D. MARINE
Study Material

MEO CLASS 4 WRITTEN: EKG

(ENGINEERING KNOWLEDGE GENERAL)

FOR INDIAN COMPETENCY EXAM

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MAY – 2023

Q1. With reference to centrifugal pumps
(a) (i) Sketch typical discharge characteristics showing variation of throughput as the discharge head and speeds are altered (4)
(ii) Explain why this characteristic profile is desirable (4)
(b) Explain the relevance of discharge characteristic for the selection of an emergency fire pumps (8)
2023/MAY/Q1
Click Here to See the Answer

Q2. (i) Discuss the use of nonmetals onboard ships and name some of the common nonmetals used (4)
(ii) What are their areas of application on ships (4)
(iii) Name the advantages and also the limitations in using non ferrous materials (8)
2023/MAY/Q2
Click Here to See the Answer

Q3. With reference to electric arc welding (a) Draw a labeled sectional sketch of a satisfactory butt weld (6)
(b) Briefly define the following defects that may occur and how they may have been caused
(i) Under cut (2)
(ii) Splatter (2)
(iii) Inclusion (2)
(iv) Blow hole (2)
(v) Incomplete root penetration (2)
2023/MAY/Q3
Click Here to See the Answer

Q4. Explain the term incinerator and the function of incineration on board ships in order to prevent or minimise contamination of marine environment Draw a typical process flow diagram of incineration How is

incinerator ash disposed of (16)
2023/MAY/Q4
Click Here to See the Answer

Q5. Explain how each of the following conditions contribute to the satisfactory performance of oil centrifuges
(a) Correct bowl speed
(b) Cleanliness of bowl
(c) Low rate of feed to bowl
(d) Contaminated oil allowed to stand for an appreciable time prior to centrifuging (16)
2023/MAY/Q5
Click Here to See the Answer

Q6. (i) Sketch and describe a fuel system diagram for a 2-stroke marine diesel engine from storage service tank to fuel injectors Show the various components and fittings which are provided in the circuit What is the purpose of mixing columns and auto deaerating valve (16)
2023/MAY/Q6
Click Here to See the Answer

Q7. State the causes and remedial actions to be taken in case of the following occurring on an air compressor (a) Water mixed in the crankcase oil (4)
(b) LP safety valve blowing (4)
(c) Bursting disc rupture (4)
(d) Problems caused by defective piston rings (4)
2023/MAY/Q7
Click Here to See the Answer

Q8. (a) Describe the effects of freshwater feed on auxiliary boilers (6)
(b) Describe the measures taken to reduce these effects (4)
(c) Describe FIVE principal boiler water tests stating the reasons for each
2023/MAY/Q8

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Q9. (i) Discuss on board testing of lubricating oil What are the salient points for which lube oil testing is necessary (4)
(ii) Name the tests which are normally carried out and reasons for same (4)
(iii) Name instruments used for measuring viscosity and flash point Explain their working principle (8)
2023/MAY/Q9
Click Here to See the Answer

JUNE – 2023

Q1. (i) Draw the stress vs strain curve showing the different phases of change that occurs when an elastic material is subjected to load (5)
(ii) What is plastic deformation of material and how it is caused Explain yield stress and how strain hardening is caused Where is this phenomenon successfully used (6)
(iii) Explain fatigue and how fatigue failure occurs Suggest means in practice as to how fatigue failure can be avoided (5)
2023/JUN/Q1
Click Here to See the Answer

Q2. (i) Which elements present in the heavy fuel oil used in marine diesel engines results in formation of SOx H_2SO_4 and CO_2 upon combustion Discuss their effects on environment post combustion (10)
(ii) What is understood by NOx and how it is produced State the temperature at which it is formed (6)
2023/JUN/Q2
Click Here to See the Answer

