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 2018

Attempt SIX questions only

Marks for each part question are shown in brackets

Q1. With reference to diesel engine NOx emissions and control:

(a) Explain how exhaust gas recirculation and direct water injection reduce engine NOx emissions but result in increased specific CO2 emissions. (6)

(b) Describe, with the aid of a sketch, a Selective Catalytic Reduction system, stating, with reasons, the monitoring and control systems required. (10)

2014/12-Q1	2017/07-Q7	2018/Dec-Q7	2019/Mar/Q1			

Q2. State what charge air system parameters must be monitored, explaining how data gathered from charge air system instrumentation is used to determine the operational performance of EACH of the following system parts:

(a) The suction air filter; (4)

(b) The turbocharger compressor; (4)

(c) The turbocharger turbine; (4)

(d) The charge air cooler. (4)

2018/March						

Q3. (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	2018/March		

Q4. (a) Describe, with the aid of sketches, the procedure for cutting out and "hanging-up" an engine cylinder of a two-stroke crosshead engine in the event of complete failure of the crosshead pin such that the crosshead pin cannot be operated and no replacement is immediately available. (12)

(b) State, with reasons, the factors which may inhibit starting and limit the operating speed of the engine with a cylinder cut out. (4)

2018/Dec						

Q5. (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	2018/March					

Q6. With reference to boilers and steam generation systems:

(a) Explain the term water hammer, stating how it is caused and describing the possible consequences of it; (4)

(b) explain how water hammer can be avoided; (4)

(c) describe, with the aid of a sketch, how the boiler fuel system may be operated in port to comply with local emission control regulations. (8)

2018/March	2019/Oct					

Q7. As Chief Engineer Officer, 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	2017/July	2018/March	2019/March			

Q8. 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	2018/March				

Q9. (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 minimize 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	2018/March				

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July 2018

Attempt SIX questions only

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Q1. As Chief Engineer write instructions for the checking of the engine Slow Turning System and subsequent monitoring of the engine Slow Turning System. The instruction must take account of problem areas which may be linked to the need for slow turning of an engine whilst selected for standby and prior to an actual start. (16)

2018/July						

Q2. (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	2018/July					

Q3. (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	2018/July			

Q4. Describe, with the aid of a sketch a diesel engine fuel system which employs direct injection of liquid gas into the cylinders. (12)

b. Explain the advantages of this type of gas injection system compared with the use of gaseous fuel in the form of gas. (4)

2018/July						

Q5. 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)

2013/July	2014/July	2015/July	2018/July			

Q6. (a) Explain fatigue cracking, stating its causes and propagation. (8)

(b) Explain how the risk of fatigue cracking of cylinder head holding studs is liable to be increased by poor maintenance and engine overload. (8)

2013/July	2018/July					

Q7. Write a report to 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/Dec	2015/Dec	2018/July				

Q8. a. State, with reasons, SIX points that should be covered by a risk assessment for the inspection of a main engine crosshead bearing. (6)

b. State how it can be ensured that the lifting equipment used for the inspection of a crosshead bearing is fit for the purpose intended. (4)

c. list THREE defects which might be detected during inspection of a crosshead pin and bearing, stating the probable cause of such defects. (6)

2012/July	2018/July					

Q9. (a) Explain how a diesel generator is prepared and selected as a standby generator. (8)

(b) Write a procedure for checking a diesel generator engine after it has been shut down and before it is returned to standby duty. (8)

2011/Dec	2013/Dec	2018/July				

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October 2018

Attempt SIX questions only

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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. (5)

2002/Oct	2009/March	2014/Oct	2015/Oct	2018/OCT		

Q2. A. Explain why pilot injection is required for a dual fuel engine when burning natural gas. (2)

b. Describe, with the aid of a sketch, the arrangements for a dual fuel engine which is capable of burning natural gas on:

i. The Otto cycle (7)

ii. The Diesel cycle (7)

2018/Oct						

Q3. With reference to crankcase lubricating oil:

(a) Describe the causes and effects of bacterial attack; (6)

(b) Explain how bacterial attack may be detected; (4)

