CERTIFICATES OF COMPETENCY IN THE MERCHANT NAVY - MARINE ENGINEER OFFICER

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

CHIEF ENGINEER (UNLIMITED)

041-35 - ENGINEERING KNOWLEDGE - GENERAL

MONDAY, 10 December 2012

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) List the procedures of a safety management system relating to the engineering department. (4)

   (b) Describe THREE of the above procedures. (6)

2. With reference to fixed installations for machinery space fires:

   (a) sketch a CO_2 bottled system; (5)

   (b) explain how the system sketched in part (a) is protected from overpressure; (2)

   (c) describe the periodic maintenance required. (3)

3. With reference to micro bacterial contamination:

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

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

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

4. With reference to centrifugal pumps:

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

   (b) state the effects of misalignment between the driving motor and the pump; (3)

   (c) describe, with the aid of a sketch, how on a new replacement motor, alignment is checked and adjusted. (4)

5. Materials used for hull and machinery are subjected to stress and strain in service.

(a) Describe EACH of the following:

(i) THREE types of stress; (3)

(ii) TWO types of strain. (1)

(b) Describe the mechanical tests carried out on a sample of steel plates used for ship's side plating. (6)

6. With reference to pneumatically operated control valves:

(a) state the reasons for fitting a valve positioner; (4)

(b) describe, with the aid of a sketch, valve hysteresis, stating how it affects the process; (3)

(c) describe how design and routine maintenance can limit hysteresis. (3)

7. With reference to the pour point of fuel oil:

(a) define the term *pour point*; (2)

(b) explain how the pour point of a fuel may be estimated onboard using simple testing equipment; (4)

(c) explain the consequences of bunkering a fuel with a pour point of 35°C. (4)

8. With reference to a domestic refrigeration plant, state TWO causes of EACH of the following conditions, stating how EACH cause may be rectified:

(a) excessive pressure; (2)

(b) low pressure at evaporator suction; (2)

(c) compressor cycling; (2)

(d) compressor running for long periods but not lowering the temperature in the cold rooms; (2)

(e) compressor operating noisily. (2)

Section B

9. With reference to the protection of electrical equipment in a distribution system:

   (a) state the aims of the protective devices; (3)

   (b) explain the principle of preferential trips, describing how it is achieved; (4)

   (c) state, with reasons, THREE causes of electrical fires. (3)

10. (a) Describe, with the aid of a sketch, a static excitation system for a generator. (8)

    (b) Explain TWO advantages of static excitation. (2)

11. With reference to a high voltage system on board ship:

    (a) state THREE advantages of this; (3)

    (b) state THREE disadvantages of this; (3)

    (c) list the main difference in the requirements on the main switchboard compared to a 440 volt. (4)

Section C

12. (a) Explain the Harmonised System of Survey & Certification (HSSC). (4)

(b) With reference to the load line certificate explain what will be inspected and how these items are kept in compliance. (6)

13. With reference to the structure of a large passenger ship, describe the requirement for preventing the spread of fire and smoke. (10)

14. 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)

(c) write a procedure for enclosed space entry. (5)

CERTIFICATES OF COMPETENCY IN THE MERCHANT NAVY - MARINE ENGINEER OFFICER

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

CHIEF ENGINEER (UNLIMITED)

041-35 - ENGINEERING KNOWLEDGE - GENERAL

DRAFT PAPER, Paper 75-15 Oct 2012

- 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. With reference to machinery parts under cyclic loading, describe, with the aid of sketches, how the propagation of even the smallest of cracks can lead to total component failure. (10)

2. With reference to microbacterial infestation:

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

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

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

3. With reference to podded thrusters for main propulsion:

   (a) distinguish between podded and azimuthing thrusters; (4)

   (b) explain the meaning of thruster and tractor propellers, stating ONE advantage of tractor units; (4)

   (c) explain what is meant by tandem podded thrusters. (2)

4. Describe the principle of operation of 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)

5. (a) Describe, with the aid of a sketch, an outboard lip seal as fitted to an oil lubricated stern tube. (6)

   (b) Explain the procedure for replacing the seal sketched in part (a) without removing the tailshaft. (4)

6. With reference to static oily water separators, explain EACH of the following:

   (a) why the supply pump should be carefully selected and matched to the separator, stating the most suitable type; (2)

   (b) how the separator achieves effective separation; (4)

   (c) how the physical properties of each of the fluids to be separated affects the rate and effectiveness of separation. (4)

7. (a) Sketch a block diagram of a fully automated air conditioning system for accommodation spaces, annotating the relevant temperatures and relative humidities throughout the system. (7)

   (b) Describe how harmful bacteria are prevented from entering an air conditioning system. (3)

8. Describe, with the aid of a block diagram, a *Hi-fog* fresh water spray fire-fighting system capable of automatically extinguishing a machinery space or compartment fire. (10)

Section B

9. (a) Explain why it is necessary to provide reverse power for a.c generators operating in parallel. (2)

(b) Sketch a reverse power relay trip. (4)

