

CLASS 1 & 2.

ENGINEERING KNOWLEDGE

INTERNAL COMBUSTION ENGINE

1. Describe the operating cycle of a Four-Stroke Diesel Engine with aid of a Timing Diagram.
2. Draw the Timing Diagram of a Four-Stroke Diesel Engine indicating the salient points.
3. Describe the operating cycle of a Two-Stroke Diesel Engine with aid of a Timing Diagram
4. Draw the Timing Diagram of a Two-Stroke Diesel Engine indicating the salient points.
5. Describe briefly the effect of a CRASH STOP on the main Propulsion Engine.
6. Write short notes on the following: (a) Indicated power, (b) Break power, (c) Mechanical efficiency.
7. What is the purpose of an Engine Indicator.
8. With the aid of a simple Diagram describe the hot oil side (from FO service tank to Engine) Fuel System of a Large Diesel Engine.
9. State the purpose of Scavenging & Super Charging.
10. What are the causes of Scavenge Fire?
11. What are the indications of Scavenge Fire?
12. State the actions to be taken in case of a Scavenge Fire.
13. With respect to Large Diesel Engines – what is the necessity of Preheating?
14. Describe the importance of gradually increasing Main Engine Speed from Full Ahead to the Full Away or Maximum Rated Speed.
15. Sketch a block diagram of a High Temperature Fresh Water Cooling system for a vessel fitted with a slow speed diesel main engine. Label all system components and indicate the direction of cooling water flow.
16. Describe the types of scavenging in 2 stroke diesel engines.
17. Explain what is meant by the term specific fuel consumption and its relationship to the terms maximum continuous rating, economical RPM and voyage planning.
18. After passing TSS you are advised of next port and its passage consist of passing a ECA, what precaution you will take and include into your passage plan? What should be notified to ECR if fuel change over operation likely to not going according to the plan prepared due to the circumstance changed, and what could be the impact in case noncompliance found out?
19. What is SOX and NOX? How to comply with SOX and NOX? What document requires? Describe all the ways possible to comply with SOX requirement.

20. You are to pass a crowded TSS within one hour, what preparation you will take in regards to the bridge watch manning level? And what preparation you would advise to be taken in regards to the engine?
21. Draw a line diagram and describe Main Engine Jacket cooling water system.
22. What is the purpose of Lubrication. Draw a line diagram of a main engine lubricating oil system.
23. What is the purpose of regular Lubricating shore analysis process.
24. Write short notes on a) EEDI b) EEOI c) SEEMP.
25. Write short notes on a) NOx file b) IAPP c) EIAPP.
26. Write five reasons for M/E auto slow down and three reasons of M/E shut down.
How to reset above slow and shut down from W/H console.
27. Under what circumstances Main Engine slow down can be bypassed from W/H console. Explain the validities for the above.
28. What are the reasons for a crankcase explosion ? What are the safety features are fitted to avoid such incident.
29. What is turning gear interlock ? In the event of Main Engine starting failure noted from Wheel House, what action to be taken.
30. What is the purpose of Main Engine Governor.
31. What do you understand by Main Engine operation with NOR & MCR.

BOILER

32. Write short notes on the following mentioning their purposes: (a) Main Steam Stop Valve, (b) Feed Water Regulating Valve, (c) Soot blower, (d) Gauge Glass.
33. State a typical classification of Marine Boilers and mention the difference in their operating principle.
34. State the advantages of Water Tube Boilers over Smoke Tube Boilers.
35. State why Boiler Water Treatment is necessary?
36. State the Tests of Boiler Water carried out on board, mentioning their purposes.
37. How is efficient steam utilization achieved?
38. Describe the boiler function with figure in details. On board VLCC what precaution to be taken when running steam driven cargo pumps?
39. What are the main safety alarm and trips are fitted with Auxiliary boiler.
40. Write short notes on a) Composite boiler b) Exhaust gas boiler. c) Exhaust gas Economizer.
41. What is the reason of Exhaust gas economizer fire ? what is the purpose of EGE soot blow.
42. What are the precaution to be observed in the event of an oil tanker cargo heating system.
43. Engineers reported there are traces of oil in the cascade tank after starting heating cargo oil. What is your responsibilities to identify the defect & remedy.
44. What is steam hammering? Describe how to avoid steam hammering.
45. What is the purpose of the safety valves of Auxiliary boiler ? How many safety valves are fitted with auxiliary boiler? Describe the validity of your answer?

REFRIGERATION

46. Name the Refrigerants used in marine installations stating their strength and weaknesses.
47. State the desirable properties of a Primary Refrigerant.
48. Describe the Operating Principle of Vapour Compression Type.
49. Sketch a Schematic diagram of Cargo Refrigeration Plant using Indirect Expansion.
50. State how insulation is done in cargo holds.
51. State the typical system faults of a Refrigeration system.
52. State the purpose of Expansion Valve.
53. Write short notes on a) ODP b) GWP. What are the main properties of new generation refrigerant gas?
54. Write short notes on a) Relative humidity b) Comfort zone.
55. Sketch a line diagram of an accommodation air condition plant.
56. Brine is used as secondary refrigerant in Refer vessels. What is brine ? Why brine is widely used ?
57. After taking new provisions, considerable icing noted on cold room evaporators and on the suction line of the refer compressor. Describe the reasons and the remedies.

