D. MARINE
Study Material

MEO CLASS 2 WRITTEN: EKG

(ENGINEERING KNOWLEDGE GENERAL)

FOR INDIAN COMPETENCY EXAM

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D. MARINE
Study Material

JAN 2025

1. Rating has been seriously injured by a "blow back" from the oil-fired auxiliary boiler. As Second engineer, make a full report to Head office explaining the circumstances of the incident and the precautionary measures now taken to reduce the possibility of a similar occurrence in the future. (16)
Click Here to See the Answer

2. a) Explain why, in spite of accurate alignment under static conditions use of flexible couplings and copious supply of lubricant, main reduction gearing in still subject to pitting, scuffing and other tooth damage (8)
b) Discuss the significance of viscosity in relation to the function of marine turbine oils as used in main propulsion installations, stating how the viscosity is controlled and what could cause it to change in service (8)

2014/JUN/08	2023/APR/07	2024/JAN/08	2025/JAN/02

Click Here to See the Answer

3. With reference to the carriage and pumping of liquefied gas cargo (6)
a) Sketch a suitable pumping system labelling the component parts. (5)
b) State; i) Why submerged hydraulically driven pumps are not úsed ii) How overheating of pump drive shaft bearings is avoided.
c) State, how the risk of fire and explosion in cargo tanks is obviated both in the loaded and discharged condition. (5)

2023/FEB/01	2023/SEP/03	2017/JAN/02	2025/JAN/03	2017/OCT/02

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4. Explain how the ingress of sea water is prevented in an oll lubricated stern bearing system. Should the system fail, describe the corrective action possible whilst the vessel is afloat. State why two stern bearing oil header tanks are fitted in some instances. (16)

2022/MAR/08	2023/NOV/03	2024/JUN/09	2025/JAN/04

Click Here to See the Answer

5a) Explain the ideal design requirements of a ship's propeller. (8)
b) briefly describe the propeller maintenance that should be carried out to prevent the fuel being wasted.

2023/JUL/05	2023/NOV/05	2024/JAN/05	2025/JAN/05

Click Here to See the Answer

6. Explain the working principle of differential Pressure Transmitter with the help of diagram and explain the following parts with their usages. A. Zero and span calibration B. Negative feedback bellow C. Pilot amplifier functions D. Zero Elevation Concept. (16)

2023/JAN/06	2024/FEB/01	2025/JAN/06

Click Here to See the Answer

7 Sketch a transmission shaft coupling which enables the propeller shaft to be withdrawn Outward.
a) describe the coupling and the method fitting and dismantling
b) state how the grip of the coupling can be checked when fitted
c) State what safety precaution should be taken when dismantling the coupling. (8)

2011/SEP/09	2014/NOV/09	2014/FEB/05

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8 a) Describe, with the aid of a sketch, an open loop system for reducing SOx emissions from engine exhaust gas, explaining how the system operates whilst the vessel is in open waters. (8)
b) Describe, with the aid of a sketch, a closed loop scrubber system for removing SOx from engine exhaust gas, explaining the operation of this unit and stating when it would be used. (8)

2022/SEP/04	2024/JUL/03	2025/JAN/08

Click Here to See the Answer

9.ay Explain electro chemical reactions and the difference between oxidation and reduction ectrochemical reactions with examples. Which reactions occur at the anode and cathode?

b) Explain galvanic corrosion and discuss the different procedures to prevent it.

2023/FEB/06	2023/APR/01	2023/SEP/04	2024/AUG/09	2025/JAN/09	

Click Here to See the Answer

FEB-2025

Explain the working principles of a Swash Plate Pump and a Hele-Shaw Pump. Compare their construction, operation, and efficiency Discuss their applications in marine systems, highlighting their advantages and limitations (16)

Click Here to See the Answer

2. a) Draw a line diagram of an accommodation air conditioning plant labelling the principal items and showing the direction of air flow (6)
b) State how
(i) Accommodation air temperature is controlled, (4)
(ii) Humidity is controlled within prescribed comfort limits, (3)
(iii) Such an installation can contribute to the efficiency of ship's main plant. (3)

Click Here to See the Answer

3. With reference to main boiler super heater arrangements:
a) Compare the advantages and disadvantages of contra flow with parallel flow design. (5)
b) Describe how the element tube banks are supported yet allow for expansion. (6)
c) Describe how boiler carryover affects super heater effectiveness and condition. (5)