Q3. (i) Sketch and describe using a block diagram the processes involved in fuel oil treatment before injection (10)
(ii) What is the purpose of centrifuging fuel and how gravity disc is selected
(iii) Why homogenisers and fine filters are used downstream (3)
2023/JUN/Q3
Click Here to See the Answer

Q4. Write short notes on following with respect to lubricating oils (a) Base oil (4)
(b) Additive (4)
(c) Contaminants (4)
(d) Sampling and testing (4)
2023/JUN/Q4
Click Here to See the Answer

Q5. (i) What is the stern tube bearing and why it is provided (4)
(ii) Name the bearing material used and how same lubricated and cooled (3)
(iii) For oil lubricated stern tubes how oil is prevented from flowing out Explain sealing arrangement with line sketch and material used (6)
(iv) Name the type of oil used for lubrication (3)
2023/JUN/Q5
Click Here to See the Answer

Q6. (i) Sketch and describe the drive mechanism of a centrifuge (10)
(ii) State the component in the horizontal and vertical drives (3)
(iii) State the purpose of providing
(a) Clutch mechanism
(b) Worm and worm wheel
(c) Bowl assembly (3)
2023/JUN/Q6
Click Here to See the Answer

Q7. Reverse osmosis is the contemporary alternative for shipboard production of drinking water
(a) Describe using simple diagrams where necessary the principle of
(i) Osmosis (3)
(ii) Reverse osmosis (3)
(b) (i) Sketch a line diagram showing a single pass system for producing fresh water from seawater (4)
(ii) Describe such a system (4)
(iii) State the safety features that may be incorporated into the plant (2)
2023/JUN/Q7
Click Here to See the Answer

Q8. With reference to electric arc welding

(a) Draw a labeled sectional sketch of a satisfactory butt weld (5)
(b) Briefly define the following defects that may occur and how they may have been caused
(i) Under cut (1)
(ii) Splatter (1)
(iii) Inclusion (1)
(iv) Blow hole (1)
(v) Incomplete root penetration (1)
(vi) Lack of fusion (1)**
(c) Why is alternating current generally more popular than direct current for metal arc welding (5)
2023/JUN/Q8
Click Here to See the Answer

Q9. Sketch and describe an independent two stage air compressor Draw a set of typical indicator diagrams and insert the various pressures and temperatures Indicate the effect of a leaking HP suction valve and excessive HP clearance volume (16)
2023/JUN/Q9
Click Here to See the Answer

JULY – 2023

Q1. (i) Define the term vibrations and through examples explain periodic and oscillatory motions (4)
(ii) Name the types of vibration and how they are classified (4)
(iii) Machineries onboard operate with their own natural vibrations which generally indicate their health Explain the term abnormal vibration and the sources from where they originate (8)
2023/JUL/Q1
Click Here to See the Answer

Q2. What is meant by corrosion control List out the techniques used in effecting corrosion control and render brief explanation of same Give one example each of their application (16)
2023/JUL/Q2
Click Here to See the Answer

Q3. Make a comprehensive list of fuel oil diesel oil and lubricating oil tanks onboard stating the purpose of each tank and their location What was their approximate capacity on your last ship (16)
2023/JUL/Q3
Click Here to See the Answer

Q4. (i) What are the types of contaminants which affect lubricating oils Briefly explain each of them (6)
(ii) What measures are adopted to prevent their entry into machinery lubricating oil systems (4)
(iii) How contaminated oils are dealt with onboard ships Particularly in case of bacterial attack (6)
2023/JUL/Q4
Click Here to See the Answer

Q5. (i) Why are deck cranes provided Name the different parts of deck cranes and what is the advantage of carrying deck cranes (6)

(ii) Name the safety stops and cutouts provided for safe operation (4)
(iii) What maintenance is required periodically (3)
(iv) What is rocking test and why same carried out (3)
2023/JUL/Q5
Click Here to See the Answer

Q6. (i) What are the types of pumps normally used for steering gear system
(ii) Using a simple sketch explain the working principle of radial piston type pumps (8)
(iii) What is understood by the term hunting action (5)
2023/JUL/Q6
Click Here to See the Answer

