



**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 : 07th July 2017

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 four-stroke timing diagram of the Diesel engine. (08 marks)
 - ii Explain the term of “Flash point and Auto ignition point of the fuel.” (02 Marks)
 - iii What are the differences between SI engines with CI engines. (02 marks)
2.
 - i. What is the meaning of Exhaust gas boiler onboard and what are the actions to be taken if exhaust gas high temperature alarm activated in the uptake. (04 marks)
 - ii. Sketch and describe the 3 boiler mountings. (06 marks)
 - iii. Explain the reasons, why Boiler water to be treated. (02 marks)
3.
 - i. Explain the working principle of Turbo charger on diesel engines and its advantages. (03 marks)
 - ii. What is an efficient Scavenging method of two stroke engines and its advantage? (03 marks)
 - iii. Briefly explain the following component of turbo Charger.
 - Turbine
 - Compressor
 - Nozzle ring (06 marks)

4.

- i. Draw and explain a Fresh Water Generator system onboard. (06 marks)
- ii. How do you use generated Fresh water to the boiler? (04 Marks)
- iii. Explain the preparation, cleaning and inspection of Fresh water storage tank onboard? (04 marks)

5.

- i. Sketch and describe the Engine lub oil system onboard? (06 marks)
- ii. What is the purpose of 3-way valve in the system? (02 marks)
- iii. What are the lub oil treatment methods onboard onboard and explain? (04 marks)

6.

- i. Briefly explain the Crank case explosion onboard? (04 marks)
- ii. What is the indication and action to be taken prior to crank case explosion. (04 marks)
- iii. What are the safety devices installed on the engine to reduce damage from Explosion? (04 marks)

7. A 240 V, 60 Hz a.c supply is applied to a coil of 0.08 H inductance and 2.8 Ω resistance connected in series with a 6.2 μF 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. Briefly explain the following characteristics of system lub oil? (04 marks)
 - Viscosity
 - Density
 - Detergency of Lub oil
- ii. Explain the TBN of 2 stroke Diesel Engine **cylinder oil**. (03 marks)
- iii. What is Scavenge fire in the Engine and indication prior to scavenge fire and how do you prevent it? (05 marks)

9.

- i. Briefly explain the SEEMP and how you can improve SEEMP onboard as Chief mate, (06 marks)
- ii. What are the present limitations of sulphur percentages (S%) of fuel use onboard. And explain what ECA is? (04 marks)
- iii. How do you ensure diesel engines onboard are complying with NOx emission regulation? (02 marks)

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

(i)

Cyl number	1	2	3	4	5
Area in mm²	1250	1890	1900	1905	1875

Card length : 110 mm
Diameter of the cylinder : 1000 mm
Piston stroke : 2200 mm
Spring constant : 90 KN/m² per mm
Engine RPM : 114 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)