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Faculty	Department / Section/Division
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Past Papers

Faculty of maritime Science
Department of Navigation

Navigation Class II (Ministry) 1999-2022

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00001

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

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE (UNLIMITED)
SUBJECT : Ship Construction
DATE : 04th Nov 2019

Time allowed **THREE** hours | Total marks : 120
ANSWER ANY SIX QUESTIONS | 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) Answer the following questions with regard to dry docking:
   a) How to carry out an inspection of a propeller during a period of dry docking?
   (05 Marks)
   b) Sketch the deficiencies that could be identified on a propeller when docking inspections are carried out. Explain the reasons for such faults and describe the preventive measures to be taken.
   (12 Marks)
   c) What are the checks that could be done to ensure a proper function of the propeller after joining a large section to a missing section of a propeller
   (03 Marks)

2) I) Explain following in relation to sliding watertight doors positioned below the water line which are used while at sea:
   a) Methods and positions of closing and opening
   b) When do you open and close such doors?
   c) How do you ensure that the strength at the opening is sufficient to with stand the water pressure of the bulkhead
   (05 Marks each)
   II) A watertight door is closed from the remote control station. Explain the sequence of events that can take place when you try to open the door locally
   (05 Marks)

3) I) Differentiate water tightness and weather tightness (04 Marks)

II) Sketch and describe the method of achieving water tightness of a hatch cover at:

a) periphery (outer edges) and

b) at the cross joint

(8 Marks each)

Your answer should indicate the method of achieving correct packing compression.

4) I) With the aid of a sketch describe how a free standing prismatic (independent) tanks for the carriage of liquefied gasses are located and supported.

(12 Marks)

II) What are the advantages offered by similar construction to effect:

a) Safety

b) Cargo containment

c) Stability

d) Effective maintenance of strength members of hull

(06 Marks)

III) What materials are used in construction of inner most linings of such tanks and indicate the important property considered in selecting such material

(02 Marks)

5) Answer the following questions with regard to rolled steel sections and plate stiffening:

a) Sketch FOUR types of rolled steel sections commonly employed to stiffen plating.

(07 Marks)

b) State where in ship's structure the rolled sections in (a) would be employed

(07 Marks)

c) Sketch ONE alternative means used to stiffen large areas of plating

(03 Marks)

d) Indicate successful use of (c) to stiffen a ship structure

(03 Marks)

6) Answer the following questions with regard to framing systems:

a) A Frame is a stiffener member attached to the inside of the hull of the ship. Explain the service rendered by that.

(05 Marks)

b) What are the types of framing systems used in construction of vessels and discuss the important features related to such framing systems.

(15 Marks)

7) State the PURPOSE of each of the following and describe where they are located in the ship structure:
   a) Sheer
   b) Bilge keel
   c) Hawse Pipe
   d) Bitter end
   e) Kort nozzle
   f) Spurling Pipe
   g) Breast hook

[03 marks each up to (f) & 2 marks for (g)]

8) Answer the below questions with regard to protective coatings:
   a) Explain the usual routine steps for surface preparation and painting of hull under water area and topside of an existing ship in dry dock. Your answer should include the reasons for each activity.

(15 Marks)

   b) What are advantages of foul release coatings as protective coating for under water areas of a ship and state their limitations in application.

(05 Marks)

9) With reference to the drainage of water from a ship's external structure, explain each of the followings:
   a) Scuppers are located in close proximity to the superstructure
   b) The freeing ports are generally located in fwd and aft areas of the weather decks
   c) Why it is essential that scuppers and freeing ports should function satisfactorily at all times
   d) Oil tankers have ship side guard rails abreast of cargo tanks

(05 Marks each)

End.

(2) Bind 2

MERCHANT SHIPPING SECRETARIAT
GOVERNMENT OF SRI LANKA
CERTIFICATE OF COMPETENCY EXAMINATION

GRADE: CHIEF MATE/MASTER ON SHIPS OF 500 GT OR MORE
SUBJECT: SHIPBOARD OPERATION
DATE : 31st AUG 2017, 0900 hrs to 1200 hrs.

Time allowed **THREE** hours — Total Marks 180
Answer **ALL** questions — Pass Marks 60%
Formulae and intermediate steps taken in reaching your answer should be clearly shown.
You may draw sketches where ever consider prudent. Electronic devices capable of storing and retrieving are **not** allowed.

1.Answer the following questions with regard to IMDG, IMSBC & BLU Codes:

a) With reference to IMDG Code, describe the precautions that you take as chief officer before loading any DG packages on board your vessel. (10 marks)

b) With reference to Solid bulk cargo handling, describe the information that the Master and /Shipper or Terminal should exchange as per BLU code. (10 marks)

c) With reference to carriage of Solid bulk cargo, describe the precautions that you should take while loading/carrying Group A, B and C cargo in bulk. (10 marks)

2. With regard to tanker operation, explain in brief the hazards of the following tankers.
   i) Oil and bulk ore / Oil carriers
   ii) Liquefied Gas Carriers
   iii) Chemical Carriers
   (05 marks each)

a) List information that should be provided by a tanker to the terminal on arrival. (15 marks)

3. With regard to timber deck cargo;

i) State the hazards that are to be considered while carrying timber deck cargo. (05 Marks)

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

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE (UNLIMITED)
SUBJECT : SHIP'S STABILITY
DATE : 06th September 2017

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) A box shaped vessel floating on even keel in dock water of R.D. 1.014 has the following particulars:

Length	124 m	Breadth	20 m
Draught	7.8 m	MCTC (salt water)	300.1

There is an empty watertight forward end bottom compartment, length 10 m, height 6.5 m, extending the full width of the vessel.

Calculate the draughts forward and aft, if this compartment is bilged.

(30 marks)

2) A vessel is upright, starboard side alongside; at an even keel draught of 5.00 m in salt water.

KG = 8.5 m

A 38 t generator is to be loaded from a railway truck ashore. The distance of the railway truck from the vessel's centerline is 19.3 m. The generator is to be loaded using the vessel's crane, the head of which is 25.1m above the keel.

Using the Hydrostatic particulars provided, calculate each of the following:

a) The maximum angle of heel during the loading operation;

(15 marks)

b) The maximum angle of heel if the vessel was listed 4^0 to port prior to loading;

(10 marks)

c) The weight of ballast water to transfer from No. 2 DB starboard to No. 2 DB port in order to achieve the list of 4^0 to port prior to loading (assume both tanks partly full and the transverse distance between the centroids of the tanks is 15 m)

(05 marks)

3) A vessel is floating upright in dock water of RD 1.012 and is about to dry dock. Her particulars are:

Draft fwd	5.34 m	Draft aft	6.66 m
KG	8.30	LBP	137.5 m

Using the hydrostatic particulars, calculate the vessel's effective GM at the critical instant.

(30 marks)

4) (a) State the minimum intact stability criteria required by the *IMO International Grain Code.*

(15 marks)

(b) Describe, with the aid of a sketch, of a curve of statical stability, the effect of increasing the GM on a vessel with a list due to a transverse shift of cargo.

(15 marks)

5) A vessel, initially upright, is to carry out an inclining test.

Present displacement 4700 t. KM 10.63 m

Total weights on board during the experiment:
Ballast 368 t, Kg 3.48 m. Tank full.
Bunkers 182 t, Kg 3.91 m. Free surface moment 974 tm.
Fresh Water 86 t, Kg 4.54 m. Slack tank. Free surface moment 799 tm
Two weights each 25 t, Kg 8.88 m.

At the time of the experiment the boilers are empty. They would usually contain a total of 26 t of water, Kg 4.22 m, with a free surface moment of 129 tm.

A deck crane, weight 21t and still ashore will be fitted on the vessel at a Kg of 9.86 m at a later date.

The plumbline has an effective vertical length of 7.90 m. The inclining weights are shifted transversely 7.50 m on each occasion and the mean horizontal deflection of the plumbline is 0.69 m. Calculate the vessel's Lightship KG.

(30 marks)

6) A vessel is floating in SW with draught Fwd 3.80 m, aft 6.40 m. A total of 2400 t of cargo is to be loaded.

- Space is available in NO. 2 (LCG 100 m foap) and in No. 4 (LCG 54 m foap)
- Length B.P. 136 m
- LCF 67 m foap
- TPC 21.8
- MCTC 150

a) Calculate the weight of cargo to load in each space in order to finish with a trim of 1.0 m by the stern.

(20 marks)

b) Determine the final draughts fwd and aft.

(10 marks)

HYDROSTATIC PARTICULARS 'A'

Draught m	Displacement t		TPC t		MCTC tm		KMt M	KB m	LCB foap m	LCF foap m
	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000				
7.00	14576	14220	23.13	22.57	184.6	180.1	8.34	3.64	70.03	67.35
6.90	14345	13996	23.06	22.50	183.0	178.5	8.35	3.58	70.08	67.46
6.80	14115	13771	22.99	22.43	181.4	177.0	8.36	3.53	70.12	67.57
6.70	13886	13548	22.92	22.36	179.9	175.5	8.37	3.48	70.16	67.68
6.60	13657	13324	22.85	22.29	178.3	174.0	8.38	3.43	70.20	67.79
6.50	13429	13102	22.78	22.23	176.8	172.5	8.39	3.38	70.24	67.90
6.40	13201	12879	22.72	22.17	175.3	171.0	8.41	3.33	70.28	68.00
6.30	12975	12658	22.66	22.11	173.9	169.6	8.43	3.28	70.32	68.10
6.20	12748	12437	22.60	22.05	172.5	168.3	8.46	3.22	70.35	68.20
6.10	12523	12217	22.54	21.99	171.1	167.0	8.49	3.17	70.38	68.30
6.00	12297	11997	22.48	21.93	169.8	165.7	8.52	3.11	70.42	68.39
5.90	12073	11778	22.43	21.87	168.5	164.4	8.55	3.06	70.46	68.43
5.80	11848	11559	22.37	21.82	167.3	163.2	8.59	3.01	70.50	68.57
5.70	11625	11342	22.32	21.77	166.1	162.1	8.63	2.95	70.53	68.65
5.60	11402	11124	22.26	21.72	165.0	161.0	8.67	2.90	70.57	68.73
5.50	11180	10908	22.21	21.66	163.9	160.0	8.71	2.85	70.60	68.80
5.40	10958	10691	22.15	21.61	162.9	158.9	8.76	2.80	70.64	68.88
5.30	10737	10476	22.10	21.56	161.8	157.9	8.81	2.74	70.68	68.95
5.20	10516	10260	22.05	21.51	160.8	156.9	8.86	2.69	70.72	69.02
5.10	10296	10045	22.00	21.46	159.8	155.9	8.92	2.63	70.75	69.09
5.00	10076	9830	21.95	21.41	158.8	154.9	8.98	2.58	70.79	69.16
4.90	9857	9616	21.90	21.36	157.9	154.0	9.06	2.53	70.82	69.23
4.80	9638	9403	21.85	21.32	156.9	153.1	9.13	2.48	70.86	69.29
4.70	9420	9190	21.80	21.27	156.0	152.2	9.22	2.43	70.90	69.35
4.60	9202	8978	21.75	21.22	155.1	151.3	9.30	2.38	70.93	69.42
4.50	8985	8766	21.70	21.17	154.2	150.5	9.40	2.32	70.96	69.48
4.40	8768	8554	21.65	21.12	153.3	149.6	9.49	2.27	71.00	69.55
4.30	8552	8344	21.60	21.07	152.4	148.7	9.60	2.22	71.04	69.62
4.20	8336	8133	21.55	21.02	151.5	147.8	9.71	2.17	71.08	69.68
4.10	8121	7923	21.50	20.97	150.6	146.9	9.83	2.12	71.12	69.74
4.00	7906	7713	21.45	20.93	149.7	146.0	9.96	2.07	71.15	69.81
3.90	7692	7505	21.40	20.88	148.7	145.1	10.11	2.01	71.18	69.88
3.80	7478	7296	21.35	20.83	147.8	144.2	10.25	1.96	71.22	69.94
3.70	7265	7088	21.30	20.78	146.8	143.3	10.41	1.91	71.25	70.00
3.60	7052	6880	21.24	20.72	145.9	142.3	10.57	1.86	71.29	70.07
3.50	6840	6673	21.19	20.67	144.9	141.3	10.76	1.81	71.33	70.14

THESE HYDROSTATIC PARTICULARS HAVE BEEN DEVELOPED WITH THE VESSEL FLOATING ON EVEN KEEL

MERCHANT SHIPPING SECRETARIAT
GOVERNMENT OF SRI LANKA
CERTIFICATE OF COMPETENCY EXAMINATION

GRADE: CHIEF MATE/MASTER ON SHIPS OF 500 GT OR MORE
SUBJECT: NAVIGATION
DATE : 04TH September 2017, 0900 hrs to 1200 hrs.

Time allowed **THREE** hours — Total Marks 200
Answer **ALL** questions — Pass Marks ~~60%~~ 70%
Formulae and intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches where ever consider prudent. Electronic devices capable of storing and retrieving are **not** allowed.

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01. A 10000 GT general cargo vessel is to make a loaded passage Charleston (South Carolina, USA) to Odessa (Ukraine) calling at Nouakchott (Mauretania).
The vessel's owners have requested that it following the shortest possible route between Charleston and Nouakchott, using the following positions for the ocean passage.

Departure position 32° 48'.0 N 079° 51'.0 W
Landfall position 18° 03'.0 N 016° 18'.0 W

i. Calculate the total distance on passage (10 marks)

ii. Determine the latitude and longitude of the vessel at the northernmost point along the track (15 Marks)

iii. Determine the distance off the island of Bermuda (32°21'N 64°48'W) when the vessel crosses longitude 64°48'W, stating whether the vessel passes North or South of the island. (15 marks)

02. On the evening of the 04th May 2006, whilst in DR position 28° 42'.0 S 094° 36'.0 W the master request the OOW to obtain a set of star sights to check the vessel's GPS receiver. The vessel is steaming on a course of 235° (T) at 14 knots. Weather conditions are clear with some low broken cloud cover to the Northwest of the vessel.

The OOW obtain the following results

Time	Star	Azimuth	True Alt	Calc Alt
1745	Canopus	142° (T)	42° 19'.7	42° 23'.6
1750	Arcturus	270° (T)	54° 12'.3	54° 13'.7
1758	Alphard	062° (T)	28° 15'.6	28° 09'.7
1815	Antares	224° (T)	19° 16'.0	19° 21'.7

i. Plot all FOUR stars for 1800hrs. (20 marks)
ii. Discuss the criteria for selecting stars for celestial observations. (10 marks)
iii. Determine the vessel's position at 1800hrs. (05 marks)

04th. 1992

03. On ~~06th~~ May ~~2006~~ at 1845 GMT a tanker in position 36^0 30'N, 034^0 45'W had an injured crew member who required immediate medical attention. At the same time, a passenger vessel in position 41^0 00'N 038^0 30'W which a doctor was onboard, agreed to assist. Rendezvous was planned at sunrise next morning. The passenger ship maintained her course and speed of 125^0(T) x 26 Knots.

i. The GMT of sunrise next morning
ii. The rendezvous position
iii. Course and speed required by the tanker to achieve rendezvous as planned.

(35 marks)

04. A vessel arrives in Istanbul and anchors to await a pilot, prior to transiting the Bosporus on the northbound passage to Odessa. The Bosporus is covered by a Traffic Separation Scheme for its entire length and in place the passage is extremely narrow (only 8 cables wide from shore to shore). The passage is also very shallow in place with numerous bank, shoals and wrecks. It is also dangerous due to the fact that there are strong current, sharp bends and frequent close quarters situations during the transit.

i. Describe the preparations to be made on the bridge prior to undertaking such a passage. (20 marks)
ii. Discus THREE factors that the master must take into consideration regarding the maneuverability of the vessel during the transit. (09 marks)
iii. Outline the precautions that should be taken in the event of an engine or steering gear failure. (06 marks)

05. Tropical Revolving Storms are common at certain times of the year in the South Pacific Ocean, especially to the North of New Zealand and off the East Coast of Australia.

(a) Sketch a plan view of a TRS in the Western South Pacific Ocean, indicating the likely track prior to and after recurving. (10 marks)

(b) Outline the actions that should be taken by the Master in EACH of the following scenarios, assuming that the storm has recurved:

(i) the vessel is to the north of the storms track but within the storm field; (5 marks)
(ii) the vessel is to the south of the storms track but within the storm field; (5 marks)
(iii) the vessel is in the path of the storm. (5 marks)

06. a) What factors should the Master take into consideration when deciding upon the composition of Bridge and Engine room watches? (10 marks)

b) State the appropriate manning levels on the bridge, for each of the following situations in clear weather:

i) Navigation during darkness on a ocean passage (02 marks)
ii) Navigation in a Traffic Separation Scheme with dense traffic (03 marks)
iii) Navigation in Suez canal with pilot onboard during darkness (03 marks)

c) Describe the contents of a master's night orders. (12 marks)

DIRECTOR GENERAL OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA
CERTIFICATE OF COMPETENCY EXAMINATION

GRADE: CHIEF MATE/MASTER ON SHIPS OF 500 GT OR MORE
SUBJECT: SHIPBOARD OPERATION
DATE : 09th December 2015, 0900 hrs to 1200 hrs.

Time allowed **THREE** hours — Total Marks 180
Answer **ALL** questions — Pass Marks 60%
Formulae and intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches where ever consider prudent. Electronic devices capable of storing and retrieving are **not** allowed.

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1) Answer the following questions with reference to ship's stability:

a) Stableness of a vessel is mainly governed by weight distribution within the ship. Improper weight distribution may lead structural and stability issues and may leads to disastrous situations. Explain in detail with suitable sketches Stable Equilibrium, Unstable Equilibrium and Neutral Equilibrium.

(15 marks)

b) Transverse statical stability of merchant vessels is the prime element in stableness which uses to judge the stability of the vessel. Due to operational conditions of vessels at ports and at sea vessels transverse statical stability may change. This is mainly due to the result of change of KG of the vessel. Explain with suitable statical stability diagrams how vessels stability will change due to increase in KG and mention how KG will increase at ports and at sea due to operational conditions of ships.

(15 marks)

2) With regard to cargo stowage and securing answer the following questions:

a) Wrong 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 stowage plan? (15 marks)

b) Seaworthiness of a vessel is mainly governed by vessels suitability and cargo worthiness. 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)

03) Write short notes on;

i) Emergency Towing Booklet

ii) SEEMP

iii) Risk Rating Factor(RF)

iv) Ship Sanitation Control Exemption Certificate (SSCEC)

v) Condition of Class (Each 5 marks)

4) Answer the following questions with reference to container ships:

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)

5) With reference to grain regulations explain,

a) what are the minimum criterion to comply for a vessel to set out to sea with a consignment of grain?

(10 marks)

b) how the heeling arm due to grain shift is derived and what are the parameters for the vessel to remain seaworthy?

(10 marks)

c) what actions you could take to improve the situation if the vessel is found not complying with the requirements?

(10 marks)

06) a.) What documents and plans to be kept ready before dry docking a vessel?

b.) What are the preparations and precautions require taking prior to dry docking a ship?

c.) List the standard items to be checked at dry dock.

d.) What is "Docking Plan"?

ND Class II

MERCHANT SHIPPING SECRETARIAT
GOVERNMENT OF SRI LANKA
CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE (UNLIMITED)
SUBJECT : SHIP'S STABILITY
DATE : 10th December 2015, 0900hrs to 1200 hrs

Time allowed **THREE hours** Total marks : 180
ANSWER ALL QUESTIONS Pass marks : 60%

Formulae and 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 box-shaped barge of uniform construction is 32 m long and displaces 352 t when empty, is divided by transverse bulkheads into four equal compartments. Cargo is loaded into each compartment and level stowed as follows:

No. 1 hold – 192 tonnes No. 2 hold – 224 tonnes
No. 3 hold – 272 tonnes No. 4 hold – 176 tonnes

a) Construct load and shearing force diagrams at the bulkheads (15 marks)

b) Construct bending moments curve for the above positions (10 marks)

c) Find the value of the maximum bending moment along the ship's length (05 marks)

2) A box shaped vessel floating on an even keel in salt water has the following particulars:

Length	130.0 m	Breadth	20.0 m
Draught	5.0 m	KG	4.5 m

There is an empty forward end compartment of 20.0 m length that extends the full width of the vessel.

Calculate the final draughts fore and aft if this compartment is bilged.

(30 marks)

3) A bulk carrier, fully laden with ore in alternate holds has to be dry docked in the following conditions:

Displacement	73000 t	KM	13.10 m
Draughts	12.45 m (even keel)	Mean TPC	62
KG	10.9 m		

The dock initially has 14 m of water over the upper surfaces of the blocks which have no declivity.

a) Calculate the GM when the water level has been lowered by 4.0 m

(20 marks)

b) Explain why a small stern trim is generally to be preferred to the even keel condition when entering dry dock

(04 marks)

c) Explain the possible dangers involved in dry docking this vessel and how these may be overcome if dry docking is for purpose of:
   i) Inspection of some side shell damage only;
   ii) Inspection of possible bottom damage.

(03 marks each)

4) The attached hydrostatic particulars provide the hydrostatic data for a vessel of, length between perpendiculars 140.0 m and summer load displacement of 14115 t.

In partly loaded condition, the vessel has the following draughts in salt water:
Fwd 5.26 m
Aft 5.48 m

The vessel is to complete loading at the summer displacement with a trim of 0.5 m by stern. The remaining cargo is to be loaded in two holds:

No. 1 hold lcg 116.0 m foap
No. 4 hold lcg 32 m foap

Using the hydrostatic data sheet, calculate each of the following:

a) The quantity to load in each hold

(25 marks)

b) The final draughts in salt water

(05 marks)

5) Answer the following questions with reference to the IMO stability criteria & ship's stability:

a) State the minimum stability requirements for a vessel in accordance with the IMO stability criteria

(10 marks)

b) At ballast passage a particular vessel complies in every respect with the stability requirements of the IMO stability criteria. At load draught, with the same GM, it does not comply. With the aid of a suitable diagram, explain why this may be so.

(10 marks)

c) Show, by means of labeled diagrams, the difference between a GZ curve for a vessel at an **angle of loll** and a GZ curve for a vessel with **list** due to an off centre weight.

(10 marks)

6) A vessel is floating upright with the following particulars:

Displacement = 20000 t KG = 9.0 m

The following cargo and bunkers are then loaded:

500 t	Kg 12.0 m	6.0 m to starboard of centerline
340 t	Kg 4.5 m	4.5 m to starboard of centerline
200 t	Kg 11.0 m	6.0 m to port of centerline

Bunkers (relative density 0.9) 150 t (Kg 1.2 m), in a centre tank of length 8 m, breadth 15 m which is slack.

