UK MARINE TRAINING CENTRE (UMTC)
SAI POOJA BUILDING, SHOP NO. 4, PLOT NO. 36, SECTOR - 34. KAMOTHE, NAVI MUMBAI - 410 209 MAHARASHTRA, INDIA.
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MARCH 2015

Attempt SIX questions only

Marks for each part question are shown in brackets

Q1. (a) Describe, with the aid of a sketch, an open loop system for reducing SOx emissions from engine exhaust gas, explaining how the system operates whilst the vessel is in open waters. (6)

(b) Describe, with the aid of a sketch, a closed loop scrubber system for removing SOx from engine exhaust gas, explaining the operation of this unit and stating when it would be used. (10)

2015/March						

Q2. (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. (4)

(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. (6)

2015/March						

Q3. As Chief Engineer Officer, write instructions for the actions to be taken in the event of a high temperature scavenge alarm being activated during a period of UMS operation, stating the reasons for EACH action. (16)

2015/March						

Q4. (a) Explain why charge air coolers are fitted to turbocharged diesel engines, stating the possible effects on engine operation and performance if they are not maintained in good condition. (6)

(b) As Chief Engineer, write instructions for the routine in-service checking of charge air cooler performance and cleanliness together with the checking of condensate draining. (6)

(c) State, with reasons, the possible consequences if condensate is not drained from the charge air cooler. (4)

2015/March						

Q5. As Chief Engineer write a report to the engineering superintendent regarding the failure of a high- pressure fuel pump unit on an electronically controlled engine. The report must explain the nature of the failure, how the failure was detected and the immediate action taken. The report must also explain the actions taken to replace the pump and the steps taken to minimise the risk of future similar fuel pump failures. (16)

2015/March						

Q6. ((a) State, with reasons, THREE properties required of a cylinder lubricant for a main engine operating on HFO. (6)

(b) Describe, with the aid of sketches, an electronically controlled cylinder lubrication system, stating how the timing and quantity of cylinder lubricant is regulated and set. (10)

2015/March						

Q7. With reference to turbochargers:

(a) explain how the operating performance of a turbocharger system may be assessed. (10)

(b) state, with reasons, defects which adversely affect the operating performance of a turbocharger. (6)

2015/March						

Q8. With reference to two stroke, slow speed engine pistons:

(a) explain what is meant by the term thermal stress and how this can cause cracking of crown surfaces; (4)

(b) sketch a cross-section of a piston, labelling the main components and indicating coolant flow; (8)

(c) state a cause of EACH of the following defects:

(i) burning of the crown upper surfaces; (2)

(ii) carbon deposits in the cooling spaces. (2)

2015/March						

Q9. With reference to an engine air starting system:

(a) explain why a slow turning system 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)

2013/March	2014/March	2014/July	2015/March				

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July 2015

Attempt SIX questions only

Marks for each part question are shown in brackets

Q1. (a) Describe the dangers associated with a main engine starting air system, explaining how these dangers are mitigated. (9)

(b) State, with reasons, THREE causes of an engine failing to fire on fuel after successfully turning over on starting air. (3)

(c) Explain how the engine is transferred to local (engine side) control in the event of failure of the main engine remote control system. (4)

2013/Dec	2015/July					

Q2. (a) State why Direct Water Injection is used on some engines, explaining how it performs

the duty intended. (8)

(b) Describe, with the aid of a sketch, a Direct Water Injection system. (8)

2013/March	2014/Oct	2015/July				

Q3. Following the failure of the engine monitoring and alarm systems, explain the checks that will have to be made and how the engine room will be operated without these systems. (16)

2015/July						

Q4. With reference to the survey of diesel main propulsion machinery by the Classification Society:

(a) explain the terms Continuous Survey of Machinery (CSM); (3)

(b) explain how classification societies have reduced the need for attendance by the surveyor; (4)

(c) describe how a planned maintenance scheme may be used in conjunction with CSM; (5)

(d) describe TWO programmes that are approved by the classification societies so that physically opening the machinery is not necessary on every occasion. (4)

2015/July						

Q5. (a) Describe, with the aid of a sketch, a waste heat recovery system for electrical generation using main engine exhaust gas in combined gas/steam turbine systems. (8)

(b) Describe the operation of the waste heat recovery system described in part (a) whilst the associated main engine is running. (8)

2015/July						

Q6. With reference to slow speed diesel engines

(a) explain why electrically driven scavenge air blowers are fitted to engines even though turbochargers are fitted. (4)

(b) describe how a turbocharger may be disabled to allow for operation of the main engine in the event of failure of the turbocharger rotor. (6)

(c) describe the procedure for operating an engine in the event of a turbocharger not being operational. (6)

2015/July						

Q7. With reference to diesel engine lubricating oil and distillate fuel oil:

(a) describe the causes and effects of microbial attack; (6)

(b) explain how microbial attack may be detected; (4)

(c) describe how an oil system may be returned to service following microbial attack. (6)

2015/July						

Q8. With reference to the use of HFO in marine diesel engines:

(a) state, with reasons, the difficulties EACH of the following Fuel Properties may cause:

(i) density; (2)

(ii) viscosity; (2)

(iii) suplhur; (2)

(iv) catalytic fines. (2)

(b) explain what system adjustments are required when these properties change. (8)

2015/ July						

Q9. (a) Outline the probable events leading to a crankcase explosion, describing the affects and hazards. (12)

(b) As a Chief Engineer Officer state, the standing orders regarding the activation of the oil mist detector. (4)

