CERTIFICATES OF COMPETENCY IN THE MERCHANT NAVY –
MARINE ENGINEER OFFICER

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

STCW 95 SECOND ENGINEER REG. III/2 (UNLIMITED)

042-27 – ENGINEERING KNOWLEDGE - GENERAL

MONDAY, 18 OCTOBER 2010

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
All questions carry equal marks

SECTION A

Attempt SIX questions only from this section

1. State how EACH of the following faults could be identified in a refrigeration system, describing how EACH could be rectified:

   (a) air in the system; (2)

   (b) moisture in the system; (2)

   (c) oil in the evaporator; (2)

   (d) overcharge; (2)

   (e) undercharge. (2)

2. (a) Describe, with the aid of a sketch, a transmission shaft coupling that enables the propeller shaft to be withdrawn outboard, labelling the main parts. (6)

   (b) Describe how the coupling sketched in Q2(a) is:

      (i) tightened; (2)

      (ii) removed. (2)

3. Explain EACH of the following metallurgical processes for a carbon steel:

   (a) hardening and tempering; (5)

   (b) annealing and normalising. (5)

4. With reference to a purifier designed for the centrifuging of lubricating oil:

(a) state the purpose of the conical disc stack; (2)

(b) explain the reason for the vertical holes in the disc stack; (2)

(c) explain the factors that determine the selection of a dam ring; (2)

(d) draw a vector diagram of the forces acting on a water particle through the disc stack. (4)

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

(i) rudder angle and time of operation; (3)

(ii) electrical requirements. (3)

(b) State why EACH of the following are fitted to steering systems:

(i) brake or locking devices; (1)

(ii) shock/buffer relief valves; (1)

(iii) steering gear stops or cut-outs; (1)

(iv) rudder stops. (1)

6. (a) Describe, with the aid of a sketch, a bulk, mechanical foam, fire fighting system using a salt water supply and venturi proportioning device. (6)

(b) State FOUR desirable effects that occur when foam is applied to an oil fire. (4)

7. With reference to control systems, explain EACH of the following:

(a) two-step action; (2)

(b) offset; (2)

(c) gain; (2)

(d) proportional action; (2)

(e) integral action. (2)

8. (a) Explain why a centrifugal pump is not self priming. (2)

(b) State FOUR methods that will assist the priming of a centrifugal pump. (4)

(c) Sketch the impeller and casing of a water ring type priming pump, describing how it operates. (4)

SECTION B

Attempt TWO questions only from this section

9. (a) Sketch a typical voltage recovery profile for an alternator. (3)

   (b) Explain what is meant by error actuated voltage control. (2)

   (c) State an example of an error actuated voltage control system. (1)

   (d) Sketch the voltage response curve when a load is applied to a generator with a failed automatic voltage regulator, stating the consequences of prolonged operation in this condition. (4)

10. Explain, with the aid of diagrams, the operation of TWO types of earth fault detection in an electrical distribution system. (10)

11. Explain, with the aid of a sketch, the operating sequence of a Star/Delta starting circuit. (10)

SECTION C

Attempt TWO questions only from this section

12. (a) Sketch a high velocity vent for a cargo oil tank. (5)

    (b) Describe how the vent sketched in Q12(a) operates. (5)

13. (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 Q13(a). (6)

14. With reference to forces acting on a rudder, explain, with the aid of a sketch, EACH of the following terms:

    (a) lift; (3)

    (b) drag; (3)

    (c) balanced. (4)