55

CERTIFICATES OF COMPETENCY IN THE MERCHANT NAVY - MARINE ENGINEER OFFICER

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

MANAGEMENT ENGINEER (UNLIMITED)

040-12 - ENGINEERING KNOWLEDGE - GENERAL

MONDAY, 17 July 2023

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 a typical shipboard application for EACH of the following metals, explaining how their properties make them particularly suitable for the stated application:

(a) stainless steel; (2)

(b) grey cast iron; (2)

(c) titanium; (2)

(d) manganese bronze; (2)

(e) aluminium; (2)

2. (a) Discuss the merits of a condition monitoring system compared to other maintenance regimes. (5)

(b) Describe how the data is gathered, stored and evaluated on a computer based vibration analysis system. (5)

3. Describe, with the aid of a sketch, the principle of operation of a radial lip stern tube sealing arrangement for an oil filled stern tube, which incorporates an air space and is designed to prevent pollution. (10)

4. With reference to centrifugal pumps:

(a) sketch a double entry impeller showing directions of flow; (3)

(b) explain why double entry impellers are fitted; (2)

(c) explain, with the aid of a Head versus Flow diagram, why a two speed pump is preferable to throttling where high and low capacities are demanded for a large sea water circulating pump. (5)

5. (a) State the regulations pertaining to the main and auxiliary steering gear with reference to EACH of the following:

(i) rudder angle and time of operation; (2)

(ii) electrical supply. (3)

(b) With reference to a hydraulic steering gear, explain EACH of the following:

(i) the factors that may contribute to the failure of a hydraulic pipe coupling; (2)

(ii) what is meant by the single failure concept. (3)

6. With reference to the on board production of fresh water for domestic purposes:

(a) explain the principles of operation of EACH of the following:

(i) low heat source evaporator; (2)

(ii) flash evaporator; (2)

(iii) reverse osmosis. (4)

(b) state the constraints placed on the installation and use of systems for shipboard production of fresh water. (2)

7. With reference to pneumatic instrument and control systems:

(a) sketch a control air dryer as fitted downstream from the instrument air compressor or reducing valve; (6)

(b) explain the operation of the dryer sketched in part (a). (4)

8. Explain the checks and procedures to be carried out prior to Unattended Machinery Space (UMS) operations. (10)

Section B

9. With reference to main a.c. generators:

(a) state the immediate and subsequent actions to be taken in the event of a high windings temperature alarm being activated; (8)

(b) state the feature of the windings cooler tubes that prevent damage to the windings in the event of leakage. (2)

10. (a) Describe, with the aid of a sketch, the constructional details of a squirrel cage rotor as fitted in an induction motor. (7)

(b) Explain why some rotors have a double cage. (3)

11. With reference to testing High Voltage equipment:

(a) explain why earthing down is considered essential; (2)

(b) state the operating voltage for an insulation resistance tester (meggar) suitable for 6.6 KV equipment; (1)

(c) describe how an insulation resistance test is carried out on High Voltage equipment, making reference to personnel safety; (5)

(d) explain why infra red temperature measurement is used on High Voltage equipment. (2)

Section C

12. (a) Explain the cause and effects of panting and pounding at the forward end of a ship. (5)

(b) Sketch the constructional details designed to resist panting and pounding. (5)

13. With reference to tank inspections:

(a) list SIX items that should be looked for in a tank inspection; (3)

(b) state where erosion would be found in ballast tanks; (2)

(b) write a procedure for enclosed space entry to a fuel oil or ballast tank, making reference to where guidance may be found. (5)

14. Describe how EACH of the following defects on a solid propeller may be repaired whilst a ship is in drydock:

(a) bent blades; (2)

(b) damaged blade tips; (4)

(c) pieces of blade missing. (4)