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 2016

Attempt SIX questions only

Marks for each part question are shown in brackets

Q1. 1. With reference to Fuel Water Emulsification to reduce diesel engine NOx emissions:

(a) Describe, with the aid of a sketch such a system. (12)

(b) Explain the disadvantages of this method. (4)

2016/March						

Q2. (a) Explain, with the aid of a graph, a large 2 stroke diesel engine load diagram, labelling the operating and limit lines. (12)

(b) On the graph sketched in part (a), with the vessel fully ballasted, at constant load and in calm weather, mark point 'x' to show the position if the hull was clean and point 'y' to show the position if the hull was fouled. (4)

2016/March						

Q3. With reference to main starting air reservoirs:

(a) state, with reasons, FOUR safety devices fitted; (4)

(b) write a procedure in order to prepare a reservoir for internal inspection; (6)

(c) describe an internal inspection, stating TWO defects which may be found and the possible causes of such defects. (6)

2016/March						

Q4. (a) Explain, with the aid of sketches, the gas combustion process in a dual fuel medium speed main engine, operating with pilot injection. (10)

(b) Explain what is meant by exhaust gas recirculation and how this may be effective in reducing air pollution. (6)

2016/March						

Q5. A significant number of machinery failures are due to poor maintenance techniques. State, with reasons, the possible consequences of poor maintenance techniques on EACH of the following:

(a) main engine lubricating oil self-cleaning filters; (4)

(b) cylinder liner honing; (4)

(c) auxiliary engine bottom end bearing overhaul; (4)

(d) fitting of piston compression and oil control rings. (4)

2016/March						

Q6. (a) Explain why variable exhaust valve closing can be advantageous in the operation of large slow speed main engines. (8)

(b) Explain, with the aid of a sketch, how variable exhaust valve closing is achieved. (6)

(c) Explain how high impact is avoided as the valve closes. (2)

2014/March	2016/March					

Q7. Describe FOUR defects which may be found during a piston/liner inspection via cylinder scavenge ports, explaining the possible causes and the action which should be taken to prevent their re-occurrence. (16)

2016/March						

Q8. With reference to failure of fuel injector nozzles due to burning:

(a) state, with reasons, THREE possible causes; (6)

(b) write a procedure to be used when investigating the cause of fuel injector nozzle burning; (6)

(c) describe a system which should be operated in order to minimise the risk of future fuel injector nozzle burning. (4)

2016/March						

Q9. (a) Explain, with the aid of sketches, the purpose of balance weights fitted to the crankshaft of a medium speed engine. (8)

(b) Describe the maintenance checks required for detachable balance weights. (4)

(c) Explain why composite pistons may be fitted to medium speed engines, stating the reasons for the materials used. (4)

2016/March						

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July 2017

Attempt SIX questions only

Marks for each part question are shown in brackets

Q1. (a) Describe, with the aid of a sketch, the water/steam circulation system for the waste heat recovery system. (5)

(b) Explain how economiser circulation pumps are maintained in a cool condition to allow for prolonged operation without problem. (3)

(c) Describe how a waste heat recovery system steam pressure is maintained and the system operated when the associated diesel engine plant is operating on EACH of the following:

(i) low engine load; (4)

(ii) low steam demand. (4)

2016/July						

Q2. As Chief Engineer Officer 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	2016/July					

Q3. As Chief Engineer Officer write a report to the company superintendent engineer concerning bacterial attack of lubricating oil in the sumps of the main engine and one of the generator engines. The report should explain how the attack was detected, damage found in the engines, investigations into the possible cause of the attack, how the immediate problem was resolved and how future incidents maybe prevented. (16)

2016/July						

Q4. (a) Describe, with the aid of a sketch, a cylinder arrangement for a dual fuel 2-stroke engine, explaining how the gaseous fuel is delivered to the cylinder and ignited. (12)

(b) Explain the term Methane Slip in reference to a dual fuel engine, stating why it occurs and the effect on the atmosphere. (4)

2016/July						

Q5. (a) List TWO automatic main engine slowdown parameters, stating why EACH is applied to an engine. (4)

(b) List TWO automatic main engine shutdown parameters, stating why EACH is applied to an engine. (4)

(c) Explain how EACH of the parameters listed in part (a) and part (b) are tested for the correct operation. (8)

2013/Oct	2016/July					

Q6. (a) Write a procedure for the action a duty engineer should take on being called to the engine room during a UMS period in the event of an engine slowdown due to a high cylinder exhaust temperature on the main propulsion engine. (6)

(b) State, with reasons, the possible causes of a high exhaust temperature on a single cylinder of a main propulsion engine. (5)

(c) Explain why a defect resulting in a high exhaust temperature on one cylinder can cause engine damage if the engine is not slowed down when the fault initially occurs. (5)

2016/July						

Q7. (a) Describe, with the aid of a sketch, an exhaust gas recirculation system, explaining how the system reduces the level of NOx in the engine exhaust gas. (12)

(b) Explain the operating and thermal efficiency problems associated with Exhaust Gas Recirculation systems. (4)

2016/July						

Q8. (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	2016/July					

Q9. (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 Officer, 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)

2016/July						

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October 2016

Attempt SIX questions only

Marks for each part question are shown in brackets

Q1. (a) Explain how the emergency diesel generator is prepared and selected for automatic operation so that it will start and connect to the switchboard in the event of a blackout. (6)

