D. MARINE
Study Material

MEO CLASS 2 WRITTEN: NA

(NAVAL ARCHITECTURE)

FOR INDIAN COMPETENCY EXAM

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D. MARINE
Study Material

JAN-2023
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;
B. Describe the corrosion problems experienced with ballast tanks;
C. state how such tanks are protected against extensive corrosion.
2021/JUL/Q2 **2022/OCT/Q1** **2023/JAN/Q1**
Click Here to See the Answer

Q2. 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
Click Here to See the Answer

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

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

Q5. Regarding the carriage of crude oil and its associated products:

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.
c) Define the terms lower and upper flammable limits Illustrating your answer by means rough sketch of a hydrocarbon vapor oxygen graph.
2023/JAN/Q5
Click Here to See the Answer

SECTION – II

Q6. A. Describe the effect of cavitation's on the propeller blades.
b) A ship has a constant cross-section in the form of a triangle which floats apex down in sea water. The ship is 85 m tong, 12 m wide at the deck and has a depth from keel to deck of 9 m. Draw the displacement curve using 1.25 m Intervals of draught from the keel to the 7 .5m waterline. From this curve obtain the Displacement in fresh water at a draught of 6.50 m. (10)
2023/JAN/Q6
Click Here to See the Answer

Q7. A. Explain how wave profile affects the shear force and bending moment curves.
b) The wetted surface area of a container ship is 5946 m2 , when travelling at its service speed, the effective power required is 11250 KW with frictional resistance 74% of the total resistance and specific fuel consumption of 0.22 Kg/kW h. To conserve fuel, the ship speed is reduced by 10%, the daily fuel consumption is then found to be 83.0 tonne, Frictional coefficient in sea water is 1.432. Speed in m/s with index (n) 1.825. Propulsive coefficient may be. assumed constant at 0.6. Determine the service speed of the ship the percentage increase in specific: fuel consumption when running at reduced speed. (10)
2023/JAN/Q7
Click Here to See the Answer

Q8. A. Explain the purpose of non-watertight longitudinal subdivision of tanks.
b) A box -barge 30 m long and 9 m beam floats at a draught of 3 m. The centre of gravity lies on the centreline and KG is 3.50 m. A mass of 10 tonne, which is already on board, is now moved 6m across the ship.
i) Estimate the angle to which the vessel will heel, using the formula $GZ=\sin\theta(GM+1/2BM\tan 2\theta)$
ii) Compare the above result with the angle of heel obtained by the metacentric formula. (10)

2023/JAN/Q8

Click Here to See the Answer

Q9. 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) A ship of 5000 tonne displacement has three rectangular double bottom tanks A: 12m long and 16m wide; Tank B: 14m long and 15m wide; C 14m long and 16m wide. calculate the free surface effect for any one tank and state in which order the tanks should be filled when making use of them for stability correction.

2023/JAN/Q9

Click Here to See the Answer

Q10. (a) List the variables which affect the force on Rudder (6)
B) A ship of 150000 tonne displacement has 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:
(i) Indicated Power;
(ii) Effective power.

2023/JAN/Q10

Click Here to See the Answer

FEB-2023

SECTION – I

Q1. 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;
B. State which alloy is used for the membrane and the reason;
C. Explain why a secondary barrier is installed.
i) Longitudinally;
ii) Transversely
2022/DEC/Q1 **2023/FEB/Q1**
Click Here to See the Answer

Q2. 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**
Click Here to See the Answer

Q3. With reference to fatigue of engineering components explain the influence of stress level and cyclical frequency on expected operating life;
A. Explain the influence of material defects on the safe operating life of an engineering component;
B. 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.
2022/FEB/Q5 **2023/FEB/Q3**
Click Here to See the Answer

Q4. A. Describe a method of the attachment of bilge keels;
B. State THREE reasons for not extending bilge keels the entire length of the vessel;

C. Evaluate the effectiveness of bilge keels for large wall sided vessels;
D. Explain TWO principles of roll damping those bilge keels exploit.
2022/OCT/Q2 **2023/FEB/Q4**
Click Here to See the Answer

