B. Tech. Degree V Semester Examination in Marine Engineering December 2014

MRE 507 NAVAL ARCHITECTURE I

Time: 3 Hours   Maximum Marks: 100

(5 × 20 = 100)

I.   (a)   Describe how the crude oil carrier differ from chemical carrier. Explain how the   (10)
            MARPOL influenced their design and operation.
     (b)   What is an offshore supply/support vessel? Explain the major design features.   (10)

OR

II. (a)   Explain the functioning of ship classification societies and statutory bodies.   (10)
     (b)   Describe the uses and types of dredgers and tugs.   (10)

III. (a)   What do you understand by ships lines?   (10)
     (b)   The half-girths of a ship 110m LBP at equal intervals are: 2.1, 6.6, 9.3, 10.5, 11.0, 11.0,   (10)
            11.0, 9.9, 7.5, 3.9 and 0.0 meters respectively. Calculate the wetted surface area of the
            ship if the wetted surface area of the appendage is 30 m^2 and allowance for longitudinal
            curvature is 0.5%. Calculate also the wetted surface area of a 6 m model of this ship.

OR

IV. (a)   A ship of length 170 m LBP has the following half ordinates in meters for a water plane.   (10)

Station	0	1	2	3	4	5	6	7	8	9	10
$\frac{1}{2}y$	1.6	5.7	8.8	10.2	10.6	10.6	10.6	10.1	8.2	4.9	0

            Calculate second moment of area of water plane about the centerline.
     (b)   A ship has the following TPC values. Calculate displacement and KB at 9 m draft.   (10)

Draft [m]	0	1.5	3.0	4.5	6.0	7.5	9.0
TPC	4.0	6.1	7.8	9.1	10.3	11.4	12.0

V.   (a)   A ship 145 m long and 20 m breadth floats at a draft of 8 m and displaces 19000t in sea   (10)
            water of density 1.025t/m^3. The TPC is 26 and midship area coefficient, Cm = 0.94.
            Calculate C_B, C_p and C_w.
     (b)   A ship of 6000 t displacement has its centre of gravity 6.2 m above keel. Cargo of   (10)
            masses 1000t, 200t, 5000t and 3000t are added at locations 0.8 m, 1.0 m, 5.0 m and 9.5m
            above the keel. Find final displacement and position of centre of gravity of the ship
            above keel.

OR

(P.T.O.)

VI.   (a)   A vessel of 9000 t displacement has 80 t of cargo on the deck. It is lifted by a derrick   (10)
whose head is 11 m above the centre of gravity of the cargo, and placed in the lower
hold 9 m below deck and 14 m forward of its original position. Calculate the shift in
the vessel's centre of gravity when the cargo is (i) just clear of the deck (ii) at the
derrick head and (c) in its final position.

      (b)   A ship of 10000 t displacement has its centre of gravity 3 m above the keel. Masses of   (10)
2000 t, 300 t and 50 t are removed from positions 1.5, 4.5 and 6 m above the keel.
Find the new displacement and position of centre of gravity.

VII.   (a)   Explain righting moment, righting lever, metacentre, stable equilibrium and unstable   (10)
equilibrium of a ship. Derive an expression for the KM_T value of a rectangular vessel
floating upright.

      (b)   The residuary resistance of the 1:20 model of a ship in sea water is 36 N when towed   (10)
at 3 kn. Calculate residuary resistance of the ship at its corresponding speed and the
power required to overcome residuary resistance at this speed.

OR

VIII.   (a)   Explain dynamical stability and its importance.   (10)

      (b)   A propeller of 4 m pitch has an efficiency of 67%. When turning at 125 rev/min the   (10)
real slip is 36% and the delivered power is 2800kW. Calculate the thrust of the
propeller.

IX.   (a)   Explain the importance of floodable length calculations and floodable length curves.   (10)

      (b)   A ship 125 m long displaces 12000 t. When a mass of 100 t is moved 75 m from   (10)
forward to aft there is a change in trim of 65 cm by stern. Calculate MCT_{1cm} and
longitudinal metacentric height.

OR

X.   (a)   Define trim, mean draft, trim aft, trim forward and MCT_{1cm}.   (10)

      (b)   A box barge 60 m long and 10 m wide floats at an even keel draft of 4 m. It has a   (10)
compartment amidships 12 m long. Calculate the new draft if this compartment is
bilged when (i) $\mu = 100\%$ (ii) $\mu = 85\%$ and (iii) $\mu = 60\%$.

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