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

2011/Dec	2014/Dec	2017/Dec	2018/Oct			

Q4. Write a report to the superintendent engineer concerning an incident of turbocharger vibration and surging which occurred on a two stroke, direct drive, main propulsion engine during a normal passage in calm weather. The report must include information about the immediate action taken to prevent damage, the subsequent action to remedy the fault and recommendations to prevent subsequent future incidents. (16)

2018/Oct						

Q5. Write a procedure for the actions to be taken in the event of an engine Oil mist alarm being activated, stating the reason for EACH action. The procedure must cover the period from activation of the alarm to return of the engine to normal operation. (16)

2009/July	2014/Oct	2015/Dec	2016/Dec	2018/Oct		

Q6. a. State, with reasons, SIX points that should be covered by a risk assessment for the inspection of a main engine crosshead bearing. (6)

b. State how it can be ensured that the lifting equipment used for the inspection of a crosshead bearing is fit for the purpose intended. (4)

c. list THREE defects which might be detected during inspection of a crosshead pin and bearing, stating the probable cause of such defects. (6)

2012/July	2018/July	2018/Oct				

Q7. A. Explain why cylinder power balance is essential to good engine operation, indicating the possible damaging effects of cylinder power imbalance. (6)

B. Describe the for checking the performance and of an engine cylinder. (4)

C. Explain how cylinder power may be balanced across an engine. (6)

2018/July						

Q8. a. Explain why top bracing is used for large crosshead engines. (4)

b. Describe, with the aid of a sketch, a hydraulic top bracing unit for a large crosshead engine indicating where the top bracing is fitted and how it operates. (6)

C. Write instructions for the checking of a large crosshead engine top bracing system and a holding down system. (6)

2018/Oct						

Q9. With reference to a waste heat boiler/economiser:

a. Write a procedure for the cleaning the gas side of an exhaust gas boiler/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 waste heat boiler/economizer cannot be operated due to tube failure. (6)

2013/Dec	2015/Dec	2018/Oct				

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December 2018

Attempt SIX questions only

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Q1. With reference to poor ignition quality fuel:

a. Explain how it can affect combustion in BOTH slow speed and medium speed engines. (8)

b. Explain how the effects on BOTH diesels engine types in part (a) can be reduced. (8)

2017/March	2018/Dec					

Q2. 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	2017/July	2018/Dec			

Q3. (A) Explain why crankshaft deflections are taken. (4)

(b) Write a procedure for the taking of main engine crankshaft deflections. (8)

(c) Explain the action to be taken if some crankshaft deflection readings are outside acceptable limits. (4)

2017/March	2017/Dec	2018/Dec				

Q4. 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 neutralizing 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	2018/Dec					

Q5. With reference to electronically controlled engines:

A. Describe how fuel injection quantity and timing is adjusted. (6)

B. Describe how the exhaust valve timing may be varied. (5)

C. Describe how starting air valves are regulated. (5)

2013/July	2014/Apr	2018/Dec				

Q6. Write a report to the superintendent engineer concerning an incident of cracking which was discovered in one piston of a main diesel engine and the subsequent discovery of cracking in another piston of the same engine. The report must include information about the immediate action taken to prevent further damage to the engine, the subsequent action to remedy the fault and recommendations to prevent subsequent future incidents. (16)

2018/Dec						

Q7. 7.A. Explain why premixing of gas and air before supply to the engine cannot be undertaken with 2-stroke cycle engines but can be applied to 4-stroke engines. (4)

B. Describe, with the aid of a sketch, the fuel arrangement at the cylinder of a 2-stroke cycle dual fuel diesel engine which operates with high pressure gas injection. (12)

2018/Dec						

Q8. a. Describe, with the aid of a sketch, a main engine fuel oil circulating system incorporating the MGO and HFO service tanks, a fuel change over system, heating and viscosity control system and tank return system. (10)

b. Write instructions for changing the system described in part (a) of the question from MGO to HFO, indicating the checks to be made during the changeover. (6)

2018/Dec						

Q9. a. Describe, with the aid of a sketch, a waste heat steam generating system incorporating separate oil-fired boiler and diesel engine exhaust gas heat recovery unit (Economizer). (10)

b. Explain how the system described in part (a) operates to ensure that the correct steam pressure is maintained during variations engine load and steam consumption. (6)

2018/Dec						