D. MARINE
Study Material

MEO CLASS 4 WRITTEN: NA

(NAVAL ARCHITECTURE)

FOR INDIAN COMPETENCY EXAM

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JANUARY – 2025(PART-1)

Q1. A virtual rise in the centre of gravity of a ship may be caused by (16)
(a) Filling a partially filled tank
(b) Using an onboard crane to lift a freely swinging heavy object
(c) Emptying a partially filled tank
(d) Transferring pipe from the setback area to the pipe rack
Briefly justify your answer
2024/APR2/Q1 **2024/JUN/Q2** **2025/JAN1/Q1**
Click Here to See the Answer

Q2. Explain the meaning and purpose of EACH of the following terms
(a) Bulbous bow (4)
(b) Hawse pipe (4)
(c) Spurling pipe (4)
(d) Cable stopper (4)
2024/APR2/Q2 **2025/JAN1/Q2**
Click Here to See the Answer

Q3. Define the main purpose of the following tank and pumping system in detail
(a) Weighted cocks on tank sounding pipes (4)
(b) Remote operated gear for bilge valves (4)
(c) Ventilation pipes for double bottom tanks (4)
(d) Explain why gauze is sometimes fitted to tank ventilation pipes and explain the effect of mesh size (4)
2023/MAY2/Q3 **2024/FEB/Q2** **2024/APR2/Q3** **2024/SEP2/Q1** **2025/JAN1/Q3**
Click Here to See the Answer

Q4. Sketch a plain bulkhead showing connections to deck sides and double bottom and the arrangement of stiffeners (16)
2024/APR2/Q4 **2025/JAN1/Q4**

Click Here to See the Answer

Q5. Write short notes on each of the following with respect to their contribution to the strength of ships (a) Strake (4)
(b) Bracket (4)
(c) Stringer (4)
(d) Girder (4)
2024/APR2/Q5 **2025/JAN1/Q5**
Click Here to See the Answer

Q6. (a) Describe the provisions of additional structural strength to withstand pounding (6)
(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 (10)
2024/APR2/Q6 **2025/JAN1/Q6**
Click Here to See the Answer

Q7. (a) Show by means of diagrams how the center of gravity of the liquid in a partly filled tank moves during rolling (6)
(b) A box barge is 15 m long 6 m wide and floats in water of 1.016 t/m^3 at a draught of 3 m 150 tonne of cargo is now added Calculate the load exerted by the water on the sides ends and bottom (10)
2024/APR2/Q7 **2025/JAN1/Q7**
Click Here to See the Answer

Q8. (a) Explain what is meant by assigned summer freeboard (6)
(b) A box shaped vessel 60 m long 10 m beam and 6 m deep is floating in salt water at drafts 4 m forward and 4.4 m aft Find how far forward of amidships a weight of 30 tonnes must be loaded if the draft aft is to remain at 4.4 m (10)
2024/APR2/Q8 **2025/JAN1/Q8**

[Click Here to See the Answer]

Q9. (a) Explain why the TPC for a given draught will vary with the density of the water in which the ship floats (6)
(b) A box shaped ship with 12 m beam is floating upright at a draft of 6.7 m Find the increase in draft if the vessel is now listed 18 degrees (10)
2024/APR2/Q9 **2025/JAN1/Q9**
[Click Here to See the Answer]

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JANUARY – 2025(PART-2)

Q1. (a) What are the advantages of corrugated bulkheads (6)
(b) Sketch and describe a corrugated transverse watertight bulkhead (10)
2023/JUN/Q3 **2023/SEP/Q4** **2024/JAN/Q4** **2024/MAY1/Q1** **2024/DEC/04** **2025/JAN2/Q1**
Click Here to See the Answer

Q2. (a) Describe in detail how brittle fracture is instrumental in causing failure of materials (6)
(b) Describe how a material is tested to assess the resistance to this type of failure (4)
(c) Suggest where this type of failure would be likely and explain how the likelihood of failure is reduced (6)
2024/MAY1/Q2 **2025/JAN2/Q2**
Click Here to See the Answer

Q3. With reference to hull protection against corrosion and fouling write a brief explanation of each of the following (a) Sacrificial anodes (6)
(b) Impressed current system (6)
(c) Means of preventing marine growth and fouling (4)
2024/MAY1/Q3 **2025/JAN2/Q3**
Click Here to See the Answer

Q4. Define the following stating how they affect the ship structure and what component parts of the ship structure help to resist the effect (a) Racking
(b) Panting (4)
(c) Pounding (4)
(d) Vibration from engine and propellers (4)
2024/MAY1/Q4 **2025/JAN2/Q4**
Click Here to See the Answer

Q5. (a) What is the fundamental purpose of a load line marking on ships (5)
(b) Sketch and describe the features of a load line marking (6)

(c) Name five conditions that must be met before freeboard is assigned to a ship (5)
2023/DEC/Q4 **2024/MAY1/Q5** **2025/JAN2/Q5**
Click Here to See the Answer

Q6. (a) Explain why the draught of a ship decreases when it passes from fresh water to seawater and vice versa (6)
(b) A bulkhead 9 m deep is supported by vertical stiffeners 750 mm apart The bulkhead is flooded to the top edge with seawater on one side only Calculate (10)
(a) Shearing force at top
(b) Shearing force at bottom
(c) Position of zero shear
2024/MAY1/Q6 **2024/SEP1/Q8** **2025/JAN2/Q6**
Click Here to See the Answer

Q7. (a) What is the purpose of conducting an inclining experiment on a new vessel (6)
(b) A mass of 6 t is moved transversely through a certain distance on a ship of 4300 t displacement when the deflection of an 11 m pendulum is found to be 120 mm The transverse metacentre is 7.25 m above the keel and KG 5.46 m Find the distance through which the mass of 6 t was moved (10)
2023/JUN/Q6 **2023/DEC/Q8** **2024/MAR/Q6** **2024/MAY1/Q7** **2024/SEP1/Q6** **2025/JAN2/Q7**
Click Here to See the Answer

