APPLIED MARINE ENGINEERING

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

1. With reference to EACH of the following materials, explain their properties and name an engineering shipboard component that benefits from these properties:

   (a) cast iron; (3) 3

   (b) cast steel; (2) 0

   (c) alloyed steel; (3) 0

   (d) wrought iron. (2) 0

2. (a) Explain how the properties of steel are modified by its carbon content. (2) 2

   (b) Explain EACH of the following terms:

   (i) annealing; (3) 3

   (ii) normalising; (3) 3

   (iii) hardening. (2) 2

3. Explain EACH of the following engineering terms, stating ONE material that exhibits EACH property:

   (a) brittleness; (2) 2

   (b) ductility; (2) 2

   (c) hardness; (2) 2

   (d) malleability; (2) 2

   (e) toughness. (2) 2

4. With reference to joining a steel hull to an aluminium superstructure:

   (a) explain, with the aid of a sketch, the process of *explosion welding*; (6) 3

   (b) explain why this joint is superior to an insulated bolt joint. (4) 2

5. (a) Describe the problems associated with two dissimilar metals in contact in the presence of sea water.

   (b) Describe THREE different methods that may be used to reduce the problems described in part (a).

6. (a) Explain how *osmosis* may occur in a fibre glass hull.

   (b) Explain how the likelihood of *osmosis* occuring in the future can be reduced during the manufacturing process of the hull.

   (c) Explain how *osmosis* may be detected in service.

7. With reference to the flowrate measuring device shown in the figure, describe the principle of operation, explaining how an analogue remote reading may be obtained.

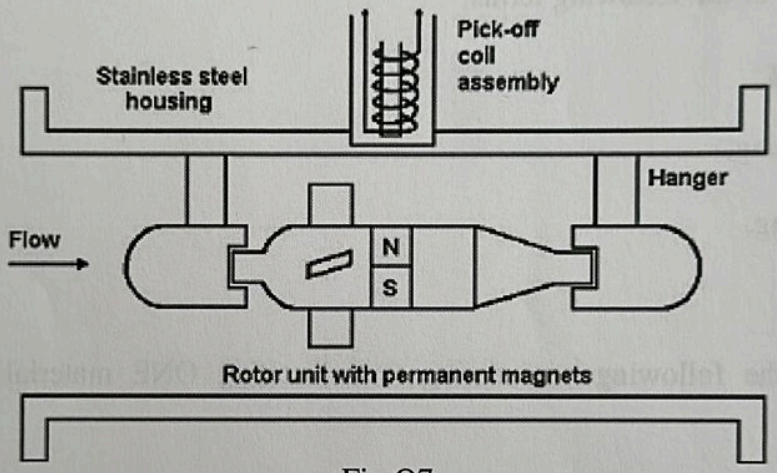

Fig Q7

8. (a) Describe, with the aid of a sketch, how a Bourdon Tube can be utilised to measure temperature.

   (b) State a typical application and location for this type of device.

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

(i) proportional bandwidth; (2) 2

(ii) integral action; (2) 1

(iii) derivative action. (2) 1

(b) Describe a 3-step method for tuning a PID controller. (4) 1

10. Explain, with the aid of a diagram, the principle of a cascade control method for regulating the freshwater coolant temperature of a diesel engine. (10) 5