Q5. 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.
B. Give reasons for the choice of thrust block position.
2021/JUL/Q1 **2021/AUG/Q1** **2022/APR/Q2** **2022/SEP/Q4** **2023/FEB/Q5**
Click Here to See the Answer

SECTION – II

Q6. A. Describe how water tightness is maintained where bulkheads are pierced by longitudinal beams or pipes.
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.
2020/OCT/Q10 **2020/DEC/Q8** **2021/JULY/Q7** **2022/JULY/Q6** **2023/FEB/Q6**
Click Here to See the Answer

Q7. A. Explain the effect on GM during the filing of a double – bottom tank
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 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.
Click Here to See the Answer

Q8: A. What is meant by the Admiralty Coefficient and the Fuel Coefficient?

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.
2021/APR/Q10 **2021/JUL/Q6** **2021/SEP/Q6** **2021/OCT/Q9** **2021/DEC0** **2022/JUL/Q8** **2023/FEB/Q8**
Click Here to See the Answer

Q9. A. Describe how the distribution of mass within the ship affects the rolling period;
B) The ½ 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.
Click Here to See the Answer

Q10: 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.
2021/JUL/Q9 **2022/APR/Q8** **2022/JUL/Q10** **2023/FEB/Q10**
Click Here to See the Answer

MARCH-2023
SECTION – I

Q1. 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;

(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.
(c) State the Second Engineer's responsibilities for the engine room gantry crane.
2023/MAR/Q1
Click Here to See the Answer

Q2. A. Explain what is meant by permissible length of compartments in passenger ships;
B. Describe how the position of bulkheads is determined.
C. Describe briefly the significance of the factor of subdivision.
2021/FEB/Q2 **2021/APR/Q3** **2021/OCT/Q3** **2022/SEP/Q2** **2022/DEC/Q3** **2023/MAR/Q2**
Click Here to See the Answer

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

Q4. (a) Describe the relationship between frictional resistance and
(i) Ship's speed;
(ii) the wetted area;
(iii) surface roughness;
(iv) The length of the vessel.
2021/FEB/Q4 **2022/JAN/Q2** **2022/JUL/Q1** **2022/DEC/Q5** **2023/MAR/Q4**
Click Here to See the Answer

Q5. 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**
Click Here to See the Answer

SECTION – II

Q6. A. Describe how water tightness is maintained where bulkheads are pierced by longitudinal beams or pipes.
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:
i. The propeller diameter;
ii. The shaft power;
iii the propeller efficiency;
iv. The thrust deduction factor.
2023/MAR/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.
b) A ship of 12000 tonne displacement has a rudder 15 m2 in area, whose centre is 5 m below the waterline. The metacentric height of the ship is 0.3 m and the centre of buoyancy is 3.3 m below the waterline. When travelling at 20 knots the rudder is turned through 30 degree. Find the initial angle of heel if the force Fr perpendicular to the plane of the rudder is given by: Fr=577Av2 Sin □ N Allow 20% for the race effect. (10)
2023/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?
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.

2023/MAR/Q8

Click Here to See the Answer

Q9. 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 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.

2021/SEP/Q7 **2023/MAR/Q9**

Click Here to See the Answer

Q10. (A) Explain the concept of dynamical stability.

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 distance of the centre of the mass from midships.

2023/MAR/Q10

Click Here to See the Answer

APR-2023
SECTION – I

Q1: With reference to dry docking, define the responsibility of the second engineer;

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**

Click Here to See the Answer

Q2. With reference to rudder carrier beings fitted to Merchant Ships:
A. Sketch a bearing designed to transfer the full weight of the rudder to ships structure.
B. Describe the consequence If the rudder carrier bearing surfaces become heavily scored.
C. Describe the consequence of and the action to be taken, if the carrier shatters.
2021/APR/Q3 **2023/APR/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;
B. State the requirements to be fulfilled before an underwater survey is acceptable to the survey authority.
C. Construct a list of the items in order of importance that the underwater survey authority should include.
2021/JAN/Q5 **2021/APR/Q5** **2021/JUL/Q1** **2021/JUL/Q3(M)**
2021/SEP/Q3 **2021/OCT/Q5** **2021/DEC/Q4** **2023/APR/Q3**
Click Here to See the Answer