Q8. A hopper barge of box form 50 m long and 10 m wide floats at a draught of 2 m in seawater when the hopper which is 15 m long and 5 m wide is loaded with mud having relative density twice that of the seawater to the level of the waterline Doors in the bottom of the hopper are now opened allowing the mud to be discharged Calculate the new draught (16)
2023/AUG/Q9 **2023/DEC/Q9** **2024/MAY1/Q8** **2025/JAN2/Q8**
Click Here to See the Answer

Q9. (a) Sketch and describe the midship section of a bulk carrier labelling the structural members (8)
(b) A vessel 40 m long has a constant cross section in the form of a trapezoid 10 m wide at the top 6 m wide at the bottom and 5 m deep It floats in seawater at a draught of 4 m Calculate its displacement (8)
2023/DEC/Q6 **2024/MAY1/Q9** **2025/JAN2/Q9**
Click Here to See the Answer

FEBRUARY – 2025

Q1. (a) What is the purpose of providing air pipes to tanks in the vessel (5)
(b) Sketch an arrangement of air vent head situated on the weather deck (c) What factors are considered in deciding the bore size of air pipe (5)
2023/NOV/Q1 **2024/JUL/Q1** **2025/FEB/Q1**
Click Here to See the Answer

Q2. (a) What is a right-handed and a left-handed propeller
(b) With the aid of simple sketches explain rake skew and pitch of the propeller
(c) What are the advantages and disadvantages of CPP
2023/MAY2/Q1 **2023/JUL/Q5** **2023/NOV/Q2** **2024/FEB/Q1** **2024/JUL/Q2** **2024/NOV/Q1** **2025/FEB/Q2**
Click Here to See the Answer

Q3. (a) What are various types of tankers for carrying bulk liquids (6)
(b) Sketch a mid ship section of a double hulled crude oil tanker (10)
2023/NOV/Q3 **2024/JUL/Q3** **2025/FEB/Q3**
Click Here to See the Answer

Q4. Briefly explain the following ship terms used (a) LOA (2)
(b) LBP (2)
(c) Breadth extreme (2)
(d) Breadth moulded (2)
(e) Depth extreme (2)
(f) Depth moulded (2)
(g) Draught extreme (2)
(h) Draught moulded (2)
2023/MAY2/Q4 **2023/NOV/Q4** **2024/FEB/Q3** **2024/JUL/Q4** **2024/NOV/Q3** **2025/FEB/Q4**
Click Here to See the Answer

Q5. What do you understand by free surface effect and how does it affect the ship stability (16)
2024/JUL/Q5 **2025/FEB/Q5**
Click Here to See the Answer

Q6. (a) What is the metric length of one shackle of an anchor chain (4)
(b) A vessel of 10000 t displacement burns 25 t of fuel per day when her speed is 12 knots Calculate the probable consumption of fuel over a voyage of 3000 nautical miles at a speed of 11 knots with a displacement of 11000 t (12)
2024/JUL/Q6 **2025/FEB/Q6**
Click Here to See the Answer

Q7. (a) What are the different types of stern used in ship construction (6)
(b) A ship consumes 360 t of fuel stores and water when moving from seawater of 1.025 t/m^3 into fresh water of 1.000 t/m^3 and on arrival it is found that the draught has remained constant Calculate the displacement in seawater (10)
2023/JUL/Q7 **2025/FEB/Q7**
Click Here to See the Answer

Q8. (a) What is a mast riser and what is the purpose of it (6)
(b) A ship 96 m long is floating at 5 m fwd draft and 6.4 m aft draft MCTC 180 tm TPC 16 COF is 2 m abaft of midships Find the location where a weight of 50 t should be placed so as to keep the aft draft constant (10)
2024/JUL/Q8 **2025/FEB/Q8**
Click Here to See the Answer

Q9. A ship 120 meters long at the waterline has equidistantly spaced half ordinates commencing from forward as follows 0 3.7 5.9 7.6 7.5 4.6 and 0.1 meters respectively Find the area of the waterplane using Simpson's second rule and the TPC at this draft Water density is 1.025 t/m^3 (16)
2023/NOV/Q9 **2024/JUL/Q9** **2025/FEB/Q9**
Click Here to See the Answer

MARCH – 2025

Q1. (a) Explain what is meant by longitudinal framing and transverse framing (8)
(b) Which types of ships would have these methods of construction Give reasons (8)
2024/MAY2/Q1 **2024/AUG/Q1** **2025/MAR/Q1**
Click Here to See the Answer

Q2. What are the main functions of (a) Fore peak (4)
(b) After peak (4)
(c) Deep tank (4)
(d) Double bottom (4)
Give examples of liquid carried in these tanks
2024/MAY2/Q2 **2024/AUG/Q2** **2025/MAR/Q2**
Click Here to See the Answer

Q3. With regards to the metacentric height which of the following statements is true (16)
(a) It is used to indicate the quality of initial stability
(b) It is located below the center of buoyancy
(c) It is measured vertically above the center of buoyancy
(d) Its determination is the objective of the inclining experiment Briefly justify your answer
2023/APR/Q4 **2024/MAY2/Q3** **2024/AUG/Q3** **2025/MAR/Q3**
Click Here to See the Answer

Q4. (a) Sketch a semi balanced rudder of your choice showing (10)
(i) A detail of the hinges or pintels about which rudder turns
(ii) Details of the rudder carrier bearing which supports the weight of the rudderstock and rudder
(b) State advantages of semi balanced rudder over an unbalanced rudder
2024/MAY2/Q4 **2024/AUG/Q4** **2025/MAR/Q4**
Click Here to See the Answer

Q5. (a) Describe the following and explain their function (9)
(i) Hawse pipe
(ii) Spurling pipe
(iii) Cable stopper
(b) With the aid of a sketch of a ship bow show the arrangement of anchor cable from anchor to chain locker (7)
2022/SEP/Q3 **2023/MAR/Q3** **2024/MAY2/Q5** **2024/AUG/Q5** **2025/MAR/Q5**
Click Here to See the Answer

