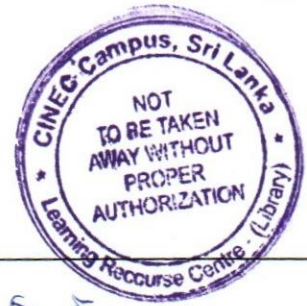




Faculty of Marine Engineering

EXAMINATION FOR CHIEF ENGINEER OFFICER**ENGINEERING KNOWLEDGE – II (Motor)**

C/2 n
minutes

Time Allowed- Three Hours

Answer Six questions.

Marks for each part of the question are shown in the brackets.

2023.07.20

1.

With reference to marine engines operated with LNG.

- a) Briefly explain the dual fuel injection technology. (6 Marks)
- b) Sketch a fuel system suitable for above engine stating the safety devices. (4 Marks)
- c) During transportation of LNG, what is “aging” (2 Marks)
- d) What is methane slip. (2 Marks)
- e) What measures are taken to minimize methane slip in dual fuel engines (2 Marks)

2.

- a) Describe the actions and checks required to ensure that a crosshead main propulsion engine may be operated in a Slow Steaming condition. (8 Marks)
- b) Explain the problems which may arise during a prolonged period of slow steaming. (4 Marks)
- c) Explain what actions should be taken before, and after the engine is returned to normal operation after a period of slow steaming. (4 Marks)

- 3. a) Explain in detail the significance of propeller curves (6 Marks)
- b) Enumerate the propeller safety margins (4 Marks)
- c) Describe the procedure of estimation of effective engine power without

Indicator diagrams but using:

- i) Fuel index (3 marks)
- ii) Turbocharger speed (3 Marks)

4. With reference to exhaust gas scrubbers

- a. Describe with the aid of a sketch Open Loop Sox scrubber system. (4 Marks)
- b. Explain the added features incorporated in closed loop scrubber system (3 Marks)
- c. Explain what systems to be monitored to ensure the scrubber system meets all IMO regulations? (3 Marks)
- d. Explain the mandatory documentation required to be kept on board. Discuss the reason for recording the operation and maintenance in a record book. (3 Marks)
- e. State the current regulations applicable for exhaust emissions and wash water discharge. (3 Marks)

5.

As chief Engineer Officer Write a report to the engineering superintendent regarding the failure of a cracked main engine cylinder liner due to cracking which resulted in water leakage from the cooling space into the cylinder. The report must explain how the defect was detected, the immediate action taken, the rectifying action taken to ensure that the engine could be operated, and the checks made on the engine before and after restarting. (16 marks)

6.

- a) With reference to abnormal and excessive cylinder liner wear.
- b) explain how it may be caused, stating how it is detected; (6 Marks)
- c) explain the effects and consequences of excessive cylinder liner wear; (5 Marks)
- d) explain how abnormal cylinder liner wear may be prevented. (5 Marks)

7.

With reference to diesel engine NOx emissions:

- a) explain how Nox is formed during operation of the engine indicating why the aim of high engine efficiency increases the problem; (6 marks)
- b) describe ONE external means by which diesel engine NOx emissions may be reduced in order to meet current regulations: (10 marks)

8.

- a) Describe with the aid of sketch an electronically controlled main engine fuel injection system. (8 Marks)
- b) Explain how the system described in part (a) functions to change the fuel injection timing when instructed by an engineer at the control terminal. (8 Marks)

9.

- a) Describe, with the aid of a sketch, a waste heat recovery system for electrical generation using main engine exhaust gas in combined gas/steam turbine systems. (8 Marks)
- b) Describe the operation of the waste heat recovery system described in part (a) whilst the associated main engine is running. (8 Marks)



Faculty of Marine Engineering

**EXAMINATION FOR CHIEF ENGINEER OFFICER
ENGINEERING KNOWLEDGE – I (GENERAL)**



TIME ALLOWED - THREE HOURS

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 of the question are shown in the brackets

2023.07.18

Pass mark 50 % of total **AND** also need to obtain the minimum of **10** Marks in each Section B and C.

