D. MARINE
Study Material

MEO CLASS 2 WRITTEN: NA

(NAVAL ARCHITECTURE)

FOR INDIAN COMPETENCY EXAM

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JAN 2025

1.With reference to membrane tanks for the carriage of liquefied gas at very low temperatures:
a) Describe with the aid of a sketch, ONE method of building up the insulation.
b) State with reasons the alloy, which is used for the membrane.
c)Describe with the aid of a sketch, how the tanks are located and supported: 5)
(i)Longitudinally.
(ii) Transversely.
2023/FEB/01 2023/APR/04 2025/JAN/01
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2. With reference to dry docking, define the responsibilities of the Second Engineer and instructions to
Junior Engineers: (16)
a) Prior to docking
b) Whilst the vessel is in dry dock
c)Prior to flooding and leaving the dock.
2023/APR/01 2023/JUL/02 2023/OCT/02 2024/SEP/02 2024/NOV/02 2025/JAN/02
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3.a) Explain what is meant by "permissible length" of compartments in passenger ships. (6)
b) Describe how the position of bulkheads is determined. (6)
c) Briefly describe the significance of the factor of subdivision (4)
2025/JAN/03
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4. Explain how the period of roll varies with (16)
a) The amplitude of roll
b) The radius of gyration
c) The initial metacentric height
d) The location of masses in the ship.

2023/MAR/03 2023/OCT/04 2024/SEP/04 2024/NOV/04 2025/JAN/04

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5. Describe the relationship between frictional resistance and
a) Ship speed
b) The wetted area
c) The surface roughness
d) The length of the vessel

2023/OCT/05 2024/SEP/05 2024/NOV/05 2025/JAN/05

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6.a) How the distribution of mass within the ship affects the rolling period? (6)
b) A ship of 14000 tonne displacement is 125 m long and floats at draughts of 7.9 m forward and 8.5 m aft. The TPC is 19, GM, 120 m and LCF 3 m forward of midships. It is required to bring the vessel to an even keel draught of 8.5 m. Calculate the mass which should be added and the distance of the centre of the mass from midships.

2023/OCT/06 2024/SEP/06 2024/NOV/06 2025/JAN/06

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7.(a) Explain how increase of draught and of displacement influence Rolling (5)
b) A pontoon has a constant cross-section as shown in Fig. Given below The metacentric Neight is 2.5m. Find the height of the centre of gravity above the keel. (10)

2025/JAN/07

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8.a) Describe the fundamental principle of a propeller. (6)
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 0.65, calculate. (10)
i)Blade area.

ii)Ship speed.
iii) Thrust power
iv)Shaft power
v)Torque
2023/OCT/08 **2024/SEP/08** **2024/NOV/08** **2025/JAN/08**
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9.a) Explain what is meant by:
i)Wave-making resistance
ii)Frictional resistance (6)
iii)Eddy-making resistance
b) When a ship is 800 nautical miles from port its speed is reduced by 20%, thereby reducing the daily fuel consumption by 42 tonne and arriving in port with 50 tonne on board. If the fuel consumption in t/h is given by the expression (0.136+0.001 V) where Vis the speed in knots, estimate:
(i) The reduced consumption per day:
(ii) The amount of fuel on board when the speed was reduced:
(iii) The percentage decrease in consumption for the latter part of the voyage,
(iv) The percentage increases in time for this latter period.
2023/OCT/09 **2024/SEP/09** **2024/NOV/09** **2025/JAN/09**
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10.a) Explain how to distinguish between list and loll and describe how to return the ship to the upright in each case. (6)
b) A ship of 5000 tonne displacement has a double bottom tank 12m long. The X breadths of the top of the tank are 5,4 and 2m respectively. The tank has a watertight centreline division. Calculate the free surface effect if the tank is partially full of fresh water on one side only.
2023/OCT/10 **2024/SEP/10** **2024/NOV/10** **2025/JAN/10**
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FEB- 2025

1.With reference to Statutory Certification:

a) State the reason for the freeboard requirements.
b) (i) Explain the term conditions of assignments.
(ii)List the items that may be examined during a related survey.
Click Here to See the Answer

2.a) Define the angle of loll with sketches and explain the conditions that lead to its occurrence on a vessel.
b) Discuss the risks associated with an angle of loll and the corrective actions that can be taken to restore the ship to an upright and stable condition.
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3. Explain the purpose and design of a bulbous bow in ship construction. How does the bulbous bow help in reducing friction and wave resistance? Discuss the impact of a bulbous bow on fuel efficiency, vessel stability, and overall hydrodynamic performance.
Click Here to See the Answer

