



**MERCHANT SHIPPING SECRETARIAT  
GOVERNMENT OF SRI LANKA  
CERTIFICATE OF COMPETENCY EXAMINATION**

GRADE : OFFICER IN CHARGE OF A NAVIGATIONAL WATCH ON SHIPS OF 500  
GT OR MORE (UNLIMITED)

SUBJECT : ENGINEERING KNOWLEDGE

DATE : 11.12.2023

Time : 3 hrs

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Time allowed **THREE hours**

Total marks : 96

**ANSWER ANY SIX QUESTIONS**

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.

- (i) Explain the different between two stroke and four stroke cycle of a diesel engine. (08 marks)
- (ii) List down the four stroke of a diesel engine. (08 Marks)

2.

- (i) Explain the meaning of water tube and smoke tube boilers. (04 marks)
- (ii) Name three equipment powered by steam other than heating purpose. (06 marks)
- (iii) List most important boiler mountings (06 Marks)

3. Make short notes on following equipment.

- (i) Emergency generator (06marks)
- (ii) Incinerator (4marks)
- (iii) Emergency fire pump (06marks)

4.

- (i) Draw a basic lay out (using block diagram) of a ships electrical power distribution system (10 Marks)

(ii) What is the different between alternating current (AC) and direct current (DC) (04 Marks)

(iii) What is the meaning of frequency of an AC power supply? (02 Marks)

5.

(i) Make a detailed sketch of a lube oil system of a marine diesel engine. (10 marks)

(ii) Name three main functions of lubricating oil. (6 marks)

6.

(i) What are the basic requirement for steering system. (8 Marks)

(ii) List down the indication and alarms in the steering system. (08 Marks)

7.

(i) What is the deferent between centrifugal pump and positive displacement pump. (6marks)

(ii) What is meant by priming of a centrifugal pump? (4 marks)

(ii) How do you know when a centrifugal pump is experiencing early stage of cavitation (6 marks)

8. What are the main causes for the following problems in a main engine?

a. Scavenge fire

b. Uptake fire

c. Starting air-line explosion

d. Crank case explosion. (4 marks each)

9.

(i) Name the equipment available on board in order to meet the “MARPOL” requirements. (6 marks)

(ii) Make a detail sketch of a hydraulic winch operation mechanism. (10 marks)

## Answers

### *CERTIFICATE OF COMPETENCY EXAMINATION*

#### **ENGINEERING KNOWLEDGE - 2022**

1. (i) Explain the different between two stroke and four stroke cycle of a diesel engine. (08 marks)

For four stroke engine piston moves four stroke to complete one operating cycle. Two revolution of crankshaft.

Two stroke engine takes only two stroke (one revolution of crankshaft) to complete the cycle.

- (ii) List down the four stroke of a diesel engine. (08 Marks)

Suction, compression, power and exhaust stroke.

2. (i) Explain the meaning of water tube and smoke tube boilers. (04 marks)

Water tube boilers water flows inside the tube while hot gas pass outside the tube transferring heat. In smoke tube boilers smoke pass through the tube while tube stack surrounded by water.

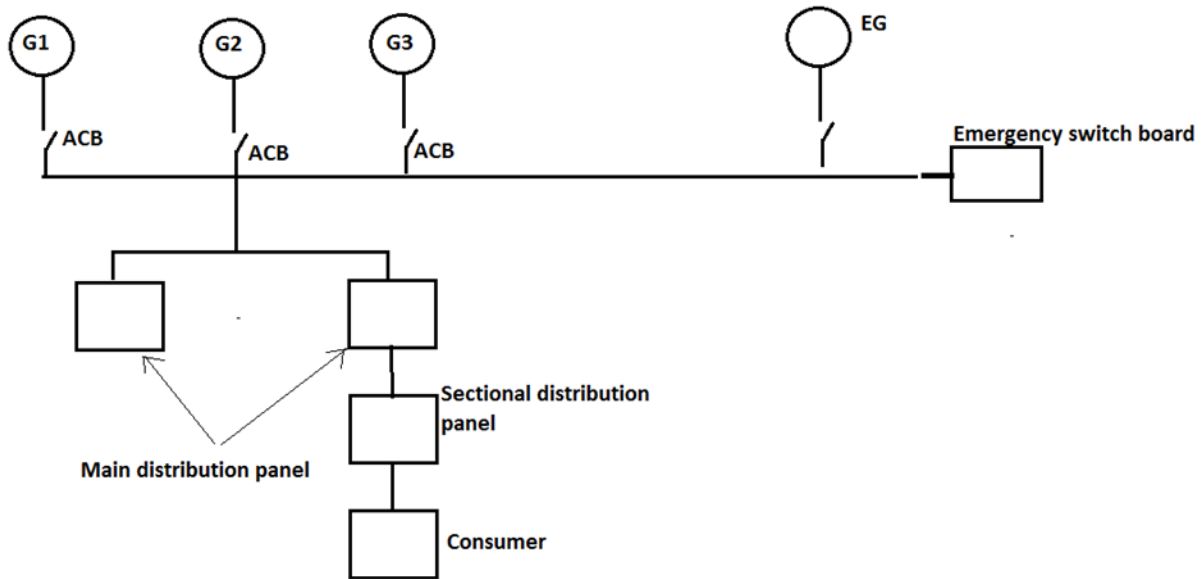
- (ii) Name three equipment powered by steam other than heating purpose. (06 marks)

