D. MARINE
Study Material

MEO CLASS 2 WRITTEN: EKG

(ENGINEERING KNOWLEDGE GENERAL)

FOR INDIAN COMPETENCY EXAM

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JAN-2024

Q.1 With respect to Windlass and deck Machinery.
(a) Describe the principle of coil operated brake suitable for winches and other deck machinery.
(b) Explain with suitable sketches how the windlass is relieved of strain when riding at anchor.
2022/APR/Q4 **2023/SEP/Q2** **2024/JAN/Q1**
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Q.2 With reference to electro-hydraulic steering gears:
A. Explain in terms of control parlance, the function of the "Hunting gear":
B. Explain the consequences if the standby pumping unit is motored:
C. State TWO methods employed to prevent the standby hydraulic pump being motored by the operating unit.
2022/MAR/Q6 **2023/JAN/Q9** **2024/JAN/Q2**
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Q.3 Explain why each of the following features is considered desirable for air compressors
a) A single-throw crank for a multi-stage compressor.
b) Minimum clearance volume.
c) Multi tubular inter-stage cooler.
d) Generous size of suction filter.
2024/JAN/Q3
Click Here to See the Answer

Q.4 Briefly Discuss the effects of following on corrosion:
(a) Dissolved Oxygen
(b) Hydrogen lon concentration
(c) Temperature
(d) Velocity
2024/JAN/Q4
Click Here to See the Answer

Q.5 a) Explain the ideal design requirements of a ships propeller.
b) briefly describe the propeller maintenance that should be carried out to prevent the fuel being wasted.Q.6 With reference to propeller shaft alignment:
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.
2022/DEC/05 **2023/FEB/02** **2023/JUL/05** **2023/NOV/05** **2024/JAN/05** **2025/JAN/05** **2025/SEP/05**
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Q.6 With reference to propeller shaft alignment:
a) State the objectives of a satisfactory alignment
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c) Explain what is meant by fair curve alignment.
d) Define "sag and gap" in shaft alignment calculation.
2022/OCT/03 **2024/JAN/06** **2024/SEP/08** **2025/APR/06**
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Q.7 GHG Ratings of ships have become new industry norms- Discuss various types of GHG Ratings applied to international shipping, with a special focus on the role of Second Engineers in improving GHG ratings of ships.
2022/JUL/05 **2022/OCT/04** **2023/OCT/05** **2024/JAN/07** **2024/JUL/01** **2025/NOV/01**
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Q.8 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
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**
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Q.9 Use of Controllable Pitch Propellers (CPP) is on the increase for main propulsion. What advantages this has over fixed pitch propellers. Discuss the principles involved in CPP propulsion naming important components of a hydraulically operated system. What fail safe & alarm systems are provided.
2024/JAN/09
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FEB – 2024

Q.1 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
2023/JAN/06 **2024/FEB/01** **2025/JAN/06**
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Q.2 With reference to Air-conditioning system onboard your vessel:
(a) Sketch and describe high pressure cut-out in a refrigeration system,
(b) The refrigeration compressor has stopped due to operation of the hip cut-out Explain.
(i) The possible cause.
(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?
2024/FEB/02 **2025/JUL/06**
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Q.3 (a) Briefly discuss the principle and the key components and elements of an ICCP system, outlining their functions in safeguarding the integrity of metal structures on ships.
2024/FEB/03
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Q.4 (a) What different methods are used for preserving ship's hull during service. What type of antifouling coats are used.
(b) State what materials are being banned by international regulation for use in Antifouling coats and the reason for banning.
(c) Discuss briefly how does paint coating on deck differ from that on super structure.
2022/JUL/09 **2024/FEB/04**
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Q.5 An engine room is operating in the unmanned (UMS) mode. In the event of a failure of the UMS systems, explain the arrangements a second engineer officer should introduce to operate the machinery in manual mode for a passage of 10 days duration.
2024/FEB/05
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Q.6 a) Discuss three metallurgical/processing techniques that are employed to enhance the creep resistance of metal alloys.
(b) Define creep and specify the conditions under which it occurs?
2024/FEB/06
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Q.7 a) Give the approximate composition, and the properties of the following metals:
(1) Manganese bronze,
(ii) Cupro-nickel,
(iii) Babbitts metal.
In each case give two examples of the metais in use on board ship and explain why the metal is chosen for the applications you mention.
(b) Explain the difference between "strength" and "stiffness" of steel. Discuss the importance of these properties in shipboard structural members and machinery components.
2024/FEB/07
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Q.8 With reference to feed regulation:

