Indian Maritime University

(A Central Un6iversity, Govt of India)

End Semester Examinations – June 2025

Programme Name: B Tech (ME)

Semester: VI

Subject Code: UG11T4605

Subject Name: Naval Architecture 2

Date: 09.06.2025	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.Residuary resistance Consists of:
a) Wave Making Resistance b) Viscous pressure Resistance or form drag
c) Eddy Resistance d) all of the above

2. The residuary resistances of similar ships are in the ratio of the cube of their linear dimensions if their speeds are:
a) in the ratio of the square root of their linear dimensions
b) in the ratio of the cube root of their linear dimensions
c) in the ratio of the under root of their linear dimensions
d) none of the above

3.Which of the following Sequence is correct in propeller theory about Theoretical Speed (Vt), Ship Speed(V) & Speed of Advance (Va) in a normal moving ship with no current/waves:

a) Vt>V>Va b) V>Vt>Va c) Vt>Va>V d) None of the above

4. Wake fraction is given by _____

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

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

5. The Significant wave height is defined as :

(a) Average wave height in a wave record

(b) Average height of the two third highest waves.

(c) Average height of the one third highest waves.

(d) Average height of the one third lowest waves.

6.The primary purpose of fitting a bulbous Bow is:
a) to reduce Wave making Resistance
b) To Reduce Frictional Resistance
c) To Prepare Ship for pounding
d) To Significantly Improve Buoyancy

7.Transmission Efficiency & Mechanical Efficiency in Ship Propulsion are respectively:
a) Delivered power/Shaft power & Shaft power/Indicated power.
b) Thrust power/Delivered power & Shaft power/Indicated power.
c) Effective Power/thrust power & Thrust power/Delivered power.
d) Delivered power/Shaft power & Thrust power/Delivered power.

8.Which of the following is NOT Linear Ship Motion:
a) Surge b) Heave c) Sway d) Yaw

9. Area of the rudder for fast ships is given by:
a) (L×d)/40
b) (L×d)/45
c) (L×d)/60
d) (L×d)/70

10. Apparent Slip & Real Slip are respectively:

a) Vt-V/Vt x 100&Vt-Va/Vt x 100 b) Vt-Va/Vt x 100 & Vt-V/Vt x 100

c) Vt-Va/Va x 100 & Vt-Va/V x 100 d) V-Vt/va x 100 & Va-Vt/V x 100

Section B

(Each question carries 02 Marks. Answer all questions)

11. State Froude's law of comparison
12. Define Real Slip ratio & Apparent Slip ratio.
13. Enumerate the term cavitation?
14. What is balanced rudder?
15. What is Blade area ratio & Disc area ratio?

Section C

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

16. Based on the following data of the propeller, calculate the Torque, Delivered Power, Thrust, Thrust Power, Speed of Advance and the efficiency of the propeller.
Diameter= 4.88m, KQ=0.015, KT=0.097, J=0.633, RPM=120

17. A ship of 15000 tonne displacement has an Admiralty Coefficient of 420 (based on shaft power). The mechanical efficiency of the machinery is 82%, shaft losses 15%, propeller efficiency 70%. At a particular speed the thrust power is 3000 kW. Calculate:
a) Indicated power (5 marks)

b) ship speed. (Using Admiralty coefficient formulae) (5 marks)

18.(a) A ship travels at 14 knots when the propeller, 5 m pitch, turns at 105 rev/min. If the wake fraction is 0.35, calculate the apparent and real slip.(5 marks)

(b) A propeller of 5.5 m diameter has a pitch ratio of 0.8. When turning at 120 rev/min, the wake fraction is found to be 0.32 and the real slip 35%. Calculate the ship speed, speed of advance and apparent slip (5 marks)

19. A 6 m model of a ship has a wetted surface area of $9m^2$, and when towed in fresh water at 3.25 knots, has a total resistance of 50 N. Calculate the effective power of the ship, 140 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, $f=0.417+ 0.773/(L+2.862)$

20.(a) With the help of neat sketch, prove that the angle of heel during a steady turn of the ship is given by $\text{Tan } \theta = V^2 \times LG/(g \times \beta \times GM)$
(β is the radius of the turning circle in m,) (6 marks)

(b) A vessel travelling at 17 knots turns with a radius of 450 m when the rudder is put hard over. The centre of gravity is 7 m above the keel, the transverse

metacentre 7.45 m above the keel and the centre of buoyancy 4 m above the keel. If the centripetal force is assumed to act at the centre of buoyancy, calculate the angle of heel when turning. The rudder force may be ignored.(4 marks)

21. A rudder has an area of 15 m^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 55 MN/m2 and the normal rudder force is given by: $F_n = 580\ AV^2 \sin\alpha$

22. Describe the following roll reduction methods:

a) Bilge keels (3 Marks)
b) Passive tank stabilizer (3 Marks)
c) Active fin stabilizers (4 Marks)