4. Define ship's total resistance. How this total resistance divided into various components? Write short notes on these components of resistance.
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5.If a ship is seriously damaged under water in way of a large fuel oil side bunker tanks what is the immediate effect and what may ultimately happen? What features in the ship would would enhance safety?
2023/MAR/Q5 2024/MAR/Q2 2025/FEB/Q5
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SECTION-II

6a) Describe how water tightness is maintained where bulkheads are pierced by longitudinal beams or pipes.
B) propeller has a pitch ratio of 0.95. When turning at 120 rev/min the real slip is 30% torque 2 fraction 0.28 and the of D.95eed 16 knots. The

thrust is found to be 400 KN, the torque 270 KNm and the QPC 0.67. Calculate:
(a) The propeller diameter
(b) The shaft power.
(c) The propeller efficiency
(d) The thrust deduction factor.
Click Here to See the Answer

7.a) Explain how to distinguish between list and loll and describe how to return the ship to the upright in each case. (6)
b) A ship of 12000 tonne displacement has a rudder 15m^2 in area, whose centre is 5m below the waterline. The metacentric height of the ship is 0.3m and the centre of buoyancy is 3.3m below the waterline. When travelling at 20 knots the rudder is turned through 30, Find the initial angle of heel if the force F perpendicular to the plane of the rudder is given by: Fa = 577 Av2 sin N Allow 20% for the race effect.
Click Here to See the Answer

8.a) Why is it important in a tender ship to keep the double bottom tanks pressed up. (6)
b) The fuel consumption of a ship at 17 knots is 47 tonne/day. The speed is reduced, and the consumption is reduced to 22 tonne/day. At the lower speed, however, the consumption per unit power is 13.2% greater than at 17 knots. Find the reduced speed and the percentage saving on a voyage of 3000 nautical miles.
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9.a) Describe how the force on the ship's bottom and the GM vary when grounding takes place.
b) A box barge 45 m long and 15 m wide floats at a level keel draught of 2 m in sea water, the load being uniformly distributed over the full length. Two masses, each of 30 tonnes, are loaded at 10 m from each end and 50 tonne is evenly distributed between them. Sketch the shear force diagram and give the maximum shear force.
Click Here to See the Answer

10.a) (a) Explain the concept of dynamical stability.
b) A ship of 14 000 tonne displacement is 125 m long and floats at draughts of 1.9 m forward and 8.5 m aft. The TPC is 19. GML 120 m and LCF 3 m forward of midships. It is required to bring the vessel to an even keel draught of 8.5 m. Calculate the mass which should be added and the distance of the centre of the mass from midships.
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MAR- 2025

Q.1 Explain the six types of ship motions along different axes. Discuss the causes of these motions and their impact on the vessel's stability and performance (8)
b) Discuss the methods employed to reduce these motions and enhance the vessel's stability and comfort. (8)
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Q.2 Explain the GZ (Righting Arm) curve used in ship stability. Discuss its significance, the information that can be obtained from the curve, and its role in assessing a ship's stability under various conditions. (16)
Click Here to See the Answer

Q.3 Explain the different types of framing systems used in ship construction. Discuss their design, structural arrangement, and advantages in ensuring the vessel's strength and stability. (16)
Click Here to See the Answer

Q.4 (a) List SIX hazards associated with the carriage of liquefied gas in bulk. (8)
(b) Sketch and describe the details of construction of a free standing prismatic tank within a gas carrier designed to carry liquefied gas (LPG). (8)
2023/NOV/04
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Q.5 a) With reference to fatigue of engineering components explain the influence of stress level and cyclical frequency on expected operating life. (6)
a) Explain the influence of material defects on the safe operating life of forged components of stern fittings (5)
c) State the factors which influence the possibility of fatigue cracking of a bed-plate transverse girder and explain how the risk of such cracking can be minimized. (5)
Click Here to See the Answer

Q.6 a) List the variables which affect the force on Rudder (6)
b) A triangular bulkhead is 7 m wide at the top and has a vertical depth of 8 m. Calculate the load on the bulkhead and the position of centre of pressure if the bulkhead is flooded with sea water on only side:
(i) to the top edge,
(ii) with 4 m head to the top edge. (10)
2023/FEB/06
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Q.7 a). Explain the effect on GM during the filing of a double -bottom tank (6)
b) An oil tanker 160m long and 22m beam floats at a draught of 9m in seawater. Cw is 0.865. The midships section is in the form of a rectangle with 1.2m radius at the bilges. A midships tank 10.5m long has twin longitudinal bulkheads and contains oil of 1.4 m3/t to a depth of 11.5m. The tank is holed to the sea for the whole of its transverse section. Find the new draught. (10)
Click Here to See the Answer

