



**DIRECTORATE OF MERCHANT SHIPPING
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 : OPERATIONAL SAFETY

DATE : 09th July 2024

Time allowed THREE hours

Total marks : 180

Answer all questions

Pass marks : 60%

Formulae and all intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches wherever required.

1) Briefly describe following:

- a) Gross tonnage
- b) Net tonnage
- c) Load density
- d) Stowage factor
- e) Proof load
- f) MSL (Maximum Securing Load)

(5 marks each)

2) Answer the following questions with regard to ISM Code;

- a) What are the objectives of ISM code and discuss how these are achieved in the following occasions;
 - i. On board a vessel
 - ii. At shore based management

(15 marks)

- b) Draw up an emergency muster list for an explosion inside an engine room. Explain the various duties you would entrust on the individuals for facing the eventualities.

(15 marks)

3) Answer the following questions with respect to MARPOL 73/78, subsequent protocols and amendments;

- a) What are the certificates to be carried on board a trading vessel to confirm compliance?

(06 marks)
- b) What equipment is fitted on board to comply with each one of the potentially polluting activities under each category?

(12 marks)

- c) What are the records to be maintained for each activity including non-machinery operated disposal of pollutants?
(12 marks)
- 4) Answer the following questions with regard to watchkeeping & cargo operations;
- a) Explain in detail how you perform a safe cargo watch on a “General Cargo vessel”.
(20 marks)
- b) Explain in general procedure of checking cargo holds and cargo gear after completion of discharging bulk cargo.
(10 marks)
- 5) Answer the following questions with regards to carriage of bulk cargoes:
- a) Write a brief description of International Grain Code.
(15 marks)
- b) What are the minimum stability criteria for a vessel to set sail with a load of bulk grain
(15 marks)
- 6) Answer the following questions with reference to FFA onboard:
- a) Briefly explain with suitable sketches basic Fire Main system (Water) used onboard ships.
(10 marks)
- b) Briefly explain advantages and disadvantages of a CO₂ system as fire controlling medium.
(10 marks)
- c) With regards to fixed CO₂ system briefly explain what are the periodical shipboard maintenance and inspections that you will carry out to check proper functioning of the system.
(10 marks)

Answers

Answers 1

Gross tonnage

Tonnage calculated as per tonnage convention in 1969 considering all spaces within the hull + all enclosed spaces above the hull with certain exemptions as defined in the regulations and calculated as specified. In other words it is the total cubic capacity of the vessel

Net tonnage

Useful tonnage calculated as per tonnage convention in 1969 and calculated as specified. That is the gross tonnage less those spaces such as engine room and crew accommodation that cannot be used for commercial that is revenue earning purpose. In other words it is the earning capacity of the vessel.

Load density

Is the maximum weight that can be safely loaded on a unit area. Load density is measured in tones per square meter.

Stowage factor – Is the volume occupied by unit weight of cargo. Usually expressed as cubic meters per tonne. It does not take into account any space which may be lost due to broken stowage.

Proof load is the load which applies to test the equipment without breaking or destructing the equipment to certify that it can bare SWL in normal operation. The proof load depends on the component and its size.

Maximum Securing Load (MSL)

is a term used to define the allowable load capacity for a device used to secure cargo to a ship. “Safe Working Load” (SWL) may be substituted for MSL for securing purposes, provided this is equal to or exceeds the strength defined by MSL.

Answer 2

a) Objective of ISM code on board and how it is achieved:

The objective of the ISM code on board is to ensure that the vessels are operated safely to prevent human injuries, damage to properties and to protect marine environment from pollution by ships.

It is being achieved as follows:

- 1) The company studies the best practice and prepares a safety management system for the company and their vessels.
- 2) The system is documented and sends on board for the implementation on board by the crew under the supervision of Master.

