

ENGINEERING KNOWLEDGE - MOTOR

Attempt SIX questions only

Marks for each part question are shown in brackets

1. Write a report for the engineering superintendent regarding the replacement at sea of bearings on one of the main engine turbochargers. The report must explain how the bearing defects were detected, the likely cause of the damage and the action which has been implemented to prevent further incidents of this type. (16)

2. (a) Explain, with the aid of a sketch, Thermal Stress, stating how thermal stress is induced in the cylinder liner when the engine is operating. (8)
- (b) Explain why thermal stress may be damaging to an engine cylinder. (4)
- (c) Explain how thermal stress may be avoided in an operating engine without reducing engine power output. (4)

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

4. (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)

5. (a) Describe, with the aid of a sketch, a main engine starting air system, stating the safety devices which are incorporated. (8)
- (b) In the event of the main engine failing to turn over on air even though there was sufficient air pressure in the starting air receivers, explain the procedure for tracing the cause of the failure. (8)

6. (a) Describe, with the aid of a sketch, an engine cooling water waste heat recovery system for generating electricity, explaining how the system operates. (8)
- (b) Describe, with the aid of sketches if necessary, how waste heat recovered for diesel engine cooling water can be utilised throughout the ship for different heating purposes, explaining how such heat recovery systems are operated. (8)

7.

- (a) Describe, with the aid of a sketch, a main engine and generator fuel system which has the capability of changing the generators from HFO to MDO operation whilst maintaining circulation of HFO in the main engine system. (8)
- (b) Write instructions for the change of the generator engines to operation on MDO whilst keeping the main engine fuel system circulated with HFO during stay in a port where fuel burning restrictions apply. (8)

8.

With reference to diesel engine NO_x emissions:

- (a) explain how NO_x 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 NO_x emissions may be reduced in order to meet current regulations. (10)

9. With reference to waste heat system generation systems:

- (a) describe, with the aid of a sketch, the water/steam circulation system for the waste heat recovery section; (5)
- (b) explain how the economiser circulation pumps are kept cool; (3)
- (c) describe how system steam pressure is maintained and the system operated when the associated diesel engine plant is operating on prolonged reduced load. (8)