D. MARINE
Study Material

MEO CLASS 2 WRITTEN: NA

(NAVAL ARCHITECTURE)

FOR INDIAN COMPETENCY EXAM

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JAN-2024

SECTION – I

Q1. A. Sketch the cross-section of a bulk carrier with either deep or shallow double bottom showing
the type of framing used; (6)
B. Describe the corrosion problems experienced with ballast tanks; (5)
C. state how such tanks are protected against extensive corrosion. (5)
2021/JUL/Q2 **2022/OCT/Q1** **2023/JAN/Q1** **2024/JAN/Q1**
Click Here to See the Answer

Q2. 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; (3)
C. Evaluate the effectiveness of bilge keels for large wall sided vessels; (4)
D. Explain TWO principles of roll damping those bilge keels exploit. (4)
2022/OCT/Q2 **2023/FEB/Q4** **2023/APR/Q5** **2023/JUN/Q1**
2024/JAN/Q2
Click Here to See the Answer

Q3. (a) What is significance of the area under the curve of statical stability or the GZ curve? Explain using a neat diagram, how this curve is used to assess the stability of the ship against a heeling arm. (16)
2024/JAN/Q3
Click Here to See the Answer

Q4. Explain the purposes of the collision bulkhead. Describe with the aid of sketches the construction of a collision bulkhead paying particular attention to the strength and attachment to the adjacent structure. (8)
b) Define “Pounding”. Describe with the aid of sketches the arrangement provided to resist pounding. (8)
2022/OCT/Q4 **2024/JAN/Q4**
Click Here to See the Answer

Q5. With respect to Induced Vibrations in a ship’s hull:

A. State FOUR sources of excitation that may induce vibration into the main hull girder: (8)
B. Suggest methods for reducing the vibration levels induced by EACH of the exciting forces in A. (8)
2022/OCT/Q5 **2023/NOV/Q2** **2024/JAN/Q5**
Click Here to See the Answer

SECTION – II

Q6. A. With reference to dynamical stability, describe the effect of an increase in wind pressure when a vessel is at its maximum angle of roll to windward.
B. An oil tanker 160 m long and 22 m beam floats at a draught of 9 m in seawater. Cw is 0.865. The midships section is in the form of a rectangle with 1.2 m radius at the bilges. A midships tank 10.5 m long has twin longitudinal bulkheads and contains oil of 1.4 m3/t to a depth of 11.5 m. The tank is holed to the sea for the whole of its transverse section. Find the new draught.
2022/OCT/Q6 **2024/JAN/Q6**
Click Here to See the Answer

Q7. A. What factors influence the frictional resistance of a ship and what formula is used to calculate the resistance? (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 overcome frictional resistance; calculate the shaft power required for a similar ship 140 m long at the corresponding speed. □ = 0.42 and n = 1.825. (10)
2022/OCT/Q7 **2024/JAN/Q7**
Click Here to See the Answer

Q8. A. Explain the purpose of non-watertight longitudinal subdivision of tanks. (6)
B. A ship 160 m long and 8700 tonne displacement floats at a waterline with
Station AP ½ 1 2 3 4 5 6 7 7 ½ FP
½ ordinate 0 2.4 5.0 7.3 7.9 8.0 8.0 7.7 5.5 2.8 0m
While floating at this waterline, the ship develops a list of 10° due to instability. Calculate the negative metacentric height when the vessel is upright in this condition. (10)

2022/OCT/Q8 **2024/JAN/Q8**
Click Here to See the Answer

Q9. A. Explain the term volumetric heeling moments. (6)
B. A ship 85 m long displaces 8100 tonne when floating in seawater at draughts of 5.25 m forward
and 5.55 m aft. TPC 9.0, GML 96 m, LCF 2 m aft of midships. It is decided to introduce water ballast to completely submerge the propeller and a draught aft of 5.85 m is required. A ballast tank 33 m aft of midships is available. Find the least amount of water required and the final draught forward. (10)
2022/OCT/Q9 **2024/JAN/Q9**
Click Here to See the Answer

Q10: A. What is meant by the Admiralty Coefficient and the Fuel Coefficient? (6)
B. A rectangular watertight bulkhead 9 m high and 14.5 m wide bas sea water on both sides, the height of water on one side being four times that on the other side. The resultant centre of pressure is 7 m from the top of the bulkhead. Calculate: (10)
i) The depths of water
ii) the resultant load on the bulkhead
2022/OCT/Q10 **2024/JAN/Q10**
Click Here to See the Answer

FEB-2024

SECTION – I

Q1. Discuss the importance of the following to be examined for meeting EEDI limitations:
A. Slimmer vessels with lower block coefficients (5)
B. Long-Stroke engines (5)
C. Low revolution large diameter propellers (6)
2023/JAN/Q4 **2024/FEB/Q1**
Click Here to See the Answer

Q2. A. Draw a simple line diagram of the bow of a ship to show the position of the following component parts of the ships anchoring system. Hawse pipe, Cable stopper, Windlass and Cable lifter, Spurling pipe and Chain locker; (6)
B. Describe the cable stopper and state its purpose. (3)
C. Show by means of a sketch how the anchor cable is attached to the ship; (3)
D. Describe how the chain locker is drained of water, sand and mud. (4)
2013/DEC/Q3 **2024/FEB/Q2**
Click Here to See the Answer

