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-2022

Q1. A. Describe an automatic self-de-sludging centrifuge suitable for dealing with fuel of density up to 1010 kg/m3 at 150C;
B. Explain how the centrifuge described in Q4 (a) is able to remove water from a fuel which has a density that is higher than that of water and state factors that may assist the operation.
C. As Second Engineer, write down the start-up procedure for the centrifuge described in Q1 (A) for the benefit of your staff;
D. State how is the problem of catalytic fines in fuel oil may be dealt with.
2022/JAN/01
Click Here to See the Answer

Q2.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 turbo-charger:
i. For fault analysis;
ii. For condition monitoring with respect to maintenance;
iii. As a substitute to opening up machinery for survey.
2022/JAN/02 **2022/DEC/01** **2025/SEP/01**
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Q3. 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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Q4. With reference to hydraulic steering gears, sketch and describe each of the following:
(A)Single failure concept;

(B)100 Percent redundancy.
2022/DEC/07 **2024/FEB/08**
Click Here to See the Answer

Q5. A. State why fixed pitch propellers have a poor efficiency when going astern.
B. With reference to controllable pitch propellers state:
i. Why is it preferable that the main servomotor be housed in the propeller hub rather than in the shafting forward of the propeller shaft?
ii. What regular maintenance and checks should be carried out to ensure maximum reliability of the gear at all times?
2023/MAR/05 **2023/JUL/03**
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Q6. 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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Q7. 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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Q8. (a) Explain Creep, Brinelling, Fretting and Fretting corrosion.
(b) Where and why does creep, Brinelling, Fretting and Fretting corrosion occur in a ship propulsion system?
2025/APR/09

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Q9. Reverse osmosis is one of the alternative method 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**
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FEB-2022

Q1. (a) Explain at least three features which assist in the starting of lifeboat engines in cold climate conditions.
(b) Describe TWO devices that control the rate of fall of a lifeboat when launched from standard davits
(C) With reference to Resolution MSC 402(96) and M.S. Notice 1 of 2020 on life boats, rescue boats, launching appliances and release gear; state who are authorized /allowed to carry out following routine jobs:
(i) Weekly and monthly inspections and routine maintenance
(ii) Annual thorough examinations and operational tests
(iii) Five-year thorough examination, overhaul, overload operational tests and repair.
2023/JAN/03 **2025/JUL/04** **2025/AUG/06**
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Q2. 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.

2021/JAN/01 **2021/APR/04** **2021/SEP/09** **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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Q3. 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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Q4. (a) Discuss the principle, different methodologies, advantages, limitations & applications of Ultrasonic testing.
(b) Explain how Magnetic Particle Testing (MPT) is carried out in different ways? State its advantages, limitations and applications

2021/OCT/04 **2021/NOV/03** **2021/DEC/07** **2022/FEB/04**

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Q5. 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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Q6. With 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.

2020/DEC/08 **2021/SEP/06** **2022/FEB/06** **2022/APR/02** **2025/APR/01**

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Q7. 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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Q8. A. Explain the necessity of intercoolers on a multi-stage compressor. 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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Q9. With reference to fatigue of engineering components:
A. Explain the influence of stress level at cyclical frequency on expected operating life.
B. Explain the influence of material defects on the safe operating life of engineering component.
C. State the factors which influence the possibility of fatigue cracking of an auxiliary boiler feed water pump shaft and explain how the risk of such cracking can be minimized.

2023/APR/08 **2023/DEC/09**

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MAR-2022

Q1. With regard to NOx control requirements of Annex VI:
(a) Explain Tier I, Tier II and Tier III requirements.
(b) Briefly explain NOx technical code and NOx Technical file. What entries are required to make in onboard NOx Technical file.
(c) The control of diesel engine NOx emissions is achieved by what means?
(d) Explain with a simple sketch any two systems for NOx emission reduction.
2022/MAR/01
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Q2. A. Describe the procedure to be adopted for the inspection of a safety valve fitted to an exhaust gas fired auxiliary boiler stating, with reasons, which parts should receive particularly close attention.
B. Describe the procedure for the setting of safety valves of exhaust gas operated auxiliary boilers;
C. Explain the required action a watch-keeping engineer should take after the setting of safety valves as in
2021/JAN/04 **2021/JUL/03** **2021/AUG/07** **2021/NOV/05**
2022/MAR/02
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Q3. 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.
2021/FEB/01 **2021/JUL/06** **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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Q4. 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.
2021/NOV/08 **2022/MAR/04** **2023/SEP/07** **2025/MAR/09**