Answers with clear sketches/diagrams, neat handwriting and clear expression will get full marks.

*C122
Ministers*

Section A

1. With reference to ship Port State Control (PSC) inspections, answer the following questions:

- a) Identify and describe at least six (6) detainable deficiencies categorized under different chapters of the Safety of Life at Sea (SOLAS) convention. (3 marks)
- b) Outline your plan of action if you receive notification of any of these deficiencies from a Port State Control Officer (PSCO). (3 marks)
- c) Explain the process of rectifying the identified deficiencies mentioned in part (b). (4 marks)

2. Regarding cargo space inert gas systems and oxygen analyzers, answer the following:

- a) Create a diagram illustrating a cargo space inert gas system that utilizes washed and cooled flue gas from a boiler. (4 marks)
- b) Discuss the safety considerations and precautions associated with operating and maintaining ship inert gas systems. (3 marks)
- c) Explain the purpose and functioning of a pressure-vacuum valve in an inert gas system. (3 marks)

3. Regarding centrifugal pumps, answer the following:

- a) Sketch and label the pump characteristic curves depicting the relationship between head, flow rate, and power consumption. Include the efficiency curve as well. (2 marks)
- b) Define the term "Net Positive Suction Head" (NPSH) and explain its significance in centrifugal pump operation. (3 marks)
- c) Discuss the potential consequences of having insufficient NPSH in a centrifugal pump system. (2 marks)
- d) Explain the phenomenon of cavitation in centrifugal pumps, including its causes and effects on pump performance. (3 marks)

4. Regarding the Chief Engineer's role in fire safety on ships, answer the following:

- a) Explain the specific responsibilities and duties of the Chief Engineer in maintaining and ensuring fire safety on board a ship. (4 marks)
- b) Describe the Chief Engineer's role during a fire emergency, including coordination with other crew members and response procedures. (3 marks)
- c) Discuss the Chief Engineer's involvement in conducting fire risk assessments and implementing preventive measures to minimize fire hazards on the ship. (3 marks)

5. As the Chief Engineer Officer, address the following:

- a) List and explain the factors to consider when storing manual metal arc welding electrodes to ensure the production of high-quality welds. (2 marks)
- b) Describe the significance of edge preparation before welding and its impact on the quality and integrity of the weld joint. (2 marks)
- c) Sketch and label two different methods of edge preparation commonly used in welding processes. (2 marks)
- d) A hairline crack is detected in a pipe. As the Chief Engineer Officer, outline the factors that need to be considered when deciding on the method of repair for the crack. (4 marks)

6. With reference to hydraulic steering gear, address the following:

- a) Explain the factors that can contribute to the failure of a hydraulic pipe coupling in the steering system. (2 marks)
- b) Discuss the utmost importance of promptly locking the rudder and isolating the affected area in the event of a hydraulic system failure. (2 marks)
- c) Describe the potential problems that may arise when locking the rudder in heavy weather conditions. (2 marks)
- d) Explain why hydraulic locking is preferred over mechanical means for securing the rudder. (2 marks)
- e) Define the concept of the single failure and its significance in hydraulic steering gear systems. (2 marks)

7. During bunkering operations, a section of the deck bunker line develops a fuel oil leak from a pinhole located in the middle of the pipe.

a) As the Chief Engineer Officer, describe the immediate actions that should be taken to prevent a potential pollution incident. (2 marks)

b) Explain the procedure for making a permanent repair to the damaged section of the deck bunker line, including any precautions to be taken and subsequent inspections that would be necessary. (8 marks)

8. 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 that incorporates an air space and is designed to prevent pollution. (10 marks)

