BT MRE-V(R/S)-11-23-3024 Reg. No. | | | | | | | | |

B

B.Tech. Degree V Semester Regular/Supplementary Examination in Marine Engineering November 2023

19-208-0507 NAVAL ARCHITECTURE I
(*2019 Scheme*)

Time: 3 Hours Maximum Marks: 60

Course Outcome
On successful completion of the course, the students will be able to:

CO1: Understand the functions of ship and types of ships.
CO2: Explain the geometry of ship and its hydrostatic calculations.
CO3: Understand transverse stability of ships and calculate of Metacentric height.
CO4: Explain longitudinal stability of ship and do trim corrections.
CO5: Gain knowledge on resistance and power calculations of ship.

Bloom's Taxonomy Levels (BL): L1 – Remember, L2 – Understand, L3 – Apply, L4 –Analyze, L5 – Evaluate, L6 – Create
PI – Programme Indicators.

(Answer *ALL* questions) (5 × 15 = 75)

			Marks	BL	CO	PI
I.	(a)	Describe the constructional details of a chemical tanker.	8	L2	1	1.4.1
	(b)	Explain how the integration of various ship systems are carried out during the design stage of a ship.	7	L2	1	1.4.1
		OR				
II.	(a)	Differentiate between the constructional features of LNG carriers and LPG carriers.	8	L2	1	1.4.1
	(b)	Explain the layout of a container ship.	7	L2	1	1.4.1
III.	(a)	Areas of a ship's equidistantly spaced waterplanes and the corresponding draughts are given below:	8	L3	2	1.4.1

Draught (m)	0	1	2	3	4
Waterplane area (m^2)	650	655	660	665	660

Plot a waterplane area curve using the above data. Calculate the ship's displacement in tonnes when floating in salt water of density 1.025 t/m^3 at 4 m draught.

	(b)	Draw lines plan of a hollow sphere. Assume suitable dimensions for the sphere. The lines plan shall include atleast five stations, five waterlines and five buttocks, all of them being equally spaced.	7	L2	2	2.3.1
		OR				
IV.	(a)	A ship is having a length on waterline of 120 m and the waterline has equidistantly spaced half-ordinates commencing from *forward* as follows: 0, 3.7, 5.9, 7.6, 7.5, 4.6, 0.1 metres respectively. Find the area of the water-plane using both Simpson's first rule and Simpson's second rule and then compare the results.	8	L3	2	1.4.1
	(b)	Explain block coefficient, midship section coefficient, prismatic coefficient and waterplane coefficient of a ship. Prove that their values are equal to unity for a vessel of uniform rectangular cross section, along its length, while floating on an even keel condition with its axis horizontal.	7	L2	2	1.4.1

(P.T.O.)

			Marks	BL	CO	PI
V.	(a)	Draw a typical statical stability curve (GZ curve) of a stable ship. How do you determine the initial metacentric height of the ship from such a curve? Explain other stability-related information of the ship that can be obtained from such a curve.	8	L3	3	1.4.1
	(b)	A wall sided ship of 7000 tonnes displacement has KB = 3.2 m, KM = 6.2 m, and KG = 5 m. Find the moment of statical stability of the ship at 25 degrees heel.	7	L3	3	1.4.1
		OR				
VI.	(a)	A ship has a displacement of 6000 tonne in seawater and it has a rectangular tank 8 m long, 6 m wide and 4 m deep. Calculate the free surface effect if this tank is partially filled with fresh water of density 1 t/m^3. Explain the effect of introducing a transverse bulkhead, at midlength of the tank, on the free surface effect.	8	L3	3	1.4.1
	(b)	A vessel is having a uniform triangular cross section, with its apex downwards, along its length. It has 32 m length, 8 m breadth at the deck and 5 m depth. If its KG is 3.7 m, find its initial metacentric height while it floats at 4 m draft on an even keel.	7	L3	3	1.4.1
VII.	(a)	Derive the expression for change in trim of a ship when it moves from sea water into fresh water.	8	L2	4	1.4.1
	(b)	A vessel of uniform rectangular cross section has length of 140 m, breadth of 20 m, depth of 10 m and transverse metacentric height of 1 m. It is floating on an even keel at a draught of 6 m. The vessel has a 20 m long compartment that is located amidships and the compartment extends over the entire breadth of the vessel. Calculate the increase in draught of the vessel and the new transverse metacentric height if the above midship-compartment is bilged.	7	L3	4	1.4.1
		OR				
VIII.	(a)	Derive the expression for longitudinal metacentric radius (BM_L) of the following: (i) Vessel which has uniform rectangular cross section along its length (ii) Vessel which has uniform triangular cross section, along its length, with its apex down.	8	L2	4	1.4.1
	(b)	A box-shaped vessel, which has 90 m length, 12 m breadth and 6 m depth, is floating on an even keel in sea water of density 1.025 t/m^3 at 3 m draught. Assume VCG of the vessel as 3.4 m. Find the new draughts at forward and aft if a mass of 60 tonnes, which was originally located amidships, is shifted aft by a distance of 30 m.	7	L3	4	1.4.1
IX.	(a)	Explain various components of ship resistance.	8	L1	5	1.4.1
	(b)	If a ship of length 125 m has a speed of 15 knots, determine the corresponding speed of a geometrically similar model having length 5 m.	3	L3	5	1.4.1
	(c)	Explain Froude Number and Froude's law of comparison.	4	L3	5	1.4.1
		OR				
X.	(a)	Define propulsive coefficient and quasi-propulsive coefficient. Explain various efficiencies associated with the conventional propulsion system of a ship.	8	L1	5	1.4.1
	(b)	Consider a ship having a displacement of 38,000 tonne in seawater. It has an Admiralty coefficient of 450 and a fuel coefficient of 74,000. Calculate the brake power required for the ship at a speed of 14 knots. Assume the frictional losses in gears and bearings to be 5%. Estimate the fuel consumption per day of the ship if it moves at a speed of 12 knots.	7	L3	5	1.4.1

Bloom's Taxonomy Levels
L1 – 10.7%, L2 – 40%,, L3 – 49.3%.

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