Q4. 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; B. State which alloy is used for the membrane and the reason; C. Explain why a secondary barrier is installed.
i) Longitudinally;
ii) Transversely
2022/DEC/Q1 **2023/FEB/Q1** **2023/APR/Q4**
Click Here to See the Answer

Q5. A. Describe a method of the attachment of bilge keels;
B. State THREE reasons for not extending bilge keels the entire length of the vessel;

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

SECTION – II

Q6. A. Describe the stability requirements of a ship for dry-docking.
B. A ship of 8000 tonne displacement, 110m long, floats in sea water of 1.024t/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.
2023/APR/Q6
Click Here to See the Answer

Q7. 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:
(i) Indicated power,
(ii) Effective power,
(iii) Ship speed.
2021/FEB/Q6 **2021/APR/Q8** **2021/OCT/Q10** **2023/APR/Q7**
Click Here to See the Answer

Q8. With respect to Buoyancy of a vessel:
A. What do you understand by reserve buoyancy what happen if the lost buoyancy is greater than the reserve buoyancy?
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.
2023/APR/Q8
Click Here to See the Answer

Q9. A. Define longitudinal centre of gravity (LCG) and longitudinal centre of buoyancy (LCB).
B. The immersed cross-sectional area 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.
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**
Click Here to See the Answer

Q10. A. What is the effect on fuel consumption per unit time, if the ship's speed is outside its operation range?
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.
2023/APR/Q10

JUNE-2023
SECTION – I

Q1. A. Describe a method of the attachment of bilge keels;
B. State THREE reasons for not extending bilge keels the entire length of the vessel;
C. Evaluate the effectiveness of bilge keels for large wall sided vessels;
D. Explain TWO principles of roll damping those bilge keels exploit.
2022/OCT/Q2 **2023/FEB/Q4** **2023/APR/Q5** **2023/JUN/Q1**

Q2. 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**
Click Here to See the Answer

Q3: Foreign going vessels are required to possess a valid safety equipment certificate renewed at intervals after survey of the safety equipment.
A. Compile a list of items that are contained in the safety equipment survey. (8)
B. From the list compiled in (a) select TWO ship systems, explain now they would be examined and identify possible defects. (8)
2023/JUNE/Q3
Click Here to See the Answer

Q4. A. With reference to fatigue of engineering components explain the influence of stress level and cyclical frequency on expected operating life.
B. Explain the influence of material defects on the safe operating life of an engineering component.
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.
2021/JUL/Q5 **2022/FEB/Q5** **2023/FEB/Q3** **2023/JUNE/Q4**
Click Here to See the Answer

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

SECTION – II

Q6. A. Describe the stability requirements of a ship for dry-docking.
b) A ship of 12000 tonne displacement has a rudder 15 m2 in area, whose centre is 5 m below the waterline. The metacentric height of the ship is 0.3 m and the centre of buoyancy is 3.3 m below the waterline. When travelling at 20 knots the rudder is turned through 30 degree. Find the initial angle of heel if the force Fr perpendicular to the plane of the rudder is given by:
Fr=577Av2 Sin □ N
Allow 20% for the race effect. (10)
2023/JUNE/Q6
Click Here to See the Answer

Q7. (a) Describe how bulkheads are tested.
B. The following data are available for a twin-screw vessel:

V (Knots)	15	16	17	18
Epn (KW)	3000	3750	4700	5650

QPC	0.73	0.73	0.72	0.71

Calculate the service speed if the breaker power for each engine is 3500Kw. The transmission is 3% and the allowances for weather and appendages 30%.