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2021/FEB/02 **2021/JUL/02** **2021/SEP/01** **2022/FEB/09** **2022/MAR/05** **2022/APR/03** **2023/APR/08** **2023/DEC/09**
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Q6. 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.
2023/JAN/09 **2024/JAN/02**
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Q7. 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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Q8. Explain how the ingress of sea water is prevented in an oil 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?
2023/NOV/03 **2024/JUN/09** **2025/JAN/04**
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Q9. With reference to multi-tubular heat exchangers explain:
(A) How and where impingement attack is likely to occur in the tubes
(B) Why is it desirable that coolant flow rate should not exceed that required to maintain correct fluid temperature
(C) Ample well-shaped water boxes and smooth tube inlets are desirable
(D) Partial obstruction of tube bore is a common cause of tube failure
2022/MAR/09
Click Here to See the Answer

APR-2022

Q1. 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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Q2. With reference to the fuel standards ISO-8217-2017 discuss the amendments made as compared to its previous edition. Explain the significance of the following:
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2021/SEP/06 **2022/FEB/06** **2022/APR/02** **2025/APR/01**
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C. State the factors which influence the possibility of fatigue cracking of an auxiliary boiler feed water pump shaft and explain how the risk of such cracking can be minimized.
2024/DEC/05
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Q4. 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.
2021/JAN/08 **2021/MAR/03** **2021/DEC/01** **2022/APR/04** **2023/SEP/02** **2024/JAN/01**
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Q5. 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**
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Q6. 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 (A);
C. State the advantages of the system described in (A) compared with containers with their own refrigeration self contained units.
2021/FEB/08 **2021/APR/08** **2022/APR/06** **2022/JUN/06** **2022/NOV/07** **2025/AUG/04**
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Q7. With reference to fuel oil viscosity:
(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.
2021/SEP/04 **2021/DEC/04** **2022/APR/07**
2025/APR/05
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Q8. You were asked to join a ship as second engineer. During briefing you were informed about frequent boiler uptake fires happening onboard. prepare a plan for to reduce boiler uptake fires. How will you monitor the progress of your plan and what instructions you will issue to the watch keepers?
2021/FEB/05 **2022/APR/08**
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Q9. 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.
2021/JAN/01 **2021/APR/04** **2021/SEP/09** **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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JUNE-2022

Q1. Describe following types of lubrication system with suitable examples
(a) Hydrodynamic Lubrication
(b) Hydrostatic lubrication
(c) Elasto-hydrodynamic lubrication
(d) Boundary lubrication
2022/JUN/01
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Q2. With respect to the properties of fuel oil, explain the significance of the following terms.
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2021/FEB/01 **2021/JUL/06** **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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Q3. 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 one of the hydraulic pipe lines.
Click Here to See the Answer

Q4. 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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Q5. 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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Q6. With Respect to Container Ship: -
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2022/NOV/07 **2025/AUG/04**
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Q7. 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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Q8: A new vessel exhibits severe aft end vibration
A. As a Second Engineer Officer, outline a procedure to investigate and identify the source of vibration
B. Suggest possible remedies to obviate / reduce aft end vibration.
2022/NOV/05
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Q9. With simple sketch explain working of Direct acting pressure reducing valve and Pilot operated pressure reducing valve. Define state of equilibrium with respect to reducing valves.

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JULY-2022

Q1. 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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Q2. A. State why fixed pitch propellers have a poor efficiency when going astern.
B. With reference to controllable pitch propellers state:
i. Why is it preferable that the main servomotor be housed in the propeller hub rather than in the shafting forward of the propeller shaft?
ii. What regular maintenance and checks should be carried out to ensure maximum reliability of the gear at all times?
2023/MAR/05 **2023/JUL/03** **2022/JAN/05** **2022/JUL/02**
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Q3. A. State the advantages of using steam turbine propulsion power for vessels carrying L.N.G as 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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Q4. As a Second engineer, how will you guide your subordinate engaged in sampling of ballast water as per the Port State Control requirement regarding (i) Discharge line sampling (ii) In-tank sampling (iii) Health and safety protocols during sampling.

