



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

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE (UNLIMITED)
SUBJECT : SHIPBOARD OPERATIONS
DATE : 26.06.2024

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. Electronic devices capable of storing and retrieving are **not** allowed.

- 1) With regard to cargo stowage and securing answer the following questions:
 - a) Now it is becoming very common practice to prepare stowage plans by shore personnel. Mis-declaration of cargo according to given stowage plan may leads to various legal issues and causes delays to vessels turnaround time. Explain in detail what are the other documents available onboard a cargo vessel to check the accuracy of current stowage plan and explain in detail procedure you will adapt to check the accuracy of current stowageplan?

(15 marks)
 - b) In order to make vessel cargo worthy proper stowage and securing of cargoes are prime consideration of vessels staff. In relation to securing of cargo what are the factors that you will consider prior deciding the lashing and securing arrangement for a cargo unit.

(15 marks)
- 2) Answer the following questions with reference to containerships:
 - a) A fully cellular type of container ship is particularly subject to torsional stresses. Explain the design arrangements to overcome these stresses.

(15 marks)
 - b) Large container vessels are specially subjected to dangerous parametric rolling. Explain in detail what is parametric rolling and how it should be minimized by a Master.

(15 marks)
- 3) Write short notes on following specifying the objectives and requirements
 - a) Polar code
 - b) Enhanced survey program
 - c) Ballast water Convention
 - d) Planned maintenance system
 - e) Shipboard Energy Efficiency Management Plan (06 marks each)

- 4) Answer following questions with regard to reefer cargo:
- a) Cargo related information supplied by the shipper is very essential in reefer trade for proper stowage, carriage and discharging of reefer cargo. Enumerate and describe information required to be supplied by the shipper in relation to cargo carried by an ordinary reefer vessel.
(15 marks)
 - b) New generation reefer vessels are fitted with controlled atmosphere (CA) type refrigeration plans. Explain how does the extended cargo preservation achieved by CA system compared to ordinary refrigeration system.
(10 marks)
 - c) During the carriage of cargo, preservation of cargo is achieved by various means. Temperature control is one of the main methods used to preserve certain cargoes. Explain with suitable examples main reasons for temperature control.
(05 marks)
- 5) Answer the following questions with regard to seaworthiness of a vessel:
- a) International Load line convention has specified the requirements during assignment of freeboard to a vessel. What are the criterions taken into consideration for the application of the deductions? (Explain at least five of the deductions)
(20 marks)
 - b) For the purpose of compliance with the provisions of International Instruments applicable for a particular ship, the flag State and the recognized organization are maintaining special relationship with each other. Explain the above statement.
(10 marks)
- 6) With reference to tanker operations,
- a) Explain how a buildup of static electricity can occur during a discharging operation of crude oil.
(10 marks)
 - b) What measures and precautions are adopted to prevent and eliminate such a build up causing accidents?
(10 marks)
 - c) Explain the main features of a shipboard oil pollution emergency plan.
(10 marks)

Model Answer no. 1

A Follow following guide lines.

- 1 Check that draft restrictions do not exceed by considering load line regulation
- 2 Ensure that the vessel does not exceed draft restrictions in any port using port guides.
- 3 Make sure the vessel remains afloat at all time by checking largest scale charts of each and every port.
- 4 Check that the load density does not exceed on tank tops, hatch covers and on deck using onboard drawings and plans
- 5 Check that entire amount of cargo can be loaded volume wise using capacity plan
- 6 In case of reefer cargo ensure sufficient reefer plugs are available using plug plan
- 7 In case of IMDG packages, ensure to comply with DOC and attachments.
- 8 Make sure Charter party allows to load IMDG cargo by referring to Charter party terms
- 9 Ensure crane derrick facilities are available for loading as well as discharging by referring to cargo gears
- 10 With the given plan ensure the vessel remain even keel or with a required stern trim or even keel.
- 11 With the given plan ensure the stresses in any place do not exceed safe limit by referring to Loadicator.
- 12 In case of deck cargo ensure sufficient lashing points are available by referring to GA plan.
- 13 Ensure port wise segregation has been marked in the cargo plan
- 14 Ensure the first discharging port cargo is loaded finally and last discharging port cargo is in the bottom.
- 15 Finally make sure vessel has sufficient positive stability after following the loading plan.

