



**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 : 28.04.2023

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Time allowed **THREE** hours Total marks : 100

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) What is the different between four-stroke and two- stroke diesel engines?  
(02 marks)
  - b) Briefly explain the functions of crankshaft and camshaft.  
(02 marks)
  - c) Sketch and describe four-stroke valve timing diagram of a Diesel engine.  
(06 marks)
  - d) Show the valve overlapping angle in above diagram.  
(02 marks)
  
2.
  - a) What are the main advantages of having turbochargers on modern diesel engines?  
(04 marks)
  - b) What is the purpose of auxiliary blowers installed in main engine scavenging system?  
(02 marks)
  - c) Briefly explain with suitable sketches different types of scavenging systems for large two stroke diesel Engines.  
(06 marks)
  
3.
  - a) With an aid of a sketch, show all the important boiler mountings installed in any type of marine boiler.  
(06 marks)
  - b) Briefly explain the functions of 4 important mountings among them.  
(04 marks)
  - c) How do we control the corrosion in the boiler?  
(02 marks)

- 4.
- a) Sketch and describe a fresh water generator widely used in marine industry. (08 marks)
  - b) What is the purpose of keeping this water in specific tanks? (02 marks)
  - c) How do you make this water into portable water? (02 marks)
- 5.
- a) What are the key features of Ship Energy Efficiency Management Plan? (04 marks)
  - b) How to implement SEEMP? (04 marks)
  - c) What are the methods and technologies used to reduce SO<sub>x</sub> Emissions from marine engines? (04 marks)
- 6.
- a) What are the functions of lubricating oil in diesel engines? (03 marks)
  - b) Make a detailed sketch of a lubricating oil system of a diesel engine showing all important components. (07 marks)
  - c) Explain how desired temperature is controlled in the system? (02 marks)
- 7.
- a) Draw and explain ship's AC power distribution system. (06 marks)
  - b) Sketch three types of DC motors. (03 marks)
  - c) State the characteristics of above motors. (03 marks)

- 8.
- With regards to steering system, name the main components which are included in the telemotor control system and their functions. (04 marks)
  - Name main alarms and indications on steering gear system. (04 marks)
  - What are the checks that should be carried out on steering system before leaving a port? (04 marks)
- 9.
- What is the meaning of a comfort zone with regards to air condition system? (02 marks)
  - Make a detailed sketch of a ref. cycle and explain the function of each component. (10 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
Area in mm <sup>2</sup>	3400	3300	3400	3050	3350	3400

Card length : 100 mm  
Diameter of the cylinder : 990 mm  
Piston stroke : 1800 mm  
Spring constant : 40 KN/m<sup>2</sup> per mm  
RPM : 90

- Calculate the power developed by each cylinder. (10 marks)
- Total power developed by the engine (02 marks)
- What will be the outcome, if engine continue to operate in this condition for an extended period? (04 marks)

Answers

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
Area in mm <sup>2</sup>	3400	3300	3400	3050	3350	3400

Card length : 100 mm  
 Diameter of the cylinder : 990 mm  
 Piston stroke : 1800 mm  
 Spring constant : 40 KN/m<sup>2</sup> per mm  
 RPM: 90

- (a) Calculate the power developed by each cylinder. (10 marks)
- (b) Total power developed by the engine ( 2 marks)
- (c) What will be the outcome, if engine continue to operate in this condition for an extended period? (04 marks)

a. Total area 3400 mm<sup>2</sup> Length = 100mm  
 Mean height =  $3400/100$  mm = 34mm  
 Mean indicated pressure =  $34 \times 40 = 1360$  KN/m<sup>2</sup>  
 Indicated power = PLAN =  $1360 \times 22/7 \times 495 \times 495 \times 1.5 \times 1.8 = 2827.7$  Kw  
 No.2 unit =  $33 \times 40 \times 22/7 \times 495 \times 495 \times 1.5 \times 1.8 = 2744.6$  Kw  
 No.3 unit = 2827.7  
 No.4 unit =  $30.5 \times 40 \times 22/7 \times 66156 = 2536.6$  Kw  
 No. 5 unit =  $33.5 \times 40 \times 22/7 \times 66156 = 2786.1$  Kw  
 Unit no.6 = 2827.7 Kw  
 Total power = 16550.4 Kw  
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(c) Engine is imbalance at this condition. Cylinder no. 4 has some problem and not developing maximum power. Long term running at this condition will be badly affected on running gear, turbocharger surging and vibration.