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) Materials used for hull and machinery are subject to stress and strain in service.

Define EACH of the following:

(i) THREE types of stress; (3)

(ii) TWO types of strain. (2)

(b) Describe the tests that may be carried out on steel to be used for ships side plating. (5)

2. (a) Describe, with the aid of a sketch, an explosimeter for the detection of combustible gas. (6)

(b) Describe how the instrument sketched in part (a) is tested and calibrated. (4)

3. With reference to automatic control:

(a) sketch a pneumatic proportional plus integral controller; (6)

(b) explain the term integral saturation; (2)

(c) explain the action to be taken by the operator in the event of integral saturation occurring. (2)

4. (a) Explain how power is transmitted through main shafting. (2)

(b) State FOUR operational factors that may induce high stress in coupling bolts. (4)

(c) Sketch a coupling bolt of improved design. (4)

5. With reference to centrifugal pumps:

(a) state the operating principle of a centrifugal pump and why it is unnecessary to fit a relief valve to it; (2)

(b) state TWO impeller types, explaining which type of application EACH would be best suited for; (4)

(c) explain why cavitation occurs, and how it is reduced by design. (4)

Section B

9. (a) Describe, with the aid of a sketch, a static excitation system for a generator. (8)

(b) Explain TWO advantages of static excitation. (2)

10. (a) With reference to the protection of electrical equipment in a distribution system:

(i) state the aims of the protective devices; (3)

(ii) list the parameters that are monitored and acted upon by the protective devices. (4)

(b) State, with reasons, THREE causes of electrical fires. (3)

11. (a) With reference to battery systems for emergency purposes, explain the precautions that must be taken with regard to personnel safety, storage and maintenance. (7)

(b) Explain how batteries are kept at the correct rate of charge. (3)

6. Describe, with the aid of a block diagram, a compensated control system for an active fin stabilisation unit. (10)

7. (a) Explain the principles of *osmosis* and *reverse osmosis*. (4)

(b) Describe how reverse osmosis is used for the production of fresh water on board ship. (4)

(c) State the limitation of the quality of the permeate in a single pass reverse osmosis system, describing how the quality of the permeate could be improved. (2)

8. Describe the inspections and tests that should be carried out to ensure satisfactory condition and operation of the ship's fire fighting equipment. (10)

Section C

12. (a) Explain the causes and effects of panting and pounding, indicating the affected areas. (5)

(b) Describe the constructional details designed to resist panting and pounding. (5)

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. (a) Describe the survey of a hollow rudder. (7)

(b) State what repairs may need to be carried out on the rudder. (3)