Cargo pump, turbo generator and steam winches.

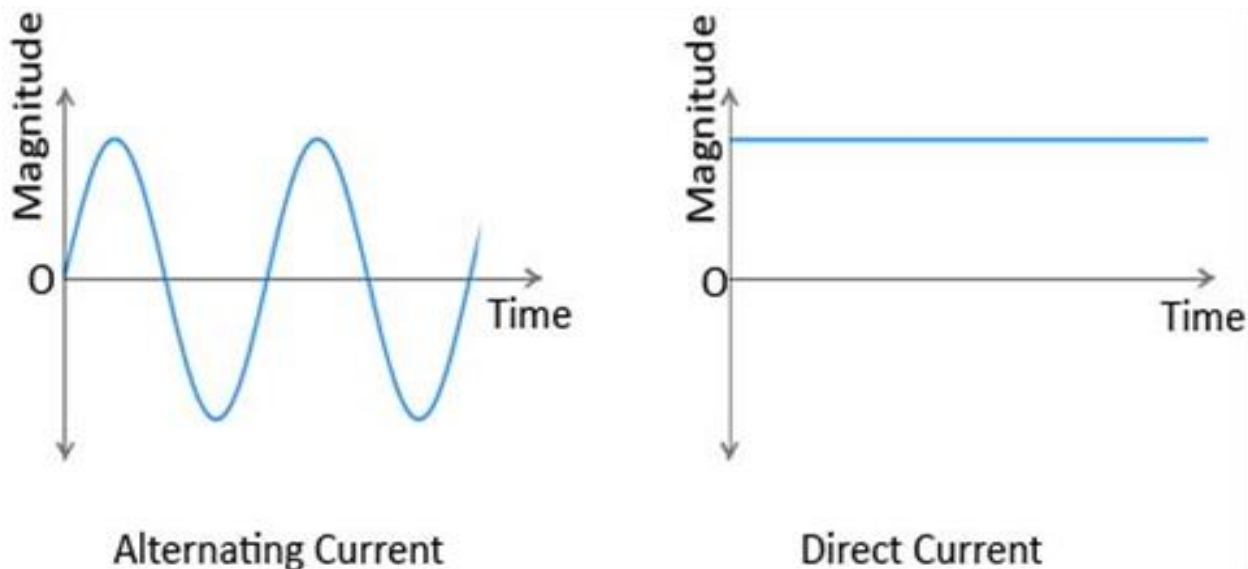
- (iii) List most important boiler mountings (06 Marks)

Safety valve, Main steam stop valve, vent valve, Gauge glass, Feed water inlet valve, Scum blow down valve.

3. (i) Draw a basic lay out (using block diagram)of a ships electrical power distribution system (10 Marks)



(ii) What is the different between alternating current (AC) and direct current (DC) (04 Marks)



(iii) What is the meaning of frequency of an AC power supply? (02 Marks)

How many cycles per second. (only in AC supply)

4. Make short notes on following equipment.

(i) Emergency generator

In case of main power failure there should be a mean of emergency power supply in order to tackle the emergency situation without any harm to crew, ship and environment. This can deliver limited essential supply. Navigation lights, steering, communication, Radar, main lube oil pump, emergency fire pump etc. Locate out side of the engine room.