Calculate the list if the final KM is 10.55 m

(30 marks)

HYDROSTATIC PARTICULARS 'A'

Draught m	Displacement t		TPC t		MCTC tm		KMt	KB	LCB foap	LCF foap
	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000	M	m	m	m
7.00	14576	14220	23.13	22.57	184.6	180.1	8.34	3.64	70.03	67.35
6.90	14345	13996	23.06	22.50	183.0	178.5	8.35	3.58	70.08	67.46
6.80	14115	13771	22.99	22.43	181.4	177.0	8.36	3.53	70.12	67.57
6.70	13886	13548	22.92	22.36	179.9	175.5	8.37	3.48	70.16	67.68
6.60	13657	13324	22.85	22.29	178.3	174.0	8.38	3.43	70.20	67.79
6.50	13429	13102	22.78	22.23	176.8	172.5	8.39	3.38	70.24	67.90
6.40	13201	12879	22.72	22.17	175.3	171.0	8.41	3.33	70.28	68.00
6.30	12975	12658	22.66	22.11	173.9	169.6	8.43	3.28	70.32	68.10
6.20	12748	12437	22.60	22.05	172.5	168.3	8.46	3.22	70.35	68.20
6.10	12523	12217	22.54	21.99	171.1	167.0	8.49	3.17	70.38	68.30
6.00	12297	11997	22.48	21.93	169.8	165.7	8.52	3.11	70.42	68.39
5.90	12073	11778	22.43	21.87	168.5	164.4	8.55	3.06	70.46	68.43
5.80	11848	11559	22.37	21.82	167.3	163.2	8.59	3.01	70.50	68.57
5.70	11625	11342	22.32	21.77	166.1	162.1	8.63	2.95	70.53	68.65
5.60	11402	11124	22.26	21.72	165.0	161.0	8.67	2.90	70.57	68.73
5.50	11180	10908	22.21	21.66	163.9	160.0	8.71	2.85	70.60	68.80
5.40	10958	10691	22.15	21.61	162.9	158.9	8.76	2.80	70.64	68.88
5.30	10737	10476	22.10	21.56	161.8	157.9	8.81	2.74	70.68	68.95
5.20	10516	10260	22.05	21.51	160.8	156.9	8.86	2.69	70.72	69.02
5.10	10296	10045	22.00	21.46	159.8	155.9	8.92	2.63	70.75	69.09
5.00	10076	9830	21.95	21.41	158.8	154.9	8.98	2.58	70.79	69.16
4.90	9857	9616	21.90	21.36	157.9	154.0	9.06	2.53	70.82	69.23
4.80	9638	9403	21.85	21.32	156.9	153.1	9.13	2.48	70.86	69.29
4.70	9420	9190	21.80	21.27	156.0	152.2	9.22	2.43	70.90	69.35
4.60	9202	8978	21.75	21.22	155.1	151.3	9.30	2.38	70.93	69.42
4.50	8985	8766	21.70	21.17	154.2	150.5	9.40	2.32	70.96	69.48
4.40	8768	8554	21.65	21.12	153.3	149.6	9.49	2.27	71.00	69.55
4.30	8552	8344	21.60	21.07	152.4	148.7	9.60	2.22	71.04	69.62
4.20	8336	8133	21.55	21.02	151.5	147.8	9.71	2.17	71.08	69.68
4.10	8121	7923	21.50	20.97	150.6	146.9	9.83	2.12	71.12	69.74
4.00	7906	7713	21.45	20.93	149.7	146.0	9.96	2.07	71.15	69.81
3.90	7692	7505	21.40	20.88	148.7	145.1	10.11	2.01	71.18	69.88
3.80	7478	7296	21.35	20.83	147.8	144.2	10.25	1.96	71.22	69.94
3.70	7265	7088	21.30	20.78	146.8	143.3	10.41	1.91	71.25	70.00
3.60	7052	6880	21.24	20.72	145.9	142.3	10.57	1.86	71.29	70.07
3.50	6840	6673	21.19	20.67	144.9	141.3	10.76	1.81	71.33	70.14

THESE HYDROSTATIC PARTICULARS HAVE BEEN DEVELOPED WITH THE VESSEL FLOATING ON EVEN KEEL

NDC lass II

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

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE (UNLIMITED)
SUBJECT : SHIP BOARD OPERATIONS
DATE : 17th November 2016

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) A ship of L = 180 m ; B = 25 m ; GM = 3.2 m ; Speed = 18 knots is to load at 126m from AP on tween deck. Specification of cargo unit of m = 48 t; dimensions = 8 x 8 x 8 m. With the aid of attached tables (Shipboard Operations Formulas and Tables to be used for Lashing Calculations) find the minimum required number of lashing if following lashings is to use.

Securing material:

Wire rope (single Use): breaking strength = 125 kN ,
Shackles, turnbuckles, deck rings: breaking strength = 180 kN
Stowage on dunnage boards: μ=0.3 (Steel – timber)

(30 marks)

2) Answer the following questions with regard to ship's stability:

a) During the process of loading the main aim of the ships master and/or the chief officer is to complete the loading operation of the vessel in upright condition. If it is unable to achieve upright condition upon completion of the loading then to correct the list by ballasting or by internal transfer of weights. Explain reasons behind the above statement in detail using diagrams and drawings if applicable why it is necessary to maintain upright condition at all times.

(20 marks)

b) Briefly explain following:
   i. Statical Stability
   ii. Dynamical stability

(05 marks each)

3) Answer following questions with regard to reefer cargo:

a) Cargo related information supplied by the shipper is very essential in refer trade for proper stowage, carriage and discharging of refer cargo. Enumerate and describe the information required to be supplied by the shipper in relation to cargo carried by an ordinary refer vessel.

(10 marks)

b) New generation refer vessels are fitted with controlled atmosphere (CA) type refrigeration plats. 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 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.

(10 marks)

4) Answer the following questions with regard to ballast water operations:

a) Ballast water convention was held years ago. Now it is in force. But not yet enforced. Describe the reasons for this delay.

(10 marks)

b) What certificates, documents and records, vessels engaged in international trade shall carry to comply with the requirements.

(05 marks)

c) Describe the dangers faced by some parts of the world due to ballast water movement by sea trade since the convention was not in force.

(10 marks)

d) Describe at least three methods that you can use as chief officer to comply with the requirement.

(05 marks)

5) Answer the below questions with regard to tanker cargo operations:

a) Explain the following,
   i. Lower Flammable Limit
   ii. Upper flammable limit
   iii. Flash point

(05 marks each)

b) Describe why any liquid cargo is not filled to 100% of the tank capacity for normal carriage by sea

(05 marks)

c) A tanker loads 3200 MT of crude oil at 30 C and SG of 0.8942. What would be the change in Ullage at discharge port where the temperature is 15 C and SG of 0.8959? Consider a change 3^{M3} by volume corresponds to a change of 0.1 cm in Ullage as per calibration tables.

(10 marks)

6) With reference to grain regulation explain,

a) What is the minimum criterion to comply for a vessel to set out to sea with a consignment of grain?
b) How the heeling arm due to grain shift is derived and what are the parameters for the vessel to remain seaworthy?
c) What action you could take to improve the situation if the vessel is found not complying with the requirements?

(10 marks each)

Shipboard Operations

Formulas and Tables to be used for Lashing Calculations

External forces calculating formula

$$F_{(x,y,z)} = ma_{(x,y,z)} + F_{w(x,y)} + F_{s(x,y)}$$

Balance forces calculation formulas

Transverse sliding : $\mathbf{Fy \leq \mu \cdot m \cdot g + fy_1 \cdot CS_1 + ... + fy_n \cdot CS_n}$

Longitudinal sliding : $\mathbf{Fx \leq \mu(m \cdot g - Fz) + fx_1 \cdot CS_1 + ... + fx_n \cdot CS_n}$

Transverse tipping : $\mathbf{Fy \cdot a \leq b \cdot m \cdot g + 0.9(CS_1 \cdot c_1 + CS_2 \cdot c_2 + ... + CS_n \cdot c_n)}$

MSLs for different securing devices (Table 1)

Material	MSL
Shackles, deckeyes, twistlocks, lashing rods, D-rings, stackers, bridge fittings, turnbuckles of mild steel	50% of breaking strength
Fibre rope	33% of breaking strength
Wire rope (single use)	80% of breaking strength
Wire rope (re-useable)	30% of breaking strength
Steel band (single use)	70% of breaking strength
Chains	50% of breaking strength
Web lashings	50% of breaking strength

The basic acceleration data (Table 2)

Transverse acceleration a_y in m/s²										Longitudinal acceleration a_x in m/s²
on deck, high	7.1	6.9	6.8	6.7	6.7	6.8	6.9	7.1	7.4	3.8
on deck, low	6.5	6.3	6.1	6.1	6.1	6.1	6.3	6.5	6.7	2.9
'tween-deck	5.9	5.6	5.5	5.4	5.4	5.5	5.6	5.9	6.2	2.0
lower hold	5.5	5.3	5.1	5.0	5.0	5.1	5.3	5.5	5.9	1.5
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9 L
Vertical acceleration a_z in m/s²										
	7.6	6.2	5.0	4.3	4.3	5.0	6.2	7.6	9.2	

Correction factors for length and speed (Table 3)

Length [m] / Speed [kN]	30	40	50	60	70	80	90	100	120	140	160	180	200	250	300
9	1,37	1,31	1,20	1,09	1,00	0,92	0,85	0,79	0,70	0,63	0,57	0,53	0,49	0,41	0,36
12	1,56	1,47	1,34	1,22	1,12	1,03	0,96	0,90	0,79	0,72	0,65	0,60	0,56	0,48	0,42
15	1,75	1,64	1,49	1,36	1,24	1,15	1,07	1,00	0,89	0,80	0,73	0,68	0,63	0,55	0,48
18	1,94	1,80	1,64	1,49	1,37	1,27	1,18	1,10	0,98	0,89	0,82	0,76	0,71	0,61	0,54
21	2,13	1,96	1,78	1,62	1,49	1,38	1,29	1,21	1,08	0,98	0,90	0,83	0,78	0,68	0,60
24	2,32	2,13	1,93	1,76	1,62	1,50	1,40	1,31	1,17	1,07	0,98	0,91	0,85	0,74	0,66

Table 3 – Correction factors for length and speed

Correction factor for B/GM<13 (Table 4)

B / GM	4	5	6	7	8	9	10	11	12	13 →
on deck. high	2,30	1,96	1,72	1,56	1,40	1,27	1,19	1,11	1,05	1,00
on deck. low	1,92	1,70	1,53	1,42	1,30	1,21	1,14	1,09	1,04	1,00
Tween-deck	1,54	1,42	1,33	1,26	1,19	1,14	1,09	1,06	1,03	1,00
lower hold	1,31	1,24	1,19	1,15	1,12	1,09	1,06	1,04	1,02	1,00

Table 4 - Correction factors for B/GM < 13

Friction coefficients (μ) (Table 5)

Materials in contact	Friction coefficient, (μ)
timber-timber, wet or dry	0.4
steel-timber or steel-rubber	0.3
steel-steel, dry	0.1
steel-steel, wet	0.0

Table 5 – Friction coefficients

Table 7 – fx-values and fy-values as a function of α, β and μ

Table 7.1 for μ = 0.4

β for fy	α														β for fx
	-30	-20	-10	0	10	20	30	40	45	50	60	70	80	90	
0	0.67	0.80	0.92	1.00	1.05	1.08	1.07	1.02	0.99	0.95	0.85	0.72	0.57	0.40	90
10	0.65	0.79	0.90	0.98	1.04	1.06	1.05	1.01	0.98	0.94	0.84	0.71	0.56	0.40	80
20	0.61	0.75	0.86	0.94	0.99	1.02	1.01	0.98	0.95	0.91	0.82	0.70	0.56	0.40	70
30	0.55	0.68	0.78	0.87	0.92	0.95	0.95	0.92	0.90	0.86	0.78	0.67	0.54	0.40	60
40	0.46	0.58	0.68	0.77	0.82	0.86	0.86	0.84	0.82	0.80	0.73	0.64	0.53	0.40	50
50	0.36	0.47	0.56	0.64	0.70	0.74	0.76	0.75	0.74	0.72	0.67	0.60	0.51	0.40	40
60	0.23	0.33	0.42	0.50	0.56	0.61	0.63	0.64	0.64	0.63	0.60	0.55	0.48	0.40	30
70	0.10	0.18	0.27	0.34	0.41	0.46	0.50	0.52	0.52	0.53	0.52	0.49	0.45	0.40	20
80	-0.05	0.03	0.10	0.17	0.24	0.30	0.35	0.39	0.41	0.42	0.43	0.44	0.42	0.40	10
90	-0.20	-0.14	-0.07	0.00	0.07	0.14	0.20	0.26	0.28	0.31	0.35	0.38	0.39	0.40	0

Table 7.2 for μ = 0.3

β for fy	α														β for fx
	-30	-20	-10	0	10	20	30	40	45	50	60	70	80	90	
0	0.72	0.84	0.93	1.00	1.04	1.04	1.02	0.96	0.92	0.87	0.76	0.62	0.47	0.30	90
10	0.70	0.82	0.92	0.98	1.02	1.03	1.00	0.95	0.91	0.86	0.75	0.62	0.47	0.30	80
20	0.66	0.78	0.87	0.94	0.98	0.99	0.96	0.91	0.88	0.83	0.73	0.60	0.46	0.30	70
30	0.60	0.71	0.80	0.87	0.90	0.92	0.90	0.86	0.82	0.79	0.69	0.58	0.45	0.30	60
40	0.51	0.62	0.70	0.77	0.81	0.82	0.81	0.78	0.75	0.72	0.64	0.54	0.43	0.30	50
50	0.41	0.50	0.58	0.64	0.69	0.71	0.71	0.69	0.67	0.64	0.58	0.50	0.41	0.30	40
60	0.28	0.37	0.44	0.50	0.54	0.57	0.58	0.58	0.57	0.55	0.51	0.45	0.38	0.30	30
70	0.15	0.22	0.28	0.34	0.39	0.42	0.45	0.45	0.45	0.45	0.43	0.40	0.35	0.30	20
80	0.00	0.06	0.12	0.17	0.22	0.27	0.30	0.33	0.33	0.34	0.35	0.34	0.33	0.30	10
90	-0.15	-0.10	-0.05	0.00	0.05	0.10	0.15	0.19	0.21	0.23	0.26	0.28	0.30	0.30	0

Table 7.3 for $\mu = 0.2$

β for fy	α														β for fx
	-30	-20	-10	0	10	20	30	40	45	50	60	70	80	90	
0	0.77	0.87	0.95	1.00	1.02	1.01	0.97	0.89	0.85	0.80	0.67	0.53	0.37	0.20	**90**
10	0.75	0.86	0.94	0.98	1.00	0.99	0.95	0.88	0.84	0.79	0.67	0.52	0.37	0.20	**80**
20	0.71	0.81	0.89	0.94	0.96	0.95	0.91	0.85	0.81	0.76	0.64	0.51	0.36	0.20	**70**
30	0.65	0.75	0.82	0.87	0.89	0.88	0.85	0.79	0.75	0.71	0.61	0.48	0.35	0.20	**60**
40	0.56	0.65	0.72	0.77	0.79	0.79	0.76	0.72	0.68	0.65	0.56	0.45	0.33	0.20	**50**
50	0.46	0.54	0.60	0.64	0.67	0.67	0.66	0.62	0.60	0.57	0.49	0.41	0.31	0.20	**40**
60	0.33	0.40	0.46	0.50	0.53	0.54	0.53	0.51	0.49	0.47	0.42	0.36	0.28	0.20	**30**
70	0.20	0.25	0.30	0.34	0.37	0.39	0.40	0.39	0.38	0.37	0.34	0.30	0.26	0.20	**20**
80	0.05	0.09	0.14	0.17	0.21	0.23	0.25	0.26	0.26	0.26	0.26	0.25	0.23	0.20	**10**
90	-0.10	-0.07	-0.03	0.00	0.03	0.07	0.10	0.13	0.14	0.15	0.17	0.19	0.20	0.20	**0**

Table 7.4 for $\mu = 0.1$

β for fy	α														β for fx
	-30	-20	-10	0	10	20	30	40	45	50	60	70	80	90	
0	0.82	0.91	0.97	1.00	1.00	0.97	0.92	0.83	0.78	0.72	0.59	0.44	0.27	0.10	**90**
10	0.80	0.89	0.95	0.98	0.99	0.96	0.90	0.82	0.77	0.71	0.58	0.43	0.27	0.10	**80**
20	0.76	0.85	0.91	0.94	0.94	0.92	0.86	0.78	0.74	0.68	0.56	0.42	0.26	0.10	**70**
30	0.70	0.78	0.84	0.87	0.87	0.85	0.80	0.73	0.68	0.63	0.52	0.39	0.25	0.10	**60**
40	0.61	0.69	0.74	0.77	0.77	0.75	0.71	0.65	0.61	0.57	0.47	0.36	0.23	0.10	**50**
50	0.51	0.57	0.62	0.64	0.65	0.64	0.61	0.56	0.53	0.49	0.41	0.31	0.21	0.10	**40**
60	0.38	0.44	0.48	0.50	0.51	0.50	0.48	0.45	0.42	0.40	0.34	0.26	0.19	0.10	**30**
70	0.25	0.29	0.32	0.34	0.35	0.36	0.35	0.33	0.31	0.30	0.26	0.21	0.16	0.10	**20**
80	0.10	0.13	0.15	0.17	0.19	0.20	0.20	0.20	0.19	0.19	0.17	0.15	0.13	0.10	**10**
90	-0.05	-0.03	-0.02	0.00	0.02	0.03	0.05	0.06	0.07	0.08	0.09	0.09	0.10	0.10	**0**

Table 7.5 for $\mu = 0.0$

β for fy	α														β for fx
	-30	-20	-10	0	10	20	30	40	45	50	60	70	80	90	
0	0.87	0.94	0.98	1.00	0.98	0.94	0.87	0.77	0.71	0.64	0.50	0.34	0.17	0.00	**90**
10	0.85	0.93	0.97	0.98	0.97	0.93	0.85	0.75	0.70	0.63	0.49	0.34	0.17	0.00	**80**
20	0.81	0.88	0.93	0.94	0.93	0.88	0.81	0.72	0.66	0.60	0.47	0.32	0.16	0.00	**70**
30	0.75	0.81	0.85	0.87	0.85	0.81	0.75	0.66	0.61	0.56	0.43	0.30	0.15	0.00	**60**
40	0.66	0.72	0.75	0.77	0.75	0.72	0.66	0.59	0.54	0.49	0.38	0.26	0.13	0.00	**50**
50	0.56	0.60	0.63	0.64	0.63	0.60	0.56	0.49	0.45	0.41	0.32	0.22	0.11	0.00	**40**
60	0.43	0.47	0.49	0.50	0.49	0.47	0.43	0.38	0.35	0.32	0.25	0.17	0.09	0.00	**30**
70	0.30	0.32	0.34	0.34	0.34	0.32	0.30	0.26	0.24	0.22	0.17	0.12	0.06	0.00	**20**
80	0.15	0.16	0.17	0.17	0.17	0.16	0.15	0.13	0.12	0.11	0.09	0.06	0.03	0.00	**10**
90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0**

Remark: $fx = \cos\alpha \cdot \sin\beta + \mu \cdot \sin\alpha$ $fy = \cos\alpha \cdot \cos\beta + \mu \cdot \sin\alpha$

2016

(2)

MERCHANT SHIPPING SECRETARIAT
GOVERNMENT OF SRI LANKA
CERTIFICATE OF COMPETENCY EXAMINATION

GRADE: CHIEF MATE/MASTER ON SHIPS OF 500 GT OR MORE
SUBJECT: STABILITY
DATE : 15th February 2016, 0900 hrs to 1200 hrs.

Time allowed **THREE** hours — Total Marks 180
Answer **ALL** questions — Pass Marks 60%
Formulae and intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches where ever consider prudent.

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1) A vessel operating in severe winter conditions may suffer from non-symmetrical ice accretion on decks and superstructure.

Describe the effects on the overall stability of the vessel making particular reference to the curve of statical stability.

(30 marks)

2) Answer the following questions with reference to bilging:

a) Briefly describe the effects on a vessel's GM due to bilging

(06 marks)

b) A boxed shaped vessel floating on an even keel in salt water has the following particulars:

Length	120.0 m	Breadth	18.0 m
Draught	5.0 m	KG	4.8 m

There is an empty deep tank amidships adjacent to the keel of length 20.00 m with a water tight flat 5.80 m above the keel, which extends the full width of the vessel.

Calculate the final draughts and the change in metacentric height if this compartment is bilged.

(24 marks)

5.966 m
0.5 m GM

Open CPN

3) A vessel displacement 10500 t KG 6.5 m loads the following grain cargo, stowage factor 1.53 m^3t^{-1}.

Hold	Weights (t)	Kg (m)	Transverse volumetric heeling moments (m^4)
1	3500	7.2	1200
2	4800	7.4	1650
3	4100	7.5	2000
4	3200	7.5	1110

The values of Kg are the volumetric centroids of the spaces.

The table below illustrates extracts from the Maximum Allowable Grain Heeling Moment Table in metre tone:

KG ⟶	6.8	6.9	7.0	7.1	7.2
Displacement					
25 500	5660	5450	5245	5040	4840
26 000	5600	5400	5200	5000	4800
26 500	5550	5360	5165	4970	4775

a) Demonstrate whether or not the vessel complies with the current Grain Rules.

(25 marks)

b) Calculate the approximate angle of heel due to the assumed grain shift

(05 marks)

4) Ship 'A' has a displacement of 13,000 t and a KG of 8.20 m in salt water.

With the aid of Data sheet – 1 (KN Curves) and Data sheet – 2 (Hydrostatic particulars) determine whether the vessel complies with the stability requirements of the current Load Line Rules.

(30 marks)

5) Answer the following questions with regard to ship's longitudinal stability:

a) "When calculating LCG (Longitudinal Centre of Gravity), more accurate results can be obtained if the moments are taken around aft or fwd perpendicular, instead of the COF". Briefly describe this statement.

(05 marks)

b) A vessel has a summer displacement of 24 800 t which corresponds to an even keel draught of 10.86 m in salt water.

In a partly loaded condition the vessel has the following particulars:

Length B.P.	180.0 m	LCF	85.0 m (foap)
Displacement	21 200 t	MCTC	210
Drafts (in SW) fwd	8.96 m	aft	9.48 m

The vessel is to complete loading at the summer displacement, with a trim of 1.00 m by the stern.

