D. MARINE
Study Material

MEO CLASS 2 WRITTEN: EKM

(ENGINEERING KNOWLEDGE MOTOR)

FOR INDIAN COMPETENCY EXAM

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JAN-2024

Q1. What is meant by 'Power balancing' with respect to reciprocating engines? Why is balance desirable and how is it obtained in the case of a large marine engine? What difficulties may be experienced in balancing an engine running at about 500 R.P.M. and how can these difficulties be overcome? (16)
2022/SEP/Q7 **2024/JAN/Q1**
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Q2. a) Explain the term fuel ignition qualify and indicate how a fuel's chemical structure Influences its value. (5)
b) State, with reasons, the possible consequences of operating an engine on a fuel with a lower ignition quality than that for which it is timed. (5)
c) (i) Explain how an engine might be adjusted to burn fuel of different ignition quality. (3)
(ii) State what checks can be carried out in order to determine that the engine is operating correctly. (3)
2022/OCT/Q2 **2024/JAN/Q2**
Click Here to See the Answer

Q3. 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 (6)
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 **2024/JAN/Q3**
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Q4. With specific to reference to any make, sketch and describe the Cylinder Lubricating System used in new generation marine diesel engines. How will

you effect the optimum cylinder oil feed with varying Sulphur content of fuel oil. (16)
2024/JAN/Q4
Click Here to See the Answer

Q5. Slow steaming has become the standard operation mode for many ship operators. Discuss various technical issues connected 'slow steaming', with particular reference to: (16)
a) Crosshead bearing damage in T/C cutout mode.
b) Cylinder liner cold corrosion
c) Exhaust valve damages
2024/JAN/Q5
Click Here to See the Answer

Q6. a) Referring to ALCAP technology in marine purifiers, discuss with diagrams, how the Sludge monitoring system along with the Water monitoring system in modern centrifugal separator has increased the separation efficiency of oil? (8)
b) With respect to new development in de-sludging in separators, discuss the "Centri Shoot Discharge" system? (8)
2024/JAN/Q6
Click Here to See the Answer

Q7. With reference to crankshafts, explain EACH of the following:
A. The cause and effects of torsional vibration (4)
B. The term critical speed indicating why it can be a problem (4)
C. The term fatigue cracking and state, with reasons, TWO factors of crankshaft operation which have greatest influence on the likelihood of fatigue cracking (4)
D. How a torsional vibration damper can reduce the effects of torsional vibration (4)
2021/APR/Q9 **20234/JAN/Q7**
Click Here to See the Answer

Q8. 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 **2023/AUG/Q2** **2024/JAN/Q8**
Click Here to See the Answer

Q9. 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. (4)
B. State with reason the types of card you would consider necessary and explain the procedure for obtaining these. (4)
C. State in order of importance the additional information required with the card. (4)
D. State your procedure for analysis of the cards and obtaining cylinder powers. (4)
2021/APR/Q3 **2023/MAR/Q3** **2024/JAN/Q9**
Click Here to See the Answer

FEB-2024

Q1. Sketch a cross section through a piston rod stuffing box.
a) Define with detail sketches the function of and difference between, sealing rings and scraper rings (10)
b) Identify with reasons those details which should receive particular attention during overhaul of the complete assembly. (6)
2015/SR07 **2024/FEB/Q1**
Click Here to See the Answer

Q2. With reference to the behaviour of fabricated bed plates & frames in service:
(a) Identify the various forces imposed simultaneously upon them. (6)
(b) Explain how engine structure withstands these forces? (5)
(c) State how these forces are transferred to ship structure? (5)
2022/OCT/Q5 **2024/FEB/Q2**

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Q3. Explain the modern methods of turbo charging available such as: (16)
a) Pulse converter system
b) Sequential turbo charging
c) Two stage turbo charging
d) Variable geometry turbochargers
2013/SR01 **2024/FEB/Q3**
Click Here to See the Answer

Q4. With respect to carriage of LNG as bunker on board ship & subsequent consumption of the fuel in the diesel engine, discuss: (16)
a) Types of bunker tank arrangement
b) Liquefied gaseous fuel containment safeties
c) Bunkering Requirements
2024/FEB/Q4
Click Here to See the Answer