(a) Describe, with the aid of sketches, the operation of a boiler feed water regulator controlled by at least two other parameters besides water level in the drum.
(b) Give reasons for the inclusion of the other elements besides water level in controlling feed flow.
(c) Deduce the possible effects on the system when the drain valve in the constant leg in the level transmitter starts to leak.
2022/OCT/05 **2024/FEB/08**
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Q.9 (a) Sketch and describe a Pilgrim Nut for securing a propeller to the screw shaft.
(b) Describe how this device is used to loosen the propeller on the shaft when removal or inspection becomes necessary.
(c) Give reasons why this method is considered to be superior to all other methods.
2024/FEB/09
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MAR – 2024

Q.1 With reference to centrifugal pumps and pumping systems:
(a) Under what conditions, a centrifugal pump require a priming device for pump to operate normally?
(b) Draw a neat graph and explain the performance curves of a centrifugal pump.
2024/MAR/01
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Q.2 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.

2022/DEC/03 **2023/JUN/04** **2023/OCT/02** **2024/MAR/02** **2024/NOV/02** **2024/DEC/09** **2025/SEP/03**

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Q.3 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**

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Q.4 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.

2024/MAR/04 **2025/JUL/09**

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Q.5 With regards to process control system explain following:
(a) Proportional Control
(b) Integral Control
(c) Derivative Control
(d) The necessity of Derivative control

2024/MAR/05 **2025/JUL/07**

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Q.6 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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Q.7 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.

2022/SEP/03 **2024/MAR/07** **2025/MAR/08** **2025/JUL/03**

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Q.8 Explain vapor compression refrigeration cycle on T-S and PH diagram and explain the purpose of EACH of the following
(a) Expansion valve
(b) Room thermostat
(c) High pressure cut out.
(d) Equalizing line.

2022/AUG/03 **2024/MAR/08**

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Q.9 (a) Explain how wear on bearing surfaces is effected by each of the following factors.
(i) Dissimilarity of materials in the contact surfaces
(ii) Relative speed of sliding between the surfaces
(iii) Roughness of the surfaces
(iv) 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.

2022/AUG/01 **2024/MAR/09** **2025/JUL/01**

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APR- 2024

Q.1 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 Irons.

2022/FEB/02 **2022/APR/09** **2022/JUL/06** **2023/JUN/01** **2023/NOV/06** **2024/APR/01** **2025/JUL/02**

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Q.2 With respect to the properties of fuel oil, explain the significance of the following terms

(a) Calculated Carbon Aromaticity index (CCAI).
(b) Open flash point and Closed flash point.
(c) The Importance of Sodium to Vanadium ratio.
(d) Octane Number.

2021/OCT/01 **2021/NOV/02** **2022/MAR/03** **2022/JUN/02** **2023/JAN/01** **2023/OCT/01** **2024/APR/02** **2025/AUG/02**

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Q.3 With regard to care of lubricating oils onboard, answer the following:
a) What is microbial degradation of lubricating oil and how is it prevented? What methods are employed to ensure correct sampling for shore-based testing?
b) What action will you take if the testing results show abnormal values of water content and TBN for the crank-case lube oil of a slow speed main engine?

2020/MAR/03 **2024/APR/03**

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Q.4 As second engineer onboard a tanker, describe the procedure for presenting a Main Boiler for survey by a classification society.