The remaining cargo is to be loaded into two holds:
No. 1 Hold (Lcg 166.0 m, foap)
No. 7 Hold (Lcg 32.0 m, foap)

Calculate:

i. The quantities to be loaded in each of the holds

(15 marks)

ii. The final draughts in salt water

(05 marks)

6) A vessel floating upright has to load two weights using the ship's own derrick. The maximum allowable list at any time is 5^0.

Using the following particulars, calculate the minimum initial metacentric height required.

Initial displacement	15,200 t
KM	8.65 m (assume constant throughout)
Derrick head	27.0 m above the keel

Two weights, each 50 tonnes on the quay, 18 m from the centre line of the vessel to be loaded. Stowage positions on deck Kg 13.5 m, 8.0 m each side of the centerline. The inboard weight is to be loaded first.

(30 marks)

KG = 7.5961 m

GM = 1.0539 m

Data sheet – 1 (KN Curves)

DISPLACEMENT — TONNE	ANGLE OF HEEL — DEGREES						
	12	20	30	40	50	60	75
15000	1.72	2.98	4.48	5.72	6.48	6.91	7.05
14500	1.73	2.98	4.51	5.79	6.58	6.95	7.08
14000	1.74	2.98	4.55	5.85	6.68	7.00	7.10
13500	1.75	2.99	4.58	5.90	6.73	7.08	7.13
13000	1.77	3.00	4.62	5.93	6.78	7.14	7.16
12500	1.78	3.03	4.63	5.98	6.83	7.18	7.18
12000	1.78	3.05	4.65	6.04	6.88	7.20	7.20
11500	1.80	3.12	4.70	6.10	6.93	7.25	7.22
11000	1.82	3.15	4.75	6.15	6.98	7.30	7.24
10500	1.83	3.19	4.79	6.18	7.02	7.35	7.27
10000	1.86	3.23	4.83	6.22	7.07	7.40	7.30
9500	1.93	3.28	4.91	6.25	7.11	7.45	7.35
9000	2.00	3.36	5.00	6.28	7.18	7.50	7.40
8500	2.05	3.43	5.04	6.32	7.20	7.55	7.41
8000	2.10	3.52	5.10	6.36	7.22	7.60	7.42
7500	2.17	3.62	5.18	6.38	7.24	7.65	7.46
7000	2.22	3.70	5.25	6.40	7.26	7.70	7.50
6500	2.32	3.85	5.35	6.43	7.27	7.70	7.51
6000	2.42	4.00	5.45	6.48	7.28	7.70	7.52
5500	2.57	4.15	5.55	6.53	7.29	7.68	7.51
5000	2.72	4.32	5.65	6.58	7.30	7.66	7.50

Data sheet – 2 (Hydrostatic particulars)

Draught m	Displacement t		TPC t		MCTC tm		KMt M	KB m	LCB foap m	LCF foap m
	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000				
7.00	14576	14220	23.13	22.57	184.6	180.1	8.34	3.64	70.03	67.35
6.90	14345	13996	23.06	22.50	183.0	178.5	8.35	3.58	70.08	67.46
6.80	14115	13771	22.99	22.43	181.4	177.0	8.36	3.53	70.12	67.57
6.70	13886	13548	22.92	22.36	179.9	175.5	8.37	3.48	70.16	67.68
6.60	13657	13324	22.85	22.29	178.3	174.0	8.38	3.43	70.20	67.79
6.50	13429	13102	22.78	22.23	176.8	172.5	8.39	3.38	70.24	67.90
6.40	13201	12879	22.72	22.17	175.3	171.0	8.41	3.33	70.28	68.00
6.30	12975	12658	22.66	22.11	173.9	169.6	8.43	3.28	70.32	68.10
6.20	12748	12437	22.60	22.05	172.5	168.3	8.46	3.22	70.35	68.20
6.10	12523	12217	22.54	21.99	171.1	167.0	8.49	3.17	70.38	68.30
6.00	12297	11997	22.48	21.93	169.8	165.7	8.52	3.11	70.42	68.39
5.90	12073	11778	22.43	21.87	168.5	164.4	8.55	3.06	70.46	68.43
5.80	11848	11559	22.37	21.82	167.3	163.2	8.59	3.01	70.50	68.57
5.70	11625	11342	22.32	21.77	166.1	162.1	8.63	2.95	70.53	68.65
5.60	11402	11124	22.26	21.72	165.0	161.0	8.67	2.90	70.57	68.73
5.50	11180	10908	22.21	21.66	163.9	160.0	8.71	2.85	70.60	68.80
5.40	10958	10691	22.15	21.61	162.9	158.9	8.76	2.80	70.64	68.88
5.30	10737	10476	22.10	21.56	161.8	157.9	8.81	2.74	70.68	68.95
5.20	10516	10260	22.05	21.51	160.8	156.9	8.86	2.69	70.72	69.02
5.10	10296	10045	22.00	21.46	159.8	155.9	8.92	2.63	70.75	69.09
5.00	10076	9830	21.95	21.41	158.8	154.9	8.98	2.58	70.79	69.16
4.90	9857	9616	21.90	21.36	157.9	154.0	9.06	2.53	70.82	69.23
4.80	9638	9403	21.85	21.32	156.9	153.1	9.13	2.48	70.86	69.29
4.70	9420	9190	21.80	21.27	156.0	152.2	9.22	2.43	70.90	69.35
4.60	9202	8978	21.75	21.22	155.1	151.3	9.30	2.38	70.93	69.42
4.50	8985	8766	21.70	21.17	154.2	150.5	9.40	2.32	70.96	69.48
4.40	8768	8554	21.65	21.12	153.3	149.6	9.49	2.27	71.00	69.55
4.30	8552	8344	21.60	21.07	152.4	148.7	9.60	2.22	71.04	69.62
4.20	8336	8133	21.55	21.02	151.5	147.8	9.71	2.17	71.08	69.68
4.10	8121	7923	21.50	20.97	150.6	146.9	9.83	2.12	71.12	69.74
4.00	7906	7713	21.45	20.93	149.7	146.0	9.96	2.07	71.15	69.81
3.90	7692	7505	21.40	20.88	148.7	145.1	10.11	2.01	71.18	69.88
3.80	7478	7296	21.35	20.83	147.8	144.2	10.25	1.96	71.22	69.94
3.70	7265	7088	21.30	20.78	146.8	143.3	10.41	1.91	71.25	70.00
3.60	7052	6880	21.24	20.72	145.9	142.3	10.57	1.86	71.29	70.07
3.50	6840	6673	21.19	20.67	144.9	141.3	10.76	1.81	71.33	70.14

THESE HYDROSTATIC PARTICULARS HAVE BEEN DEVELOPED WITH THE VESSEL FLOATING ON EVEN KEEL

NAVIGATION 2016

DIRECTOR GENERAL'S OFFICE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA
CERTIFICATE OF COMPETENCY EXAMINATION

GRADE: CHIEF MATE/MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT: NAVIGATION
DATE : 12th February 2016, 0900 hrs to 1200 hrs.

Time allowed **THREE** hours — Total Marks 200
Answer **ALL** questions — Pass Marks 70%
Formulae and intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches where ever consider prudent.

---

1) A vessel departs Numea, New Caledonia bound for Concepcion, Chile. The charterer wishes the master to take full advantage of the shortest possible route to Coquimbo. But an ordinary great circle track enters the Winter Load Line Zone whose northern limit is 33° S.

After completion of loading at Numea, the vessel's Winter load line marks are overloaded by 390 tonnes of fuel and water which must be consumed before entering the Winter Zone. The vessel consumes 32 tonnes of fuel and water per day, at her service speed of 14.7 knots

Departure position off Numea:	22° 54' S	167° 06' E
Landfall position off Concepcion:	36° 48' S	073° 12' W

Calculate the shortest legal route.

(35 marks)

6160.27' ?

2) A vessel is making good a course of 120° (T) at a speed of 12 knots. The DR position at 0630 hrs was 32° 14' S 128° 17' E. Four stars were observed at different times, which gave the following azimuths and intercepts:

Time	Star	Azimuth	Intercept
0618	A	022°	2.2' away
0624	B	127°	2.1' towards
0639	C	185°	3.8' towards
0645	D	333°	6.5' away

The same DR was used for all intercepts. Find, by plotting, the vessel's most probable position at 0630 hrs.

(30 marks)

32° 17-3' S
128° 19-25' E

dep' 1.9'
d'lat = 3.3'

3) Blind pilotage means the navigation of a ship through restricted waters in low visibility with little or no recourse to the visual observation of objects outside the ship. Answer the following questions with reference to blind pilotage:

a) Briefly describe the general principals of planning and execution of blind pilotage

(08 marks)

b) Outline the Blind Pilotage **planning** guidelines.

(15 marks)

c) Outline the Blind Pilotage **execution** guidelines.

(12 marks)

4) A vessel trades regularly to the Baltic, where, in the winter months, sea ice and ice accretion may be experienced.

a) Explain the preparation required for a ship to navigate in Baltic Sea in ice conditions.

(15 marks)

b) List the sources from which a master may gain information about ice conditions in the Baltic.

(05 marks)

c) Describe five operational problems with regard to navigation in High latitudes.

(10 marks)

5) Answer the following questions with regard to search and rescue operations:

a) List the factors to be considered when establishing the search datum

(12 marks)

b) What are the factors that will be considered in appointing an On Scene Coordinator (OSC)?

(08 marks)

c) Describe the duties of the OSC at the end of a successful SAR operation

(05 marks)

2016

S.B.O.

MERCHANT SHIPPING SECRETARIAT
GOVERNMENT OF SRI LANKA
CERTIFICATE OF COMPETENCY EXAMINATION

GRADE: CHIEF MATE/MASTER ON SHIPS OF 500 GT OR MORE
SUBJECT: SHIPBOARD OPERATION
DATE : 11th February 2016, 0900 hrs to 1200 hrs.

Time allowed **THREE** hours — Total Marks 180
Answer **ALL** questions — Pass Marks 60%
Formulae and intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches where ever consider prudent. Electronic devices capable of storing and retrieving; are **not** allowed.

---

1) Write short notes on following specifying objectives and requirements
   a) Polar code
   b) Enhanced survey program
   c) Ballast water convention and Regulations
   d) Ship Sanitation Control Exemption Certificate (SSCEC)
   e) Shipboard energy Efficiency Management Plan
   f) Cargo Securing Manual

(05 marks each)

2) Answer the following questions with regard to carriage of bulk cargoes:
   a) With reference to solid bulk cargoes, explain in detail on board test procedure for cargoes which may liquefy to determine the possibility of liquefaction.

(10 marks)

   b) With reference to ISM code describe how you implement ISM on a brand new bulk carrier, if this bulk carrier is the first bulk vessel in a company with container fleet.

(10 marks)

   c) With reference to International grain code, describe how you derive heeling arm curve.

(10 marks)

3) 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)

EECP
EED2

b) For the purpose of seaworthiness and cargo worthiness of a vessel, Flag states and classification societies are maintaining special relationship with each other. Explain above statement.

(10 marks)

4) A vessel is to load a heavy cargo unit require lashing according to vessels CSM (Cargo Securing Manual). Find the minimum required number of lashing if below mentioned lashing materials being used for the purpose and show lashing arrangement that you will adapt with a suitable diagram. **Use the formulas and tables in Annex – I.**

Details of the vessel

Length = 180 m | Breadth = 25 m | GM = 3.2 m
Speed = 18Kts | load density 25MT/m³ | TPC = 56MT/cm
MCTC = 578

Cargo unit is to load at 126m from AP on twin deck.

Specification of cargo unit

Weight = 48MT Dimensions = 8 x 8 x 8 in meters.

Details of securing material

Wire rope (single Use): breaking strength = 125 kN.
Shackles, turnbuckles, deck rings: breaking strength = 180 kN
Stowage on dunnage boards, μ=0.3 (Steel – timber)

(30 marks)

5) Answer following in relation to managerial stability of vessels:

a) A vessel with 5 cargo holds has loaded with bulk Alumina powder in cargo holds and general cargoes on deck experienced a bad weather and inclined to a particular angel. Stowage factor and angle of repose of the bulk alumina is 1.26M³/MT and 14° respectively. Explain in detail how you will asses above situation and effective remedial actions to be taken for all identified situations.

(15 marks)

b) With reference to above it is identified that listing of the vessel has caused due to shifting of bulk Alumina powder. Explain in detail with suitable diagrams and GZ curves the effect of above cargo shift on vessels transverse stability.

(15 Marks)

06) a) With regard to tanker operation, explain in brief the hazards of the following tankers.

i) Oil and bulk ore / Oil carriers

ii) Liquefied Gas Carriers

iii) Chemical Carriers (05 marks each) x 3

a) List information that should be provided by a tanker to the terminal on arrival.

(15 marks)

Annex - I

Formulas and Tables to be used for Lashing Calculations

External forces calculating formula

$$F_{(x\,y\,z)} = ma_{(x\,y\,z)} + F_{w(x\,y\,z)} - F_{c(x\,y\,z)}$$

Balance forces calculation formulas

Transverse sliding : $Fy \leq \mu \cdot m \cdot g + fy_1 \cdot CS_1 + \ldots + fy_n \cdot CS_n$

Longitudinal sliding : $Fx \leq \mu(m \cdot g - Fz) + fx_1 \cdot CS_1 + \ldots + fx_n \cdot CS_n$

Transverse tipping : $Fy \cdot a \leq b \cdot m \cdot g + 0.9(CS_1 \cdot c_1 + CS_2 \cdot c_2 + \ldots + CS_n \cdot c_n)$

MSLs for different securing devices (Table 1)

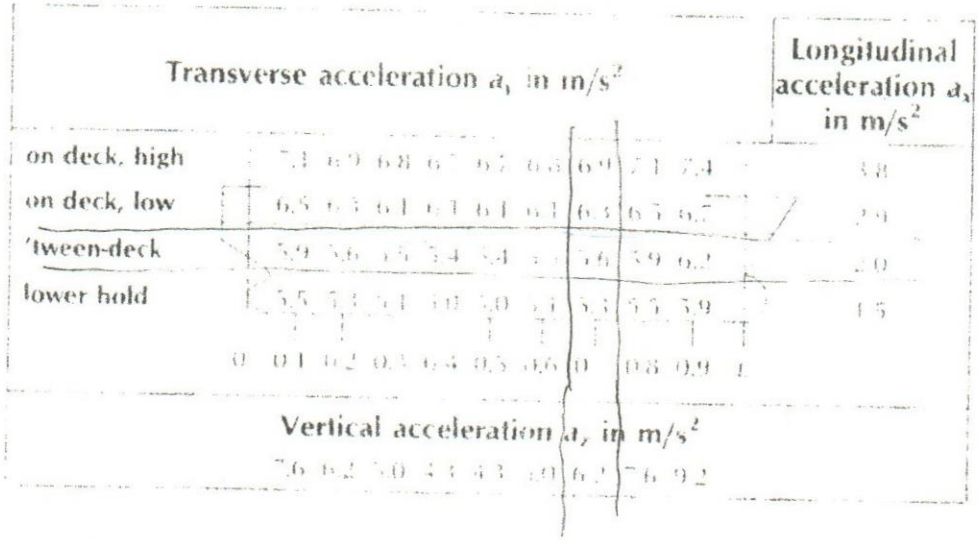
Material	MSL
Shackles, deckeyes, twistlocks, lashing rods, D-rings, stackers, bridge fittings, turnbuckles of mild steel	50% of breaking strength
Fibre rope	33% of breaking strength
Wire rope (single use)	80% of breaking strength
Wire rope (re-useable)	30% of breaking strength
Steel band (single use)	70% of breaking strength
Chains	50% of breaking strength
Web lashings	50% of breaking strength

+CS

257.4 ?

4/

The basic acceleration data (Table 2)



Correction factors for length and speed (Table 3)

Length [m] / Speed [kN]	30	40	50	60	70	80	90	100	120	140	160	180	200	250	300
9	1.37	1.31	1.20	1.09	1.00	0.92	0.85	0.79	0.70	0.63	0.57	0.53	0.49	0.41	0.36
12	1.56	1.47	1.34	1.22	1.12	1.03	0.96	0.90	0.79	0.72	0.65	0.60	0.56	0.48	0.42
15	1.75	1.64	1.49	1.36	1.24	1.15	1.07	1.00	0.89	0.80	0.73	0.68	0.63	0.55	0.48
18	1.94	1.80	1.64	1.49	1.37	1.27	1.18	1.10	0.98	0.89	0.82	0.76	0.71	0.61	0.54
21	2.13	1.96	1.78	1.62	1.49	1.38	1.29	1.21	1.08	0.98	0.90	0.83	0.78	0.68	0.60
24	2.32	2.13	1.93	1.76	1.62	1.50	1.40	1.31	1.17	1.07	0.98	0.91	0.85	0.74	0.66

Table 3 – Correction factors for length and speed

Correction factor for B/GM<13 (Table 4)

B/GM	4	5	6	7	8	9	10	11	12	13 —
on deck, high	2.30	1.96	1.72	1.56	1.40	1.27	1.19	1.11	1.05	1.00
on deck, low	1.92	1.70	1.53	1.42	1.30	1.21	1.14	1.09	1.04	1.00
'tween-deck	1.54	1.42	1.33	1.26	1.19	1.14	1.09	1.06	1.03	1.00
lower hold	1.31	1.24	1.19	1.15	1.12	1.09	1.06	1.04	1.02	1.01

Table 4 – Correction factors for B/GM 13

72·96
257·4
226·18

Friction coefficients (μ) (Table 5)

Materials in contact	Friction coefficient, (μ)
timber-timber, wet or dry	0.4
steel-timber or steel-rubber	0.3
steel-steel, dry	0.1
steel-steel, wet	0.0

Table 5 – Friction coefficients

Table 7 – fx-values and fy-values as a function of α, β and μ

Table 7.1 for μ = 0.4

β for fy	α														
	-30	-20	-10	0	10	20	30	40	45	50	60	70	80	90	
0	0.67	0.80	0.92	1.00	1.05	1.08	1.07	1.02	0.99	0.95	0.85	0.72	0.57	0.40	90
10	0.65	0.79	0.90	0.98	1.04	1.06	1.05	1.01	0.98	0.94	0.84	0.71	0.56	0.40	80
20	0.61	0.75	0.86	0.94	0.99	1.02	1.01	0.98	0.95	0.91	0.82	0.70	0.56	0.40	70
30	0.55	0.68	0.78	0.87	0.92	0.95	0.95	0.92	0.90	0.86	0.78	0.67	0.54	0.40	60
40	0.46	0.58	0.68	0.77	0.82	0.86	0.86	0.84	0.82	0.80	0.73	0.64	0.53	0.40	50
50	0.36	0.47	0.56	0.64	0.70	0.74	0.76	0.75	0.74	0.72	0.67	0.60	0.51	0.40	40
60	0.23	0.33	0.42	0.50	0.56	0.61	0.63	0.64	0.64	0.63	0.60	0.55	0.48	0.39	30
70	0.10	0.18	0.27	0.34	0.41	0.46	0.50	0.52	0.52	0.53	0.52	0.49	0.45	0.40	20
80	-0.05	0.03	0.10	0.17	0.24	0.30	0.35	0.39	0.41	0.42	0.43	0.44	0.42	0.40	10
90	-0.20	-0.14	-0.07	0.00	0.07	0.14	0.20	0.26	0.28	0.31	0.35	0.38	0.39	0.40	0

Table 7.2 for μ = 0.3

β for fy	α														
	30	20	-10	0	10	20	30	40	45	50	60	70	80	90	
0	0.72	0.84	0.95	1.00	1.04	1.04	1.02	0.96	0.92	0.87	0.76	0.62	0.47	0.30	90
10	0.70	0.82	0.92	0.98	1.02	1.03	1.00	0.95	0.91	0.86	0.75	0.62	0.47	0.30	80
20	0.66	0.78	0.87	0.94	0.98	0.99	0.96	0.91	0.88	0.83	0.73	0.60	0.46	0.30	70
30	0.60	0.71	0.80	0.87	0.90	0.92	0.90	0.86	0.82	0.79	0.69	0.58	0.45	0.30	60
40	0.51	0.62	0.70	0.77	0.81	0.82	0.81	0.78	0.75	0.72	0.64	0.54	0.43	0.30	50
50	0.41	0.50	0.58	0.64	0.69	0.71	0.71	0.69	0.67	0.64	0.58	0.50	0.41	0.30	40
60	0.28	0.37	0.44	0.50	0.54	0.57	0.58	0.58	0.57	0.55	0.51	0.45	0.38	0.30	30
70	0.15	0.22	0.28	0.34	0.39	0.42	0.45	0.45	0.45	0.45	0.43	0.40	0.35	0.30	20
80	0.00	0.06	0.12	0.17	0.22	0.27	0.31	0.33	0.33	0.34	0.35	0.34	0.33	0.30	10
90	-0.15	-0.10	-0.05	0.00	0.05	0.10	0.15	0.19	0.21	0.23	0.26	0.28	0.30	0.30	0

Table 7.3 for μ = 0.2

β for fy	α														β for fx
	-30	-20	-10	0	10	20	30	40	45	50	60	70	80	90	
0	0.77	0.87	0.95	1.00	1.02	1.01	0.97	0.89	0.85	0.80	0.67	0.53	0.37	0.20	90
10	0.75	0.86	0.94	0.98	1.00	0.99	0.95	0.88	0.84	0.79	0.67	0.52	0.37	0.20	80
20	0.71	0.81	0.89	0.94	0.96	0.95	0.91	0.85	0.81	0.76	0.64	0.51	0.36	0.20	70
30	0.65	0.75	0.82	0.87	0.89	0.88	0.85	0.79	0.75	0.71	0.61	0.48	0.35	0.20	60
40	0.56	0.65	0.72	0.77	0.79	0.79	0.76	0.72	0.68	0.65	0.56	0.45	0.33	0.20	50
50	0.46	0.54	0.60	0.64	0.67	0.67	0.66	0.62	0.60	0.57	0.49	0.41	0.31	0.20	40
60	0.33	0.40	0.46	0.50	0.53	0.54	0.53	0.51	0.49	0.47	0.42	0.36	0.28	0.20	30
70	0.20	0.25	0.30	0.34	0.37	0.39	0.40	0.39	0.38	0.37	0.34	0.30	0.26	0.20	20
80	0.05	0.09	0.14	0.17	0.21	0.23	0.25	0.26	0.26	0.26	0.26	0.25	0.23	0.20	10
90	-0.10	-0.07	-0.03	0.00	0.03	0.07	0.10	0.13	0.14	0.15	0.17	0.19	0.20	0.20	0