Q5. 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. (10)
b) State with reasons the factors which influence the speed at which the engine may be safely operated. (6)
2021/JUL/Q2 **2023/AUG/Q4** **2024/FEB/Q5**
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Q6. a) Sketch and describe a flywheel that would be fitted to a large marine diesel engine. (8)
b) Explain the role of the flywheel during engine starting and stopping operations, including its function in providing momentum for initial engine rotation. (4)

c) Discuss the recent advancements in flywheel technology for main engines, such as light-weight materials, enhanced designs, or integrated monitoring systems. (4)
2024/FEB/Q6
Click Here to See the Answer

Q7. a) Compare the advantages of forged and built-up crankshafts with special reference to the magnitude of the stresses in the cranks; (5)
b) How would you check the deflections by means of a dial gauge through one revolution of the shaft? (4)
c) How are the readings obtained interpreted? (4)
d) How wear is down measured? (3)
2024/FEB/Q7
Click Here to See the Answer

Q8. Describe the procedure in lining up an engine bedplate, main bearings, gear box, thrust block, propeller shafting and tail-end shaft, assuming this to be a new ship. (16)
2011/8 **2024/FEB/Q8**
Click Here to See the Answer

Q9. Describe the developments that have taken place in the design of bearings of slow speed marine diesel engines, focusing on the reasons for such changes. (16)
2024/FEB/Q9
Click Here to See the Answer

MAR-2024

Q1. 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/JUNE/Q2** **2023/AUG/Q6** **2024/MAR/Q1**
Click Here to See the Answer

Q2. (a) Describe, with the aid of sketches, the procedure for cutting out and "hanging-up" an engine cylinder of a two-stroke crosshead engine in the event of complete failure of the crosshead pin such that the crosshead pin cannot be operated and no replacement is immediately available. (12)
(b) State, with reasons, the factors which may inhibit starting and limit the operating speed of the engine with a cylinder cut out. (4)
2022/DEC/Q6 **2024/MAR/Q2**
Click Here to See the Answer

Q3. Selective catalytic Reactors (SCR) are being extensively used in marine diesel engines for the compliance of Tier-III NOx emission requirements. Explain various types of SCRs in use with particular focus on the following:- (16)
a) High-Pressure SCRs (HPSCR) vs Low-Pressure SCRs (LPSCR)
b) SCRs with static mixers.
c) SCRs installed upstream the turbocharger(s) Vs downstream turbochargers.
2022/JUL/Q6 **2022/OCT/Q4** **2022/DEC/Q4** **2024/MAR/Q3**
Click Here to See the Answer

Q4. a) With reference to main engine starting and reversing:
A. Define the function of air distributors. (5)
b) Give reasons why air distributors are not fitted to some large direct reversing engines. (3)
c) Briefly Discuss the potential issues with air distributors and their respective solutions. (8)
2024/MAR/Q4
Click Here to See the Answer

Q5. Misalignment of the main shafting between engine and propeller causes bearing overloads and shaft stress,

A. State the difficulties associated with checking shaft alignment and the reasons why results are unreliable due to external factors; (5)
B. Explain with a simple sketch how a bearing load is assessed. (5)
C. Explain how uneven loading could be rectified. (6)
2021/AUG/Q4 **2022/FEB/Q4** **2024/MAR/Q5**
Click Here to See the Answer

Q6. Discuss the consequences of failure to maintain correct clearances in the case of main diesel engine crankshaft and bottom end bearings. Sketch a bottom end bearing paying particular attention to the arrangement of ensuring uninterrupted flow of oil to the top end bearing. (16)
2020/MAR/Q2 **2021/OCT/Q5** **2024/MAR/Q6**
Click Here to See the Answer

Q7. With reference to electronically controlled engines:
(a) Describe how fuel injection quantity and timing is adjusted. (6)
(b) Describe how the exhaust valve timing may be varied. (5)
(c) Describe how starting air valves are regulated. (5)
2022/AUG/Q7 **2024/MAR/Q7**
Click Here to See the Answer

Q8. Discuss critically the following alternative types of main propelling machinery for installation in a
proposed new ship –
A. 2 stroke single acting cross head type slow speed engine; (8)
B. 4 stroke single–acting with reverses / reduction gear. (8)
2024/MAR/Q8
Click Here to See the Answer

Q9. a) Briefly discuss the advantages, disadvantages and working of pulse type cylinder lubrication system. (8)
b) Explain the process of calculating specific cylinder oil consumption of main engine. (8)
2024/MAR/Q9
Click Here to See the Answer

