UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION

SEPTEMBER 2016

SUBJECT CODE	:	LMB 20303
SUBJECT TITLE	:	SHIP CONSTRUCTION
LEVEL	:	BACHELOR
TIME / DURATION	:	9.00 am – 12.00 pm (3 HOURS)
DATE	:	24 JANUARY 2017

INSTRUCTIONS TO CANDIDATES

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

THERE ARE 8 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.

Question 1

a) Refer to figure 1 below. List the components of ship highlighted :

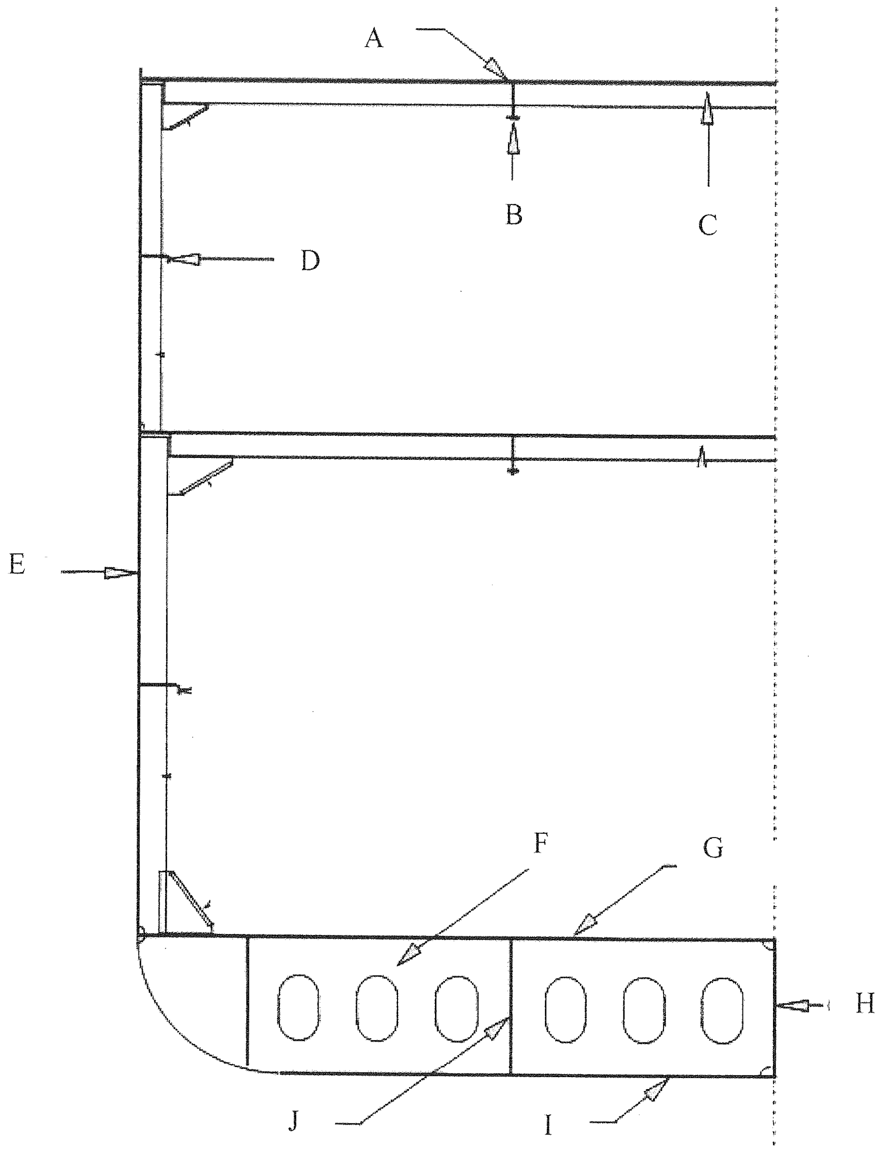


Figure 1

(5 marks)

b) 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.

(4 marks)

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

(2 marks)

iii) Define an efficiency of a superstructure.

(4 marks)

iv) If the superstructure efficiency of a frigate is 0.75, the upper deck stress for the ship without a superstructure (σ_o) is 180 N/mm^2 and stress when the superstructure is fully effective is 150 N/mm^2, calculate the stress subjected to the upper deck.