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

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Q.5 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**
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Q.6 Sketch and describe the operation of a four ram electro-hydraulic steering gear system. Indicate and explain the valve positions for the operation of the system when one pump is isolated, and the unit is operating on two rams only.
2021/SEP/08 **2021/NOV/04** **2022/FEB/05** **2022/APR/05** **2024/APR/06**
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Q.7 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.
2021/APR/09 **2020/MAR/07** **2024/APR/07** **2025/AUG/03**
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Q.8 a) Detail the desirable properties of a refrigerant.
b) Make a table and compare following refrigerants for use in a provision cooling plant for a 50000 DWT Oil tanker: R-22, R-134a.
2023/AUG/09 **2023/DEC/03** **2024/APR/08** **2024/NOV/05**
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Q.9 Sketch a sealing arrangement for an oil-lubricated stern tube. Identify the common forms of seal failure; State how oil loss due to seal failure can be

restricted whilst on passage? What is the material used for sealing rings and propeller shaft liner?

2023/JUN/03 **2023/AUG/01** **2024/APR/09** **2024/DEC/04**

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JUNE 2024

1). Describe in detail each of the following processes and give an example where each is likely to occur in marine engineering: State how in each case the initiation of the process is prevented or minimized.
A. Corrosion fatigue;
B. Stress corrosion;
C. Creeping cracks;
D. Casting cracks

2024/JUN/01

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2. With regards to boiler water level control. Explain the following
a) Shrink and swell phenomenon
b) Cascade control
c) Split control
d) Condensing chamber-Function and location.

2024/JUN/02

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3. With reference to Keyless Propeller:
a) Sketch a section through a keyless sleeved propeller.
b) State the advantages of using a keyless sleeved propeller.
c) State with reason, Which metal sleeve should be made for contact with the forged mild steel tail shaft?
d) State the material uses to bond the sleeve to the propeller and the general thickness of the bonding material.

2023/OCT/09 **2023/DEC/07** **2024/JUN/03**

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4.) 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;
(iv) Explain the limitations of checking shaft alignment solely by hydraulic jacking methods.

2022/DEC/08 **2023/AUG/05** **2024/JUN/04** **2024/DEC/07** **2025/SEP/08**

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5.) With respect to Energy efficient running of ships.
a) Sketch and explain the optimization of propeller hull interface flow devices and improvement of propulsion efficiency.
b) sketch and explain the optimization of Auxiliary machinery using VFDs.

2021/SEP/07 **2022/FEB/07** **2023/NOV/09** **2024/JUN/05**

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6.a) Examine in detail three common but entirely different reasons for loss of steering gear systems.
b) State how failure is inhibited in the design, operation and maintenance of steering gear systems
c) Describe how a vessel may make port upon irreparable failure of the steering telemotor.

2024/JUN/06 **2025/FEB/08**

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7.a) Draw a block diagram for a fully automated accommodation air conditioning unit, Tabelling the component parts and indicating the directions of air flow.
b) Explain 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?

2024/JUN/07 **2025/SEP/04**

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8. Sketch and describe a stockless anchor illustrating the method or device used to attach to the chain cable. When the anchor and cable are ranged during the ships underwater survey what parts require special attention and what defects are likely to be discovered.

2023/NOV/03 **2024/JUN/09** **2025/JAN/04**

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9. Explain how the ingress of sea water is prevented in an oil lubricated stern bearing system. Should the system fall, describe the corrective action possible whilst the vessel is afloat. State why two stern bearing oil header tanks are fitted in some instances?

2023/NOV/03 **2024/JUN/09** **2025/JAN/04**

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JUL-2024

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.

2022/JUL/05 **2022/OCT/04** **2023/OCT/05** **2024/JAN/07** **2024/JUL/01** **2025/NOV/01**

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2.a) Define creep and specify the conditions under which it occurs?
b) Discuss three 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**

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3a) Describe, with the aid of a sketch, an open loop system for reducing 50x emissions from engine exhaust gas, explaining how the system operates whilst the vessel is in open waters.

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.

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

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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.

2023/AUG/03 **2024/JUL/04** **2025/FEB/04** **2025/JUN/04** – **2025/OCT/04** **2025/NOV/04**

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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.

b) Name the alternate refrigerant gases available and being used onboard.

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.

2023/JAN/04 **2023/MAR/03** **2023/JUN/02** **2024/JUL/05** **2025/NOV/05**

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6.a) 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

(c) Discuss the single fuel concept.