Q6. (a) Define centre of flotation What happens to the draught and trim of a ship if a small mass is added to the ship at the centre of flotation (6)
(b) A ship of displacement 10010 tonnes has KM 6.7 m and GM 0.76 m A mass of 10 tonnes having KG 7.6 m is shifted transversely The deflection of a pendulum of length 7.6 m is 0.125 m Find the distance through which the mass is shifted Also find the position of the new centre of gravity above the keel due to the removal of the same mass (10)
2024/MAY2/Q6 **2024/AUG/Q6** **2025/MAR/Q6**
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Q7. (a) What is meant by statical stability What are the factors that influence stability (6)
(b) A box barge 25 m long and 4 m wide floats in fresh water at a draught of 1.2 m and has an empty mid length compartment 5 m long The bottom of the barge is lined with teak (rd 0.805) 120 mm thick After grounding all the teak is torn off and the centre compartment laid open to the sea Calculate the final draught (10)
2024/MAY2/Q7 **2024/AUG/Q7** **2025/MAR/Q7**
Click Here to See the Answer

Q8. The 1/2 ordinates of a waterplane 120 m long are as follows (16)
Section AP 1/2 | 1 | 1½ | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 8½ | 9 | 9½ | FP
1/2 ord 1.2 | 3.5 | 5.3 | 6.8 | 8.0 | 8.3 | 8.5 | 8.5 | 8.5 | 8.4 | 8.2 | 7.9 | 6.2 | 3.5 | 0 m
Calculate

(a) Waterplane area
(b) Distance of centroid from midships
2023/AUG/Q8 **2024/JUN/Q8** **2024/MAY2/Q8** **2024/AUG/Q8** **2025/MAR/Q8**
Click Here to See the Answer

Q9. A ballast tank is 15 m long 12 m wide and 1.4 m deep and is filled with fresh water Calculate the load on the top and short side if (16)
(a) The tank is just completely full
(b) There is a head of 7 m of water above the tank top
2023/AUG/Q6 **2024/MAY2/Q9** **2024/AUG/Q9** **2025/MAR/Q9**
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APRIL – 2025(PART-1)

Q1. Describe with the aid of sketches how each of the following contribute towards improving the propulsive efficiency of a ship (16)
(a) Ducted propeller
(b) Costa bulb as fitted to rudder
(c) Grim wheel vane as fitted aft of the propeller
2024/JUN/Q1 **2025/APR1/Q1**
Click Here to See the Answer

Q2. A virtual rise in the centre of gravity of a ship may be caused by (16)
(a) Filling a partially filled tank
(b) Using an onboard crane to lift a freely swinging heavy object
(c) Emptying a partially filled tank
(d) Transferring pipe from the setback area to the pipe rack
Briefly justify your answer
2024/APR2/Q1 **2024/JUN/Q2** **2025/JAN1/Q1** **2025/APR1/Q2**
Click Here to See the Answer

Q3. (a) Sketch a water tight door and frame showing manner of attachment to bulkhead and the additional reinforcement carried by the bulkhead to compensate for the aperture (8)
(b) Explain how water tightness of the door and frame mating surface is ensured with an hydrostatic pressure tending to force the faces apart (4)
(c) Describe the means of remote closing operation of the door and state how many closing stations there are and their position (4)
2022/AUG/Q3 **2023/APR/Q2** **2024/JAN/Q2** **2024/JUN/Q3** **2025/APR1/Q3**
Click Here to See the Answer

Q4. (a) Sketch the arrangement of rudder stock bearings glands and method of suspension of a pintleless rudder labelling the component parts
(b) State how the bearing wear down is measured and what prevents the rudder from jumping (8)
2022/AUG/Q4 **2023/AUG/Q2** **2024/JUN/Q4** **2025/APR1/Q4**

Click Here to See the Answer

Q5. Describe the construction of chain lockers and how cables are secured in the lockers Explain how to secure anchors in preparation for a sea passage (16)
2023/AUG/Q3 **2024/JUN/Q5** **2025/APR1/Q5**
Click Here to See the Answer

Q6. (a) Explain in brief the term bulwark and freeing port (6)
(b) A ballast tank is 15 m long 12 m wide and 1.4 m deep and is filled with fresh water Calculate the load on the top and short side if (10)**
(i) The tank is just completely full
(ii) There is a head of 7 m of water above the tank top
2024/JUN/Q6 **2025/APR1/Q6**
Click Here to See the Answer

Q7. (a) What is freeboard of a ship Why oil tankers have less freeboard (6)
(b) A box barge 25 m long and 4 m wide floats in fresh water at a draught of 1.2 m and has an empty mid length compartment 5 m long The bottom of the barge is lined with teak (rd 0.805) 120 mm thick After grounding all the teak is torn off and the centre compartment laid open to the sea Calculate the final draught (10)
2024/JUN/Q7 **2025/APR1/Q7**
Click Here to See the Answer

Q8. The 1/2 ordinates of a waterplane 120 m long are as follows (16)
Section AP 1/2 | 1 | 1½ | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 8½ | 9 | 9½ | FP
1/2 ord 1.2 | 3.5 | 5.3 | 6.8 | 8.0 | 8.3 | 8.5 | 8.5 | 8.5 | 8.4 | 8.2 | 7.9 | 6.2 | 3.5 | 0 m
Calculate
(a) Waterplane area
(b) Distance of centroid from midships
2023/AUG/Q8 **2024/JUN/Q8** **2024/MAY2/Q8** **2024/AUG/Q8** **2025/MAR/Q8** **2025/APR1/Q8**
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Q9. A vessel about to complete loading in a summer zone is expected to enter a winter zone after steaming from the loading port for 10 days On passage fuel consumption is expected to be 30 tonnes per day and water consumption 15 tonnes per day The ship is at present floating in water of density 1.013 tonnes/m^3 at a draft of 9.0 m (16)
Summer load draft: 9.475 m FWA: 203 mm
TPC: 30 tonnes/cm Find
(a) The maximum permissible draft on completion of loading
(b) The amount of cargo which the vessel can load
(Note: A vessel passing from a summer zone to a winter zone or from a tropical zone to summer zone must arrive at the zone boundary at the draft appropriate to that zone)
2024/JUN/Q9 **2025/APR1/Q9**
Click Here to See the Answer