2022/APR/08	2022/JUN/09

Click Here to See the Answer

4.With reference to a tubular heat exchanger, state the various types used on board a ship and explain with sketches how the construction, flow pattern, baffles, differ from each other depending upon the medium in use. (16)
2024/JUL/04 **2025/FEB/04**
Click Here to See the Answer

5. a) How is the power to weight ratio of an engine sought to be increased by continuous development? (8)
b) Discuss the limiting factors, what is the typical power to weight ratio of a slow speed marine diesel engine of current generation?
2023/MAR/09 **2025/FEB/05**
Click Here to See the Answer

6.With reference to hull cathodic protection systems of the impressed current type:
a) Sketch and describe such a system
b) Explain how protection may be ensured for the rudder and propeller(8)
Cristate any precautions that should be taken when this type of system is installed.
2023/FEB/04 **2023/OCT/08** **2025/FEB/06**
Click Here to See the Answer

7. Exhaust gas cleaning system is one of the systems used on board ship to reduce SOX emissions.
a) Briefly discuss various types of Exhaust gas cleaning system used on board ship.
b) What all data to be monitored and recorded when EGCS is in use to ensure that system meets all IMO regulations. (5)
c) What action you would take as second engineer if the system stopped working (6)
2023/OCT/07 **2025/FEB/07**
Click Here to See the Answer

8. a) Examine in detail three common but entirely different reasons for loss of steering gear Systems. (6)

b) State how failure is inhibited in the design, operation and maintenance of steering gear systems [5]
c) Describe how a vessel may make port upon irreparable failure of the steering telemotor (5)
2024/JUN/06 **2025/FEB/08**
Click Here to See the Answer

9. Hydrogen damage is a general term used for mechanical damage of metal caused by the presence of hydrogen, briefly discuss the different types of hydrogen damage and how these damages can be prevented?
a) Hydrogen blistering
b) Hydrogen embrittlement Decarburization:
d) Hydrogen attack.
Click Here to See the Answer

MARCH -2025

1.a) Define creep and specify the conditions under which it occurs?(8)
b) Discuss three metallurgical processing techniques that are employed to enhance the creep resistance of metal alloys (8)
2024/FEB/06
Click Here to See the Answer
2. You have been appointed as Second Engineer on a crude carrier, recently purchased by your shipping company. The company superintendent requests that you examine the vessel with a view to increasing its deadweight capacity without altening the ship's length. Outline the suggestions that you would make, justifying your proposals. (16)
2004/AUG/ **2024/DEC/01**
Click Here to See the Answer
3.a) Describe with the aid of sketches where necessary a vane type steering gear showing how to weight of the rudder and stock are carried and the arrangement that allow for wear down (6)
b) State how the vanes described in (a) are secured and the method of sealing the edges (5)

c) State how, if necessary, the steering gear is locked for rudder maintenance. (5)

2023/APR/04 **2023/SEP/01** **2025/MAR/03**

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4. With reference to sleeved keyless propellers:
a) state with reasons why the following practices are not advisable when removing the propeller from its shaft: (8)
i) expansion of boss by intense concentrated heating by blow torch
ii) the use of wedges or jacks.
(b) Describe a system that is used to remove the propeller from its shaft. (8)

2022/SEP/06 **2024/NOV/03**

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5. As a second engineer onboard a tanker describe the preparation and procedure for presenting a Main Boiler for survey to assification society by the shipboard staff. (16)

2023/DEC/01 **2024/APR/04** **2025/MAR/05**

Click Here to See the Answer

6 a) Describe the preparation necessary before the application (in dry dock) of sophisticated or approved long life coating to the underwater surface of the hull (6)
b) State the significance of the roughness profile
c) List the different sophisticated coatings which are available.

2023/JUL/04 **2024/OCT/01** **2025/MAR/06**

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7 a) Explain with a sketch the operation of an automatic expansion valve as fitted in the direct expansion refrigeration plants How is this valve adjusted? (6)
b) Explain how critical temperature restricts plant operation and how these limitations can be overcome?
c) Explain how this system maintains the provision room at different temperatures?