2023/JUNE/Q7

Click Here to See the Answer

Q8. (a) Explain what is meant by left and right handed propellers, and also explain the rotation of propellers in a twin-screw ship.

b) A ship 120m long displaces 8000 tonne, GML is 102m, TPC 17.5 and LCF 2m aft of midships. It arrives in port with draughts of 6.3m forward and 6.6m aft. During the voyage the following changes in loading have taken place:

Fuel used 200 tonne 18m forward of midships

Water used 100 tonne 3m aft of midships

Stores used 10 tonne 9m aft of midships

Ballast added 300 tonne 24m forward of midships

Calculate the original draughts. (10)

2023/JUNE/Q8

Click Here to See the Answer

Q9. A. Explain the effect of bilging a centreline compartment located away from amidships.

b) A ship of 4000 tonne displacement has a mass of 50 tonne on board, on the centre line of the tank top. A derrick, whose head is 18 m above the CG of the mass, is used to lift it. Find the shift in the ship's centre of gravity from its original position when the mass is

(i) lifted Just clear of the tank top

(ii) raised to the derrick head

(iii) placed on the deck 12 m above the tank top. (10)

2023/JUNE/Q9

Click Here to See the Answer

Q10. 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) A box shaped vessel of length 100 metres and breadth 18 metres, floats in salt water on an even keel at 7.5 metres draft. KG = 4 metres. The ship has a continuous center line bulkhead which is watertight. Find the list if a compartment amidships, which is 15 metres long and is empty, is bilged on one side.
2023/JUNE/Q10
Click Here to See the Answer

JULY-2023
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; (6)
c) Explain TWO principles of roll damping those bilge keels exploit. (4)
2023/JULY/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.
2023/JULY/Q2
Click Here to See the Answer

Q3. With reference to statutory certification;
a) State the reasons for the freeboard requirements. (6)
b) (i)Explain the tern conditions of assignments; (5)
(ii)List the items that may be examined during a related survey. (5)
2023/JULY/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.
a) Intermediate shafting (4)
b) Propeller shafting (4)
c) Shafting coupling bolts (4)
d) Main thrust pads. (4)
2022/MAR/Q2 **2023/JULY/Q4**
Click Here to See the Answer

Q5. 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)
2021/JAN/Q3 **2022/FEB/Q3** **2023/JULY/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
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 fine draughts:

Draught	Displacement (t)	MCTI cm	LCB from midships	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
Click Here to See the Answer

Q8. a) Explain how the distribution of masses affects rolling and pitching; (6)
b) A ship turns is 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
Click Here to See the Answer

Q9. a) Describe the effect of cavitation's 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**
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
Click Here to See the Answer

AUG-2023
SECTION – I

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.
a) Intermediate shafting (4)
b) Propeller shafting (4)
c) Shafting coupling bolts (4)
d) Main thrust pads. (4)
2022/MAR/Q2 **2023/JULY/Q4** **2023/AUG/Q1**
Click Here to See the Answer

2. 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)
2021/JAN/Q3 **2022/FEB/Q3** **2023/JULY/Q5** **2023/AUG/Q2**

Click Here to See the Answer

Q3. A. Describe the preparation necessary before the application (in day dock) of sophisticated or approved long life coating to the underwater surface of the hull; (6)
B. State the significance of the roughness profile. (5)
C. List the different sophisticated costing which are available. (5)
2023/AUG/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)
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**
Click Here to See the Answer

Q5. Regarding 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**
Click Here to See the Answer

SECTION – II

Q6. 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

Click Here to See the Answer

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 20cms in a plumb line 4m long. If the KM=7 m, calculate the KG (10)

2023/AUG/Q7

Click Here to See the Answer

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 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)

2023/AUG/Q8

Click Here to See the Answer

Q9. a) Explain why the rudder angle does not normally exceeds 35°. (6)
b) A ship of 12000 tonne displacement has a rudder 15m2 in area, whose centre is 5 m 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)

2023/AUG/Q9

Click Here to See the Answer

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) 3000 3750 4700 5650
QPC 0.73 0.73 0.72 0.71
Calculate the service speed if the breaker power for each engine is 350Kw. The transmission is 3% and the allowances for weather and appendages 30%. (10)
2023/AUG/Q10
Click Here to See the Answer