2022/JUL/04
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Q5. 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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Q6. 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.
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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Q7. 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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Q8. 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.
2021/NOV/07 2022/JUL/08 2025/AUG/05
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Q9. (a) What different methods are used for preserving ships 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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AUG-2022

Q1. (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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Q2. With respect to the survey of diesel main propulsion machinery by Classification Society:
(a) Explain the term Continuous Survey of Machinery (CSM).
(b) Explain how Class has reduced the need for attendance by the surveyor for some work.
(c) Describe how a planned maintenance scheme may be used to advantage with CSM.
(d) Describe TWO programs that are approved by the Class in order that physical opening up machinery is not necessary on every occasion.
2022/AUG/02 **2023/OCT/04**
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Q3. 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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Q4. Exhaust gas cleaning system is one of the system 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.
(c) What action you will take as second engineer if the system stopped working.
2022/AUG/04 **2022/NOV/04** **2023/OCT/07** **2025/FEB/07**
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Q5. With reference to static oily water separators, explain each of the following;
(a) Why the supply pump should be carefully selected and matched to the separator.
(b) How the separator achieves effective separation?
(C) How the physical properties of each of the fluids to be separated affects the rate and effectiveness of separation?
2022/AUG/05
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Q6. Describe, with the aid of a graph, each of the following types of ferrous material failure, stating one practical example of each and how these material failures can be prevented during manufacturing and during operation
(a) Creep
(b) Fatigue
(c) Fracture
2022/AUG/06
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Q7. With reference to sleeved keyless propeller assemblies:
(i) State, with reasons, the metals used in the manufacture of the sleeve and tail end shaft;
(ii)State the type and thickness of material used to bond the sleeve to the propeller boss.
B. When removing the propeller from the tail end shaft, state why the following procedures are not recommended:
(i) Application of push off force by means of wedges or jacks and draw off force by strong back;
(ii) Expansion of propeller boss by concentrated local heating with gas torches.
C. State the correct procedure for the removal of the propeller from tail end shaft.
2022/AUG/07 **2023/JAN/07**
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Q8. Explain the causes of the formation of mil scale on steel plate.
(b) Describe the preparation necessary before the application of conventional paints to the underwater surface of the hull.
(c) Describe a coating scheme for the underwater hull using conventional paints.
2023/OCT/06
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Q9. With reference to ships air conditioning plants:
(a) state the temperatures and relative humidity at EACH of the points that are regarded as the boundaries of the comfort zone;
(b) explain how the temperatures and relative humidity could be maintained within the comfort zone whenthe ship is in EACH of the following locations:
(i) North West Europe in winter;
(ii) Arabian Gulf in summer.
(c) State with reasons FOUR locations within the accommodation that conditioned air must not be recirculated.
2022/AUG/09
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SEP-2022

Q1. With reference to automatic sprinkler system for firefighting purposes:
a) Explain, with the aid of a heat release versus time diagram, the difference between fire control and fire suppression
b) State the limitations of using glass bulb to activate sprinkler heads and suggest, with reasons, an alternative mechanism
c) The safety devices incorporated in the system
d) The parameters governing the volume of the pressure tank
2022/SEP/01 **2023/DEC/02**
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Q2. 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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Q3. 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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Q4. (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.
(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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Q5. Briefly discuss the following and state how these 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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Q6. 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** **2025/APR/08**

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Q7. With reference to main boiler super heater arrangements:
A. Compare the advantages and disadvantages of contra flow with parallel flow design.
B. Describe how the element tube banks are supported yet allow for expansion.
C. Describe how boiler carryover affects super heater effectiveness and condition.

2022/SEP/07 **2023/SEP/09** **2025/FEB/03**

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Q8. 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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Q9. Misalignment of the Main shafting between engine and propeller causes bearing overloads and shaft stress.
a) State the difficulties associated with checking the shaft alignment and the reasons why results are unreliable due to external factors.
b) State the reasons for misalignment
c) Explain with a simple sketch how a bearing load is assessed.
d) Explain how uneven loading could be rectified
e) Why wear down in main bearings is critical to the condition of the condition of the crankshaft and propeller system.
2021/AUG/04 **2022/FEB/04** **2024/MAR/05**
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OCT-2022

Q1. Discuss, with reference to the superheater outlet temperature of the main boiler operating at a constant load, the following statements:
a) An increase in excess air will tend to cause a decrease in superheater outlet temperature due to the cooling effect of more air being introduced.
b) A decrease in economizer inlet temperature will tend to cause a decrease in super heater outlet temperature due to the cooling effect of more water being introduced.
c) Badly fouled generating tube banks will cause an increase in the super heater outlet temperature.
d) Excessive amounts of total dissolved solids in the boiler water will cause variations in the super heater outlet temperature.
2023/APR/02
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2.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.
2022/OCT/02 **2024/OCT/09**
Click Here to See the Answer