2023/FEB/03 **2024/AUG/02** **2025/MAR/07**
Click Here to See the Answer

8. a) Explain why pilot injection is required for a Dual fuel engine when burning natural gas. (8)
b) Describe, with the aid of a sketch, the arangements for a dual fuel engine which is capable of burning natural gas on
a) The otto cycle
b) The Dresel cycle
2023/OCT/01
Click Here to See the Answer

9. Describe with a sketch a pneumatic relay and show how feedback can be achieved when such a relay is used in conjunction with a flapper mechanism.
2022/MAR/04 **2023/SEP/07** **2025/MAR/09**
Click Here to See the Answer

APRIL -2025

Q.1With reference to the fuel standards ISO-8217-2017 discuss the amendments made as compared to its previous edition. Explain the significance of the following:
(a) Pour point, cloud point and cold filter plugging point.
(b) Cat fines
(c) Fatty Acid methyl Easter
(d) Dissolved H2S in fuel. (16)
2022/FEB/06 **2022/APR/02** **2025/APR/01**
Click Here to See the Answer

Q.2 How do preventive, predictive and corrective maintenance strategies differ in the management of ship equipment, and what are the advantages and disadvantages of each approach in ensuring the reliability and longevity of machinery onboard ship? (16)
2024/AUG/08 **2025/APR/02**
Click Here to See the Answer

Q.3a) Describe the key phases and microstructures present in the iron-carbon equilibrium diagram and explain their significance in the heat treatment of steel. (8)
b) How do the different regions of the iron-carbon diagram influence the mechanical properties of steel, such as hardness, toughness, and ductility? Provide examples of how specific compositions and heat treatments can achieve desired properties. (8)
2024/AUG/01 **2025/APR/03**
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Q.4a) As per SOLAS regulations, what checks and tests must be carried out on the steering gear system before the ship's departure from port? Explain the procedures involved and the documentation required.(8)
b) Explain the construction, working, and purpose of hunting gear in a steering gear system. What are the consequences of its failure? (8)
Click Here to See the Answer

Q.5 With reference to fuel oil viscosity: (16)
(a) Explain why correct fuel oil viscosity is necessary
(b) Describe TWO methods for the measurements of viscosity that are suitable for the inclusion into a pneumatic or electronic control system;
(c) State, with reasons, a control action for a viscosity controller.
2022/APR/07 **2025/APR/05**
Click Here to See the Answer

Q.6With reference to propeller shaft alignment: (16)
a) State the objectives of a satisfactory alignment
b) State the conditions that must be met to achieve satisfactory alignment
C) Explain what is meant by fair curve alignment
d) Define "sag and gap" in shaft alignment calculation.
Click Here to See the Answer

Q.7a) Explain the purpose and main components of an air conditioning system used on ships. Describe the layout and working of the system with the

help of a neat diagram. Discuss the function of the unloaded in the compressor and its importance during system operation. (10)
b) Name the thermodynamic cycle on which the marine air conditioning system operates. Explain this cycle using a pressure-enthalpy (P-h) diagram and describe the role of each component in the cycle. (6)
Click Here to See the Answer

Q.8With reference to keyless propellers explain: (16)
a) Why keys and keyways have been eliminated
b) How angular slip is avoided
c) Why mounting upon and removal of a propeller shaft requires a different technique than that employed for propeller with keys.
d) State with reasons why use of wedges and jacks are not advisable when removing the propeller from its shaft.
2024/NOV/03 **2025/APR/08**
Click Here to See the Answer

Q.9a) Explain the action of EACH of the following metallurgical mechanism:
(i) Creep
(ii) Brinelling
(iii) Fretting
(iv) Fretting corrosion (10)
b) State, with reasons, where EACH of the mechanisms in occur in ship propulsion System. (6)
2022/JAN/08
Click Here to See the Answer

JUNE-2025

Q.1 You are a 2nd engineer on a ship fitted with an open loop scrubber, during a Loaded voyage, the display panel remote & local panel stop working. Write a letter to your office on the breakdown, & the steps you have taken to bring back to normal operations, make references to the relevant regulations? (16)
2025/JUN/01