APRIL-2024

Q1. Describe how each of the following procedure may be accomplished by bridge control equipment for a direct reversing 2 stroke diesel engine –
A. Setting the direction of rotation (6)
B. Starting (5)
C. Controlling speed (5)
2024/APR/Q1
Click Here to See the Answer

Q2. With reference to auxiliary diesel engines, suggest probable causes that would create EACH of the
following conditions and state how they would be rectified:
A. Knocking (6)
B. Loss of power (5)
C. Loss of lubricating oil pressure (5)
2024/MAR/Q2
Click Here to See the Answer

Q3. With reference to large starting air receivers:
A. Explain where corrosion is likely to occur and state why it occurs in these regions. (4)
B. State the how the incidence of corrosion in air receivers might be minimized. (4)
C. If serious corrosion is detected in a starting air receiver and that receiver must be used explain how you, as Second Engineer, would determine the maximum pressure to which the receiver should be subjected. (4)

D. State the further action a Second engineer must take upon discovering such air receiver corrosion. (4)
2024/MAR/Q3
Click Here to See the Answer

Q4. 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** **2024/MAR/Q4**
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Q5. (a) Describe, with the aid of a sketch, the main engine auxiliary equipment for automatic monitoring and regulation of the fuel viscosity. (6)
(b) Explain the operation of the system, which incorporates the equipment described in
(c) For an engine which is maneuvered on distillate fuel but operated on heavy residual oil at sea, static, as second engineer, the standing orders you would issue for the procedure to be adopted when changing from distillate fuel to heavy residual oil and vice versa. (5)
2021/APR/Q8 **2024/APR/Q5**
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Q6. With reference to timing chains:
A. State the cause of chain elongation in service, using a sketch of a section of a camshaft roller chain to illustrate your answer. (4)
B. State:
i. The effects of increased chain length. (3)
ii. The method of assessing percentage increase in length. (3)
C. i) Explain how the effects of elongation are corrected. (3)
ii) State why a limit is placed on percentage chain elongation and give typical example. (3)
2024/APR/Q6

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Q7. A. Describe with the aid of a sketch, the arrangement of exhaust and air inlet passages in a medium speed four stroke engine cylinder head. (5)
B. With reference to [A] indicate where cracking might be expected stating the likely cause. (3)
C. Explain the different factors that tend to cause distortion of 4stroke cylinder head. (3)
D. Explain how the effects described in are minimized by design. (5)
2024/APR/Q7
Click Here to See the Answer

Q8. A. Describe briefly the operation of an electrical or hydraulic main engine governor. (8)
B. For the type described indicate how failure can occur and the action to be taken if immediate correction cannot be achieved and the engine must be operated. (8)
2024/APR/Q8
Click Here to See the Answer

Q9. a) Describe, with the aid of a sketch, a main engine cylinder relief valve. (10)
b) List the conditions, which may cause the valves, sketched in (a) to lift. (6)
2024/APR/Q9
Click Here to See the Answer

JUNE-2024

Q1. How are large slow speed engines structured to withstand the following forces?
A. Forces due to combustion load; (6)
B. Guide forces. (5)
C. Inertia forces. (5)
2022/JAN/Q8 **2023/NOV/Q5** **2024/JUN/Q1**
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Q2. 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)
2021/DEC/Q9 **2022/MAR/Q2** **2022/APR/Q5** **2023/JUNE/Q8** **2023/AUG/Q3** **2024/JUN/Q2**
Click Here to See the Answer

Q3. a) Describe with the aid of a sketch the construction of a single collar thrust bearing. (6)
b) Explain the principle on which it works. (5)
c) Explain how you would take the essential clearances and explain the significance of them. (5)
2024/JUN/Q3
Click Here to See the Answer

Q4. Fatigue is one of the main causes of crankshaft failure.
A. Sketch and indicate the most likely location of a fatigue crack; (4)
B. How is a fatigue failure identified; (4)
C. Describe initiation of a fatigue crack; (4)
D. Sketch and Describe the methods used to inhibit fatigue cracks. (4)
2020/DEC/Q7 **2021/FEB/Q4** **2021/APR/Q1** **2021/JUL/Q7** **2024/JUN/Q4**
Click Here to See the Answer

