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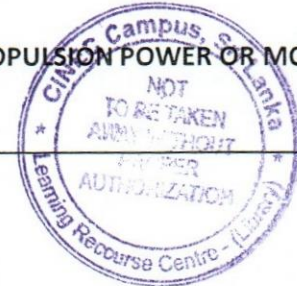
C/2 TD Ministry

CINEC CAMPUS(PVT)LTD

Faculty of Marine Engineering

Department of Marine Engineering

**CHIEF ENGINEER & SECOND 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**

**Pass mark 50 % of total AND also need to obtain the minimum of 8 Marks in each Section B and C.**

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

**08.12.2023**

**Section A**

1.

With reference to multi-tubular heat exchangers, explain the impact of each of the following factors on achieving satisfactory performance,

- a) The thickness of tube walls (2 marks)
- b) The density of tubes in the tube plate (2 marks)
- c) The selection of tube materials (2 marks)
- d) The rates of coolant flow (2 marks)
- e) The unobstructed passage of coolant at the entry and exit points from the tubes (2 marks)

2. a) With reference to tanks containing hydrocarbon liquids and vapors: define EACH of the following terms:

- i. Explosive limits; (2 Marks)
- ii. Vapor pressure; (2 Marks)
- iii. Flash point. (2 Marks)
- b) Explain the process of calibrating a multi-gas detector. (4 Marks)

3. Regarding Refrigeration systems:

- a) Describe the Relief and Unloading Arrangements Employed in Reciprocating Compressors for Refrigeration. (4 points)
- b) Elaborate on the Significance and Importance of Incorporating Relief and Unloading Arrangements in Reciprocating Compressors for Refrigeration Applications. (4 points)
- c) Generate a Diagram Illustrating a Refrigerated (Reefer) Container and Provide Clear Labels for its Key Components. (2 marks)

4. Sketch each of the following electric arc welding defects stating the cause of each defect:

- a) undercutting; (2 marks)
- b) penetration; (2 marks)
- c) lack of fusion; (2 marks)
- d) slag inclusion. (2 marks)
- e) What precautions should be taken when storing welding rods for an extended period? (2 marks)

5. With respect to centrifugal pumps:

- a) Elaborate on non-invasive methods for assessing pump performance without the necessity of pump dismantling. (3 Marks)
- b) Outline the effects of misalignment between the driving motor and the pump in the context of centrifugal pumps. (2 Marks)
- c) Illustrate, with the assistance of a diagram, the process for checking and adjusting alignment on a newly installed replacement motor in the context of centrifugal pump systems. (5 Marks)

6. In relation to a keyless propeller designed for hydraulic (wet) fit and withdrawal:

- a) Explain the process of fitting the propeller onto the propeller shaft (4 marks)
- b) State how the propeller is extracted from the propeller shaft (2 marks)
- c) Identify two advantages of this keyless hydraulic system in comparison to conventional dry-fit systems (2 marks)
- d) Clarify the mechanism through which thrust is effectively transmitted in this keyless propeller system without utilizing a key and keyway (2 marks)



7. With reference to steam boilers.

- a) Explain the causes of corrosion and erosion in marine steam boilers. (2 marks)
- b) Discuss preventive measures to mitigate corrosion and erosion in boiler components. (2 marks)
- c) Outline a systematic approach for troubleshooting common issues in marine steam boilers. (3 marks)
- d) Provide examples of potential problems and their corresponding corrective actions. (3 marks)

8. a) Explain the significance of sterilizing fresh water for potable use on board ships. (1 mark)
- b) Provide reasons for the necessity of re-mineralizing potable water. (2 marks)
- c) Illustrate, with the aid of a sketch, a method of freshwater purification utilizing silver ions for sterilization. (5 marks)
- d) State one advantage and one disadvantage associated with the use of ultraviolet radiation for the sterilization of fresh water. (2 marks)

### **Section B**

9. With reference to the protection equipment of 03 phase electrical distribution systems on ships:
- a) state the purpose of the fitting protective devices to such systems. (3 Marks)
  - b) list the parameters that are monitored and used to trigger the protective devices. (4 Marks)
  - c) state, with reasons, THREE causes of electrical fires. (3 Marks)

10.

In the context of electrical maintenance and safety aboard a vessel,

- a) Elaborate on the significance of electrical safety within the engine room and state the responsibilities of the Second Engineer in ensuring adherence to safety regulations. (4 marks)
- b) Provide guidelines on the safe handling of electrical equipment in potentially hazardous zones on a ship, such as fuel storage or engine compartments. (4 marks)
- c) State the maintenance practices for shipboard electrical systems and briefly explain the role of the Second Engineer in supervising and coordinating these activities. (4 marks)

11.