Q.8 a) What is meant by the Admiralty Coefficient and the Fuel Coefficient? (6)
b) A slip of 14900 tonne displacement has a shaft power of 4460 Kw at 14.55 knots. The shaft power is reduced to 4120 kW and the fuel consumption at the same displacement is 541 kg/h. Calculate the fuel coefficient for the ship. (10)
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Q.9 a) Describe the stability requirements of a ship for dry-docking. (6)
b) The 1½ ordinates of a water plane at 15m intervals, commencing from aft, are 1, 7, 10.5, 11, 11, 10.5, 8, 4 and 0m. Calculate:
(a). TPC
(b). Distance of the centre of flotation from midships.
(c). Second moment of area of the water plane about a transverse axis through the centre of flotation. (10)
2023/FEB/09
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Q.10 a)Describe the effect of cavitation's on the propeller blades.(6)
b) The following data are available from the hydrostatic curves of a vessel.

Draught (m)	KB(m)	KM(m)	I(m4)
4.9	2.49	10.73	65.25
5.2	2.61	10.79	68.86

Calculate the TPC at a draught of 5.05m. (10)
2023/JAN/06
Click Here to See the Answer

APRIL-2025

Q1. a) Define hogging and sagging with the help of neat sketches. Explain the causes of these structural
conditions and when they are most likely to occur during a voyage. (8)
b) Discuss the effects of hogging and sagging on a ship's structural integrity. What measures are taken in design,
loading, and operation to minimize their impact? (8)
2025/APR/Q1
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Q2. a) Define the term angle of loll. Explain the conditions under which it occurs and support your answer with a diagram showing the stability curve and ship's position at the angle of loll. (8)
b) Describe the actions to be taken to correct the angle of loll and restore positive stability. What precautions must be taken during the corrective process to avoid worsening the situation? (8)
2025/APR/Q2
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Q3. Discuss the need for adequate support of engine room gantry cranes, detailing the following
a) Sketch section through the engine room casing showing how the crane is supported by the ship structure. (6)
b) State what restricts the forward and aft limits of the crane and what is fitted to prevent the crane damaging the forward and aft bulkheads or casing. (5)
c) State the Second Engineer's responsibilities for the engine room gantry crane. (5)
2023/MAR/Q1 **2025/APR/Q3**
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Q4. With reference to Underwater Inspection in lieu of Dry docking (UWILD)
A. Explain in detail, how an underwater survey is carried out. (6)
B. State the requirements to be fulfilled before an underwater survey is acceptable to the survey authority. (5)
C. Construct a list of the items in order of importance that the underwater survey authority should include. (5)
2023/APR/Q3 **2023/AUG/Q4** **2024/MAR/Q1** **2025/APR/Q4**
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Q5. Describe the effect of the following on the ship's stability. (16)
A. Ice formation on superstructures
B. Effects of wind and waves

C. Changes that takes place during the ships voyage
D. Bilging of a compartment
E. While water is being pumped out from the dry dock.
2025/APR/Q5
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Q6. A. Describe the stability requirements of a ship for dry-docking. (6)
B. A ship of 8000 tonne displacement, 110m long, floats in sea water of 1.024 t/m 3 at draughts of 6m forward
and 6.3 m aft. The TPC is 16, LCB 0.6 m aft of midships, LCF 3m aft of midships and MCT1cm 65 tonne m, the
vessel now moves into fresh water of 1.000 t/m3 . Calculate the distance a mass of 50 tonne must be moved to
bring the vessel to an even keel and determine the final draught. (10)
2023/APR/Q6 2024/OCT/Q10 2025/APR/Q6
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Q7. a) Describe the effect of cavitations on the propeller blades. (6)
b) 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: (10)
(i) Indicated power
(ii) Effective power
(iii) Ship speed.
2025/APR/Q7
Click Here to See the Answer