Click Here to See the Answer

Q.2a) Define creep and specify the conditions under which it occurs? (8)
b) Discuss three metallurgical processing techniques that are employed to enhance the creep resistance of metal alloys. (8)
2024/JUL/02 **2024/SEP/09** **2025/MAR/01** **2025/JUN/02**
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Q.3a) Describe, with the aid of a sketch, an open loop system for reducing SOX emissions from engine exhaust gas, explaining how the system operates whilst the vessel is in open waters. (6)
b) Describe, with the aid of a sketch, a closed loop scrubber system for removing SOX from engine exhaust gas, explaining the operation of this unit and stating when it would be used. (10)
2024/JUL/03 **2025/JAN/08** **2025/JUN/03**
Click Here to See the Answer

Q.4 With reference to a tubular heat exchanger, state the various types used on board a ship and explain with sketches how the construction, flow pattern, baffles, differ from each other depending upon the medium in use. (16)
2023/AUG/03 **2024/JUL/04** **2025/FEB/04** **2025/JUN/04**
Click Here to See the Answer

Q.5 With Reference to Refrigeration systems uses onboard:
a) How do we choose environmentally friendly refrigerants for ships? (6)
b) How do CFCs, HCFCs, HFCs, and natural refrigerants like ammonia and carbon dioxide compare in terms of ozone depletion (ODP) and global warming potential (GWP)? (4)
c) What are the benefits and challenges of using natural or low-GWP refrigerants on marine vessels? (3)
d) Explain the steps you will take to ensure that release of refrigerant gases from the plant in minimized during normal operation and during maintenance activities. (3)
Click Here to See the Answer

Q.6a) Describe with the aid of a sketch, the main engine ancillary equipment for automatic monitoring and regulation of fuel viscosity. (6)
b) Explain the operation of equipment described in (5)
c) Discuss the single fuel concept. (5)
2023/APR/05 **2024/JUL/06** **2025/JUN/06**
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Q.7a) Explain the concept of a fail-safe and fail-set system on a ship, providing examples of each system. (6)
b) Describe the advantages and disadvantages of both systems. (5)
c) How do the design differences impact the overall reliability and safety of the vessel. (5)
2024/JUL/07 **2025/JUN/07**
Click Here to See the Answer

Q.8a) Sketch a line diagram showing the layout components of a hydraulic system with a variable delivery, Pressure compensated pump and accumulator, suitable for the operation of deck machinery. (8)
b) Describe the operation of the system sketched in . (8)
2023/JUN/06 **2024/JUL/08** **2025/JUN/08**
Click Here to See the Answer

Q.9 What are the differences between destructive and non-destructive testing methods for materials? Discuss the advantages and disadvantages of each approach, and provide examples of specific tests used in both categories to ensure the integrity and quality of materials used in shipbuilding. (16)
2024/JUL/09 **2025/JUN/09**
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JULY-2025

1.a) Explain how wear on bearing surfaces is affected by each of the following factors:
Dissimilarity of materials in the contact surfaces
(i) Relative speed of sliding between the surfaces
(ii) Roughness of the surfaces
(iii) Incompatibility of lubricant and bearing material.
b) Describe how each effect may be identified during inspection. Suggest corrective action at either operational or maintenance stages. (16 marks)
2022/AUG/01 **2024/MAR/09** **2025/JUL/01**
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2 Cast iron is most widely used metal after steel in Marine Engineering. Most cast irons consist of graphite in steel like matrix. Discuss the variation of properties that may arise with reference to pearlitic grey cast iron and spherical grey cast iron. Describe briefly the treatment necessary to produce these two types of Iron. (16 marks)
2022/JUL/06 **2023/JUN/01** **2023/NOV/06** **2024/APR/01** **2025/JUL/02**
Click Here to See the Answer

3.a) Explain why pilot injection is required for a Dual fuel engine when burning natural gas.
b) Describe, with the aid of a sketch, the arrangements for a dual fuel engine which is capable of burning natural gas on:
a) The Otto cycle
b) The Diesel cycle. (16 marks)
2022/SEP/03 **2024/MAR/07** **2025/MAR/08** **2025/JUL/03**
Click Here to See the Answer

4. Reverse osmosis is the modern alternative for shipboard production of drinking water.
a) Describe using simple diagrams, if necessary, the principle of reverse osmosis. (8 marks)

b) Sketch a line diagram showing a single pass system for producing fresh water from seawater and describe the system. (8 marks)
2023/JAN/03 **2025/JUL/04**
Click Here to See the Answer

