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 : 25th February 2019 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) Sketch and describe two stroke and four stroke timing diagram of a diesel engine.
(08 marks)

(b) Briefly explain the term "Scavenging" with regard to diesel engine.
(04 marks)

2. (a) Briefly explain with suitable sketches different types of scavenging system for large two stroke diesel Engine.
(06 marks)

(b) List down the advantages of using Turbochargers on large two stroke marine diesel engine.
(06 marks)

3. (a) Draw and explain how fresh water is generated on board?
(08 marks)

(b) Explain the necessary treatment to be done before using fresh water as potable water.
(04 marks)

4. (a) Show all the important boiler mountings installed in large marine boiler.
(06 marks)

(b) Briefly explain the functions of 6 important mountings among them.
(06 marks)

5. (a) Explain with diagram(s) how sewage is treated on board before discharging to sea?
(08 marks)

(b) What are the important points to be considered, when you chose toilet cleaning agents onboard. (04 marks)

6. (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_x** Emission from marine engines?

(04 marks)

7. (a) Sketch and describe the refrigeration cycle.

(08 marks)

(b) Explain the purpose of condenser, Evaporator, TX valve and compressor.

(04marks)

8. (a) Explain, why some motors starts with STAR connection and subsequently change over to DELTA.

(04 marks)

(b) Sketch a diagram to show how a motor windings are connected to STAR and DELTA.

(08 marks)

9. (a) Name different types of steering system used in ship steering system.

(04 marks)

(b) Name main alarms and indication 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)

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

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

i. 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
ii.Total power = 16550.4 Kw
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(iii) 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.