APRIL – 2025(PART-2)

Q1. (a) What are the various static stresses that act on a vessel at rest in still water Explain with the aid of sketches (10)
(b) Give examples for dynamic stresses on a vessel (6)
2023/MAY1/Q1 **2023/JUL/Q1** **2023/OCT/Q1** **2024/MAR/Q1** **2024/SEP1/Q1** **2025/APR2/Q1**
Click Here to See the Answer

Q2. (a) What is bilging and what are the effects of bilging (8)
(b) How are bulkheads classified (3)
(c) What are the advantages of water tight bulkheads How is the water tight bulkhead tested (5)
2023/MAY1/Q3 **2023/JUN/Q2** **2024/MAR/Q2** **2024/SEP1/Q2** **2025/APR2/Q2**
Click Here to See the Answer

Q3. Explain the meaning and purpose of EACH of the following terms
(a) Flare (3)
(b) Bulwark (3)
(c) Coaming (3)
(d) Freeing port (3)
(e) Scupper (2)
(f) Rise of floor (2)
2024/MAR/Q3 **2024/SEP1/Q3** **2025/APR2/Q3**
Click Here to See the Answer

Q4. (a) Sketch a semi balanced rudder showing (10)
(i) A detail of the hinges or pintles about which rudder turns
(ii) Details of the rudder carrier bearing which supports the weight of the rudderstock and rudder
(b) State advantages of semi balanced rudder over an unbalanced rudder
(c) What acts as rudder stops What is their purpose and at what angle from mid position would you expect the rudder stops to be set (3)
2023/MAR/Q1 **2024/MAR/Q4** **2024/SEP1/Q4** **2025/APR2/Q4**

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Q5. (a) What is free surface effect (6)
(b) Explain the methods used to reduce the free surface effect in ship construction and while operating the ship (10)
2023/FEB/Q4 **2023/MAY1/Q4** **2023/JUN/Q4** **2023/SEP/Q5** **2024/JAN/Q5** **2024/SEP1/Q5** **2024/DEC1/Q5** **2025/APR2/Q5**
Click Here to See the Answer

Q6. (a) What is the purpose of conducting an inclining experiment on a new vessel (6)
(b) A mass of 6 t is moved transversely through a certain distance on a ship of 4300 t displacement when the deflection of an 11 m pendulum is found to be 120 mm The transverse metacentre is 7.25 m above the keel and KG 5.46 m Find the distance through which the mass of 6 t was moved (10)
2023/FEB/Q6 **2023/JUN/Q6** **2023/DEC/Q8** **2024/MAR/Q6** **2024/MAY1/Q7** **2024/SEP1/Q6** **2025/JAN2/Q7** **2025/APR2/Q6**
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Q7. (a) What are the various resistances acting against the motion of the ship (6)
(b) A vessel of 10000 t displacement burns 25 t of fuel per day when her speed is 12 knots Calculate the probable consumption of fuel over a voyage of 3000 nautical miles at a speed of 11 knots with a displacement of 11000 t (10)
2023/FEB/Q8 **2024/MAR/Q7** **2024/SEP1/Q7** **2025/APR2/Q7**
Click Here to See the Answer

Q8. (a) Explain why the draught of a ship decreases when it passes from fresh water to seawater and vice versa (6)
(b) A bulkhead 9 m deep is supported by vertical stiffeners 750 mm apart The bulkhead is flooded to the top edge with seawater on one side only Calculate (10)**
(a) Shearing force at top
(b) Shearing force at bottom

(c) Position of zero shear
2024/MAY1/Q6 **2024/SEP1/Q8** **2025/JAN2/Q6** **2025/APR2/Q8**
Click Here to See the Answer

Q9. (a) With aid of a simple sketch show the normal positions of centre of gravity of a stable ship relative to keel centre of buoyancy and metacentre (b) A ship has 300 t of cargo in the hold 24 m forward of the midships The displacement of the vessel is 6000 t and its centre of gravity is 1.2 m forward of midships Find the new position of the centre of gravity if this cargo is moved to an after hold 40 m from midships (10)
2023/APR/Q9 **2024/MAR/Q9** **2024/SEP1/Q9** **2025/APR2/Q9**
Click Here to See the Answer

JUNE – 2025

Q1. State with reasons the main purpose of the following (4×4)
(i) Bulbous bow
(ii) Collision bulkhead
(iii) Bilge keel
(iv) Sheer
2025/JUN/Q1
Click Here to See the Answer

Q2. A virtual rise in the centre of gravity of a ship may be caused by (16)
(a) Filling a partially filled tank
(b) Using an onboard crane to lift a freely swinging heavy object
(c) Emptying a partially filled tank
(d) Transferring pipe from the setback area to the pipe rack
Briefly justify your answer
2024/APR2/Q1 **2024/JUN/Q2** **2025/JAN1/Q1** **2025/APR1/Q2** **2025/JUN/Q2**
Click Here to See the Answer

Q3. (a) Sketch a water tight door and frame showing manner of attachment to bulkhead and the additional reinforcement carried by the bulkhead to compensate for the aperture (8)
(b) Explain how water tightness of the door and frame mating surface is ensured with an hydrostatic pressure tending to force the faces apart (4)
(c) Describe the means of remote closing operation of the door and state how many closing stations there are and their position (4)
2022/AUG/Q3 **2023/APR/Q2** **2024/JAN/Q2** **2024/JUN/Q3** **2025/APR1/Q3** **2025/JUN/Q3**
Click Here to See the Answer

Q4. (a) Sketch the arrangement of rudder stock bearings glands and method of suspension of a pintleless rudder labelling the component parts
(b) State how the bearing wear down is measured and what prevents the rudder from jumping (8)

2022/AUG/Q4 **2023/AUG/Q2** **2024/JUN/Q4** **2025/APR1/Q4** **2025/JUN/Q4**
Click Here to See the Answer

Q5. Describe the construction of chain lockers and how cables are secured in the lockers Explain how to secure anchors in preparation for a sea passage (16)
2023/AUG/Q3 **2024/JUN/Q5** **2025/APR1/Q5** **2025/JUN/Q5**
Click Here to See the Answer

