



**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 : 07<sup>th</sup> April 2017

Time : 0900 to 1200 hrs

Time allowed **THREE** hours

Total marks : 96

Answer **8 questions** in total including mandatory **question no 10**

Pass marks : 50%

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.

1.
  - i. Sketch and describe the two strokes and four stroke timing diagram of a Diesel engine. (08 marks)
  - ii Explain the term “over lapping” with regard to timing diagram of 2S and 4S diesel engine. (02 marks)
  - iii Differentiate between SI engines and CI engines. (02 marks)
  
2.
  - i. What is the purpose of having boiler onboard? (02 marks)
  - ii. Sketch and describe the boiler water Circulating system diagram. (08 marks)  
Briefly explain how the boiler water level automatically control on the diagram you sketched.
  - iii. Explain the reasons, why Boiler water to be treated. (02 marks)
  
3.
  - i. Explain the term of Turbo charging with regard to diesel engines and its advantages. (04 marks)
  - ii. What is Turbo Charger surging and how it is occurred? (02 marks)
  - iii. Briefly sketch and describe the Scavenging methods of two stroke engines and explain what is the most efficient method and its advantage. (06 marks)
  
4.
  - i. Draw and explain a Fresh Water Generator system onboard. (06 marks)
  - ii. How do you make the generated fresh water drinkable? (03 marks)
  - iii. Explain the preparation, cleaning and inspection of Fresh water storage tanks onboard? (03 marks)

5.

- i. Sketch and describe the Engine cooling system onboard? (06 marks)
- ii. Why preheater is in the system? (02 marks)
- iii. Why it is necessary to make cooling water treatment onboard and explain the suitability of using Potassium Chromate as a treatment? (04 marks)

6.

- i. Briefly explain the Up-take fire onboard. (04 marks)
- ii. What are the actions to be taken when there is an Up-take fire? (04 marks)
- iii. What actions to be taken after a scavenge fire? (04 marks)

7. A 230 V, 50 Hz AC supply is applied to a coil of 0.06 H inductance and 2.5  $\Omega$  resistance connected in series with a 6.8  $\mu F$  capacitor.

- i. Draw phasor diagram for above R-L-C series circuit. (03 marks)
- ii. Calculate (05 marks)
  - a) Impedance
  - b) Current
  - c) power utilization.
- iii. Derive equation for voltage and current with phase angle and frequency. (04 marks)

8.

- i. Explain the system lubricant properties. (04 marks)
- ii. Explain the characteristics of lub oil and what is the Important and difference of TBN value concerning cylinder oil and system lub oil? (04 marks)
- iii. What is “hot spot” reference to crank case explosion? (01 marks)
- iv. What is the indication prior to crank case explosion and how do you prevent it?(03 marks)

9.

- i. Briefly explain the SEEMP and how you can improve SEEMP onboard as Chief mate, (07 marks)
- ii. How do you control SO<sub>x</sub> onboard? (02 marks)
- iii. Briefly explain the term of NO<sub>x</sub> level and how do you ensure diesel engines onboard are comply with NO<sub>x</sub> emission regulations? (03 marks)

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

(i)

<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>2020</b>	<b>2112</b>	<b>2003</b>	<b>2031</b>	<b>1260</b>

Card length : 100 mm  
Diameter of the cylinder : 1000 mm  
Piston stroke : 2200 mm  
Spring constant : 90 KN/m<sup>2</sup> per mm  
Engine RPM : 120 rpm

Calculate the total power (Indicated power) developed by the engine.

- (ii) What will be the consequences, if engine continue to operate in this condition? (02 marks)