With reference to an alkaline battery cell:

- a) Describe a typical cell, stating the materials used; (4 Marks)
- b) Describe the electro-chemical process that takes place during discharge and charge. (2 Marks)
- c) State the effects of overcharge. (2 Marks)
- d) State the advantages of an alkaline cell compared with a lead acid cell. (2 Marks)

**Section C**

12. a. Briefly describe the necessary procedures and preparations involved in the dry-docking process for vessels. (4 Marks)
- b. What are the important documentation and drawings that must be submitted to the relevant authorities during the dry-docking process. (3 Marks)
- c. State the survey and maintenance tasks undertaken throughout the dry-docking period, (3 Marks)
- 13
- With reference to large container carriers.
- a) Sketch a transverse section of a modern container carrier. (6 Marks)
- b) Explain the function of the following.
- i) bilge keels; (2 Marks)
- ii) passive (uncontrolled) stabilizing tanks. (2 Marks)
- 14.
- a) compare the benefits of sacrificial anodes versus impressed current systems in corrosion protection. (2 Marks)
- b) Illustrate, with the help of diagrams, the impressed current system designed for application on a ship. Provide a detailed explanation of the components and their functions. (6 Marks)
- c) State the specific situations or conditions under which an impressed current cathodic protection (ICCP) system is typically deactivated. (2 Marks)



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**CHIEF ENGINEER & SECOND 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

Pass mark 50 % of total **AND** also need to obtain the minimum of **8** Marks in each Section B and C.

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

07.02.2022

**Section A**

1. As a Second Engineer of a vessel which is scheduled for a Safety equipment renewal survey. Explain a survey route listing at least 10 statutory items to be examined, the test required and information needed to facilitate the work for surveyor. [10 Marks]
  
2.
  - a. With respect to the steering gear, answer the following:
    - A. Explain with a diagram, a "fail safe steering gear" suitable for use on a tanker of more than 100000 T dwt; [6 Marks]
    - b. Explain the sequence of events that take place when an oil leak takes place in one of the hydraulic pipe lines. [4 Marks]
  
3. a. With reference to tanks containing hydrocarbon liquids and vapors: define EACH of the following terms:
  - i. Explosive limits; [2 Marks]
  - ii. Vapor pressure; [2 Marks]
  - iii. Flash point. [2 Marks]
  
- 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 Marks]

- 4.
- a. Write short note on the followings
- i. Metal – locking; [2 Marks]
  - ii. TIG and MIG welding; [2 Marks]
  - iii. Brazing; [2 Marks]
  - iv. Soldering. [2 Marks]
- b. Discuss the meaning of welding procedure specification (WPS) and welder performance qualification (WPQ). [2 Marks]
5. With reference to a two-speed sea water circulating centrifugal pump.
- a. Sketch typical discharge characteristics showing variation of throughput against discharge head for both speed condition. [4 Marks]
  - b. Explain why these characteristic profiles are desirable. [3 Marks]
  - c. Explain why two speed operation may desirable. [3 Marks]
6. With reference to a ship's air conditioning plant:
- a. Define the term comfort zone; [2 Marks]
  - b. State the objectives of maintaining the conditioned air within the comfort zone; [2 Marks]
  - c. State, with reasons, FIVE areas from which the conditioned air must not be recirculated. [3 Marks]
  - d. With related to overhaul of an AC compressor, discuss a proper procedure to be followed during recovery and recharge process of the refrigerant. [3 Marks]
7. With reference to an emergency generator discuss following including legislative requirements.
- a. Starting arrangements, [2 Marks]
  - b. Cooling systems, [2 Marks]
  - c. Fuel and its supply, [2 Marks]
  - d. Periodic attention required, [2 Marks]
  - e. Location. [2 Marks]
8. With reference to Vacuum Sewage System:
- a. Sketch & Describe a Vacuum Sewage System. [5 Marks]
  - b. State the advantages of Vacuum Sewage System. [2 Marks]
  - c. State the different causes of dropping vacuum. [3 Marks]

### Section B

- 9.
- a. Explain why it is necessary to have reverse power protection for alternators intended for parallel operation. [3 Marks]
  - b. Sketch a reverse power relay trip. [3 Marks]
  - c. Explain principle on which the operation of the relay trip is based, describing how tripping is activated. [2 Marks]
  - d. State the typical set values of reverse power tripping for,
    - i. Diesel driven alternators [1 Marks]
    - ii. Turbo alternators [1 Marks]



