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. (a) Describe, with the aid of sketches, how the test pieces for a Class 1 pressure vessel are obtained. (6)

   (b) List the tests which are carried out on the test pieces described in Q(a). (4)

2. (a) Sketch an annotated block diagram of a closed loop control circuit. (5)

   (b) Describe how the control loop sketched in Q(a) operates. (5)

3. With reference to oil filled stern tubes:

   describe, with the aid of a sketch, the principle of operation of a combination seal, which incorporates a wrapped bellows radial face seal and a lip seal. (10)

4. With reference to microbacterial infestation:

   (a) list the engine room systems that may be affected by this type of contamination; (2)

   (b) explain the conditions required for bacteria to evolve; (6)

   (c) describe how the presence of microbial contamination could be detected. (2)

5. With reference to centrifugal pumps and pumping systems:

   (a) explain the principle of operation of a centrifugal pump; (4)

   (b) define net positive suction head available (NPSHa); (2)

   (c) state the effects of temperature on NPSHa; (2)

   (d) describe how the effects of temperature can be overcome. (2)

6. (a) Sketch a rotary vane steering and hydraulic circuit showing 2 x 50% units and the directional control valves. (6)

   (b) Describe how the system in part (a) can still operate should an oil leak occur. (2)

   (c) State the advantages of rotary vane compared to four ram steering gear. (2)

7. With reference to ships air conditioning plants:

(a) state the temperatures and relative humidities at EACH of the points that are regarded as the boundaries of the comfort zone; (2)

(b) explain how the temperatures and relative humidities could be maintained within the comfort zone when the ship is in EACH of the following locations:

(i) North West Europe in winter; (2)

(ii) Arabian Gulf in summer; (2)

(c) state, with reasons, FOUR locations within the accommodation that conditioned air must not be recirculated. (4)

8. As Chief Engineer Officer, describe the examinations that would be carried out during a safety equipment survey with regard to fire safety. (10)

Section B

9. Describe, with the aid of a circuit diagram, the operation of an automatic voltage regulator (AVR) which employs the use of thyristors. (10)

10. Describe the construction and operation of EACH of the following:

    (a) synchronous motor; (5)

    (b) induction motor. (5)

11. (a) Sketch a wiring diagram of a shore connection for the supply of electrical power to a vessel, showing the phase sequence indicator. (4)

    (b) Explain the consequences of connecting an electrical shore supply in EACH of the following cases:

        (i) in the wrong phase sequence; (2)

        (ii) at a higher voltage; (2)

        (iii) at a higher frequency. (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 the classification of ships, explain EACH of the following:

(a) why ships are built to classification society rules; (5)

(b) the meaning of the notation ✠ 100A1; (4)

(c) how a ship remains in class throughout the life of the vessel. (1)

14. With reference to large fixed bladed propellers:

(a) describe, with the aid of a sketch, EACH of the following:

(i) the effect of hull fouling; (3)

(ii) operation in clean hull, ballast condition. (3)

(b) explain why fitting a *light propeller* may be beneficial. (4)