

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. Explain EACH of the following metallurgical processes:
 - (a) induction hardening; (3)
 - (b) nitriding; (3)
 - (c) case hardening. (4)

2. With reference to fuel oil viscosity:
 - (a) explain why correct fuel oil viscosity is necessary; (2)
 - (b) describe TWO methods for the measurement of viscosity that are suitable for the inclusion into a pneumatic or electronic control system; (6)
 - (c) state, with reasons, a control action for a viscosity controller. (2)

3.
 - (a) Explain how power is transmitted through main propulsion shafting. (3)
 - (b) State THREE operational factors that may induce high stress in shaft coupling bolts. (3)
 - (c) Sketch a hydraulic type of shaft coupling bolt. (4)

4.
 - (a) Describe, with the aid of a sketch, the principle of operation of a gear type pump, indicating the direction of flow of the fluid. (6)
 - (b) State the materials that gear type pump components may be manufactured from. (2)
 - (c) State an application that is suitable for the employment of gear pumps, and why they are suited. (2)

5. With reference to centrifugal separators used for oily bilge duty:
- (a) explain why centrifugal oily water separators are superior to those which rely on gravity; (3)
 - (b) describe, with the aid of a sketch, how flow over the centrifugal separator plates can break down emulsions by encouraging flocculation of particles and coalescence of droplets; (5)
 - (c) state how the bilge overboard control valve can only be operated by the Chief Engineer; (1)
 - (d) state a value of overboard parts per million oil content that may be set which is below the generally recommended value. (1)
6. With reference to activated fin stabilisers, explain EACH of the following:
- (a) why such units are preferred to passive tanks in large vessels; (3)
 - (b) why these units are preferred for passenger and fast cargo ships; (3)
 - (c) why partial, rather than maximum damping of ship movement in heavy weather, is advisable for reasons other than overstressing the fin stocks and activating gear. (4)
7. With reference to the on board production of fresh water for domestic purposes:
- (a) explain the principles of operation of EACH of the following:
 - (i) low heat source evaporator; (2)
 - (ii) flash evaporator; (2)
 - (iii) reverse osmosis. (4)
 - (b) state the constraints placed on the installation and use of systems for shipboard production of fresh water. (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 1
9. With reference to main a.c. generators:

- (a) state the immediate and subsequent actions to be taken in the event of a high windings temperature alarm being activated; (8)
- (b) state the feature of the windings cooler tubes that prevent damage to the windings in the event of leakage. (2)

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) Sketch a circuit diagram of an emergency generator power supply and distribution system, indicating the essential services provided at 440 volts ac, 220 volts ac and 24 volts dc. (6)
- (b) State the regulations pertaining to the emergency generator. (4)

Section C

12. Describe EACH of the following, stating what component parts of the ship's structure help resist the effect:
- (a) racking; (2)
 - (b) panting; (2)
 - (c) pounding; (2)
 - (d) water pressure effect; (2)
 - (e) drydocking stresses. (2)
13. (a) Sketch a method of attaching an anchor cable to a ship's structure, showing how the cable could be released in an emergency. (5)
- (b) Explain how chain lockers are emptied of water and silt, stating any restrictions that may have to be observed. (3)
- (c) State the dangers associated with entering a chain locker. (2)
14. Describe an in-water survey to classification society requirements of the underwater structure of a large vessel. (10)