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***B.Tech. Degree VI Semester Regular/Supplementary Examination
in Marine Engineering June 2024***

**19-208-0607 NAVAL ARCHITECTURE - II
(2019 Scheme)**

Time: 3 Hours

Maximum Marks: 60

Course Outcome

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

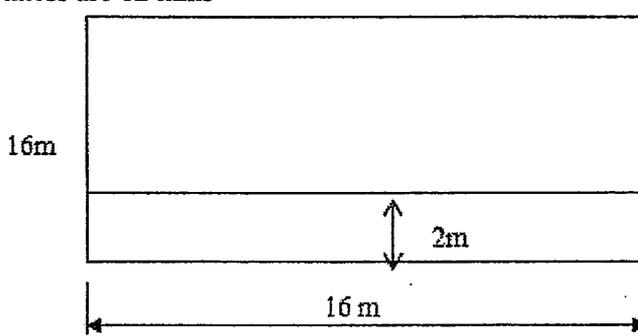
- CO1: Understand the basic concepts of strength of ship and calculate bending moment and deflection.
 CO2: Gain knowledge regarding propellers and design propeller.
 CO3: Calculate the forces acting on rudder and angle of heel while turning.
 CO4: Explain how the ocean waves affect the rolling pitching and yawing.
 CO5: Understand the different sources of ship vibration and the prevention of vibration.

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) Self weight of a Box Barge of 60 m long, 10 m wide is 300 t evenly distributed over the length. Barge is divided into five equal compartments 12 m each. Hold no.2 and 4 filled with equal quantities of Cargo and other compartments kept empty. The Barge is having a draft of 3 m in FW after loading. Prepare the Weight, Buoyancy, Load, SF and BM Curves.	12	L2	1	1.4.1
	(b) Find SF and BM at 20 m from aft end.	3	L1	1	1.4.1
OR					
II.	(a) Compute Section Modulus at Deck and Bottom Shell for the Mid Ship section of a ship given below: All thickness are 12 mms	12	L1	1	1.4.1
					
	(b) Find the shear stresses at Deck and Bottom Shell when a BM of 600 Mnm is acting on the ship.	3	L1	1	1.4.1

(P.T.O.)

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		Marks	BL	CO	PI
III.	The following data apply to a ship travelling at 16 knots: Propeller speed 1.8 revs/sec Propeller pitch ratio 0.9 Real slip ratio 0.33 Taylor wake fraction 0.30 Torque delivered to the propeller 420 kNm Propeller thrust 560 kNm Quasi-propulsive coefficient (QPC) 0.7 Determine each of the following: (i) The apparent slip ratio (ii) Propeller diameter (iii) The propeller efficiency (iv) EHP.	15	L3	2	1.4.1
OR					
IV.	A Ship's propeller diameter = 5.5 m, pitch of ratio = 0.9, blade area ratio = 0.5. When the propeller operated at 1.75 revs/sec, the following results were recorded: apparent slip ratio - 0.05 wake factor - 0.30 thrust power - 3450 KW propeller efficiency - 65% Determine each of the following for the above condition: (i) the ship's speed (ii) the real ship ratio (iii) the thrust per unit area of blade surface (iv) the torque delivered to the propeller.	15	L3	2	1.4.1
V.	(a) Describe Balanced, Semi-balanced and Unbalanced Rudders with the aid of neat sketches.	7	L2	3	3.1.1
	(b) What are the advantages of fitting a Balanced Rudder? Derive the 'Angle of heel' when the Rudder is turning at sea.	8	L2	3	3.1.1
OR					
VI.	A spade-type rudder has an area of 6.33 m ² . At its maximum designed rudder angle of 35°, the center of effort is 0.12 m aft of the axis of rotation and 1.6 m below the lower edge of the rudder stock bearing. The force on the rudder normal to the plane of the rudder is given by the expression: $F_N = 18.32 A v^2 \alpha$ newtons where: A = rudder area (m ²) v = ship speed (m/s) a = rudder angle (degrees) The equivalent twisting moment (TE) is given by: $T_E = M + \sqrt{M^2 + T^2}$ where: M = bending moment T = torque The maximum stress in the rudder material is to be limited to 77 MN/m ² . Calculate each of the following: (i) the diameter of the rudder stock required for a ship speed of 16 knots (ii) the speed to which the ship must be restricted, given that the effective diameter of rudder stock reduced by wear and corrosion to 375 mm.	15	L3	4	1.4.1

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		Marks	BL	CO	PI
VII.	(a) Write down equation for sinusoidal wave and explain the terms wave number, wave frequency, wave period and wave velocity.	8	L3	4	1.4.1
	(b) A ship at a displacement 10000 t has GMt = 0.5 m. and rolling period = 22 seconds, calculate the mass of cargo to be shifted 4 m above to increase the rolling period to 24 seconds.	7	L3	4	1.4.1
OR					
VIII.	(a) Derive the equation of motion for free rolling of in a ship.	8	L3	4	1.4.1
	(b) Hydrostatic particulars of a ship at a draft of 8 m (in sea water) are given below: Displacement = 6635 t, VCB = 4.252 m, KMt = 8.25 m, KG = 7.78 m. Calculate the Rolling Period.	7	L3	4	1.4.1
IX.	(a) With reference to ship hull vibration, define each of the following terms: (i) frequency (ii) amplitude (iii) node (iv) anti-node (v) mode.	15	L2	5	1.4.1
	(b) Define the term RESONANCE and explain its significance with respect to ship vibration.				
	(c) State three adverse effects of ship vibration.				
	(d) State four sources of ship vibration.				
OR					
X.	With respect to ship hull vibration, explain, with the aid of diagrams, each of the following terms: (i) two-node vertical mode (ii) three-node horizontal mode (iii) describe how hull vibration can be minimised in vessels during the design stage and on the vessels already built.	15	L2	5	4.1.3

Blooms's Taxonomy Level

L1 – 12%, L2 – 38%, L3 – 50%.
