

Indian Maritime University
(A Central University, Govt of India)
Sep/Oct'25 SE
Programme Name: B Sc (NS)
Semester: IV
Subject Code: UG21T5402
Subject Name: Ship Stability Paper II

Date: 09.09.2025

Max Marks: 70

Duration: 03 Hrs

Pass Marks: 35

General Instructions

- (i) All Sections (A, B & C) are to be attempted and all the questions compulsory.
- (ii) Options, if any, are specified in respective sections.
- (iii) Trim and Stability particulars of M.V. Hindship allowed
- (iv) Scientific Calculator (Non-Programmable) Permitted

Section A

Ten MCQs/Fill in the Blanks of **01 Mark each** – Choose the correct answer as applicable.

1. Which factor does NOT directly affect a ship's trim?
 - a. Longitudinal distribution of weight.
 - b. Transverse distribution of weight.
 - c. Addition or removal of weight at the bow.
 - d. Addition or removal of weight at the stern.

2. In ship stability, the Centre of Flotation (CF) is best described as:
 - a. The point through which the buoyant force acts vertically upward.
 - b. The point around which the vessel trims, typically located at the geometric centre of the waterplane area.
 - c. The point where the ship's weight is considered to act vertically downward.
 - d. The point that determines the ship's metacentric height.

3. What do cross curves of stability represent in naval architecture?
 - a. The relationship between the righting arm (GZ) and the ship's displacement for various angles of heel.
 - b. The relationship between the righting arm (GZ) and the angle of heel for a specific displacement.
 - c. The relationship between the metacentric height (GM) and the angle of heel for a specific displacement.
 - d. The relationship between the centre of buoyancy (B) and the centre of gravity (G) for various displacements.

4. How are cross curves of stability typically utilized to derive a ship's statical stability curve for a specific loading condition?
 - a. By integrating the area under the cross curve corresponding to the ship's displacement.
 - b. By differentiating the cross curve with respect to the angle of heel.
 - c. By averaging the KN values across all angles of heel for the given displacement
 - d. By interpolating the cross curves for the given displacement and subtracting the product of KG and the sine of the heel angle from the interpolated KN values

5. Which of the following is a requirement for applying Simpson's 1/3 Rule?
 - a. The number of intervals must be odd.
 - b. The function must be linear.
 - c. The number of intervals must be even.
 - d. The function must be quadratic.

6. Area = $(3h/8) \times (\text{sum of products})$ is given by which Simpson's
 - a. First Rule
 - b. Second Rule
 - c. Third Rule
 - d. The Trapezoidal Rule

7. What is the primary concern when transporting bulk grain cargoes in terms of ship stability?
 - a. Increased buoyancy
 - b. Cargo compaction
 - c. Shifting of cargo leading to heeling
 - d. Excessive moisture content

8. Which of the following measures is NOT recommended to ensure the stability of a vessel carrying bulk grain cargo?
 - a. Filling cargo holds completely and trimming the grain level.
 - b. Installing longitudinal divisions or shifting boards within the holds.
 - c. Leaving cargo holds partially filled without securing the grain.
 - d. Using saucering or bundling techniques to reduce free surface effects

9. Upon encountering an angle of loll, which corrective action should be avoided to prevent further instability?
 - a. Adding ballast to lower tanks to lower the centre of gravity
 - b. Removing weight from high positions to reduce the centre of gravity
 - c. Transferring cargo transversely to counteract the heel
 - d. Pumping out ballast from upper wing tanks to decrease the centre of gravity.

10. Angle of Loll is the angle at which the vessel has
 - a. Positive GM

- b. Negative GM
- c. Zero GM when upright
- d. Zero GM when inclined

Section B

Five Questions of **02 Marks each**

11. Define "Trim" and "Even keel" in the context of Ship Stability?
12. If initial trim is 0.5m by Head and final trim is 0.4m by the Head, what is the change of trim and its direction?
13. A ship has a displacement of 10,000 tonnes and a metacentric height (GM) of 0.4 meters. Calculate the righting moment when the ship is heeled to an angle of 5 degrees.
- 14a. State the wall sided formula to obtain GZ values at Moderate to large angles of heel, and
- 14b. State the formula for calculating the value of the angle of loll?
15. State the three stability requirements for ships loading grain in bulk.

Section C

Five Questions of 10 Marks each.

- 16a. Define Centre of Gravity? Centre of Buoyancy? Metacentre? and centre of flotation? **-4 marks**
- 16b. A ship 90 m long is floating at drafts 4.5 m F and 5.0 m A. The centre of flotation is 1.5 m aft of amidships. TPC 10. MCTC 120 tm. Find the new drafts if a total weight of 450 tonnes is loaded in a position 14 m forward of amidships. **- 6 marks**
- 17a. State the formula for Simpson's First, Second and third rule? **- 3 marks**
- 17.b A ship 120 metres long at the waterline has equidistantly spaced half-ordinates commencing from forward as follows:
0, 3.7, 5.9, 7.5, 4.6 and 0.1 metres, respectively.
Find the area of the waterplane and TPC at this draft? **- 7 marks**
18. Sketch the intact stability curve and explain the various information obtained from it? **-5 marks for the sketch and 5 marks for the information**

19. M. V. Hindship is floating at a draft of F 5.65 m and A 7.45m, LCG 70.47m, forward of AP, loads 500 tonnes of cargo, 100.5 m forward of AP.

Calculate:

- (1) her final displacement. - 4 marks
- (2) final Hydrostatic draft. - 3 marks
- (3) her final drafts F and A -3 marks

20. Derive the formula for calculating MCTC? - **10 marks**

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