5. With reference to gear pumps used for lubricating oil transfer:
a) Sketch and describe a gear type pump indicating the flow of fluid. (6 marks)
b) State the materials that gear type pump components may be manufactured from. (4 marks)
(c) Specify THREE applications that are suitable for the employment of gear type pumps. (6)
2020/DEC/07 **2025/JUL/05**
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6. With Reference to Air-conditioning System onboard your vessel:
a. Sketch and describe a high-pressure cut-out in a refrigeration system. (6)
b. The refrigeration compressor has stopped due to operation of the high-pressure cut-out. Explain:
i. The possible causes.
ii. How these causes would be found and possible remedies.
c. What steps are taken if the compressor "short-cycle" on low pressure cut-out? (4)
2024/FEB/02 **2025/JUL/06**
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7. With regards to process control system explain following:
(a) Proportional Control
(b) Integral Control
(c) Derivative Control
(d) The necessity of Derivative control (16)
Click Here to See the Answer

8. With regards to main transmission shaft flange coupling arrangements:

a) Sketch a hollow type coupling bolt and the hydraulic head/nut and loading rod which are used to fit it.
b) Describe how the bolt is fitted.
c) State the advantage of the hollow coupling bolt as compared to the traditional type of coupling bolt.
2023/JUN/08 **2024/MAR/03** **2024/APR/05** **2025/JUL/08**
Click Here to See the Answer

9. With reference to electrohydraulic steering gear systems with four rams
a) With the aid of a sketch describe the working principle of hydraulic pump.
b) Explain the method adopted to prevent hydraulic oil leakage along the rams.
c) Discuss the methods adopted to prevent damage to the steering gear due to jumping of rudder in heavy seas.
(16)
2024/MAR/04 **2025/JUL/09**
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AUG-2025

1. Describe the importance of maintaining the quality of lube oil in maintaining the proper health of marine diesel engines highlighting the role of
(a) Automatic back flushing filters.
(b) Lube oil separators
(c) Magnetic filters
(d) Visual Inspection
(e) Periodic laboratory tests. (16)
2023/DEC/04 **2025/AUG/01**
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2. With respect to the properties of fuel oil, explain the significance of the following terms.
(a) Calculated Carbon Aromaticity Inbox (CCAI).

(b) Open flash point and Closed flash point.
(c) The importance of Sodium to Vanadium Ratio.
(d) Octane Number. (16)
2022/MAR/03 **2022/JUN/02** **2023/JAN/01** **2023/OCT/01** **2024/APR/02** **2025/AUG/02**
Click Here to See the Answer

3. With reference to Vacuum Sewage System
(a) Sketch & Describe a Vacuum Sewage System.
(b) State the advantages of Vacuum Sewage System.
(c) State the different causes of dropping vacuum (16)
2021/APR/09 **2020/MAR/07** **2024/APR/07** **2025/AUG/03**
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4. With Respect to Container Ship:
a) Sketch a ship's indirect refrigeration system arranged for cooling containers stowed in stacks in the hold
b) Describe the refrigeration system sketched in
c) State the advantages of the system described in compared with containers with their own refrigeration self-contained units. (16)
2022/NOV/07 **2025/AUG/04** **2022/APR/06** **2022/JUN/06**
Click Here to See the Answer

5. Discuss the causes of corrosion and the means by which corrosion of the following may be limited by manufacturers and ship's personnel respectively:
a) Internal and External surfaces of auxiliary steam lines
b) External surfaces of auxiliary boilers
c) Water boxes of seawater coolers and condensers
d) Main sea water inlet pipes. (16)
2021/NOV/07 **2022/JUL/08** **2025/AUG/05**
Click Here to See the Answer

6. Reverse osmosis is one of the alternative methods for shipboard production of drinking water.

(a) Describe using simple diagrams, if necessary, the principle of reverse osmosis.
(b)(i) Sketch a line diagram showing a single pass system for producing fresh water from sea water
(ii) Describe such a system.
2023/JAN/03 **2025/JUL/04** **2025/AUG/06**
Click Here to See the Answer

7. With reference to Gear pumps used for lubricating oil transfer.
(a) Sketch and describe a gear type pump indicating the flow of fluid.
(b) state the materials that gear type pump components may be manufactured from.
(c) specify THREE applications that are suitable for the employment of gear type pumps.
2025/JUL/05 **2025/AUG/07**
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8. With reference to Flue gas Inert gas system:
a) Sketch a line diagram showing a typical 'Inert Gas System used for inerting the cargo tanks of oil tankers, labelling the component parts.
b) Describe the system.
c) State what oxygen content you would expect in the flue gases if good combustion is achieved.
Click Here to See the Answer