Q7. (i) Sketch and describe a composite boiler and explain its working principle (12)
(ii) What do you understand by the term heat recovery Briefly explain as to how it contributes to increasing plant efficiency (4)
2023/JUL/Q7
Click Here to See the Answer

Q8. (i) Explain the basic theory of air compressors using a basic P-V cycle diagram for a single stage air compressor showing
(a) adiabatic
(b) polytropic
(c) isothermal lines of compression (6)
(ii) Explain the advantages of multistage compression and intercooling Superimpose the effects of both on the P-V diagram mentioned above (6)
(iii) Briefly explain bumping clearance (4)
2023/JUL/Q8
Click Here to See the Answer

Q9. (i) In a refrigeration and air conditioning system what are the different methods for detecting gas leakage (3)
(ii) Name different types of detectors available and state how they are used

to identify point of leakage What safeties are observed when performing leak detection (4)
(iii) Explain how leakages in the piping system are rectified
(a) Temporarily
(b) Permanently (5)
(iv) What records are to be created and maintained whilst carrying out repair maintenance on the refrigeration system (4)

2023/JUL/Q9

Click Here to See the Answer

AUGUST – 2023

Q1. (a) With reference to auxiliary boiler safety valves
(i) Describe with the aid of a sketch the safety valve for an auxiliary boiler
(ii) Identify with reasons the parts that particularly require close attention during overhaul
(b) Describe the duties of a watch keeper with respect to a running boiler
2023/AUG/Q1
Click Here to See the Answer

Q2. (a) Sketch a line diagram showing a typical inert gas system used for inerting the cargo tanks of oil tankers labelling the component parts (6)
(b) Describe the system (8)
(c) State what oxygen content you would expect in the flue gases if good combustion is achieved (2)
2023/AUG/Q2
Click Here to See the Answer

Q3. Outline the measures to prevent fires caused by spillage of fuel lubricating and hydraulic oil involving EACH of the following (a) Pipes filters valves and cocks (2)
(b) Oil units (2)
(c) Overflow arrangements (2)
(d) Sounding arrangements (2)
(e) Thermometer fittings (2)
(f) Pumps and fittings (2)
(g) Electric cables (2)
(h) Exhaust trunkings (2)
2023/AUG/Q3
Click Here to See the Answer

Q4. (a) Describe with aid of a line diagram the layout and components of a hydraulic system suitable for operation of deck machinery (8)
(b) Explain how the hydraulic system pressure is controlled assuming the

use of a variable delivery pump (4)
(c) State which design of hydraulic motor is used in the system described in (b) (4)
2023/AUG/Q4
Click Here to See the Answer

Q5. With reference to control system state what is meant by
(a) Two step action (6)
(b) Proportional control (5)
(c) Offset (5)
2023/AUG/Q5
Click Here to See the Answer

Q6. Explain why each of the following features is considered desirable for air compressors (a) A single throw crank for a multi stage compressor (4)
(b) Minimum clearance volume (4)
(c) Multi tubular inter stage cooler (4)
(d) Generous size of suction filter (4)
2023/AUG/Q6
Click Here to See the Answer

Q7. (a) Describe each of the following (i) Work hardening (ii) Nitriding (iii) Cold working (iv) Normalising (8)
(b) With reference to the component parts of shipboard machinery and equipment state with reason one example of where EACH of (a) may be used (8)
2023/AUG/Q7
Click Here to See the Answer

Q8. (a) Sketch a steering gear arrangement capable of 100 percent redundancy (8)
(b) Describe the operation of the arrangement in
(C) when the working pump oil manifold develops a serious leak (8)
2023/AUG/Q8

Click Here to See the Answer

Q9. Make a diagrammatic sketch of an exhaust gas boiler Describe its construction and explain how it is maintained in an efficient condition (16)
2023/AUG/Q9
Click Here to See the Answer