Table 7.4 for μ = 0.1

β for fy	α														β for fx
	-30	-20	-10	0	10	20	30	40	45	50	60	70	80	90	
0	0.82	0.91	0.97	1.00	1.00	0.97	0.92	0.83	0.78	0.72	0.59	0.44	0.27	0.10	90
10	0.80	0.89	0.95	0.98	0.99	0.96	0.90	0.82	0.77	0.71	0.58	0.43	0.27	0.10	80
20	0.76	0.85	0.91	0.94	0.94	0.92	0.86	0.78	0.74	0.68	0.56	0.42	0.26	0.10	70
30	0.70	0.78	0.84	0.87	0.87	0.85	0.80	0.73	0.68	0.63	0.52	0.39	0.25	0.10	60
40	0.61	0.69	0.74	0.77	0.77	0.75	0.71	0.65	0.61	0.57	0.47	0.36	0.23	0.10	50
50	0.51	0.57	0.62	0.64	0.65	0.64	0.61	0.56	0.53	0.49	0.41	0.31	0.21	0.10	40
60	0.38	0.44	0.48	0.50	0.51	0.50	0.48	0.45	0.42	0.40	0.34	0.26	0.19	0.10	30
70	0.25	0.29	0.32	0.34	0.35	0.36	0.35	0.33	0.31	0.30	0.26	0.21	0.16	0.10	20
80	0.10	0.13	0.15	0.17	0.19	0.20	0.20	0.20	0.19	0.19	0.17	0.15	0.13	0.10	10
90	-0.05	-0.03	-0.02	0.00	0.02	0.03	0.05	0.06	0.07	0.08	0.09	0.09	0.10	0.10	0

Table 7.5 for $\mu = 0.0$

β for fy	α														β for fx
	-30	-20	-10	0	10	20	30	40	45	50	60	70	80	90	
0	0.87	0.94	0.98	1.00	0.98	0.94	0.87	0.77	0.71	0.64	0.50	0.34	0.17	0.00	**90**
10	0.85	0.93	0.97	0.98	0.97	0.93	0.85	0.75	0.70	0.63	0.49	0.34	0.17	0.00	**80**
20	0.81	0.88	0.93	0.94	0.93	0.88	0.81	0.72	0.66	0.60	0.47	0.32	0.16	0.00	**70**
30	0.75	0.81	0.85	0.87	0.85	0.81	0.75	0.66	0.61	0.56	0.43	0.30	0.15	0.00	**60**
40	0.66	0.72	0.75	0.77	0.75	0.72	0.66	0.59	0.54	0.49	0.38	0.26	0.13	0.00	**50**
50	0.56	0.60	0.63	0.64	0.63	0.60	0.56	0.49	0.45	0.41	0.32	0.22	0.11	0.00	**40**
60	0.43	0.47	0.49	0.50	0.49	0.47	0.43	0.38	0.35	0.32	0.25	0.17	0.09	0.00	**30**
70	0.30	0.32	0.34	0.34	0.34	0.32	0.30	0.26	0.24	0.22	0.17	0.12	0.06	0.00	**20**
80	0.15	0.16	0.17	0.17	0.17	0.16	0.15	0.13	0.12	0.11	0.09	0.06	0.03	0.00	**10**
90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0**

Remark: $fx = \cos\alpha \cdot \sin\beta + \mu \cdot \sin\alpha$ $fy = \cos\alpha \cdot \cos\beta + \mu \cdot \sin\alpha$

2ND class FT

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

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE (UNLIMITED)
SUBJECT : SHIP'S STABILITY
DATE : 10th December 2015

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) A box-shaped barge of uniform construction is 32 m long and displaces 352 t when empty, is divided by transverse bulkheads into four equal compartments. Cargo is loaded into each compartment and level stowed as follows:

No. 1 hold – 192 tonnes No. 2 hold – 224 tonnes
No. 3 hold – 272 tonnes No. 4 hold – 176 tonnes

a) Construct load and shearing force diagrams at the bulkheads (15 marks)

b) Construct bending moments curve for the above positions (10 marks)

c) Find the value of the maximum bending moment along the ship's length (05 marks)

2) A box shaped vessel floating on an even keel in salt water has the following particulars:

Length	130.0 m	Breadth	20.0 m
Draught	5.0 m	KG	4.5 m

There is an empty forward end compartment of 20.0 m length that extends the full width of the vessel.

Calculate the final draughts fore and aft if this compartment is bilged. (30 marks)

3) A bulk carrier, fully laden with ore in alternate holds has to be dry docked in the following conditions:

Displacement	73000 t	KM	13.10 m
Draughts	12.45 m (even keel)	Mean TPC	62
KG	10.9 m		

The dock initially has 14 m of water over the upper surfaces of the blocks which have no declivity.

a) Calculate the GM when the water level has been lowered by 4.0 m

(20 marks)

b) Explain why a small stern trim is generally to be preferred to the even keel condition when entering dry dock

(04 marks)

c) Explain the possible dangers involved in dry docking this vessel and how these may be overcome if dry docking is for purpose of:
   i) Inspection of some side shell damage only;
   ii) Inspection of possible bottom damage.

(03 marks each)

4) The attached hydrostatic particulars provide the hydrostatic data for a vessel of, length between perpendiculars 140.0 m and summer load displacement of 14115 t.

In partly loaded condition, the vessel has the following draughts in salt water:
Fwd 5.26 m
Aft 5.48 m

The vessel is to complete loading at the summer displacement with a trim of 0.5 m by stern. The remaining cargo is to be loaded in two holds:

No. 1 hold lcg 116.0 m foap
No. 4 hold lcg 32 m foap

Using the hydrostatic data sheet, calculate each of the following:

a) The quantity to load in each hold

(25 marks)

b) The final draughts in salt water

(05 marks)

5) Answer the following questions with reference to the IMO stability criteria & ship's stability:

a) State the minimum stability requirements for a vessel in accordance with the IMO stability criteria

(10 marks)

b) At ballast passage a particular vessel complies in every respect with the stability requirements of the IMO stability criteria. At load draught, with the same GM, it does not comply. With the aid of a suitable diagram, explain why this may be so.

(10 marks)

c) Show, by means of labeled diagrams, the difference between a GZ curve for a vessel at an angle of loll and a GZ curve for a vessel with list due to an off centre weight.

(10 marks)

6) A vessel is floating upright with the following particulars:

Displacement = 20000 t KG = 9.0 m

The following cargo and bunkers are then loaded:

500 t	Kg 12.0 m	6.0 m to starboard of centerline
340 t	Kg 4.5 m	4.5 m to starboard of centerline
200 t	Kg 11.0 m	6.0 m to port of centerline

Bunkers (relative density 0.9) 150 t (Kg 1.2 m), in a centre tank of length 8 m, breadth 15 m which is slack.

Calculate the list if the final KM is 10.55 m

(30 marks)

HYDROSTATIC PARTICULARS 'A'

Draught m	Displacement t		TPC t		MCTC tm		KMt M	KB m	LCB foap m	LCF foap m
	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000				
7.00	14576	14220	23.13	22.57	184.6	180.1	8.34	3.64	70.03	67.35
6.90	14345	13996	23.06	22.50	183.0	178.5	8.35	3.58	70.08	67.46
6.80	14115	13771	22.99	22.43	181.4	177.0	8.36	3.53	70.12	67.57
6.70	13886	13548	22.92	22.36	179.9	175.5	8.37	3.48	70.16	67.68
6.60	13657	13324	22.85	22.29	178.3	174.0	8.38	3.43	70.20	67.79
6.50	13429	13102	22.78	22.23	176.8	172.5	8.39	3.38	70.24	67.90
6.40	13201	12879	22.72	22.17	175.3	171.0	8.41	3.33	70.28	68.00
6.30	12975	12658	22.66	22.11	173.9	169.6	8.43	3.28	70.32	68.10
6.20	12748	12437	22.60	22.05	172.5	168.3	8.46	3.22	70.35	68.20
6.10	12523	12217	22.54	21.99	171.1	167.0	8.49	3.17	70.38	68.30
6.00	12297	11997	22.48	21.93	169.8	165.7	8.52	3.11	70.42	68.39
5.90	12073	11778	22.43	21.87	168.5	164.4	8.55	3.06	70.46	68.43
5.80	11848	11559	22.37	21.82	167.3	163.2	8.59	3.01	70.50	68.57
5.70	11625	11342	22.32	21.77	166.1	162.1	8.63	2.95	70.53	68.65
5.60	11402	11124	22.26	21.72	165.0	161.0	8.67	2.90	70.57	68.73
5.50	11180	10908	22.21	21.66	163.9	160.0	8.71	2.85	70.60	68.80
5.40	10958	10691	22.15	21.61	162.9	158.9	8.76	2.80	70.64	68.88
5.30	10737	10476	22.10	21.56	161.8	157.9	8.81	2.74	70.68	68.95
5.20	10516	10260	22.05	21.51	160.8	156.9	8.86	2.69	70.72	69.02
5.10	10296	10045	22.00	21.46	159.8	155.9	8.92	2.63	70.75	69.09
5.00	10076	9830	21.95	21.41	158.8	154.9	8.98	2.58	70.79	69.16
4.90	9857	9616	21.90	21.36	157.9	154.0	9.06	2.53	70.82	69.23
4.80	9638	9403	21.85	21.32	156.9	153.1	9.13	2.48	70.86	69.29
4.70	9420	9190	21.80	21.27	156.0	152.2	9.22	2.43	70.90	69.35
4.60	9202	8978	21.75	21.22	155.1	151.3	9.30	2.38	70.93	69.42
4.50	8985	8766	21.70	21.17	154.2	150.5	9.40	2.32	70.96	69.48
4.40	8768	8554	21.65	21.12	153.3	149.6	9.49	2.27	71.00	69.55
4.30	8552	8344	21.60	21.07	152.4	148.7	9.60	2.22	71.04	69.62
4.20	8336	8133	21.55	21.02	151.5	147.8	9.71	2.17	71.08	69.68
4.10	8121	7923	21.50	20.97	150.6	146.9	9.83	2.12	71.12	69.74
4.00	7906	7713	21.45	20.93	149.7	146.0	9.96	2.07	71.15	69.81
3.90	7692	7505	21.40	20.88	148.7	145.1	10.11	2.01	71.18	69.88
3.80	7478	7296	21.35	20.83	147.8	144.2	10.25	1.96	71.22	69.94
3.70	7265	7088	21.30	20.78	146.8	143.3	10.41	1.91	71.25	70.00
3.60	7052	6880	21.24	20.72	145.9	142.3	10.57	1.86	71.29	70.07
3.50	6840	6673	21.19	20.67	144.9	141.3	10.76	1.81	71.33	70.14

THESE HYDROSTATIC PARTICULARS HAVE BEEN DEVELOPED WITH THE VESSEL FLOATING ON EVEN KEEL

ND Class II

Ministry Past Papers

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

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE (UNLIMITED)
SUBJECT : SHIP'S STABILITY
DATE : 21th August 2015

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) A vessel, initially upright, is to carry out an inclining test. Present displacement 5700 t, KM 10.83m. Total weights on board during the experiment are:
   - Ballast 370 t, KG 3.47m, tank full.
   - Bunkers 165 t, KG 3.98m, free surface moment 956 tm.
   - Water 95 t, KG 4.44m, slack tank. Free surface moment 910 tm.
   - Boiler water 19 t, KG 4.18m, free surface moment 102 tm.
   - Two inclining weights each weighing 28 t, KG 8.44m
   - A deck crane weights 19 t and still ashore will be fitted on the vessel at a KG of 9.74m at a later date.

   a) The plumb lines have an effective vertical length of 7.85m. The inclining weights are shifted transversely 7.0 m on each occasion and the mean horizontal deflection of the plumb line is 0.65m. Calculate the vessel's lightship KG.

   (25 marks)

   b) Explain why a vessel's lightship KG may change over a period of time.

   (05 marks)

2) A box shaped vessel floating upright on an even keel in salt water has the following particulars:
   - Length BP : 150.00 m
   - Breadth: 28.00 m
   - Even keel draught: 8.60 m
   - KG: 9.20 m

   The vessel has two longitudinal bulkheads each 9.00 m from the side of the vessel. Calculate the angle of heel if an amidship side compartment having a length of 24.00m is bilged.

   (30 marks)

3) Answer the following questions with reference to GZ curves;

a) Derive the following formula with an aid of a diagram;

$GZ = \quad KN - KG \times \sin\theta$

(05 marks)

b) A vessel has a displacement of 85,000 t, KG_{solid} of 10.68 m, FSM of 6761 tm. With the aid of Data sheet -1 and Data sheet – 2 draw a GZ curve and determine the following;

(16 marks)

i) Maximum GZ and the angle at which it occurs

(03 marks)

ii) The range of positive stability and

(03 marks)

iii) The angle of heel at which the deck edge would immerse

(03 marks)

4) A vessel is floating in SW at draught Fwd 3.80 m, aft 6.40 m. A total of 2400 tonne of cargo is to be loaded.

- Space is available in NO. 2 (LCG 100 m foap) and in No. 4 (LCG 54 m foap)
- Length B.P. 136 m
- LCF 67 m foap
- TPC 21.8
- MCTC 150

a) Calculate the weight of cargo to load in each space in order to finish with a trim of 1.0 m by the stern.

(20 marks)

b) Determine the final draughts fwd and aft.

(10 marks)

5) Answer the following questions with reference to loading grain in bulk;

a) State the intact stability criteria for ships carrying grain in bulk

(20 marks)

b) Derive the formula;

$\lambda_o = \Sigma$ VHM / (Stowage Factor x W)

(05 marks)

c) The grain stability criteria states "After loading, the master shall ensure that the ship is upright before proceeding to sea". Describe the reason for this criteria.

(05 marks)

6) A vessel initially upright and on an even keel, has the following particulars:
   - Draught in salt water 6.80 m
   - Breadth 20.42 m
   - KG 7.88 m
   - Further particulars of the vessel can be found in the "Hydrostatic particulars A" provided below.

The vessel's heavy lift derrick is to be used to discharge a 60 tonne tank from a centreline position, KG 5.23m. The derrick head is 29.28m above the keel and 15.80m out of the centreline when plumbing over side. Answer the following questions;

a) Calculate the maximum list angle.

(07 marks)

b) Calculate the increase in draught when the vessel is at maximum list angle as calculated in question (a) above, assuming rectangular cross section midships.

(05 marks)

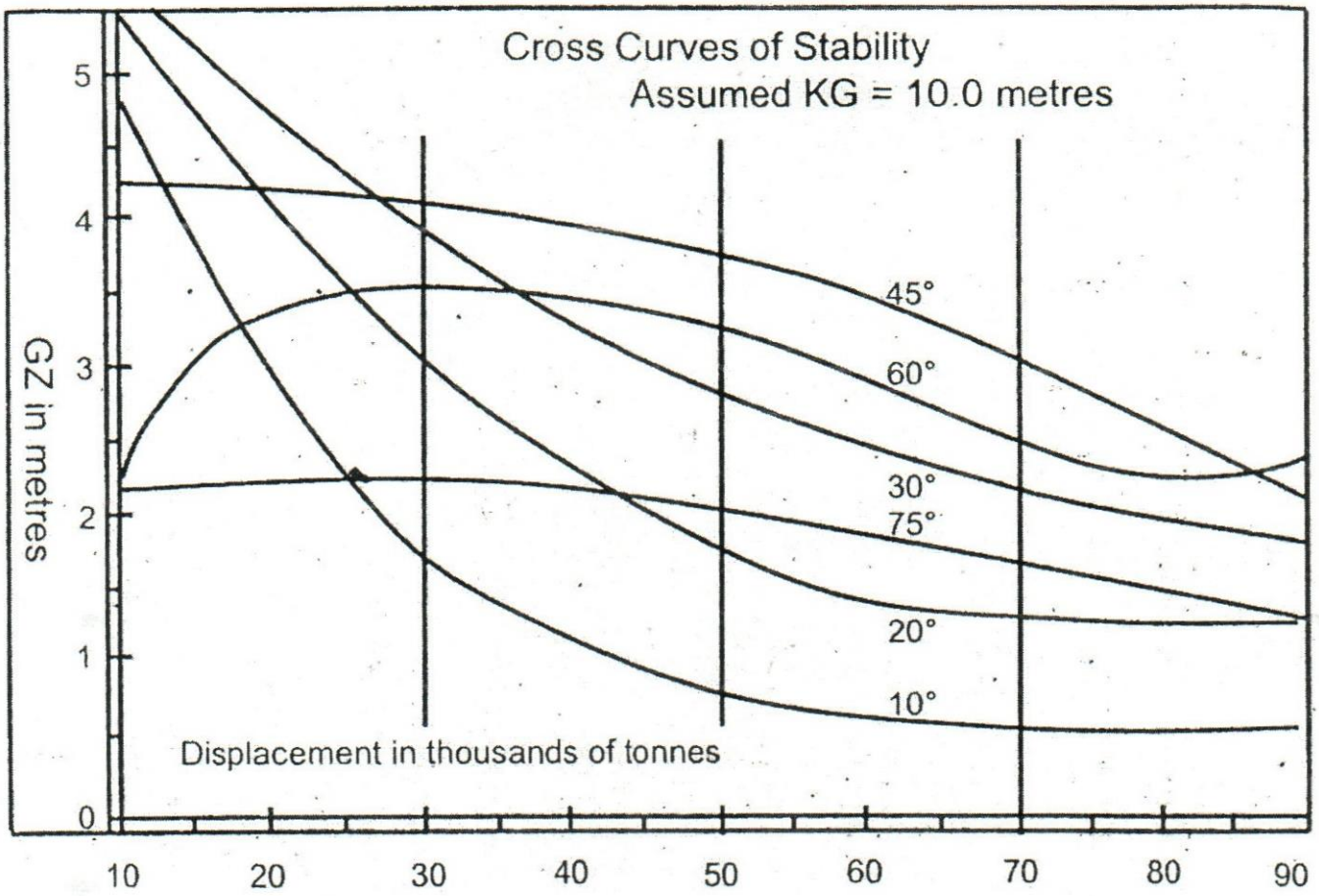
c) Calculate the maximum allowable KG prior to discharging the tank in order to limit the list angle to 5°.

(10 marks)

d) List the methods available to reduce the KG from 7.88 m to the required KG as calculated in above (c).

(08 marks)

DATA SHEET – 1


Cross Curves of Stability
Assumed KG = 10.0 metres
GZ in metres
Displacement in thousands of tonnes
45°
60°
30°
75°
20°
10°
0
1
2
3
4
5
10
20
30
40
50
60
70
80
90

DATA SHEET – 1

Hydrostatic particulars

d	W sw	TPC	MCTC	HB	HF	KB	KM_T	KM_L
11.00	70941	68.58	1083.0	5.37F	1.96F	5.64	13.24	366
11.20	72315	68.74	1091.3	5.30F	1.72F	5.75	13.22	362
11.40	73693	68.91	1099.5	5.23F	1.47F	5.85	13.20	358
11.60	75074	69.07	1107.8	5.16F	1.22F	5.95	13.18	354
11.80	76458	69.24	1115.9	5.09F	0.98F	6.06	13.17	351
12.00	77845	69.40	1124.0	5.02F	0.74F	6.16	13.16	347
12.20	79237	69.56	1131.3	4.94F	0.53F	6.26	13.16	343
12.40	80633	69.72	1138.4	4.87F	0.32F	6.37	13.16	340
12.60	82032	69.88	1145.5	4.79F	0.12F	6.47	13.16	336
12.80	83434	70.03	1152.4	4.71F	0.08A	6.58	13.17	333
13.00	84839	70.19	1159.1	4.62F	0.27A	6.68	13.18	329
13.20	86246	70.34	1165.8	4.54F	0.46A	6.79	13.19	326
13.40	87657	70.49	1172.3	4.46F	0.64A	6.89	13.21	323
13.60	89070	70.63	1178.8	4.38F	0.81A	7.00	13.22	320
13.80	90485	70.78	1185.1	4.29F	0.98A	7.10	13.25	316
14.00	91904	70.92	1191.3	4.21F	1.14A	7.21	13.27	313
14.20	93324	71.06	1197.4	4.13F	1.29A	7.31	13.30	310
14.40	94747	71.19	1203.3	4.04F	1.44A	7.42	13.33	308
14.60	96173	71.32	1209.2	3.96F	1.58A	7.52	13.36	305
14.80	97600	71.45	1215.0	3.88F	1.72A	7.63	13.39	302
15.00	99030	71.57	1220.7	3.79F	1.84A	7.73	13.43	299

d = draft in metres, K = keel, H = amidships, LOA 245 m,

LBP 236 m, GT 42000 Tons, NT 28000 Tons

Light W 14000 t, Load W 98000 t, Deadweight 84000 t.

DATA SHEET – 3

HYDROSTATIC PARTICULARS 'A'

Draught m	Displacement t		TPC t		MCTC tm		KMt M	KB m	LCB foap m	LCF foap m
	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000				
7.00	14576	14220	23.13	22.57	184.6	180.1	8.34	3.64	70.03	67.35
6.90	14345	13996	23.06	22.50	183.0	178.5	8.35	3.58	70.08	67.46
6.80	14115	13771	22.99	22.43	181.4	177.0	8.36	3.53	70.12	67.57
6.70	13886	13548	22.92	22.36	179.9	175.5	8.37	3.48	70.16	67.68
6.60	13657	13324	22.85	22.29	178.3	174.0	8.38	3.43	70.20	67.79
6.50	13429	13102	22.78	22.23	176.8	172.5	8.39	3.38	70.24	67.90
6.40	13201	12879	22.72	22.17	175.3	171.0	8.41	3.33	70.28	68.00
6.30	12975	12658	22.66	22.11	173.9	169.6	8.43	3.28	70.32	68.10
6.20	12748	12437	22.60	22.05	172.5	168.3	8.46	3.22	70.35	68.20
6.10	12523	12217	22.54	21.99	171.1	167.0	8.49	3.17	70.38	68.30
6.00	12297	11997	22.48	21.93	169.8	165.7	8.52	3.11	70.42	68.39
5.90	12073	11778	22.43	21.87	168.5	164.4	8.55	3.06	70.46	68.43
5.80	11848	11559	22.37	21.82	167.3	163.2	8.59	3.01	70.50	68.57
5.70	11625	11342	22.32	21.77	166.1	162.1	8.63	2.95	70.53	68.65
5.60	11402	11124	22.26	21.72	165.0	161.0	8.67	2.90	70.57	68.73
5.50	11180	10908	22.21	21.66	163.9	160.0	8.71	2.85	70.60	68.80
5.40	10958	10691	22.15	21.61	162.9	158.9	8.76	2.80	70.64	68.88
5.30	10737	10476	22.10	21.56	161.8	157.9	8.81	2.74	70.68	68.95
5.20	10516	10260	22.05	21.51	160.8	156.9	8.86	2.69	70.72	69.02
5.10	10296	10045	22.00	21.46	159.8	155.9	8.92	2.63	70.75	69.09
5.00	10076	9830	21.95	21.41	158.8	154.9	8.98	2.58	70.79	69.16
4.90	9857	9616	21.90	21.36	157.9	154.0	9.06	2.53	70.82	69.23
4.80	9638	9403	21.85	21.32	156.9	153.1	9.13	2.48	70.86	69.29
4.70	9420	9190	21.80	21.27	156.0	152.2	9.22	2.43	70.90	69.35
4.60	9202	8978	21.75	21.22	155.1	151.3	9.30	2.38	70.93	69.42
4.50	8985	8766	21.70	21.17	154.2	150.5	9.40	2.32	70.96	69.48
4.40	8768	8554	21.65	21.12	153.3	149.6	9.49	2.27	71.00	69.55
4.30	8552	8344	21.60	21.07	152.4	148.7	9.60	2.22	71.04	69.62
4.20	8336	8133	21.55	21.02	151.5	147.8	9.71	2.17	71.08	69.68
4.10	8121	7923	21.50	20.97	150.6	146.9	9.83	2.12	71.12	69.74
4.00	7906	7713	21.45	20.93	149.7	146.0	9.96	2.07	71.15	69.81
3.90	7692	7505	21.40	20.88	148.7	145.1	10.11	2.01	71.18	69.88
3.80	7478	7296	21.35	20.83	147.8	144.2	10.25	1.96	71.22	69.94
3.70	7265	7088	21.30	20.78	146.8	143.3	10.41	1.91	71.25	70.00
3.60	7052	6880	21.24	20.72	145.9	142.3	10.57	1.86	71.29	70.07
3.50	6840	6673	21.19	20.67	144.9	141.3	10.76	1.81	71.33	70.14

THESE HYDROSTATIC PARTICULARS HAVE BEEN DEVELOPED WITH THE VESSEL FLOATING ON EVEN KEEL

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

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE (UNLIMITED)
SUBJECT : SHIP'S STABILITY
DATE : May 2015

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) Worksheet -1 (Trim and Stability pro-forma) provides data relevant to a particular condition of the loading of a vessel in salt water.