SEP-2023
SECTION – I

Q1. 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**
Click Here to See the Answer

Q2. A rudder of a vessel requires extensive welding repairs and as a Chief Engineer you are requested to supervise –
A. Suggest a suitable type of welding process; (6)
B. State with reasons FOUR common welding defects that can occur there; (5)
C. State what tests may be carried out before returning the rudder to service.
2021/FEB/Q5 **2022/JUN/Q5** **2023/SEP/Q2**
Click Here to See the Answer

Q3. 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). (16)
2021/JUL/Q5 **2021/AUG/Q5** **2021/SEP/Q2**
Click Here to See the Answer

Q4: With regard to the carriage of crude oil and its associated products:

a) i. Sketch and describe the operation of an explosimeter suitable for testing pump rooms or tanks; (10)
ii. State why false readings are likely to be given by the explosimeter. (3)
b) State the publication that gives guidance on safety. (3)
2023/SEP/Q4
Click Here to See the Answer

Q5. Give a reasoned opinion as to the validity of the following assertions concerning ship structure:
A. Crack propagation in propeller shaft 'A' brackets or spectacles frames is indicative of inadequate scantlings and strength; (8)
B. The adequate provision of freeing ports is as critical to seaworthiness as watertight integrity. (8)
2022/JUN/Q3 **2023/SEP/Q5**
Click Here to See the Answer

SECTION – II

Q6. 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 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/SEP/Q6
Click Here to See the Answer

Q7. a) Describe the stability requirements of a ship for dry-docking. (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)

2023/SEP/Q7
Click Here to See the Answer

Q8: 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)
2021/APR/Q10 **2021/JUL/Q6** **2021/SEP/Q6** **2021/OCT/Q9** **2022/JUL/Q8** **2023/FEB/Q8** **2023/SEP/Q8**
Click Here to See the Answer

Q9. A. What is Prismatic Co-efficient (CP). Derive the formula CP = □□ □□ , where □□ = Co-efficient of fineness and □□ = midship section area co-efficient. (6)
B) The ½ 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/SEP/Q9
Click Here to See the Answer

Q10. 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. (16)
2023/SEP/Q10
Click Here to See the Answer

OCT-2023
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**
Click Here to See the Answer

Q2. With reference to dry docking, define the responsibilities of the Second Engineer and instructions to Junior Engineers:
A. Prior to docking; (6)
B. Whilst the vessel is in dry dock; (5)
C. Prior to flooding and leaving the dock. (5)
2022/JAN/Q4 **2022/MAR/Q3** **2022/DEC/Q2** **2023/APR/Q1** **2023/JULY/Q2** **2023/OCT/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. (5)
C. Describe briefly the significance of the factor of subdivision. (5)
2021/FEB/Q2 **2021/APR/Q3** **2021/OCT/Q3** **2022/SEP/Q2** **2022/DEC/Q3** **2023/MAR/Q2** **2023/OCT/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)

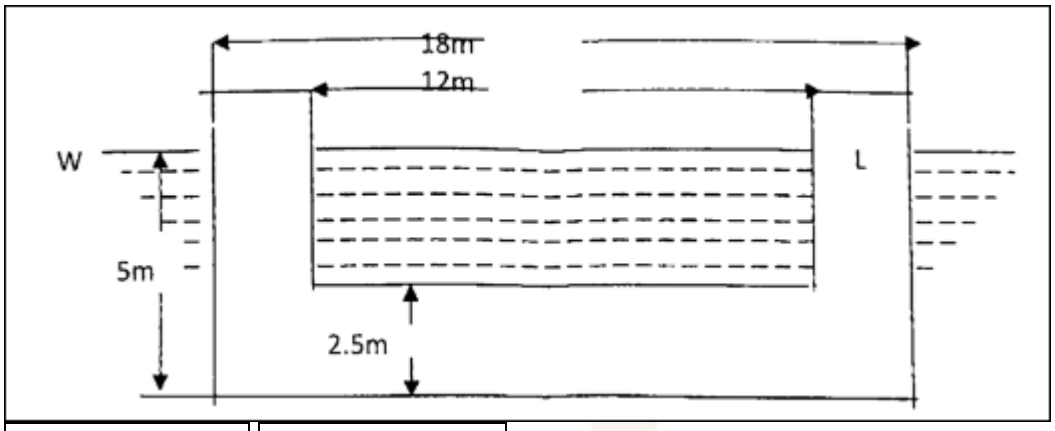
C. The initial metacentric height; (4)
D. The location of masses in the ship. (4)
2021/MAR/Q5 **2021/APR/Q5** **2021/SEP/Q5** **2022/DEC/Q4** **2023/MAR/Q3** **2023/OCT/Q4**
Click Here to See the Answer

