Indian Maritime University

(A Central University, Govt of India)

End Semester Examinations – June 2024

Programme Name: B Tech (ME)

Semester: VI

Subject Code: UG11T4605

Subject Name: Naval Architecture 2

Date: 10.06.2024	Max Marks: 70
Duration: 03 Hrs	Pass Marks: 35

General Instructions

(i) All Sections (A, B & C) are to be attempted.
(ii) Options, if any, are specified in respective section.

Section A

Answer all questions. Each question carries 1 mark

Select the most appropriate answer from the given choices for each of the following questions.

1. Which one of the following can have a negative value?

   (a) Apparent Slip
   (b) Real Slip
   (c) Quasi- Propulsive Coefficient
   (d) Thrust Deduction Fraction

2. The ratio of effective power to delivered power is called ----------

   (a) Propulsive Coefficient
   (b) Hull Efficiency
   (c) Quasi-Propulsive Coefficient
   (d) Transmission Efficiency

3. The function of fin stabiliser is

   (a) Resist longitudinal bending
   (b) Roll stabilisation
   (c) Resist yawing
   (d) Resist corrosion

4. Which of the following rudders will have the least twisting moment on the rudder stock with respect to the given rudder force?

(a) Balanced
(b) Unbalanced
(c) Semi-balanced
(d) L-shaped

5. With respect to ship movement in waves, a sea that is coming directly on the bow with the crests almost perpendicular to the ship's centreline is called_____.

(a) Beam Sea
(b) Head Sea
(c) Bow Sea
(d) Following Sea

6. Wake fraction is given by _____

(a) (Va-V) / V
(b) (V-Va) / Va
(c) (V-Va) / V
(d) (Va-V) / Va

7. The factor used to calculate true effective power of a ship (fitted with all appendages and in normal sea conditions) from the effective power of naked hull (from model test results) is called as_____.

(a) thrust deduction factor
(b) ship correlation factor
(c) service margin
(d) engine load margin

8. Area of the rudder for slow ships is from the formula _____

(a) L x d/30
(b) L x d/70
(c) L x d/45
(d) L x d/60

9. A propeller that revolves in the anti-clockwise direction (when viewed from aft) when propelling the ship forward is called a_____.

(a) inward turning propeller
(b) right hand propeller
(c) outward turning propeller
(d) left hand propeller

10. The significant wave height is defined as

(a) Average wave height in a wave record
(b) Average apparent height of the two third highest waves in a wave record
(c) Average apparent height of the one third highest waves in a wave record
(d) Average apparent height of the one third lowest waves in a wave record

Section B

(Each question carries 02 Marks. Answer all questions)

11. List out different types of rudder and also distinguish between a fully balanced and an unbalanced rudder.

12. Explain significant wave height of a sea spectrum. What is its significance?

13. What are the factors influencing the frictional resistance of a ship?

14. Define hull efficiency. How is it related to the Taylor wake fraction (w) and thrust deduction fraction (t)?

15. Explain real and apparent slip of a propeller

Section C

(Each question carries 10 Marks. Answer any 05)

16. (a) State the important assumptions of Axial Momentum Theory and the important inferences that can be drawn regarding the following propeller efficiency (5 Marks)

(b) List the various parameters recorded during an open water test for a model propeller and draw a neat labeled diagram of typical open water characteristics curves. (5 Marks)

17. A 6.5 m model of a ship has a wetted surface area of 8 m^2, and when towed in fresh water at 3.25 knots, has a total resistance of 44 N. Calculate the effective power of the ship, 130 m long, at its corresponding speed given that SCF = 1.15, the speed index, n = 1.825 and Froude's frictional resistance coefficient in SW, $f = 0.417 + \frac{0.773}{L+2.862}$. (10 Marks)

18. A ship travelling at 15.5 knots has a propeller of 5.5 m pitch turning at 95 rev/min. The thrust of the propeller is 380 kN and the delivered power 3540 kW. If the real slip is 20% and the thrust deduction factor 0.198, calculate the Thrust Power, QPC and the wake fraction. (10 Marks)

19.(a) Describe the Controllable Pitch Propeller along with its advantages compared to FPP. (5 Marks)

(b) A propeller 6m diameter has a pitch ratio of 0.9, BAR 0.48 and when turning at 110 rev/min, has a real slip of 25% and wake fraction 0.30. If the propeller delivers a thrust of 300 kN and the propeller efficiency is 65 %, calculate:

a) blade area
b) ship speed
c) thrust power
d) delivered power
e) torque. (5 Marks)

20. Write short note on following (5x2=10 Marks)

a) Wave Spectra
b) Trochoidal Waves
c) Anti-roll Tanks
d) Propeller Cavitation
e) Vertical Axis Propeller

21. A rudder has an area of 15 m^2 with its centre of effort 0.90m 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 55 MN/m^2 . (10 Marks)

22. a) A ship of 15000 tonne displacement requires 3500 kW at a particular speed, calculate the shaft power required by a similar ship of 18000 tonne displacement at its corresponding speed. (3 Marks)

b) The fuel coefficient of a ship of 14000 tonne displacement is 75000. Calculate the fuel consumption per day if the vessel travels at 12.5 knots. (3 Marks)

c) State Froude's law of comparison. A ship of length 100 meters has a speed of 15 knots. Determine the corresponding speed of its model of length 4 m.

(4 Marks)