Section B

9. With reference to electronic automation systems in the engine room, provide answers to the following:

a) Discuss the advantages and challenges of utilizing electronic automation systems for engine room operations and outline the Chief Engineer's responsibilities in overseeing their maintenance and troubleshooting. (4 marks)

b) Explain the importance of conducting regular inspections and tests on electronic control systems, such as engine monitoring and alarm systems, and describe the Chief Engineer's role in coordinating these activities. (3 marks)

c) Outline the procedures for ensuring the proper functioning and calibration of electronic sensors and instrumentation used in monitoring various parameters in the engine room and explain the Chief Engineer's responsibilities in this regard. (3 marks)

10. Regarding electrical maintenance and safety on board, address the following:

a) Explain the importance of electrical safety measures and procedures in the engine room and describe the Chief Engineer's responsibilities in ensuring compliance with electrical safety regulations. (3marks)

b) Discuss the procedures and precautions for working with electrical equipment in hazardous areas on board a ship, such as fuel storage areas or engine compartments. (3 marks)

c) Outline the maintenance practices and schedules for electrical systems and equipment on board a ship, emphasizing the Chief Engineer's role in overseeing and coordinating these activities. (4 marks)

11. Regarding generator control and operation, answer the following:

- a) Explain the function and operation of automatic voltage regulators (AVRs) in maintaining the desired output voltage of synchronous generators. (3 marks)
- b) Discuss the role of generator protection systems in safeguarding generators from faults and abnormal operating conditions and describe the chief engineer's responsibilities in monitoring and maintaining these systems. (5 marks)
- c) Define the term "synchronous impedance" (2 marks)

Section C

12. Describe the following emergencies occurred in a vessel

- a) Insufficient reserve buoyancy leading to progressive flooding (3 marks)
- b) Progressive flooding due to excessive List or Trim (2 marks)
- c) Capsizing due to loss of stability (2 Marks)
- d) Structural failure (3 Marks)

13. In the context of shipbuilding materials and techniques, answer the following:

- a) Explain the importance of edge preparation on plates that are to be Butt weld (2 Marks)
- b) State the factors in the storage of welding electrode which will assist in producing good quality welds (2 Marks)
- c) Discuss the importance of welding procedures and inspections in ship construction and outline the Chief Engineer's responsibilities in ensuring the quality and integrity of welded joints. (4 marks)
- d) State the methods used for inspecting welding runs in ship construction. (2 marks)

14.

Regarding hull maintenance and machinery alignment during ship construction and dry docking, address the following:

- a) Explain the importance of proper hull maintenance in ensuring the vessel's structural integrity and seaworthiness. (2 marks)
- b) Discuss the Chief Engineer's role in overseeing the inspection and repair of structural components, such as hull sections and frames, during the dry-docking process. (2 marks)
- c) Outline the procedures and considerations for conducting alignment checks and adjustments during the construction phase and commissioning of the ship's machinery. Explain the Chief Engineer's involvement in this process. (6 marks)



CINEC CAMPUS(PVT)LTD

Faculty of Marine Engineering

Department of Marine Engineering

C/2
Mini

**EXAMINATION FOR CHIEF ENGINEER OFFICER ON SHIPS OF 3000KW PROPULSION POWER OR MORE
ENGINEERING KNOWLEDGE – I (GENERAL)**

TIME ALLOWED - THREE HOURS

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 of the question are shown in the brackets

2023.01.19

Pass mark 50 % of total **AND** also need to obtain the minimum of **10** Marks in each Section B and C.

Answers with clear sketches/diagrams, neat handwriting and clear expression will get full marks.

Section A

1. With reference to ship Port State Control (PSC) Inspection;

- a) State at least Six (6) detainable deficiencies under the different chapters of SOLAS (3 marks)
- b) Explain your plan of action if you are notified above deficiencies by Port State Control Officer (PSCO) (3 Marks)
- c) Explain how you can rectify above deficiencies (4 Marks)

2. a) Sketch a cargo space inert gas system that uses washed and cooled flue gas from

- a boiler (4 Marks)
- b) Describe the procedure of calibrating a multi gas detector (2 Marks)
- c) Explain the correct procedure of gas freeing a cargo tank (4 marks)

3. Explain basic concept for the following with reference to ship Automatic Control

Engineering;