Model Answer 1b

- 1 Ensure that the CSS code is available onboard and refer to it.
- 2 **Read** cargo securing manual and follow it.
- 3 Follow Company SMS on cargo securing
- 4 Ensure sufficient lashing gears are available
- 5 **Before** lashing check that the load has been distributed using required dunnage.
- 6 Calculate required lashing forces under worst weather conditions
- 7 Check that the sufficient lashing points are available
- 8 After calculating make a lashing plan and give it to the responsible crew.
- 9 After carrying out lashing for vertical, horizontal and athwart ship forces make sure the lashings are properly tight.
- 10 Ensure no excessive tightness on lashings
- 11 Ensure to check lashing frequently as required
- 12 Make sure to enter all details in the log book

Model answer no.2

Torsional stress:

A) An effect on the structure which has the tendency to deform its structure. The torsional stress is due to bending moments and sheering forces caused by uneven distribution of weights associated with wave action at sea.

Torsional stress on fully cellular container vessels;

Although every vessel has some amount of torsional stress, a fully cellular container vessel has much more pronounced torsional stress due to following three reasons;

1. Large hatch openings on deck
2. Uneven distribution of weights on the vessel due to inherent nature of container carriage.
3. Relatively high speed of the vessel and therefore wave action is more pronounced.
4. These vessels do not have own gear.

Measures taken to minimize torsional stresses on fully cellular container vessels;

1. **Garboard** strake, Sheer strake and Bilge strake has been made stronger than any other vessels and constructed by using high tensile steel.
2. **Longitudinal girders** are provided near the side plating
3. **Torsional boxes** are fitted by using double plate system at the end of a hatchway on both side of the vessel near the hull plating on sheer strake to absorb much of the distortional stresses.
4. **Double bottom** plating has been made stronger by using solid floors with close scantlings.
5. **Since** deck longitudinal cannot be fixed, additional longitudinal girders are provided to bottom plating.
6. **Scantlings** on sheer strake has been increased.
7. **Wing tanks are provided** when and where possible.

d) Usually, a vessel rolls when sea is on the beam or bow. It pitches when the sea is ahead, stern or on the bow. When the sea is on or near the bow, head or stern pitching and rolling could occur almost simultaneously. This **combination of rolling and pitching is called parametric rolling**. Although every vessel may encounter parametric rolling the effect is very conspicuous on high-speed vessels with more flared bow and stream lined hull just like on large container vessels. Therefore, parametric rolling with larger roll angle quickly generates in n or near

head/stern sea conditions. Usually, the period of parametric rolling is about half the natural rolling period. It occurs in phase with large pitch angle. There are two pitch cycles for each roll cycle. The maximum roll always occurs when the pitch is down. Unexpectedly, the roll angle can increase from a few degrees to over 30 degrees in only a few cycles.

f) Cargo Securing Manual

Model answer Q no. 3

- ❖ a) **Polar code:** The International Maritime Organization (IMO) has adopted the International Code for Ships Operating in Polar Waters (Polar Code), and related amendments to the International Convention for the Safety of Life at Sea (SOLAS) to make it mandatory and to protect ships and people aboard them, both seafarers and passengers, in the harsh environment of the waters surrounding the two poles.
- ❖ The Polar Code and SOLAS amendments were adopted by IMO's Maritime Safety Committee (MSC), during their session from 17 to 21 November 2014.
- ❖ The Polar code covers, full range of design, construction, equipment, operational, training, search, rescue and environmental protection matters relevant to ships operating in waters surrounding the two poles' ships.
- ❖ All ships trading in the Polar Regions already have to comply with all relevant international standards adopted by IMO.
- ❖ The newly adopted SOLAS chapter XIV adds additional requirements on Safety measures for ships operating in polar waters by making Polar Code mandatory.