- 3) For the implementation master conducts safety committee meeting every month to find out deficiencies on safety matters and to bring proposals to minimize any known safety related issues. For this purpose a check list system is maintained for every important activity and the drills are carried out regularly as per the SMS and using the particular check list.
- 4) Whenever incident, accident or injury occurs, future preventive actions and root cause analysis are being done and same is reported to the company
- 5) Sufficient spares are maintained for every important equipment and ensure no safety related deficiencies during PSC inspection

The objective of the ISM code and how it is achieved by shore based management. The objective is to ensure that the company and the vessels are operated as per the requirements of International Safety Management system to prevent accidents, injuries and environmental pollution

It is being achieved as follows:

- 1) As described by ISM code, the company prepares a Safety Management System for all vessels under their management. The documents are maintained to prove that the company is capable to maintain a safety management policy. The company is being audited by an approved quality assurance organization.
- 2) If the audits prove that the company complies with the contents of ISM, company is issued a Document of Compliance (DOC)
- 3) Then the company must ensure their vessels are being run to comply with ISM code and the safety management Policy of the company. For this purpose a DPA is appointed to monitor the activities and ensure safety management of the vessels. They are responsible to appoint a company to audit the vessels and obtain ISMC for the vessel.
- 4) Further company must obtain reports of incidents, accidents and non-conformities from the vessel and ensure that the remedial action is taken to minimize repetition

- b) Draw up a usual IMO approved muster list

Answers 3

Answers 3

- a) Certificates to be carried:

As per Marpol annex 1	-	IOPP certificate
As per Marpol annex 2 noxious liquid substance	-	Noxious liquid substance certificate if carrying
As per Marpol annex 3	-	DOC to carry IMDG cargo in package form
As per Marpol annex 4	-	ISPP certificate

- As per Marpol annex 5 - Garbage record book + Certificates of garbage disposal
- As per Marpol annex 6 - IAPP certificate

b) Equipment required:

As per Marpol annex 1 all cargo vessels of above 150 GT and tankers of above 400 GT shall be fitted with oily water separator with ODM

As per Marpol annex 2 - No equipment other than cooling plant and gas pressure gages

As per Marpol annex 3 - Safety equipments as specified by attachment to DOC

As per Marpol annex 4 - Vessels shall have any of the following: Sewage retention tank or Sewage treatment plant

As per Marpol annex 5 - Shall have proper garbage storage facility and or incinerator

As per Marpol annex 6 - Shall be fitted with equipments to restrict or arrest SO_x and NO_x

c) Records to be maintained:

As per annex 1 vessel shall maintain an approved type of oil record book and all activities pertaining to oil shall be entered therein.

The part 1 shall be maintained by Chief Officer of a tanker and enter all activities like loading, discharging, transferring and discharging of tank washings.

Part 2 to be maintained by Chief Engineer and shall enter all about bunker oil loading, transferring and discharge of machinery space bilges and sludge tank.

As per annex 2: Maintained all activity records

As per annex 3: Vessel shall maintain an updated record of IMDG cargo at all times.

As per annex 4: Maintained all activity records

As per annex 5: All activities including disposal and records

As per annex 6: A record of fuel oil, diesel oil and emission

Answer 4

Answer 4 (a):

Explanation of port watch keeping.

Answer 4 (b):

Explanation of post cargo operation checks.

Answer – 5(a)

- International Grain Code is a code published by IMO as per SOLAS requirement
- This booklet shall be carried by all vessels engaged in carrying grain in bulk irrespective of their size of the vessel.
- The booklet provides information and carrying requirement of grain on purposely built vessels as well as non-purpose built vessels.
- The booklet provides securing methods of grain on filled compartment and partly filled compartment.
- The main objective of the booklet is to ensure safety of the vessel in case of shift of grain and to prevent excessive heel due to shift of grain. For this purpose calculation procedures are provided with maximum permissible grain heeling moment
- The booklet provides VHM for each filled and partly filled compartment

Answer – 5(b)

- 1) The angle of heel, due to the shift of grain shall not be greater than 12 degrees or the angle at which the deck edge is immersed, whichever is lesser.
- 2) In the stability diagram, the net or residual area between the heeling arm curve and the righting arm curve as specified by the regulation shall be not less than 0.075 meter radians at all conditions of loading.
- 3) The initial meta-centric height, after correcting for the free surface effects of liquids in tanks, shall be not less than 0.30m.
- 4) Vessel shall be upright before sailing

Answer – 5(c)

Iron ore is non-edible cargo and grain is edible cargo. Therefore, extra precautions are required when loading grain cargo.