Q3. (a) State the reasons for the freeboard requirement, (5)
(b) Explain the term condition of assignment and explain how these are maintained for a ship. (6)
(c) Using a diagram indicate the freeboard of type A, type B, type B60 and type B100 vessels giving an example of each type. (5)
2023/JAN/Q3 **2023/DEC/Q1** **2024/FEB/Q3**
Click Here to See the Answer

Q4. A. Describe the double bottom and framing arrangement used in the machinery space to cope up with the concentrated loads and vibration, together with shaft and thrust block support. (10)
B. Give reasons for the choice of thrust block position. (6)
2021/JUL/Q1 **2021/AUG/Q1** **2022/APR/Q2** **2022/SEP/Q4**
2023/FEB/Q5 **2023/DEC/Q2** **2024/FEB/Q4**
Click Here to See the Answer

Q5. With reference to a periodically unattended machinery space of a dry cargo vessel discusses the requirements for: (16)
A. Protection against flooding;
B. Control of propulsion machinery from the navigating bridge.
2021/JUL/Q4 **2021/AUG/Q4** **2021/SEP/Q4** **2021/DEC/Q2**
2023/DEC/Q4 **2024/FEB/Q5**
Click Here to See the Answer

SECTION – II

Q6. (A) Explain the concept of dynamical stability. (6)

b) A vessel of 8000 tonne displacement has 75 tonnes of cargo on the deck. It is lifted by a derrick whose head is 10.5m above the centre of gravity of the cargo and placed in the lower hold 9m below the deck and 14m forward of its original position. Calculate the shift in the vessel's centre of gravity from its original position when the cargo is: (10)
(i) just clear of the deck
(ii) at the derrick head
(iii) in its final position.

2024/FEB/Q6

Click Here to See the Answer

Q7. a) Describe how water tightness is maintained where bulkheads are pierced by longitudinal beams or pipes. (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. (10)
Calculate:
(i) Indicated power,
(ii) Effective power,
(iii) Ship speed.

2024/FEB/Q7

Click Here to See the Answer

Q8. a) What is Prismatic Co-efficient (CP). Derive the formula CP = □□ □□, where □□ = Co-efficient of fineness and □□ = midship section area co-efficient. (6)
b) A watertight door is 1.2m high and 0.75m wide, with a 0.6m sill. The bulkhead is flooded with seawater to a deapth of 3m on one side and 1.5m on the other side. Draw the load diagram and from it determine the resultant load and position of the centre of pressure on the door. (10)

2024/FEB/Q8

Click Here to See the Answer

Q9. a) Describe briefly the inclining experiment and explain how the results are used. (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)

2024/FEB/Q9

Click Here to See the Answer

Q10. 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, GML 120 m and LCF 3 m forward of midships. It is required to bring the vessel to an even keel draught of 8.5m. Calculate the mass which should be added and the distance of the distance of the centre of the mass from midships. (16)

2024/FEB/Q10

Click Here to See the Answer

MARCH-2024

SECTION – I

Q1. With reference to Underwater Inspection in lieu of Dry docking (UWILD)
A. Explain in detail, how an underwater survey is carried out; (7)
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. (4)

2021/JAN/Q5 **2021/APR/Q5** **2021/JUL/Q1** **2021/JUL/Q3** **2021/SEP/Q3** **2021/OCT/Q5** **2021/DEC/Q4** **2022/SEP/Q3** **2023/APR/Q3** **2023/AUG/Q4** **2024/MAR/Q1**

Click Here to See the Answer

Q2. If a ship is seriously damaged under water in way of a large fuel oil side bunker tank what is the immediate effect and what may ultimately happen? What features in the ship would enhance safety?

2022/AUG/Q4 **2023/MAR/Q5** **2024/MAR/Q2**

Click Here to See the Answer

Q3. 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)
2021/JAN/Q2 **2021/MAR/Q1** **2021/APR/Q1** **2024/MAR/Q3**
Click Here to See the Answer

Q4. Discuss the importance of the following to be examined for meeting EEDI limitations: (16)
A. Slimmer vessels with lower block coefficients
B. Long-Stroke engines
C. Low revolution large diameter propellers
2023/JAN/Q4 **2024/FEB/Q1** **2024/MAR/Q4**
Click Here to See the Answer

Q5. a) Sketch the cross-section of a bulk carrier with either deep or shallow double bottom showing the type of framing used; (8)
b) i) Describe the corrosion problems experienced with ballast tanks;
ii) state how such tanks are protected against extensive corrosion. (8)
2021/JUL/Q2 **2022/OCT/Q1** **2023/JAN/Q1** **2024/JAN/Q1**
2024/MAR/Q5
Click Here to See the Answer