Q6. (a) Explain in brief the term bulwark and freeing port (6)
(b) A ballast tank is 15 m long 12 m wide and 1.4 m deep and is filled with fresh water Calculate the load on the top and short side if (10)**
(i) The tank is just completely full
(ii) There is a head of 7 m of water above the tank top
2024/JUN/Q6 **2025/APR1/Q6** **2025/JUN/Q6**
Click Here to See the Answer

Q7. (a) What is freeboard of a ship Why oil tankers have less freeboard (6)
(b) A ship's length at the waterline is 180 meters with a maximum beam of 30 meters and a draft of 9 meters If the ship's volume of displacement is 38880 cubic meters calculate its block coefficient (10)
2025/JUN/Q7
Click Here to See the Answer

Q8. The half ordinates of a ship's waterplane which is 80 m long commencing from forward at equal intervals are as follows 0.2 4.0 5.0 5.2 5.0 4.0 and 0.2 m respectively Calculate the area of the waterplane using Simpson's First Rule (16)
2025/JUN/Q8
Click Here to See the Answer

Q9. (a) Explain why the draught of a ship decreases when it passes from fresh water to seawater and vice versa (6)
(b) A lock gate which is 15 m wide has salt water on one side to a depth of 8

m and fresh water on the other side to a depth of 9 m Find the resultant thrust on the lock gate and state on which side of the gate it acts (10)
2023/MAY/Q9 **2024/JAN/Q7** **2024/MAR/Q8** **2024/DEC/Q7** **2025/JUN/Q9**
Click Here to See the Answer

JULY – 2025

Q1. With regards to the metacentric height which of the following statements is true (16)
(a) It is used to indicate the quality of initial stability
(b) It is located below the center of buoyancy
(c) It is measured vertically above the center of buoyancy
(d) Its determination is the objective of the inclining experiment
Briefly justify your answer
2023/APR/Q4 **2024/MAY2/Q3** **2024/AUG/Q3** **2025/MAR/Q3** **2025/JUL/Q1**
Click Here to See the Answer

Q2. Explain the meaning and purpose of EACH of the following terms (a) Bulbous bow (4)
(b) Hawse pipe (4)
(c) Spurling pipe (4)
(d) Cable stopper (4)
2024/APR2/Q2 **2025/JAN1/Q2** **2025/JUL/Q2**
Click Here to See the Answer

Q3. Define the main purpose of the following tank and pumping system in detail
(a) Weighted cocks on tank sounding pipes (4)
(b) Remote operated gear for bilge valves (4)
(c) Ventilation pipes for double bottom tanks (4)
(d) Explain why gauze is sometimes fitted to tank ventilation pipes and explain the effect of mesh size (4)
2022/SEP/Q4 **2023/MAR/Q4** **2023/MAY2/Q3** **2024/FEB/Q2** **2024/APR2/Q3** **2024/SEP2/Q1** **2024/NOV/Q2** **2025/JAN1/Q3** **2025/JUL/Q3**
Click Here to See the Answer

Q4. Sketch a plain bulkhead showing connections to deck sides and double bottom and the arrangement of stiffeners (16)
2024/APR2/Q4 **2025/JAN1/Q4** **2025/JUL/Q4**
Click Here to See the Answer

Q5. Write short notes on each of the following with respect to their contribution to the strength of ships (a) Strake (4)
(b) Bracket (4)
(c) Stringer (4)
(d) Girder (4)
2024/APR2/Q5 **2025/JAN1/Q5** **2025/JUL/Q5**
Click Here to See the Answer

Q6. (a) Describe the provisions of additional structural strength to withstand pounding (6)
(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 (10)
2022/AUG/Q8 **2024/APR2/Q6** **2025/JAN1/Q6** **2025/JUL/Q6**
Click Here to See the Answer

Q7. (a) Show by means of diagrams how the center of gravity of the liquid in a partly filled tank moves during rolling (6)
(b) A box barge is 15 m long 6 m wide and floats in water of 1.016 t/m^3 at a draught of 3 m 150 tonne of cargo is now added Calculate the load exerted by the water on the sides ends and bottom (10)
2024/APR2/Q7 **2025/JAN1/Q7** **2025/JUL/Q7**
Click Here to See the Answer

Q8. (a) Explain what is meant by assigned summer freeboard (6)
(b) A box shaped vessel 60 m long 10 m beam and 6 m deep is floating in salt water at drafts 4 m forward and 4.4 m aft Find how far forward of

amidships a weight of 30 tonnes must be loaded if the draft aft is to remain at 4.4 m (10)
2024/APR2/Q8 **2025/JAN1/Q8** **2025/JUL/Q8**
Click Here to See the Answer

Q9. (a) Explain why the TPC for a given draught will vary with the density of the water in which the ship floats (6)
(b) A box shaped ship with 12 m beam is floating upright at a draft of 6.7 m Find the increase in draft if the vessel is now listed 18 degrees (10)
2024/APR2/Q9 **2025/JAN1/Q9** **2025/JUL/Q9**
Click Here to See the Answer

AUGUST – 2025

Q1. For a ship the center of buoyancy and the metacenter are in the line of action of the buoyant force (16)
(a) Only when there is positive stability
(b) Only when there is negative stability
(c) Only when there is neutral stability
(d) At all times
Justify your answer
2024/APR1/Q1 **2024/DEC2/Q1** **2025/AUG/Q1**
Click Here to See the Answer

Q2. Explain the meaning and purpose of EACH of the following terms (4×4)
(a) Duct keel
(b) Margin line
(c) Sheer
(d) Round of bilge
2024/APR1/Q2 **2024/DEC2/Q2** **2025/AUG/Q2**
Click Here to See the Answer

Q3. With reference to hull protection against corrosion describe how EACH of the following operate (16)
(a) Sacrificial anodes (8)
(b) Impressed current system (8)
2023/OCT/Q4 **2024/APR1/Q3** **2024/DEC2/Q3** **2025/AUG/Q3**
Click Here to See the Answer