Q5. (a) Describe the relationship between frictional resistance and (16)
(i) Ship's speed;
(ii) the wetted area;
(iii) surface roughness;
(iv) The length of the vessel.
2021/FEB/Q4 **2022/JAN/Q2** **2022/JUL/Q1** **2022/DEC/Q5** **2023/MAR/Q4** **2023/OCT/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 distance of the centre of the mass from midships. (10)
2022/DEC/Q6 **2023/OCT/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**
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 faction 10.30. 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**
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**
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**
Click Here to See the Answer

NOV-2023
SECTION – I

Q1. With reference to Crude Oil Carriers
a) Explain Each of the following.
i) Segregated Ballast Tanks (3)
ii) Clean Ballast Tanks (2)
iii) Protective Locations (3)
b) i) Explain the Crude oil Washing System for cargo tank cleaning. (4)
ii) State the advantages of Crude Oil Washing. (4)
2023/NOV/Q1
Click Here to See the Answer

Q2. 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**
Click Here to See the Answer

Q3. A. Explain how to distinguish between list and loll and describe how to return the ship to the upright

in each case. (8)
B. Explain the term angle of loll and state what, if any dangers it poses to a vessel. (8)
2023/NOV/Q3
Click Here to See the Answer

Q4. List the 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. (16)
2023/NOV/Q4
Click Here to See the Answer

Q5. With reference to Ship stability:
a. With the help of a neat sketch explain the relevant features of a G-Z curve. (8)
b. What are the effects of the below mentioned conditions on the G-Z curve:
i. Increased freeboard, (3)
ii. Increased beam, and (3)
iii. Increased GM. (2)
2021/FEB/Q1 **2023/NOV/Q5**
Click Here to See the Answer

SECTION – II

Q6. A. what is 'form stability' & 'weight stability'. (6)
b) The end bulkhead of the wing tank of an oil tanker has the following widths at 3m intervals commencing at the deck: 6.0, 6.0, 5.3, 3.6 and 0.6 m. Calculate the load on the bulkhead and the position of the centre of pressure if the tank is full of oil relative density 0.8. (10)
2023/NOV/Q6
Click Here to See the Answer

Q7. A. Explain how trim occurs and explain the effect of trim on tank soundings. (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.

2023/NOV/Q7

Click Here to See the Answer

Q8. Explain why the bilging of empty double-bottom tanks that are wholly below the waterline leads to an increase in GM. (6)
b. A ship of 22000 tonne displacement is 160 m long and MCTI cm 280tonne m, waterplane area 3060 m2 centre of buoyancy 1 m aft of midships and centre of flotation 4 m aft of midships. It floats in water of 1.007 t/ m3 at draughts of 8.15 m forward and 8.75 m aft.
Calculate the new draughts if the vessel moves into sea water of 1.026 t/ m2
Calculate the metacentric height of the vessel. (10)

2023/NOV/Q8

Click Here to See the Answer

Q9. A. Define hull efficiency and propeller efficiency. (6)
b. When a propeller of 4.8 m pitch turns at 110 rpm, the apparent slip is found to be —S % and the real slip is 1.5 S %. If the wake speed is 25 % of the ship speed, calculate the ship speed, apparent slip and the real slip. (10)