2023/APR/05 **2024/JUL/06** **2025/JUN/06** **2025/NOV/06**

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7.a) Explain the concept of a fail-safe and fail-set system on a ship, providing examples of each system.

b) Describe the advantages and disadvantages of both systems.
c) How do the design differences impact the overall reliability and safety of the vessel.

2024/JUL/07 **2025/JUN/07** **2025/NOV/07**

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8.a) 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.
b). Describe the operation of the system sketched in part.

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2023/JUN/06 **2024/JUL/08** **2025/JUN/08**

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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.

2024/JUL/09 **2025/JUN/09** **2025/NOV/09**

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AUG -2024

1.a) Describe the key phases and microstructures present in the iron-carbon equilibrium diagram and explain their significance in the heat treatment of steel.
b) How do the different regions of the iron-carbon diagram influence the mechanical properties of steel such as hardness, toughness, and ductility? Provide example of how specific compositions and heat treatments can achieve desired properties.

2024/AUG/01 **2025/APR/03**

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2. a) Explain with a sketch the operation of a automatic expansion valve as fitted in the direct expansion refrigeration plants. How is this valve adjusted?

b) Explain how critical temperature restricts plant operation and how this limitation can be overcome?
c) Explain how this system maintains the provision rooms at different temperatures?

2022/OCT/08 **2023/FEB/03** **2024/AUG/02** **2025/MAR/07**

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3. With reference to inert gas generator fitted on gas carriers:
a) Sketch a line diagram showing a typical inert gas system used for inerting in gas carriers, labelling the component parts.
b) Describe the system.
c) State the function of a chiller used in this type of inert gas generator.

2023/JUN/09 **2024/AUG/03**

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4. What are the key parameters analysed During lab testing of lubricating oll used in ship machinery And how do these test results help in determining the condition of the oil and the health of the machinery.

2024/AUG/04

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5. With reference to main propulsion shaft system:
a) Describe a method of the hydraulic jacking to check bearing loads.
b) Sketch the bearing load versus shift lift dial Gauge reading graph obtained by the method described in part (a) annotating the graph and how the characteristic of bearing load is obtained.

2023/NOV/08 **2024/AUG/05**

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6. With reference to a four- ram hydraulic gear having duplicate pumps-
a) Sketch the arrangement of relief make up, isolating and by-pass valves.
b) Explain the use of isolating and by – pass valves, if one of the cylinders has fractured.
c) Describe the arrangement provided to indicate the loss of hydraulic fluid due to leakage.

2024/AUG/06

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7.With reference to chemical tanker
a) sketch a suitable cargo pumping and stripping system labelling the component parts and indicating the direction of fluid flow.
b) State the requirement of the regulations evolved to reduce pollution of the sea by chemical tanker cargoes.
2024/AUG/07
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8.How to 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?
2024/AUG/08 **2025/APR/02**
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9.A) Explain electro chemical reaction and the difference between oxidation and reduction electro chemical reactions with examples. Which reactions occurs at the anode and cathode?
b) Explain galvanic corrosion and discuss the different procedures to prevent it.
2022/NOV/09 **2023/FEB/06** **2023/APR/01** **2023/SEP/04** – **2024/AUG/09** **2025/JAN/09**
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SEP-2024

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1. With reference to radial lip seals for propulsion shafting:
a) Describe, with the aid of a sketch, an outboard seal arrangement as fitted to an oil lubricated stern tube
b) Explain, with reasons, the possible actions that should be taken in the event of loss of oil from the header tank.
2022/FEB/03 **2021/DEC/09** **2021/SEP/03** **2021/AUG/04** – **2022/JUL/01** **2024/SEP/01**

