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** *VT*.

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)**

$\text{Tan}\theta = \Delta V^2 x\ LG/(g\ x \beta x\ GM)$

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: Cf=0.075(log10Rn−2)2 $Rn\ for\ model$=6.195×106 $and\ Rn\ for\ ship$=9.0941×108. 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.