

INDIAN MARITIME UNIVERSITY

Time Bound Assignment September/October 2020

B Tech (ME) Arrear Examinations

**Naval Architecture - II
UG11T1605 / UG11T2605**

Date: 28/09/2020

Maximum Marks: 70

Time: 3 Hrs

Pass Marks: 35

Part – A (Compulsory)

Answer the following -

(10x2=20 Marks)

1. Define pitch of a propeller?
2. In a fixed pitch propeller blade, explain how the pitch angle varies from the root to the tip of the blade.
3. State reasons for positioning the propeller at the stern of the ship.
4. What is advance velocity in a propeller?
5. What is ship correlation factor (SCF)?
6. What is Admiralty coefficient?
7. What are the factors affecting wind wave development?
8. What is Quasi Propulsive Coefficient (QPC)?
9. What are various anti rolling devices used in ships?
10. What are various types of rudders used on ships?

Part – B

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

11. (a) Define specific fuel consumption. How does it vary with the ship speed? The fuel coefficient of a ship of 14000 tonnes displacement is 75000. Calculate the fuel consumption per day if the vessel travels at 12.5 knots. **(5 Marks)**

(b) A ship of 8000t displacement has a rudder of area 22m^2 . The ship has a GM of 0.6m, KG of 6.1m and the Centre of Lateral Resistance is 3.8m above the keel. The maximum rudder angle is 35° and the centroid of the rudder is 2.2m above the keel. Calculate the angle and direction of heel due to the force on the rudder if it is put hard over to port when travelling at 20 knots.

Note: $F_N = 15.5 A V^2$

(5 Marks)

Q.12 (a) What are the components of resistance? What is Froude's law of comparison? **(5 Marks)**

(b) A ship 120m long with a wetted surface area of 2860m^2 is required to have a speed of 15 knots. A model 5m long is tested and found to have a resistance of 29.5N.

Calculate the effective power at service speed for the ship given that Froude's frictional coefficient for the model is 1.74 and the ship is 1.43 when $n = 1.825$ and velocity is in m/s. **(5 Marks)**

Q.13 (a) A ship's propeller has a pitch ratio of 0.9 and a diameter of 4.5m. When the propeller rotates at 120 rev/min the following data apply:

Thrust	:	700kN
Propeller efficiency	:	65%
Taylor Wake Fraction	:	0.3
Service Speed	:	16 knots

Calculate each of the following:

- the apparent slip
- the real slip
- the thrust power
- the delivered power

(6 Marks)

(b) What is directional stability of a ship? How it affects ship manoeuvrability? **(4 Marks)**

Q.14 (a) A rudder has an area of 15m^2 with its centre of effort 0.9 m from the centre of stock. The maximum rudder angle is 35° 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 55MN/m² and the rudder force parallel to the centre line is given by:

$$F = 580 Av^2 \text{ N with } V \text{ in m/s.} \quad \textbf{(5 Marks)}$$

(b) What is turning circle manoeuvre. Describe the terms advance, transfer and tactical diameter with the help of a sketch. **(5 Marks)**

Q.15 (a) What is blade element theory for propeller design. Briefly describe the method to find thrust and torque on a propeller.

(5 Marks)

(b) How is open water test carried out on a propeller?

Show that

$$\eta_o = \frac{K_T J}{K_Q 2\pi}$$

(5 Marks)

Q.16 (a) What is propeller cavitation? What are problems associated with cavitation? How can it be reduced? **(5 Marks)**

(b) Given the following data for a propeller: Diameter = 4.88m, K_Q = 0.015, K_T = 0.097, J = 0.633, N = 120.

Determine PD; PT; VA and Efficiency. **(5 Marks)**

Q. 17 (a) Explain the wave energy spectrum and state its significance.

(5 Marks)

(b) Briefly describe the difference between shallow water waves and deep-water waves.

(5 Marks)

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