Indian Maritime University

(A Central University, Govt of India)

Mar/Apr'26 SE

Programme Name: B Tech (ME)

Semester: V

Subject Code: UG11T4505

Subject Name: NAVAL ARCHITECTURE-I

Date: 09.03.2026	Max Marks: 70
Duration: 03 Hrs	Pass Marks: 35

General Instructions: All Sections (A, B & C) are to be attempted and options, if any, are specified in respective section.

Section A

Answer all ten (10) MCQs/Fill in the Blanks of 01 Mark each and choose the correct answer as applicable. (Marks 10x1=10)

1. Curve lines under Profile View of a ship are ---

a. Curvilinear of Buttocks,
b. Curvilinear of Stations
c. Curvilinear of Water lines,
d. None of the above

2.Fresh Water Allowance (FWA) of a ship represents:

a. The change in trim when entering fresh water
b. The change in draft when a ship moves from salt water to fresh water
c. The change in displacement due to fuel consumption
d. The change in stability when loading cargo

3. You are required to find area of waterplane of a ship enclosed between 13 equally spaced stations from AP to FP. Which of the following can you use?

(a) Simpson's, First rule applicable,
(b) Simpson's second rule applicable
(c) Simpson's first or second rule applicable,
(d) Morrisch's formula

4. When a weight is moved in transverse direction it may cause
a. List
b. Heel
c. Trim
d. Loll

5 Transverse stability of a ship refers to its ability to resist:

a. Rolling motion (sideways tilting)
b. Pitching motion (fore and aft movement)
c. Yawing motion (turning about a vertical axis)
d. Heaving motion (up and down movement)

6. Select the correct statements when a ship enters from fresh water to seawater:
a. Draft will increase and trim by bow,
b. Draft will increase and trim by aft
c. Draft will decrease and trim by aft ,
d. Draft will decrease and trim by bow

7. In the Added Weight Method, the effect of flooding is treated as:
a. Loss of displacement
b. Loss of weight
c. Increase in buoyancy
d. Gain of weight (water added to the ship)

8. The main purpose of SOLAS damage stability requirements is:

a. To improve ship speed and fuel efficiency
b. To simplify ship construction
c. To reduce air pollution
d. To ensure the ship can remain afloat and stable after damage or flooding

9. At the point where shear force = 0, the bending moment is:

a. Minimum
b. Maximum or minimum
c. Zero
d. Constant

10. The load curve of a ship represents:

a. Cargo weight distribution only
b. Distribution of buoyancy only
c. The difference between buoyancy and weight per unit length
d. The total displacement of the ship

Section B

Answer all five (5) Questions of 02 Marks each.

(Marks 5x2=10)

11. Explain the Bonjean Curve

12. What is meant by free surface effect?

13. State the difference between trim and heel.

14. Explain Permeability.

15. Explain the Sagging condition of the ship.

Section C

Answer any five (5) Questions out of Seven (7) Questions of 10 Marks each. **(Marks 5x10=50)**

16. The ½ ordinates (m) of a water plane 120 m long are as follows:

Stn.	AP	$\frac{1}{2}$	1	2	3	4	5	6	7	8	9	$9\frac{1}{2}$	10
$\frac{1}{2}$ ord	2	3.5	7	9.5	10.5	10.8	11	10	8	6	4	2	0

Calculate : (a) Waterplane area (b) LCF from midships, (c) Second moment of area of water plane about a transverse axis through the centre of flotation.
(Marks 3+3+4)

17. A ship of 12000 tonne displacement has a second moment of area about the centreline of 72 X $10^3 m^4$.(a) If the metacentric height is negative - 0.05 m, calculate the angle of loll. (b) During a voyage, the same vessel is found to have an angle of loll of 13°, Calculate the initial metacentric height.

(Marks 5+5)

18. An oil tanker 24 m wide displaces 25000 tonnes when loaded in nine equal tanks, each 10 m long, with oil relative density 0.8. Calculate the total free surface effect with the following:

a) A longitudinal centreline bulkhead
b) Twin longitudinal bulkheads, forming three equal tanks
c) Twin longitudinal bulkheads, the centre compartment having a width of 12 m.

Marks(3+3+4)

19. A ship 120 m long and 9100 tonnes displacement floats at a level keel draught of 6.5 m in fresh water of 1000 kg/m^3. MCTC is 130 t.m, TPC in seawater 16.5 t, LCB is 2.3 m forward of midships. LCF is 0.6 m aft of amidships. Calculate a) the new draught at forward and b) the new draft at aft if the vessel moves into seawater of 1024 t/cm^3 without a change in displacement in tonnes.

(Marks =10)

20. A box-shaped vessel 100m long and 12 m wide floats at an even keel draft of 6 m in seawater. A compartment 10 m long and 12 m broad is empty. The forward bulkhead of this compartment is 10 m from the forward end of the ship. Find the drafts forward and aft if this hold is bilged.

(Marks -10)

21.a) Explain the concept of major criteria related to IMO code of intact stability recommended for passenger and cargo ships.

b) Draw a Standard Load Line Marking for a Cargo ship.

(Marks 5+5)

22. A box-shaped barge 40mX5 m has a light draft of 0.8 m forward and aft in seawater. It has four identical holds, each 10m long. Cargo is loaded level as follows from the bow end:

Cargo hold 1 =198 t
Cargo hold 2=100t
Cargo hold 3=100t
Cargo hold 4 =198 t
Draw the Load curve, SF and BM curves. (Marks 4+3+3)