Q5. a) Outline the problems associated with effective lubrication of the liner and piston assembly of a large slow speed engine. (6)
b) What are the causes of cloverleafing and micro seizure. (5)
c) Explain the composition of a cylinder oil suitable for an engine operating on residual fuel. (5)
2024/JUN/Q5
Click Here to See the Answer

Q6. With reference to Bridge control of a large slow speed propulsion engine.
A. How is starting and reversing achieved? (8)
B. Investigate and suggest remedial action required if the engine, (8)
(i) Fails to turn on air.
(ii) Turns on air but fails to fire on fuel.
(iii) Fails to reverse.
2021/FEB/Q5 **2021/APR/Q3** **2021/OCT/Q2** **2022/JAN/Q6** **2022/APR/Q3** **2022/JUN/Q2 2023/MAR/Q8** **2024/JUN/Q6**
Click Here to See the Answer

Q7. With reference to mechanical/hydraulic governors explain: (16)
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.
2022/MAR/Q5 **2022/JUN/Q6** **2023/MAR/Q4** **2024/JUN/Q7**
Click Here to See the Answer

Q8. With reference to medium speed engine cylinder liners:
A. Explain the cause and effects of polishing or glazing. (6)
B. Sketch and describe fitting of an anti-polishing ring in the liner. (5)
C. Explain the action of anti-polishing ring during the operation of the engine. (5)
2021/MAR/Q6 **2021/JUL/Q8** **2022/JAN/Q7** **2024/JUN/Q8**
Click Here to See the Answer

Q9. With reference to piston rings: (16)
a) Analyze the causes of breakage.
b) How maintenance and engine operation can minimize breakage.
c) Explain the possible consequences with respect to performance and safety of operating the engine with broken or severely worn rings.
2022/JAN/Q4 **2022/JAN/Q4**
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JULY-2024

Q1. 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. (8)
2021/JAN/Q3 **2023/NOV/Q8** **2024/JUL/Q1**
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Q2. a) Sketch a cylinder relief valve suitable for a large slow speed engine. (4)

b) Describe its salient design features. (4)
c) State the purpose of fitting such a device. (4)
d) State the possible circumstances when the relief valve may lift and indicate the action to be taken to prevent damage to the engine. (4)
2024/JUL/Q2
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Q3. With reference to the burning of heavy residual fuel in the main engine:
a) State with reasons FOUR modifications which need to be made as compared with the same engine burning distillate fuels. (8)
b) State with reasons SIX properties you would require seeing in the specification for residual fuel indicating the effect EACH of these properties might have with respect to the storage and burning of the fuel. (8)
2024/JUL/Q3
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Q4. a) Enumerate the causes of vibration in diesel machinery and shafting. (5)
b) Describe procedures by which it may be reduced by operating personnel, suitable design and devices. (6)
c) State the possible effects of vibration on machinery and crewmembers. (5)
2020/FEB/Q4 **2024/JUL/Q4**
Click Here to See the Answer

Q5. a) Describe how propeller shaft/stern bearing clearance is measured. (4)
b) Identify with reasons the major factors which substantially determine the range of permissible clearance. (4)
c) State with reasons what parts of propeller shafts should receive particularly close inspection upon withdrawal of such shafts for survey. (4)
d) State why some propeller shafts require less frequent inspection than others. (4)
2024/JUL/Q5
Click Here to See the Answer

Q6. 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)
2021/FEB/Q1 **2023/DEC/Q7** **2024/JUL/Q6**
Click Here to See the Answer

Q7.a) What is the purpose of the main thrust bearing? (4)
b) When checking the main thrust bearing, what dimensional checks would be necessary? (4)
c) How is a thrust bearing cooled? (4)
d) Describe, with a sketch, the special chocking arrangements normal to thrust bearing. (4)
2024/JUL/Q7
Click Here to See the Answer

Q8. (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. (5)
2022/AUG/Q6 **2023/FEB/Q1** **2023/OCT/Q6** **2023/DEC/Q2**
2024/JUL/Q8
Click Here to See the Answer

Q9. A. Sketch and describe a flywheel that would be fitted to a large marine diesel engine. (6)
B. Show in the sketches how it is fitted and secured. (5)
C. What is the purpose of the flywheel? Recently some engine makers have considerably reduced the size of the flywheel. Explain how this can be done. (5)
2024/JUL/Q9
Click Here to See the Answer