Q4. With reference to bilge keels
(a) Describe how the design and method of attachment reduce the possibility of damage to the shell plate (8)
(b) State what testing must be carried out (4)
(c) Explain why the bilge keels do not extend the full length of the vessel (4)
2024/DEC2/Q4 **2025/AUG/Q4**
Click Here to See the Answer

Q5. With reference to large bulk carriers (a) Sketch a cross section of a bulk carrier through the midship (8)
(b) Explain the design features that have evolved to minimise the possibility of failure (8)
2024/DEC2/Q5 **2025/AUG/Q5**
Click Here to See the Answer

Q6. (a) Define angle of loll (6)
(b) A box barge 60 m long and 10 m wide floats at an even keel draught of 4 m It has a compartment amidships 12 m long Calculate the new draught if this compartment is laid open to the sea when (10)**
(i) μ is 100%
(ii) μ is 85%
(iii) μ is 60%
2024/APR1/Q6 **2024/DEC2/Q6** **2025/AUG/Q6**
Click Here to See the Answer

Q7. (a) What do you understand by coffin plate (6)
(b) A ship displacing 10000 tonne and travelling at 16 knots has a fuel consumption of 41 tonne per day Calculate the consumption per day if the displacement is increased to 13750 tonne and the speed is increased to 17 knots Within this speed range fuel consumption per day varies as $(\text{speed})^3\sqrt{\Delta}$ (10)
2024/APR1/Q7 **2024/DEC2/Q7** **2025/AUG/Q7**
Click Here to See the Answer

Q8. (a) Compare fixed pitch with controllable pitch propellers (6)
(b) A ship of 12400 tonne displacement is 120 m long 17.5 m beam and floats at a draught of 7.5 m The propeller has a pitch ratio of 0.75 and when turning at 100 rev/min produces a ship speed of 12 knots with a real slip of 30% Calculate the apparent slip pitch and diameter of the propeller The wake fraction w may be found from the expression $w = 0.5Cb - 0.05$ (10)
2024/APR1/Q8 **2024/DEC2/Q8** **2025/AUG/Q8**
Click Here to See the Answer

Q9. (a) What are the water pressure loads on the ship's hull (6)
(b) The water plane area of a ship at 8.4 m draught is 1670 m^2 The area of successive water planes at 1.40 m intervals below this are 1600 1540 1420 1270 1080 and 690 m^2 respectively Calculate the displacement in fresh water at 8.4 m draught and the draught at which the ship would lie in sea water with the same displacement (10)

2025/AUG/Q9

Click Here to See the Answer

SEPTEMBER – 2025

Q1. (a) What is the purpose of providing air pipes to tanks in the vessel (6)
(b) Sketch an arrangement of air vent head situated on the weather deck
(c) What factors are considered in deciding the bore size of air pipe (5)
2023/NOV/Q1 **2024/JUL/Q1** **2025/FEB/Q1** **2025/SEP/Q1**
Click Here to See the Answer

Q2. (a) What is a right handed and a left handed propeller (5)
(b) With the aid of simple sketches explain rake skew and pitch of the propeller (6)
(c) What are the advantages and disadvantages of CPP (5)
2023/FEB/Q7 **2023/MAY2/Q1** **2023/JUL/Q5** **2023/NOV/Q2** **2024/FEB/Q1** **2024/JUL/Q2** **2024/NOV/Q1** **2025/FEB/Q2** **2025/SEP/Q2**
Click Here to See the Answer

Q3. (a) What are various types of tankers for carrying bulk liquids (6)
(b) Sketch a mid-ship section of a double hulled crude oil tanker (10)
2023/NOV/Q3 **2024/JUL/Q3** **2025/FEB/Q3** **2025/SEP/Q3**
Click Here to See the Answer

Q4. Briefly explain the following ship terms used (a) LOA (2)
(b) LBP (2)
(c) Breadth extreme (2)
(d) Breadth moulded (2)
(e) Depth extreme (2)
(f) Depth moulded (2)
(g) Draught extreme (2)
(h) Draught moulded (2)
2023/MAY2/Q4 **2023/NOV/Q4** **2024/FEB/Q3** **2024/JUL/Q4** **2024/NOV/Q3** **2025/FEB/Q4** **2025/SEP/Q4**
Click Here to See the Answer

Q5. What do you understand by free surface effect and how does it affect the ship stability (16)
2024/JUL/Q5 **2025/FEB/Q5** **2025/SEP/Q5**
Click Here to See the Answer

Q6. (a) What is the metric length of one shackle of an anchor chain (4)
(b) A vessel of 10000 t displacement burns 25 t of fuel per day when her speed is 12 knots Calculate the probable consumption of fuel over a voyage of 3000 nautical miles at a speed of 11 knots with a displacement of 11000 t (12)
2024/JUL/Q6 **2025/FEB/Q6** **2025/SEP/Q6**
Click Here to See the Answer

Q. (a) What are the different types of stern used in ship construction (6)
(b) A ship consumes 360 t of fuel stores and water when moving from sea water of 1.025 t/m^3 into fresh water of 1.000 t/m^3 and on arrival it is found that the draught has remained constant Calculate the displacement in sea water (10)
2024/JUL/Q7 **2025/FEB/Q7** **2025/SEP/Q7**
Click Here to See the Answer

Q8. (a) What is a mast riser and what is the purpose of it (6)
(b) A ship 96 m long is floating at 5 m fwd draft and 6.4 m aft draft MCTC 180 tm TPC 16 COF is 2 m abaft of midships Find the location where a weight of 50 t should be placed so as to keep the aft draft constant (10)
2024/JUL/Q8 **2025/FEB/Q8** **2025/SEP/Q8**
Click Here to See the Answer

Q9. A ship 120 meters long at the waterline has equidistantly spaced half ordinates commencing from forward as follows 0 3.7 5.9 7.6 7.5 4.6 and 0.1 meters respectively Find the area of the waterplane using Simpson's Second rule and the TPC at this draft Water density is 1.025 t/m^3 (16)
2023/NOV/Q9 **2024/JUL/Q9** **2025/FEB/Q9** **2025/SEP/Q9**
Click Here to See the Answer