(ii) Incinerator (4marks)

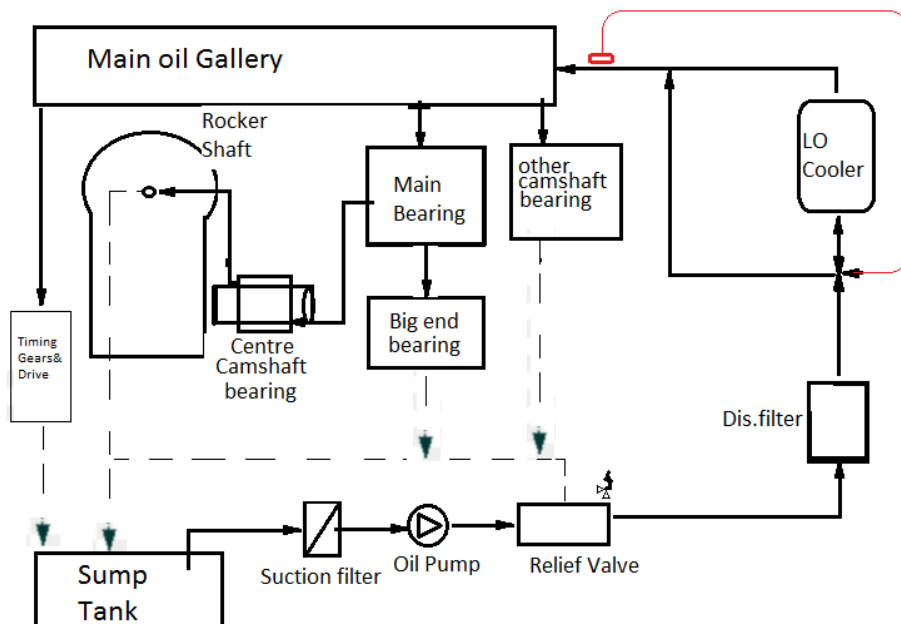
To dispose (burning) sludge generated by the purifiers incinerators are used.

(iii) Emergency fire pump (06marks)

This pump is fitted on board, outside the machinery space, and remote from the Engine room.

This is independent of the main power source. It supplies the ship's fire main, when the machinery space pumps are not available. This is also located outside of the engine room. If there is an engine room fire it is impossible to use engine room fire pump. This should be able to supply high pressure sea water jets to the highest point of the ship at lowest draught. If ship is not provided with emergency generator this should be engine driven. Suction valve should be kept at open position at all times.

5. (i) Make a detailed sketch of a lube oil system of a marine diesel engine. (10 marks)



(ii) Name three main functions of lubricating oil. (6 marks)

Lubricating (reduce friction), cleaning and cooling.

6. (i) What are the basic requirement for steering system. (8 Marks)

It should have power supply from Main as well as Emergency switch board.

It should be able to move the rudder rapidly to any position, in response to the order from the bridge and hold in the required position.

It should have ability to relieve abnormal stress and return the rudder to its required position.

It should be able to maintain the ship on course.

(ii) List down the indication and alarms in the steering system. (08 Marks)

a. In the wheel house audio visual alarms are provided, in case of

b. Steering gear status indication.

c. Fault alarms. (Low level alarm to be fitted to each hydraulic reservoir,

d. Rudder position indicator.

Single phasing alarm

e. Overload alarm (the pump motor doesn't trip the starter of the motor, but only activates the overload alarm .)

f. power failure (no voltage ) alarm

7. (i) What is the deferent between centrifugal pump and positive displacement pump. (6marks)

Centrifugal pump need to be primed at the starting of the pump before pumping the liquid. Discharge valve should be close at the start.

Positive displacement pump no need to prime. Good for heavy viscus oil.

(ii) What is meant by priming of a centrifugal pump? (4 marks)

Pump casing and impeller must be filled with the liquid being pumped and it should remain flooded with the medium being pumped during operation.

(iii) How do you know when a centrifugal pump is experiencing early stage of cavitation (6 marks)

Following signs can notice.

Visible pressure fluctuation on the pressure gauge

Pressure drop

Vibration

Noicy

8. What are the main causes for the following problems in a main engine?

a. Scavenge fire

Build up of oil deposits due to

Un burnt fuel, crankcase oil and cylinder lubricating oil.

Piston ring blow past.

Dirty scavenge space (poor maintenance)

Leaky stuffing box scraper rings

b. Uptake fire

Faulty injector

Faulty combustion

Extended running on low load

c. Starting air line explosion

Leaky air starting valve

Excessive oil accumulation in the air line due to over lubrication of compressor..

d. Crank case explosion. (3 marks each)

When there is hot spot formed example in bearing, connecting rod, guide, piston trunk, gear train become over heated.

Insufficient cooling.

Crankcase breather not functioning properly

9. (i) Name the equipment available on board in order to meet the “MARPOL” requirements. (6 marks)

Oily water separator, incinerator, sewage treatment plant.

(ii) Make a detail sketch of a hydraulic winch operation mechanism. (10 marks)

