CBCS SCHEME

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21MR63

# Sixth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
## Naval Architecture

Time: 3 hrs. Max. Marks: 100

***Note: Answer any FIVE full questions, choosing ONE full question from each module.***



### Module-1

1 a. A block of wood 4m long, 0.3 m wide and 0.25 m thick floats at a draught of 0.15 m in sea water. Calculate the mass of the wood and its relative density. **(10 Marks)**

b. A ship displaces 12, 240 $m^3$ of sea water at a particular draught.
i) Calculate the displacement of the ship.
ii) How many tones of cargo would have to be discharged for the vessel to float at the same draught in fresh water? **(10 Marks)**

**OR**

2 a. The equally-spaced half ordinates of a watertight flat 27 m long are 1.1, 2.7, 4.0, 5.1, 6.1, 6.9 and 7.7 m respectively. Calculate the area of the flat. **(10 Marks)**

b. A fore peak bulk head is 4.8 m deep and 5.5 m wide at the deck. At regular intervals of 1.2 m below the deck, the horizontal widths are 5.0, 4.0, 2.5 and 0.5 m respectively. The bulkhead is flooded to the top edge with sea water on one side only. Calculate : i) Area of bulkhead ii) Load on bulkhead iii) Position of centre of pressure. **(10 Marks)**

### Module-2

3 a. A ship of 5000 ton displacement has a mass of 200 ton on the fore deck 55 m fwd of midships. Calculate the shift in the C.G of the ship if the mass is moved to a position 8 m fwd of midships. **(05 Marks)**

b. A ship of 1000 ton displacement has a mass of 60 ton lying on the deck. A derrick, whose head is 7.5 m above the C.G of the mass, is used to place the mass of the tank top 10.5 m below the deck. Calculate the shift in the vessels C-G when the mass is
i) Just clear of the deck
ii) At the derrick head
iii) In its final position. **(15 Marks)**

**OR**

4 a. A ship 110 m long displaces 9000 ton and has a wetted surface area of 2205 $m^2$. Calculate the displacement and wetted surface area of a 6 m model of the ship. **(10 Marks)**

b. What are coefficients of form? Explain them in detail. **(10 Marks)**

### Module-3

5 a. The righting levers of a ship of 15,000 ton displacement at angles of heel of 15°, 30°, 45° and 60° are 0.29, 0.70, 0.93 and 0.90 m respectively. Calculate the dynamical stability of the ship at 60° heel. **(10 Marks)**

b. A ship of 12,000 tonne displacement has a second moment of area about the centerline of $72 \times 10^3$ $m^4$. If the meta centric height is -0.05 m, calculate the angle of loll. **(10 Marks)**

**OR**

6 a. What is meant by statical stability of ships? Explain the different conditions of equilibrium of ships. **(14 Marks)**

b. A mass of 6 tonne is moved transversely through a distance of 14 m on a ship of 4300 tonne displacement, when the deflection of an 11 m pendulum is found to be 120 mm. The transverse metacentre is 7.25 m above the keel. Determine the height of the C.G above the keel. **(06 Marks)**

## Module-4

7 a. A ship of 10,000 tonne displacement has a water plane area of 1300 $m^2$. The ship loads in water of 1.010 $t/m^3$ and moves into water of 1.026 $t/m^3$. Find the change in mean draught. **(08 Marks)**

b. Explain the following in brief:
i) Buoyancy ii) Reserved buoyancy iii) Permeability iv) Trim. **(12 Marks)**

**OR**

8 a. A ship of 14,000 tonne displacement has an admiralty co-efficient of 450. Calculate the shaft power required at 16 knots. **(06 Marks)**

b. A vessel uses 125 tonne of fuel on a voyage when travelling at 16 knots. Calculate the mass of fuel saved if, on the return voyage, the speed is reduced to 15 knots, the displacement of the ship remaining constant. **(06 Marks)**

c. Briefly explain the following:
i) Frictional resistance ($R_f$) ii) $R_r$ iii) e.p iv) e.p (naked). **(08 Marks)**

## Module-5

9 Briefly explain the following terms of a marine propeller:
i) Diameter ii) Pitch iii) Pitch ratio iv) Theoretical speed v) Apparel slip
vi) Wake fraction vii) Projected area viii) Developed area ix) BAR x) DAR. **(20 Marks)**

**OR**

10 a. A ship of 8000 tonne displacement has a rudder of area 18 $m^2$. The centre of lateral resistance is 4 m above the keel. While the centroid of the rudder is 2.35 m above the keel. The maximum rudder angle is 35°. Calculate the angle of heel due to the force on the rudder if the latter is put hard over to port when travelling at 21 knots with a metacentric height of 0.4 m. **(10 Marks)**

b. Explain in detail about types of rudder. **(10 Marks)**

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