Q8. a) With respect to Buoyancy of a vessel:
What do you understand by reserve buoyancy what happen if the lost buoyancy is greater than the reserve
buoyancy? (6)
b) A forward deep tank 12 m long extends from a longitudinal bulkhead to the ship's side. The widths of the tank

surface measured from the longitudinal bulkhead at regular intervals are 10, 9, 7, 4 and 1 m. Calculate the
second moment of area of the tank surface about a longitudinal axis passing through its centroid. (10)
2025/APR/Q8
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Q9. (a) Define longitudinal centre of gravity (LCG) and longitudinal centre of buoyancy (LCB). (6)
(b) The immersed cross-sectional areas of a ship 120m long, commencing fr
om aft are 2, 40, 79, 100, 103, 104,
104, 103, 97, 58 and 0 m2. Calculate:
(i) Displacement
(ii) Longitudinal position of the centre of buoyancy. (10)
2023/APR/Q9 2024/AUG/Q8 2025/APR/Q9
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Q10. a) What is the effect on fuel consumption per unit time, if the ship's speed is outside its operation range? (6)
b) An oil tanker 160m long and 22m beam floats at a draught of 9m in seawater. C w is 0.865. The midships
section is in the form of a rectangle with 1.2m radius at the bilges. A midships tank 10.5m long has twin
longitudinal bulkheads and contains oil of 1.4 m 3 /t to a depth of 11.5m. The tank is holed to the sea for the
whole of its transverse section. Find the new draught. (10)
2023/APR/Q10 2025/APR/Q10
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JUNE-2025

Q.1 a) Describe a method of the attachment of bilge keels; (6)
b) State THREE reasons for not extending bilge keels the entire length of the vessel; (6)

c) Explain TWO principles of roll damping those bilge keels exploit. (4)
2023/JUL/01 2024/JUN/01 2024/OCT/01 2025/JUN/01
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Q.2 A. What is the purpose of water tight doors fitted on bulkheads? (4)
B. Name the locations of water tight door in a vessel. (4)
C. Sketch and describe a vertically mounted water tight door. (8)
2024/JUN/02
Click Here to See the Answer

Q.3With reference to ship's rudder state:
A. Why can a breached hollow rudder add to fuel costs? (6)
B. Why excessive pintle clearance should not be tolerated? (5)
C. Why fitted bolts are used in connecting upper and lower stocks? (5)
Click Here to See the Answer
2023/JUN/05 2024/JUN/03 2025/JUN/03

Q.4With reference to International Load Line Statutory Certification,
A. State the reasons for the freeboard requirements;
B. (i) Explain the term "conditions of assignments"
(ii) List the items that may be examined during a Load line survey after a vessel's major repairs in the dry-dock.
Click Here to See the Answer

Q.5A. Sketch a transverse section through the hold space of a container ship hull. (8)
B. Referring to the sketch in (a) describe how adequate structural strength is built into the hull. (8)
2024/MAR/03 2024/JUN/05 2024/JUL/01 2025/JUN/05
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Q.6 A. Describe how the force on the ship's bottom and the GM varies when grounding takes place. (6)
B. A ship of 8,000 tones displacement takes the ground on a sand bank on a falling tide at an even keel draft of 5.2 meters. KG 4.0 meters. The

predicted depth of water over the sand bank at the following low water is 3.2 meters. Calculate the GM at this time assuming that the KM will then be 5.0 meters and that mean TPC is 15 tons. (10)
2022/FEB/06 **2024/JUN/06** **2025/JUN/06**
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Q.7A. Describe stability requirement for dry-docking. (6)
B. A box shaped vessel, 50 meters long x 10 meters wide, floats in salt water on an even keel at a draft of 4 meters. A center line longitudinal watertight bulkhead extends from end to end and for the full depth of the vessel. A compartment amidships on the starboard side is 15 meters long and contains cargo with permeability 30%. Calculate the list if this compartment is bilged. KG = 3 meters. (10)
2024/JUN/07 **2025/JUN/07**
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Q.8 A. Define longitudinal centre of gravity (LCG) and longitudinal centre of buoyancy (LCB). (6)
B. A ship 120m long floats has draughts of 5.50m forward and 5.80m aft; MCT1 cm 80 tonne m, TPC 13, LCF 2.5m forward of midships. Calculate the new draughts when a mass of 110 tonne is added 24m aft of midships. (10)
2024/JUN/08 **2025/JUN/08**
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Q.9A. List the precautions necessary before an inclining experiment is carried out. (6)
B. The speed of a ship is increased to 18% above normal for 7.5 hours, and then reduced to 9% below normal for 10 hours. The speed is then reduced for the remainder of the day so that the consumption for the day is the normal amount. Find the percentage difference between the distance travelled in that day and the normal distance travelled per day. (10)
2024/JUN/09
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Q.10 With reference to fixed pitch propellers:
a. Explain Propeller Slip and Propeller Thrust.
b. The shaft power of a ship is 3000 KW, the ship's speed V is 13.2 knot. Propeller rps is 1.27. Propeller pitch is 5.5m and the speed of advance is 11 Knots. Find:
i. Real Slip
ii. Wake fraction
iii. Propeller thrust, when its efficiency, η = 70%
2024/JUN/10 **2025/JUN/10**
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JULY-2025

