



**DIRECTORATE OF MERCHANT SHIPPING
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 : 05th March 2021 Time : 0900 to 1200 hrs

Time allowed **THREE** hours Total marks : 100
Answer **8 questions** 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.

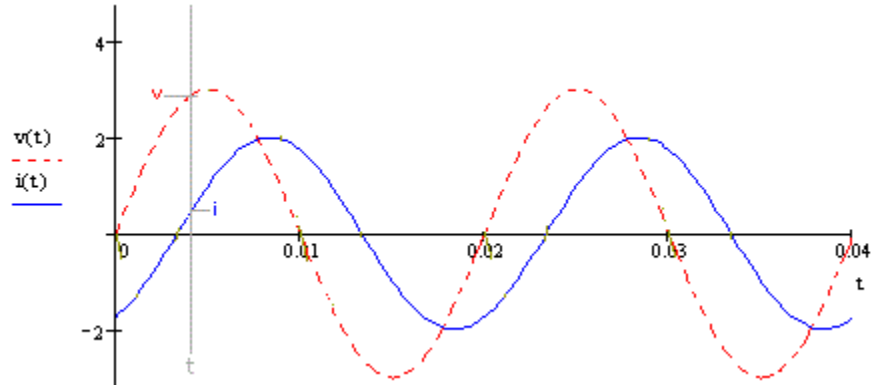
1.
 - a) With an aid of a flow chart express how conversion of energy in the fuel transform into a rotary motion of a rolling vehicle. (04 marks)
 - b) How engines are categorized according to their speed, working principle and design? (04 marks)
 - c) What are the advantage of slow speed engine when compare with medium speed engine? (04 marks)

2.
 - a) What is meant by specific fuel oil consumption? (03 marks)
 - b) How modern engines are designed to improve the out- put power without increasing size of the engine? (03 marks)
 - c) With a suitable sketch show how heat energy of the engine is shared by shaft power, lubricating oil, exhaust gas, jacket cooling water, air cooler and radiation. (06 marks)

3.
 - a) What are the important parameters which should be closely monitored and controlled when diesel engine is running? (06 marks)
 - b) With an aid of a sketch Explain jacket water cooling system of a diesel engine. (06 marks)

4. There are various mountings attached into the boiler for safe operation.
- (a) Briefly explain the purpose of following boiler mountings.
- i) Safety valves
 - ii) Gauge glass
 - iii) Vent valve
 - iv) Main steam stop valve
 - v) Scum down valve
 - vi) Drain valve
 - vii) Sampling valve (salinometer cock)
 - viii) Burner unit
- (01 mark each)
- (b) How corrosion is controlled in boilers.
- (04 marks)
- 5.
- a) Sketch and describe an oily water separator which can be used to pump out bilges in the engine room.
- (08 marks)
- b) State the limitation imposed on above system with regarding to “MARPOL”
- (04 marks)
6. For the maximum utilization of energy, minimizing wastages “SEEMP” has been introduced in marine industry.
- a) What is meant by “SEEMP”?
- (02 marks)
- b) Explain how to implement SEEMP on board ship?
- (06 marks)
- c) What are the methods and technologies used to reduce so_x Emission from marine engines?
- (04 marks)
- 7.
- a) State the important specification you should check when you buy an electrical equipment?
- (03 marks)
- b) Explain, why some motors start with STAR connection and subsequently change over to DELTA.
- (04 marks)
- c) List down the equipment powered by emergency generator.
- (05 marks)

8. The wave forms of alternating current $i(t) = 2 \sin\left(2\pi ft - \frac{\pi}{3}\right)$ and voltage $v(t) = 3 \sin(2\pi ft)$ are shown in following diagram.



Determine

- V_{rms}
- I_{rms}
- Power factor
- Power consumption

(03 marks each)

9.

- with a suitable diagram show how to categorize pumps in the engine room. (04 marks)
- Make a detailed sketch of a centrifugal pump naming all important parts and explain the function of each part. (08 marks)

(08 marks)

10. When taking indicator cards of a 6 Cylinder slow speed diesel engine, following information were obtained.

Cylinder No.	1	2	3	4	5	6	7
Area in cm ²	34	33	33	34	34	33.5	34

Card length : 10 cm
Diameter of the cylinder : 990 mm
Piston stroke : 1800 mm
Spring constant : 4.0×10^5 N/m² per cm
RPM : 90

(a) Calculate the power developed by each cylinder.

(14 marks)

(b) Total power developed by the engine

(02 marks)