OCTOBER – 2025

Q1. (a) What are the advantages of corrugated bulkheads (6)
(b) Sketch and describe a corrugated transverse watertight bulkhead (10)
2023/JUN/Q3 **2023/SEP/Q4** **2024/JAN/Q4** **2024/MAY1/Q1** **2024/DEC1/Q4** **2025/JAN2/Q1** **2025/OCT/Q1**
Click Here to See the Answer

Q2. (a) Describe in detail how brittle fracture is instrumental in causing failure of materials (6)
(b) Describe how a material is tested to assess the resistance to this type of failure (4)
(c) Suggest where this type of failure would be likely and explain how the likelihood of failure is reduced (6)
2024/MAY1/Q2 **2025/JAN2/Q2** **2025/OCT/Q2**
Click Here to See the Answer

Q3. With reference to hull protection against corrosion and fouling write a brief explanation of each of the following (a) Sacrificial anodes (6)
(b) Impressed current system (6)
(c) Means of preventing marine growth and fouling (4)
2024/MAY1/Q3 **2025/JAN2/Q3** **2025/OCT/Q3**
Click Here to See the Answer

Q4. Define the following stating how they affect the ship structure and what component parts of the ship structure help to resist the effect (a) Racking
(b) Panting (4)
(c) Pounding (4)
(d) Vibration from engine and propellers (4)
2024/MAY1/Q4 **2025/JAN2/Q4** **2025/OCT/Q4**
Click Here to See the Answer

Q5. (a) What is the fundamental purpose of a load line marking on ships (5)
(b) Sketch and describe the features of a load line marking (6)
(c) Name five conditions that must be met before freeboard is assigned to a

ship (5)
2023/DEC/Q4 **2024/MAY1/Q5** **2024/OCT/Q4** **2025/JAN2/Q5** **2025/OCT/Q5**
Click Here to See the Answer

Q6. (a) Explain why the draught of a ship decreases when it passes from fresh water to seawater and vice versa (6)
(b) A bulkhead 9 m deep is supported by vertical stiffeners 750 mm apart The bulkhead is flooded to the top edge with sea water on one side only Calculate (10)**
(a) Shearing force at top
(b) Shearing force at bottom
(c) Position of zero shear
2024/MAY1/Q6 **2024/SEP1/Q8** **2025/OCT/Q6**
Click Here to See the Answer

Q7. (a) What is the purpose of conducting an inclining experiment on a new vessel (6)
(b) A mass of 6 t is moved transversely through a certain distance on a ship of 4300 t displacement when the deflection of an 11 m pendulum is found to be 120 mm The transverse metacentre is 7.25 m above the keel and KG 5.46 m Find the distance through which the mass of 6 t was moved (10)
2023/FEB/Q6 **2023/JUN/Q6** **2023/DEC/Q8** **2024/MAR/Q6** **2024/MAY1/Q7** **2024/SEP1/Q6** **2025/JAN2/Q7** **2025/APR2/Q6** **2025/OCT/Q7**
Click Here to See the Answer

Q8. A hopper barge of box form 50 m long and 10 m wide floats at a draught of 2 m in seawater when the hopper which is 15 m long and 5 m wide is loaded with mud having relative density twice that of the seawater to the level of the waterline Doors in the bottom of the hopper are now opened allowing the mud to be discharged Calculate the new draught (16)
2023/AUG/Q9 **2023/DEC/Q9** **2024/MAY1/Q8** **2024/OCT/Q9** **2025/JAN2/Q8** **2025/OCT/Q8**

Click Here to See the Answer

Q9. (a) Sketch and describe the midship section of a bulk carrier labelling the structural members (8)
(b) A vessel 40 m long has a constant cross section in the form of a trapezoid 10 m wide at the top 6 m wide at the bottom and 5 m deep It floats in sea water at a draught of 4 m Calculate its displacement (8)
2023/DEC/Q6 **2024/MAY1/Q9** **2024/OCT/Q6** **2025/JAN2/Q9** **2025/OCT/Q9**
Click Here to See the Answer

NOVEMBER- 2025

Q1. (a) Describe the following and explain their function (8)
(i) Hawse pipe
(ii) Spurling pipe
(iii) Cable stopper
(iv) Bitter end
(b) With the aid of a sketch of a ship bow show the arrangement of anchor cable from anchor to chain locker (8)
2024/JAN/Q1 **2024/DEC1/Q1** **2025/NOV/Q1**
Click Here to See the Answer

Q2. In the absence of external forces adding weight to one side of a floating vessel will cause the vessel to (16)
(a) Heel until the angle of loll is reached
(b) List until the centre of buoyancy is aligned vertically with the centre of gravity
(c) Trim to the side opposite TCG until all moments are equal
(d) Decrease draft at the centre of flotation
Briefly justify your answer
2024/DEC1/Q2 **2025/NOV/Q2**
Click Here to See the Answer

Q3. (a) Draw a labelled sketch of midship section of a double hull oil tanker
(b) What are Aframax Suezmax ULCC and VLCC tankers (8)
2023/JUN/Q1 **2024/JAN/Q3** **2024/DEC1/Q3** **2025/NOV/Q3**
Click Here to See the Answer

Q4. (a) What are the advantages of corrugated bulkheads (6)
(b) Sketch and describe a corrugated transverse watertight bulkhead (10)
2023/JUN/Q3 **2023/SEP/Q4** **2024/JAN/Q4** **2024/MAY1/Q1**
2024/DEC1/Q4 **2025/JAN2/Q1** **2025/OCT/Q1** **2025/NOV/Q4**
Click Here to See the Answer

Q5. (a) What is free surface effect (6)
(b) Explain the methods used to reduce the free surface effect in ship construction and while operating the ship (10)
2023/FEB/Q4 **2023/MAY1/Q4** **2023/JUN/Q4** **2023/SEP/Q5** **2024/JAN/Q5** **2024/SEP1/Q5** **2024/DEC1/Q5** **2025/APR2/Q5** **2025/NOV/Q5**
Click Here to See the Answer

