UK MARINE TRAINING CENTRE (UMTC)
SAI POOJA BUILDING, SHOP NO. 4, PLOT NO. 36, SECTOR - 34. KAMOTHE, NAVI MUMBAI - 410 209 MAHARASHTRA, INDIA.
EMAIL : umtcindia1234@gmail.com | PH : +91 9673855053, +91 7021406134

MARCH 2014

Attempt SIX questions only

Marks for each part question are shown in brackets

Q1. 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 action 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 in order to prevent problems due to water in the fuel. (5)

2014/March						

Q2. 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)

2014/March						

Q3. With reference to a ship with a single service tank, write a procedure for changing the entire main engine and auxiliary engine fuel oil supplies and treatment system from Heavy Fuel Oil (HFO) to Low Sulphur Heavy Fuel Oil (LSHFO) in preparation for the vessel entering an Emission Control Area (ECA), indicating the approximate times of EACH action prior to entering the ECA. (16)

2014/March						

Q4. With reference to main slow speed engine safety systems:

(a) list FOUR engine operating parameters which will initiate an automatic engine slowdown, indicating in

EACH case why an automatic slowdown is necessary; (8)

(b) list TWO engine operating parameters which will initiate an automatic engine shutdown, indicating in

EACH case why an automatic shutdown is necessary; (4)

(c) explain how the operation of EACH shutdown listed on part (b) may be tested. (4)

2014/March						

Q5. With reference to slow speed diesel engine turbocharging:

(a) explain why water separators are fitted; (4)

(b) describe how an engine may be operated in the event of a charge air cooler being damaged beyond immediate repair; (6)

(c) describe how an engine may be operated in the event of a turbocharger bearing failure which cannot be repaired immediately. (6)

2014/March						

Q6. With reference to electronically controlled engines:

(a) describe how fuel injection quantity and timing is adjusted; (6)

(b) describe how the exhaust valve timing maybe varied; (5)

(c) describe how starting air valves are regulated. (5)

2013/July	2014/March					

Q7. (a) Describe the sequence of events that could lead to a crankcase explosion. (6)

(b) Describe an obscuration type oil mist detector, explaining its operation. (10)

2014/March						

Q8. (a) With reference to safety, state, with reasons, THREE fluid pipeline systems which require particular attention prior to dismantling main machinery for overhaul. (9)

(b) Write instructions for the preparation to lift a main engine cylinder cover from finished with engines to being ready to lift from the engine. (7)

2013/July	2014/March					

Q9. (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								

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July 2014

Attempt SIX questions only

Marks for each part question are shown in brackets

Q1. With reference to diesel engine NOx emissions:

(a) explain how NOx is formed during operation of the engine indicating why the aim of high engine efficiency increases the problem; (6)

(b) describe ONE external means by which diesel engine NOx emissions may be reduced in order to meet current regulations. (10)

2014/July						

Q2. 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						

Q3. 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 be selected to initiate an automatic engine shutdown, in EACH case explaining why this parameter MUST shut down the engine. (4)

2014/July						

Q4. (a) Write instructions for the actions to be taken in the event of a scavenge fire outbreak during a

night-time period of UMS operations. The instructions must cover the period from the initial alarm until

the engine is in a safe condition. (6)

(b) Describe the procedure for restarting of the engine and operation up to the changeover to UMS. (4)

(c) Explain the possible consequences if a scavenge fire is not attended to immediately. (6)

2014/July						

Q5. (a) Describe the actions and checks required to ensure that a crosshead main propulsion

engine may be operated in a Slow Steaming condition. (8)

(b) Explain the problems which may arise during a prolonged period of Slow Steaming. (4)

(c) Explain what actions should be taken before and after the engine is returned to normal operation after a period of Slow Steaming. (4)

2014/July						

Q6. (a) Describe, with the aid of sketches, the procedure for removing a turbocharger rotor. In this description it may be assumed that permissions have been granted and that a risk assessment has been conducted. (6)

(b) State the risks associated with lifting the various turbocharger components involved in the procedure in part (a). (6)

(c) Explain the system which must be in place on board ship to ensure that all lifting equipment has a current test certificate and is fit for use. (4)

2014/July						

Q7. (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						

Q8. With reference to a main engine starting air system:

(a) explain why a slow turning system is fitted; (3)

(b) explain how the slow turning system operates when an engine start is initiated; (5)

