

**Indian Maritime University**  
(A Central University, Govt. Of India)  
**End Semester Examination Dec-2019/Jan-2020**  
**B. Tech(Marine Engineering)**  
Semester -VI  
**Naval Architecture II**  
**(UG11T1605/2605)**

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Date: 09-01-2020

Max Marks: **70**

Time: 3 Hrs

Pass Marks: **35**

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**Part – A (compulsory)**

**Answer the following (10x2=20 Marks)**

1. What is the difference between adjustable-pitch propeller and controllable-pitch propeller?
2. Mention any four common dimensionless parameters that are used in propeller design and are a means of comparing propellers' performances.
3. Write any two benefits of having twin propellers for propulsion?
4. What are the two main functions of a rudder?
5. What is a bow rudder? When is it used?
6. What are called the static loads acting on a ship which is afloat in still water? Mention the two parts of static loads?
7. Choose the correct answer with respect to a floating ship:
  - (i) *"The area under the buoyancy curve must equal the area under the weight curve".*
  - (ii) *"The area under the buoyancy curve must be greater than the area under the weight curve".*
  - (iii) *"The area under the buoyancy curve must be less than the area under the weight curve".*
8. Mention the importance of drawing Shear force and Bending moment diagrams for a ship.
9. What are the causes for formation of (i) Capillary waves, (ii) Gravity waves, (iii) Long period waves and (iv) Ordinary tidal waves.
10. What is (i) Sway and (ii) Yaw with reference to ship motions?

**Part – B**

**Answer any 5 out of 7 questions (5 x 10= 50 marks)**

11. Describe open water testing of marine screw propellers in a towing tunnel. What are  $K_T$ ,  $K_Q$  and Advance coefficients? (10)
12. A ship of 15,000 tonne displacement is 120 m long, 20 m beam and floats at a draught of 8 m in sea water of density  $1.025 \text{ t/m}^3$ . The propeller has a face pitch ratio of 0.75 and, when turning at 100 rev/min, produces a ship speed of 12 knots with a real slip of 30%. Calculate (i) the apparent slip, (ii) pitch and

(iii) diameter of the propeller. The wake fraction 'w' may be found from the expression:  $w = 0.5C_b - 0.05$ . (10)

13(a). Mention the (i) principle, (ii) applicability and (iii) advantage of waterjet propulsion. (2+1+2=5)

(b). Write notes on Zigzag manoeuvring test on a ship's rudder. (5)

14(a). Draw a hydrofoil section of a rudder in the water stream and mention following forces in the drawing when the rudder is turned to an angle. Also give a short description of the mentioned items. (i) Angle of attack, (ii) Lift, (iii) Drag, (iv) Normal force (8)

(b). What is meant by Rudder stalling or burbling? (2)

15. A rudder has an area of  $16 \text{ m}^2$  with its centre of effort 1m from the centre of stock. The maximum rudder angle is  $35^\circ$  and it 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  $58 \text{ MN/m}^2$  and the rudder force parallel to the centerline of the ship is given by:  $F = 580 Av^2 \text{ N}$  with v in m/s (10)

16. A box-shaped barge of uniform construction is 32 m long and displaces 352 tonnes when empty, is divided by transverse bulkheads into four equal compartments. Cargo is loaded into each compartment and level stowed as follows:

(a) No. 1 hold 192 tonnes

(b) No. 2 hold 224 tonnes

(c) No. 3 hold 272 tonnes

(d) No. 4 hold 176 tonnes

Construct load and shearing force diagrams, calculate the bending moments at the bulkheads and at the position of maximum value; hence draw the bending moment diagram. (10)

17. Describe the following roll reduction methods. (i) Bilge keels, (ii) Active fin stabilizers, (iii) Passive tank stabilizers (2+4+4)