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18MR52

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. Define the following terms :
   (i)   Centre of pressure
   (ii) Specific gravity.
   (iii) Buoyancy.
   (iv) Centroid   (06 Marks)
   b. Derive an expression for load on an immersed plane.   (06 Marks)
   c. A ballast tank is 15 m long, 12 m wide and 1.4 m deep and is filled with fresh water. Calculate the load on the top and short side, if
   (i) The tank is just completely full.
   (ii) There is a head of 7 m of water above the tank top.   (08 Marks)

OR

2 a. Define the following terms :
   (i)   aft perpendicular
   (ii) forward perpendicular
   (iii) length overall
   (iv) Draught   (06 Marks)
   b. Explain Simpson's rule.   (06 Marks)
   c. The TPC values of a ship at 1.5 m intervals of draughts, commencing at the keel, are 4.0, 6.1, 7.8, 9.1, 10.3, 11.4 and 12 m respectively. Calculate at a draught of 9 m,
   (i) Displacement
   (ii) KB.   (08 Marks)

Module-2

3 a. Define dead weight, gross tonnage, net tonnage.   (06 Marks)
   b. Explain wetted surface area.   (04 Marks)
   c. A ship displaces 9450 tonne and has a black co-efficient of 0.7. The area of immersed midship section is 106 m^2. If beam = $0.13 \times$ length = $2.1 \times$ draught, calculate (i) Length of the ship (ii) Prismatic co-efficient (iii) Midship section area co-efficient. (10 Marks)

OR

4 a. Derive an expression for shift in center of gravity due to movement of mass.   (08 Marks)
   b. Explain the effect of a suspended mass.   (06 Marks)
   c. A ship of 10,000 tonne displacement has a mass of 60 tonne lying on the deck. A derrick, whose head is 7.5 m above the centre of gravity of the mass, is used to place the mass on the tank top 10.5 m below the deck. Calculate the shift in the vessel's centre of gravity when the mass is,
   (i)   Just clear of the deck.
   (ii) At the derrick head.
   (iii) In its final position.   (06 Marks)

Module-3

5   a.   Explain the following terms with respect to stability of ships :
       (i)   Equilibrium   (ii)   Stable   (iii)   Unstable
       (iv)   Neutral equilibrium   **(12 Marks)**

   b.   A ship of 8000 tonne displacement has its centre of gravity 4.5 m above the keel and transverse metacentre 5 m above the keel when a rectangular tank 7.5 m long and 15 m wide contain sea water. A mass of 10 tonne is moved 12 m across the deck. Calculate the angle of heel :
       (i)   If there is no free surface of water.
       (ii)   If the water does not completely fill the tank.   **(08 Marks)**

OR

6   a.   Explain the two sections of ship resistance.   **(10 Marks)**

   b.   Define fuel co-efficient and admiralty co-efficient.   **(04 Marks)**

   c.   A plate drawn through fresh water at 3 m/s has a frictional resistance of 12 N/m^2. Estimate the power required to overcome the frictional resistance of a ship at 12 knots if the wetted surface area is 3300 m^2 and the index of speed is 1.9.   **(06 Marks)**

Module-4

7   a.   Derive an expression for change in mean draught due to change in density.   **(08 Marks)**

   b.   A ship 120 m long and 9100 tonne displacement floats at a level keel draught of 6.50 m in fresh water of 1.00 t/m^3. MCTI cm 130 tonne m, TPC in sea water 16.5, LCB 2.30 m forward of midships. LCF 0.6 m aft of midships. Calculate the new draughts if the vessel moves into sea water of 1.024 t/m^3 without change in displacement.   **(12 Marks)**

OR

8   a.   Derive an expression for change in trim due to change in density.   **(08 Marks)**

   b.   Define : (i) Reserve Buoyancy   (ii) Permeability   **(04 Marks)**

   c.   A ship 125 m long displaces 12,000 tonne, when a mass of 100 tonne is moved 75 m from forward to aft there is a change in trim of 65 cm by the stern. Calculate
       (i)   MCTIcm
       (ii)   The longitudinal metacentric height.
       (iii)   The distance moved by the centre of gravity of the ship.   **(08 Marks)**

Module-5

9   a.   Define : (i) Pitch of the propeller   (ii) Apparent slip   (iii) Speed of advance
       (iv) True slip   **(06 Marks)**

   b.   How the pitch of the propeller can be measured? Explain.   **(06 Marks)**

   c.   A ship of 15000 tonne displacement has an admiralty co-efficient, based on shaft power, of 420. The mechanical efficiency of the machinery is 83%, shaft losses 6%, propeller efficiency 65% and QPC 0.71. At a particular speed the thrust power is 2550 kW.
       Calculate : (i) Indicated power   (ii) Effective power
       (iii) Ship speed   **(08 Marks)**

OR

10   a.   Define : (i) Brake power   (ii) Thrust power
       (iii) Quasi-propulsive co-efficient   (iv) Effective power   **(06 Marks)**

   b.   Derive an expression for angel of hell due to force on rudder.   **(06 Marks)**

   c.   A ship whose maximum speed is 18 knots, has a rudder of area 25 m^2. The distance from the centre of stock to the centre of effort of the rudder is 1.2 m and the maximum rudder angel is $35°$. If the maximum allowable stress in the stock is 85 MN/m^2, calculate the diameter of the stock. The rudder force parallel to the streamline should be taken as 580 Av^2, N.   **(08 Marks)**

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