Q1. State how and why the following machinery items are affected when the maximum service speed of a vessel is consistently maintained in heavy weather. (16)
a) Intermediate shafting
b) Propeller shafting
c) Shafting coupling bolts
d) Main thrust pads.
2022/MAR/Q2 **2023/JULY/Q4** **2023/AUG/Q1** **2024/JUL/Q4** **2025/JUL/Q1**
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Q2. a) Describe the arrangement made in a main structural bulkhead for a watertight door aperture. (5)
b) Explain a procedure for ensuring that sliding watertight doors are operated safely. (5)
c) Differentiate between the categories of watertight door and state the regulation pertaining each type. (6)
2022/FEB/Q3 **2023/JULY/Q5** **2023/AUG/Q2** **2025/JUL/Q2**
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Q3. Describe the preparation necessary before the application (in dry dock) of sophisticated or approved long life coating to the underwater surface of the hull.
a. State the significance of the roughness profile. (8)
b. List the different sophisticated costing which are available. (8)
2023/AUG/Q3 2023/SEP/Q1 2025/JUL/Q3
Click Here to See the Answer

Q4. With reference to Underwater Inspection in lieu of Dry docking (UWILD)
A. Explain in detail, how an underwater survey is carried out. (6)
B. State the requirements to be fulfilled before an underwater survey is acceptable to the survey authority. (5)
C. Construct a list of the items in order of importance that the underwater survey authority should include. (5)
2023/APR/Q3 2023/AUG/Q4 2024/MAR/Q1 2025/APR/Q4 2025/JUL/Q4
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Q5. With Regard the carriage of crude oil and its associated products: (6)
a) (i) State the dangers involved.
(ii) State what publications give guidance on safety.
b) Sketch and describe the operation of an explosimeter suitable for testing pump rooms or tanks. (5)
c) Define the terms lower and upper flammable limits Illustrating your answer by means rough sketch of a hydrocarbon vapour oxygen graph. (5)

2023/JAN/Q5 2023/AUG/Q5 2025/JUL/Q5
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SECTION – II

Q6. A. Explain why the bilging of empty double-bottom or deep tanks below the waterline leads to an increase in GM. (6)
B. A ship of 10,000 tonnes displacement has GM = 0.5 metres. The period of roll in still water is 20 seconds. Find the new period of roll if a mass of 50 tonnes is discharged from a position 14 metres above the centre of gravity. (10)

2023/AUG/Q6 2025/JUL/Q6
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Q7. A. Describe the ways in which an unstable ship can be made stable. (6)
B. When a mass of 25 tonnes is shifted 15m transversely across the deck of a ship of 8,000 tonnes displacement, it causes a deflection of 20cm in a plumb line 4 m long. If the KM = 7m, calculate the KG (10)

2023/AUG/Q7 2025/JUL/Q7
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Q8. A) Describe the process of correcting a negative GM. (6)
B. A ship 120 m long displaces 10500 tonne and has a wetted surface area of 3000 m2 . At 15 knots the shaft power is 4100 kW, propulsive coefficient 0.6 and 55% of the thrust is available to overcomefrictional resistance. calculate the shaft power required for a similar ship 140 m long at the corresponding speed. f = 0.42 and n = 1.825 (10)

2023/AUG/Q8 2025/JUL/Q8
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Q9. A) Explain why the rudder angle does not normally exceed 35°. (6)
b) A ship of 12000 tonne displacement has a rudder 15m2 in area, whose centre is 5m below the waterline. The metacentric height of the ship is 0.3m and the centre of buoyancy is 3.3m below the waterline. When travelling at 20 knots the rudder is turned through 30°. Find the initial angle of heel if the force Fn perpendicular to the plane of the rudder is given by: Fn=577 Av 2 sin α N. Allow 20% for the race effect. (10)

2023/AUG/Q9 2025/JUL/Q9
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Q10. A. List the components of residuary resistance. (6)
B. The following data are available for a twin-screw vessel:

