverse beam of length L m of grain carrying ship cargo hold designed to carry a uniformly distributed load w t/m can be represented by a structure loaded as shown in Figure 5. Both ends are assumed to be fully welded (i.e fixed ends). Derive the expression of the generalized bending moment of the beam, at a distance x from one end beyond the mid length of the beam, given that the fixing moments at both ends are equal to $wL^2/12$.

(8 marks)

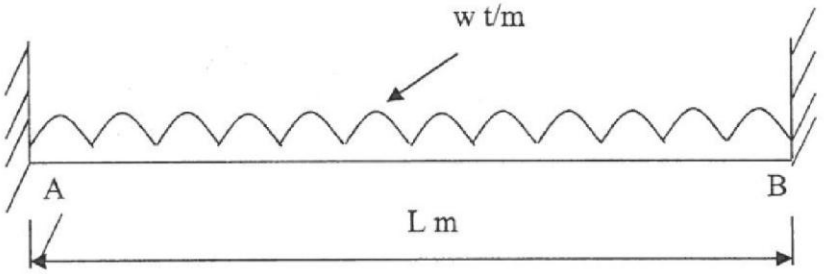

Figure 5

(b) In a ship, the maximum shearing force is 44.76 MN. *AY* about the neutral axis is 151,000 m cm². I about the neutral axis is 2,758,000 m² cm² and the thickness of the shell plating at the neutral axis is 2.14 cm. Determine the shear stress at the neutral axis.

(4 marks)

(c) Figure 6 shows a cross section of a pontoon installed with 5 equally spaced longitudinal watertight bulkheads used by army for floating bridge for river crossing of dimension as shown. Each pontoon is designed to withstand a maximum bending moment of 350 MNm for track-wheeled armoured vehicles. Calculate the second moment of area and the stresses on the keel and the main deck subjected to the pontoon. The thickness of the top and the bottom decks is 25 mm the bulkheadss are 20 mm thick.

(8 marks)

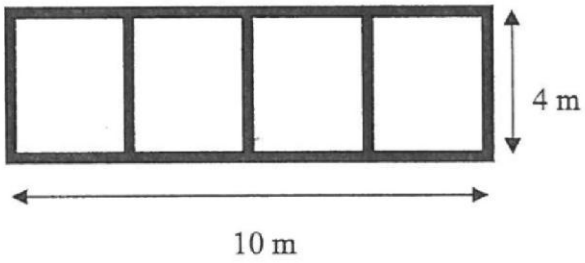

Figure 6

END OF EXAMINATION PAPER