SECTION – II

Q6. 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 propeller has a pitch ratio of 0.95. When turning at 120 rev/min the real slip is 30%, the wake fraction 0.28 and the ship speed 16 knots. The thrust is found to be 400 KN, the torque 270 KN-m and the QPC 0.67. Calculate: (10)
i. The propeller diameter.
ii. The shaft power.
iii the propeller efficiency.
iv. The thrust deduction factor.
2024/MAR/Q6
Click Here to See the Answer

Q7. A. What factors influence the frictional resistance of a ship and what formula is used to calculate the resistance? (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: Fa=577 Av2 sin N, Allow 20% for the race effect. (10)
2024/MAR/Q7
Click Here to See the Answer

Q8. A. Why is it important in a tender ship to keep the double bottom tanks pressed up? (6)
B. A ship of 6000 tonne displacement has a wetted surface area of 2500 m2 and a speed of 15 knots.
(i) Calculate the corresponding speed and wetted surface area of as similar ship of 2000 tonne displacement.
(ii) If the ship resistance is of the form R=0.45 S V1.83 N; find the resistance of the 6000 tonne Ship. (10)
2021/AUG/Q8 **2024/MAR/Q8**
Click Here to See the Answer

Q9. A. Explain the effects on stability when a tank is partially filled with liquid. (6)
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 tonne, 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. (10)
2024/MAR/Q9
Click Here to See the Answer

Q10. The breadth of the upper edge of a deep tank bulkhead is 12 metres. The vertical heights of the bulkhead at equidistant intervals across it are 0.3, 5, 6,

5, 3 and 0 metres respectively. Find the depth of the centre of pressure below the waterline when the tank is filled to a head of 2 metres above the top of the tank.

2021/JAN/Q8 **2021/AUG/Q10** **2024/MAR/Q10**

Click Here to See the Answer

APRIL-2024
SECTION – I

Q1. A. With reference to the underwater surface of a ship's hull
i. Describe a hull plate roughness analyser system.
ii. State the significance of the roughness profile and compare the typical roughness values for a new ship and a ship eight years old.
B. Which reference to the application of self-polishing paint in dry dock – i. Describe the plate preparation necessary.
ii. State the defects that may occur in the paint coating if it is not correctly applied.

2021/NOV/Q3 **2023/JUNE/Q2** **2024/APR/Q1**

Click Here to See the Answer

Q2. 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: (6)
B. State with reasons the alloy, which is used for the membrane; (4)
C. Describe with the aid of a sketch, how the tanks are located and supported. (6)
i) Longitudinally
ii) Transversely

2022/DEC/Q1 **2023/FEB/Q1** **2023/APR/Q4** **2023/OCT/Q1** **2024/APR/Q2**

Click Here to See the Answer

Q3. Describe a forced ventilation system for the machinery spaces and a natural ventilation system for a lower hold. Why hold ventilation is considered necessary?

2021/APR/Q4 **2024/APR/Q3**
Click Here to See the Answer

Q4. With respect to trim and stability, describe the following –
A. Effects on centre of gravity of slack tanks;
B. Effect on stability of ice formation on superstructure;
C. Effects of wind and waves on ship's stability;
D. Effect of water absorption by deck cargo and retention of water on deck.
2023/JAN/Q2 **2024/APR/Q4**
Click Here to See the Answer

Q5. With reference to the prevention of hull corrosion discuss:
A. Surface preparation and painting of new ship plates.
B. Design of the ships structure and its maintenance.
C. Cathodic protection by sacrificial anodes, of the internal and external areas of the ship.
2022/JUL/Q4 **2022/AUG/Q5** **2023/FEB/Q2** **2024/APR/Q5**
Click Here to See the Answer

SECTION – II

Q6. A) Describe how the distribution of mass within the ship affects the rolling period; (6)
b) The righting moments of a ship at angles of heel of 0, 15°, 30°, 45°, and 60° are 0, 1690, 5430, 9360 and 9140 k/Nm respectively. Calculate the dynamical stability at 60°. (10)
2023/JULY/Q6 **2024/APR/Q6**
Click Here to See the Answer
Q7. A) Describe briefly the significance of the factor of sub-division; (6)
b) A ship 120m long has a light displacement of 4000 tonne and LCG in this condition 2.5m aft of midships. (10)
The following items are then added:
Cargo 10000 tonne LCG 3.0 m forward of midships
Fuel 1500 tonne LCG 2.0 m aft of midships
Water 400 tonne LCG 8.0 m aft of midships

Stores 100 tonne LCG 10.0m forward of midships
Using the following hydrostatic data, calculate the final draughts:

Draught	Displacement (t)	MCTI cm	LCB from midships (m)	LCF from midships (m)
8.50	16650	183	1.94 F	1.20A
8.00	15350	175	2.10 F	0.60F

2023/JULY/Q7 **2024/APR/Q7**
Click Here to See the Answer

Q8. A. Explain the effect of trim on tank soundings.
B.A ship of 6600 tonne displacement has KG 3.6m and KM 4.3m. A mass of 50 tonne is now lifted from the quay by one of the ship's derricks whose head is 80m above the keel. The ship heels to a maximum of 9.5° while the mass is being transferred. Calculate the outreach of the derrick from the ship's centreline.
2024/APR/Q8
Click Here to See the Answer