FIRE & SAFETY

58. Name the types of Fire Detectors used on board.
59. Describe with the aid of sketch operating principle of each type of fire detectors.
60. State how often the fire detectors to be tested ? state the procedure of testing each type of detectors.
61. Where is the fire detection control panel located. How to locate a fire.
62. Sketch a CO2 Total Flooding System and briefly describe the operating procedure.
63. Name the Total Flooding systems used on board other than CO2 .
64. Why CO2 is preferred for total flooding system?
65. Describe with aid of a sketch Cargo hold CO2 Flooding system, where detection, alarm and flooding are incorporated together.
66. Describe the requirements of Emergency Fire Pump with respect to its Location, Power Supply and Capacity.
67. Describe with the aid of a sketch the operational features of a Emergency Fire Pump.
68. Describe the common difficulties with the suction of Emergency fire pump, especially during the vessel is with ballast condition.

69. Write short notes on a) Quick closing valves b) Emergency stop switch of Engine room pumps and blowers.
70. Describe what is enclosed space ? Procedure of entrance to a enclosed space.
71. Name a few toxic gases that are mostly noted on tanker vessels. What is TLV of toxic gas ?
72. What is a) fixed gas detection system b) Portable gas detection equipment c) Personal gas detection equipment.
73. Draw the flammability diagram and highlight the LEL & UFL region. What is the purpose of inert gas on tanker vessels.
74. Draw a line diagram of an inert gas system suitable for crude oil tanker.
75. Write short notes on a) VOC b) VRS c) VIQ

AUTOMATION AND CONTROL

76. State the advantages of automation.
77. State the types of temperature sensors and describe with sketch example of one sensor.
78. Define the Following: (a) controlled condition, (b) monitoring element, (c) measured value, (d) deviation, (e) comparator.
79. Describe the advantage and disadvantages of Open Loop and Closed Loop control system.
80. State the requirements of UMS operation of Engine Room.
81. State the advantage and disadvantage of Pneumatic, Electronic and Hydraulics as control system medium.
 81. a) Draw a typical Navigation Light Circuit diagram.
 - (b) Explain how it works.
82. What are the purposes of autopilot. Draw a simplified block diagram of an autopilot system
83. Describe the reasons for bridge control of main engine. Describe how such control is achieved

PUMPS AND AUXILIARIES

84. Describe a typical classification of Pumps.
85. Mention at least one use of each type of pumps.
86. Write down the strength and weaknesses of Centrifugal and reciprocating pumps.
87. Draw a Bilge pumping arrangement indicating all principle components.

88. With the aid of a diagram explain the working principle of a Fresh Water Generator.

89. What is the limitation of an evaporator type Fresh water generator? Name and describe the operating principle of the alternative type of Fresh water generator.

90. Draw a block diagram of the above Fresh water generator.

90. Describe with the aid of a sketch the operating principle of an Oily Water Separator.

91. Classify common pump types along with their respective usage. How priming is done in Centrifugal pumps?

92. The same four common failure modes exist for both a positive displacement pump and a centrifugal pump. List each failure mode and two possible causes of each failure mode for each pump type.

92. What are the possible reasons and remedy for "No pump suction" in centrifugal pump?

93. Describe Reciprocating Pump?

94. Briefly describe the types of pumps that are typically used in the following systems and explain why for each case: Fire Hydrants; Engine Room Bilge; Main Engine Fuel Oil; and Hydraulic Hatch Cover.

95. How priming is done in centrifugal pump?

96. For both centrifugal and positive displacement pumps, describe, when monitoring a running pump, what operational parameters would indicate to you there was a possible problem with the pump.

97.. List the main components of a vessel's bilge system and briefly describe the role of each.

98 . Describe the operating principle of an oily water separator along with a neat figure.

99. List the components of a ship's fire main system and briefly describe the requirements of the system. Itemize any special requirements for the emergency fire pump.

100. What types of accidents could cause pollution during bunker operations? What actions should be taken in the event of a spillage of fuel oil during a bunkering operation?

101. Describe Annex 1 machinery space bilge discharge criteria ? Under what legislation it is possible to pump Engine room bilges at special area. Which is the pumping out of bilges is always prohibited ?

102. Describe the MARPOL Annex-1 regulation for pumping out of a tanker vessel slop tank.

105. What are master's responsibilities prior to signing the ORB part 1 & 2.

DECK MACHINERY

103. State the basic maintenance task for Deck Machinery.

104. State the basic maintenance task for Hatch Covers.

105. State how you can test its alarm function.

106. How the hydraulic oil can be contaminated. What are the remedies.

107. What are the safety features fitted with cargo operating hydraulic cranes. What are the procedures of testing and how often to be tested.

