CERTIFICATES OF COMPETENCY FOR ENGINEERS (YACHT)

EXAMINATIONS ADMINISTERED BY THE
SCOTTISH QUALIFICATIONS AUTHORITY
ON BEHALF OF
MARITIME AND COASTGUARD AGENCY

SMALL VESSEL CHIEF ENGINEER UNLIMITED

058-01 - APPLIED MARINE ENGINEERING

FRIDAY, 23 November 2018

1400-1600 hrs

Examination paper inserts:

Notes for the guidance of candidates:

1. Non-programmable calculators may be used.
2. All formulae used must be stated and the method of working and ALL intermediate steps must be made clear in the answer.

Materials to be supplied by examination centres:

Candidate's examination workbook

APPLIED MARINE ENGINEERING

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

1. State, with reasons, a different material suitable for EACH of the following applications:

   (a) a large motor vessel propeller; (2)

   (b) a centrifugal pump impeller; (2)

   (c) a sea water cooled heat exchanger tube; (2)

   (d) a 300mm diameter sea water cooling pipe; (2)

   (e) a cylinder head of a small auxiliary engine. (2)

2. (a) Outline THREE disadvantages of using aluminium in vessel construction. (3)

   (b) Outline THREE advantages of using steel in vessel construction. (3)

   (c) Outline FOUR conditions necessary in the preparation of steel surfaces prior to painting, to ensure a good surface finish. (4)

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

   (b) Explain EACH of the following terms:

      (i) annealing; (3)

      (ii) normalising; (3)

      (iii) hardening. (2)

4. (a) List FOUR methods for non-destructive crack detection. (4)

   (b) Describe TWO procedures from the methods listed in part (a). (6)

5. With reference to oxy-acetylene welding:

   (a) describe the process; (2)

   (b) explain why it is important to get the gas mixture correct; (3)

   (c) list the design safety features and inspections to be carried out on the welding torch and cylinders before commencing welding. (5)

6. (a) With reference to fretting corrosion:

(i) explain the process; (3)

(ii) state a common cause; (1)

(iii) state how it is normally detected. (1)

(b) With reference to pitting corrosion:

(i) explain the term *pitting corrosion*; (1)

(ii) state TWO common causes; (2)

(iii) explain why it is considered to be dangerous. (2)

7. With reference to root whitening in GRP hull construction:

(a) explain the term *root whitening*, stating where it is most likely to occur; (2)

(b) explain TWO possible reasons why this may happen; (4)

(c) state TWO possible actions that could be taken if it is discovered. (4)

8. With reference to strain gauges:

(a) describe, with the aid of a sketch, the principle and operation of a simple strain gauge, stating the formula used to determine its change in properties; (5)

(b) explain how the device is connected into an electrical circuit to accurately measure pressure; (3)

(c) state TWO practical applications in a vessel. (2)

9. (a) State the relationship between *proportional band* and *gain*. (2)

(b) The figure shows the level in a water tank is being controlled by a float and lever proportional system.

(i) Describe how the gain of the control system can be increased and decreased. (2)

(ii) Describe what happens when the flow out is increased. (2)

(iii) Describe the effect of increasing the controller gain with respect to the steady state tank level when the outflow is increased. (2)

(iv) Describe how the introduction of Integral action would affect this system. (2)

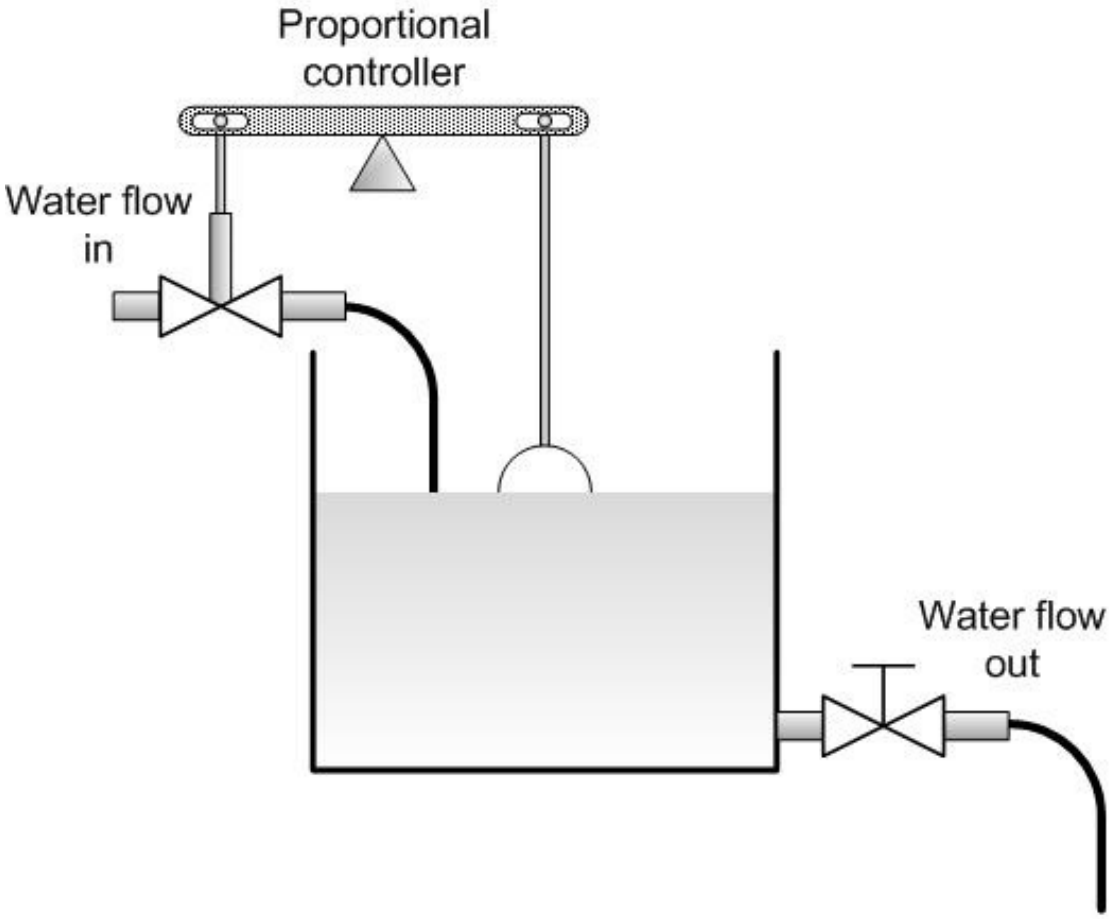

Fig Q9

10. (a) Explain the term *failsafe* in a control system, stating TWO examples where this term is applied. (4)

(b) Explain the term *failset* in a control system, stating TWO examples where this term is applied. (4)

(c) State what is meant by a 4:3 control valve. (2)