CERTIFICATES OF COMPETENCY IN THE MERCHANT NAVY - MARINE ENGINEER OFFICER

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

SECOND ENGINEER (UNLIMITED)

042-27 - ENGINEERING KNOWLEDGE - GENERAL

MONDAY, 14 October 2013

0915-1215 hrs

Examination paper inserts:

Notes for the guidance of candidates:

Candidates are required to obtain 50% of the total marks allocated to this paper to gain a pass **AND** also obtain a minimum 40% in Sections A, B and C of the paper.

Materials to be supplied by examination centres:

Candidate's examination workbook

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. State, with reasons, the materials used in EACH of the following components of a centrifugal pump for sea water circulating duties:

   (a) casing; (2)

   (b) impeller; (2)

   (c) shaft; (2)

   (d) wear rings; (2)

   (e) mechanical seal. (2)

2. Describe, with the aid of a sketch, the operation of a system for remote indication of the level of water in an auxiliary boiler. (10)

3. (a) Sketch a single cylinder, double acting reciprocating pump, labelling the component parts. (6)

   (b) State how pressure fluctuations are dampened. (1)

   (c) State, with reasons, the duties that the pump sketched in part (a) is particularly suited. (3)

4. When on deep sea passage, as Second Engineer Officer, on entering the engine room you are met with the following scenario: a strong smell of sewage effluent; sewage treatment plant showing high level alarm; aft bilge well in high alarm; sewage discharge pump running but amperes reading low.

   State the actions to be taken and maintenance required to restore the plant to correct working order. (10)

5. (a) Sketch a stern tube lubricating oil system. (5)

   (b) Explain why some vessels require more than one stern tube header tank. (2)

   (c) Describe the arrangement which prevents both oil loss and sea water ingress, at the tailshaft. (3)

6. (a) Describe a method of ship stabilisation that employs a passive tank system. (4)

(b) State THREE advantages and THREE disadvantages of the system described in part (a). (6)

7. (a) Sketch a cross section through a room solenoid valve used in a provisions refrigerating plant. (5)

(b) Describe the operation of the valve sketched in part (a) making reference to the cold room temperature. (3)

(c) Explain how solenoid valves affect the operation of a refrigeration compressor. (2)

8. Describe, with the aid of a sketch, an explosimeter for the detection of combustible gas. (10)

Section B

9. (a) Sketch a section through an a.c. induction motor. (5)

(b) Describe the construction of the motor sketched in part (a). (5)

10. With reference to the protection of High Voltage electric a.c. motors:

(a) state the type of fuse that is fitted and how it prevents single phasing; (3)

(b) describe the operation of EACH of the following direct temperature sensors:

(i) resistance temperature device; (3)

(ii) thermistor. (4)

11. (a) Sketch a circuit that allows both trickle charging and fast charging of lead-acid batteries. (6)

(b) State, with reasons, why trickle charge and fast charge provision is necessary. (2)

(c) Explain why lead-acid batteries may have to be taken off charge in hot climates. (2)

Section C

12. (a) Sketch a midship section of a ship, labelling EACH of the following:

- camber
- bilge radius
- bilge keel
- flat of bottom
- rise of floor

(5)

(b) State FIVE terms used to describe the conditions that relate to the distortion a hull undergoes, stating in EACH case, the stresses involved. (5)

13. (a) Sketch a sea chest suitable for the connection of a main sea water inlet valve, labelling all of the fittings. (5)

(b) Explain why a bilge injection valve is incorporated into the main sea water system, describing how it is tested. (4)

(c) Compare the valve diameters of the bilge and main injection valves. (1)

14. With reference to ship's lifeboats:

(a) sketch a main brake; (5)

(b) state the safety features incorporated in the brake should the operator:

(i) let go of the brake handle completely during lowering; (1)

(ii) attempt to lower the lifeboat too quickly; (1)

(c) state the maximum rate of descent when launching; (1)

(d) explain how the lifeboat is protected from falling back into the water if the power fails when hoisting the boat. (2)