Q6. (a) What is the significance of GM-GZ curve (6)
(b) The pitch of a propeller is measured by means of a batten and cord The horizontal ordinate is found to be 40 cm while the vertical ordinate 1.15 m at a distance of 2.6 m from the centre of the boss Calculate the pitch of the propeller and the blade width at that point (10)
2022/SEP/Q7 **2022/AUG/Q7** **2023/MAR/Q7** **2023/MAY1/Q7** **2024/JAN/Q6** **2024/DEC1/Q6** **2025/NOV/Q6**
Click Here to See the Answer

Q7. (a) Explain why the draught of a ship decreases when it passes from fresh water to seawater and vice versa (6)
(b) A lock gate which is 15 m wide has salt water on one side to a depth of 8 m and fresh water on the other side to a depth of 9 m Find the resultant thrust on the lock gate and state on which side of the gate it acts (10)
2023/MAY/Q9 **2024/JAN/Q7** **2024/MAR/Q8** **2024/DEC/Q7** **2025/JUN/Q9** **2025/NOV/Q7**
Click Here to See the Answer

Q8. (a) Describe the function of the stern frame (6)
(b) The water plane area of a ship at 8.4 m draught is 1670 m^2 The area of successive water planes at 1.40 m intervals below this are 1600 1540 1420 1270 1080 and 690 m^2 respectively Calculate the displacement in fresh water at 8.4 m draught and the draught at which the ship would lie in sea water with the same displacement (10)
2023/APR/Q6 **2024/JAN/Q8** **2024/DEC1/Q8** **2025/NOV/Q8**
Click Here to See the Answer

Q9. (a) Explain why an unstable ship is dangerous (6)
(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 (10)

2022/SEP/Q8 **2023/MAR/Q8** **2023/MAY1/Q8** **2024/JAN/Q9** **2024/DEC1/Q9** **2025/NOV/Q9**

Click Here to See the Answer

DECEMBER – 2025

Q1. (a) Explain what is meant by longitudinal framing and transverse framing (8)
(b) Which types of ships would have these methods of construction Give reasons (8)
2024/MAY2/Q1 **2024/AUG/Q1** **2025/MAR/Q1** **2025/DEC/Q1**
Click Here to See the Answer

Q2. What are the main functions of (a) Fore peak (4)
(b) After peak (4)
(c) Deep tank (4)
(d) Double bottom (4)
Give examples of liquid carried in these tanks
2024/MAY2/Q2 **2024/AUG/Q2** **2025/MAR/Q2** **2025/DEC/Q2**
Click Here to See the Answer

Q3. With regards to the metacentric height which of the following statements is true (16)
(a) It is used to indicate the quality of initial stability
(b) It is located below the center of buoyancy
(c) It is measured vertically above the center of buoyancy
(d) Its determination is the objective of the inclining experiment
Briefly justify your answer
2023/APR/Q4 **2024/MAY2/Q3** **2024/AUG/Q3** **2025/MAR/Q3** **2025/JUL/Q1** **2025/DEC/Q3**
Click Here to See the Answer

Q4. (a) Sketch a semi balanced rudder of your choice showing (10)
(i) A detail of the hinges or pintels about which rudder turns
(ii) Details of the rudder carrier bearing which supports the weight of the rudderstock and rudder
(b) State advantages of semi balanced rudder over an unbalanced rudder
2024/MAY2/Q4 **2024/AUG/Q4** **2025/MAR/Q4** **2025/DEC/Q4**
Click Here to See the Answer

Q5. Define centre of buoyancy and show with the aid of sketches how a vessel which is stable will return to the upright after being heeled by an external force (16)
2023/MAY2/Q5 **2024/FEB/Q4** **2024/SEP2/Q2** **2024/NOV/Q4** **2025/DEC/Q5**
Click Here to See the Answer

Q6. (a) Define Centre of Flotation What happens to the draught and trim of a ship if a small mass is added to the ship at the Centre of Flotation (6)
(b) A ship of displacement 10010 tonnes has KM 6.7 m and GM 0.76 m A mass of 10 tonnes having KG 7.6 m is shifted transversely The deflection of a pendulum of length 7.6 m is 0.125 m Find the distance through which the mass is shifted Also find the position of the new centre of gravity above the keel due to the removal of the same mass (10)
2024/MAY2/Q6 **2024/AUG/Q6** **2025/MAR/Q6** **2025/DEC/Q6**
Click Here to See the Answer

Q7. (a) What is meant by statical stability What are the factors that influence stability (6)
(b) A box barge 25 m long and 4 m wide floats in fresh water at a draught of 1.2 m and has an empty mid length compartment 5 m long The bottom of the barge is lined with teak (rd 0.805) 120 mm thick After grounding all the teak is torn off and the centre compartment laid open to the sea Calculate the final draught (10)
2024/MAY2/Q7 **2024/AUG/Q7** **2025/MAR/Q7** **2025/DEC/Q7**
Click Here to See the Answer

Q8. The 1/2 ordinates of a waterplane 120 m long are as follows (16)
Section AP 1/2 | 1 | 1½ | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 8½ | 9 | 9½ | FP
1/2 ord 1.2 | 3.5 | 5.3 | 6.8 | 8.0 | 8.3 | 8.5 | 8.5 | 8.5 | 8.4 | 8.2 | 7.9 | 6.2 | 3.5 | 0 m Calculate
(a) Waterplane area
(b) Distance of centroid from midships

2023/AUG/Q8 **2024/JUN/Q8** **2024/MAY2/Q8** **2024/AUG/Q8** **2025/MAR/Q8** **2025/APR1/Q8** **2025/DEC/Q8**

Click Here to See the Answer

Q9. A ballast tank is 15 m long 12 m wide and 1.4 m deep and is filled with fresh water Calculate the load on the top and short side if (16)
(a) The tank is just completely full
(b) There is a head of 7 m of water above the tank top

2023/AUG/Q6 **2024/MAY2/Q9** **2024/AUG/Q9** **2025/MAR/Q9** **2025/DEC/Q9**

Click Here to See the Answer