By the completion of the Worksheet – 1 with the aid of the 'Hydrostatic Particulars Table A' and showing all additional calculations in your answer book, determine each of the following:

a) Final fwd and aft draughts

b) Final transverse GM_f

(12 marks)

(18 marks)

2) With the aid of labeled sketches, show the effects of each of the following on a vessel's curve of statical stability:

a) a strong beam wind on a vessel with a high freeboard and a large number of containers on deck;

b) a change in the KG of the vessel due to the consumption of fuel and water from double bottom tanks during the voyage (assume the tanks are full at the time of sailing);

c) the loading of a full cargo of timber on deck

(10 marks each)

3) Answer the following questions with regards to bilging of a vessel:

a) Briefly describe the contents of a damage stability calculations book available onboard a vessel.

(05 marks)

b) A box shaped vessel 120 m long and 15 m wide floats at an even keel draught of 6.5 m in salt water. A compartment at the forward end, 10 m long 15 m wide, is empty. Assuming the bilge GM_L is equal to bilge BM_L, find the new draughts fwd and aft if this compartment gets bilged.

(25 marks)

4) Answer the following questions with regards to change of density:

a) With the aid of a labelled sketch explain why the trim is subjected to change when a vessel moves from one density of water to another.

(05 marks)

b) A vessel floating in salt water has the following particulars:

Displacement	18,000 t	LBP	220 m
LCB	100 m foap	LCF	120 m foap
MCTC	200	TPC	23
Draft fwd	7.85 m	aft	8.55 m

The vessel has two bunker tanks. The forward tank has it's centroid 205 m forward of the aft perpendicular and the after tank has it's centroid 75 m forward of the aft perpendicular. Calculate the following;

i) The amount of fuel to transfer between the bunker tanks in order to arrive alongside at a fresh water berth on an even keel.

(15 marks)

ii) The arrival draft forward and aft.

(10 marks)

5) A box shaped vessel of length 98.0 m, breadth 14.2 m, depth 9.3 m is floating in salt water at an even keel draught of 5.6 m.

a) Calculate the righting moment when the vessel is heeled to the angle of deck edge immersion if the KG is 5.50 m.

(20 marks)

b) Calculate the angle of loll if the KG is 6.0 m.

(10 marks)

6) Answer the following questions with regards to free surface effect and list:

a) List the factors which affect the free surface effect.

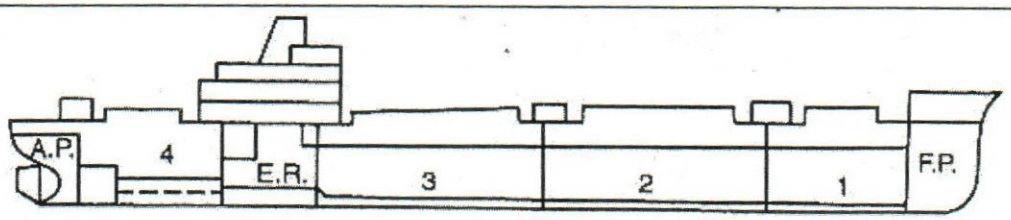
(10 marks)

b) A vessel of 8200 t displacement, KG 6.3 m, KM 8.0 m is floating upright. A double bottom tank of regular cross section is divided in to two equal parts each 40.0 m long,

8.0 m wide and 1.6 m deep. The starboard side tank is full of fresh water and the port side tank is empty. Calculate the angle of list when half of the water is transferred to the port side tank.

(20 marks)

Worksheet -1 (Trim and Stability pro-forma)



CONDITION: FULLY LOADED – GENERAL CARGO

Compartment	Capacity m^3	Stowage Factor m^3/t	Weight t	KG m	Vertical Moment tm	Free Surface Moment tm	LCG foap m	Longitudinal Moment tm
All Holds	14 562	1.86		6.78			73.15	
1 TD	264	2.48		10.71			114.33	
2 TD	1688	2.74		10.60			93.57	
3 TD	1986	2.72		10.51			63.92	
Consumables			1464	–	4112	2560	–	58 675
Deadweight								
Lightship			3831	8.21			61.67	
DISPLACEMENT								

HYDROSTATICS	True Mean Draught	LCB foap	LCF foap
LENGTH B.P. 130.00 m	MCTC		
TRIM			KM_T
			KG
DRAUGHTS: F.	A.		GM_{fluid}

HYDROSTATIC PARTICULARS 'A'

Draught m	Displacement t		TPC t		MCTC tm		KMt M	KB m	LCB foap m	LCF foap m
	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000				
7.00	14576	14220	23.13	22.57	184.6	180.1	8.34	3.64	70.03	67.35
6.90	14345	13996	23.06	22.50	183.0	178.5	8.35	3.58	70.08	67.46
6.80	14115	13771	22.99	22.43	181.4	177.0	8.36	3.53	70.12	67.57
6.70	13886	13548	22.92	22.36	179.9	175.5	8.37	3.48	70.16	67.68
6.60	13657	13324	22.85	22.29	178.3	174.0	8.38	3.43	70.20	67.79
6.50	13429	13102	22.78	22.23	176.8	172.5	8.39	3.38	70.24	67.90
6.40	13201	12879	22.72	22.17	175.3	171.0	8.41	3.33	70.28	68.00
6.30	12975	12658	22.66	22.11	173.9	169.6	8.43	3.28	70.32	68.10
6.20	12748	12437	22.60	22.05	172.5	168.3	8.46	3.22	70.35	68.20
6.10	12523	12217	22.54	21.99	171.1	167.0	8.49	3.17	70.38	68.30
6.00	12297	11997	22.48	21.93	169.8	165.7	8.52	3.11	70.42	68.39
5.90	12073	11778	22.43	21.87	168.5	164.4	8.55	3.06	70.46	68.43
5.80	11848	11559	22.37	21.82	167.3	163.2	8.59	3.01	70.50	68.57
5.70	11625	11342	22.32	21.77	166.1	162.1	8.63	2.95	70.53	68.65
5.60	11402	11124	22.26	21.72	165.0	161.0	8.67	2.90	70.57	68.73
5.50	11180	10908	22.21	21.66	163.9	160.0	8.71	2.85	70.60	68.80
5.40	10958	10691	22.15	21.61	162.9	158.9	8.76	2.80	70.64	68.88
5.30	10737	10476	22.10	21.56	161.8	157.9	8.81	2.74	70.68	68.95
5.20	10516	10260	22.05	21.51	160.8	156.9	8.86	2.69	70.72	69.02
5.10	10296	10045	22.00	21.46	159.8	155.9	8.92	2.63	70.75	69.09
5.00	10076	9830	21.95	21.41	158.8	154.9	8.98	2.58	70.79	69.16
4.90	9857	9616	21.90	21.36	157.9	154.0	9.06	2.53	70.82	69.23
4.80	9638	9403	21.85	21.32	156.9	153.1	9.13	2.48	70.86	69.29
4.70	9420	9190	21.80	21.27	156.0	152.2	9.22	2.43	70.90	69.35
4.60	9202	8978	21.75	21.22	155.1	151.3	9.30	2.38	70.93	69.42
4.50	8985	8766	21.70	21.17	154.2	150.5	9.40	2.32	70.96	69.48
4.40	8768	8554	21.65	21.12	153.3	149.6	9.49	2.27	71.00	69.55
4.30	8552	8344	21.60	21.07	152.4	148.7	9.60	2.22	71.04	69.62
4.20	8336	8133	21.55	21.02	151.5	147.8	9.71	2.17	71.08	69.68
4.10	8121	7923	21.50	20.97	150.6	146.9	9.83	2.12	71.12	69.74
4.00	7906	7713	21.45	20.93	149.7	146.0	9.96	2.07	71.15	69.81
3.90	7692	7505	21.40	20.88	148.7	145.1	10.11	2.01	71.18	69.88
3.80	7478	7296	21.35	20.83	147.8	144.2	10.25	1.96	71.22	69.94
3.70	7265	7088	21.30	20.78	146.8	143.3	10.41	1.91	71.25	70.00
3.60	7052	6880	21.24	20.72	145.9	142.3	10.57	1.86	71.29	70.07
3.50	6840	6673	21.19	20.67	144.9	141.3	10.76	1.81	71.33	70.14

THESE HYDROSTATIC PARTICULARS HAVE BEEN DEVELOPED WITH THE VESSEL FLOATING ON EVEN KEEL

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

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE (UNLIMITED)
SUBJECT : SHIP'S STABILITY
DATE : August 2014

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) A vessel is floating in salt water with the following particulars;
Fwd draft 4.2 m — Aft draft 5.4 m
LBP 142 m — LCG 68.906 m.

She is expected to carryout following operations at the port;

Remarks	Weight (t)	Lcg (m)	Load/discharge
No. 1 hold	650	132	Load
No. 2 hold	750	105	Load
No. 3 hold	1500	56	Load
No. 4 hold	1600	48	Load
No. 4 centre DB Tk	50	138	De-ballast
No. 2 centre DB Tk	25	58	De-ballast

With the aid of the hydrostatic particulars (Data sheet – 1) provided, calculate the anticipated drafts fwd and aft, at the completion of above operations.

(30 marks)

2) a) Define the term bilging and the effects on a vessel as a result.

(05 marks)

b) A vessel 180 m long & 20 m wide is boxed shaped and afloat in salt water at an even keel draft of 7.40 m. A double bottom tank at the midship, starboard side is rectangular 10 m long, 10 m wide, 1.0 m deep and empty. Calculate the list if this tank is now bilged, given that KG = 7.6 m and FSM = 900 tm.

(25 marks)

3) A vessel with a high deck cargo of containers will experience adverse affects due to strong beam winds on the lateral windage areas.

Explain how the effects of steady and gusting winds are determined and state the minimum stability requirements with respect to wind heeling under the current regulations.

(30 marks)

4) (a) Describe the effect of trim and GM on a vessel during dry docking.

(05 marks)

(b) A vessel being dry docked for the purpose of refitting of a lost rudder has the following particulars on entry to the dock.

Displacement	13000 t	KG	8.50 m	LCF	76.00 foap
KM	8.80 m	MCTC	170		
Draughts fwd	4.80 m	aft	6.70 m		

Calculate the GM at the critical instant, as the dock is being emptied.

(05 marks)

c) While in the dock, the rudder, weighing 28 t, Kg 3.20 m, is fitted in position at the aft perpendicular. Calculate the GM at the critical instant as the dock is being refilled.

(20 marks)

5) a) Derive the following formula which is relevant to grain calculations;

λ_o **= Σ VHM / (Stowage Factor x displacement)**

(05 marks)

b) A vessel is to load grain (stowage factor 1.39 m^3/t) into several compartments to a total displacement of 13250 t. She has a KG of 8.50 m before loading grain. The compartments are loaded as follows:

Hold	Grain volume (m^3)	Kg (m)	Lcg (m) foap	Horizontal heeling moments (m^4)
No. 1 LH (full)	2215	5.08	114.5	659.5
No. 2 LH (full)	4672	4.95	90.0	850
No. 3 LH (full)	1536	4.94	51.7	770
No. 4 LH (full)	3454	4.95	23.9	760
No. 2 TD (full)	1675	10.79	115.5	659.0

No. 3 TD is loaded to an ullage of 2.80 m.

With the aid of Data Sheets 2 and 3, determine whether the vessel complies with the minimum requirements under the statutory grain rules.

(25 marks)

6) a) With the aid of a diagram, derive the following formula;

Tan (list) = listing moment / (displacement x GM)

(05 marks)

A vessel is floating upright with the following particulars;

Displacement = 10180 t KM = 9.6 m

A locomotive weighing 120 t is to be loaded using the vessels heavy lift from a position 18.0 m to port of the vessel's centre line. The derrick head is 21.0 m above the keel.

a) Calculate the maximum allowable KG prior to loading in order to limit the list to a maximum of 6^0 during the loading operation.

(20 marks)

b) Using the KG calculated above, determine the final angle of list if the locomotive is stowed in a position, Kg 2.50 m, 4.00 m to port of the vessels centre line.

(10 marks)

Data Sheet – 1

HYDROSTATIC PARTICULARS 'A'

Draught m	Displacement t		TPC t		MCTC tm		KMt M	KB m	LCB foap m	LCF foap m
	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000				
7.00	14576	14220	23.13	22.57	184.6	180.1	8.34	3.64	70.03	67.35
6.90	14345	13996	23.06	22.50	183.0	178.5	8.35	3.58	70.08	67.46
6.80	14115	13771	22.99	22.43	181.4	177.0	8.36	3.53	70.12	67.57
6.70	13886	13548	22.92	22.36	179.9	175.5	8.37	3.48	70.16	67.68
6.60	13657	13324	22.85	22.29	178.3	174.0	8.38	3.43	70.20	67.79
6.50	13429	13102	22.78	22.23	176.8	172.5	8.39	3.38	70.24	67.90
6.40	13201	12879	22.72	22.17	175.3	171.0	8.41	3.33	70.28	68.00
6.30	12975	12658	22.66	22.11	173.9	169.6	8.43	3.28	70.32	68.10
6.20	12748	12437	22.60	22.05	172.5	168.3	8.46	3.22	70.35	68.20
6.10	12523	12217	22.54	21.99	171.1	167.0	8.49	3.17	70.38	68.30
6.00	12297	11997	22.48	21.93	169.8	165.7	8.52	3.11	70.42	68.39
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5.60	11402	11124	22.26	21.72	165.0	161.0	8.67	2.90	70.57	68.73
5.50	11180	10908	22.21	21.66	163.9	160.0	8.71	2.85	70.60	68.80
5.40	10958	10691	22.15	21.61	162.9	158.9	8.76	2.80	70.64	68.88
5.30	10737	10476	22.10	21.56	161.8	157.9	8.81	2.74	70.68	68.95
5.20	10516	10260	22.05	21.51	160.8	156.9	8.86	2.69	70.72	69.02
5.10	10296	10045	22.00	21.46	159.8	155.9	8.92	2.63	70.75	69.09
5.00	10076	9830	21.95	21.41	158.8	154.9	8.98	2.58	70.79	69.16
4.90	9857	9616	21.90	21.36	157.9	154.0	9.06	2.53	70.82	69.23
4.80	9638	9403	21.85	21.32	156.9	153.1	9.13	2.48	70.86	69.29
4.70	9420	9190	21.80	21.27	156.0	152.2	9.22	2.43	70.90	69.35
4.60	9202	8978	21.75	21.22	155.1	151.3	9.30	2.38	70.93	69.42
4.50	8985	8766	21.70	21.17	154.2	150.5	9.40	2.32	70.96	69.48
4.40	8768	8554	21.65	21.12	153.3	149.6	9.49	2.27	71.00	69.55
4.30	8552	8344	21.60	21.07	152.4	148.7	9.60	2.22	71.04	69.62
4.20	8336	8133	21.55	21.02	151.5	147.8	9.71	2.17	71.08	69.68
4.10	8121	7923	21.50	20.97	150.6	146.9	9.83	2.12	71.12	69.74
4.00	7906	7713	21.45	20.93	149.7	146.0	9.96	2.07	71.15	69.81
3.90	7692	7505	21.40	20.88	148.7	145.1	10.11	2.01	71.18	69.88
3.80	7478	7296	21.35	20.83	147.8	144.2	10.25	1.96	71.22	69.94
3.70	7265	7088	21.30	20.78	146.8	143.3	10.41	1.91	71.25	70.00
3.60	7052	6880	21.24	20.72	145.9	142.3	10.57	1.86	71.29	70.07
3.50	6840	6673	21.19	20.67	144.9	141.3	10.76	1.81	71.33	70.14

THESE HYDROSTATIC PARTICULARS HAVE BEEN DEVELOPED WITH THE VESSEL FLOATING ON EVEN KEEL

Data sheet – 2

TABLE OF MAXIMUM PERMISSIBLE GRAIN HEELING MOMENTS (tm)

Displacement tonne	FLUID KG (metres)									
	6.50	6.60	6.70	6.80	6.90	7.00	7.10	7.20	7.30	7.40
14 500	6141	5820	5499	5179	4858	4537	4217	3896	3575	3255
14 000	5957	5647	5338	5028	4719	4409	4099	3790	3480	3171
13 500	5924	5625	5327	5028	4730	4431	4132	3834	3535	3237
13 000	5934	5647	5359	5072	4784	4497	4209	3922	3634	3347
12 500	5891	5614	5338	5062	4785	4509	4232	3956	3679	3403
12 000	5857	5591	5326	5061	4795	4630	4265	3999	3734	3468
11 500	5893	5639	5385	5130	4876	4622	4368	4113	3859	3605
11 000	5944	5701	5457	5214	4971	4728	4484	4241	3998	3755
10 500	5948	5716	5484	5251	5019	4787	4555	4323	4090	3858
10 000	5940	5719	5498	5276	5055	4834	4613	4392	4171	3950
9500	5961	5751	5541	5331	5121	4911	4701	4491	4281	4071
9000	6027	5828	5629	5430	5231	5032	4833	4634	4435	4236
8500	6127	5939	5751	5563	5375	5187	4999	4811	4623	4435
8000	6210	6033	5856	5679	5502	5325	5148	4971	4795	4618
7500	6252	6087	5921	5755	5589	5423	5257	5091	4926	4760
7000	6343	6189	6034	5879	5724	5569	5415	5260	5105	4950
6500	6550	6406	6262	6118	5975	5831	5687	5543	5400	5256
6000	6832	6699	6566	6434	6301	6168	6035	5903	5770	5637
5500	7120	6998	6877	6755	6633	6512	6390	6268	6147	6025
5000	7320	7209	7099	6988	6877	6767	6656	6546	6435	6325

Data sheet – 3

VOLUMETRIC HEELING MOMENTS OF PARTLY FILLED COMPARTMENTS

ULLAGE DATUM: Top of Hatch-Side Coaming at its Mid-Length

COMPARTMENT No: 3TD (NO C.L. DIVISION)

ULLAGE m	VOLUME OF GRAIN m^3	HORIZONTAL HEELING MOMENT m^4	Kg of GRAIN m
0.25	1686	598	11.24
0.50	1668	659	11.19
0.75	1649	746	11.13
1.00	1628	864	11.07
1.25	1607	1016	11.01
1.50	1510	1176	10.94
1.75	1416	1372	10.98
2.00	1324	1577	10.82
2.25	1232	1799	10.75
2.50	1144	2017	10.69
2.75	1059	2218	10.63
3.00	970	2388	10.59
3.25	883	2512	10.55
3.50	800	2579	10.50
3.75	714	2575	10.45
4.00	633	2500	10.39
4.25	550	2362	10.31
4.50	467	2155	10.21
4.75	384	1908	10.10
5.00	302	1592	9.98
5.25	222	1239	9.81
5.50	143	848	9.56
5.75	64	380	9.27
5.95	0	0	8.70

ULLAGE FOR MAXIMUM HORIZONTAL MOMENT

3.60	764	2580	10.49

MERCHANT SHIPPING SECRETARIAT
GOVERNMENT OF SRI LANKA
CERTIFICATE OF COMPETENCY EXAMINATION

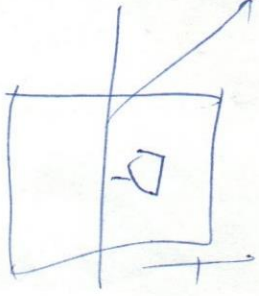
GRADE : **CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE**
SUBJECT : **SHIPBOARD OPERATIONS**
DATE : **08th May 2015 From 0900hrs to 1200hrs**

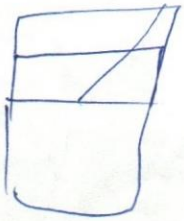
Time allowed THREE hours — Total Marks 180
Answer **ALL** questions — Pass Marks 70%
Formulae and intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches wherever considered necessary.
Marks for each question are shown in brackets.