AUG-2024

Q1. (a) Define the term Torsional Vibration with respect to an engine crankshaft, stating the effect that high levels can have on an engine crankshaft. (6)
(b) Explain how engine deterioration influences the risk of Torsional Vibration, stating what can be done to minimise that risk. (5)
(c) Explain TWO 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. (5)
2022/AUG/Q9 **2024/AUG/Q1**
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Q2. What is meant by 'Power balancing' with respect to reciprocating engines? Why is balance desirable and how is it obtained in the case of a large marine engine? What difficulties may be experienced in balancing an engine running at about 500 R.P.M. and how can these difficulties be overcome? (16)
2022/SEP/Q7 **2024/JAN/Q1** **2024/AUG/Q2**
Click Here to See the Answer

Q3. What are the key parameters used to assess marine fuel quality, and how do these parameters impact engine performance, fuel efficiency, and emissions control on a ship? (16)
2024/AUG/Q3
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Q4. a) What is the purpose and key procedures involved in the running-in process of a engine, and how does this process contribute to the long-term reliability and performance of the engine? (8)
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b) What are the common issues that can arise during the running-in period of a engine, and what measures should be taken to monitor and address these issues to prevent potential damage or inefficiencies? (8)
2024/AUG/Q4
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Q5. Why should the exclusion of oxygen from the boiler water of a water-tube boiler be regarded as important? Describe measures, both mechanical and chemical, that are intended to achieve oxygen free boiler water under working conditions. What precautions would you take when laying up a water-tube boiler for (a) a considerable period, (b) a few days? (16)
2024/AUG/Q5
Click Here to See the Answer

Q6. Describe methods of static and dynamic balancing of an engine and describe what are first order, second order and higher order moments in engine. (16)
2019/OCT/Q2 **2024/AUG/Q6**
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Q7. A. Difficulty has been experienced in maintaining engine speed at the set value. State the possible causes and how each of these causes may be detected. (8)
B. Describe the action to be taken in order to ensure safe operation of the main engine plant in the event of complete failure of the remote control and sensing equipment. (8)
2024/AUG/Q7
Click Here to See the Answer

Q8. 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. (10)

(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. (6)
2023/FEB/Q2 **2024/AUG/Q8**
Click Here to See the Answer

Q9. What is slow steaming & how it's achieved without engine modification? Enumerate various operational issues with slow steaming. How such operational issues can be dealt with? (16)
2022/OCT/Q3 **2024/AUG/Q9**
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SEP-2024

Q1. a) Sketch and describe a flywheel that would be fitted to a large marine diesel engine.
b) Show in the sketches how it is fitted and secured. (6)
c) What is the purpose of the flywheel? (4)
d) Recently some engine makers have considerably reduced the size of the flywheel. Explain how this can be done. (6)
2024/JUL/Q9 **2024/SEP/Q1**
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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 (6)
(c) Describe, with the aid of a sketch, an air starting system, explaining how the slow turning system operates. (6)
2022/DEC/Q1 **2023/SEP/Q2** **2024/SEP/Q2**
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Q3. a. Explain why top bracing is used for large crosshead engines. (4)
b. Describe, with the aid of a sketch, a hydraulic top bracing unit for a large crosshead engine indicating where the top bracing is fitted and how it operates. (6)

c. Write instructions for the checking of a large crosshead engine top bracing system and a holding down system. (6)
2022/DEC/Q8 **2024/SEP/Q3**
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Q4. (a) Explain why variable exhaust valve closing can be advantageous in the operation of large slow speed main engines. (6)
(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. (4)
2022/DEC/Q9 **2023/OCT/Q5** **2024/SEP/Q4**
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Q5. With reference to tubular heat exchangers explain: (16)
a) How differential movement tubes and body is accommodated when the tube plates are rigidly located in the body.
b) How and why turbulence is imparted to fluid flow through the tubes.
c) Why it has become possible to discard sacrificial anodes in sea water coolers.
d) What is meant by the term 'guided flow', with particular reference to oil heaters.
2022/SEP/Q9 **2024/SEP/Q5**
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Q6. With respect to piston cooling in large two stroke marine engines
a) Briefly discuss the relative advantages and disadvantages of oil and water for piston cooling. (6)
b) Sketch a piston for a large two-stroke crosshead engines indicating the coolant flow. (6)
c) State the causes of piston cracking and burning and how it can be avoided. (4)
2018/DEC/Q4 **2024/SEP/Q6**
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Q7. a) State the reasons for persistent slackening of holding down bolts of a main engine. (8)
b) i) State the advantages of using non-metallic chocking for main engines. (4)
ii) State precautions to be observed when fitting non-metallic chocks in order to ensure accurate chocking. (4)
2024/SEP/Q7
Click Here to See the Answer

