

ENGINEERING KNOWLEDGE - GENERAL

Attempt TEN questions only as follows:

SIX questions from section A

TWO questions from section B

TWO questions from section C

Marks for each part question are shown in brackets

Section A

1. With reference to air receivers:

- (a) explain why air receivers are prone to corrosion; (3)
- (b) state how corrosion can be prevented; (3)
- (c) if significant corrosion is detected during a regular inspection, explain how the air receiver may still be safely used in service until a permanent repair can be effected. (4)

2. (a) Explain EACH of the following control terms:

- (i) proportional action; (2)
- (ii) integral action. (2)

(b) Describe, with the aid of a sketch, a control system that may be enhanced by the inclusion of cascade control. (6)

3. (a) Sketch a muff type propeller shaft coupling. (5)

(b) Describe how this type of coupling is connected. (5)

4. With reference to heat exchangers, describe how EACH of the following design aspects promote heat transfer:

- (a) material selection; (5)
- (b) flow patterns; (3)
- (c) extended surface areas. (2)

5. (a) Describe, with the aid of a sketch, the operation of a biological sewage treatment plant. (10)

6.

With reference to a hydraulic steering gear, explain EACH of the following:

- (a) the factors that may contribute to the failure of a hydraulic pipe coupling; (2)
- (b) why it is of the utmost importance that in the event of a hydraulic system failure that the rudder is locked and isolation of the affected area is achieved as soon as possible; (2)
- (c) the problems that may occur when locking the rudder in heavy weather; (2)
- (d) why hydraulic locking is preferable to mechanical means; (2)
- (e) what is meant by the single failure concept. (2)

7.

With reference to a vapour compression refrigeration plant:

- (a) explain the purpose of EACH of the following:
 - (i) expansion valve; (2)
 - (ii) room thermostat; (2)
 - (iii) high pressure cut out. (2)
- (b) explain why EACH of the following conditions are desirable:
 - (i) superheating at the compressor suction; (2)
 - (ii) undercooling at the condenser outlet. (2)

8.

With reference to fixed fire fighting systems employing fresh water in a high fog or mist form, explain EACH of the following:

- (a) how the fire is contained and extinguished; (4)
- (b) the importance of particle size and flow rate; (4)
- (c) state the means by which the system may be activated. (2)

Section B

9. Describe, with the aid of a circuit diagram, the operation of a shaft generator that uses a frequency converter. (10)

10. With reference to overload protection for electric motors, describe the principle of operation of EACH of the following types of overload relay:

(a) thermal; (3)

(b) magnetic; (3)

(c) electronic. (4)

11. (a). Explain, with the aid of a sketch, the principle of operation of an earth leakage detection system of the instrument type. (6)

(b) Explain why an insulated neutral system is used extensively on board ships. (2)

(c) State, with reasons, why a single earth fault on an insulated neutral system should always be cleared as soon as possible. (2)

Section C

12. State FIVE terms used to describe the conditions that relate to the distortion a ship's hull undergoes in heavy seas, stating in EACH case the type of stresses involved and where the stresses occur. (10)

13. With reference to watertight doors:

- (a) explain the factors that affect the number and size compatible with the proper working of the ship; (3)
- (b) explain the operating requirements of watertight doors below the weather deck; (3)
- (c) outline the potential hazards when passing through power operated watertight doors stating how these are overcome. (4)

14. With reference to the International Convention for the Control and Management of Ships' Ballast Water and Sediments:

- (a) state the aims of the Ballast Water Management Convention; (2)
- (b) explain the difference between ballast water standards D-1 and D-2; (2)
- (c) state, with reasons, the documentation required by ships in international traffic to manage their ballast water and sediments. (6)