1. With regard to the IMDG Code ,
   a) Explain the importance of the code in your words. **(08 marks)**
   b) Explain how a DG package is labeled before being placed on board which is of multiple hazards and a severe pollutant by nature. **(08 marks)**
   c) Explain the importance of entries under the following columns in the Dangerous Cargo List.
      (i) Subsidiary Risk (ii) Limited Quantities (iii) Packing **(09 marks)**
   d) As per ~~EMS~~ MFAG schedule casualties are treated symptomatically. Explain what this statement mean to you. **(05 marks)**

2. a) Explain with suitable sketches how beam and freeboard is related to the behavior of a vessel in a seaway. How it is reflected in the shape of the GZ curve ? **(12 marks)**
   b) A vessel with a displacement of 14840 tonnes , with a KM of 10.6m has to load two lifts each weighing 65 tonnes , at a KG of 15.0m and 9.0m respectively on either side of the centerline. The vessel has to use her own gear whose head is 24.0m above the keel and maximum reach is 18.0m from the centerline. What should be the highest KG of the vessel before commencing the operation to incur a maximum list of six degrees during the process. Consider the inboard weight being loaded first. **(18 marks)**

Contd/……..2





3. With regard to Trading Certificates on board a vessel,

a) Explain how and why flag-states delegate the responsibilities to Classification Societies for the process of maintaining their vessels seaworthy and trade worthy ? **(12 marks)**

b) What convenience has been implemented by harmonizing the surveys on board ? Elaborate from the viewpoint of ship owner and seafarer. **(10 marks)**

c) What main differences could you highlight in the trading certificates of a Bulk Carrier and a Passenger vessel ? **(08 marks)**

4. With regard to dry docking ,

a) What documentation and plans are most likely to be readily available. **(08 marks)**

b) State the preparation and precautions you would adopt for entry in to dry dock. **(06 marks)**

c) Explain term critical period relevant to dry docking. **(06 marks)**

d) Describe in detail hull and ballast tank inspection procedure as management team member of the ship. **(10 marks)**

5) With reference to Grain Regulations,

a) Explain how the heeling arm is derived. **(10 marks)**

b) State the minimum intact stability criteria required by the above regulations **(10 marks)**

c) Explain how the adverse effect of the vertical shift of grain surface could be compensated. **(10 marks)**

6) With regards to tanker ships operation explain flowing.

a) How you would inert and gas free a cargo tank for man entry. (10 marks)

b) Explain the procedure of calibrating and checking the accuracy of an Oxygen analyzer. (10 marks)

c) Sketch and describe the purpose of the PV breaker fitted on to the IG (Inert Gas) line.

20
21.

Capt Ranjith Perera.
Nautical Department.
ND Class II
ministry.

MERCHANT SHIPPING SECRETARIAT
GOVERNMENT OF SRI LANKA
CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : **CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE**
SUBJECT : **SHIPBOARD OPERATIONS**
DATE : **08th May 2015 From 0900hrs to 1200hrs**

Time allowed THREE hours — Total Marks 180
Answer **ALL** questions — Pass Marks ~~70%~~ 60%.
Formulae and intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches wherever considered necessary.
Marks for each question are shown in brackets.

1. With regard to the IMDG Code .
   a) Explain the importance of the code in your words. **(08 marks)**
   b) Explain how a DG package is labeled before being placed on board which is of multiple hazards and a severe pollutant by nature. **(08 marks)**
   c) Explain the importance of entries under the following columns in the Dangerous Cargo List.
      (i) Subsidiary Risk (ii) Limited Quantities (iii) Packing **(09 marks)**
   d) As per ~~EMS~~ MFAG schedule casualties are treated symptomatically. Explain what this statement mean to you. **(05 marks)**

2. a) Explain with suitable sketches how beam and freeboard is related to the behavior of a vessel in a seaway. How it is reflected in the shape of the GZ curve ? **(12 marks)**
   b) A vessel with a displacement of 14840 tonnes , with a KM of 10.6m has to load two lifts each weighing 65 tonnes , at a ~~KG~~ distance of 15.0m and 9.0m respectively on either side of the centerline. The vessel has to use her own gear whose head is 24.0m above the keel and maximum reach is 18.0m from the centerline. What should be the highest KG of the vessel before commencing the operation to incur a maximum list of six degrees during the process. Consider the inboard weight being loaded first. **(18 marks)**

inboard KG
either side

Contd/.....2

3. With regard to Trading Certificates on board a vessel,

a) Explain how and why flag states delegate the responsibilities to Classification Societies for the process of maintaining their vessels seaworthy and trade worthy ? **(12 marks)**

b) What convenience has been implemented by harmonizing the surveys on board ? Elaborate from the viewpoint of ship owner and seafarer. **(10 marks)**

c) What main differences could you highlight in the trading certificates of a Bulk Carrier and a Passenger vessel ? **(08 marks)**

4. With regard to dry docking ,

a) What documentation and plans are most likely to be readily available. **(08 marks)**

b) State the preparation and precautions you would adopt for entry in to dry dock. **(06 marks)**

c) Explain term critical period relevant to dry docking. **(06 marks)**

d) Describe in detail hull and ballast tank inspection procedure as management team member of the ship. **(10 marks)**

5) With reference to Grain Regulations,

a) Explain how the heeling arm is derived. **(10 marks)**

b) State the minimum intact stability criteria required by the above regulations **(10 marks)**

c) Explain how the adverse effect of the vertical shift of grain surface could be compensated. **(10 marks)**

6) With regards to tanker ships operation explain flowing.

a) How you would inert and gas free a cargo tank for man entry. (10 marks)

b) Explain the procedure of calibrating and checking the accuracy of an Oxygen analyzer. (10 marks)

c) Sketch and describe the purpose of the PV breaker fitted on to the IG (Inert Gas) line.

(10 marks)

MERCHANT SHIPPING SECRETARIAT
GOVERNMENT OF SRI LANKA
CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : **CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE**
SUBJECT : *NAVIGATION*
DATE : **08th May 2015 From 0900hrs to 1200hrs**

Time allowed THREE hours — Total Marks 200
Answer **ALL** questions — Pass Marks 70%
Formulae and intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches wherever considered necessary.
Marks for each question are shown in brackets.

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1. A 115000 GT bulk carrier is to make a loaded passage between Valparaiso (Chile) to Yokohama (Japan), carrying a cargo of phosphates and is expected to have a departure draught of 16.6 meters. The vessel carries navigation equipment as per statute and has a service speed of 16.0 knots. The vessel is due to depart Valparaiso on the 1st September.

   The vessel is to use the following departure and landfall positions.

   Departure Position 33° 03.0' S, 071° 48.0' W

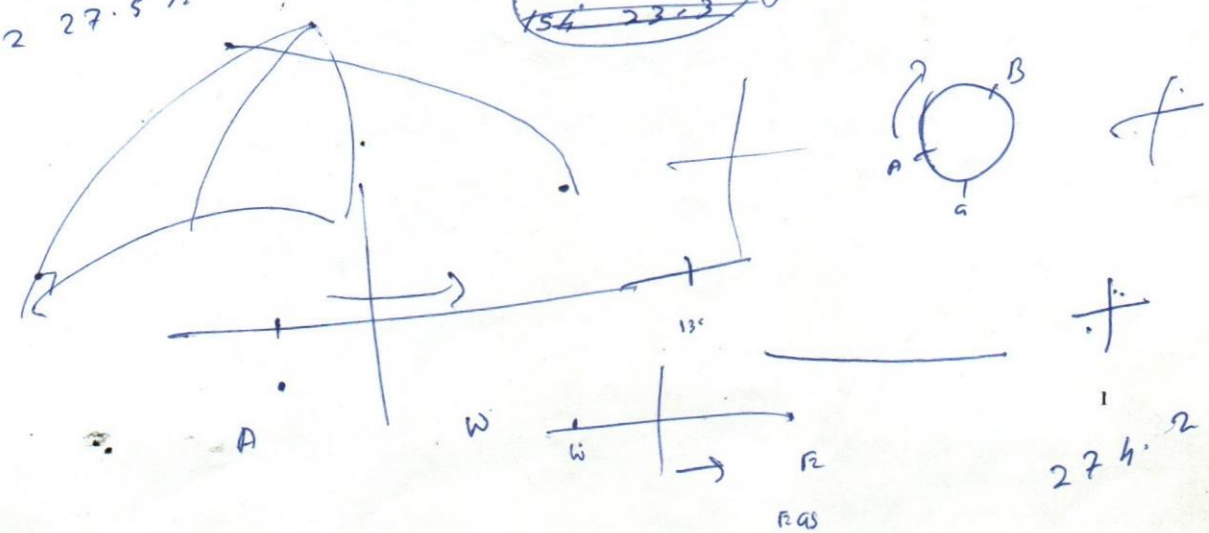
   Landfall Position 35° 18'.0' N, 139° 42.0' E

   Calculate EACH of the following:

   i. The great circle distance. (10 marks)

   ii. The final course on the great circle track. (15 marks)

   iii. The position of the vertex, lying North of the Equator. (15 marks)



4. A vessel is due to enter the port of Antwerp via the locks at Boudewijnsluis (European Tide Tables port no 1539a).

The vessel is expected to arrive off the lock entrance on the PM flood tide on the 18th April.

The charted depth of the lock sill is 6.8 m and the vessel's draught is 9.8 m. The vessel must clear the locks with 1.5m under the keel.

Using Worksheet - 1, determine the earliest time (UT) the vessel can enter the locks. (20 marks)

1409 kt 1309 ut

5. Vessels engaged on passages across the North Atlantic Ocean may encounter icebergs.

i. Describe the sources and type of information that are available to the Master regarding icebergs. (15 marks)

ii. Outline the factors that should be considered by a prudent Master when determining the risks involved in encountering dangerous ice. (20 marks)

iii. Outline the reporting procedure that is to be followed by the Master on encountering dangerous ice. (10 marks)

6. i. Explain the factors to be considered when appointing an On scene Co-ordinator in a Search and Rescue incident. (10 marks)

ii. Following are data related to a Search and Rescue Operation.

- The distress vessel position for 1000 GMT / Position source known
- Weather- N'ly Wind 20 kts and Sea 1.2 m
- Vessel arriving at 1200 hrs
- Water current 225° x 2.0 kts
- Wind driven current WSW x 1.5 kts
- Abandon in a 15 man life raft without drogue
- Visibility 10 nm
- Search speed 12 kts
- Search time 2.0 hrs

SP = 4.59
At : 110.16
R = 5.2

Using the above information;

a. With an aid of a sketch show the new datum point for the search and rescue operation. (10 marks)

b. Find the track spacing and the search area. (05 marks)

c. With aid of a sketch explain Parallel Track Search. (10 marks)

2. While on a passage one of the engine room ratings falls and breaks a leg. The Master decides to that the rating needs immediate attention and makes contact with a US warship at 0830 hrs UT on the 21st September.

The vessel's current position is 21^0 30.0' N, 167^0 24.0' E. The warship is in position 24^0 54.0' N, 172^0 36.0' E.

It is agreed to rendezvous at sunrise the following day with own vessel maintaining a course of 345^0 (T) and at a maximum speed of 18 knots.

Calculate each of the following:

i. The UT of sunrise. (15 marks)

ii. The rendezvous position. (15 marks)

iii. The course and speed required by the warship to make the rendezvous. (10 marks)

3. The OOW obtains the following observations during morning twilight on the 13th under clear skies, good visibility and calm seas. The vessel was steaming at 19 knots on a course of 095^0 (T).

Time Calc Alt	Object	Azimuth	True Alt
0545 hrs 41°10.9'	Arcturus	037°(T)	41°15.7'
0550 hrs 43°20.4'	Rigel	130°(T)	43°13.8'
0555 hrs 36°39.4'	Vega	315°(T)	36°45.3'
0603 hrs 58°27.1'	Canopus	220°(T)	58°19.5'

Determine the vessel's position at 0600 hrs. using a DR position of 31°45'N, 062°24'W to work each sight. (20 marks)

MERCHANT SHIPPING SECRETARIAT
GOVERNMENT OF SRI LANKA
CERTIFICATE OF COMPETENCY EXAMINATION

GRADE: CHIEF MATE/MASTER ON SHIPS OF 500 GT OR MORE
SUBJECT: STABILITY
DATE : 11th May 2015, 0900 hrs to 1200 hrs.

Time allowed **THREE** hours. Total Marks 180
Answer **ALL** questions Pass Marks 60%
Formulae and intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches where ever consider prudent.

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1) Worksheet -1 (Trim and Stability pro-forma) provides data relevant to a particular condition of the loading of a vessel in salt water.

By the completion of the Worksheet – 1 with the aid of the 'Hydrostatic Particulars Table A' and showing all additional calculations in your answer book, determine each of the following:

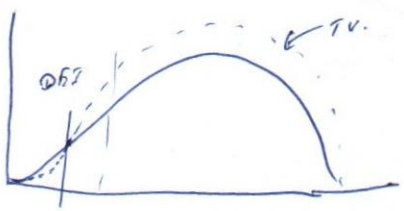
a) Final fwd and aft draughts (12 marks)

b) Final transverse GM_f (18 marks)

2) With the aid of labeled sketches, show the effects of each of the following on a vessel's curve of statical stability:

a) a strong beam wind on a vessel with a high freeboard and a large number of containers on deck;
b) a change in the KG of the vessel due to the consumption of fuel and water from double bottom tanks during the voyage (assume the tanks are full at the time of sailing);
c) the loading of a full cargo of timber on deck

(10 marks each)



3) Answer the following questions with regards to bilging of a vessel:

a) Briefly describe the contents of a damage stability calculations book available onboard a vessel.

(05 marks)

b) A box shaped vessel 120 m long and 15 m wide floats at an even keel draught of 6.5 m in salt water. A compartment at the forward end, 10 m long 15 m wide, is empty. Assuming the bilge GM_L is equal to bilge BM_L, find the new draughts fwd and aft if this compartment gets bilged.

F - 9.376
A - 5.157

(25 marks)

4) Answer the following questions with regards to change of density:

a) With the aid of a labelled sketch explain why the trim is subjected to change when a vessel moves from one density of water to another.

COT = $\frac{\omega (LCG - LCF)}{RD_1 \; MCTC_2}$

(05 marks)

b) A vessel floating in salt water has the following particulars:

Displacement	18,000 t	LBP	220 m
LCB	100 m foap	LCF	120 m foap
MCTC	200	TPC	23
Draft fwd	7.85 m	aft	8.55 m

The vessel has two bunker tanks. The forward tank has it's centroid 205 m forward of the aft perpendicular and the after tank has it's centroid 75 m forward of the aft perpendicular. Calculate the following;

i) The amount of fuel to transfer between the bunker tanks in order to arrive alongside at a fresh water berth on an even keel. 172.6 ✓

(15 marks)

ii) The arrival draft forward and aft. 8.365 ✓ F=A

(10 marks)

5) A box shaped vessel of length 98.0 m, breadth 14.2 m, depth 9.3 m is floating in salt water at an even keel draught of 5.6 m.

a) Calculate the righting moment when the vessel is heeled to the angle of deck edge immersion if the KG is 5.50 m. 3986.55 - 2611.146 tm

(20 marks)

b) Calculate the angle of loll if the KG is 6.0 m. 27.06 θ

(10 marks)

AOL θ = 20.06°

6) Answer the following questions with regards to free surface effect and list:

a) List the factors which affect the free surface effect.

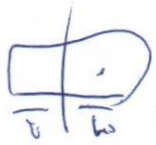
(10 marks)

b) A vessel of 8200 t displacement, KG 6.3 m, KM 8.0 m is floating upright. A double bottom tank of regular cross section is divided in to two equal parts each 40.0 m long, 8.0 m wide and 1.6 m deep. The starboard side tank is full of fresh water and the port side tank is empty. Calculate the angle of list when half of the water is transferred to the port side tank.

(20 marks)

$\theta = 43.9°$ ✓

$GM = 1.296$



List = 10.8°

HYDROSTATIC PARTICULARS 'A'

Draught m	Displacement t		TPC t		MCTC tm		KMt M	KB m	LCB foap m	LCF foap m
	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000				
7.00	14576	14220	23.13	22.57	184.6	180.1	8.34	3.64	70.03	67.35
6.90	14345	13996	23.06	22.50	183.0	178.5	8.35	3.58	70.08	67.46
6.80	14115	13771	22.99	22.43	181.4	177.0	8.36	3.53	70.12	67.57
6.70	13886	13548	22.92	22.36	179.9	175.5	8.37	3.48	70.16	67.68
6.60	13657	13324	22.85	22.29	178.3	174.0	8.38	3.43	70.20	67.79
6.50	13429	13102	22.78	22.23	176.8	172.5	8.39	3.38	70.24	67.90
6.40	13201	12879	22.72	22.17	175.3	171.0	8.41	3.33	70.28	68.00
6.30	12975	12658	22.66	22.11	173.9	169.6	8.43	3.28	70.32	68.10
6.20	12748	12437	22.60	22.05	172.5	168.3	8.46	3.22	70.35	68.20
6.10	12523	12217	22.54	21.99	171.1	167.0	8.49	3.17	70.38	68.30
6.00	12297	11997	22.48	21.93	169.8	165.7	8.52	3.11	70.42	68.39
5.90	12073	11778	22.43	21.87	168.5	164.4	8.55	3.06	70.46	68.43
5.80	11848	11559	22.37	21.82	167.3	163.2	8.59	3.01	70.50	68.57
5.70	11625	11342	22.32	21.77	166.1	162.1	8.63	2.95	70.53	68.65
5.60	11402	11124	22.26	21.72	165.0	161.0	8.67	2.90	70.57	68.73
5.50	11180	10908	22.21	21.66	163.9	160.0	8.71	2.85	70.60	68.80
5.40	10958	10691	22.15	21.61	162.9	158.9	8.76	2.80	70.64	68.88
5.30	10737	10476	22.10	21.56	161.8	157.9	8.81	2.74	70.68	68.95
5.20	10516	10260	22.05	21.51	160.8	156.9	8.86	2.69	70.72	69.02
5.10	10296	10045	22.00	21.46	159.8	155.9	8.92	2.63	70.75	69.09
5.00	10076	9830	21.95	21.41	158.8	154.9	8.98	2.58	70.79	69.16
4.90	9857	9616	21.90	21.36	157.9	154.0	9.06	2.53	70.82	69.23
4.80	9638	9403	21.85	21.32	156.9	153.1	9.13	2.48	70.86	69.29
4.70	9420	9190	21.80	21.27	156.0	152.2	9.22	2.43	70.90	69.35
4.60	9202	8978	21.75	21.22	155.1	151.3	9.30	2.38	70.93	69.42
4.50	8985	8766	21.70	21.17	154.2	150.5	9.40	2.32	70.96	69.48
4.40	8768	8554	21.65	21.12	153.3	149.6	9.49	2.27	71.00	69.55
4.30	8552	8344	21.60	21.07	152.4	148.7	9.60	2.22	71.04	69.62
4.20	8336	8133	21.55	21.02	151.5	147.8	9.71	2.17	71.08	69.68
4.10	8121	7923	21.50	20.97	150.6	146.9	9.83	2.12	71.12	69.74
4.00	7906	7713	21.45	20.93	149.7	146.0	9.96	2.07	71.15	69.81
3.90	7692	7505	21.40	20.88	148.7	145.1	10.11	2.01	71.18	69.88
3.80	7478	7296	21.35	20.83	147.8	144.2	10.25	1.96	71.22	69.94
3.70	7265	7088	21.30	20.78	146.8	143.3	10.41	1.91	71.25	70.00
3.60	7052	6880	21.24	20.72	145.9	142.3	10.57	1.86	71.29	70.07
3.50	6840	6673	21.19	20.67	144.9	141.3	10.76	1.81	71.33	70.14

THESE HYDROSTATIC PARTICULARS HAVE BEEN DEVELOPED WITH THE VESSEL FLOATING ON EVEN KEEL

DIRECTOR GENERAL'S OFFICE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA
CERTIFICATE OF COMPETENCY EXAMINATION

GRADE: CHIEF MATE/MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT: STABILITY
DATE : 11th August 2014, 0900 hrs to 1200 hrs.

Time allowed **THREE** hours — Total Marks 180
Answer **ALL** questions — Pass Marks 60%
Formulae and intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches where ever consider prudent.

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1) A vessel is floating in salt water with the following particulars;

Fwd draft 4.2 m — Aft draft 5.4 m
LBP 142 m — LCG 68.906 m.

She is expected to carryout following operations at the port;

Remarks	Weight (t)	Lcg (m)	Load/discharge
No. 1 hold	650	132	Load
No. 2 hold	750	105	Load
No. 3 hold	1500	56	Load
No. 4 hold	1600	48	Load
No. 4 centre DB Tk	50	138	De-ballast
No. 2 centre DB Tk	25	58	De-ballast

With the aid of the hydrostatic particulars (Data sheet – 1) provided, calculate the anticipated drafts fwd and aft, at the completion of above operations.

(30 marks)

2) a) Define the term bilging and the effects on a vessel as a result of bilging.

(05 marks)

b) A vessel 180 m long & 20 m wide is boxed shaped and afloat in salt water at an even keel draft of 7.40 m. A double bottom tank at the midship, starboard side is rectangular 10 m long, 10 m wide, 1.0 m deep and empty. Calculate the list if this tank is now bilged, given that KG = 7.6 m and FSM = 900 tm.

(25 marks)

5) a) Derive the following formula which is relevant to grain calculations;

λ_o **= Σ VHM / (Stowage Factor x displacement)**

(05 marks)

b) A vessel is to load grain (stowage factor 1.39 m^3/t) into several compartments to a total displacement of 13250 t. She has a KG of 8.50 m before loading grain. The compartments are loaded as follows:

Hold	Grain volume (m^3)	Kg (m)	Lcg (m) foap	Horizontal heeling moments (m^4)
No. 1 LH (full)	2215	5.08	114.5	659.5
No. 2 LH (full)	4672	4.95	90.0	850
No. 3 LH (full)	1536	4.94	51.7	770
No. 4 LH (full)	3454	4.95	23.9	760
No. 2 TD (full)	1675	10.79	115.5	659.0

No. 3 TD is loaded to an ullage of 2.80 m.

With the aid of Data Sheets 2 and 3, determine whether the vessel complies with the minimum requirements under the statutory grain rules.

(25 marks)

6) a) With the aid of a diagram, derive the following formula;

Tan (list) = listing moment / (displacement x GM)

(04 marks)

A vessel is floating upright with the following particulars;

Displacement = 10180 t KM = 9.6 m

A locomotive weighing 120 t is to be loaded using the vessels heavy lift from a position 18.0 m to port of the vessel's centre line. The derrick head is 21.0 m above the keel.

a) Calculate the maximum allowable KG prior to loading in order to limit the list to a maximum of 6^0 during the loading operation.

(18 marks)

b) Using the KG calculated above, determine the final angle of list if the locomotive is stowed in a position, Kg 2.50 m, 4.00 m to port of the vessels centre line.

(08 marks)

A vessel with a high deck cargo of containers will experience adverse affects due to strong beam winds on the lateral windage areas.

Explain how the effects of steady and gusting winds are determined and state the minimum stability requirements with respect to wind heeling under the current regulations.

(30 marks)

4) (a) Describe the effect of trim and GM on a vessel during dry docking.

(05 marks)

(b) A vessel being dry docked for the purpose of refitting of a lost rudder has the following particulars on entry to the dock.

Displacement	13000 t	KG	8.50 m	LCF	76.00 foap
KM	8.80 m	MCTC	170		
Draughts fwd	4.80 m	aft	6.70 m		

Calculate the GM at the critical instant, as the dock is being emptied.