Q8. a) Analyse the problem of cylinder liner lubrication with reference to oil injection timing relative to piston position, speed and direction of motion. (6)
b) Describe the worst effects of inaccurate lubricant injection timing and how it can have a detrimental effect on developed power in the cylinder. (4)
c) Describe with sketches the arrangement for conveying the oil through the cylinder jacket. (6)
2023/OCT/Q7 **2024/SEP/Q8**
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Q9. With reference to four stroke diesel engine emission control:
(a) Describe how the Miller Cycle operates to control NOx emissions. (6)
(b) Describe, with reasons, the modifications needed for a medium speed engine to operate on the Miller Cycle. (6)
(c) Give the advantages and disadvantages of closed against open scrubber systems. (4)
2023/JAN/Q2 **2024/SEP/Q9**
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OCT-2024

Q1. 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. (6)
B. Explain the possible causes of oxidation of lubricating oil. (5)
C. State the frequency with which oil samples should be taken for analysis. (5)
2023/APR/Q7 **2024/OCT/Q1**
Click Here to See the Answer

Q2. During a river passage the propeller of a light ship is rotating at dead show revolutions ahead when it strikes a large floating object causing a

momentary drop in engine revolutions. As the Second Engineer of the vessel describe in report format, the inspection of the vessel's propulsion and transmission system that you would supervise to ensure that is safe for the vessel to continue in voyage. Assume that the vessel is anchored and that no outside assistance is available. (16)
2024/OCT/Q2
Click Here to See the Answer

Q3. Give a list of the properties or tests by which distillate and blended fuels may be specified or decisions be made on their fitness for use. Name the properties or constituents that may be found in a blended fuel having a high viscosity and high carbon content. Explain how they may cause problems in engine operation. (16)
2024/OCT/Q3
Click Here to See the Answer

Q4. a) Explain the construction, working and adjustment procedure of a high-lift safety valve used on marine boilers. (8)
b) Describe the procedure, purpose and safety precautions involved in conducting an accumulation of pressure test on a marine boiler. (8)
2024/OCT/Q4
Click Here to See the Answer

Q5. A. Sketch and describe the means used for operation of air starting valves of a large engine.
B. Explain how engine reversal is affected. (16)
2016/SR02 **2017/SR10** **2024/OCT/Q5**
Click Here to See the Answer

Q6. An auxiliary engine exhibits a tendency to hunt to such an extent that the engine speed variation prohibits the connection of the machine to the switchboard.
A. Discuss the possible causes of hunting. (8)
B. Explain how the problem of hunting can be rectified. (8)
2021/JAN/Q8 **2021/NOV/Q6** **2024/OCT/Q6**

Click Here to See the Answer

Q7. Explain the term “cascade control” and sketch such a system suitable for use with a main engine jacket cooling water system. Show the variation of pressure and temperature at major points of the system. (16)
2021/JUL/Q5 **2021/NOV/Q5** **2022/APR/Q1** **2024/OCT/Q7**
Click Here to See the Answer

Q8. 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. (6)
(b) Explain how the fuel pumps are operated and the common rail pressure is maintained. (5)
(c) Explain how fuel injection timing and quantity is regulated for the common rail fuel system sketched in part (a). (5)
2023/FEB/Q3 **2024/OCT/Q8**
Click Here to See the Answer

Q9. 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. (6)
b) With respect to cam material, describe the heat treatment employed during manufacture. (5)
c) Explain how the position of the cam relative to the crankshaft is altered when changing from Ahead to Astern running. (5)
2024/OCT/Q9
Click Here to See the Answer

NOV-2024

Q1.a) Describe the procedures and equipment used to ensure a ship’s NOx emissions comply with international standards. (8)

b) List and describe the key methods used on board ships to reduce NOx emissions. Discuss how each method functions to lower NOx levels in exhaust gases. (8)