(c) Explain the principle on which the operation of the relay trip sketched in part (b) is based, describing how it is activated. (4)

10. (a) Sketch a circuit diagram of a self excited a.c. generator. (5)

(b) Describe the operation of the circuit sketched in part (a). (5)

11. With reference to a three phase electrical distribution system:

(a) discuss the advantages and disadvantages of an insulated neutral system; (8)

(b) describe how an earthed neutral system is earthed and the measures taken to limit the maximum earth fault current. (2)

Section C

12. As Chief Engineer Officer of an older vessel which has recently been purchased, write a report to the Superintendent Engineer detailing the items that should be inspected to ensure that the *conditions of assignment* are satisfactorily complied with. (10)

13. Explain the methods adopted in modern shipbuilding practice to prevent hull fractures due to corrosion fatigue, making reference to the sequence of assembly of the plating and welding and the subsequent protection on completion of construction. (10)

14. With reference to double hulled oil tankers:

    (a) sketch a mid ship cross section; (5)

    (b) state the reason for the evolution of this type of design; (1)

    (c) state FOUR disadvantages of this type of design. (4)

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 CHIEF ENGINEER REG. III/2 (UNLIMITED)

041-35 – ENGINEERING KNOWLEDGE - GENERAL

MONDAY, 26 MARCH 2012

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. Following bunkering operations, it is discovered that the vessel received a quantity which was short of what was stipulated in the pre-delivery document.

   As Chief Engineer Officer, write a Note of Protest to the Master of the bunkering vessel. (10)

2. With reference to multi-tubular heat exchangers, explain how EACH of the following contribute to satisfactory performance:

   (a) tube wall thickness; (2)

   (b) dense population of tubes in the tube plate; (2)

   (c) tube materials selection; (2)

   (d) coolant flow rates; (2)

   (e) unimpeded passage of coolant at entry and exit from the tubes. (2)

3. Describe, with the aid of a block diagram, a compensated control system for an active fin stabilisation unit. (10)

4. With reference to stern tube bearings:

   (a) explain why large diameter white metal lined bearings are susceptible to failure; (5)

   (b) outline the merits of non metallic bearings. (5)

5. (a) State the affinity laws for a centrifugal pump. (3)

(b) State the effects on the pump affinity laws of fitting a slightly smaller diameter impeller. (2)

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

6. (a) With reference to a vapour compression refrigeration plant, explain why EACH of the following conditions are desirable:

(i) superheating at the compressor suction; (3)

(ii) undercooling at the condenser outlet. (3)

(b) Describe, with the aid of a Pressure-Enthalpy diagram, how the evaporator cooling load is affected by the conditions stated in Q6(a). (4)

7. In deck machinery hydraulic systems, state the functions of the hydraulic oil reservoir, explaining how these functions determine the construction and dimensions of the oil reservoir, making reference to the volume of the hydraulic fluid in the system. (10)

8. Describe a procedure for a function test of the operation of a machinery space CO_2 smothering system. (10)

SECTION B

Attempt TWO questions only from this section

9. Describe, with the aid of a block diagram, how automatic starting, load sharing and stopping of generators in response to load changing is effected. (10)

10. State the main electrical survey items applicable to a periodical Classification Society survey. (10)

11. With reference to High Voltage systems:

    (a) explain how the permit to work procedure is carried out before any maintenance work commences; (5)

    (b) outline the procedure to be adopted when using portable earthing leads. (5)

SECTION C

Attempt TWO questions only from this section

12. Sketch FIVE methods used to prevent the distortion of ships plates and frames during major welded hull repairs in dry dock. (10)

13. With reference to corrosion found in the steelwork of cargo oil tanks:

    (a) explain the factors that cause corrosion in cargo oil tanks; (4)

    (b) state, with reasons, areas most likely to be affected by such action; (3)

    (c) describe the methods employed to minimise corrosion in cargo oil tanks. (3)

14. (a) Define *propeller slip.* (2)

    (b) State, with reasons, FOUR conditions which will affect the *propeller slip.* (8)

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 CHIEF ENGINEER REG. III/2 (UNLIMITED)

041-35 – ENGINEERING KNOWLEDGE - GENERAL

MONDAY, 26 MARCH 2012

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. Following bunkering operations, it is discovered that the vessel received a quantity which was short of what was stipulated in the pre-delivery document.

