TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology
Department of Mechanical & Automotive Engineering
UNIVERSITY EXAMINATION FOR:
Diploma in Marine Engineering
Diploma in Nautical Sciences
EMR 2225 & 2227 : SHIP STABILITY II
SPECIAL/ SUPPLEMENTARY EXAMINATION
SERIES: AUGUST 2019
TIME: 2 HOURS
DATE: Pick Date **Aug 2019**

Instruction to Candidates:
You should have the following for this examination
- *Student I.D. Card & Examination Pass*
- *Answer booklet*
- *Non-Programmable scientific calculator*

This paper consists of **FIVE** questions. Attempt question **ONE** and any other **TWO** questions.
Maximum marks for each part of a question are as shown.
Do not write on the question paper.

Question ONE
a) Explain the virtual increase in KG for slack tanks using an example of a tanker rolling. **(4 marks)**
b) A ship 150 m long has half ordinates commencing from the aft are as follows.
   0, 5, 9, 9, 9, 7 & 0 metres respectively.
   Find the position of the centre of flotation, from the forward. **(6 marks)**
c) With the aid of a well labeled sketch, show the following on a GZ-cross curve of stability defining each of them:
      i.   Initial metacentric height
      ii. Angle of contra flexure
      iii. Range of stability
      iv. Angle of vanishing stability

v.   Negative stability   **(10 marks)**

Question TWO

a) Differentiate between 'list' and 'trim' as applied to ship stability.   **(2 marks)**

b) Discuss the three measures taken to reduce the free surface effect of slack tanks on the ship's stability.   **(6 marks)**

c) A ship arrives in port trimmed 25 cm by the stern. The centre of flotation is amidships. MCT 1 cm 100 tonnes m. A total of 3800 tonnes of cargo is to be discharged from 4 holds, and 360 tonnes of bunkers loaded in No. 4 double bottom tank. 1200 tonnes of the cargo is to be discharged from No. 2 hold and 600 tonnes from No. 3 hold. Find the amount to be discharged from Nos. 1 and 4 holds if the ship is to complete on an even keel.

> Centre of gravity of No. 1 hold is 50m forward of the centre of flotation
> Centre of gravity of No. 2 hold is 30m forward of the centre of flotation
> Centre of gravity of No. 3 hold is 20m abaft of the centre of flotation
> Centre of gravity of No. 4 hold is 45m abaft of the centre of flotation
> Centre of gravity of No. 4 DB tank is 5m abaft of the centre of flotation

(12 marks)

Question THREE

a) Outline FOUR ways of correcting unstable and neutral equilibrium in ship statical stability.   **(4 marks)**

b) State the Archimedes principle and explain why ship-shaped objects float in water whereas the materials making them do not float   **(7 marks)**

c) A box-shaped vessel 40m x 6m x 3m is floating in salt water on an even keel at 2m draft F and A. Find the new drafts if a weight of 35 tonnes is discharged from a position 6m from forward. MCT 1 cm = 8.4 tonnes m.   **(9 marks)**

Question FOUR

a) Differentiate between GZ and KN cross curves of stability.   **(4 marks)**

b) Discuss the three measures taken to reduce the free surface effect of slack tanks on the ship stability   **(6 marks)**

c) Discuss five effects of loss of intact buoyancy on ships.   **(10 marks)**

Question FIVE

a) A ship loaded with a full cargo of timber and timber on deck is alongside a quay and has taken up an angle of loll away from the quay. Describe the correct method of discharging the deck cargo.   **(4 marks)**

b) Explain the three methods used to determine the ship's centre of floatation.

(6 marks)

c) A ship of 9900 tonnes displacement has KM = 7.3 m, and KG = 6.4 m. She has yet to load two 50 tonne lifts with her own gear and the first lift is to be placed on deck on the inshore side (KG 9 m and centre of gravity 6m out from the centre line). When the derrick plumbs the quay its head is 15 m above the keel and 12m out from the centre line. Calculate the maximum list during the operation. **(10 marks)**