2023/NOV/Q9

Click Here to See the Answer

Q10. A. Why is it important in a tender ship to keep the double bottom tanks pressed up? (6)
b) A double bottom tank is 23m long. The half breadths of the top of the tank are 5.5, 4.6, 4.3, 3.7 and 3.0m respectively. When the ship displaces 5350 tonnes, the loss in metacentric height due to free surface is 0.2m. Calculate the density of the liquid in the tank. (10)

2023/NOV/Q10

Click Here to See the Answer

DEC-2023

SECTION – I

Q1. (a) State the reasons for the freeboard requirement, (4)
(b) Explain the term condition of assignment and explain how these are maintained for a ship. (4)
(c) Using a diagram indicate the freeboard of type A, type B, type B60 and type B100 vessels giving an example of each type. (8)
2023/JAN/Q3 **2023/DEC/Q1**
Click Here to See the Answer

Q2. 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**
Click Here to See the Answer

Q3. A. With reference to fatigue of engineering components 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 an engineering component. (4)
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. (6)
2021/JUL/Q5 **2022/FEB/Q5** **2023/FEB/Q3** **2023/JUNE/Q4** **2023/DEC/Q3**
Click Here to See the Answer

Q4. With reference to a periodically unattended machinery space of a dry cargo vessel discusses the requirements for;
A. Protection against flooding; (8)
B. Control of propulsion machinery from the navigating bridge. (8)
2021/JUL/Q4 **2021/AUG/Q4** **2021/SEP/Q4** **2021/DEC/Q2** **2023/DEC/Q4**
Click Here to See the Answer

Q5. (a) Where on the hull plating would the following tests be carried out on the ship's hulls during dry- dock.
(i) Hammer;
(ii) Hose; (8)
B. Briefly identify which part of the external plating of ship's bull requires the closest attention. (8)
2023/DEC/Q5
Click Here to See the Answer

SECTION – II

Q6. A. Explain what is meant by floodable length? (6)
B. (i) Construct a graph from the following information:
Mean draft (m) 3.0 3.5 4.0 4.5
TPC (tons) 8.0 8.5 9.2 10.0
(ii) From this graph find the TPC's at draft of 3.2m; and 4.3m
(iii) If the ship is floating at a mean draft of 4m, and then loads 50 tons of cargo, 10 tons of fresh water, and 25 tons of bunkers, whilst 45 tons of ballast are discharged, find the final mean draft. (10)
2021/JUL/Q10 **2023/DEC/Q6**
Click Here to See the Answer

Q7. (a) Describe how bulkheads are tested. (6)
(b) A double bottom tank containing seawater is 6m long, 12m wide and 1m deep. The inlet pipe from the pump has its center 75mm above the outer bottom. The pump has a pressure of 70 kN/m2 and is
left running indefinitely. calculate the load on the tank top:

(i) If there is no outlet.
(ii) If the overflow pipe extends 5m above the tank top. (10)
2023/DEC/Q7
Click Here to See the Answer

Q8. (a) Define coefficient of fineness of water plane area, block coefficient and midships coefficient. (6)
(b) A box shaped vessel has length 100m and breadth 12m and floats at a range of drafts from 1m to 10m. Produce curves of KB1, BM and KM. (10)
2023/DEC/Q8
Click Here to See the Answer

Q9. (A) Explain the concept of dynamical stability. (6)
(b) A ship of 5000 tonne displacement has three rectangular double bottom tanks A: 12m long and 16m wide; Tank B: 14m long and 15m wide; C 14m long and 16m wide.
Calculate the free surface effect for any one tank and state in which order the tanks should be filled when making use of them for stability correction. (10)
2022/APR/Q9 **2023/DEC/Q9**
Click Here to See the Answer

Q10. A ship 120m long displaces 12000 tonne. The following data are available from trial results:
V (knots) 10 11 12 13 14 15
SP (kw) 880 1155 1520 2010 2670 3600
(a) Draw the curve of admiralty coefficients on a base of speed
(b) Estimate the shaft power required for a similar ship 140m long at 14 knots. (16)
2023/DEC/Q10
Click Here to See the Answer