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, 13 December 2021

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. Describe, with the aid of a graph, EACH of the following types of ferrous material failure, stating ONE practical example of EACH:

   (a) creep; (5)

   (b) fatigue. (5)

2. Describe, with the aid of a sketch, the principle of operation of a capacitance electrode level measuring transmitter. (10)

3. (a) Explain EACH of the following control terms:

   (i) proportional action; (2)

   (ii) integral action; (2)

   (iii) derivitive action. (2)

   (b) Explain why proportional, integral and derivative actions are combined in one controller (PID), stating an example where it may be used. (4)

4. (a) Describe a method of checking main transmission shaft alignment which does not involve the removal of shaft coupling bolts. (5)

   (b) State why the shaft alignment should be checked when the ship is afloat in a light ship condition. (1)

   (c) A shaft system is found to be excessively misaligned so as to cause serious bending of the shaft. State what effect this could have on EACH of the following:

   (i) the shaft coupling bolts; (1)

   (ii) the shaft bearings. (1)

   (d) State, with reasons, which of the effects in part (c) would cause the most concern. (2)

5. Describe EACH of the following heat exchanger types, stating a suitable application for EACH type:

(a) parallel flow; (3)

(b) contra flow; (3)

(c) mixed flow. (4)

6. With reference to microbacterial infestation:

(a) list the engine room systems that may be affected by this type of contamination; (2)

(b) explain the conditions required for bacteria to evolve; (6)

(c) describe how the presence of microbial contamination could be detected. (2)

7. With reference to deck machinery:

(a) sketch a line diagram showing the layout and components of a hydraulic system with a variable delivery, pressure compensated pump and accumulator, suitable for the operation of deck machinery; (5)

(b) discuss the advantages of using electrically driven machinery over hydraulically driven winches and windlasses. (5)

8. As Chief Engineer Officer, describe the examinations that would be carried out during a safety equipment survey with regard to fire safety. (10)

Section B

9. Describe, with the aid of a circuit diagram, the operation of an automatic voltage regulator (AVR) which employs the use of thyristors. (10)

10. With reference to a.c.induction motors:

(a) state, with reasons, the type of fuses used for protection; (2)

(b) explain the effects of single phasing; (3)

(c) describe how thermistors can be used to protect the motor; (3)

(d) state TWO types of relay that provide electrical overload protection. (2)

11. (a) Explain, with the aid of a sketch, the principle of operation of an earth leakage detection system of the instrument type. (6)

(b) Explain why an insulated neutral system is used extensively on board ships. (2)

(c) State, with reasons, why a single earth fault on an insulated neutral system should always be cleared as soon as possible. (2)

Section C

12. (a) Describe the stresses that the hull of an ocean going vessel is subjected to when it encounters heavy weather. (5)

(b) Explain the constructional details of ships which resist the stresses described in part (a). (5)

13. With reference to a bulk carrier, describe, as Chief Engineer Officer, the inspection that should be carried out on the upper topside areas. (10)

14. (a) List FIVE of the nine hazard classes of Dangerous Goods as stated in the International Maritime Dangerous Goods (IMDG) code. (5)

(b) State the documentation that must accompany any hazardous shipment, explaining the purpose of this documentation. (5)