(c) write a procedure for determining the reason for a main engine starting air system failing to operate. (8)

2014/July						

Q9. (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)

2014/July						

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October 2014

Attempt SIX questions only

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Q1. With reference to diesel engine exhaust emissions:

(a) explain the cause and effects of EACH of the following:

(i) Oxides of Nitrogen (NOx); (3)

(ii) Oxides of Sulphur (SOx); (3)

(b) describe ONE method by which the level of NOx emissions may be reduced; (5)

(c) explain how the effects on the engine components of sulphur in the fuel may be minimised. (5)

2013/July	2014/Oct					

Q2. (a) Explain the action to be taken to ensure that the main engine may be operated in the event of an exhaust gas economiser developing a serious leak which cannot be immediately repaired. (6)

(b) Describe how the heat transfer surfaces of an economiser are maintained in a clean condition. (4)

(c) Explain the actions which should be taken in the event of a soot fire in the economiser. (6)

2014/Oct						

Q3 With reference to main engine crankshafts:

(a) explain the term axial vibration; (4)

(b) describe, with the aid of a sketch, how axial vibration may be minimised; (6)

(c) state with reasons which bearing would be most at risk due to the effects of axial vibration; (3)

(d) describe how damage to the bearing stated in part (c) may be repaired. (3)

2014/Oct						

Q4. (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)

2104/Oct						

Q5. With reference to exhaust valves on medium speed engines burning heavy fuel oil:

(a) state the disadvantages of the mechanical operation of valves; (4)

(b) explain how multiple inlet exhaust valves reduce pumping losses; (4)

(c) explain the reasons for multiple springs on each valve; (4)

(d) state reasons for rotating exhaust valves and how this can be achieved. (4)

2014/Oct						

Q6. 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/Oct						

Q7. (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)

2015/Oct						

Q8. With reference to main engine safety systems:

(a) list FOUR engine operating parameters which will initiate an automatic engine

slowdown, indicating in EACH case why an automatic slowdown is necessary; (8)

(b) list TWO engine operating parameters which will initiate an automatic engine shutdown,

indicating in EACH case why an automatic shutdown is necessary; (4)

(c) explain how the operation of EACH shutdown listed in part (b) may be tested. (4)

2014/Oct						

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						

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December 2014

Attempt SIX questions only

Marks for each part question are shown in brackets

Q1. As Chief Engineer, write a report to the engineering superintendent regarding failure of a four-stroke main engine, to complete a slow turning procedure and the discovery of water around a cylinder head gasket after the failed slow turning attempt. The report must outline possible causes of the problem and the steps taken to identify the exact cause. The report must also explain the measures taken to rectify the defect(s) and the steps taken to prevent similar future incidents. (16)

2014/Dec							

Q2. Describe, with the aid of a sketch, a main engine holding down system explaining how the design

features help prevent excessive stress in the holding down studs. (8)

(b) Describe, with the aid of a sketch, an engine top bracing arrangement, explaining why they are fitted

and checked for operational performance. (8)

2014/Dec						

Q3. (a) rite 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)

2014/Dec						

Q4. (a) Describe, with the aid of a sketch, an external system for reducing engine NOx emissions, explaining the chemistry of the process. (8)

(b) Explain why Urea is used in the Selective Catalytic Reduction process instead of ammonia. (4)

(c) Explain why the exhaust gas quality must be monitored before and after the Selective Catalytic Reduction unit, stating how such monitoring influences operation of the SCR unit. (4)

2014/Dec							

Q5. (a) Explain why an engine`s cylinders should develop equal power at all loads, indicating the possible consequences if cylinder power balance is not maintained. (5)

(b) Describe ONE method which may be used for assessing cylinder power, explaining the steps involved in the assessment. (5)

(c) Explain how cylinder power adjustments are made to achieve cylinder power balance. (6)

2014/Dec							

Q6. 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/Dec						

Q7. (a) Describe the causes and effects of bacterial attack on crankcase lubricating oil. (6)

(b) Explain how bacterial attack on crankcase oil may be detected. (4)

(c) Describe how a crankcase lubricating oil system may be returned to service following bacterial attack of the lubricating oil. (6)

2014/Dec						

Q8. 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/Dec						

Q9. 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 be selected to initiate an automatic engine shutdown, in EACH case explaining why this parameter MUST shut down the engine. (4)

2014/Dec							