SEPTEMBER – 2023

Q1. Write short notes on the following pertaining to the use of copper alloys in seawater systems (a) Use of copper nickel and formation of protective film for use in seawater (4)
(b) Cavitation (4)
(c) Dezincification (4)
(d) Marine biofouling (4)
2023/SEP/Q1
Click Here to See the Answer

Q2. (i) Explain the purpose and applications of using lubricating oils onboard (8)
(ii) Name the types of lubricating oil used on ships and mention various properties of same and their significance (8)
2023/SEP/Q2
Click Here to See the Answer

Q3. (i) What is meant by the term corrosion and how does it occur in nature
(ii) Name different types of wet and dry corrosion at least four of them with brief account of their occurrence and suitable preventive measures for their control (10)
2023/SEP/Q3
Click Here to See the Answer

Q4. Explain the procedures to be followed before during and after taking bunker and transferring of the bunker (8)
(i) State the checklists to be adopted before during and after bunkering (4)
(ii) Make a schematic showing the storage and fuel transfer lines onboard
2023/SEP/Q4
Click Here to See the Answer

Q5. Describe the functional components of a reefer plant for the domestic refrigeration system and temperatures to be maintained in different cold rooms (8)
(i) Describe the pressure switches (2)
(ii) The tubular heat exchanger (2)
(iii) The oil separator (2)
(iv) The drier system (2)
2023/SEP/Q5
Click Here to See the Answer

Q6. (i) Sketch and describe a biological sewage treatment system (6)
(ii) How does the biological sewage treatment plant work Explain (6)
(iii) What is understood by the term BOD What factors affect BOD (4)
2023/SEP/Q6
Click Here to See the Answer

Q7. (i) What is the significance of oil water interface in fuel oil purifiers (3)
(ii) Explain the principle of desludging operation (6)
(iii) What is the purpose of operating water sealing water and replacement water How is operating water supplied and at what pressure (7)
2023/SEP/Q7
Click Here to See the Answer

Q8. (i) What is the basic function of heat exchanger (3)
(ii) Draw a line diagram showing the temperature gradient between the fluids at an intermediate heat conductive wall of a heat exchanger (3)
(iii) Explain with respect to flow pattern
(a) Parallel flow
(b) Contra flow
(c) Turbulent flow
(d) Streamline flow (10)
2023/SEP/Q8
Click Here to See the Answer

Q9. (i) Explain the term incinerator and the function of incineration onboard ships in order to prevent minimize contamination of marine environment Draw a typical process flow diagram on incineration How is incinerator ash disposed off (16)

2023/SEP/Q9

Click Here to See the Answer

OCTOBER – 2023

Q1. With reference to centrifugal pumps
(a) (i) Sketch typical discharge characteristics showing variation of throughput as the discharge head and speeds are altered (4)
(ii) Explain why this characteristic profile is desirable (4)
(b) Explain the relevance of discharge characteristic for the selection of an emergency fire pump (8)
2023/OCT/Q1
Click Here to See the Answer

Q2. Reverse osmosis is the contemporary alternative for shipboard production of drinking water
(a) Describe using simple diagrams where necessary the principle of (i) Osmosis (3)
(ii) Reverse osmosis (3)
(b) Sketch a line diagram showing a single pass system for producing fresh water from seawater (4)
(ii) Describe such a system (4)
(iii) State the safety features that may be incorporated into the plant (2)
2023/JUN/Q7 **2023/OCT/Q2**
Click Here to See the Answer