(05 marks)

c) While in the dock, the rudder, weighing 28 t, Kg 3.20 m, is fitted in position at the aft perpendicular. Calculate the GM at the critical instant as the dock is being refilled.

(20 marks)

Data sheet – 3

VOLUMETRIC HEELING MOMENTS OF PARTLY FILLED COMPARTMENTS

ULLAGE DATUM: Top of Hatch-Side Coaming at its Mid-Length

COMPARTMENT No: 3TD (NO C.L. DIVISION)

ULLAGE m	VOLUME OF GRAIN m^3	HORIZONTAL HEELING MOMENT m^4	Kg of GRAIN m
0.25	1686	598	11.24
0.50	1668	659	11.19
0.75	1649	746	11.13
1.00	1628	864	11.07
1.25	1607	1016	11.01
1.50	1510	1176	10.94
1.75	1416	1372	10.98
2.00	1324	1577	10.82
2.25	1232	1799	10.75
2.50	1144	2017	10.69
2.75	1059	2218	10.63
3.00	970	2388	10.59
3.25	883	2512	10.55
3.50	800	2579	10.50
3.75	714	2575	10.45
4.00	633	2500	10.39
4.25	550	2362	10.31
4.50	467	2155	10.21
4.75	384	1908	10.10
5.00	302	1592	9.98
5.25	222	1239	9.81
5.50	143	848	9.56
5.75	64	380	9.27
5.95	0	0	8.70

ULLAGE FOR MAXIMUM HORIZONTAL MOMENT

3.60	764	2580	10.49

Data sheet – 2

TABLE OF MAXIMUM PERMISSIBLE GRAIN HEELING MOMENTS (tm)

Displacement tonne	FLUID KG (metres)									
	6.50	6.60	6.70	6.80	6.90	7.00	7.10	7.20	7.30	7.40
14 500	6141	5820	5499	5179	4858	4537	4217	3896	3575	3255
14 000	5957	5647	5338	5028	4719	4409	4099	3790	3480	3171
13 500	5924	5625	5327	5028	4730	4431	4132	3834	3535	3237
13 000	5934	5647	5359	5072	4784	4497	4209	3922	3634	3347
12 500	5891	5614	5338	5062	4785	4509	4232	3956	3679	3403
12 000	5857	5591	5326	5061	4795	4630	4265	3999	3734	3468
11 500	5893	5639	5385	5130	4876	4622	4368	4113	3859	3605
11 000	5944	5701	5457	5214	4971	4728	4484	4241	3998	3755
10 500	5948	5716	5484	5251	5019	4787	4555	4323	4090	3858
10 000	5940	5719	5498	5276	5055	4834	4613	4392	4171	3950
9500	5961	5751	5541	5331	5121	4911	4701	4491	4281	4071
9000	6027	5828	5629	5430	5231	5032	4833	4634	4435	4236
8500	6127	5939	5751	5563	5375	5187	4999	4811	4623	4435
8000	6210	6033	5856	5679	5502	5325	5148	4971	4795	4618
7500	6252	6087	5921	5755	5589	5423	5257	5091	4926	4760
7000	6343	6189	6034	5879	5724	5569	5415	5260	5105	4950
6500	6550	6406	6262	6118	5975	5831	5687	5543	5400	5256
6000	6832	6699	6566	6434	6301	6168	6035	5903	5770	5637
5500	7120	6998	6877	6755	6633	6512	6390	6268	6147	6025
5000	7320	7209	7099	6988	6877	6767	6656	6546	6435	6325

Data Sheet – 1

HYDROSTATIC PARTICULARS 'A'

Draught m	Displacement t		TPC t		MCTC tm		KMt M	KB m	LCB foap m	LCF foap m
	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000				
7.00	14576	14220	23.13	22.57	184.6	180.1	8.34	3.64	70.03	67.35
6.90	14345	13996	23.06	22.50	183.0	178.5	8.35	3.58	70.08	67.46
6.80	14115	13771	22.99	22.43	181.4	177.0	8.36	3.53	70.12	67.57
6.70	13886	13548	22.92	22.36	179.9	175.5	8.37	3.48	70.16	67.68
6.60	13657	13324	22.85	22.29	178.3	174.0	8.38	3.43	70.20	67.79
6.50	13429	13102	22.78	22.23	176.8	172.5	8.39	3.38	70.24	67.90
6.40	13201	12879	22.72	22.17	175.3	171.0	8.41	3.33	70.28	68.00
6.30	12975	12658	22.66	22.11	173.9	169.6	8.43	3.28	70.32	68.10
6.20	12748	12437	22.60	22.05	172.5	168.3	8.46	3.22	70.35	68.20
6.10	12523	12217	22.54	21.99	171.1	167.0	8.49	3.17	70.38	68.30
6.00	12297	11997	22.48	21.93	169.8	165.7	8.52	3.11	70.42	68.39
5.90	12073	11778	22.43	21.87	168.5	164.4	8.55	3.06	70.46	68.43
5.80	11848	11559	22.37	21.82	167.3	163.2	8.59	3.01	70.50	68.57
5.70	11625	11342	22.32	21.77	166.1	162.1	8.63	2.95	70.53	68.65
5.60	11402	11124	22.26	21.72	165.0	161.0	8.67	2.90	70.57	68.73
5.50	11180	10908	22.21	21.66	163.9	160.0	8.71	2.85	70.60	68.80
5.40	10958	10691	22.15	21.61	162.9	158.9	8.76	2.80	70.64	68.88
5.30	10737	10476	22.10	21.56	161.8	157.9	8.81	2.74	70.68	68.95
5.20	10516	10260	22.05	21.51	160.8	156.9	8.86	2.69	70.72	69.02
5.10	10296	10045	22.00	21.46	159.8	155.9	8.92	2.63	70.75	69.09
5.00	10076	9830	21.95	21.41	158.8	154.9	8.98	2.58	70.79	69.16
4.90	9857	9616	21.90	21.36	157.9	154.0	9.06	2.53	70.82	69.23
4.80	9638	9403	21.85	21.32	156.9	153.1	9.13	2.48	70.86	69.29
4.70	9420	9190	21.80	21.27	156.0	152.2	9.22	2.43	70.90	69.35
4.60	9202	8978	21.75	21.22	155.1	151.3	9.30	2.38	70.93	69.42
4.50	8985	8766	21.70	21.17	154.2	150.5	9.40	2.32	70.96	69.48
4.40	8768	8554	21.65	21.12	153.3	149.6	9.49	2.27	71.00	69.55
4.30	8552	8344	21.60	21.07	152.4	148.7	9.60	2.22	71.04	69.62
4.20	8336	8133	21.55	21.02	151.5	147.8	9.71	2.17	71.08	69.68
4.10	8121	7923	21.50	20.97	150.6	146.9	9.83	2.12	71.12	69.74
4.00	7906	7713	21.45	20.93	149.7	146.0	9.96	2.07	71.15	69.81
3.90	7692	7505	21.40	20.88	148.7	145.1	10.11	2.01	71.18	69.88
3.80	7478	7296	21.35	20.83	147.8	144.2	10.25	1.96	71.22	69.94
3.70	7265	7088	21.30	20.78	146.8	143.3	10.41	1.91	71.25	70.00
3.60	7052	6880	21.24	20.72	145.9	142.3	10.57	1.86	71.29	70.07
3.50	6840	6673	21.19	20.67	144.9	141.3	10.76	1.81	71.33	70.14

THESE HYDROSTATIC PARTICULARS HAVE BEEN DEVELOPED WITH THE VESSEL FLOATING ON EVEN KEEL.

DIRECTOR GENERAL'S OFFICE
OF MERCHANT OFFICE
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE
SUBJECT: NAVIGATION
DATE : 04th October 2013, 0900 hrs to 1200 hrs.

S. Weerabahu

Time allowed **THREE** hours
Answer **ALL** questions
Total Marks 200
Pass Marks 70%
Formulae and intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches where ever considered prudent.

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01. A 40 000 GT container vessel is to make a fully laden passage from Gothenburg (Sweden) to Montreal (Quebec, Canada) in August. The vessel has an all seasons load line has a service speed of 19.5 knots.

The vessel's owners have indicated that the vessel is to pass to the North of Scotland and transit the Belle Isle Strait prior to entering the St. Lawrence River.

The departure and landfall positions for the trans oceanic leg of the passage are as follows;

Departure Position	58° 43'.0 N	5° 00'.0 W	(5 miles N of Cape Wrath)
Landfall Position	51° 44'.0 N	56° 00'.0 W	(Entrance to Belle Isle Strait)

With reference to the departure and landfall positions, calculate EACH of the following:

i. the great circle distance; (10 marks)
ii. the initial course on the great circle track; (10 marks)
iii. the position of the vertex; (15 marks)

02. Vessels approaching Newfoundland and the Grand Banks from seaward are likely to encounter several navigational hazards.

i. With reference to Datasheets Q2(a)(I) and Q2(a)(2), outline SIX hazards which a vessel may encounter during passage at anytime in the year. (15 marks)

ii. Vessels encountering certain types of, navigational hazards are required by law to pass on information to other vessels and coast radio stations in the vicinity.

a. Detail the circumstances to which these regulations apply: (10 marks)

b. Describe the information that is required to be transmitted for each type of hazard. (10 marks)

03. At 1815hrs a vessel is in DR position 21° 12′N 154° 35′E steering a course 247°T at 16 knots. At evening twilight a group of stars is observed by sextant altitude and the following results were obtained:

Time	Star	Azimuth	Intercept
1810	Vega	269°	1′.2 Towards
1817	Arcturus	330°	2′.3 Towards
1825	Nunki	153°	2′.3 Away
1835	Altair	095°	7′.4 Away

The same DR position was used throughout.

Find, the vessel's Most Probable Position at 1815hrs. (30 marks)

04. During a naval exercise in the North Atlantic, a Royal Navy frigate in position 61° 08′N 19° 56′W is required to refuel from an RFA supply vessel currently in position 62° 15′N 19° 20′W.

Time is 2205 GMT, May 29 1976. It has been agreed that the two vessels will rendezvous at sunrise on the following day to start bunkering.

The RFA vessel will maintain her present course 249° T at 14.3 knots.

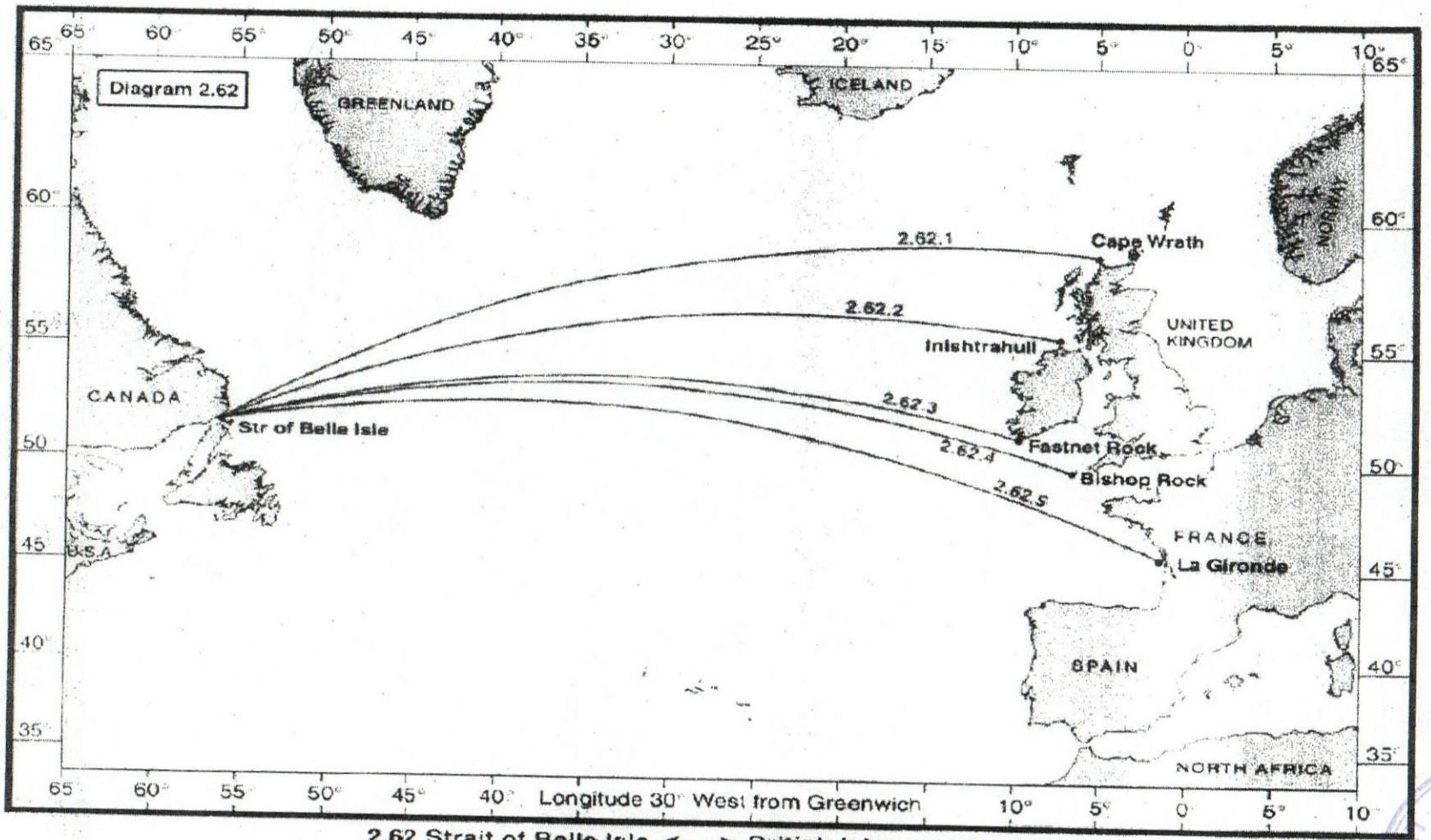
Calculate EACH of the following:

i. the GMT of sunrise; (15 marks)
ii. the rendezvous position; (15 marks)
iii. the course and speed required of the frigate to rendezvous as arranged. (10 marks)

05. A vessel is required to make a passage through an area where pack ice and ice accretion may be encountered. Describe the problems that may be experienced with regards to EACH of the following:

i. the maintenance of navigational accuracy; (10 marks)
ii. the performance of navigational instruments and electronic navigational aids; (08 marks)
iii. the use of floating navigation aids; (08 marks)
iv. the use of sectored leading lights (04 marks)

06. i. Describe how the concept of Bridge Team Management has improved the safety culture onboard ships. (15 marks)
ii. List down the information that should be discussed as part of the Master-Pilot exchange and importance of same to pilotage. (15 marks)



2.62 Strait of Belle Isle ← → British Isles and Biscay

Newfoundland Banks

2.17

After passing the Strait of Belle Isle and the E coast of Newfoundland, the Labrador Current covers the whole of the Grand Banks except, during summer, the extreme S part. A large branch of the current follows the E edge of the bank; this is the part which carries ice farthest S to reach the transatlantic shipping routes. Another branch rounds Cape Race and sets SW. Although some of the water that has passed on to the Grand Banks continues in a more S direction, especially during August to October, the bulk of it sets SW and continues, as a SW- going set, to fill thee region between Newfoundland Nova Scotia, and the Gulf Stream.

The Labrador Current subsequently continues S along the coast of the United States as a cold current as far as about 36° N from November to January, 37° N from February to April, 38° N from May to July, and 40° N from August to October. Between the S limit of the Labrador Current and the Tail of the Bank, the warm and cold waters converge on a line which is known as the `Northern Edge' (or sometimes the North Wall) of the Gulf Stream. The E end of the Northern Edge presents the greatest hydrographic contrasts to be found in the world, the water changing from the olive or bottle green of the Arctic side to the indigo blue of the Gulf Stream. A temperature change of 12° C to 0° C has been recorded within a ship's length.

The currents off the coasts of Labrador and Newfoundland are complex; for details, reference should be made to Admiralty Sailing Directions.

ICE

General remarks

2.25

The following brief account of ice in the North Atlantic Ocean is by no means comprehensive. Before undertaking voyages through areas in which ice is likely to be met, The Mariner's Handbook and the relevant Admiralty Sailing Directions should be studied, as well as the monthly Routeing Charts, which show the ice limits. These limits are also shown approximately on Diagrams (1) and (1b), but they may not always agree with the Routeing Charts, which endeavour to show the extreme limits on a monthly basis as far as this is possible with the limited and variable data available.

2.25.1

Five-day Ice Charts, obtainable from the Director General, Meteorological Office, Met.O. I a(l), Headquarters Annexe, Eastern Road, Bracknell, Berks, RGI2 2UR should also be studied.

Facsimile broadcasts of ice charts are also available, as set out in Admiralty List of Radio Signals Vol 5.

A factor always to be borne in mind where ice conditions are concerned is their great variability. For this reason, and on account of the sparsity of observations in many areas, the charted positions of ice limits must be regarded as approximate. The dates which follow refer to average conditions.

Ice limits' and drift

2.26

The Routeing Charts show the influence of the ocean currents (2.15 and 2.17) in setting the pack ice over much of the area of the Grand Banks of Newfoundland from the latter part of January until May, while the E part of the ocean remains ice-free to high latitudes.

Almost all the icebergs which menace the North Atlantic routes originate in the glaciers of the W coast of Greenland where they are calved at a rate of several thousand a year. Most are carried N by the West Greenland Current, round the head of Baffin Bay, and then S by the Canadian and Labrador Currents, and when they finally reach the shipping routes they may be several years old. The bergs calved on the E coast of Greenland also drift S, and may be met off Kap Farvel.

Some drift across the East Greenland Current and may be met throughout the year on the E flank of that current, extending SW from the W extremity of Iceland.

Others drift round Kap Farvel, but they do not survive the relatively warm water of Davis Strait and are not a source of danger on the regular transatlantic routes. Icebergs may be found beyond the limits of the pack ice at all seasons, but mostly in early summer; in winter many are frozen into the pack ice.

Ice in specific localities

2.27

Kap Farvel. The greatest distance at which bergs are met S of Kap Farvel is generally about 120 miles. This usually occurs in May when they may be encountered as far E as 66° N, 32° W. Their least extent is in December. Bergs are not usually met S of 48° N between September and December, but may be encountered in any month N of 52° N.

2.27.1

Saint Lawrence River below Montreal is closed by ice between early December and mid-April. Commercial navigation ceases in most pans of the Gulf of Saint Lawrence by mid-December; in the S pan, navigation is not considered safe between early December and mid-April.

2.27.2

Strait of Belle Isle is generally not navigable from late December until June.

2.27.3

Cabot Strait is usually navigable from mid-April until February. Pack ice arrives from N off Cape Race about the end of January in an ordinary season, extending round the coasts of the Avalon Peninsula in February, until early May.

2.27.4

The Grand Banks of Newfoundland are entirely free of pack ice between July and December inclusive. Pack ice reaches the banks in January and extends farthest S in March and April, on the E edge of the banks. In very rare seasons, dangerous pack ice may extend to the Tail of the Bank and even S of it but, on average, the floes begin to break up on reaching 45° N.

In the region of the Grand Banks, the worst season for icebergs is between March and July, with April, May and June as the months of greatest frequency. Bergs are not often found S of 40° N or E of 40°W, though occasionally they may be considerably outside these limits. They are particularly prevalent around the E flank of the banks, on which many of them ground. More detail is given in Admiralty Sailing Directions.

Strait of Belle Isle

2.35

Approaching from the E in low visibility, soundings on the banks E of Newfoundland and Labrador will be found of great assistance if not certain of the position.

A Traffic Separation Scheme (1.28) has been established in the Strait.

Newfoundland coasts

2.36

Fog is exceedingly prevalent off the S coast of Newfoundland, especially in summer. The set of the current and the indraughts into the deep bays, particularly on their E sides, should be guarded against.

Approaching from the E in thick weather, radiobeacons on the E coast of Newfoundland or other radio aids, and soundings over the Grand Banks and Ballard Bank should indicate the position with enough accuracy to round Cape Race in safety.

Although the current between the Grand Banks and Newfoundland ordinarily sets SW at a rate which may slightly exceed 1 knot, it is not unusual, particularly for a short period before a gale, for the current to be so disturbed as to set across its ordinary direction or even to be reversed on the surface. Close inshore, it is affected by the tidal steams.

The currents between Cape Race and Saint Pierre are irregular, with a greatest rate of 1 knot, and are influenced by the wind, and, near the shore, by the tidal streams. See Admiralty Sailing Directions.

Approaching from the W, Cape Pine and Cape Race should not be closed in depths of less than 55 m unless certain of the position.

Grand Banks of Newfoundland

2.37

The principal shipping routes from N European ports to ports on the E coast of the US, and to the Gulf of Saint Lawrence through Cabot Strait, lead over or near the Grand Banks.

They are among the busiest routes in the world. At the same time they are amongst the most dangerous.

Icebergs, growlers and pack ice are common in this region notorious for the frequency and density of its fogs. Many depressions pass close to the area so that gales are frequent and severe. In addition, many fishing vessels are found throughout the year on the Grand Banks, as well as vessels and platforms used to exploit oil, gas and mineral deposits.

In view of these hazards the International Convention for the Safety of Life at Sea, (1974) advises that all ships proceeding on voyages in the vicinity of the Grand Banks should avoid as far as practicable, the fishing banks of Newfoundland N of 43° N and to pass outside regions known or believed to he endangered by ice.

The International Ice Patrol Service also advises against venturing into pack ice N of 45° 30' N before the middle of April.

2.27.5

Denmark Strait is normally free of ice on its E side throughout the year, but on rare occasions, as in the spring of 1968, the ice spreads across from Greenland to close the strait. Icebergs may be met throughout the year on both sides of Denmark Strait.

Ice Information Services

2.28

Ice information, comprising up-to-date reports and forecasts from Gulf of Saint Lawrence, the Grand Banks of Newfoundland, Greenland, Iceland and the NW approaches to Europe are transmitted from the coast radio stations listed in Admiralty List of Radio Signals Vol 5, and can be obtained from the Meteorological Office, Met.O. 1 a(1), Headquarters Annexe, Eastern Road, Bracknell, Berks, RGl2 2UR.

International Ice Patrol is operated by the US Coast Guard with the primary object of collecting data and warning shipping of the amount and extent of icebergs and sea ice in the vicinity of the Grand Banks. The service operates principally between the parallels of 39o N and 50° N and the meridians of 42° and 60° W during the ice season from February or March until about theend of June.