Q9. A. Explain the effect on GM during the filling of a double – bottom tank
B. A ship of 8,000 tonnes displacement has KM 7.5m, and KG 7.0m. A double bottom tank is 12 meters long 15 meters wide and 1 meter deep. The tank is divided longitudinally at the centre line and both sides are full or small water. Calculate the list if one side is pumped on until it is half empty.
2024/APR/Q9
Click Here to See the Answer

Q10. A ship of 9.900 tonnes displacement has KM 7.3m, and KG 6.4m. She has yet to load two 50 tonne lifts her own gear and the first lift is to be placed on deck on the inshore side (KG = 9m and
center of gravity = 6m, out from center line). When the derrick plumbs the quay, its head is 15m above the keel and 12m out rom center line. Calculate the maximum list during the operation.
2021/APR/Q9 **2024/APR/Q10**
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JUNE-2024

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**
Click Here to See the Answer

Q2. a) What is the purpose of watertight doors fitted on bulkheads? (4)
b) Name the locations of watertight door in a vessel. (4)
c) Sketch and describe a vertically mounted watertight door. (8)
2024/JUN/Q2
Click Here to See the Answer

Q3. With reference to ship's rudder state:-
a) Why a breached hollow rudder 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**

Q4. 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)
2021/JAN/Q1 **2021/MAR/Q4** **2021/AUG/Q3** **2022/FEB/Q2**
2022/APR/Q4 2022/JUNE/Q1 **2023/JUL/Q3** **2024/JUN/Q4**
Click Here to See the Answer

Q5. 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)
2021/JAN/Q2 **2021/MAR/Q1** **2021/APR/Q1** **2024/MAR/Q3**

2024/JUNE/Q5
Click Here to See the Answer

SECTION – II

Q6. 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**
Click Here to See the Answer

Q7. 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
Click Here to See the Answer

Q8. 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**
Click Here to See the Answer

Q9. A. List the precautions necessary before an inclining experiment is carried out.

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.

2024/JUN/Q9

Click Here to See the Answer

Q10. 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 5.5m and the speed of advance is 11 Knots. Find:
i. Real Slip
ii. Wake fraction
iii. Propeller thrust, when its efficiency, $\eta = 70\%$ (10)

Click Here to See the Answer

JULY-2024

SECTION – I

Q1. 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)

2021/JAN/Q2 **2021/MAR/Q1** **2021/APR/Q1** **2024/MAR/Q3** **2024/JUNE/Q5** **2024/JUL/Q1**

Click Here to See the Answer

Q2. With reference to dry docking, define the responsibilities of the Second Engineer: (16)
A. Prior to docking.
B. Whilst the vessel is in dry dock.
C. Prior to flooding and leaving the dock.

2024/JUL/Q2

Click Here to See the Answer

Q3. With respect to Induced Vibrations in a ship's hull:
A. State FOUR sources of excitation that may induce vibration into the main hull girder. (8)
B. Suggest methods for reducing the vibration levels induced by EACH of the exciting forces in A. (8)
2022/OCT/Q5 | 2023/NOV/Q2 | 2024/JAN/Q5 | 2024/JUL/Q3
Click Here to See the Answer

Q4. 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
Click Here to See the Answer

Q5. With reference to Roll-on Roll-off ferries.
A. Describe the problem of free surface effect.
B. Explain how it is intended that water should be cleared from car or cargo decks.
C. Describe possible methods for improving the stability and survivability of these vessels.
2022/JUL/Q2 | 2022/SEP/Q5 | 2024/JUL/Q5
Click Here to See the Answer

SECTION – II

Q6.A. 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)

2024/JUL/Q6
Click Here to See the Answer

Q7. 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 120m long has a light displacement of 4000 tonne and LCG in this condition 2.5m aft of midships. (10)
The following items are then added:
Cargo 10000 tonne LCG 3.0 m forward of midships
Fuel 1500 tonne LCG 2.0 m aft of midships
Water 400 tonne LCG 8.0 m aft of midships
Stores 100 tonne LCG 10.0m forward of midships
Using the following hydrostatic data, calculate the final draughts:

Draught	Displacement (t)	MCTI cm	LCB from midships (m)	LCF from midships (m)
8.50	16650	183	1.94 F	1.20A
8.00	15350	175	2.10 F	0.60F

2024/JUL/Q7
Click Here to See the Answer

Q8. A) Explain how the distribution of masses affects rolling and pitching. (6)
B) A ship turns in a circle of radius 100 metres at a speed of 15 knots. The GM is 2/3 metres and BG is 1 metre. If g = 981 cm/sec2 and 1 knot is equal to 1.8532 Km/hour, find the heel due to turning. (10)
2023/JULY/Q8 **2024/JUL/Q8**
Click Here to See the Answer

Q9. A) Describe the effect of cavitations on the propeller blades. (6)
B) A propeller 4.6m diameter has a pitch of 4.3m and boss diameter of 0.75. The real slip is 28% at 95 rev/min. Calculate the speed of advance, thrust and thrust power. (10)
2021/APR/Q7 **2021/NOV/Q7** **2023/JULY/Q9** **2024/JUL/Q9**
Click Here to See the Answer