108. What is load test of cranes? How is it carried out? What is rocking test on hydraulic cranes.

109. What do you understand by windlass & mooring winch brake holding capacity test.

110. What is the procedure of running deck hydraulic machineries in extreme cold climate.

111. What are the difficulties and remedies if the hydraulic oil temperature is high.

112. Describe the procedure of pumping out of chain locker.

PROPELLER AND SHAFTING.

115. Sketch and describe an oil lubricated stern tube bearing.

116. How is the Stern tube kept oil tight?

117. What are the relative advantages and disadvantages of controllable pitch propeller over fixed pitch propeller?

118. State the precautions to take with a CPP before:

- a. Starting the main engines
- b. Going to sea
- c. Entering harbor or confined waters

119. What is propeller pitch? What are the factors affecting ship speed? How ship speed can be optimized in accordance with SEEMP?

120. How many types rudder, describe with figure. Describe a few reasons of sluggish rudder operation.

STEERING GEAR

121. State the actions to be taken in the event of a Steering Failure.
122. State the types of Steering Gears. Describe the operating principle of one type with the aid of a sketch.
123. Describe a Four Ram type steering system. On what vessel type(s) might this steering arrangement be found?
124. Write the advantage & disadvantage of ram type & Rotary vane steering gear.
125. What is follow up and non follow up system?
126. Briefly describe the Hunting gear mechanism in steering gear system.
127. For a modern steering gear system, describe:
 ❑ how emergency steering is achieved, i.e. what aids are in the steering flat; and
 ❑ what safety features are incorporated into the system if fitted in an Oil Tanker?
128. Describe a rotary vane steering system. How is redundancy obtained with this type of system? On what vessel type(s) might this steering arrangement be found?
129. Describe the SOLAS requirements of Main & auxiliary steering gear.
130. What are the checks and tests to be carried out on steering gear system prior departure and arrival port.
131. What are the alarms fitted with steering gear system.

CALCULATION QUESTIONS

133. A ship travelled a distance of 800 nautical miles at a speed of 10 knots and burned 100 tonne of fuel on the voyage. How far could this ship travel at a speed of 12 knots on a total consumption of 220 tonne?

134. A ship's propeller has a pitch of 5.1m; in 24 hours steaming at a propeller speed of 91 rev/min, it was found that the vessel logged 331 nautical miles, find the percentage slip.

135. A ship covers a voyage of 2400 nautical miles at a speed of 10 knots and consumes 600 tonne of fuel. What would be the probable consumption of fuel over the same distance at a speed of 11 knots.

136. A propeller of 4.5 m pitch turns at 120 rev/min and drives the ship at 15.5 knots. Calculate the propeller slip.

137. A propeller of 4 m pitch has an efficiency of 67%. When turning at 125 rev/min the real slip is 36% and the delivered power 2800 kw. Calculate the thrust of the propeller.

138. The speed of ship is increased to 18% above normal for 7.5 hours. Then reduced to 9% below normal for 10 hours. The speed is then reduced for the remainder of the day so that the consumption for the day is the normal amount. Find the percentage difference between the distance traveled in that day and the normal distance travelled per day.

139. A ship of 14 900 tonne displacement has a shaft power of 4460 kW at 14.55 knots. The shaft power is reduced to 4120 kW and the fuel consumption at the same displacement is 451 kg/h. calculate the fuel coefficient for the ship.

140. The daily fuel consumption of a ship at 17 knots is 42 tonne. Calculate the speed of the ship if the consumption is reduced to 28 tonne per day, and the specific consumption at the reduced speed is 18% more than 17 knots.

141. The normal speed of a ship is 14 knots and the fuel consumption per hour is given by $0.12 + 0.001 V^3$ tonne, with V in knots, calculate:
(a) Total consumption over a voyage of 1700 nautical miles
(b) The speed at which vessel must travel to save 0.42 tonne of fuel per hour.

142. A propeller of 5.5 m diameter has a pitch ratio of 0.8. When turning at 120 rpm, the wake fraction is found to be 0.32 and the apparent slip 4.44%. Calculate the Ship speed, speed of advance and real slip.

143. A ship's speed was 18 knots. A reduction of 3.5 knots gave a saving in fuel consumption of 22 tonnes per day. Calculate the consumption per day at 18 knots.

144. A ship travels at 15.5 knots when the propeller, 4.5 m pitch, turns at 120 rpm. If the wake fraction is 0.30, calculate the apparent and real slip.

145. A ship travels at 14 knots when the propeller, 5 m pitch, turns at 105 rpm. If the wake fraction is 0.35, calculate the apparent and real slip.

146. A ship's speed is increased by 20% above normal for eight hours, reduced by 10% below normal for 10 hours and for the remaining 6 hours of the day the speed is normal. Calculate the % variation in fuel consumption in that day from normal.