

Indian Maritime University

(A Central University, Govt of India)

End Semester Examinations – June 2024

Programme Name: B Tech (NAOE)

Semester: IV

Subject Code: UG12T2402

Subject Name: Hydrostatics & Stability

Date: 30.05.2024

Max Marks: 70

Duration: 03 Hrs

Pass Marks: 35

General Instructions

- (i) All Sections (A, B & C) are to be attempted.
- (ii) Options, if any, are specified in respective section.

Section A

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

1. What is the primary function of a watertight bulkhead onboard a ship?
 - a) To create separate living compartments for passengers and crew.
 - b) To subdivide the underwater hull into watertight sections for stability.
 - c) To limit flooding to a specific area in case of a hull breach.
 - d) To create additional storage space for cargo.
2. A ship is considered unstable when its center of gravity (G) is located
 - a) Above its metacenter (M).
 - b) Below its metacenter (M).
 - c) Forward of its center of buoyancy (B).
 - d) Aft of its center of buoyancy (B).
3. What is the free surface effect, and how does it impact ship stability?
 - a) It describes the additional buoyancy experienced by a ship in calm seas.
 - b) It has no impact on stability and is only a concern for partially filled tanks in rough seas.
 - c) It refers to the movement of liquid in partially filled tanks, which can shift the center of gravity and reduce stability.
 - d) It's the pressure exerted by wind on the sails of a ship.
4. What is the main factor influencing the angle of loll for an unstable ship?
 - a) The size and type of the ship's rudder.
 - b) The overall weight of the cargo onboard.
 - c) The vertical distance between the center of gravity (G) and the metacenter (M).
 - d) The wind speed and direction.

5. The righting moment of a ship acts to:
 - a) Increase the angle of heel.
 - b) Return the ship upright after heeling.
 - c) Cause the ship to capsize.
 - d) Reduce the ship's buoyancy.
6. Which of the following factors would have the LEAST impact on a ship's initial stability?
 - a) The vertical distance between the center of gravity (G) and the center of buoyancy (B).
 - b) The weight distribution of cargo onboard.
 - c) The ship's size and overall dimensions.
 - d) The wind speed and direction (assuming calm seas).
7. According to the IMO's one-compartment standard, a ship must remain afloat and stable after flooding in:
 - a) The engine room only.
 - b) Any two compartments.
 - c) Any specific designated compartment.
 - d) One compartment anywhere along its length.
8. What is the main consequence of excessive heeling during a turn?
 - a) Improved fuel efficiency.
 - b) Reduced stability and increased risk of capsizing.
 - c) Enhanced maneuverability.
 - d) Faster turning speed.
9. Probabilistic damage stability (PDS) is a relatively new approach that considers:
 - a) Only the worst-case damage scenario.
 - b) The probability of various damage scenarios.
 - c) The impact of specific cargo types on stability.
 - d) The effectiveness of life rafts in case of emergencies.
10. What is the primary purpose of dry docking a ship?
 - a) To clean and repaint the underwater hull.
 - b) To perform repairs below the waterline.
 - c) Both A and B
 - d) To load and unload cargo.

Section B

Five Questions of 02 Marks each

11. Define Lightship displacement.
12. Name the applications of Bonjean curves
13. Name the ways to mitigate free surface effect.
14. List down any two intact stability criteria mandated by IMO.

15. Define two-compartment standard.

Section C

Seven Questions of 10 Marks each of which any 05 questions to be answered.

16. A ship has displacement of 1747 tonnes in sea water; a CB of 0.537 and a CM of 0.834. The area of the immersed midship section is 30 sq.m and the ratio of beam to draft is 3.53. Find the length, beam and draft of the ship.
17. Explain the effects of change of Breadth, Depth and Form on stability.
18. The length of a portion of the wooden deck of a ship is 22 m and the half-breadths at equally spaced ordinates are 8.00, 7.80, 7.40, 6.61 and 5.64 m. There is an opening for a hatchway in the deck measuring 6 m x 4.5 m. If the deck is to be covered with wood which is 65 mm thick and weighing 0.8 tonnes per m, find the mass of wood required, in tonnes.
19. List down the features of righting arm (GZ) and its curve.
20. Write down key points to ensure a safe operation during dry docking a vessel.
21. Make a comparison between deterministic and probabilistic damage stability assessment.
22. A square and a circle have the same centres and the same area. What is the ratio of their moments of inertia about an axis through the centre and parallel to one of the sides of the square? If the square and circle had the same moments of inertia about the axis, what would be the ratio of their areas?