Q10. A) Describe the stability requirements of a ship for dry-docking. (6)
B) A ship 130m long displaces 14000 tonne when floating at draughts of 7.5m forward and 8.10m aft. GML – 125m, TPC – 18, LCF-3m aft of midships. Calculate the final draughts when a mass of 180 tonne
lying 40m aft of midships is removed from the ship. (10)
2023/JULY/Q10 **2024/JUL/10**
Click Here to See the Answer

AUG-2024
SECTION – I

Q1. (a) List out the merits and demerits of longitudinal framing system. Explain which demerits of longitudinal framing system are mitigated by use of mixed framing system without affecting the merits? (8)
(b) List and explain with a sketch the type of loads and failure mechanism that would be of concerns for the longitudinal strength of the hull girder of a bulk carrier. (8)
2021/NOV/Q5 **2021/DEC/Q1** **2024/AUG/Q1**
Click Here to See the Answer

Q2. a) Explain the concept of metacentric height (GM) and its significance in ship stability. (4)
b) Differentiate between initial stability and overall stability. How are they assessed during ship design? (4)
c) Discuss the effect of free surface in tanks on the stability of a ship. How can this effect be minimized? (4)
d) Explain the criteria for determining a ship's intact stability according to the International Maritime Organization (IMO) regulations. (4)
2024/AUG/Q2
Click Here to See the Answer

Q3. With the help of sketches explain the different types of strakes used in ship construction. What material is generally used for Hull plating and What are the tests carried out on Hull steel plating for certification as per class rules. (16)

2021/FEB/Q3 **2022/JUN/Q4** **2024/AUG/Q3**
Click Here to See the Answer

Q4. Discuss the different components of a ship's total resistance as it moves through water. Explain how each component contributes to the overall resistance, and describe the methods used to reduce these resistances in modern ship design. (16)
2024/AUG/Q4
Click Here to See the Answer

Q5. Describe with the aid of diagrammatic sketches the following systems used for transporting liquefied gas in bulk:
a) Free-standing prismatic tanks
b) Membrane tanks.
c) Free-standing spherical tanks. (16)
2022/SEP/Q1 **2024/AUG/Q5**
Click Here to See the Answer

SECTION – II

Q6. a) 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 (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. (10)
Calculate:
(i) Indicated power
(ii) Effective power
(iii) Ship speed.
2024/AUG/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)
2021/JAN/Q6 **2021/JUL/Q8** **2021/SEP/Q8** **2021/DEC/Q7** **2022/FEB/Q7** **2022/JUN/Q7** **2024/AUG/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 centre 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**
Click Here to See the Answer

Q9. a) Explain the term Angle of loll and state the dangers it poses to a vessel. What action to be taken to correct angle of loll. (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)
2024/AUG/Q9
Click Here to See the Answer

Q10. a) Explain the concept of dynamical stability. (6)
b) 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. The diameter of the Propeller is 4.8m. The results of the speed trial show that true slip may be regarded as constant over a range of 9 to 13 knots and is 30%, w = 0.5CB-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. (10)
2024/AUG/Q10
Click Here to See the Answer

SEP-2024
SECTION – I

Q1. 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: (6)
B. State with reasons the alloy, which is used for the membrane. (4)
C. Describe with the aid of a sketch, how the tanks are located and supported. (6)
i) Longitudinally
ii) Transversely

2022/DEC/Q1 **2023/FEB/Q12023/APR/Q4** **2023/OCT/Q1** **2024/APR/Q2** **2024/SEP/Q1**
Click Here to See the Answer

Q2. 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.
2022/JAN/Q4 **2022/MAR/Q3** **2022/DEC/Q2** **2023/APR/Q1** **2023/JULY/Q2** **2023/OCT/Q2** **2024/SEP/Q2**
Click Here to See the Answer

Q3. 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)
2021/FEB/Q2 **2021/APR/Q3** **2021/OCT/Q3** **2022/SEP/Q2** **2022/DEC/Q3** **2023/MAR/Q2** **2023/OCT/Q3** **2024/SEP/Q3**

