

## APPLIED MARINE ENGINEERING

Attempt ALL questions  
Marks for each part question are shown in brackets

- 1 (a) Define the meaning of the term *alloy*, stating why they are used. (3)
- (b) Describe the changes in the mechanical properties of steel with increasing amounts of carbon. (4)
- (c) List SIX common alloying elements used in the production of steel. (3)

- 2 With reference to the case hardening of bearing journals:
- (a) explain why this process may be carried out; (2)
- (b) describe EACH of the following processes:
- (i) induction hardening; (3)
- (ii) nitriding; (3)
- (c) explain why the processes described in part (b) are best suited to this application. (2)

- 3 (a) State the TWO steps occurring in the fracture process of a material. (2)
- (b) Explain EACH of the following fracture failures:
- (i) highly ductile fracture; (2)
- (ii) moderately ductile fracture; (2)
- (iii) brittle fracture. (2)
- (c) Explain the process of *fatigue failure* and its significance in engineering design. (2)

- 4 List THREE advantages and TWO disadvantages for EACH of the following welding processes:
- (a) gas tungsten arc welding (TIG); (5)
- (b) covered electrode welding. (5)



5. With reference to the protection of aluminium from corrosion: (4)

- (a) explain the naturally occurring process and its limitations; (6)
- (b) explain the process of anodising, stating its advantages.

6. A vessel has been laid up for a considerable time with shore power connected. Routine underwater hull inspections reveal an unusually high deterioration rate of the vessel's anodes. Assuming the dockside wiring, shore power connections and bonding systems are all in good condition and correctly connected: (8)

- (a) explain how this may occur; (2)
- (b) state TWO devices that should be fitted to prevent this situation occurring.

7. Describe, with the aid of a sketch, the principle and operation of a Bourdon tube gauge. (10)

8. Explain EACH of the following control terms:

- (a) settling time; (2)
- (b) repeatability; (2)
- (c) dead zone; (2)
- (d) hysteresis; (2)
- (e) proportional bandwidth. (2)

9. (a) Describe, with the aid of a sketch, the principle and operation of a potentiometer. (6)

(b) Explain how a potentiometer can be used to measure rotary movement. (4)



10. On passage at full sea speed, a high jacket water temperature alarm goes off. The header tank is full, there are no leaks in the systems, both the HT and SW pumps are running and in good condition, however the temperature is continuing to rise.

- (a) State the immediate course of action that should be taken, explaining why. (2)
- (b) From the information on the supplied system diagram, shown in the figure below, describe THREE possible actions that may bring the plant back to within normal operating parameters. (8)

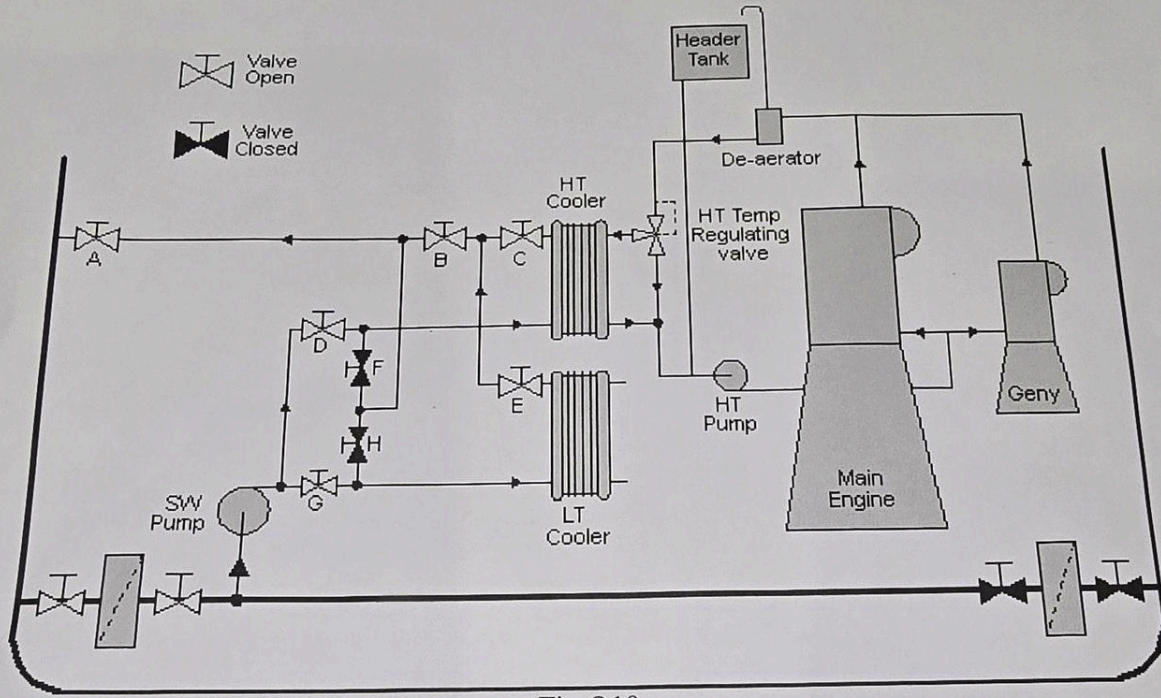


Fig Q10