D. MARINE
Study Material

MEO CLASS 2 WRITTEN: EKM

(ENGINEERING KNOWLEDGE MOTOR)

FOR INDIAN COMPETENCY EXAM

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D. MARINE
Study Material

JAN-2023

Q1. A. Discuss the nature of the forces to which a main engine crankshaft is subjected in normal service and explain how the resulting stress are maintained at a safe limit by design and efficient maintenance respectively.
B. Indicate the circumstances under which the crankshaft may--
i. over stressed;
ii. Become defective without being over stressed.
2021/JAN/Q4 **2023/JAN/Q1**
Click Here to See the Answer

Q2. With reference to four stroke diesel engine emission control:
(a) Describe how the Miller Cycle operates to control NOx emissions;
(b) Describe, with reasons, the modifications needed for a medium speed engine to operate on the Miller Cycle;
(c) give the advantages and disadvantages of closed against open scrubber systems.
2023/JAN/Q2
Click Here to See the Answer

Q3. Describe the developments that have taken place in the design of bearings of slow speed marine diesel engines, including geometry and material, focusing on the reasons for such changes.
2023/JAN/Q3
Click Here to See the Answer

Q4. A. What is "virtual tappet" in the hydraulically actuated air spring return exhaust valves, and how is it set.
B. Explain why the damage occurs to the seats of the exhaust valves due to furrowing and cutting.
C. How an incident of "valve drop" leading to extensive damage to running gear can occur.
2023/JAN/Q4
Click Here to See the Answer

Q5. With regards to modern 4-stroke diesel engine explain the following;
A. The function of protection ring installed on the upper part of liner;
B. The modification in fuel injection drive system compared to conventional 4-stroke engine;
C. Staggering of layout for multi hole nozzles;
D. Effect of swirl and squish during the combustion process and how swirl and squish is generated.

2023/JAN/Q5

Click Here to See the Answer

Q6. Discuss the key factors considered when the power density of 2 stroke diesel engines is being increased.
a) Explain how T/C performance curves are matched to the propulsion engine requirements?
b) Explain how the engine performance is matched to the propulsion power?
c) Explain the influence of the calculation of the intermediate shafting system for a given power of the engine and propeller diameter?

2023/JAN/Q6

Click Here to See the Answer

Q7. If a main engine piston seizes in its liner at sea and it is not possible to replace the unit, explain, in detail, what provisions are made in the engine, to enable the ship to reach port?

2023/JAN/Q7

Click Here to See the Answer

Q8. 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.

2023/JAN/Q8

Click Here to See the Answer

Q9. A. Explain the term Variable Injection Timing (VIT) when applied to fuel pumps and state why a change in timing of fuel injection may be required.;
B. Describe, with the aid of sketches a VIT fuel pump and explain how the change in timing is achieved whilst the pump is in operation
C. Explain how it may be determined that individual fuel pumps are injecting the correct quantity of fuel with the correct timing at a particular pump setting.
2021/APR/Q7 **2021/JUL/Q6 2021/AUG/Q6** **2022/FEB/Q6** **2022/SEP/Q2**
Click Here to See the Answer

FEB-2023

Q1. (a) Explain why highly efficient diesel engines tend to produce more NOx than low performance diesel engines.
(b) Describe, with the aid of a sketch, a Selective Catalytic Reduction (SCR) unit for a marine propulsion diesel engine.
(c) Explain why accurate monitoring of the exhaust gas flows entering and leaving a Selective Catalytic Reduction unit are required and how these readings are used to control the reduction chemical supplied to the SCR unit.
2022/AUG/Q6 **2023/FEB/Q1**
Click Here to See the Answer

Q2. With reference to diesel engine SOX exhaust gas cleaning and pollution control:
(a) State, with reasons, which system parameters are monitored, explaining where the monitoring devices are located, how the data is stored and how data is made available to regulatory authorities
(b) State how pollution of sea water can be caused by the use of SOX exhaust gas cleaning systems, explaining how such pollution is prevented.
2023/FEB/Q2
Click Here to See the Answer

Q3. With reference to a main engine fuel system of the high pressure common rail type
(a) Sketch a common rail fuel injection system from booster pump inlet to cylinder head fuel valves, labelling the MAIN components;
(b) Explain how the fuel pumps are operated and the common rail pressure is maintained;
(c) Explain how fuel injection timing and quantity is regulated for the common rail fuel system sketched in part (a).
2023/FEB/Q3
Click Here to See the Answer

Q4. (a) Explain how the build-up of residue in the scavenge space of a large slow speed two stroke engine is minimized by design, operation, and maintenance.
(b) Explain the possible damage which could be caused by a scavenge fire.
2023/FEB/Q4
Click Here to See the Answer