(5 marks)

Question 2

(a) Two 500 ton LNG containers are to be shipped on a rectangular barge (figure 2) 100m long and 25m wide. The barge draws 1m when unloaded (the density of water may be approximated to 1 t/m^3. The container can be considered to be uniformly loaded into the compartment to which they are located. Plot the load Diagram, Shear Force Diagram and Bending Moment Diagram.

Designating values of the shear and bending moment at each 20m station and at amidships as follows.

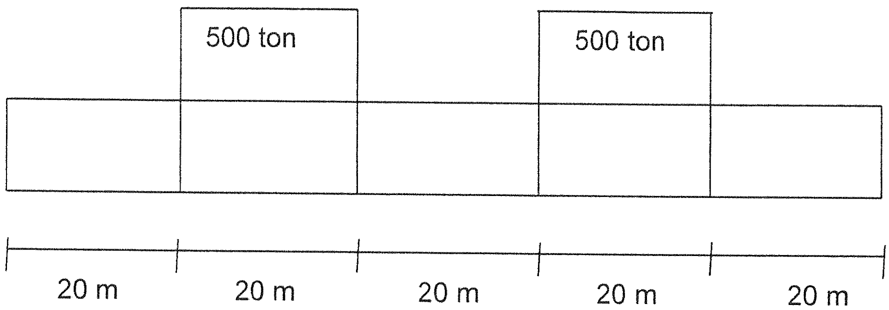


Figure 2

(12 marks)

(b) The LBP of the ship is 180 m and the beam is 28 m and block coefficient 0.75. The hull weight is 5000 tonnes having LCG 25.5 m from amidships. The mean LCB is 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:

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
Machinery	1500	7.5 m aft
Fuel Oil	400	8.0 m aft
Fresh Water	150	10.0 m fwd

Table 1

(8 marks)

SECTION B (Total: 60 marks)
INSTRUCTION: Answer only THREE (3) questions

Question 3

(a) From your understanding on the basic stress and strain in ship structures, explain these basic stress and strain and show their relationship mathematically.

(5 marks)

(b) A ship sails through a rough weather at sea is subjected to a bending moment. Derive the general expression of the stress subjected to the structure at a coordinate (x,y) as the ship rolls to Ø degrees.

(5 marks)

(c) The beam below (figure 3) is to be used as a deck girder for box-shaped barge. Please calculate;

a) The True Neutral Axis

b) The Moment of Inertia about the Neutral Axis

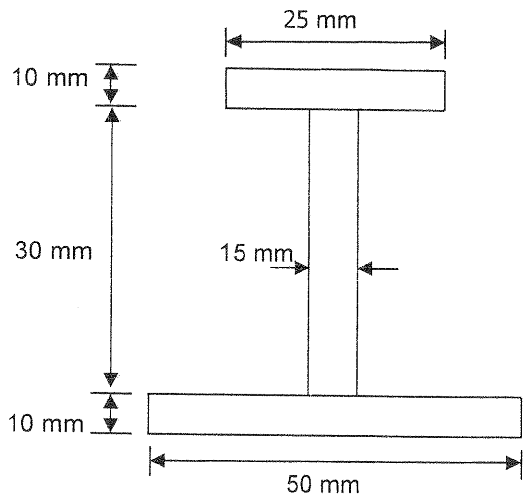


Figure 3

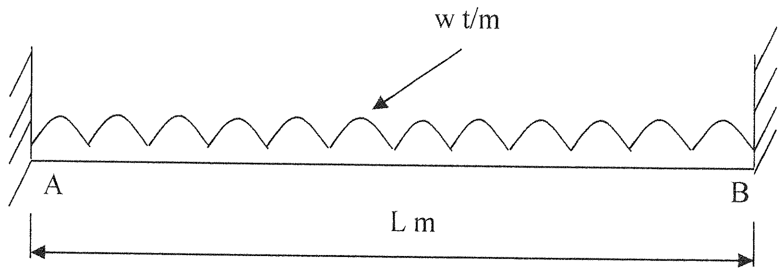
(10 arks)

Question 4

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 4. 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 $wL^2/12$

(12 marks)

Figure 4



b) Calculate the stress subjected to the ship at a coordinate position of 12 m from the ship's centerline and 10 m from the inclined neutral axis on the midships section as the ship rolls to 20 degrees, given that the second moment of areas about the neutral axis (I_{NA}) is 300m^4 and about the ship vertical centerline (I_{CL}) is 250 m^4 and the midships bending moment is 450 MNm.