Q3. 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/OCT/03 **2024/JAN/06** **2024/SEP/08** **2025/APR/06**
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Q4. 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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Q5. 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**
Click Here to See the Answer

Q6.a) Define the cause and effect of thermal stressing in cylinder heads, liners, and pistons.

b) Explain why thermal stressing is aggravated with an increase in the cylinder bore.
c)Explain how stress concentration and it's effects is relieved by maintenance and operational practices.
2022/OCT/06
Click Here to See the Answer

Q7. With reference to air conditioning units
a) With the aid of a sketch, explain the operation of a unit that includes means of dehumidifying, humidifying, and refrigerated cooling.
b) (i) Describe the conditions that could lead to legionella growth.
(ii) List the precautions necessary in the maintenance of air conditioning systems to reduce the risk of legionnaires disease being contacted.
2022/OCT/07
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Q8.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?
b) Explain how critical temperature restricts plant operation and how these limitations 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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Q9. (a) Describe the properties of each of the following alloys used in marine engineering, giving a practical example for which, each is suited:
(i) cupro-nickel
(ii) white metal
(iii) titanium.
b) Discuss the merits of EACH of the following alloys for use in the casting of large propellers:
(i) nickel aluminium bronze
(ii) stainless steel.
c) Describe the tests that may be carried out on steel to be used for ship's side plating.

2022/OCT/09
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NOV-2022

1.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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2. With respect to bunkers handling on ships using LNG as alternative fuel, discuss the following:
(a) How are the bunkers taken onboard ships tanks?
(b) Discuss the check lists, arrival checks and factors to be considered for bunkering?
(c) Risk analysis methodology to ensure safe bunkering operations?
(d) Explain how the bunker is prepared and used onboard the engines?
2022/NOV/02
Click Here to See the Answer

3.a) Sketch a transmission shaft coupling which enables the propeller shaft to be withdrawn outboard.
b) (i) Describe the coupling and the method of fitting and dismantling. (i) State how the grip of the coupling can be checked when fitted
(iii) State what safety precaution should be taken when dismantling the coupling.
2022/NOV/03 2025/JAN/07
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4. 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 IMOregulations.
(c) What action you would take as second engineer if the system stopped working.
2022/AUG/04 **2022/NOV/04** **2023/OCT/07** **2025/FEB/07**
Click Here to See the Answer

5. A new vessel exhibits severe aft end vibration
a) As a Second Engineer Officer, outline a procedure to investigate and identify the source of vibration
b) Suggest possible remedies to obviate / reduce aft end vibration.
2021/FEB/09 **2022/JUN/08** **2022/NOV/05**
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7.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 and disadvantages of the system described in . compared with containers with their own refrigeration self-contained units.
2022/NOV/07 **2025/AUG/04**
Click Here to See the Answer

8. 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**
Click Here to See the Answer

9.a) Explain electro chemical reactions and the difference between oxidation and reduction electrochemical 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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DEC-2022

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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**
Click Here to See the Answer

Q2. With respect to bunkers handling on ships using LNG as alternative fuel, discuss the following:
(a) How are the bunkers taken onboard ships tanks?
(b) Discuss the check lists, arrival checks and factors to be considered for bunkering?
(c) Risk analysis methodology to ensure safe bunkering operations?
(d) Explain how the bunker is prepared and used onboard the engines?
2022/NOV/02
Click Here to See the Answer.

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2022/NOV/03 **2025/JAN/07**
Click Here to See the Answer

Q4. Exhaust gas cleaning system is one of the systems used on board ship to reduce SOX emissions-

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Click Here to See the Answer

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2021/FEB/09 **2022/JUN/08** **2022/NOV/05**
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Q6. Briefly describe the tests made on a piece of metal to determine its suitability for use in engineering. Explain clearly what is meant by any four of the following metallurgical terms:
(a) Work hardening,
(b) Case hardening,
(c) Annealing.
(d) Normalising,
(e) Nitriding.
Click Here to See the Answer

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c) State the advantages and disadvantages of the system described in . compared with containers with their own refrigeration self-contained units.
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2022/NOV/07 **2025/AUG/04**
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2022/NOV/08 **2024/SEP/07**

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2022/NOV/09 **2023/FEB/06** **2023/APR/01** **2023/SEP/04** **2024/AUG/09** **2025/JAN/09**

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