

**Indian Maritime University**  
**(A Central University, Govt of India)**  
**End Semester Examinations – December 2023**  
**Programme Name: B Tech (ME)**  
**Semester: V**  
**Subject Code: UG11T3506**  
**Subject Name: Naval Architecture I**

Date: 08.12.2023

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**

**Choose the correct answer as applicable. (10 x 1 = 10 marks)**

1. If a vessel rolls to the starboard side, and there are no movable or moving weights on board, the ship's centre of gravity will
  - a) move to starboard
  - b) move to port
  - c) move directly down
  - d) stay in the same position
2. Position of centre of buoyancy for a triangular barge (apex down) above the keel:
  - a)  $(2/3)$ depth
  - b)  $(1/2)$ draft
  - c)  $(2/3)$ draft
  - d)  $(1/2)$ depth
3. Aim of the Inclining Experiment is to determine
  - (a) GM in Loaded condition
  - (b) KG in light condition
  - (c) BM in light condition
  - (d) KB in light condition
4. Percentage of volume of the space which may be occupied by seawater if the space is flooded:
  - a) Intact volume
  - b) Permeability
  - c) Reserve buoyancy
  - d) Flooded volume
5. In When a ship travels from sea water to fresh water her mean draught-
  - a) decreases
  - b) increases
  - c) Remains unchanged
  - d) change is unpredictable

6. The addition of a small weight at the ship's center of flotation will
- have no effect on the stability
  - decrease the forward draft and increase the after draft
  - increase the forward draft and decrease the after draft
  - have no effect on the trim
7. In transverse stability, the horizontal distance between the vertical lines of action of gravitational and the buoyant forces is called the
- metacentric height
  - metacentric radius
  - righting lever
  - trimming lever
8. Curves of immersed cross-sectional area of a ship, plotted against draught for each transverse section, are known as:
- Bonjean Curves
  - Cross curves of Stability
  - Displacement Curves
  - Hydrostatic Curves
9. The difference between the total watertight volume of the ship and the volume of its submerged part when floating is called as
- Buoyancy
  - Reserve of buoyancy
  - Displacement
  - Residual buoyancy
10. What happens when a weight lying on the deck of the ship is lifted clear by an onboard crane?
- Its CG shifts up to the crane head
  - KG of the ship increases
  - GM of the ship reduces
  - all of the above

### Section B

Answer following questions in brief.

(5×2 = 10 Marks)

- Define Block coefficient.
- Define TPC and explain how it varies with draught and density of water.
- Explain about Simpson's third Rule of Integration.
- Explain angle of Loll. How can it be corrected?
- Distinguish between stiff and tender ships.

### Section C

Attempt any 05 questions.

(10 Marks each)

- What is free surface effect? Write any three ways to reduce it. [5 marks]
  - A ship 160 m long and 20m beam floats at a draft of 8 m and displaces 19550 tonne. The TPC is 26 t and midship sectional area coefficient 0.95. Calculate the block, prismatic and water plane area coefficients. [5 marks]

17.

a) A ship is floating upright on an even keel at 6m draft forward and aft. The areas of waterplane commencing from the keel are 5000, 5600, 6020, 6025, 6045, 6075, 6100. Find the ship's volume of displacement and KB at this draft. [5 marks]

b) A wooden block of uniform density has a constant cross-section in the form of a triangle, apex down. The width is 0.5 m and the depth 0.5 m. It floats at a draft of 0.45 m. Calculate the metacentric height. [5 marks]

18. A ship of 8100 tonne displacement floats upright in sea water,  $KG = 7.5m$  and  $GM = 0.45m$ . A tank,  $KG$  is 0.5m above the keel and 4m from the centerline, contains 100 tonne of water ballast. Neglecting the free surface effect, calculate the angle up to which the ship will heel, when the ballast water is pumped out. [10 marks]

19. A ship 120 m long floats have draughts of 5.50 m forward and 5.80 m aft;  $MCT/cm$  80 tonne-m,  $TPC$  13 t,  $LCF$  2.5 m forward of midships. Calculate the new draughts when a mass of 110 tonne is added 24m aft of midships. [10 marks]

20.

a) In the context of ship's longitudinal strength, explain about weight curve, buoyancy curve & load curve. [5 marks]

b) A ship of 8000 tonne displacement floats in sea water & has a  $TPC$  of 14 tonne. The vessel moves into fresh water and loads 300 tonne of oil fuel. Calculate the change in mean draft. [5 marks]

21. A box barge of uniform construction is 40 m long is divided by transverse bulkheads into four equal compartments. She displaces 2000 tonnes when cargo is loaded into each compartment and level stowed as follows: 300 tonnes in No.1 hold; 420 tonnes in No.2 hold; 480 tonnes in No. 3 hold; and 280 tonnes in No. 4 hold. Draw the load, shearing force and bending moment diagrams, showing position and value of maximum bending moment. [10 mark]

21. A box-shaped vessel 150 m long, 20 m beam, is floating upright in salt water at an even keel draft of 6 m. The collision bulkhead is situated 8 m from forward. Find the new drafts if the vessel is now bilged forward of the collision bulkhead. [10 marks]

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