

APPLIED MARINE ENGINEERING

Attempt ALL questions

Marks for each part question are shown in brackets

1. (a) List FIVE different desirable properties of aluminium. (5)
- (b) In modern vessels identify parts that utilises EACH of the properties listed in part (a). (5)

2. With reference to EACH of the following materials, list their percentage composition and a different application for EACH material on board, stating, with reasons, why they are suitable for this application:
 - (a) cupro-nickel; (2)
 - (b) aluminium bronze; (2)
 - (c) admiralty brass; (2)
 - (d) duralumin; (2)
 - (e) solder. (2)

3. With reference to case hardening steel components:
 - (a) describe the changes that occur with this process; (3)
 - (b) explain why it may be required; (2)
 - (c) describe EACH of the following processes:
 - (i) a simple shipboard process; (3)
 - (ii) solid pack carburising. (2)

4. With reference to fatigue failure of components:
 - (a) describe how material fatigue testing is carried out in the laboratory; (2)
 - (b) sketch the surface appearance of a fatigue fracture; (2)
 - (c) describe the THREE stages of the failure; (3)
 - (d) list the methods available on board to limit the possibility of fatigue failure to a propeller shaft. (3)

5. Describe, with the aid of sketches, FIVE defects that may be present on a weld produced using the covered electrode welding process. (10)

porosity
slag
undercut
underfill
incomplete fusion

alignment
rubber coupling

6. With reference to the cathodic protection of hull fittings:
- (a) explain how sacrificial anodes achieve this; (2)
 - (b) state where sacrificial anodes would be fitted and why; (4)
 - (c) describe an impressed current system, stating the principle on which it works. (4)
7. Explain EACH of the following terms:
- (a) galvanic corrosion; (2)
 - (b) cavitation damage; (2)
 - (c) erosion damage; (2)
 - (d) stress corrosion; (2)
 - (e) atmospheric corrosion. (2)
8. (a) Describe with the aid of a sketch, how Bi-metallic strips are utilised to measure temperature. (8)
- (b) State a typical application for this type of device and its main shortcoming. (2)
9. With reference to engine governors, explain EACH of the following terms:
- (a) sensitivity; (2)
 - (b) hunting; (2)
 - (c) speed droop; (2)
 - (d) stability; (2)
 - (e) isochronous governing. (2)

10. (a) State the reasons for fitting a pneumatic process valve with EACH of the following:
- (i) a volume booster; (2)
 - (ii) a feedback positioner. (2)
- (b) State, with reasons, the type of actuator fitted to the process valves for EACH of the following systems:
- (i) a fuel supply system in which the valve must not move on loss of power to the control system; *fail set* (3)
 - (ii) a lubrication oil cooling system in which the valve diverts the oil through a cooler. *fail safe.* (3)