(8 marks)

Question 5

a) State five (5) design constraints that engineer and designer need to be considered.

(5 marks)

b) The midship section of a ship breadth 16.5 m and depth 11 m can be assumed as shown in Figure 5 below. All the material are steel and has a thickness of 1.25 cm. Determine the moment of inertia of the section about the neutral axis. Finally, calculate the section modulus and stress in the upper deck and bottom shell when the ship is subjected to a sagging bending moment of 31 000 tonne meter.

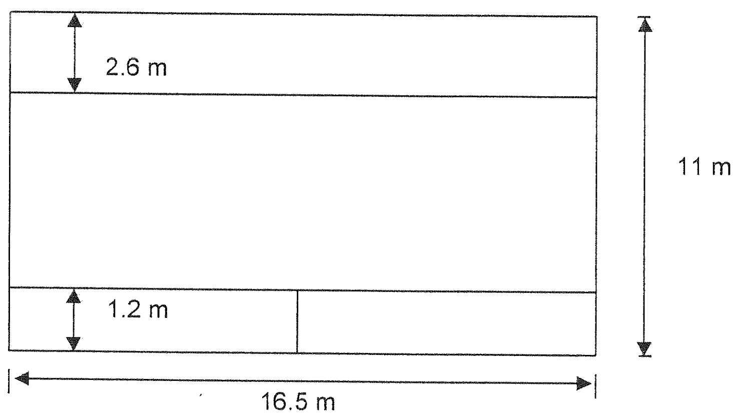


Figure 5

(15 marks)

Question 6

(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.

(5 marks)

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

(5 marks)

(b) A continuous beam ABC (figure 6) 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:

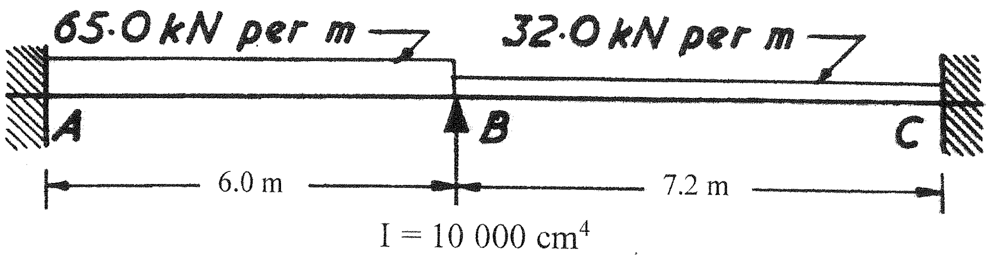


Figure 6

Please analyze 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.

(10 marks)

END OF QUESTION

List of Formula :

Strain Energy Method:

Loading Type	Strain Energy Constant Variables	Strain Energy General Case
Axial	$U = \frac{F^2 l}{2EA}$	$U = \int_0^l \frac{F^2 dx}{2EA}$
Bending	$U = \frac{M^2 l}{2EI}$	$U = \int_0^l \frac{M^2 dx}{2EI}$
Torsion	$U = \frac{T^2 l}{2GJ}$	$U = \int_0^l \frac{T^2 dx}{2GJ}$
Direct Shear	$U = \frac{F^2 l}{2AG}$	$U = \int_0^l \frac{F^2 dx}{2AG}$
Traverse Shear	$U = \frac{K V^2 l}{2GA}$	$U = \int_0^l \frac{K V^2 dx}{2GA}$

Moment Distribution Method:

1st Principle :

$$M_{AB} = \frac{1}{2} M_{BA}$$

2nd Principle

$$M_{BA} = 4E \tan\theta \frac{I}{L}$$

3rd Principle

$$M_{BA} = 3E\theta \frac{I}{L}$$

4th Principle

$$M_{AB} = M_{BA} = \frac{6EId}{L^2}$$

5th Principle

$$M_{BA} = \frac{3EId}{L^2} = \frac{6EId}{2L^2}$$