USN | | | | | | | | | | **18MR52**

Fifth Semester B.E. Degree Examination, June/July 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. The half ordinate planes of a water plane 180m long are as follows :

Section	AP	½	1	2	3	4	5	6	7	8	9	9½	FP
½ ord :	0	5.0	5	8	10.5	13.5	13.5	12.5	11.0	7.5	3	1	0m

   Calculate the area of the water plane.   **(12 Marks)**

   b. A rectangular double bottom tank 12m long and 10m wide is full of sea water. Calculate the head of water above the tank top if the load due to the water pressure on the tank top is 9.6MN.   **(08 Marks)**

OR

2 a. The immersed cross – sectional area of a ship are 120m long. Commencing from the aft are 2, 40, 79, 100, 103, 104, 104, 103, 97, 58 and 0m^2.   **(10 Marks)**

   b. Define the following terms aft perpendicular, forward perpendicular, length between perpendiculars, relative density.   **(10 Marks)**

Module-2

3 a. Explain with the help of a neat sketch : i) C_w ii) C_m iii) C_b iv) C_p.   **(12 Marks)**

   b. A ship of 4000 tonne displacement has its centre of gravity 6m above the keel. Find the new displacement and position of the centre of gravity when masses of 100, 200, 5000 and 3000 tonne are added at positions 0.8, 1.0, 5.0 and 9.5m above the keel.   **(08 Marks)**

OR

4 a. A ship 135m long, 18m beam and 7.6m drought has a displacement of 14,000 tonnes. The area of the load water plane is 1925m^2 and the area of the immersed midship section 130m^2 calculate : i) C_w ii) C_m iii) C_b iv) C_p.   **(10 Marks)**

   b. A ship of 8500 tonne displacement is composed of masses 2000, 3000, 1000, 2000 and 5000 tonnes at positions 2, 5, 8, 10 and 14m above the keel. Determine the height of the centre of gravity of the ship above the keel.   **(10 Marks)**

Module-3

5 a. Explain with neat diagrams :
   i)   Stable equilibrium
   ii) Unstable equilibrium
   iii) Neutral equilibrium.   **(10 Marks)**

   b. A ship whose wetted surface area is 5150m^2 travels at 15 knots. Calculate the frictional resistance and the power required to overcome this resistance. Given f = 0.422, n = 1.825.
                                                                                   (10 Marks)

OR

6   a.   What is residuary resistance? Explain 3 types of residual resistance with percentage of losses. **(10 Marks)**

    b.   A plate drawer through fresh water at 3m/s has a frictional resistance of $12N/m^2$. Estimate the power required to overcome the frictional resistance of a ship at 12 knots if the wetted surface area is $3300m^2$ and the index of speed is 1.9. **(10 Marks)**

Module-4

7   a.   Define :
    i)   Buoyancy
    ii) Reserve Buoyancy
    iii) Permeability and explain briefly. **(10 Marks)**

    b.   215 tonne of oil fuel and stores are used in a ship while passing from sea water of $1.026t/m^3$. If the mean draught remains un altered, calculate the displacement in the river water. **(10 Marks)**

OR

8   A ship 125m long has a light displacement of 4000 tonne with LCG 1.60m of midships. The following items are uses added :

Item	LCG
Cargo 8500T	3.9m fwd of midships
Fuel 1200T	3.1m aft of midships
Water 200t	3.6m aft of midship
Stores 100T	30.5m fwd midship

At 14000 tonne displacement the mean draught is 7.8m, MCTI cm 160 tonne, LCB 2.00m forward of midships and LCF 1.5m aft of midships. Calculate the final draught. **(20 Marks)**

Module-5

9   a.   Explain the phenomenon of cavitation and its effects on the ships propellers. **(08 Marks)**

    b.   The total resistance of a ship at 13 knots is 180kN, the QPC is 0.70, shaft losses 5% and the mechanical efficiency 87%. Calculate the indicated power. **(12 Marks)**

OR

10 a.   Explain the relation between the various powers effecting the propeller and the ships and efficiency. **(10 Marks)**

    b.   A rudder has an area of $15m^2$ with its centre of effort 0.9m from centre of stock. The maximum rudder angle is $35°$ and is designed for a service speed of 15 knots. Calculate the diameter of the rudder stock, if the maximum allowable stress in the stock is $55MN/m^2$ [Assume K = 580]. **(10 Marks)**

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