V (Knots)	15	16	17	18
Epn (KW)	3750	3000	4700	5650
QPC	0.73	0.73	0.72	0.71

2023/AUG/Q10 2025/JUL/Q10
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AUG-2025

Q1. a) Explain the six types of ship motions along different axes. Discuss the causes of these motions and their impact on the vessel's stability and performance.
b) Discuss the methods employed to reduce these motions and enhance the vessel's stability and comfort. (8)
2025/MAR/01 **2025/AUG/01**
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Q2. Describe the relationship between frictional resistance and
(a) Ship speed.
(b) The wetted surface area.
(c) The surface roughness.
2023/OCT/05 **2024/SEP/05** **2024/NOV/05** **2025/JAN/05** **2025/AUG/02**
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Q3. During a voyage, sea water is found leaking into the engine room through a small hole in the ship side plating. What type of repairs will you carry out as an immediate action as a second engineer? What are the other actions and reporting procedures undertaken by the vessel to comply with class and flag requirements and procedures? How will you ensure that prompt and thorough repairs are undertaken as a permanent measure?
2025/AUG/03
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Q4. (a) List SIX hazards associated with the carriage of liquefied gas in bulk.
(b) Sketch and describe the details of construction of a free-standing prismatic tank within a gas carrier designed to carry liquefied gas (LPG). (8)
2021/AUG/05 **2023/SEP/03** **2025/MAR/04** **2025/AUG/04**
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Q5. a) With reference to fatigue of hull structures explain the influence of stress level and cyclical frequency on expected operating life. (6)
b) Explain the influence of material defects on the safe operating life of forged components of stern fittings. (5)
c) State the factors which influence the possibility of fatigue cracking of a bed-plate transverse girder and explain how the risk of such cracking can be minimized. (5)
2025/MAR/05 **2025/AUG/05**
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Q6. a) List the variables which affect the force on a rudder. (6)
b) A triangular bulkhead is 7 m wide at the top and has a vertical depth of 8 m. Calculate the load on the bulkhead and the position of centre of pressure if the bulkhead is flooded with sea water on only side.
(i) to the top edge
(ii) with 4 m head to the top edge. (10)
2025/MAR/06 **2025/AUG/06**
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Q7. A. Explain the effect on GM during the filing of a double – bottom tank. (6)
B. The length of a ship is 18 times the draught. while the breadth is 2.1 times the draft. At the load water plane, the water plane area co-efficient is 0.83 and the difference between the TPC in sea water and the TPC in fresh water is 0.7. Determine the length of the ship and TPC in fresh water.
2023/FEB/07 **2025/MAR/07**
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Q8. A. What is meant by the Admiralty Coefficient and the Fuel Coefficient? (6)
B. A ship of 14900 tonne displacement has a shaft power of 4460 kW at 14.55 knots. The shaft power is reduced to 4120 kW and the fuel consumption at the same displacement is 541 kg/h. Calculate the fuel coefficient for the ship. (10)
2023/FEB/08 **2023/SEP/08** **2025/MAR/08** **2025/AUG/08**
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Q9. A) Describe the stability requirements of a ship for dry-docking. (6)
B) The ½ ordinates of a waterplane at 15m intervals, commencing from aft, are 1, 7, 10.5, 11, 11, 10.5, 8, 4 and 0m. Calculate:
(a) TPC.
(b) Distance of the centre of flotation from midships.
(c) Second moment of area of the waterplane about a transverse axis through the centre of flotation. (10)
2025/MAR/09 **2025/AUG/09**
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Q10. a) Describe the effect of cavitations on the propeller blades. (6)
b) The following data are available from the hydrostatic curves of a vessel. Calculate the TPC at a draught of 5.05m. (10)

Draught (m)	KB (m)	KM (m)	I (m4)
4.9	2.49	10.73	65250
5.2	2.61	10.79	68860

Click Here to See the Answer

SEP-2025

Q1. Vessel has gone through very heavy weather. On arrival at safe anchorage, you are conducting your inspection to determine damages to hull.
A. List the areas you will inspect. (3)
B. List your findings of any significance. (6)
C. Write a report to company suggesting repairs if any. (7)
2022/JUN/Q2 **2025/JUN/Q2** **2025/SEP/Q1**
Click Here to See the Answer