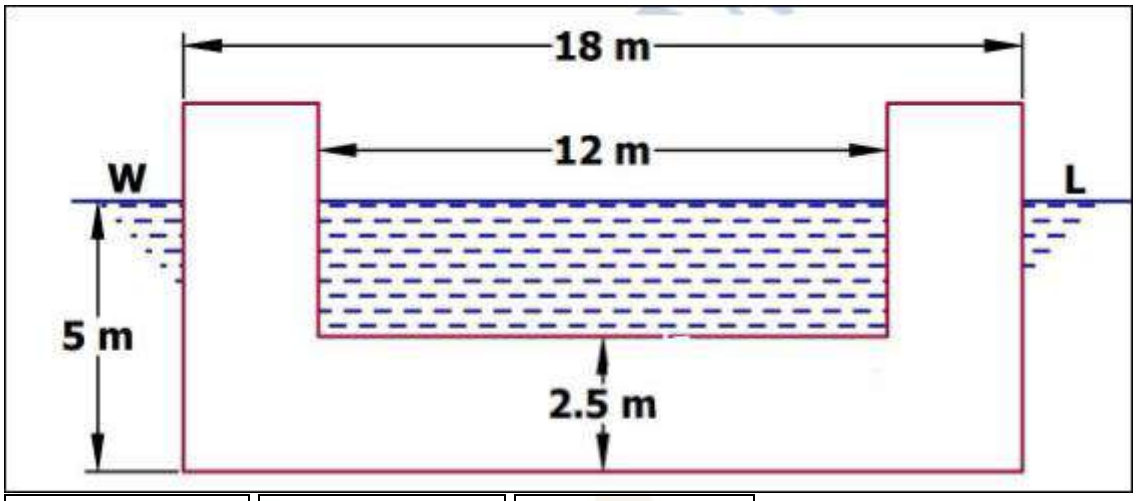
Q4. Explain how the period of roll varies with –
A. The amplitude of roll. (4)
B. The radius of gyration. (4)
C. The initial metacentric height. (4)
D. The location of masses in the ship. (4)
2021/MAR/Q5 2021/APR/Q5 2021/SEP/Q5 2022/DEC/Q4
Q5. (a) Describe the relationship between frictional resistance and
(i) Ship's speed. (4)

(ii) the wetted area. (4)
(iii) surface roughness. (4)
(iv) The length of the vessel. (4)
2021/FEB/Q4 **2022/JAN/Q2** **2022/JUL/Q1** **2022/DEC/Q5**
2023/MAR/Q4 **2023/OCT/Q5** **2024/SEP/Q5**
Click Here to See the Answer

SECTION – II

Q6. A. Describe 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, GML 120 m and LCF 3 m forward of midships. It is required to bring the vessel to an even keel draught of 8.5m. Calculate the mass which should be added and the distance of the centre of the mass from midships. (10)
2022/DEC/Q6 **2023/OCT/Q6** **2024/SEP/Q6**
Click Here to See the Answer

Q7. A. Explain how increase of draught and of displacement influence rolling. (6)
B. A pontoon has a constant cross-section as shown in Fig. Given below the metacentre height is 2.5m.
Find the height of the centre of gravity above the keel. (10)



2022/DEC/Q7 2023/OCT/Q7 2024/SEP/Q7

Click Here to See the Answer

Q8. 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

2022/DEC/08 2023/OCT/Q8 2024/SEP/Q8

Click Here to See the Answer

Q9. A. Explain what is meant by: i. Wave-making resistance. ii. Frictional resistance. iii. Eddy-making resistance. (6)
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 V3) where V is the speed in knots, estimate: (10)
(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.
2022/DEC/Q9 **2023/OCT/Q9** **2024/SEP/Q9**
Click Here to See the Answer

Q10. 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 ½ 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. (10)
2022/DEC/Q10 **2023/OCT/Q10** **2024/SEP/Q10**

OCT-2024
SECTION – I

Q1. 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. (5)
c) Explain TWO principles of roll damping that bilge keels exploit. (5)
2023/JULY/Q1 **2024/JUN/Q1** **2024/OCT/Q1**
Click Here to See the Answer

Q2. With reference to membrane tanks for the carriage of liquefied gas at very low temperatures.
a) Describe with a sketch one method of building up the insulation. (6)
b) State which alloy is used for the membrane and the reason. (5)
c) Explain why a secondary barrier is installed. (5)
2024/OCT/Q2
Click Here to See the Answer

Q3. 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)

2024/OCT/Q3
Click Here to See the Answer

Q4. a) Sketch the cross-section of a bulk carrier with either deep or shallow double bottom showing the type of framing used. (8)
b) i) Describe the corrosion problems experienced with ballast tanks. (4)
ii) State how such tanks are protected against extensive corrosion. (4)
2021/JUL/Q2 **2022/OCT/Q1** **2023/JAN/Q1** **2024/JAN/Q1** **2024/MAR/Q5** **2024/OCT/Q4**
Click Here to See the Answer

Q5. With regard to ship construction details for transverse watertight bulkheads: -
A. State the purpose of this type of bulkhead. (3)
B. State how the bulkheads are tested for water tightness. (3)
C. If it is necessary to penetrate the bulkhead, precaution must be taken to ensure that the watertight integrity and the strength of the bulkhead is maintained. With this in mind, describe, using simple sketches, how the following pass-through bulkheads. (10)
i. Main transmission shaft
ii. Electrical cables
iii. Fuel oil transfer pipes
iv. Air and sounding pipes.
2021/SEP/Q1 **2022/JAN/Q3** **2024/OCT/Q5**

SECTION – II

Q6.a) Explain the purpose of non-watertight longitudinal subdivision of tanks. (6)
b) A ship 90m long displaces 5200 tonne and floats at draughts of 4.95m forward and 5.35 m aft when in sea water of 1023 kg/m3. The waterplane area is 1100m2, GML 95m, LCB 0.6m forward of midships and LCF 2.2m aft of midships. Calculate the new draughts when the vessel moves into fresh water of 1002 kg/m3. (10)
2024/OCT/Q6
Click Here to See the Answer