b) **Enhance survey program (AS per ESP code)**

Implemented using SOLAS XII

The way ships are maintained has changed since last decade or two. Rarely will it happen that a seafarer completes his contract without the ship going through any survey or inspection. It is now surveys and inspections all the way. We have one or more surveys and inspections to cover each element of the ship. For example, surveys for safety equipment certificate ensures that ship's safety equipment are maintained in the way these should be. Safety construction, load line

certificate surveys deal with the construction part of the ship. The Enhanced survey program is applicable for bulk carriers and oil tankers only. In 1993, IACS introduced Enhanced survey program for more close-up inspections of these ships.

C) Ballast water convention:

A convention adopted by IMO on 13th February 2004. The convention came into force 12 months after ratification by 30 member states representing 35% of world merchant shipping tonnage. Required conditions met on 8th September 2016 & Convention was enforced on 8th September 2017

The purpose of this convention is to prevent, minimize and ultimately eliminate the transfer of harmful aquatic organisms and pathogens through the control and management of ship's ballast water and sediments. Parties to this convention are allowed or given right to enforce more stringent measures if required. When repairs to ballast tanks or cleaning facilities are provided parties to this convention should ensure to provide facilities for the reception of sediments in their ports. Under this convention ships are required to be surveyed and issue a ballast water management certificate. Ships can be inspected by PSC to ensure that they comply with the ballast water management requirements. The PSC can inspect the ballast water record book and carry out test on ballast water samples before allowing discharge of ballast water.

But PSC shall avoid unduly delaying or detaining ships.

To comply with the requirements;

The ships shall implement a **ballast water management plan** approved by the administration.

Ships must have a **ballast water record book** to record when ballast water is taken on board, circulated or treated for ballast water management purposes and discharged into sea or reception facility. The ballast water management plan shall and comply with the required ballast water **exchange standard** or ballast water **performance standard**.

All ships when using **ballast water exchange** shall conduct exchange at least 200 nautical miles from the nearest land and in water at least 200 meters in depth. When the ship is unable to conduct ballast water exchange as above then carry out exchange as far as possible from the nearest land but the distance shall not be less than 50 nautical miles and the depth not less than 200 meters. To comply with ballast water exchange standard, ships shall exchange 95% volumetric exchange. If, the ships comply, with pumping through method, pumping through shall be carried out to three times the volume of each tank.

When complying with **ballast water performance standard**- Ships shall discharge less than 10 viable organisms per cubic meter greater than or equal to 50 micrometers in dimension. Or 10 viable organisms per milliliter less than 50 micrometers in dimension

D Planned maintenance system:

1. The PMS - Planned Maintenance System is a paper/software-based system which allows ship owners or operators to carry out maintenance in intervals according to manufacturers and class/Classification society requirements.
2. The maintenance, primarily supervised by the on-board personnel, is then credited towards inspections required by periodic surveys.
3. The planning and scheduling of the maintenance, as well as its documentation, must be made according to a system that is approved by classification societies like American Bureau of Shipping, Germanischer Lloyd, Lloyd's Register, Bureau Veritas or Det Norske Veritas, etc.
4. All these classification societies are members of IACS (International Association Of Classification Societies Ltd).