Q2. Explain how the period of roll varies with:
A. The amplitude of roll. (4)
B. The radius of gyration. (4)
C. The initial metacentric height. (4)
D. The location of masses in the ship. (4)
2023/MAR/Q3 **2023/OCT/Q4** **2024/SEP/Q4** **2024/NOV/Q4** **2025/JAN/Q4** **2025/SEP/Q2**

Click Here to See the Answer

Q3. With reference to Underwater Inspection in lieu of Dry docking (UWILD)
A. Explain in detail, how an underwater survey is carried out. (6)
B. State the requirements to be fulfilled before an underwater survey is acceptable to the survey authority. (5)
C. Construct a list of the items in order of importance that the underwater survey authority should include. (5)
Click Here to See the Answer

Q4. a) Describe a method of the attachment of bilge keels. (5)
b) State THREE reasons for not extending bilge keels the entire length of the vessel. (6)
c) Explain TWO principles of roll damping that bilge keels exploit. (5)
2023/JULY/Q1 **2024/JUN/Q1** **2024/OCT/Q1** **2025/JUN/Q1** **2025/SEP/Q4**
Click Here to See the Answer

Q5. List SIX hazards that arise with the carriage of liquefied gas in bulk. Describe, with the aid of a sketch. The details of construction of a prismatic cargo tank within a gas carrier designed to carry liquefied gas (LPG)
2021/JUL/Q5 **2021/AUG/Q5** **2021/SEP/Q2**
2025/MAR/Q4 **2025/AUG/Q4** **2025/SEP/Q5**
Click Here to See the Answer

SECTION – II

Q6. 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. (16)
Calculate:
(i) Indicated power
(ii) Effective power
(iii) Ship speed.

2021/FEB/Q6 **2021/APR/Q8** **2021/OCT/Q10** **2023/APR/Q7** **2025/SEP/Q6**

Click Here to See the Answer

Q7. A. Describe stability requirement for dry-docking. (6)
B. A ship of 8000 tonne displacement floats upright in seawater, with KG = 7.6m and GM = 0.5m. A tank, whose Kg is 0.6m above the keel and 3.5m from the center line contains 100 tonne of water ballast. Neglecting the free surface effect, calculate the angle which the ship will heel, when the ballast water is pumped out. (10)

021/JAN/Q6 **2021/JUL/Q8** **2021/SEP/Q8** **2021/DEC/Q7** **2022/FEB/Q7 2022/JUN/Q7 2024/AUG/Q7 2025/SEP/Q7**

Click Here to See the Answer

Q8. (a) Define longitudinal centre of gravity (LCG) and longitudinal centre of buoyancy (LCB). (6)
(b) The immersed cross-sectional areas of a ship 120m long, commencing from aft are 2, 40, 79, 100, 103, 104, 104, 103, 97, 58 and 0 m2.
Calculate:
(i) Displacement
(ii) Longitudinal position of the center of buoyancy. (10)

2021/JAN/Q7 **2021/FEB/Q9** **2021/JUL/Q9** **2021/AUG/Q9** **2021/SEP/Q9** **2021/DEC/Q8** **2022/MAR/Q7** **2022/JUN/Q8** **2023/APR/Q9 2024/AUG/Q8** **2025/APR/Q9** **2025/SEP/Q8**

Click Here to See the Answer

Q9. a) With respect to Buoyancy of a vessel:
What do you understand by reserve buoyancy what happen if the lost buoyancy is greater than the reserve buoyancy? (6)
b) A forward deep tank 12 m long extends from a longitudinal bulkhead to the ship's side. The widths of the tank surface measured from the longitudinal bulkhead at regular intervals are 10, 9, 7, 4 and 1 m. Calculate the second moment of area of the tank surface about a longitudinal axis passing through

its centroid. (10)
2025/APR/Q8 **2025/SEP/Q9**
Click Here to See the Answer

Q10. A ship of length 140m, Breadth of 18.5m, draught of 8.1m and a displacement of 17,025 tonnes in sea water, has a face pitch ratio of 0.673. Diameter of the Propeller is 4.8m. The results of the speedy trial show that true slip may be regarded as constant over a range of 9 to 13 knots and is 30%, w = 0.5C b-0.05. If fuel used is 20t/day at 13 knots and fuel consumption/day varies as cube of speed of ship, Determine the fuel consumption, when propeller runs at 110 rpm.
2021/FEB/Q8 **2022/JUN/10** **2025/SEP/Q10**
Click Here to See the Answer