Q5. With reference to power Management Systems:
(a) Describe, with the aid of sketches, a starting air systems;
(b) State the precautions and conditions which must be observed when an auxiliary engine is under control of the Power Management Systems;
(c) Explain how an auxiliary engine is started when under the control of the Power Management System.
2023/FEB/Q5
Click Here to See the Answer

6. a) For a large slow speed direct reversing engine, describe in detail the profile of a cam suitable for fuel pump operation in either the ahead or astern mode
b) With respect to cam material, describe the heat treatment employed during manufacture.
c) Explain how the position of the cam relative to the crankshaft is altered when changing from ahead to astern running,
d) State how the position of the cam would be correctly set if it were replaced.

2023/FEB/Q6
Click Here to See the Answer

7. During recent months It has been necessary to frequently retighten some main engine holding down bolts as the steel chocks have become loose:
(a) Explain possible reasons for this.
(b) State with reasons why re-chocking using a different material might reduce the Incidence
(c) Explain the possible consequences if the situation is allowed to continue unchecked.

2023/FEB/Q7
Click Here to See the Answer

Q8. With reference to fatigue of engineering components;
(a) Draw an S/N curve for steel, showing the fatigue limit and two representative stress cycle condition on the graph
(b) Explain how a component is designed to avoid fatigue failure, suing the S/N curve drawn in part (a)
(c) Explain how poor maintenance and incorrect machinery operation can result in fatigue failure even though a component is designed to operate below the fatigue limit

2023/FEB/Q8
Click Here to See the Answer

Q9. A report on the analysis of the main crosshead engine crankcase lubricating oil indicates the following contaminants or property changes. In EACH of the following cases give reasons for the possible causes of the contamination or property change, explaining how the actual cause would be detected; .
A. The presence of fresh water;
B. White metal fragments;
C. Reduced alkalinity reserve;
D. Reduced anti oxidation reserve.

2023/FEB/Q9
Click Here to See the Answer

MAR-2023

Q1. A) Explain with a simple sketch the principle of a hybrid turbo charger, what are the advantages? What are the challenges? (8)
b) Discuss the statement in detail, "Hybrid turbo charger will improve overall plant efficiency" (8)
2023/MAR/Q1
Click Here to See the Answer

Q2. Control air is essential for shipboard machinery pneumatic systems for efficient operation, discuss the need of quality air for pneumatic systems in present modern machinery
(b) What are the different types of air dryers? Which dryer is more energy efficient and why (8)
2023/MAR/Q2
Click Here to See the Answer

Q3. As second engineer you have been requested to obtain a set of indicator card from the large slow speed engine of a recently purchased second hand ship.
A. Describe your initial checks and preparations;
B. State with reason the types of card you would consider necessary and explain the procedure for obtaining these;
C. State in order of importance the additional information required with the card;
D. State your procedure for analysis of the cards and obtaining cylinder powers.
2020/NOV/Q3 **2021/APR/Q3** **2023/MAR/Q3**
Click Here to See the Answer

Q4. With reference to mechanical/hydraulic governors explain:
A. Why flyweights are driven at a higher rotational speed than the engine;
B. How dead band effects are reduced;
C. How hunting is reduced;

D. How the output torque is increased.
2020/NOV/Q8 **2022/MAR/Q5** **2022/JUN/Q6** **2023/MAR/Q4**
Click Here to See the Answer

Q5. Accidental grounding of the ship in which you are second engineer has occurred while on passage between ports.
a) Describe your immediate concerns as attempts are made to re-float the ship using the main engines
b) Following failure to re-float and assuming operation on residual fuel at the time of the accident state your next priorities (5)
c) Describe any checks or inspection you Consider necessary before restarting the main engine after the ship has been re-floated (5)
2023/MAR/Q5
Click Here to See the Answer

Q6. You have been appointed as Second engineer to a new vessel that experiences severe aft end vibrations. The problem is sought to emanate from the propeller. Describe the cause of vibration and suggest possible remedies including the selection a new propeller with a different number of bladed.
2023/MAR/Q6
Click Here to See the Answer

Q7. A. Discuss the principal forces a large diesel engine crankshaft must withstand while in service and how the stresses resulting from these forces are kept within acceptable limits by good design and operation criteria; (8)
B. Discuss the manner in which the crankshaft may be overstressed and the consequences arising there from. (8)
2023/MAR/Q7
Click Here to See the Answer

Q8. With reference to bridge control of a large slow speed propulsion engine.
A. How is starting and reversing achieved?
B. Investigate and suggest remedial action required if the engine,
(i) Fails to turn on air.
(ii) Turns on air but fails to fire on fuel;