- a) The basic concept of open and closed loop control system (with suitable block Diagrams) (4 Marks)
- b) Essential components in process control loops. (3 Marks)
- c) Oily water interface monitoring device. (3 Marks)

4. As Chief Engineer Officer, write a report to the Superintendent Engineer naming the

items and describing the examinations that were carried out during a safety equipment survey regarding fire safety. (10 marks)

5. With regards to main transmission shaft flange coupling arrangements;

- a) Sketch a hollow type coupling bolt and the hydraulic head/nut and loading rod which are used to fit it. (4 Marks)
- b) Describe how the bolt is fitted. (4 Marks)
- c) State the advantage of the hollow coupling bolt as compared to the traditional type of coupling bolt. (2 Marks)

6. a) As a Chief Engineer describe the procedure you employ for bunkering at a port for

ascertaining and receiving correct grade and quantity of fuel from shore supplies

in case of a dispute regarding fuel oil received (4 Marks)

b) Describe the methods used by some of the bunker supplies to artificially enhance the quantity of supplied bunkers. (2Marks)

c) What are the new features added to BDN with the implementation of latest Sulphur limits of fuel oil. (2 marks)

d) In the event of leaking few liters of fuel to sea during bunkering, state your immediate action and state the parties to be reported. (2 marks)

7. The vessel upon which you are serving as Chief Engineer pass through a heavy storm

And subsequently the steering gear abnormally sluggish

- a) Describe the inspection you would carry out in order to find cause of malfunction (5 Marks)
- b) State the corrective actions that may carried out at sea (3 Marks)
- c) Explain the tests that should be carried out prior to returning the gear to service (2 Marks)

8. Describe each of the following properties of material used on ships.

- a) Strength (2 Marks)
- b) Hardness ((2 Marks)
- c) Ductility (2 Marks)
- d) Brittleness (2 Marks)
- e) State metal surface hardening processes used in engine components (2 Marks)

Section B

9. Discuss the operation and characteristics for the following semiconductor devices

- a) Insulated gate bipolar transistor (2 Marks)
- b) Uni-junction transistor (2 Marks)
- c) Ideal and practical operational amplifier (4 Marks)
- d) Silicon Control rectifier (2 Marks)

10. With reference to High Voltage equipment;

- a) Explain why earthing down is considered essential (2 Marks)
- b) State the operating voltage for an insulation resistance tester (Meggar) suitable for 6.6 KV equipment (1 Mark)
- c) Describe how an insulation resistance test is carried out on High Voltage Equipment, making reference to personnel safety; (5 Marks)
- d) Explain why infra-red temperature measurement is used on High Voltage Equipment (2 Marks)

11. With reference to alternating current generators;

- a) Explain the meaning of the term synchronous impedance (4 Marks)
- b) Explain with the aid of phasor diagrams, the effect of altering the excitation of one of a pair of machines that are operating in parallel (4 Marks)
- c) What safety features are incorporated in the switch gear to minimize the damage to the equipment by a motoring incident of two generators running in parallel. (2 Marks)

Section C

12. a) Explain the importance of edge preparation on plates that are to be
Butt weld (4 Marks)
- b) State the factors in the storage of welding electrode which will assist
in producing good quality welds (2 Marks)
- c) A hairline crack detected in a pressure component when the vessel at sea.
As Chief Engineer discuss the factors you will be considered in
Reaching the decision on the repair to be undertaken. (4 Marks)
13. a) As a chief engineer describe different steps that need consideration while planning
a drydocking project of a ship due for its first special survey. (8 marks)
- b) State the areas you would personally check prior flooding the drydock. (2 marks)
14. With reference to Liquefied Gas Containment,
- a) Sketch a typical midship section of an Independent Type A liquefied Gas carrier and
briefly explain the main construction features with material used for various
components. (06 Marks)
- b) State why secondary barriers are required for Liquefied Gas Containments? (02 Marks)
- c) State which tanks are not required to have full secondary barriers. (02 Marks)