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, 12 December 2022

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. (a) Describe the properties of EACH of the following alloys used in marine engineering, giving a practical example for which EACH are suited:

(i) cupro-nickel; (2)

(ii) white metal; (2)

(iii) titanium. (2)

(b) Discuss the merits of EACH of the following alloys for use in the casting of large propellers:

(i) nickel aluminium bronze; (2)

(ii) stainless steel. (2)

2. (a) State the factors in the storage of Manual Metal Arc welding electrodes which will assist in producing good quality welds. (2)

(b) Explain the importance of edge preparation before welding. (2)

(c) Sketch THREE electric arc welding defects, stating the cause of EACH. (6)

3. (a) Describe, with the aid of a sketch, the principle of operation of a modern shaft torsion meter. (8)

(b) Explain why it is important in terms of hull efficiency to measure and compare shaft torque and speed. (2)

4. (a) Sketch a hydraulic type of shaft coupling bolt. (4)

(b) State the advantages of the arrangement in part (a) compared to conventional bolts. (3)

(c) State THREE operational factors that may induce high stress in shaft coupling bolts. (3)

5. With reference to centrifugal pumps:

(a) explain how the internal condition may be assessed without having to dismantle the pump; (3)

(b) state the effects of misalignment between the driving motor and the pump; (2)

(c) describe, with the aid of a sketch, how misalignment may be corrected. (5)

6. (a) Sketch an oily water separator that complies with current MARPOL regulations. (5)

(b) Describe a monitoring system that ensures that the oil discharge content is below the recommended maximum and that logs and retains data. Also mention any other measures to ensure that illegal discharges are prohibited. (5)

7. With reference to refrigeration systems:

(a) explain why undercooling of the refrigerant at the condenser outlet is desirable; (3)

(b) describe, with the aid of a sketch, how a heat exchanger could be incorporated in the circuit to enhance undercooling; (5)

(c) explain the possible consequences of the refrigerant having a dryness fraction at the compressor suction. (2)

8. With reference to tanks containing hydrocarbon liquids and vapours:

(a) define EACH of the following terms:

(i) explosive limits; (2)

(ii) vapour pressure; (2)

(iii) flash point. (2)

(b) explain how the atmosphere in cargo tanks containing varying percentages of flammable gas can be maintained in a safe condition at all times. (4)

Section B

9. (a) Explain the term *power factor*. (2)

(b) Explain why it is detrimental to have a low power factor. (2)

(c) Explain, with the aid of phasor diagrams, how a synchronous motor may be used to assist in power factor correction. (6)

10. Describe the construction and operation of EACH of the following:

(a) synchronous motor; (5)

(b) induction motor. (5)

11. (a) With reference to battery systems for emergency purposes, explain the precautions that must be taken with regard to personnel safety, storage and maintenance. (7)

(b) Explain how batteries are kept at the correct rate of charge. (3)

Section C

12. (a) Sketch a method of attaching an anchor cable to a ship's structure, showing how the cable could be released in an emergency. (5)

(b) Explain how chain lockers are emptied of water and silt, stating any restrictions that may have to be observed. (3)

(c) State the dangers associated with entering a chain locker. (2)

13. With reference to structural fire protection in passenger ship accommodation spaces:

(a) define the meaning of Class A bulkheads, stating the requirements; (4)

(b) discuss the design of ventilation systems to prevent the spread of smoke and fire; (4)

(c) explain how the integrity of the bulkhead is retained, with respect to ventilation trunkings, where A Class bulkheads have to be penetrated. (2)

14. Describe the items that should be inspected to ensure that the conditions of assignment of Load Line are satisfactorily complied with. (10)