Q3. With reference to electric arc welding
(a) Draw a labeled sectional sketch of a satisfactory butt weld (5)
(b) Briefly describe the cause of the following defects in welding
(i) Under cut (1)
(ii) Splatter (1)
(iii) Inclusion (1)
(iv) Blow hole (1)
(v) Incomplete root penetration (1)
(vi) Lack of fusion (1)
(c) Why is alternating current generally more popular than direct current

for metal arc welding (5)
2023/OCT/Q3
Click Here to See the Answer

Q4. Sketch and describe an independent two stage air compressor Draw a set of typical indicator diagrams and insert the various pressures and temperatures Indicate the effect of a leaking HP suction valve and excessive HP clearance volume (16)
2023/OCT/Q4
Click Here to See the Answer

Q5. Explain how each of the following conditions contribute to the satisfactory performance of oil centrifuges
(a) Correct bowl speed
(b) Cleanliness of bowl
(c) Low rate of feed to bowl
(d) Contaminated oil allowed to stand for an appreciable time prior to centrifuging (16)
2023/OCT/Q5
Click Here to See the Answer

Q6. State with reasons the causes of fatigue cracking of engineering components
(a) State with reasons how material and design defects can influence fatigue life
(b) With reference to engine bed plate transverse girders explain how the incidence of fatigue cracking can be minimized (16)
2023/OCT/Q6
Click Here to See the Answer

Q7. (a) Sketch in simple form a constant speed hele shaw pump suitable for a hydraulic steering gear (6)
(b) Describe the pump and its principle of operation (5)
(c) What characteristics of the pump make it suitable for use in steering

gear system (5)
2023/OCT/Q7
Click Here to See the Answer

Q8. (a) Describe the effects of freshwater feed on auxiliary boilers (6)
(b) Describe the measures taken to reduce these effects (4)
(c) Describe FIVE principal boiler water tests stating the reason for each (6)
2023/OCT/Q8
Click Here to See the Answer

Q9. With reference to main refrigeration plants give reason for each of the following operational irregularities and state how these are dealt with
(a) Rapid loss of lubricating oil from the crankcase of a vee block compressor
(b) Steady fall off in refrigeration effect over a comparatively short period of time (4)
(c) Excessive icing up at compressor suction (4)
(d) Short cycling (4)
2023/OCT/Q9
Click Here to See the Answer

NOVEMBER – 2023

Q1. (i) Sketch and describe using a fuel oil treatment before injection (10)
(ii) What is the purpose of centrifuging fuel and how gravity disc is selected
(iii) Why homogenisers and fine filters are used downstream (3)
2023/JUN/Q3 **2023/NOV/Q1**
Click Here to See the Answer

Q2. (i) Explain using a simple line diagram difference between lubricating oil systems dealing with cylinder lubrication vis-à-vis crankcase lubrication
(ii) State the properties of oil essential in each of these cases (4)
(iii) What is synthetic oil How it is different from mineral oil Where is it used (5)
2023/NOV/Q2
Click Here to See the Answer

Q3. Sketch and describe a four ram electro hydraulic steering system showing pump isolating valves relief valves and bypass valves (10)
(ii) Indicate and explain valve position for one pump isolation and one unit isolation (6)
2023/NOV/Q3
Click Here to See the Answer

Q4. (i) Sketch and describe the modern purification system using ALCAP concept for purifying fuel with specific gravity about 0.991 (8)
(ii) Explain how ALCAP separator operates as clarifier and how is the water drained off (4)
(iii) What is paring disc How does it function (4)
2023/NOV/Q4
Click Here to See the Answer

Q5. (i) Explain with reasons as to why boiler water testing is carried out onboard (6)
(ii) Explain procedure for collecting boiler water sample State precautions

(iii) Mention with procedure and recommended values for the tests which need to be carried on boiler water as a routine (6)

2023/NOV/Q5

Click Here to See the Answer

Q6. (i) Explain the term volumetric efficiency in respect of air compressors
(ii) State reasons for drop in volumetric efficiency and how same can be restored (7)
(iii) Explain the purpose of unloader Name the methods used for unloading for starting and stopping when on automatic operation (6)

