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 : 30th November 2018 Time : 0900 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) 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 SOx 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.

a) With regards to steering system, name the main components which are included in the telemotor control system and their functions.

(04 marks)

b) Name main alarms and indications on steering gear system.

(04 marks)

c) What are the checks that should be carried out on steering system before leaving a port?

(04 marks)

9.

a) What is the meaning of a comfort zone with regards to air condition system?

(02 marks)

b) 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 mm2	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^2 per mm
RPM : 90

(a) Calculate the power developed by each cylinder.

(10 marks)

(b) Total power developed by the engine

(02 marks)

(c) 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 mm2	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^2 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 mm2 Length = 100mm
Mean height = 3400/100 mm = 34mm
Mean indicated pressure = 34 X 40 = 1360 KN/m2
Indicated power = PLAN = 1360X 22/7X.495X.495X1.5X1.8 = 2827.7 Kw
No.2 unit = 33X40X22/7X.495X.495X1.5X1.8 = 2744.6 Kw
No.3 unit = 2827.7
No.4 unit = 30.5X40X22/7X.66156 = 2536.6 Kw
No. 5 unit = 33.5X40X22/7X.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.