



**MERCHANT SHIPPING SECRETARIAT**  
**GOVERNMENT OF SRI LANKA**  
**CERTIFICATE OF COMPETENCY EXAMINATION**

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE (UNLIMITED)  
SUBJECT : Engine and control systems  
DATE : 29 Feb 2024

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Time allowed **THREE** hours Total marks : 96  
Answer **8 questions** including mandatory **question no 10** Pass marks : 50%

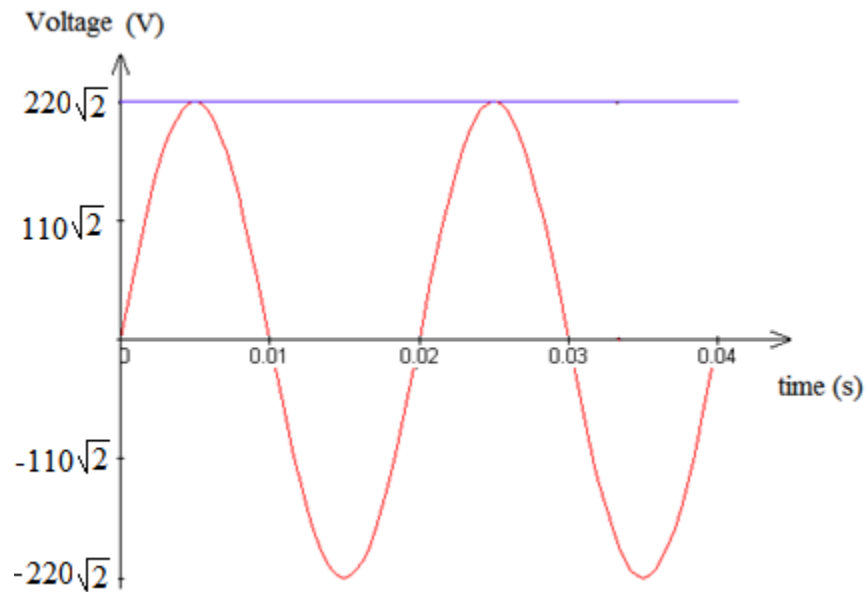
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Formulae and all intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches wherever required. Electronic devices capable of storing and retrieving are **NOT** allowed.

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1.
  - a) Sketch and describe the four-stroke timing diagram of a Diesel engine and explain the term of overlap (08 marks)
  - b) Explain the term of “Uniflow” scavenge and its advantages. (04 marks)
  
2.
  - a) Briefly explain the three boiler mountings and their importance. (06 marks)
  - b) Why it is necessary to clean /water wash Exhaust Gas Boiler tubes frequently? (02 marks)
  - c) Explain the reasons, why Boiler water to be treated. (04 marks)
  
3.
  - a) Explain the two types of Turbo charging systems in marine use. (04 marks)
  - b) What is Turbo charger Surging and how does it occur? (02 marks)
  - c) Briefly sketch and describe the Scavenging methods. (06 marks)
  
4.
  - a) Draw and explain a positive displacement pump. (06 marks)
  - b) What is the use of centrifugal pump onboard and its advantages? (03 marks)
  - c) What are the problems occurring in Ballast pumps during Ballast operation and how do you overcome the said faults? (03 marks)

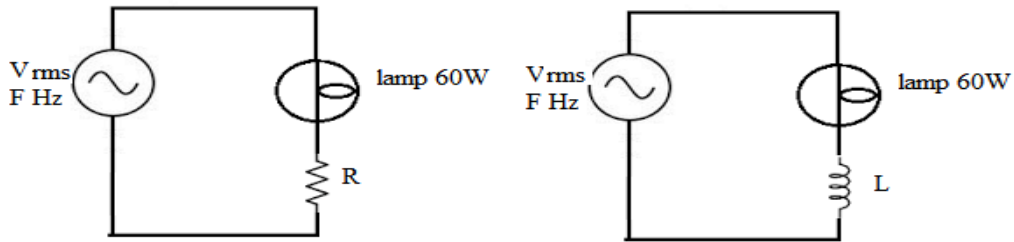
- 5.
- Sketch and describe the Refrigeration cycle. (08 marks)
  - Explain the purpose of Receiver, Drier, Solenoids and Control unit reference to the Ship's refrigeration plant. (04 marks)
- 6.
- What are the reasons to have a crank case explosion? (04 marks)
  - What are the actions to be taken when there is a crank case explosion? (04 marks)
  - What actions to be taken after a scavenge fire? (04 marks)
7. i) The graph below shows how a sinusoidal alternating voltage varies with time, when voltage source is connected across a device.



With the aid of above diagram determine

- $V_{rms}$ . (02 marks)
- Frequency (F) (02 marks)

ii) A 100V, 60W lamp is to be operated on above power supply.



Find the value of

- a) Non-inductive resistance (02 marks)
- b) Pure inductance in series with the lamp so that the lamp is not over run. (03 marks)
- c) Which would be preferable in above two methods? (03 marks)

8.

- a) Sketch and describe the main engine cooling water system and explain how cooling water inlet temperature control. (08 marks)
- b) Why cooling water treatment to be done? (01 mark)
- c) What are the main purposes of the system oil in the large 2 stroke engine? (03 marks)

9.

- a) Draw and explain the fresh water generator system (Evaporator). (08 marks)
- b) How to prepare potable water from evaporated fresh water? (04 marks)

10. Following card areas were obtained from power cards taken from a 5 cylinder slow speed diesel engine.

<b>Cyl number</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Area in mm<sup>2</sup></b>	<b>1530</b>	<b>1500</b>	<b>1590</b>	<b>1510</b>	<b>930</b>

Card length : 110 mm  
Diameter of the cylinder : 980 mm  
Piston stroke : 2100 mm  
Spring constant : 85 KN/m<sup>2</sup> per mm  
RPM : 120

- a) Calculate the total power (Indicated power) developed by the engine. (10 marks)
- b) What will be the consequences, if engine continue to operate in this condition? (02 marks)