Having a planned maintenance system on ships is now mandatory as per ISM (International Safety Management Code)

e) **Ship board Energy Efficiency Management Plan**

The SEEMP establishes a mechanism for a shipping company and/or a ship to improve the energy efficiency of ship operations. The SEEMP provides an approach for monitoring ship and fleet efficiency performance over time using, for example, the Energy Efficiency Operational Indicator (EEOI) as a monitoring and/or benchmark tool. The SEEMP urges the ship owner and operator at each stage of the operation of the ship to review and consider operational practices and technology upgrades to optimize the energy efficiency performance of a ship

Answer Q 4

- 1 Type of cargo, Loading and packing method.
- 2 Loading temperature
- 3 Carriage temperature
- 4 stowage factors
- 5 Total weight and number of packages.
- 6 Required hatch inspection
- 7 Temperature of the cargo hold before commenced loading operation
- 8 Hatch inspection certificate
- 9 Any special carriage instructions
- 10 Relative humidity required during the carriage
- 11 Reporting requirement

B Controlled Atmosphere (CA) in Transportation

Perishable cargoes are carried under refrigerated conditions because lowering the temperature at which they are held extends their storage life. The term “refrigerated cargo” includes both frozen and chilled cargo but only the latter may additionally benefit from controlled atmosphere or modified atmosphere carriage applications.

Under temperature-controlled atmosphere cargo is chilled so as to control the ripening process. Controlled Atmosphere / Modified Atmosphere (CA / MA) is a system which change the ratio of these gases and control the atmosphere around a refrigerated cargo to further extend its storage life beyond that which can be achieved by refrigeration alone.

Additional information required if controlled atmosphere (CA) shipments

- Levels (ranges) for O₂, CO₂, humidity, ethylene.
- Permitted time to reach specified levels.
- Procedure in event of CA system failure.
- Safety requirements.
- Discharge atmosphere requirements. **(10 marks)**

C

Reasons for Temperature Control

- Prevention of damage by microorganisms
- Prevention of changes in the cargo
- Gas evolution (O₂, CO₂, humidity, ethylene) **(05 marks)**

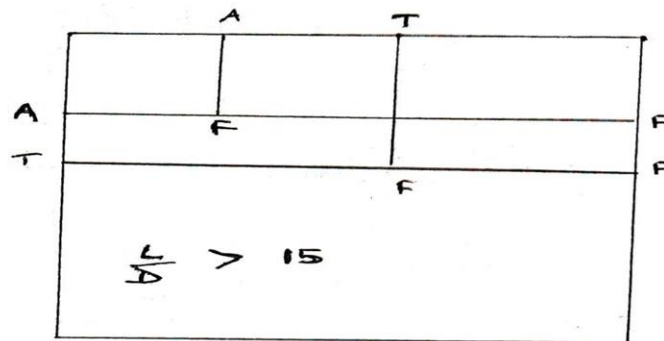
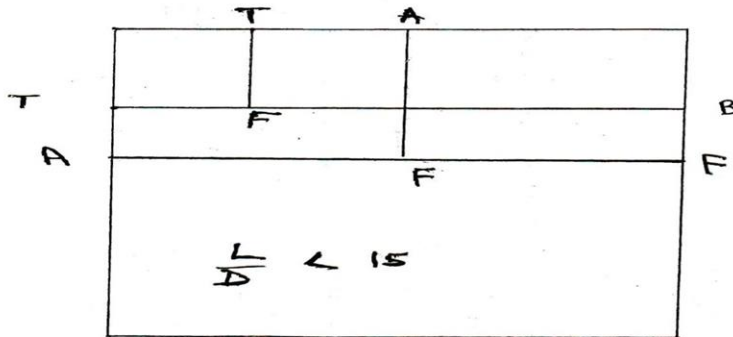
Model Answer: Question 5