(iii) Fails to reverse.
2020/DEC/Q1 **2021/FEB/Q5** **2021/APR/Q3** **2021/OCT/Q2**
2022/JAN/Q6 **2022/APR/Q3** **2022/JUN/Q2** **2023/MAR/Q8**
Click Here to See the Answer

Q9. Common rail fuel injection systems have made a come back in marine diesel engines, the older mechanically controlled system have been replaced by electronic/hydraulic controlled system. Describe, with a line diagram any one type of a modern CR system, mentioning the engine type.
b) Compare the advantages and disadvantages of the common rail fuel injection system with the jerk type of injection system. Give examples of their use in modern diesel engines.
2022/SEP/Q1 **2023/MAR/Q9**
Click Here to See the Answer

APR-2023

Q1. Marine diesel engines run on the diesel cycle. With the introduction of natural gas as marine fuel, Otto cycle is also employed in some engines. Explain the difference between the two cycles and elaborate on the suitability of natural gas a fuel in such engines
2022/JUL/Q3 **2023/APR/Q1**
Click Here to See the Answer

Q2: Explain why the use of residual fuels for the operation of large slow speed or of medium speed engines, may be responsible for the following problems with turbocharger nozzles, shrouds and blades and how in each, the problem may be minimized:
A. Build-up of deposits;
B. Hot corrosion;
C. Erosion
2020/FEB/Q2 **2021/JUL/Q5** **2023/APR/Q2**
Click Here to See the Answer

Q3. a). If an auxiliary diesel generator over-speeds and runs away while off the load, explain: -
i. How it can be stopped,
ii. What is likely to be the reasons for the failure.
b). Give-details of what cheeks are made after the machine has been stopped:
(i) Mechanically,
(ii) Electrically.
2021/JUL/Q9 **2023/APR/Q3**
Click Here to See the Answer

Q4. Explain each of the following:
A. Why wear down in main bearings is critical to the condition of the crankshaft and propeller shaft system.
B. Why total reliance is placed on frictional grip in conventional built up crankshaft
C. Why hole oils are given large fillets in crankpin and journals.
2022/NOV/Q4 **2023/APR/Q4**
Click Here to See the Answer

Q5. With reference to crankcase diaphragm glands:
A. Explain why effectiveness deteriorates in service.
B. Describe the procedure for renewal of parts so that efficiency is restored and rod scoring is avoided;
C. Describe how effectiveness is restored if spares are unavailable;
D. Explain the functions of the upper and lower sections.
2023/APR/Q5
Click Here to See the Answer

Q6. A. Sketch and describe a control system for manoeuvring a main diesel engine from the bridge
B. Explain how local control may be effected in case of breakdown of the control system described in 2 (A).
2021/APR/Q5 **2021/JUL/Q2** **2021/AUG/Q3** **2022/FEB/Q2** **2023/APR/Q6**
Click Here to See the Answer

Q7. A. Describe the precaution necessary during the initial running-in of an Auxiliary Engine run on which is newly installed or has a major overhaul;
B. Explain the possible causes of oxidation of lubricating oil.
C. State the frequency with which oil samples should be taken for analysis.
2023/APR/Q7
Click Here to See the Answer

Q8. A. How is fuel oil injected into the cylinder of a heavy oil two stroke cycle internal combustion engine and how is it ignited?
B. Show by a timing diagram at what point of stroke injection of the fuelbegins and ends. Name the engine to which your answer refers.
C. Explain the effect of advancing the timing of injection on: i. Fuel per brake horse power hour; ii. Exhaust temperature ; iii. Cylinder maximum pressure
2023/APR/Q8
Click Here to See the Answer

Q9. With reference to large fabricated bed plates explain:
A. With reason, why longitudinal strength and rigidity is important in spite of the contributions made by ship's structure.
B. With sketches show how the combustions loads imposed on piston and cylinder heads are transmitted to and absorbed by bed plates.
2023/APR/Q9
Click Here to See the Answer

JUNE-2023

Q1. a) To improve the power-to-weight ratio of an engine, it is necessary to increase the mep. Discuss the importance of turbocharger compression ratio in this regard. Why has it become necessary to introduce two- stage turbocharging?
b) With reference to turbochargers with variable turbine area, explain
i)Which area is varied

ii)Why is it varied
iii)How is it varied.
2022/OCT/Q8 **2023/JUNE/Q1**
Click Here to See the Answer

Q2. A. What is "virtual tappet" in the hydraulically actuated air spring return exhaust valves, and how is it set.
B. Explain why the damage occurs to the seats of the exhaust valves due to furrowing and cutting.
C. How an incident of "valve drop" leading to extensive damage to running gear can occur.
2023/JAN/Q4 **2023/JAN/Q4** **2023/JUNE/Q2**
Click Here to See the Answer