2015/July						

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October 2015

Attempt SIX questions only

Marks for each part question are shown in brackets

Q1. With reference to slow speed diesel engine turbocharging:

(a) explain why electrically driven scavenge air blowers are sometimes fitted; (4)

(b) describe how a turbocharger may be disabled to allow for operation of the main engine in the event of failure of the turbocharger rotor; (8)

(c) describe the procedure for running an engine in the event of a turbocharger not being operational. (4)

2015/July	2015/Oct					

Q2. With reference to medium speed diesel engine cylinder liners:

(a) explain the cause and effects of liner polishing or glazing; (6)

(b) explain the action of an anti-polishing ring during the operation of the engine; (5)

(c) describe how effective cylinder lubrications achieved. (5)

2015/ Oct						

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; (8)

(c) explain how fuel injector nozzles are cooled on engines which are not fitted with a separate nozzle cooling system. (4)

2015/Oct						

Q4. While operating in heavy weather the main engine loses power and misfires. Investigation shows considerable quantities of water in the fuel.

(a) As Chief Engineer Officer explain the immediate actions which should be taken to ensure safe operation of the ship. (6)

(b) State, with reasons, the possible sources of water entering the fuel storage, handling and supply system. (5)

(c) As Chief Engineer Officer write the standing orders that would be issued with respect to operation of the fuel storage, handling and supply system. (5)

2014/March	2104/Oct	2015/Oct				

Q5. With reference to diesel engine cylinder head exhaust valves:

(a) state, with reasons, the indications of valve burn out; (4)

(b) state the causes of burnt out valves; (4)

(c) describe the onboard procedures and practices that would minimise valve failure. (8)

2015/Oct						

Q6. Write a report to the engineering superintendent regarding the failure at sea of a crosshead main engine bottom end bearing. The report must explain how the defect was detected, the immediate action taken to prevent further engine damage, the subsequent action taken to ensure that the vessel was able to continue on passage to the next port, probable cause of the bearing failure and other checks made on the engine. (16)

2015/Oct						

Q7. (a) State, with reasons, SIX points which should be covered in a risk assessment for the replacement of a crosshead main engine fuel injection pump in port. (6)

(b) Write instructions for the replacement of a crosshead main engine fuel injection pump. (10)

2015/Oct						

Q8. (a) Describe, with the aid of a sketch, a hydraulic top bracing for a large 2 stroke diesel engine. (14)

(b) State the advantage of the hydraulic type over the friction type top bracing. (2)

2015/Oct						

Q9. Most medium speed diesel engines at sea do not have tie bolts. Explain the design and manufacturing aspects of why this is possible when medium speed engines have combustion pressures equal to or even greater than slow speed engines. (16)

2015/Oct						

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December 2015

Attempt SIX questions only

Marks for each part question are shown in brackets

Q1. (Write a report for the engineering superintendent regarding the replacement at sea of a damaged main engine cylinder cover. The report must explain how the problem was detected, the likely cause of the damage and the action which has been instituted to prevent further incidents of this type. (16)

2013/July	2013/Dec	2015/Dec					

Q2. Write instructions for the actions to be taken by a duty engineer following activation of a slow speed main engine exhaust gas differential temperature alarm during a period of unmanned machinery operation. The instructions must cover the period from activation of the alarm to return of the main engine to normal operation. (16)

2015/Dec						

Q3. (a) Explain why highly efficient diesel engines tend to produce more NOx than low performance diesel engines. (4)

(b) Describe, with the aid of a sketch, a Selective Catalytic Reduction (SCR) unit for a marine propulsion diesel engine. (8)

(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. (4)

2014/Dec	2015/Dec					

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. (12)

(b) Describe the procedure of closing up the bottle and the initial pressurisation to working pressure. (4)

2014/Oct	2015/Dec						

Q5. (a) Explain why a diesel engine cylinder is supplied with excess air. (4)

(b) Explain why fuel droplet size produced during injection has to be within narrow limits in order to enable good cylinder combustion to be achieved. (4)

(c) Explain how the desired fuel droplet size is produced by fuel injectors. (4)

(d) State why fuel injection timing has to be controlled within narrow limits to enable economic engine operation without bearing overload. (4)

2014/July	2015/Dec						

Q6. (a) Describe, with the aid of a sketch, either a diesel engine Open Loop SOx scrubber system or a Closed Loop SOx scrubber system. (10)

(b) Explain what systems need to be monitored in order to ensure that the scrubber system meets all IMO regulations. (6)

2015/Dec						

Q7. With reference to main engine crankcase explosions:

(a) explain the cycle of events leading to a secondary crankcase explosion. (6)

(b) as Chief Engineer, explain how an engine system should be managed in order to minimise the risk of a crankcase explosion and the effects of a crankcase explosion should one occur. (10)

2013/Dec	2015/Dec					

Q8. With reference to main engine safety systems:

(a) state, with reasons, THREE engine operating parameters which should initiate an automatic slowdown if engine operation is outside of set value conditions; (6)

(b) describe how the operation of each slowdown listed in part (a) may be tested; (6)

(c) list two engine operating parameters which should initiate an automatic engine shutdown, in EACH case explaining why this parameter MUST shut down the engine. (4)

2014/March	2014/July	2014/Oct	2014/Dec	2015/Dec		

Q9. With reference to an economiser:

(a) write a procedure for the cleaning of the gas side of an 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 economiser cannot be operated due to tube failure. (6)

2013/Dec	2015/Dec						