(b) Write a procedure for manual starting and running of the emergency generator, indicating how frequently this procedure should be carried out and stating which operating parameters should be checked. (6)

(c) State the procedure for testing the emergency generator automatic start. (4)

2016/Oct						

Q2. (With reference to engine operation:

(a) state, with reasons, the symptoms which would indicate a cylinder head was cracked between the combustion chamber and the water space; (4)

(b) describe the actions that should be taken if the engine with the symptoms in part (a) cannot be immediately stopped; (6)

(c) write a report to the Superintendent outlining the probable cause and actions to prevent further occurrence. (6)

2013/ Oct	2016/Oct					

Q3 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	2016/Oct					

Q4. (a) Explain how the fitting of multiple air inlet and exhaust valves to a four-stroke engine can improve the gas exchange process. (4)

(b) Explain how multiple air inlet valves allow for the development of increased cylinder power. (4)

(c) Explain how multiple exhaust valves allow for an mcrease in engine output power available at the flywheel. (4)

(d) Sketch a rocker/pushrod arrangement for actuating a double valve system, showing where the pushrod (tappet) clearances are adjusted. (4)

2016/Oct						

Q5. With reference to main starting air reservoirs:

(a) state, with reasons, FOUR safety devices fitted; (4)

(b) write a procedure in order to prepare a reservoir for internal inspection; (6)

(c) describe an internal inspection, stating TWO defects which may be found and the possible causes of such defects. (6)

2014/Oct	2016/March	2016/Oct				

Q6. With reference to the local control of a main engine following failure of the automatic control system, explain how the engine can be monitored and controlled. (16)

2016/Oct						

Q7. (a) Describe, with the aid of sketches, a main engine hydraulically operated exhaust valve system which is designed to rotate in service. (8)

(b) Explain how the timing of the exhaust valve described in part (a) is controlled. (4)

(c) State why valve rotation is desirable. (4)

2013/March	2016/Oct					

Q8. As Chief Engineer Officer, explain how the quantity and quality of the fuel delivered during bunkering should be verified. (16)

2016/Oct						

Q9. With reference to diesel engine exhaust emissions, describe the causes and effects of EACH of the

following:

(a) carbon monoxide; (4)

(b) carbon dioxide; (4)

(c) hydrocarbons; (4)

(d) particulate matter. (4)

2016/Oct						

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December 2016

Attempt SIX questions only

Marks for each part question are shown in brackets

Q1. (a) Write a procedure for the action a duty engineer should take on being called to the engine room during a UMS period in the event of an engine slowdown due to a high cylinder exhaust temperature on the main propulsion engine. (6)

(b) State, with reasons, the possible causes of a high exhaust temperature on a single cylinder of a main propulsion engine. (5)

(c) Explain why a defect resulting in a high exhaust temperature on one cylinder can cause engine damage if the engine is not slowed down when the fault initially occurs. (5)

2013/March	2014/Dec	2016/July	2016/Dec				

Q2. (a) Explain why multiple exhaust valves are fitted to some medium speed diesel engines. (6)

(b) Explain how the valve actuator (tappet) clearance is set for multiple valve installations. (4)

(c) Write instructions for checking the valve operating mechanisms of a medium speed engine. (6)

2016/Dec						

Q3. With reference to marine diesel engine Selective Catalytic Reduction (SCR):

(a) explain, with the aid of a graph, the influence that fuel sulphur content has on the operation of an SCR unit; (4)

(b) explain how the operation of a turbocharger system can have a detrimental effect on the unit when burning high sulphur fuel; (4)

(c) describe, with the aid of a sketch, a system which maintains good engine performance of the turbocharger system and good NOx reduction when burning high sulphur fuel, explaining how conflicting conditions are met. (8)

2016/Dec						

Q4. As Chief Engineer Officer write a report to the company superintendent engineer concerning bacterial attack of lubricating oil in the sumps of the main engine and one of the generator engines. The report should explain how the attack was detected, damage found in the engines, investigations into the possible cause of the attack, how the immediate problem was resolved and how future incidents may be prevented. (16)

2014/July	2016/July	2016/Dec					

Q5. (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 Officer, 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	2016/July	2016/Dec					

Q6. (a) Describe, with the aid of sketches, the procedure for lifting a cylinder cover from a slow speed crosshead engine, explaining how the lifting gear is attached to the cover. (6)

(b) State the risks that may be associated with lifting a cylinder cover using the procedure described in part (a). (4)

(c) Describe the arrangements which must be in place to ensure that all lifting equipment has a current test certificate and is fit for operation. (6)

2016/Dec						

Q7. With reference to diesel engine hybrid SOx scrubber systems:

(a) state the fluids used in the open and closed loops of the scrubber, explaining how these fluids are controlled to meet the scrubbing demand at different engine loads; (6)

(b) state the circumstances under which Open Loop scrubbing would be used and Closed Loop scrubbing would be used; (2)

(c) describe how the effective SOx neutralising effect of the fluid used in the closed loop system is maintained during long operating periods and how pollution of the sea is avoided. (8)

2016/Dec						

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;

(ii) carbon deposits in the cooling spaces.

2015/March	2016/Dec					

Q9. Write a procedure for the actions to be taken in the event of an engine oil mist detector alarm being activated, stating the reasons for EACH action. The procedure must cover the period from activation of the alarm to return of the engine to normal operation. (16)

2014/Oct	2014/Dec	2015/Dec	2016/Dec				