9. With reference to auxiliary boiler safety valve:
a) Describe, with aid of a Sketch the safety valves for an auxiliary boiler
b) Identify, with reasons, the part that require particularly close attention during overhaul
c) Describe how the safety valves are reset after an overhaul.
2009/FEB/** **2025/AUG/09**
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SEP-2025

1.a) Explain how analysis of used lubricating oil can be used as a "health-monitoring" tool for diesel engines.
B. Describe how vibration measurement can be used with a main engine turbocharger:
i. For fault analysis.
ii. For condition monitoring with respect to maintenance.
iii. As a substitute to opening machinery for survey.
2022/JAN/02 **2022/DEC/01** **2025/SEP/01**
Click Here to See the Answer

2. Compare the destructive testing done on engineering materials with non-destructive testing done on engineering components. Briefly describe one destructive test and two non-destructive tests to illustrate your answer.
2022/DEC/02 **2024/NOV/01** **2025/SEP/02**
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3. a) State the advantages of using steam turbine propulsion power for vessels carrying LNG cargo.
b) With regard to the use of L.N.G. cargo as boiler fuel explain:
(i)The safety precautions relating to the gas pipeline supplying the boiler and burning the gas in the boiler,
(ii) The means of getting rid of "excess gases" during loading or discharge.
2023/OCT/02 **2024/MAR/02** **2024/NOV/02** **2024/DEC/09** **2025/SEP/03**
Click Here to See the Answer

4 a) Draw a block diagram for a fully automated accommodation air conditioning unit, labelling the component parts, and indicating the directions of air flow bExplain why the unit includes means of dehumidification and humidification.
c) A chart is used for ensuring that the accommodation conditions are within the so-called Comfort Zone: what useful information does the chart give?

5.a) Explain the ideal design requirements of a ship's propeller.
b) Briefly describe the propeller maintenance that should be carried out to prevent fuel being wasted.
2022/DEC/05 **2023/FEB/02** **2023/JUL/05** **2023/NOV/05** **2024/JAN/05** **2025/JAN/05** **2025/SEP/05**
Click Here to See the Answer

6.a) Describe the preparation necessary before the application (In dry dock) of sophisticated or approved long life coating to the underwater surface of the hull.
b) State the significance of the roughness profile.
test the different sophisticated coating which are available.
2022/DEC/06 **2023/APR/06** **2023/JUL/04** **2024/OCT/01** **2025/MAR/06**
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7.With reference to steels used in shipbuilding and marine engineering:
a) describe EACH of the following types of failure.
(i) Brittle failure
(ii)-Ductile failure.
b) Explain the term ductile to brittle transition stating the factor that determines ductile to brittle transition.
c) Describe a test to determine the value of brittle fracture of a specimen test piece
2022/DEC/07 **2024/NOV/09**
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8. With reference to shaft alignment:
a) Explain the meaning of fair curve or rational alignment;
b) Shaft alignment is often verified using hydraulic jacks to obtain a simple graph. Sketch such a graph, indicating the following:
(i) Static load;
(ii) Hysteresis;
(iii) Influence number;
c) Explain the limitations of checking shaft alignment solely by

hydraulic jacking methods.
2022/DEC/08 **2023/AUG/05** **2024/JUN/04** **2024/DEC/07**
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9. Define proportional control action.
b) Sketch and describe a simple pneumatic proportional controller.
c) State a suitable process where a proportional controller may be employed.
d) State the disadvantage of proportional only action.
2022/DEC/09 **2024/OCT/05**
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OCT-2025

1.(a) Describe with the aid of sketches where necessary a vane type steering gear, showing how the weight of the rudder and stock are carried and the arrangement that allow for wear down. (6)
(b) State how the vanes described in (a) are secured and the method of sealing the edges. (5)
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2023/APR/04 **2023/SEP/01** **2025/MAR/03**
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iii) Such an installation can contribute to the efficiency of ship's main plant.
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(a) Compare the advantages and disadvantages of contra flow with parallel flow design. (5)

