

Indian Maritime University
(A Central University, Govt of India)
Supplementary Examinations – September/October 2024
Programme Name: B Tech (ME)

Semester: VI

Subject Code: UG11T4605

Subject Name: Naval Architecture II

Date: 29.10.2024	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

1. The ratio of efficiency of propeller in behind ship condition to the efficiency of propeller in open water condition is called :-
 - (a) Quasi-Propulsive Coefficient
 - (b) Propulsive efficiency
 - (c) Relative Rotative Efficiency
 - (d) Propeller efficiency
2. 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 lowest waves in a wave record
 - D. Average apparent height of the one third highest waves in a wave record
3. 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) Hull resistance
 - (d) Appendage resistance

4. Which of the following statements correctly describes the relation between time period of rolling (TR) and transverse metacentric height of ship (GMT)
 - (a) TR increases with increasing GMT
 - (b) TR reduces with increasing GMT
 - (c) TR reduces with decreasing GMT
 - (d) TR does not depend on GMT
5. In a turning circle test, the distance travelled by the centre of gravity of the ship in a direction of the original course after the instant the rudder is put over is called as _____.
 - (a) Transfer
 - (b) Advance
 - (c) Tactical diameter
 - (d) Turning circle diameter
6. The ratio of effective power to delivered power is called -----
 - (a) Propulsive Coefficient
 - (b) Hull Efficiency
 - (c) Quasi-Propulsive Coefficient
 - (d) Transmission Efficiency
7. Which one of the following is NOT a part of residuary resistance of the ship?
 - (a) Air Resistance
 - (b) Appendage resistance
 - (c) Eddy Resistance
 - (d) Wave-making Resistance
8. As per the Froude's law of comparison, the corresponding speeds of two geometrically similar ships are in the ratio of _____.
 - (a) their Lengths
 - (b) their displacements
 - (c) square roots of their lengths
 - (d) square roots of their displacements
9. Which of the following theories of propeller action assumes that the propeller is an actuator disc imparting a uniform acceleration to all fluid passing through it.
 - (a) Blade element theory
 - (b) Circulation theory
 - (c) Lifting line theory
 - (d) Axial Momentum theory.
10. The ITTC Model-ship correlation line method of Ship Resistance calculation is based on
 - (a) Froude's Number
 - (b) Reynold's Number
 - (c) Mach Number
 - (d) Weber Number

Section B

(Each question carries 02 Marks. Answer all questions)

11. What are the factors influencing the frictional resistance of a ship?
12. With the help of a neat sketch show the six degrees of freedom of a ship, which of these are rotational & which are translational.
13. Compare Sinusoidal waves with Trochoidal waves.
14. Explain PITCH RATIO & THEORETICAL SPEED V_T .
15. Explain real and apparent slip of a propeller

Section C

Seven Questions of 10 Marks each of which any 05 questions to be answered.

16. a) With the help of neat sketch, prove that the angle of heel during a steady turn of the ship is given by (06 Marks)
$$\tan\theta = \Delta V \times Lg / (g \times B \times GM)$$
- 16(b) A ship with a metacentric height of 0.4 m has a speed of 21 knots. The centre of gravity is 6.2 m above the keel, while the centre of lateral resistance is 4 m above the keel. The rudder is put hard over to port and the vessel turns in a circle 1100 m radius. Calculate the angle to which the ship will heel. (04 MARKS)
- 17a) With the help neat sketch, describe the Turning Circle test .
- 17 b) Explain With the neat sketch Zig-Zag Manoeuvre Test.
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 6 m model of a ship has a wetted surface area of 7 m², and when towed in fresh water at 3 knots, has a total resistance of 35 N. Calculate the effective power of the ship, 120 m long, at its corresponding speed.
 $n = 1.825$; f from formula: $SCF = 1.15$.

20. A ship is 140 m long has a speed of 15 knots. Wetted surface area of the ship is 3300 m², Density of sea water = 1025 kg/m³. Tests on a geometrically similar model 4.9 m long, run at corresponding speed, gave a total resistance of 19 N in fresh water whose density was 1000 kg/m³. Estimate total resistance of the ship using ITTC 1957 model ship correlation line. Given: $C_f = 0.075(\log_{10} R_n - 2)^2$ R_n for model = 6.195 x 10⁶ and R_n for ship = 9.0941 x 10⁸. Use Roughness allowance, $CA = 0.0004$ (10 Marks)

21. A ship of 15000 tonne displacement has an Admiralty Coefficient, based on shaft power, of 420. The mechanical efficiency of the machinery is 83%, shaft losses 6%, propeller efficiency 65% and QPC 0.71. At a particular speed the thrust power is 2550 kW.

Calculate:

- a) indicated power
- b) effective power
- c) ship speed.

22. Ship whose maximum speed is 18 knots has a rudder of area 25 m². The distance from the centre of stock to the centre of effort of the rudder is 1.2 m and the maximum rudder angle 35°. If the maximum allowable stress in the stock is 85 MN/m², calculate the diameter of the stock.