   As Chief Engineer Officer, write a Note of Protest to the Master of the bunkering vessel. (10)

2. With reference to multi-tubular heat exchangers, explain how EACH of the following contribute to satisfactory performance:

   (a) tube wall thickness; (2)

   (b) dense population of tubes in the tube plate; (2)

   (c) tube materials selection; (2)

   (d) coolant flow rates; (2)

   (e) unimpeded passage of coolant at entry and exit from the tubes. (2)

3. Describe, with the aid of a block diagram, a compensated control system for an active fin stabilisation unit. (10)

4. With reference to stern tube bearings:

   (a) explain why large diameter white metal lined bearings are susceptible to failure; (5)

   (b) outline the merits of non metallic bearings. (5)

5. (a) State the affinity laws for a centrifugal pump. (3)

(b) State the effects on the pump affinity laws of fitting a slightly smaller diameter impeller. (2)

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

6. (a) With reference to a vapour compression refrigeration plant, explain why EACH of the following conditions are desirable:

(i) superheating at the compressor suction; (3)

(ii) undercooling at the condenser outlet. (3)

(b) Describe, with the aid of a Pressure-Enthalpy diagram, how the evaporator cooling load is affected by the conditions stated in Q6(a). (4)

7. In deck machinery hydraulic systems, state the functions of the hydraulic oil reservoir, explaining how these functions determine the construction and dimensions of the oil reservoir, making reference to the volume of the hydraulic fluid in the system. (10)

8. Describe a procedure for a function test of the operation of a machinery space CO_2 smothering system. (10)

SECTION B

Attempt TWO questions only from this section

9. Describe, with the aid of a block diagram, how automatic starting, load sharing and stopping of generators in response to load changing is effected. (10)

10. State the main electrical survey items applicable to a periodical Classification Society survey. (10)

11. With reference to High Voltage systems:

    (a) explain how the permit to work procedure is carried out before any maintenance work commences; (5)

    (b) outline the procedure to be adopted when using portable earthing leads. (5)

SECTION C

Attempt TWO questions only from this section

12. Sketch FIVE methods used to prevent the distortion of ships plates and frames during major welded hull repairs in dry dock. (10)

13. With reference to corrosion found in the steelwork of cargo oil tanks:

    (a) explain the factors that cause corrosion in cargo oil tanks; (4)

    (b) state, with reasons, areas most likely to be affected by such action; (3)

    (c) describe the methods employed to minimise corrosion in cargo oil tanks. (3)

14. (a) Define *propeller slip.* (2)

    (b) State, with reasons, FOUR conditions which will affect the *propeller slip.* (8)

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 CHIEF ENGINEER REG. III/2 (UNLIMITED)

041-35 – ENGINEERING KNOWLEDGE - GENERAL

MONDAY, 16 JULY 2012

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. As Chief Engineer Officer compile a report to be submitted to the company concerning the inspection of an inert gas system designed to combat machinery space fires. (10)

2. (a) State, with reasons, the potential hazards that may be present in EACH of the following spaces:

   (i) an oily bilge tank; (2)

   (ii) a ballast tank; (2)

   (iii) a refrigerated space. (2)

   (b) State the procedures to be undertaken prior to entering enclosed spaces. (4)

3. (a) Describe, with the aid of a sketch, a pneumatic three term controller. (6)

   (b) Describe a method that would enable the controller sketched in Q3(a) to be tuned to a process. (4)

4. With reference to a domestic refrigeration system, state TWO causes of EACH of the following conditions, stating how EACH cause may be rectified:

   (a) excessive discharge pressure; (2)

   (b) low pressure at evaporator suction; (2)

   (c) compressor short cycling; (2)

   (d) compressor running for long periods but not lowering the temperature in the cold rooms; (2)

   (e) compressor operating noisily. (2)

5. With reference to electro-hydraulic steering gear:

(a) describe, with the aid of a sketch, the operation of a gear with two fifty percent units conforming to the single failure criteria; (8)

(b) state the precautions when operating on two rams only. (2)

6. (a) Explain how power is transmitted through main shafting. (2)

(b) State FOUR operational factors that may induce high stress in coupling bolts. (4)

(c) Sketch a coupling bolt of improved design. (4)

7. (a) Sketch an azimuthing podded thruster. (4)

(b) State SIX advantages of adopting azimuthing podded units for main propulsion compared with in line shafting driven propellers. (6)

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

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

(c) Sketch TWO methods of plate edge preparation. (2)

(d) A hairline crack is detected in a pipe, as Chief Engineer Officer, state the factors to be taken into account in reaching a decision on the method of repair. (4)

SECTION B

Attempt TWO questions only from this section

9. Describe, with the aid of a sketch, the operation of a temperature measuring device that employs a thermo-couple. (10)

10. Explain, with the aid of a circuit diagram, the operation of a star/delta starter for a polyphase motor including the ancillary starter circuit. (10)

11. (a) Explain the meaning of EACH of the following terms when applied to electrical equipment:

    (i) intrinsically safe; (2)

    (ii) flameproof; (2)

    (iii) increased safety; (2)

    (iv) pressurised enclosure. (2)

    (b) State TWO types of lighting equipment that may be installed in the pump room areas of a crude petroleum carrier. (2)

SECTION C

Attempt TWO questions only from this section

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

13. (a) Explain EACH of the following terms:

    (i) watertight; (3)

    (ii) weathertight. (3)

    (b) Explain why deck scuppers and freeing ports are as critical to seaworthiness as watertight integrity. (4)

14. Describe the in-water survey to classification society requirements of the underwater structure of a very large carrier. (10)