Q7. (a) Describe how thrust power is determined. (6)
(b) The following information relates to a model propeller of 400mm pitch:
Rev/Min 400 450 500 550 600
Thrust N 175 260 365 480 610
Torque Nm 16.8 22.4 28.2 34.3 40.5
(i) Plot curves of thrust and torque against rev/min
(ii) When the speed of advance of the model is 150 m / min and slip 0.20, calculate the efficiency. (10)
2024/OCT/Q7
Click Here to See the Answer

Q8. A. Explain why the amplitude of ship motion should be limited. (6)
B. A ship of 8100 tonne displacement floats upright in seawater. KG = 7.5m and GM = 0.45m A tank, whose centre of gravity is 0.5m above the keel and 4m from the centreline, contains 100 tonne of water ballast neglecting free face effect, calculate the angle of heel when the ballast is pumped out. (10)
2024/OCT/Q8
Click Here to See the Answer

Q9. a) Explain the effect of bilging a centreline compartment located away from amidships. (6)
B. A ship of 5000 tonne displacement has a double bottom tank 12m long. The ½ 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. (10)
2024/OCT/Q9
Click Here to See the Answer

Q10. 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/m3 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 1.000t/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**

Click Here to See the Answer

NOV-2024
SECTION – I

Q1. 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: (6)
B. State with reasons the alloy, which is used for the membrane. (4)
C. Describe with the aid of a sketch, how the tanks are located and supported. (6)
i) Longitudinally
ii) Transversely
2022/DEC/Q1 **2023/FEB/Q1** **2023/APR/Q4** **2023/OCT/Q1** **2024/APR/Q2** **2024/SEP/Q1** **2024/NOV/Q1**
Click Here to See the Answer

Q2. 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.
2022/JAN/Q4 **2022/MAR/Q3** **2022/DEC/Q2** **2023/APR/Q1** **2023/JULY/Q2** **2023/OCT/Q2** **2024/SEP/Q2** **2024/NOV/Q2**
Click Here to See the Answer

Q3. 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)
2021/FEB/Q2 **2021/APR/Q3** **2021/OCT/Q3** **2022/SEP/Q2** **2022/DEC/Q3** **2023/MAR/Q2** **2023/OCT/Q3** **2024/SEP/Q3** **2024/NOV/Q3**
Click Here to See the Answer

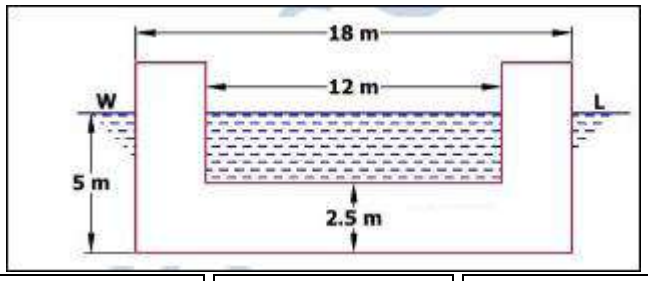
Q4. Explain how the period of roll varies with –
A. The amplitude of roll. (4)
B. The radius of gyration. (4)
C. The initial metacentric height. (4)
D. The location of masses in the ship. (4)
2021/MAR/Q5 **2021/APR/Q5** **2021/SEP/Q5** **2022/DEC/Q4**
2023/MAR/Q3 **2023/OCT/Q4** **2024/SEP/Q4** **2024/NOV/Q4**
Click Here to See the Answer

Q5. (a) Describe the relationship between frictional resistance and
(i) Ship's speed. (4)
(ii) the wetted area. (4)
(iii) surface roughness. (4)
(iv) The length of the vessel. (4)
2021/FEB/Q4 **2022/JAN/Q2** **2022/JUL/Q1** **2022/DEC/Q5**
2023/MAR/Q4 **2023/OCT/Q5** **2024/SEP/Q5** **2024/NOV/Q5**

SECTION – II

Q6. A. Describe 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, GML 120 m and LCF 3 m forward of midships. It is required to bring the vessel to an even keel draught of 8.5m. Calculate the mass which should be added and the distance of the centre of the mass from midships. (10)
2022/DEC/Q6 **2023/OCT/Q6** **2024/SEP/Q6** **2024/NOV/Q6**
Click Here to See the Answer

Q7. A. Explain how increase of draught and of displacement influence rolling. (6)
B. A pontoon has a constant cross-section as shown in Fig. Given below the metacentre height is 2.5m. Find the height of the centre of gravity above the keel. (10)



2022/DEC/Q7 **2023/OCT/Q7** **2024/SEP/Q7** **2024/NOV/Q7**
Click Here to See the Answer

Q8. 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
2022/DEC/08 **2023/OCT/Q8** **2024/SEP/Q8** **2024/NOV/Q8**
Click Here to See the Answer