5a **The freeboard corrections that should be made to standard freeboard;**

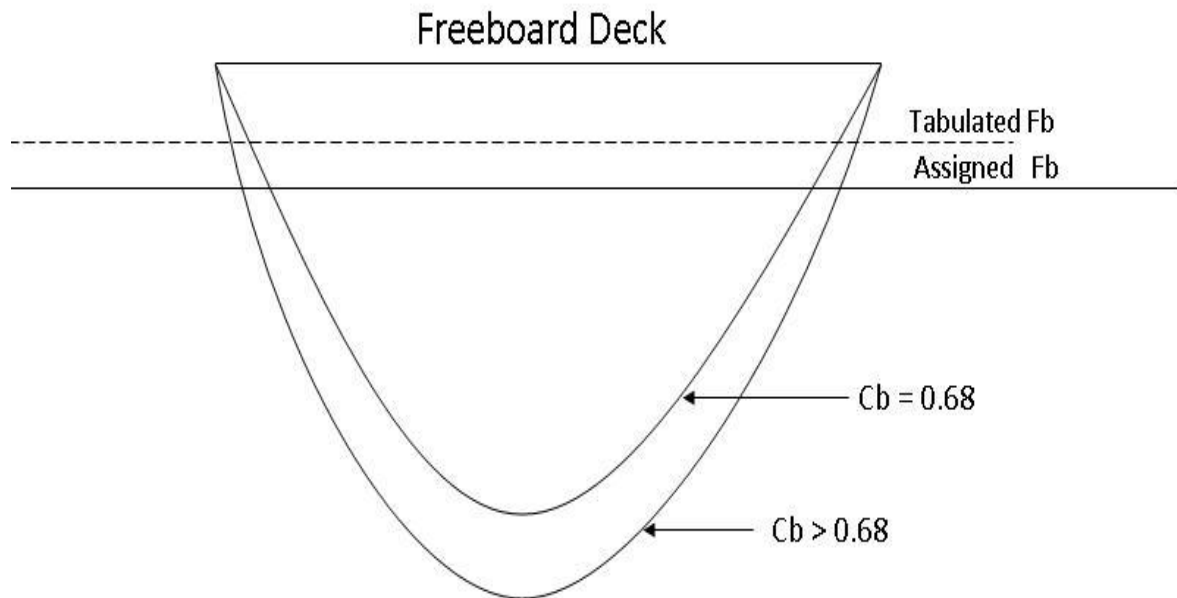
- a) **The length to depth ratio;** the standard ratio for the tabulated freeboard is 15. If L/D is less than 15, the given tabulated freeboard in the LL regulation is increased. If L/D is more than 15, freeboard is reduced provided the vessel has superstructures complying with the regulations. Otherwise, no reduction is given.

The freeboard correction is given in mm by the following formula.

Correction L/D = $(D-L/15) \times L/0.48$ where D and L in meters.



- b) **The block coefficient:** The standard block coefficient is 0.68. If, block coefficient is more than 0.68 the assigned freeboard must be increased. So that to ensure vessel has additional reserve buoyancy.
 If block coefficient is less than 0.68 no reduction is given. Because less C_b vessels are high speed vessels and too small freeboard can result in shipping undue quantities of heavy water in bad weather.

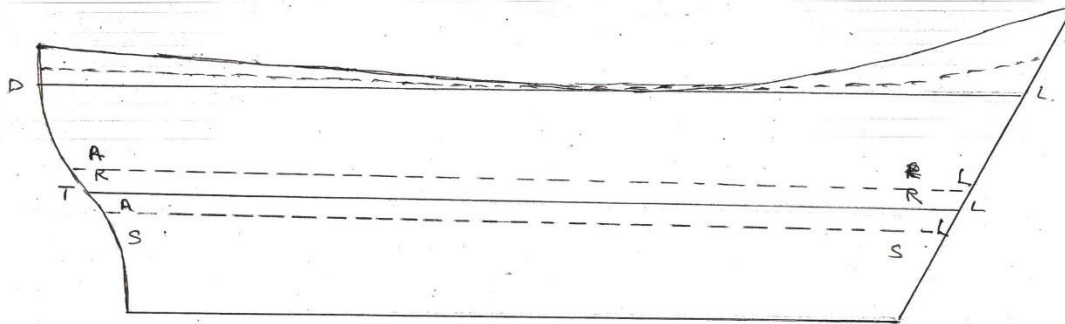


c) **A parabolic sheer curve on the freeboard deck;** the standard ship has a parabolic sheer curve attaining a specific height at each end of the ship.