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2.a) Describe the design and construction features of a bed plate of a large marine engine, including the materials used and why they are selected for this application.
b) Discuss the importance of the bed plate in ensuring the proper alignment and support of the engine components. Include in your answer how it handles the loads and stresses during engine operation.
2024/SEP/02
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3a) Explain the key parameters tested during the laboratory analysis of marine fuel oil and their impact on engine operation if they are not in range
b) What remedial measures should be taken if the fuel oil parameters are found to be out of acceptable range? Discuss the potential actions for issues like high water content, excessive sulphur, low flashpoint, Acid number and Ash content.
2024/SEP/03
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4,a) Sketch and describe a valve suitable for reducing air pressure and maintaining the feduced pressure within close limits.
b). Describe the processes through which air from the starting air receivers should be treated before it is used in a pneumatic control system
2023/MAR/08 **2023/NOV/02** **2024/SEP/04**
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5 With reference to hydraulic steering gears, sketch and describe each of the following:
(A)Single failure concept
(B)100 Percent redundancy.
2024/SEP/05
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6. a) Describe, with the aid of a sketch, an external system for reducing engine NOx explaining the chemistry of the process. emission,

b) Explain why Urea is used in the selective catalytic reduction process instead of ammonia.
(c) Explain why the exhaust gas quality must be monitored before and after the selective catalytic reduction unit, stating how such monitoring influences operation of the SCR unit.
2023/DEC/06 **2024/SEP/06**
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7. a) Sketch diagrammatically an auxiliary boiler automatic combustion control system and explain how it operates.
b) Specify how 'fail-safe' conditions are ensured.
c) How, the master controller follows steam pressure variations and air fuel ratio is adjusted
2022/NOV/08 **2024/SEP/07**
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8. With reference to propeller shaft alignment:
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
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9. a) Define creep and specify the conditions under which it occurs?
b) Discuss three 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**
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OCT-2024

1.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.

c) List the different sophisticated coatings which are available
2021/AUG/03 **2022/DEC/06** **2023/APR/06** **2023/JUL/04** **2024/OCT/01** **2025/MAR/06**
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2. a) Define the term Torsional Vibration with respect to an engine crankshaft, stating the effect that high levels can have on an engine crankshaft.
b) Explain how engine deterioration influences the risk of Torsional Vibration, stating what can be done to minimise that risk.
c) Explain possible reasons for the activation of a Torsional Vibration alarm after an engine has been started if there had been no previous history of such an alarm and if no maintenance had been undertaken on the engine whilst it was stopped.
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3.a) Explain why centrifugal pumps cannot handle air or vapours to effect priming yet turbo-blowers operating on the same principle can.
b). If a vessel is fully laden, how may it be ascertained that the fire pump priming arrangements would operate satisfactorily in the ballast condition.
c) Explain a suitable method of priming suitable for a centrifugal pump.
2022/JAN/07 **2024/OCT/03**
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4. State why the temperature of lubricating oll supplied to an engine needs close control. Sketch and describe an arrangement and explain the principle of operation of instrumentation and control equipment for automatically maintaining the temperature of lubricating oil supplied to an engine at its desired value.
2023/FEB/07 **2023/APR/09** **2024/OCT/04**
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5. (a) Define proportional control action.
b) Sketch and describe a simple pneumatic proportional controller.
c) State a process where a proportional controlier may be employed.
d) State the disadvantage of proportional only action.
2022/DEC/09 **2024/OCT/05** **2025/SEP/09**

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6. What are the major types of stainless steels used on merchant ships? Briefly explain each type. Which grades would you recommended for use in sea water environment? Why?
2022/JUL/07 **2024/OCT/06**
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7. With respect to the refrigeration system on board vessels, answer the following
a) Why are some TEVs fitted with an external equalizing connection?
b) What is the purpose of a back pressure valve. what will the effect if it leaks?
c)How does an electronic TEV function
2023/JUL/07 **2023/SEP/06** **2023/NOV/04** **2024/OCT/07**
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8. Sketch and describe a "fail safe steering gear" suitable for use on a tanker of more than 100,000 T dwt; Explain the sequence of events that take place when an oil leak takes place in any of the hydraulic pipelines.
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9. a) Define fatigue and fracture and specify the conditions under which it occurs.
b) Describe the different fracture modes and the mechanism of crack propagation in different fracture modes.
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NOV 2024