Q3. Explain the functional and constructional difference between the Torsional and Axial vibration dampers with the help of net sketches, Explain the function of the side and Top bracing of the main engine.
2020/MAR/Q1 **2022/OCT/Q1** **2023/JUNE/Q3**
Click Here to See the Answer

Q4. During recent months a number of fuel injector needle valves have seized in their bodies during engine operation.
A. Explain the effects on engine operation.
B. State the possible causes.
C. As Second Engineer, state with reasons, the instructions to be issued in order to minimize this problem.
2023/JUNE/Q4
Click Here to See the Answer

Q5. Crankshaft deflections taken from a large slow speed engine show an apparent alignment problem.
a) (i) Describe the investigation to find the actual degree of misalignment. (4)
(ii) State FOUR possible causes of the misalignment. (4)
b) State the influence of changes of hull loading, sea water temperature and the temperature of the deck on crankshaft alignment. (4)

c) State why bearing wear may be a result of misalignment rather than a cause. (4)
Click Here to See the Answer

Q6. During morning inspection after an overnight period of UMS operation the following changes were detected:
(a) A slight but perceptible change in engine noise
(b) An alternation in engine speed.
(c) A change in exhaust temperature spread pattern.
Explain, with reasons, the possible causes of each such changes, indicating how normal operations might be restored.
2022/JUL/Q7 **2023/JUNE/Q6**
Click Here to See the Answer

Q7. Sketch and describe the different types of crankshafts used in marine engines. also describe the process of induction hardening performed on crankshafts and give the advantages of this process for the crankshafts.
2023/JUNE/Q7
Click Here to See the Answer

Q8. Sketch a Main Engine air starting distributor and describe how it operates. List the safety devices and interlocks incorporated in main engine air starting system and state the purpose of each.
2020/DEC/Q2 **2021/APR/Q9** **2021/DEC/Q9** **2022/MAR/Q2** **2022/APR/Q5** **2023/JUNE/Q8**
Click Here to See the Answer

Q9. Common rail fuel injection systems have made a come back in marine diesel engines, the older mechanically controlled system have been replaced by electronic/hydraulic controlled system. Describe, with a line diagram any one type of a modern CR system, mentioning the engine type.
b) Compare the advantages and disadvantages of the common rail fuel injection system with the jerk type of injection system. Give examples of their use in modern diesel engines.
2022/SEP/Q1 **2023/MAR/Q9** **2023/JUNE/Q9**

Click Here to See the Answer

JULY-2023

Q1. Sketch and describe the arrangement of a main engine camshaft chain. Describe the repair procedure following fracture of one chain link during operation of the engine. Give possible reasons for the failure and explain how the chain is set initially at the correct degree of tension. (16)

2020/DEC/Q9 **2021/JAN/Q9** **2021/FEB/Q8** **2021/APR/Q5** **2021/JUL/Q9** **2021/OCT/Q1** **2021/DEC/Q5** **2022/APR/Q7** **2022/AUG/Q8** **2023/JUL/Q1**

Click Here to See the Answer

Q2. Periodical Lubricating Oil Analysis, its correct interpretation and corrective measures are of critical significance for the maintenance of marine machineries. With reference to the modern analysis techniques employed for the condition of L.O, discuss the following:

A) Elemental (Spectrometric) Analysis (4)

B) Fourier Transform Infrared (FTIR) Spectroscopy (4)

C) Particle Count (4)

D) Base Number Vs Acid Number (4)

2023/JUL/Q2

Click Here to See the Answer

Q3. (a) Why is the axial clearance of a main thrust bearing an important dimension? (6)

(b) How is this clearance measured? (6)

(c) Describe how the thrust pads are removed for inspection and state what you would look for in particular. (4)

2022/AUG/Q3 **2023/JUL/Q3**

Click Here to See the Answer

Q4. a) Describe the actions and checks required to ensure that a crosshead main propulsion engine may be operated in a slow steaming condition. (8)
b) Explain the problems which may arise during a prolonged period of slow steaming (4)
c) Explain what actions should be taken before and after the engine is returned to normal operation after a period of slow steaming (4)
2023/JUL/Q4
Click Here to See the Answer

Q5. a) Explain why an engine's cylinders should develop equal power at all loads, indicating the possible consequences if cylinder power balance is not maintained (6)
b) Describe ONE method which may be used for assessing cylinder power, explaining the steps involved in the assessment (4)
C) Explain how the cylinder power adjustments are made to achieve cylinder power balance (6)
2023/JUL/Q5
Click Here to See the Answer