(b) Describe how the element tube banks are supported yet allow for expansion. (6)
(c) Describe how boiler carryover affects super heater effectiveness and condition. (5)
2021/DEC/08 **2022/MAR/08** **2022/APR/08** **2022/JUN/09**
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4.With reference to a tubular heat exchanger, state the various types used on board a ship and explain with sketches how the construction, flow pattern, baffles, differ from each other depending upon the medium in use. (16)
2023/AUG/03 **2024/JUL/04** **2025/FEB/04** **2025/JUN/04**
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5.Discuss the causes of corrosion and the means by which corrosion of the following may be limited by manufacturers and ship's personnel respectively:
(a) Internal and external surfaces of auxiliary steam lines. (4)
(b) External surfaces of auxiliary boilers. (4)
(c) Water boxes of seawater coolers and condensers. (4)
(d) Main sea water inlet pipes. (4)
2020/OCT/06 **2021/NOV/07** **2022/JUL/08** **2025/AUG/05**
Click Here to See the Answer

6. With reference to hull cathodic protection systems of the impressed current type:
(a) Sketch and describe such a system. (8)
(b) Explain how protection may be ensured for the rudder and propeller. (4)
(c) State any precautions that should be taken when this type of system is installed. (4)
2023/FEB/04 **2023/OCT/08** **2025/FEB/06** **2025/OCT/06**
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7. With reference to reciprocating air compressors explain why:
(a) Clearance volume is critical to efficiency,
(b) Spring-loaded plate valves are invariably used;
(c) Compression is accomplished in apparently unequal stages:

(d) Inter-cooling is used between stages.
2020/NOV/04 **2021/DEC/02**
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8.(a) Examine in detail three common but entirely different reasons for loss of steering gear systems. (6)
(b) State how failure is inhibited in the design, operation and maintenance of steering gear systems. (6)
(c) Describe how a vessel may make port upon irreparable failure of the steering telemotor. (4)
2024/JUN/06 **2025/FEB/08**
Click Here to See the Answer

9. Hydrogen damage is a general term used for mechanical damage of metal caused by the presence of hydrogen, briefly discuss the different types of hydrogen damage and how these damages can be prevented:
a) Hydrogen blistering.
b) Hydrogen embrittlement.
c) Decarburization.
d) Hydrogen attack.
2022/SEP/05 **2023/MAR/06** **2023/AUG/06** **2024/MAR/06** **2025/FEB/09**
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NOV-2025

Q.1 GHG Ratings of ships have become new industry norms-Discuss various types of GHG Ratings applied to international shipping, with special focus on the role of second engineers in improving GHG ratings of ships. (16)
2022/JUL/05 **2022/OCT/04** **2024/JAN/07** **2024/JUL/01**
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2.a) Define creep and specify the conditions under which it occurs? (8)
b) Discuss three metallurgical processing techniques that are employed to enhance the creep
resistance of metal alloys.(8)

2022/SEP/02 **2022/NOV/01** **2024/JUL/02** **2024/SEP/09** **2025/MAR/01** **2025/JUN/02**

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Q.3 a) Describe, with the aid of a sketch, an open loop system for reducing SOx emissions from engine exhaust gas, explaining how the system operates whilst the vessel is in open waters. (6)
b) Describe, with the aid of a sketch, a closed loop scrubber system for removing SOx from engine exhaust gas, explaining the operation of this unit and stating when it would be used.(10)

2022/SEP/04 **2024/JUL/03** **2025/JAN/08** **2025/JUN/03**

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Q.4. With reference to a tubular heat exchanger, state the various types used on board a ship and explain with sketches how the construction, flow pattern, baffles, differ from each other depending upon the medium in use (16)

2023/AUG/03 **2024/JUL/04** **2025/FEB/04** **2025/JUN/04**

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Q.5. With respect to refrigeration gases used on-board vessels, answer the following:
a). Explain Ozone Depleting Potential (ODP) and Global warming potential (GWP) of conventional refrigerant gases. (7)
b) Name the alternate refrigerant gases available and being used onboard. (4)
c). Explain the steps you will take to ensure that release of refrigerant gases from the plant in minimized during normal operation and during maintenance activities. (5)