- 10.
- a. Sketch a circuit diagram of a push button direct on line contactor starter, incorporating overload short circuit protection. [4 Marks]
- b. Indicate, on a sketch of the typical characteristics curves of a current torque against speed, the disadvantages of a direct on line start squirrel cage induction motor [6 Marks]
- 11.
- a. Explain why a 3-phase synchronous motor is not self-starting [2 Marks]
- b. Draw a schematic diagram of an electric drive system powered by a 3-phase synchronous induction motor [2 Marks]
- c. With reference to Q11. a explain how EACH of the following is achieved
- i. Starting [1 Marks]
- ii. Speed control [1 Marks]
- iii. Reversal of rotation [1 Marks]
- iv. State the advantages obtained when a 3 phase synchronous motor operates at unity power factor [3 Marks]

### Section C

12. With reference to dry docking of a vessel
- a. How the vessel is planned and prepared for dry docking [3 Marks]
- b. State the pre docking information and drawings given to dry dock authority [3 Marks]
- c. Describe the Extent of survey/items to be examined and repairs carried out in dry dock taking the advantage of dry dock occupation [4 Marks]
- 13.
- a. Sketch the forward construction of a ship [6 Marks]
- b. Explain the term "Pounding", discussing the arrangements made to resist "Pounding" [2 Marks]
- c. What are the advantages and disadvantages of a bulbous bow. [2 Marks]
- 14.
- a. Describe how the propeller wake occurs [6 Marks]
- b. Explain the influence of wake on
- i. Propeller efficiency [2 Marks]
- ii. Hull induced vibration [2 Marks]

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**REPARATORY COURSE FOR CHIEF ENGINEER & SECOND ENGINEER OFFICER ON SHIPS OF 3000KW  
PROPULSION POWER OR MORE**

**ENGINEERING KNOWLEDGE – II (Motor)**

**WITHDRAWAL EXAMINATION**

Time Allowed- Three Hours

Answer Six questions

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

07.02.2022

01. With reference to exhaust gas scrubbers
- a. Describe with the aid of a sketch Open Loop Sox scrubber system. **(6 Marks)**
  - b. Explain the added features incorporated in closed loop scrubber system **(4 Marks)**
- Explain what systems to be monitored in order to ensure the scrubber system meets all IMO regulations? **(3 Marks)**
- c. State the requirement of wash water discharge. **(3 Marks)**
02. With reference to turbochargers:
- a. Explain the term surging, stating how it occurs and its effect on the turbocharger; **[6Marks]**
  - b. Explain how the possibility of surge is minimised. **(4Marks)**
  - c. Explain the action to be taken in the event of surging, stating why this action should be taken promptly. **(3 Marks)**
  - d. Describe how operational performance of a turbocharger may be assessed **(3 Marks]**
- 03.
- With reference to electronically controlled marine slow speed engine;
- a) Sketch a starting air system with slow turning function **(8 Marks)**
  - b) Explain the importance of slow turning **(4 Marks)**
  - c) State the safety devices fitted in the system **(4 Marks)**



04. With reference to dual-fuel two stroke engines used in LNG carriers
- State the advantages of these engines (2 Marks)
  - Describe with an aid of a sketch the operation of gas injection system. (9 Marks)
  - Explain the safety features incorporated in the gas piping system (3 Marks)
  - What do you mean "aging" of LNG during transportation. (2 Marks)
05. With reference to Crankshaft deflection of a large two stroke engine:
- describes the method of obtaining crankshaft deflection readings, stating the purpose of the procedure; [10 Marks]
  - explains how the accuracy of the readings is ensured; [3 Marks]
  - state the reasons of obtaining readings away from manufacturers recommended values [3 Marks]
- 06.
- State, with reasons, the required properties of a crankcase oil; [6 Marks]
  - State, with reasons, a suitable mesh size for the crankcase lubricating oil filter elements; [2 Marks]
  - Describe how the defect is traced and the cause determined when white metal particles are found in the main lubricating oil filters [6 Marks]
- 07.
- State the common causes of scavenge fires [4 Marks]
  - List the indications that a scavenge fire is in progress [4 Marks]
  - State the conditions that may initiate a crankcase explosion [4 Marks]
  - Explain the condition to cause a secondary crankcase explosion. [4 Marks]
- 08.
- Describe, with the aid of sketches, a chocking and holding down arrangement for a main engine. [6 Marks]
  - Describe how the tightness of the holding down and chocking system is checked, explaining why the system must be always maintained in a tight condition. [6 Marks]
  - Explain why engine side and end braces are used, stating how they are checked. [4 Marks]
09. As Second Engineer, you have been requested to obtain a set of indicator cards from a large slow speed diesel engine of a recently acquired old vessel.
- Describe your initial checks and preparations (6 Marks)
  - State, in order of importance, the additional information required with the cards. (4 Marks)
  - State, in order of importance, the additional information required with the cards. (3 Marks)
  - State your procedure for analysis of the cards and obtaining cylinder powers. (3 Marks)