Q6. a) Describe, with the aid of a sketch, the arrangement of the Gas and liquid fuel systems at the cylinder of a dual fuel 4-stroke engine, stating the input and output signals at the controller. (12)
(b) Describe the arrangement of the gas fuel piping system used for a 4 stroke dual fuel engine with safety features incorporated. (4)
2022/SEP/Q5 **2023/JUL/Q6**
Click Here to See the Answer

Q7. a) Describe, with the aid of a sketch, a main engine holding down system explaining how the design features help prevent excessive stress in the holding down studs (8)
b) Describe, with the aid of a sketch, an engine top bracing arrangement, explaining why they are fitted and checked for operational performance (8)
2023/JUL/Q7
Click Here to See the Answer

Q8. With reference to four stroke diesel engine emission control:
(a) Describe how the Miller Cycle operates to control NOx emissions; (8)
(b) Describe, with reasons, the modifications needed for a medium speed engine to operate on the Miller Cycle; (8)
2023/JUL/Q8
Click Here to See the Answer

Q9. with reference to a slow speed diesel engine fitted with a single turbocharger. describe, with reasons, the possible action which could be taken to enable the main engine to be operated, If whilst on oceanic passage, a small portion of one of the impeller vanes breaks off and impacted with the charge air cooler. (16)
2021/OCT/Q6 **2023/JUL/Q9**
Click Here to See the Answer

AUG-2023

Q1. A. Explain the term Variable Injection Timing (VIT) when applied to fuel pumps and state why a change in timing of fuel injection may be required. (5)
B. Describe, with the aid of sketches a VIT fuel pump and explain how the change in timing is achieved whilst the pump is in operation. (5)
C. Explain how it may be determined that individual fuel pumps are injecting the correct quantity of fuel with the correct timing at a particular pump setting. (6)
2021/JUL/Q6 **2021/AUG/Q6** **2022/FEB/Q6** **2022/SEP/Q2**
2023/JAN/Q9 **2023/AUG/Q1**
Click Here to See the Answer

Q2. With reference to a particular make of main propulsion unit, describe how the engine is reversed manually and discuss with the aid of a diagram the safety precautions which would be required if the control were operated remote from the machinery space. (16)
2021/APR/Q1
Click Here to See the Answer

Q3. a) Sketch and describe Main Engine starting air distributor. (8)
b) List the safety devices and interlocks incorporated in main engine air starting system and state the purpose of each. (8)
2020/OCT/Q6 **2020/NOV/Q6** **2020/DEC/Q2** **2021/APR/Q9**
2021/DEC/Q9 **2022/MAR/Q2** **2022/APR/Q5** **2023/JUNE/Q8**
Click Here to See the Answer

Q4. During a routine crankcase inspection a main engine top end bearing is found to be wiped and subsequent inspection shows that the pin is badly scored.
A. Explain in detail the action which should be taken to enable the engine to be safety operated so that the vessel may reach a port where effective repair facilities are available. (8)
B. State with reasons the factors which influence the speed at which the engine may be safely operated.
2021/JUL/Q2 **2023/AUG/Q4**
Click Here to See the Answer

Q5. a) Describe, with the aid of a sketch, an external system for reducing engine NOx emission, explaining the chemistry of the process. (8)
b) Explain why Urea is used in the selective catalytic reduction process instead of ammonia. (4)
(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. (4)
2022/SEP/Q4 **2023/AUG/Q5**
Click Here to See the Answer

Q6. A. What is "virtual tappet" in the hydraulically actuated air spring return exhaust valves, and how is it set. (8)
B. Explain why the damage occurs to the seats of the exhaust valves due to furrowing and cutting. (4)
C. How an incident of "valve drop" leading to extensive damage to running gear can occur. (4)

2023/JAN/Q4 2023/JAN/Q4 2023/JUNE/Q2 2023/AUG/Q6
Click Here to See the Answer

Q7. With reference to the crankshaft and running gear of an engine, explain EACH of the following:
a) static balance, (4)
b) Dynamic balance, (4)
c) Torque reaction couple, (4)
d) Critical speed (4)
2021/AUG/Q5 2022/FEB/Q5 2023/AUG/Q7
Click Here to See the Answer

Q8. (a) Explain the factors you would consider in deciding whether to open up a cylinder unit for overhaul? After opening the unit and preparing for assembly, how would you decide whether to renew or re-use piston rings? (8)
(b) List the causes of piston ring failure which may result in gas leakage or ring breakage. (8)
2020/DEC/Q3 2021/JUL/Q4 2021/SEP/Q1 2021/NOV/Q4
2022/FEB/Q1 2023/AUG/Q8
Click Here to See the Answer