This height is 25mm at the aft perpendicular and 50mm at the forward perpendicular.

Due to the sheer v/l is provided with, an additional reserve buoyancy. It also minimizes the amount of water shipped on deck. Therefore, if the sheer is excess freeboard can be **decreased**.

If, the sheer is in deficiency, freeboard is **increased**. Sheer correction calculation methods are given in regulation 38.



d) Superstructure correction: Calculations of tabular freeboard have been made on the basis that the vessel does not have a superstructure. If the superstructure is enclosed and built as per load line requirements that superstructure provides additional reserve buoyancy. Therefore a reduction in freeboard can be given to such vessel.

The standard height of the superstructure is determined according to the length of the vessel.

If the length is 75 meters or less standard height is 1.8 meters. If the length is 125 meters or more standard height is 2.3 meters.

In the tables - freeboard reduction is given as follows.

For length of 24 meters, reduction is 350 mm.

For length of 85 meters, reduction is 860 mm.

For length of 122 meters or more 1071 mm

e) Bow height: The bow height is defined as the vertical distance at the forward perpendicular between the waterline and the exposed deck at side.

When the length is less than 250 meters the bow height should be not less than $56 L (1 - L/500) \times 1.36 / (Cb + 0.68)$ in millimeters.

When the length is above 250 meters the bow height should be not less than 7000 $(1.36 / (Cb + 0.68))$ in millimeters.

Bow height should be computed as follows:

Take tabular freeboard as	= X
Correction L/D	= + or – ve
Cb correction	= + ve
Sheer correction	= + or –ve
Superstructure correction	= -ve
Total value after correction	= Y

Compare Y, freeboard value with minimum required bow height. If Y is lesser

5b Model Answer:

Class cannot work alone on the other hand flag state find it difficult to work alone

(Explain the responsibility and authority of the flag state. Explain the ability, experience and availability of class societies in almost every port. Mention class society has to be appointed by the ship owner by the approval of flag state. It should be one of the IACS member))

Answer Q 6

a) Due to physical contact and separation of dissimilar materials static electricity could occur.

During discharging of oil it can occur due to

- 1 Discharging oil passing through pipe lines.
- 2 Ejection of gas or liquid through pipe lines.
- 3 Use of jet/spray mode during crude oil washing
- 4 Lowering of steel sounding tape or ullage lines through the oil
- 5 Lowering of sample container or thermometers by using synthetic ropes.
- 6 Air bubble in Oil
- 7 Drop of liquid (splash) at height

b)

- 1 All ships and shore hoses should be properly bonded
- 2 Cow equipments should be properly bonded
- 3 Discharging starts with very slow rate
- 4 Reduce height of oil drop
- 5 Newer use synthetic ropes for lowering above items.
- 6 Sounding tapes and ullage tapes made up with non conductive materials
- 7 Provide insulation flange at the manifold
- 8 Maintain O₂ percentages less than 8% within cargo space
- 9 Vessel should be properly earthed by using shore earthline
- 10 Avoid using of water to clean and wash pipe lines.

c)

SOPEP manual is statutory document. It has to be prepared by the company and approved by the administration.

All ships above 400 GT and oil tankers above 150 GT and above shall carry SOPEP manual.

It has to be in loose leaf format. In front it should show contents, manuals and how to use it.

SOPEP manual provide following details:

- 1 Actions to be taken by master when reporting oil pollution incidents
- 2 National and local contact points and numbers.
- 3 Reporting procedures
- 4 When to report, whom to report and what is to report
- 5 Detail description of each person on board that has to be taken during oil damage incident.
- 6 How to coordinate with authorities in case of combined is to be carried out.
- 7 Update list of SOPEP equipment

National and local contact list to be updated every three months period.