OCT-2025

SECTION – I

Q1. a) Describe a method of the attachment of bilge keels. (5)
b) State THREE reasons for not extending bilge keels the entire length of the vessel. (6)
c) Explain TWO principles of roll damping that bilge keels exploit. (5)
2023/JULY/Q1 **2024/JUN/Q1** **2024/OCT/Q1** **2025/JUN/Q1** **2025/SEP/Q4** **2025/OCT/Q1**
Click Here to See the Answer

Q2. With reference to ship's rudder state:-
a) Why a breached hollow rudder can adds to fuel costs? (6)
b) Why excessive pintle clearance should not be tolerated? (5)
c) Why fitted bolts are used in connecting upper and lower stocks? (5)
2023/JUNE/Q5 **2024/JUNE/Q3** **2025/JUN/Q3** **2025/OCT/Q2**
Click Here to See the Answer

Q3. With reference to International Load Line Statutory Certification,
A. State the reasons for the freeboard requirements. (6)
B. Explain the term “conditions of assignments”. (5)
C. List the items that may be examined during a Load line survey after a vessel’s major repairs in the dry-dock. (5)
021/AUG/Q3 **2022/FEB/Q2** **2022/APR/Q4** **2022/JUNE/Q1** **2023/JUL/Q3** **2024/JUN/Q4** **2025/JUN/Q4** **2025/OCT/Q3**
Click Here to See the Answer

Q4. A. Sketch a transverse section through the hold space of a container ship hull. (8)
B. Referring to the sketch in (A) describe how adequate structural strength is built into the hull. (8)
021/JAN/Q2 **2021/MAR/Q1** **2021/APR/Q1** **2024/MAR/Q3** **2024/JUNE/Q5** **2024/JUL/Q1** **2025/JUN/Q5** **2025/OCT/Q4**
Click Here to See the Answer

Q5. A. Describe how the force on the ship’s bottom and the GM vary when grounding takes place. (6)
B. A ship of 8,000 tonnes displacement takes the ground on a sand bank on a falling tide at an even keel draft of 5.2 metres. KG 4.0 metres. The predicted depth of water over the sand bank at the following low water is 3.2 metres. Calculate the GM at this time assuming that the KM will then be 5.0 metres and that mean TPC is 15 tonne. (10)
2021/APR/Q7 **2021/OCT/Q7** **2022/FEB/Q6** **2024/JUN/Q6** **2025/JUN/Q6** **2025/OCT/Q5**
Click Here to See the Answer

Q6. A. Describe stability requirement for dry-docking. (6)
B. A box shaped vessel, 50 metres long × 10 metres wide, floats in salt water on an even keel at a draft of 4 metres. A centre line longitudinal watertight bulkhead extends from end to end and for the full depth of the vessel. A compartment amidships on the starboard side is 15 metres long and contains cargo with permeability 30%. Calculate the list if this compartment is bilged. KG = 3 metres. (10)
2024/JUN/Q7 **2025/JUN/Q7** **2025/OCT/Q6**
Click Here to See the Answer

Q7. A. Define longitudinal centre of gravity (LCG) and longitudinal centre of buoyancy (LCB). (6)
B. A ship 120m long floats has draughts of 5.50m forward and 5.80m aft. MCT1 cm 80 tonne m, TPC 13, LCF 2.5m forward of midships. Calculate the new draughts when a mass of 110 tonne is added 24m aft of midships. (10)
2021/APR/Q6 **2022/FEB/Q8** **2024/JUN/Q8** **2025/JUN/Q8** **2025/OCT/Q7**
Click Here to See the Answer

Q8. A. List the precautions necessary before an inclining experiment is carried out. (6)
B. The speed of a ship is increased to 18% above normal for 7.5 hours, and then reduced to 9% below normal for 10 hours. The speed is then reduced for the remainder of the day so that the consumption for the day is the normal amount. Find the percentage difference between the distance travelled in that day and the normal distance travelled per day. (10)
2024/JUN/Q9 **2025/JUN/Q9** **2025/OCT/Q8**
Click Here to See the Answer

Q9. With reference to fixed pitch propellers:
a. Explain Propeller Slip and Propeller Thrust. (6)
b. The shaft power of a ship is 3000 kW, the ship's speed V is 13.2 knot. Propeller rps is 1.27. Propeller
pitch is 5.5 m and the speed of advance is 11 Knots. Find:
i. Real Slip
ii. Wake fraction
iii. Propeller thrust, when its efficiency, η = 70% (10)

2021/APR/Q9 **2024/JUN/Q10** **2025/JUN/Q10** **2025/OCT/Q9**

Click Here to See the Answer