Q9. A. How is fuel oil injected into the cylinder of a heavy oil two stroke cycle internal combustion engine and how is it ignited? Show by a timing diagram at what point of stroke injection of the fuel begins and ends. Name the engine to which your answer refers. Explain the effect of advancing the timing of injection on:
a) Fuel per brake horsepower hour.
b) Exhaust temperature.
c) Cylinder maximum pressure. (16)
2023/APR/Q8 2023/AUG/Q9
Click Here to See the Answer

SEP-2023

Q1. (a) Explain the term torsional vibration, indicating the effect this can have on an engine crankshaft.
(b) Explain why a detuner/vibration damper might be fitted to an engine. (5)
(c) Explain why an engine might have a barred speed range and why the engine should not be operated continuously in that range. (5)
2022/DEC/5 **2023/SEP/Q1**
Click Here to See the Answer

Q2. With reference to an engine air starting system
(a) Explain why a slow turning is fitted (4)
(b) State, with reasons, when a slow turning system operates (2)
(c) Describe, with the aid of a sketch, an air starting system, explaining how the slow turning system operates. (10)
2022/DEC/Q1 **2023/SEP/Q2**
Click Here to See the Answer

Q3. a) Describe, with the aid of a sketch, a main engine holding down system explaining how the design features help prevent excessive stress in the holding down studs (8)
b) Describe, with the aid of a sketch, an engine top bracing arrangement, explaining why they are fitted and checked for operational performance (8)
2023/JUL/Q7 **2023/SEP/Q3**
Click Here to See the Answer

Q4. With reference to abnormal and excessive cylinder liner wear
(a) Explain how may be caused, stating how it is detected: (4)
(b) Explain the effects and consequences of excessive cylinder liner wear (4)
(c) Explain how abnormal cylinder liner wear may be prevented. (4)
(d) Explain how the liner wear rate is calculated. (4)
2023/SEP/Q4
Click Here to See the Answer

Q5.a) Sketch a commonly employed method of attachment between crosshead and slippers. (8)
b) Explain why guide clearance is strictly limited. (4)
c) Give reasons why lubricant is usually fed to the slippers and not the guides.
2023/SEP/Q5
Click Here to See the Answer

Q6. a. Describe, with the aid of a sketch a diesel engine fuel system which employs direct injection of liquid gas into the cylinders. (12)
b. Explain the advantages of this type of gas injection system compared with the use of gaseous fuel in the form of gas. (4)
2023/SEP/Q6
Click Here to See the Answer

Q7. With reference to a Closed Loop engine exhaust gas SOX scrubber system:
a. Describe, with the aid of a sketch, such a system; (8)
b. State, with reasons, the fluid which is used for SOX scrubbing in this system; (4)
c. State how the effectiveness of the scrubbing fluid is maintained and how the sludge is removed and disposed of. (4)
2023/SEP/Q7
Click Here to See the Answer

Q8. With reference to Main engine crankshafts:
a) Explain the term axial vibration (4)
b) Describe, with the aid of a sketch, how axial vibration may be minimized
c) State with reasons which bearing would be most at risk due to the effects of axial vibration (3)
d) Describe how damage to the bearing stated in part (c) may be repaired. (3)
2022/SEP/Q8 **2023/SEP/Q8**
Click Here to See the Answer

Q9. With reference to a waste heat boiler/economiser:
a. Write a procedure for the cleaning the gas side of a waste heat boiler/economiser when the associated

main engine is:
(i) running; (5)
(ii) stopped. (5)
b. Write a procedure for operation of the main engine when the associated waste heat boiler/economizer cannot be operated due to tube failure. (6)
2023/SEP/Q9
Click Here to See the Answer

OCT-2023

Q1. a) Explain why pilot injection is required for a Dual fuel engine when burning natural gas. (2)
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 (7)
b) The Diesel cycle (7)
Click Here to See the Answer

Q2. (A) Explain why crankshaft deflections are taken. (4)
(b) Write a procedure for the taking of main engine crankshaft deflections. (8)
(c) Explain the action to be taken if some crankshaft deflection readings are outside acceptable limits.
2023/OCT/Q2
Click Here to See the Answer

Q3. With reference to engine fuel injector nozzle cooling;
(a) Explain why fuel injector nozzle cooling is necessary (4)
(b) Describe, with the aid of a sketch, the operation of a nozzle cooling system for a generator engine;
(c) Explain how fuel injector nozzles are cooled on engines which are not fitted with a separate nozzle cooling system (4)
2023/OCT/Q3
Click Here to See the Answer

Q4.a) Describe the procedure for entry into, and inspection of, the inside of a starting air bottle, stating the types of defects which may be present with their possible causes.
b) Describe the procedure of closing up the bottle and the initial pressurization to working pressure. (4)
2023/OCT/Q4
Click Here to See the Answer

