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***B.Tech. Degree V Semester Examination in
Marine Engineering December 2018***

**MRE 1507 NAVAL ARCHITECTURE I
(2013 Scheme)**

(Non-programmable scientific calculator is permitted)

Time: 3 Hours

Maximum Marks: 100

(5 × 20 = 100)

- I. (a) Draw a neat sketch of the general arrangement and midship section of a tanker and indicate the various parts. (10)
- (b) Briefly describe the design features of LASH ships and container ships. (10)
- OR**
- II. (a) Briefly explain the constructional features of general cargo ships and bulk carriers with the help of neat sketches. (10)
- (b) Explain various types of tugs and dredgers. (10)
- III. (a) Draw lines plan drawing for a ship and explain various information contained in it. Why do you draw lines plan for ships? (10)
- (b) Consider a ship having LBP = 150 m floating in seawater of density 1.025 t/m³. Full breadths of a water plane of the ship at each of the stations are as follows:

Station number	0	½	1	2	3	4	5	6	7	8	9	9½	10
Full breadth (m)	0	6	12	15	18	21	21	20	18	14	9	6	4

Find (i) water plane area (ii) LCF (iii) TPC

OR

- IV. (a) Explain the effect of suspended masses on centre of gravity of a ship. (5)
- (b) Consider a ship having LBP (mld) = 90 m, mass = 4000 t, LCG = 43.50 m forward of AP and VCG = 4 m above baseline. If a mass of 200 t is added at FP at a height of 12 m above the baseline, find new location of the centre of gravity of the ship. (5)
- (c) Describe 'similar figures'. (5)
- (d) Write down the expressions for various form coefficients used to describe ship's geometry. (5)
- V. (a) Describe the neutral equilibrium condition of ship. How can you change the condition of a ship from neutral equilibrium to stable equilibrium? (8)
- (b) Describe the stability of ship at large angles of heel. (6)
- (c) Derive the expression for initial transverse metacentric height of a box shaped vessel that floats on an even keel. Assume length of ship = L, breadth = B, depth = D, draft = T and KG = g. (6)

OR

(P.T.O.)

- VI. (a) Briefly describe how and why an inclining experiment is conducted for a ship. (10)
- (b) While conducting an inclining experiment of a ship, a mass of 15 tonnes was moved in the transverse direction by a distance of 8 metres. If the corresponding deflection on a 5 m long pendulum is 0.125 m, calculate the displacement of the ship. Assume $GM_T = 1.2$ m. (5)
- (c) Describe free surface effect. (5)

- VII. (a) Discuss the stability of a ship during drycocking. Derive an expression for the virtual loss in metacentric height due to docking. (10)
- (b) Consider a box shaped vessel having length = L, breadth = B and depth = D floating on an even keel at draft = T. Describe the effect of bilging of an empty compartment amidships, having length = l, breadth = B and depth = D, on the draft and trim of the vessel. What would be the change in mean draft if the compartment contains cargo having a permeability of 50%? (10)

OR

- VIII. (a) Differentiate between LCB and LCF of a ship. (2)
- (b) Consider a box shaped vessel, having length = L, breadth = B, depth = D, draft = T and $VCG = \frac{1}{2} T$, floating on an even keel. Find its longitudinal metacentric height. (8)
- (c) A ship having LBP = 90 m floats at drafts $T_{AP} = 5$ m $T_{FP} = 4.5$ m. Find the new drafts at the perpendiculars if the ship is loaded with a total mass of 450 tonnes at a location on main deck at 14 m forward of midship. Assume LCF = 1.5 m aft of midship, TPC = 10 tonnes and $MCT_{1cm} = 120$ tonnes-m. (10)

- IX. (a) Explain various efficiencies associated with ship propulsion. (8)
- (b) A 6000 tonnes destroyer develops a total power of 44740 kW at a speed of 30 knots. Calculate its bare hull resistance if the effective power is 50% of this total power. (3)
- (c) A $1/20^{\text{th}}$ scale model of a ship in seawater appears to have a residuary resistance of 36 N when towed at a speed of 3 knots. Find (i) corresponding speed of the ship (ii) residuary resistance of the ship at the corresponding speed (iii) power required to overcome the residuary resistance of the ship at the corresponding speed. (9)

OR

- X. (a) Describe the various components of hull resistance. (12)
- (b) Define fuel coefficient. Write down its expression. Explain the terms in the expression. (4)
- (c) To achieve a certain speed, a ship of 18000 tonnes displacement requires a shaft power of 4330 kW. Estimate the shaft power requirement for a similar ship of 15000 tonnes displacement at the corresponding speed. (4)