1. 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.
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2. 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.
2022/DEC/03 **2023/JUN/04** **2023/OCT/02** **2024/MAR/02** **2024/NOV/02**
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3. With reference to keyless propellers explain:
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
2022/SEP/06 **2024/NOV/03**
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4. In a Rotary vane steering gear, briefly state.
a) How are the fixed and moving vanes attached to cylinder and rotor respectively.
b) How many sets of vanes are provided? What is the limitation factor to number of vanes.
c) How is strength imparted to moving vanes to enable them to act as rudder stops?
d) How is rudder uplift accommodated
2022/SEP/08 **2024/NOV/04**
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5. Detail the desirable properties of a refrigerant. Make a table and compare following refrigerants for use in a provision cooling plant for a 50000 DWT Oil tanker: R-22, R-134a.
2023/AUG/09 **2023/DEC/03** **2024/APR/08** **2024/NOV/05**
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6.a) Explain the necessity of intercoolers on a multi-stage compressor. b) What attention is required to keep them safe and in good working order? Sketch and describe an intercooler suitable for a 2400kPa compressor and state materials used.
b) What attention is needed before opening up an air compressor for inspection?
c) What faults are likely to develop in an air compressor and how are they remedied

2021/MAR/06 **2022/FEB/08** **2017/JAN/04** **2024/NOV/06**

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7. Sketch and describe a boiler water level controller of the float operated type. State the reasons for having this mechanism on the boiler and using this controller and boiler for analogy explain the following terms.
a) Detecting element
b) Servo motor
c)Desired Value

2021/FEB/04 **2022/JAN/03** **2022/JUN/07** **2023/NOV/01** **2024/NOV/07**

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8. A shipping company is investigating the possibility of converting a vessel from a traditionally manned engine room to Unattended Machinery Space (UMS) operations. As Second Engineer Officer sailing on the vessel, write a report to the Superintendent Engineer listing the essential requirements for UMS classification and any additional work required.

2023/NOV/07 **2024/NOV/08**

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9. 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.
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DEC -2024

1. You have been appointed as Second Engineer of an older vessel which is in dry-dock and recently been purchased by your shipping company. Describe, in detail about your inspection, to ensure that the equipment's on-board ship related to safety equipment survey are satisfactorily complied with. (16)
2024/DEC/01
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2.Sketch a high-lift safety-valve lid and seat detailing their special features. Describe how such a valve is overhauled and any clearances that should be measured and noted.(16)
2024/DEC/02
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3.a) Sketch and describe TWO methods that employ manometric means for measuring tank contents. (6)
b) State what corrections are made to the readings obtained by the methods described in (a) in order to gauge the mass contents.(5)
c) Explain how bunkering requirements may be estimated when no records of main engine fuel consumption are available on board. (5)
2024/DEC/03
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4. A Sketch a sealing arrangement for an oil lubricated stern tube.
a) Identify the common form of seal failure.
b) State how oil loss due to seal failure can be restricted whist on passage.

c) What material is used for sealing ring and propeller shaft liner?
2023/JUN/03 **2023/AUG/01** **2024/APR/09** **2024/DEC/04**
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5.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.(5)
c) State the factors which influence the possibility of fatigue cracking of a bed-plate transverse girder and explain how the risk of such cracking can be minimized.
2023/APR/08 **2023/DEC/09**
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6.With respect to tankers describe.
a) How a pump room is ventilated.
b) How cargo tanks are ventilated
c)Cargo tank protection as per SOLAS 1974.
d)Additional alarms provided for inert gas systems of the 'inert gas generator type.
2024/DEC/06
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7.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 (16)
2022/DEC/08 **2023/AUG/05** **2024/JUN/04** **2024/DEC/07** **2025/SEP/08**
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8. With reference to oll / water separators:
a) Describes with the aid of a sketch, the working of such a separator. (6)

b) Explain the consequence if the interface detector position is Incorrect.
c) Enumerate the various possibilities by which oil / water interface can be moved. (6)

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9.a) State the advantages of using steam turbine propulsion power for vessels carrying (8)
L. N. G. cargo(8)
b) With regard to the use of LNG 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

2022/JUL/03 **2022/DEC/03** **2023/JUN/04** **2023/OCT/02** **2024/MAR/02** **2024/NOV/02** **2024/DEC/09** **2025/SEP/03**

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