Q5. (a) Explain why variable exhaust valve closing can be advantageous in the operation of large slow speed main engines. (8)
(b) Explain, with the aid of a sketch, how variable exhaust valve closing is achieved. (6)
(c) Explain how high impact is avoided as the valve closes. (2)
2022/DEC/Q9 **2023/OCT/Q5**
Click Here to See the Answer

Q6. (a) Explain why highly efficient diesel engines tend to produce more NOx than low performance diesel engines. (6)
(b) Describe, with the aid of a sketch, a Selective Catalytic Reduction (SCR) unit for a marine propulsion diesel engine. (5)
(c) Explain why accurate monitoring of the exhaust gas flows entering and leaving a Selective Catalytic Reduction unit are required and how these readings are used to control the reduction chemical supplied to the SCR unit.
2022/AUG/Q6 **2023/FEB/Q1** **2023/OCT/Q6**
Click Here to See the Answer

Q7. Analyse the problem of cylinder liner lubrication with reference to oil injection timing relative to piston position, speed and direction of motion. Describe the worst effects of inaccurate lubricant injection timing and how it can have a detrimental effect on developed power in the cylinder. Describe with sketches the arrangement for conveying the oil through the cylinder jacket.
2023/OCT/Q7
Click Here to See the Answer

Q8. With reference to solid propellers state:
a) how badly damaged blade tips are restored? (6)
b) why propellers need balancing from time to time. (5)
c) why intense concentrated heat should not be applied to bosses. (5)
2023/OCT/Q8
Click Here to See the Answer

Q9. a) Describe with the aid of a simple labelled sketch the important features of a reduction gearbox suitable for installation with medium speed engines.
b) State the materials used for gears and briefly explain how the gears are manufactured (5)
(c) As Second Engineer describe how you would conduct an inspection of the gearing and at the same time give instruction to a cadet on the type of damage most likely to be found. (5)
2023/OCT/Q9
Click Here to See the Answer

NOV-2023

Q1. With regards to connecting rod ovality of four stroke diesel Engine. Explain Following.
a) Importance of connecting rod ovality. (4)
b) Method of measuring the connecting rod ovality. (4)
C) Discuss the impact of ovality if it increases beyond the maximum allowable limit. (4)
d) Method of ascertaining the elongation of connecting rod bolts. (4)
2021/MAR/Q8 **2021/APR/Q4** **2021/SEP/Q7** **2022/JAN/Q9** **2023/NOV/Q1**
Click Here to See the Answer

Q2. Describe the starting and reversing system of an electronically controlled diesel engine and compare with engine having CAM SHAFT and explain the following;
A. Reduction in Air Consumption during Engine Starting; (8)
B. Improved performance during Astern starting and Crash Astern. (8)

2021/APR/Q8 **2021/SEP/Q8** **2021/DEC/Q1** **2022/MAR/Q1** **2023/NOV/Q2**

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Q3. With reference to Modern diesel Engine describe the features of High pressure Miller cycle and discuss The following.
(a) Reduction in Air Temperature due to Miller Cycle; (4)
(b) Recovery of Pressure in the Combustion chamber during the Miller cycle;
(c) Effect of Miller Cycle on specific fuel consumption and NOx emission; (4)
(d) The impact on various parameters during low load operation using Miller cycle. (4)

2023/NOV/Q3

Click Here to See the Answer

Q4. With regards to modern diesel engine raising the Life Cycle Value (LCV) describe the importance of following;
(a) Low Sac Volume of Fuel Injection Valve; (4)
(b) Fuel Valve opening Pressure regulation; (4)
(c) Contamination of combustion Chamber and impact on LCV; (4)
(d) Contamination of lube oil and impact on LCV. (4)

2023/NOV/Q4

Click Here to See the Answer

Q5. How are large slow speed engines structured to withstand the following forces?
A. Forces due to combustion load; (16)
B. Guide forces.
C. Inertia forces.

2022/JAN/Q8 **2023/NOV/Q5**

Click Here to See the Answer

Q6. Explain the functional and constructional difference between the Torsional and Axial vibration dampers with the help of net sketches, Explain the function of the side and Top bracing of the main engine. (16)

2019/AUG/Q1 **2020/MAR/Q1** **2022/OCT/Q1** **2023/JUNE/Q3** **2023/NOV/Q6**
Click Here to See the Answer

Q7. a) Describe, with the aid of a sketch, the arrangement of the Gas and liquid fuel systems at the cylinder of a dual fuel 4-stroke engine, stating the input and output signals at the controller. (8)
(b) Describe the arrangement of the gas fuel piping system used for a 4 stroke dual fuel engine with safety features incorporated. (8)
2022/SEP/Q5 **2023/JUL/Q6** **2023/NOV/Q7**
Click Here to See the Answer