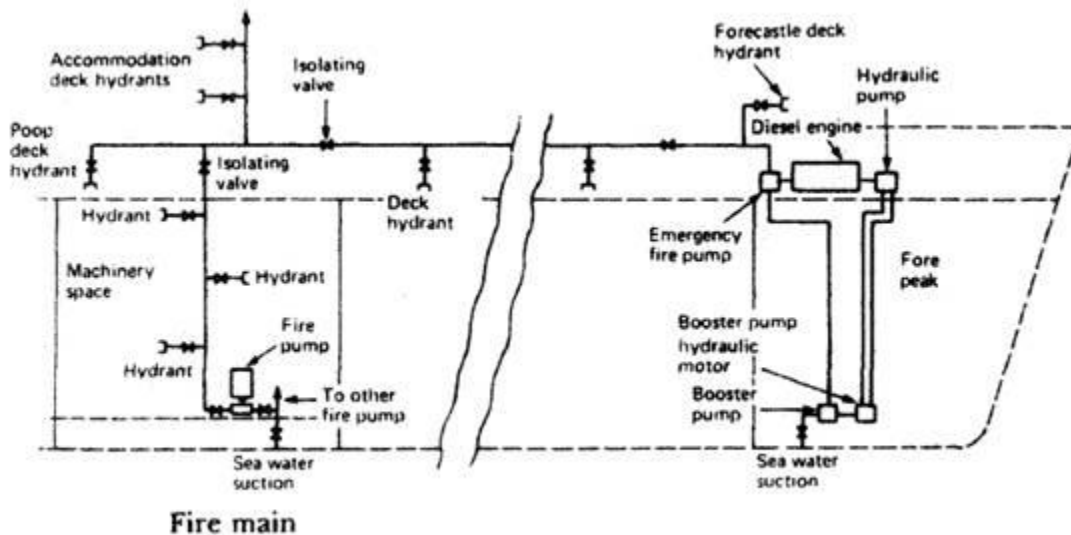
Hatches and access should be thoroughly clean in every area to remove all old cargo residues.

Bilges should be clean and empty. Ensure no any damage to structure. The structure is free of any loose rust. After thorough cleaning and washing holds should be dried. Bilges should be checked for suction and activation of non-return valve.

Ensure holds are free of any insects and if required fumigate. Hatches should to be checked for weather tightness.

All electrical wiring should be fully insulated and safe. Check that CO2 system is working and in order. Check the stability of vessel with full load of cargo using a pre-planned cargo system. If all in order inform agent to send surveyor for hold inspection.

Answer 6(a)



- A sea water supply system to fire hydrants is fitted to every ship.
- Mainly uses the fire pump and emergency fire pump but general service pump can be coupled to the fire line.
- An emergency fire pump will also be located remote from the machinery space and with independent means of power.
- A system of hydrant outlets, each with an isolating valve, is located around the ship.
- These nozzles are usually of the jet/spray type providing either type of discharge as required.
- Sea water is being used as a cooling agent in fighting Class A fires.
- An international shore connection is always carried on board ship.

Answer – 6(b)

Advantages

- It is a non corrosive gas.
- It is available everywhere
- It does not conduct electricity.
- It does not leaves any kind of residue.

- It is non-flammable.

Disadvantages

- toxic gas at high concentration
- does not last for a long time.

Answer 6(c)

- Regularly blowing of pipes
- The level in the Co2 bottles
- weight check of CO2
- Sensors
- Cabinet door alarms
- All pipings, cables and connections
- When checking cables and pulleys for correct function make sure to disconnect at the bottle valve to prevent accidental release of CO2