2023/JAN/04 **2023/MAR/03** **2023/JUN/02** **2024/JUL/05**

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Q.6.a) Describe with the aid of a sketch, the main engine ancillary equipment for automatic monitoring and regulation of fuel viscosity. (6)
b) Explain the operation of equipment described in (a) above. (5)

c) Discuss the single fuel concept. (5)
2013/DEC/02 **2023/APR/05** **2024/JUL/06** **2025/JUN/06**
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Q. 7.a) Explain the concept of a fail-safe and fail-set system on a ship, providing examples of each system. (6)
b) Describe the advantages and disadvantages of both systems. (5)
c) How do the design differences impact the overall reliability and safety of the vessel (5)
2024/JUL/07 **2025/JUN/07**
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Q. 8. (a) Explain the Operational principle of a ship's stabilizer. (8)
(b) Describe with sketches Active and Passive types of stabilizers.(8)
Click Here to See the Answer

Q. 9. What are the differences between destructive and non-destructive testing methods for materials? Discuss the advantages and disadvantages of each approach, and provide examples of specific tests used in both categories to ensure the integrity and quality of materials used in shipbuilding. (16)
2024/JUL/09 **2025/JUN/09**
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DEC-2025

1). A Rating has been seriously injured by a "blow back" from the oil-fired audlary boiler. As Second engineer, make a full report to Head office explaining the circumstances of the incident and the precautionary measures now takes to reduce the possibility of a similar occurrence in the future (16)
Click Here to See the Answer

2) Define creep and specify the conditions under which it occurs?
b) Discuss the various metallurgical processing techniques that are employed to enhance the creep resistance of metal alloys
2022/SEP/02 **2022/NOV/01** **2024/JUL/02** **2024/SEP/09**
2025/MAR/01 **2025/JUN/02** **2025/NOV/02** **2025/DEC/02**
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3) With reference to a tubuler heat exchanger, state the various types used on board a ship and explain with sketches how the construction, flow pattern, baffles, differ from each other depending upon the medium in use. (16)
2023/AUG/03 **2024/JUL/04** **2025/FEB/04** **2025/JUN/04**
2025/OCT/04 **2025/NOV/04** **2025/DEC/03**
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4. With Reference to Refrigeration systems uses onboard
a. How do we choose environmentally friendly refrigerants for ships?
b. How do CFC, HCFCs, HFCs, and natural refrigerants like ammonia and carbon dioxide corspare in terms of come depletion (ODP) and global warming potential (GWP)? (4)
c. Explain the benefits and challenges of using natural or low-GWP refrigerants on marine vessels?
d. Explain the steps you will take to ensure that release of refrigerant gases from the plant in minimized during normal operation and during maintenance activities (5)
2025/JUN/05 **2025/DEC/04**
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5 a) Describe with the aid of sketches where necessary a vane type steering gear showing how the weight of the rudder and stock are carried and the arrangement that allow for wear down.
b) State how the vanes described in (a) are secured and the method of sealing the edges.
c) State how, if necessary, the steering gear is locked for rudder maintenance.
2023/APR/04 **2023/SEP/01** **2025/MAR/03** **2025/OCT/01** **2025/DEC/05**
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6a.) Describe with the aid of a sketch, the main engine ancillary equipment for automatic monitoring and regulation of fuel viscosity
b) Explain the operation of equipment described in Q (a).
c) Discuss the single fuel concept
2023/APR/05 **2024/JUL/06** **2025/JUN/06** **2025/NOV/06** **2025/DEC/06**
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7a) Describe the preparation necessary before the application (In dry dock) of sophisticated or approved long life coating to the underwater surface of the hull.
b) State the significance of the roughness profile.
c)List the different sophisticated coating which are available.
2023/AUG/03 **2023/SEP/01** **2025/JUL/03**
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8a) Explain why, despite accurate alignment under static conditions use of flexible couplings and copious supply of lubricant, main reduction gearing in still subject to pitting, scutting and other tooth damage.
b) Discuss the significance of viscosity in relation to the function of marine turbine oils as used in main propulsion Installations, stating how the viscosity is controlled and what could cause it to change in service.
2023/APR/07 **2024/JAN/08** **2025/JAN/02** **2025/DEC/08**
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9. a) Briefly describe the operation of an electrical or hydraulic main engine governar.
b) For the type described indicate how failure can occur and the action to be taken if immediate correction cannot be achieved and the engine must be operated

2023/APR/03 **2025/DEC/09**

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