2023/NOV/Q6

Click Here to See the Answer

Q7. (i) Using a line diagram show the arrangement of emergency bilge suction for a general cargo ship (8)
(ii) State the purpose of bilge injection valve and to which pump or pumps it is connected Give reasons (4)
(iii) State requirements with respect to the diameter of bilge injection valve and main sea suction valve on sea chest (4)

2023/NOV/Q7

Click Here to See the Answer

Q8. (i) Define centrifugal pump and where it is used on ships Using a simple line diagram show a circuit which includes a centrifugal pump Explain the meaning of suction lift (6)
(ii) Sketch and describe the construction of centrifugal pump labelling its parts What is a lantern ring and why is it fitted (10)

2023/NOV/Q8

Click Here to See the Answer

Q9. (i) State the advantages and disadvantages in using centrifugal pump on ship duties (4)
(ii) How should a centrifugal pump be operated in order to get best results
(iii) State maintenance schedule for the pump What parts of the pump are

closely checked during surveys (7)
2023/NOV/Q9
Click Here to See the Answer

DECEMBER – 2023

Q1. (a) What are the different types of coupling bolts used in practice Name at least 3 (3)
(b) Explain with the help of sketch as to how a pilgrim hydraulic bolt is fitted and removed (8)
(c) How are fitted bolts installed on the coupling (5)
2023/DEC/Q1
Click Here to See the Answer

Q2. (i) Sketch and describe the modern purification system using ALCAP concept for purifying fuel specific gravity about 0.991 (8)
(ii) Explain how ALCAP separator operates as clarifier and how is the water drained off (4)
(iii) What is paring disc How does it function (4)
2023/NOV/Q4 **2023/DEC/Q2**
Click Here to See the Answer

Q3. (a) Sketch and describe a low-pressure control air system used on board ships showing arrangements to deal with dust oil and moisture as well as safety system (8)
(b) Explain using a line diagram arrangement provided to reduce the air pressure to 7/8 bar required for control air system (8)
2023/DEC/Q3
Click Here to See the Answer

Q4. (a) Whilst on seawatch you observe that the oil mist detector in engine room has triggered an alarm and crankcase door of one unit feels hotter than rest What pre emptive action will you take as watchkeeper (10)
(b) Draw a simple line diagram of an OMD and explain its working (6)
2023/DEC/Q4
Click Here to See the Answer

Q5. (i) Define centrifugal pump and where it is used on ships Using a simple line diagram show a circuit which include a centrifugal pump Explain the meaning of suction lift (6)
(ii) Sketch and describe the construction of centrifugal pump labelling its parts What is a lantern ring and why is it fitted (10)
2023/NOV/Q8 **2023/DEC/Q5**
Click Here to See the Answer

Q6. Explain the following terms and give examples where each condition might occur (a) Stress corrosion cracking (6)
(b) Creep cracking (5)
(c) Corrosion fatigue (5)
2023/DEC/Q6
Click Here to See the Answer

Q7. (a) What are the safety devices fitted to an air compressor (4)
(b) What is the purpose of the scum valve on a boiler (4)
(c) What is the function of an evaporator in a refrigeration system (4)
(d) Regarding the emergency bilge injection valve what is its relative size compared to the main sea water injection valve (4)
2023/DEC/Q7
Click Here to See the Answer

Q8. (a) Sketch a two-ram type hydraulic steering gear with a single electro hydraulic pumping unit Show the hunting gear arrangement and indicate valve positions (8)
(b) State the purpose of and describe the operation of
(i) Hydraulic shock buffer valves
(ii) Oil replenishing tank
(iii) Hunting gear (8)
2023/DEC/Q8
Click Here to See the Answer

Q9. (a) Explain why air receivers should be drained frequently and its internal surfaces to be provided with protective coatings (6)
(b) Describe the procedure for internal inspection of air receivers and the possible defects that may be encountered Suggest suitable repair methods for the defects (6)
(c) Describe fault conditions associated with air receiver mountings and the remedies to rectify the same (4)

2023/DEC/Q9

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