Q9. A. Explain what is meant by: i. Wave-making resistance. ii. Frictional resistance. iii. Eddy-making resistance. (6)
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 V3) where V is the speed in knots, estimate: (10)
(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.
2022/DEC/Q9 **2023/OCT/Q9** **2024/SEP/Q9** **2024/NOV/Q9**
Click Here to See the Answer

Q10. 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 ½ 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. (10)
2022/DEC/Q10 **2023/OCT/Q10** **2024/SEP/Q10** **2024/NOV/Q10**
Click Here to See the Answer

DEC-2024
SECTION – I

Q1. A) State the reasons for the freeboard requirement. (6)
b) Explain the term condition of assignment and explain how these are maintained for a ship. (5)
c) What is the difference between a Type "A" and a Type "B" ship. (5)
2024/DEC/Q1
Click Here to See the Answer

Q2. a) Sketch the cross-section of a bulk carrier with either deep or shallow double bottom showing the type of framing used. (8)
b) i) Describe the corrosion problems experienced with ballast tanks.
ii) State how such tanks are protected against extensive corrosion. (8)
2021/JUL/Q2 **2022/OCT/Q1** **2023/JAN/Q1** **2024/JAN/Q1**
2024/MAR/Q5 **2024/OCT/Q4** **2024/DEC/Q2**
Click Here to See the Answer

Q3. a) With the aid of a sketch describe the method of attachment for a bilge keel and hence explain what protection is made to reduce the possibility of the shell being punctured in the event of damage to the keel. (6)
b) State why the keel does not extend for the length of the ship. (5)
c) Evaluate the effectiveness of bilge keels for large wall sided vessels. (5)
2013/MAR/Q3 **2013/AUG/Q1** **2024/DEC/Q3**
Click Here to See the Answer

Q4. a) Draw a simple line diagram of the bow of a ship to show the position of the following component parts of the ships anchoring system. Hawse pipe, Cable stopper, Windlass and Cable lifter, Spurling pipe and Chain locker. (4)
b) Describe the cable stopper and state its purpose. (4)
c) Show by means of a sketch how the anchor cable is attached to the ship. (4)
d) Describe how the chain locker is drained of water, sand and mud. (4)
2024/FEB/Q2 **2024/DEC/Q4**
Click Here to See the Answer

Q5. With reference to membrane tanks for the carriage of liquefied gas at very low temperatures.
a) Describe with a sketch one method of building up the insulation. (6)
b) State which alloy is used for the membrane and the reason. (5)
c) Explain why a secondary barrier is installed. (5)
2024/OCT/Q2 **2024/DEC/Q5**
Click Here to See the Answer

SECTION – II

Q6. a) Describe how the distribution of mass within the ship affects the rolling period. (6)
b) The righting moments of a ship at angles of heel of 0, 15°, 30°, 45°, and 60° are 0, 1690, 5430, 9360 and 9140 kN-m respectively. Calculate the dynamical stability at 60°. (10)
2023/JULY/Q6 **2024/APR/Q6** **2024/DEC/Q6**
Click Here to See the Answer

Q7. a) Describe briefly the significance of the factor of subdivision. (6)
b) A ship 120m long has a light displacement of 4000 tonne and LCG in this condition 2.5m aft of midships. (10)
The following items are then added:
Cargo 10000 tonne LCG 3.0 m forward of midships
Fuel 1500 tonne LCG 2.0 m aft of midships
Water 400 tonne LCG 8.0 m aft of midships
Stores 100 tonne LCG 10.0m forward of midships
Using the following hydrostatic data, calculate the final draughts:

Draught(m)	Displacement (t)	MCT 1 cm (t m)	LCB from midships (m)	LCF from midships (m)
8.50	16650	183	1.94 F	1.20A
8.00	15350	175	2.10 F	0.60F

2023/JULY/Q7 **2024/APR/Q7** **2024/DEC/Q7**
Click Here to See the Answer

Q8. A) Explain how the distribution of masses affects rolling and pitching. (6)
B) A ship turns in a circle of radius 100 metres at a speed of 15 knots. The GM is 2/3 metres and BG is 1 metre. If g = 981 cm/sec2 and 1 knot is equal to 1.8532 Km/hour, find the heel due to turning. (10)
2023/JULY/Q8 **2024/JUL/Q8** **2024/DEC/Q8**
Click Here to See the Answer

Q9. A) Describe the effect of cavitations on the propeller blades. (6)
B) A propeller 4.6m diameter has a pitch of 4.3m and boss diameter of 0.75 m. The real slip is 28% at 95 rev/min. Calculate the speed of advance, thrust and thrust power. (10)
2021/APR/Q7 **2021/NOV/Q7** **2023/JULY/Q9** **2024/JUL/Q9** **2024/DEC/Q9**
Click Here to See the Answer

Q10. A) Describe the stability requirements of a ship for dry-docking. (6)
B) A ship 130m long displaces 14000 tonne when floating at draughts of 7.5m forward and 8.10m aft. GML – 125m, TPC – 18, LCF-3m aft of midships. Calculate the final draughts when a mass of 180 tonne lying 40m aft of midships is removed from the ship. (10)
2023/JULY/Q10 **2024/JUL/10** **2024/DEC/Q10**
Click Here to See the Answer