Q8. With reference to 2-Stroke Slow Speed Engine:
A. Sketch and describe Main Engine Exhaust Valve. (8)
B. List out a procedure for test of Main Engine Exhaust Valve after overhaul.
2021/JAN/Q3 2023/NOV/Q8
Click Here to See the Answer

Q9. a) Explain the possible reasons T/C vibration while operating at a steady speed. (3)
b) State how the incidence of turbo charger vibration might be minimized. (3)
c) Explain the action to be taken in to maintain 2 stroke – engine operation in the event of turbo charger having to be taken out of service. (6)
d) Indicate the effect of this action will have on engine operation. (4)
{How is the engine operation affected when operated with a by-passed T/C}
2021/MAR/Q1 2021/SEP/Q4 2022/AUG/Q1 2023/NOV/Q9
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DEC-2023

Q1. Common rail fuel injection systems have made a come back in marine diesel engines, the older mechanically controlled system have been replaced by electronic/hydraulic controlled system. Describe, with a line diagram any one type of a modern CR system, mentioning the engine type. (8)

b) Compare the advantages and disadvantages of the common rail fuel injection system with the jerk type of injection system. Give examples of their use in modern diesel engines.
2022/SEP/Q1 **2023/MAR/Q9** **2023/JUNE/Q9** **2023/DEC/Q1**
Click Here to See the Answer

Q2. (a) Explain why highly efficient diesel engines tend to produce more NOx than low performance diesel engines. (5)
(b) Describe, with the aid of a sketch, a Selective Catalytic Reduction (SCR) unit for a marine propulsion diesel engine. (6)
(c) Explain why accurate monitoring of the exhaust gas flows entering and leaving a Selective Catalytic Reduction unit are required and how these readings are used to control the reduction chemical supplied to the SCR unit.
2022/AUG/Q6 **2023/FEB/Q1** **2023/OCT/Q6** **2023/DEC/Q2**
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Q3. Crankcase oil mist detectors have undergone a lot of changes in recent years. Compare the modern types with multiple sensor units with the traditional single sensor type, where sampling was done sequentially. What is meant be addressable sensors? (16)
2022/NOV/Q1 **2023/DEC/Q3**
Click Here to See the Answer

Q4. Discuss the significance of cylinder lubrication in two stroke diesel engines considering the impact of Annex VI of Marpol 73/78. Explain:
(a) Two level cylinder lubrication incorporated on few diesel engines. (8)
(b) The effect of over and under lubrication on engines. (8)
2023/DEC/Q4
Click Here to See the Answer

Q5. With regards to modern diesel engines revolution pick up sensor, discuss with suitable diagram the following;
A. Functioning of revolution pick up sensor;
B. Adjustment of pick up sensor;
C. Adjustment of rotary encoder;

D. Adjustment of pulse angle offset. (16)
2023/DEC/Q5
Click Here to See the Answer

Q6. With respect to large two stroke crosshead main engines.
A. Sketch and describe a crosshead designed to prevent or minimize bearing edge loading. (8)
B. State how the arrangement described achieves its purpose. (4)
C. What would be an acceptable range of bearing clearance for the top end bearing and bottom end bearings of a large two-stroke marine diesel engine.
2021/MAR/Q7 **2022/MAR/Q7** **2023/DEC/Q6**
Click Here to See the Answer

Q7. Sketch and show all parts of a two-stroke engine stuffing box. Describe the procedure of overhauling two stroke engine stuffing box, without removing piston. All safety precautions and proper tools used for overhaul to be mentioned. (16)
2020/NOV/Q5 **2021/FEB/Q1** **2023/DEC/Q7**
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Q8: Explain why the use of residual fuels for the operation of large slow speed or of medium speed engines, may be responsible for the following problems with turbocharger nozzles, shrouds and blades and how in each, the problem may be minimized:
A. Build-up of deposits.
B. Hot corrosion.
C. Erosion (16)
2020/FEB/Q2 **2021/JUL/Q5** **2023/APR/Q2** **2023/DEC/Q8**
Click Here to See the Answer

Q9. Sketch and describe the arrangement of a main engine camshaft chain. Describe the repair procedure following fracture of one chain link during operation of the engine. Give possible reasons for the failure and explain how the chain is set initially at the correct degree of tension. (16)
2020/DEC/Q9 **2021/JAN/Q9** **2021/FEB/Q8** **2021/APR/Q5**

D. MARINE
Study Material

2021/JUL/Q9 2021/OCT/Q1 2021/DEC/Q5 2022/APR/Q7 2022/AUG/Q8 2023/JUL/Q1 2023/DEC/Q9

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