2024/NOV/Q1

Click Here to See the Answer

Q2.a) Explain the function of thrust bearings in marine engines and why they are critical for the propulsion system. Define the roles of ahead and astern thrust bearings in marine propulsion systems. Why is it essential to have both types of thrust bearings in a ship's main engine setup. (8)
b) Explain how the ahead and astern thrust bearings handle the directional thrust generated by the propeller. Discuss the procedures for monitoring their condition and ensuring they are adequately supporting the load in both operational directions. (8)

2024/NOV/Q2

Click Here to See the Answer

Q3. a) Describe the purpose and function of an air start distributor in a marine diesel engine. Why is it critical for engine starting operations? (6)
b) Explain how the air start distributor works, including its role in timing the supply of compressed air to the engine cylinders. Discuss how it ensures the correct firing order and timing during the start-up sequence. (5)
c) Describe how the cam profile and rotation are designed to ensure proper firing order and timing in the air start distributor. (5)

2024/NOV/Q3

Click Here to See the Answer

Q4.a) Sketch and describe a flywheel that would be fitted to a large marine diesel engine. (6)
b) Show in the sketches how it is fitted and secured. (3)
c) What is the purpose of the flywheel? (3)
d) Recently some engine makers have considerably reduced the size of the flywheel. Explain how this can be done. (4)

2024/JUL/Q9 **2024/SEP/Q1** **2024/NOV/Q4**

Click Here to See the Answer

Q5. 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)
2022/FEB/Q5 **2023/AUG/Q7** **2024/APR/Q4** **2024/NOV/Q5**
Click Here to See the Answer

Q6. Variable injection timing was introduced to bring down SFOC figures, especially over a wide range of power. Explain with a graph the variation in Pmax with respect to engine power, with VIT in use and without.
Explain clearly how the fuel consumption is reduced. How is VIT and FQS achieved in camshaft less engines. (16)
2024/NOV/Q6
Click Here to See the Answer

Q7.a) What is "virtual tappet" in the hydraulically actuated air spring return exhaust valves, and how is it set. (6)
b) Explain why the damage occurs to the seats of the exhaust valves due to furrowing and cutting. (5)
c) How an incident of "valve drop" leading to extensive damage to running gear can occur. (5)
2023/JAN/Q4 **2023/JUNE/Q2** **2023/AUG/Q6**
2024/MAR/Q1 **2024/NOV/Q7**
Click Here to See the Answer

Q8. 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. (16)
2023/JAN/Q3 **2024/NOV/Q8**
Click Here to See the Answer

Q9. 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. Indicate the circumstances under which the crankshaft may i. over stressed, ii. Become defective without being over stressed. (16)
2021/JAN/Q4 **2023/JAN/Q1** **2024/NOV/Q9**
Click Here to See the Answer

DEC-2024

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 as a fuel in such engines. (16)
2022/JUL/Q3 **2023/APR/Q1** **2024/DEC/Q1**
Click Here to See the Answer

Q2. Explain why the 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)
2021/JUL/Q5 **2023/APR/Q2** **2023/DEC/Q8** **2024/DEC/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? (8)
b). Give-details of what checks are made after the machine has been stopped:
(i) Mechanically,
(ii) Electrically. (8)
2021/JUL/Q9 **2023/APR/Q3** **2024/DEC/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. (6)
B. Why total reliance is placed on frictional grip in conventional built up crankshaft. (5)
C. Why hole oils are given large fillets in crankpin and journals. (5)
2022/NOV/Q4 **2023/APR/Q4** **2024/DEC/Q4**
Click Here to See the Answer

Q5. With reference to crankcase diaphragm glands: Explain why effectiveness deteriorates in service.
A. Describe the procedure for renewal of parts so that efficiency is restored. (6)
B. Describe how effectiveness is restored if spares are unavailable. (5)
C. Explain the functions of the upper and lower sections. (5)
2023/APR/Q5 **2024/DEC/Q5**
Click Here to See the Answer

Q6. 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 **2024/DEC/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? (16)
2023/JAN/Q7 **2024/DEC/Q7**
Click Here to See the Answer

Q8. a) State the reasons for persistent slackening of holding down bolts of a main engine. (6)

b) i) State the advantages of using non-metallic choking for main engines. (5)
ii) State precautions to be observed when fitting non-metallic chocks in order to ensure accurate chocking. (5)
2024/SEP/Q7 **2024/DEC/Q8**
Click Here to See the Answer

Q9. 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. (16)
2023/OCT/Q7 **2024/SEP/Q8** **2024/DEC/Q9**
Click Here to See the Answer