In spite of the efforts of the International Ice Patrol bergs are known to drift unnoticed into the usual routes in the vicinity of the Grand Banks. For details of the International Ice Patrol, see Admiralty Sailing Directions and Admiralty List of Radio Signals Vol 5.

Ice Advisory Service, maintained by the Canadian Coast Guard during the winter navigational season, is based on aerial reconnaissance. Reports of existing and forecast ice conditions are broadcast from certain Canadian radio stations. For details of the service, see Admiralty Sailing Directions and Admiralty List of Radio Signals Vol 5, Ice Navigation in Canadian Waters issued by the Canadian Coast Guard, should also be consulted.

2.28.1

Caution. Carefully conducted tests by the International Ice Patrol have shown that radar cannot provide positive assurance for iceberg detection. Seawater is a better reflector than ice. This means that unless a berg or growler is observed outside the area of `sea return' or `clutter' it will not be detected by radar.

The average range of detection of a dangerous growler, if detected, is only 4 miles.

Radar is a valuable aid, but its use cannot replace the traditional caution exercised during a passage passing near the Grand Banks during the ice season.

M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
7 00	180 44.3	N21 16.8	204 19.3	13.1	N15 39.3	6.4	54.3
01	195 44.2	17.2	218 51.4	13.0	15 45.7	6.3	54.3
02	210 44.2	17.6	233 23.4	13.0	15 52.0	6.3	54.3
03	225 44.1	18.1	247 55.4	13.0	15 58.3	6.1	54.3
04	240 44.0	18.5	262 27.4	12.9	16 04.4	6.2	54.3
05	255 44.0	18.9	276 59.3	12.9	16 10.6	6.0	54.4
06	270 43.9	N21 19.3	291 31.2	12.8	N16 16.6	6.0	54.4
07	285 43.8	19.7	306 03.0	12.8	16 22.6	5.9	54.4
08	300 43.7	20.1	320 34.8	12.7	16 28.5	5.8	54.4
09	315 43.7	20.5	335 06.5	12.7	16 34.3	5.8	54.4
10	330 43.6	21.0	349 38.2	12.7	16 40.1	5.6	54.4
11	345 43.5	21.4	4 09.9	12.6	16 45.7	5.7	54.4
12	0 43.4	N21 21.8	18 41.5	12.5	N16 51.4	5.5	54.4
13	15 43.4	22.2	33 13.0	12.6	16 56.9	5.4	54.4
14	30 43.3	22.6	47 44.6	12.4	17 02.3	5.4	54.4
15	45 43.2	23.0	62 16.0	12.4	17 07.7	5.3	54.5
16	60 43.1	23.4	76 47.4	12.4	17 13.0	5.3	54.5
17	75 43.1	23.8	91 18.8	12.4	17 18.3	5.1	54.5
18	90 43.0	N21 24.2	105 50.2	12.3	N17 23.4	5.1	54.5
19	105 42.9	24.7	120 21.5	12.2	17 28.5	5.0	54.5
20	120 42.8	25.1	134 52.7	12.2	17 33.5	4.9	54.5
21	135 42.8	25.5	149 23.9	12.2	17 38.4	4.9	54.5
22	150 42.7	25.9	163 55.1	12.1	17 43.3	4.7	54.5
23	165 42.6	26.3	178 26.2	12.1	17 48.0	4.7	54.6
8 00	180 42.5	N21 26.7	192 57.3	12.0	N17 52.7	4.6	54.6
01	195 42.4	27.1	207 28.3	12.0	17 57.3	4.5	54.6
02	210 42.4	27.5	221 59.3	11.9	18 01.8	4.5	54.6
03	225 42.3	27.9	236 30.2	11.9	18 06.3	4.3	54.6
04	240 42.2	28.3	251 01.1	11.9	18 10.6	4.3	54.6
05	255 42.1	28.7	265 32.0	11.8	18 14.9	4.2	54.6
06	270 42.1	N21 29.1	280 02.8	11.8	N18 19.1	4.1	54.6
07	285 42.0	29.5	294 33.6	11.7	18 23.2	4.0	54.7
08	300 41.9	29.9	309 04.3	11.7	18 27.2	3.9	54.7
09	315 41.8	30.3	323 35.0	11.7	18 31.1	3.9	54.7
10	330 41.7	30.7	338 05.7	11.6	18 35.0	3.7	54.7
11	345 41.7	31.1	352 36.3	11.5	18 38.7	3.7	54.7
12	0 41.6	N21 31.5	7 06.8	11.6	N18 42.4	3.6	54.7
13	15 41.5	31.9	21 37.4	11.5	18 46.0	3.5	54.7
14	30 41.4	32.3	36 07.9	11.4	18 49.5	3.4	54.8
15	45 41.3	32.7	50 38.3	11.4	18 52.9	3.3	54.8
16	60 41.3	33.1	65 08.7	11.4	18 56.2	3.2	54.8
17	75 41.2	33.5	79 39.1	11.3	18 59.4	3.1	54.8
18	90 41.1	N21 33.8	94 09.4	11.3	N19 02.5	3.1	54.8
19	105 41.0	34.2	108 39.7	11.3	19 05.6	2.9	54.8
20	120 40.9	34.6	123 10.0	11.2	19 08.5	2.9	54.9
21	135 40.9	35.0	137 40.2	11.2	19 11.4	2.7	54.9
22	150 40.8	35.4	152 10.4	11.2	19 14.1	2.7	54.9
23	165 40.7	35.8	166 40.6	11.1	19 16.8	2.6	54.9
9 00	180 40.6	N21 36.2	181 10.7	11.1	N19 19.4	2.5	54.9
01	195 40.5	36.6	195 40.8	11.0	19 21.9	2.4	54.9
02	210 40.4	37.0	210 10.8	11.0	19 24.3	2.3	54.9
03	225 40.4	37.4	224 40.8	11.0	19 26.6	2.2	55.0
04	240 40.3	37.7	239 10.8	10.9	19 28.8	2.1	55.0
05	255 40.2	38.1	253 40.7	11.0	19 30.9	2.0	55.0
06	270 40.1	N21 38.5	268 10.7	10.8	N19 32.9	1.9	55.0
07	285 40.0	38.9	282 40.5	10.9	19 34.8	1.9	55.0
08	300 39.9	39.3	297 10.4	10.8	19 36.7	1.7	55.0
09	315 39.9	39.7	311 40.2	10.8	19 38.4	1.6	55.1
10	330 39.8	40.0	326 10.0	10.7	19 40.0	1.5	55.1
11	345 39.7	40.4	340 39.7	10.8	19 41.5	1.5	55.1
12	0 39.6	N21 40.8	355 09.5	10.7	N19 43.0	1.3	55.1
13	15 39.5	41.2	9 39.2	10.6	19 44.3	1.2	55.1
14	30 39.4	41.6	24 08.8	10.7	19 45.5	1.2	55.1
15	45 39.4	41.9	38 38.5	10.6	19 46.7	1.0	55.2
16	60 39.3	42.3	53 08.1	10.6	19 47.7	1.0	55.2
17	75 39.2	42.7	67 37.7	10.5	19 48.7	0.8	55.2
18	90 39.1	N21 43.1	82 07.2	10.6	N19 49.5	0.7	55.2
19	105 39.0	43.5	96 36.8	10.5	19 50.2	0.7	55.2
20	120 38.9	43.8	111 06.3	10.5	19 50.9	0.5	55.2
21	135 38.8	44.2	125 35.8	10.4	19 51.4	0.5	55.3
22	150 38.8	44.6	140 05.2	10.5	19 51.9	0.3	55.3
23	165 38.7	45.0	154 34.7	10.4	19 52.2	0.2	55.3
	S.D. 15.8	d 0.4	S.D.	14.8	14.9		15.0

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 27	28	29	30
°	h m	h m	h m	h m	h m	h m	h m
N 72	□	□	□	{ 00 24 / 23 46 }	□	□	□
N 70	□	□	□	01 03	01 01	01 02	01 23
68	□	□	□	01 29	01 39	01 59	02 38
66	////	////	01 29	01 49	02 06	02 33	03 15
64	////	////	02 08	02 05	02 26	02 57	03 41
62	////	00 46	02 35	02 18	02 43	03 17	04 02
60	////	01 38	02 56	02 30	02 57	03 32	04 19
N 58	////	02 08	03 13	02 40	03 09	03 46	04 33
56	00 41	02 31	03 27	02 48	03 19	03 58	04 45
54	01 29	02 49	03 39	02 56	03 28	04 08	04 55
52	01 57	03 04	03 50	03 03	03 37	04 17	05 05
50	02 18	03 17	03 59	03 09	03 44	04 25	05 13
45	02 57	03 43	04 19	03 23	04 00	04 42	05 31
N 40	03 24	04 03	04 35	03 34	04 13	04 57	05 46
35	03 44	04 20	04 49	03 44	04 24	05 09	05 58
30	04 01	04 34	05 00	03 52	04 34	05 19	06 09
20	04 28	04 56	05 20	04 07	04 50	05 37	06 27
N 10	04 48	05 15	05 38	04 19	05 05	05 53	06 43
0	05 06	05 31	05 54	04 32	05 19	06 08	06 58
S 10	05 21	05 47	06 09	04 44	05 33	06 23	07 14
20	05 36	06 03	06 26	04 57	05 47	06 39	07 30
30	05 50	06 20	06 45	05 11	06 05	06 57	07 48
35	05 58	06 29	06 57	05 20	06 14	07 08	07 59
40	06 06	06 39	07 09	05 30	06 26	07 20	08 12
45	06 15	06 51	07 24	05 42	06 39	07 35	08 26
S 50	06 25	07 06	07 43	05 56	06 56	07 52	08 44
52	06 30	07 12	07 51	06 02	07 03	08 01	08 53
54	06 34	07 19	08 01	06 10	07 12	08 10	09 02
56	06 39	07 27	08 12	06 18	07 22	08 21	09 13
58	06 45	07 36	08 25	06 27	07 33	08 33	09 25
S 60	06 51	07 46	08 40	06 38	07 45	08 47	09 39

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 27	28	29	30
°	h m	h m	h m	h m	h m	h m	h m
N 72	□	□	□	22 18	□	□	□
N 70	□	□	□	21 04	22 44	24 08	00 08
68	□	□	□	20 26	21 47	22 53	23 34
66	22 29	////	////	20 00	21 14	22 15	23 00
64	21 49	////	////	19 40	20 50	21 49	22 35
62	21 21	23 16	////	19 24	20 30	21 28	22 15
60	21 00	22 19	////	19 10	20 15	21 12	21 59
N 58	20 43	21 48	////	18 59	20 01	20 58	21 46
56	20 29	21 25	23 19	18 49	19 50	20 46	21 34
54	20 16	21 07	22 28	18 40	19 40	20 35	21 24
52	20 06	20 51	21 59	18 32	19 31	20 26	21 15
50	19 56	20 38	21 37	18 25	19 23	20 17	21 06
45	19 36	20 12	20 59	18 09	19 06	20 00	20 49
N 40	19 20	19 52	20 31	17 57	18 52	19 45	20 35
35	19 06	19 35	20 11	17 46	18 40	19 33	20 23
30	18 54	19 21	19 54	17 37	18 30	19 22	20 12
20	18 34	18 58	19 27	17 21	18 12	19 03	19 54
N 10	18 17	18 40	19 06	17 07	17 57	18 47	19 38
0	18 01	18 23	18 49	16 54	17 42	18 32	19 23
S 10	17 45	18 07	18 33	16 41	17 28	18 17	19 08
20	17 28	17 52	18 19	16 27	17 13	18 01	18 52
30	17 09	17 35	18 04	16 11	16 55	17 42	18 34
35	16 58	17 25	17 56	16 02	16 45	17 32	18 23
40	16 45	17 15	17 48	15 52	16 33	17 19	18 11
45	16 30	17 03	17 39	15 40	16 19	17 04	17 56
S 50	16 11	16 49	17 29	15 25	16 02	16 47	17 38
52	16 03	16 42	17 25	15 18	15 54	16 38	17 30
54	15 53	16 35	17 20	15 10	15 46	16 29	17 20
56	15 42	16 27	17 14	15 01	15 36	16 18	17 10
58	15 29	16 18	17 09	14 52	15 24	16 06	16 58
S 60	15 14	16 08	17 02	14 41	15 11	15 52	16 44

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
27	02 57	02 54	11 57	10 43	23 06	28	
28	02 50	02 46	11 57	11 31	23 55	29	
29	02 43	02 39	11 57	12 20	24 45	00	●

G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
30 00	180 38.6	N21 45.3	169 04.1	10.4	N19 52.4	0.2	55.3
01	195 38.5	45.7	183 33.5	10.4	19 52.6	0.0	55.3
02	210 38.4	46.1	198 02.9	10.3	19 52.6	0.1	55.4
03	225 38.3	46.4	212 32.2	10.4	19 52.5	0.1	55.4
04	240 38.2	46.8	227 01.6	10.3	19 52.4	0.3	55.4
05	255 38.1	47.2	241 30.9	10.3	19 52.1	0.4	55.4
06	270 38.1	N21 47.6	256 00.2	10.3	N19 51.7	0.4	55.4
07	285 38.0	47.9	270 29.5	10.3	19 51.3	0.6	55.4
08	300 37.9	48.3	284 58.8	10.2	19 50.7	0.7	55.5
S 09	315 37.8	48.7	299 28.0	10.2	19 50.0	0.8	55.5
U 10	330 37.7	49.0	313 57.2	10.3	19 49.2	0.9	55.5
N 11	345 37.6	49.4	328 26.5	10.2	19 48.3	1.0	55.5
D 12	0 37.5	N21 49.8	342 55.7	10.2	N19 47.3	1.1	55.5
A 13	15 37.4	50.1	357 24.9	10.1	19 46.2	1.1	55.6
Y 14	30 37.4	50.5	11 54.0	10.2	19 45.1	1.3	55.6
15	45 37.3	50.8	26 23.2	10.1	19 43.8	1.4	55.6
16	60 37.2	51.2	40 52.3	10.2	19 42.4	1.6	55.6
17	75 37.1	51.6	55 21.5	10.1	19 40.8	1.6	55.6
18	90 37.0	N21 51.9	69 50.6	10.1	N19 39.2	1.7	55.6
19	105 36.9	52.3	84 19.7	10.2	19 37.5	1.8	55.7
20	120 36.8	52.7	98 48.9	10.1	19 35.7	1.9	55.7
21	135 36.7	53.0	113 18.0	10.1	19 33.8	2.0	55.7
22	150 36.6	53.4	127 47.1	10.1	19 31.8	2.1	55.7
23	165 36.5	53.7	142 16.2	10.0	19 29.7	2.3	55.7
31 00	180 36.5	N21 54.1	156 45.2	10.1	N19 27.4	2.3	55.8
01	195 36.4	54.4	171 14.3	10.1	19 25.1	2.4	55.8
02	210 36.3	54.8	185 43.4	10.1	19 22.7	2.6	55.8
03	225 36.2	55.2	200 12.5	10.0	19 20.1	2.6	55.8
04	240 36.1	55.5	214 41.5	10.1	19 17.5	2.8	55.8
05	255 36.0	55.9	229 10.6	10.0	19 14.7	2.8	55.9
06	270 35.9	N21 56.2	243 39.6	10.1	N19 11.9	2.9	55.9
07	285 35.8	56.6	258 08.7	10.1	19 09.0	3.1	55.9
08	300 35.7	56.9	272 37.8	10.0	19 05.9	3.1	55.9
M 09	315 35.6	57.3	287 06.8	10.1	19 02.8	3.3	55.9
O 10	330 35.5	57.6	301 35.9	10.0	18 59.5	3.4	56.0
N 11	345 35.4	58.0	316 04.9	10.1	18 56.1	3.4	56.0
D 12	0 35.3	N21 58.3	330 34.0	10.0	N18 52.7	3.6	56.0
A 13	15 35.3	58.7	345 03.0	10.1	18 49.1	3.6	56.0
Y 14	30 35.2	59.0	359 32.1	10.0	18 45.5	3.8	56.0
15	45 35.1	59.4	14 01.1	10.1	18 41.7	3.9	56.1
16	60 35.0	21 59.7	28 30.2	10.1	18 37.8	3.9	56.1
17	75 34.9	22 00.1	42 59.3	10.0	18 33.9	4.1	56.1
18	90 34.8	N22 00.4	57 28.3	10.1	N18 29.8	4.1	56.1
19	105 34.7	00.8	71 57.4	10.1	18 25.7	4.3	56.1
20	120 34.6	01.1	86 26.5	10.1	18 21.4	4.4	56.2
21	135 34.5	01.4	100 55.6	10.1	18 17.0	4.4	56.2
22	150 34.4	01.8	115 24.7	10.1	18 12.6	4.6	56.2
23	165 34.3	02.1	129 53.8	10.1	18 08.0	4.7	56.2
1 00	180 34.2	N22 02.5	144 22.9	10.1	N18 03.3	4.7	56.2
01	195 34.1	02.8	158 52.0	10.1	17 58.6	4.9	56.3
02	210 34.0	03.1	173 21.1	10.1	17 53.7	4.9	56.3
03	225 33.9	03.5	187 50.2	10.2	17 48.8	5.1	56.3
04	240 33.8	03.8	202 19.4	10.1	17 43.7	5.1	56.3
05	255 33.7	04.2	216 48.5	10.2	17 38.6	5.3	56.4
06	270 33.6	N22 04.5	231 17.7	10.1	N17 33.3	5.3	56.4
07	285 33.6	04.8	245 46.8	10.2	17 28.0	5.4	56.4
08	300 33.5	05.2	260 16.0	10.2	17 22.6	5.6	56.4
T 09	315 33.4	05.5	274 45.2	10.2	17 17.0	5.6	56.4
U 10	330 33.3	05.8	289 14.4	10.2	17 11.4	5.7	56.5
E 11	345 33.2	06.2	303 43.6	10.2	17 05.7	5.8	56.5
S 12	0 33.1	N22 06.5	318 12.8	10.2	N16 59.9	5.9	56.5
D 13	15 33.0	06.8	332 42.0	10.3	16 54.0	6.1	56.5
A 14	30 32.9	07.2	347 11.3	10.2	16 47.9	6.0	56.5
Y 15	45 32.8	07.5	1 40.5	10.3	16 41.9	6.2	56.6
16	60 32.7	07.8	16 09.8	10.3	16 35.7	6.3	56.6
17	75 32.6	08.2	30 39.1	10.3	16 29.4	6.4	56.6
18	90 32.5	N22 08.5	45 08.4	10.3	N16 23.0	6.5	56.6
19	105 32.4	08.8	59 37.7	10.3	16 16.5	6.5	56.7
20	120 32.3	09.2	74 07.0	10.3	16 10.0	6.6	56.7
21	135 32.2	09.5	88 36.3	10.4	16 03.4	6.8	56.7
22	150 32.1	09.8	103 05.7	10.3	15 56.6	6.8	56.7
23	165 32.0	10.1	117 35.0	10.4	15 49.8	6.9	56.7
	S.D. 15.8	d 0.3	S.D. 15.1		15.3		15.4

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 30	Moonrise 31	Moonrise 1	Moonrise 2
°	h m	h m	h m	h m	h m	h m	h m
N 72	▢	▢	▢	▢	▢	03 14	05 43
N 70	▢	▢	▢	01 23	02 45	04 30	06 18
68	▢	▢	▢	02 38	03 43	05 08	06 42
66	////	////	01 17	03 15	04 17	05 34	07 01
64	////	////	02 00	03 41	04 41	05 54	07 16
62	////	00 19	02 29	04 02	05 00	06 11	07 29
60	////	01 29	02 51	04 19	05 16	06 24	07 40
N 58	////	02 02	03 08	04 33	05 30	06 36	07 49
56	00 17	02 26	03 23	04 45	05 41	06 46	07 57
54	01 21	02 45	03 36	04 55	05 51	06 55	08 04
52	01 52	03 00	03 47	05 05	06 00	07 03	08 11
50	02 14	03 14	03 57	05 13	06 08	07 10	08 16
45	02 54	03 41	04 17	05 31	06 26	07 25	08 29
N 40	03 21	04 02	04 34	05 46	06 40	07 38	08 39
35	03 43	04 18	04 47	05 58	06 51	07 48	08 48
30	04 00	04 33	05 00	06 09	07 02	07 58	08 56
20	04 27	04 56	05 20	06 27	07 20	08 14	09 09
N 10	04 48	05 15	05 38	06 43	07 35	08 28	09 21
0	05 06	05 32	05 54	06 58	07 50	08 41	09 32
S 10	05 22	05 48	06 10	07 14	08 04	08 54	09 42
20	05 37	06 04	06 27	07 30	08 20	09 08	09 54
30	05 52	06 21	06 47	07 48	08 37	09 24	10 07
35	05 59	06 31	06 58	07 59	08 48	09 33	10 15
40	06 08	06 42	07 12	08 12	09 00	09 43	10 23
45	06 17	06 54	07 27	08 26	09 13	09 56	10 34
S 50	06 28	07 08	07 46	08 44	09 30	10 11	10 46
52	06 32	07 15	07 55	08 53	09 38	10 18	10 51
54	06 37	07 23	08 05	09 02	09 47	10 25	10 57
56	06 43	07 31	08 16	09 13	09 57	10 34	11 04
58	06 49	07 40	08 29	09 25	10 09	10 44	11 12
S 60	06 55	07 50	08 45	09 39	10 22	10 55	11 21

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 30	Moonset 31	Moonset 1	Moonset 2
°	h m	h m	h m	h m	h m	h m	h m
N 72	▢	▢	▢	▢	▢	01 50	01 07
N 70	▢	▢	▢	00 08	00 32	00 34	00 32
68	▢	▢	▢	23 34	23 55	24 06	00 06
66	22 43	////	////	23 00	23 29	23 47	23 59
64	21 57	////	////	22 35	23 08	23 31	23 47
62	21 28	////	////	22 15	22 51	23 18	23 38
60	21 06	22 29	////	21 59	22 37	23 06	23 29
N 58	20 48	21 55	////	21 46	22 25	22 56	23 22
56	20 33	21 31	////	21 34	22 14	22 48	23 16
54	20 20	21 11	22 37	21 24	22 05	22 40	23 10
52	20 09	20 56	22 05	21 15	21 57	22 33	23 05
50	19 59	20 42	21 42	21 06	21 50	22 27	23 00
45	19 39	20 15	21 02	20 49	21 34	22 14	22 49
N 40	19 22	19 54	20 34	20 35	21 21	22 02	22 41
35	19 08	19 37	20 13	20 23	21 09	21 53	22 33
30	18 56	19 23	19 56	20 12	21 00	21 45	22 27
20	18 35	19 00	19 28	19 54	20 43	21 30	22 15
N 10	18 18	18 40	19 07	19 38	20 28	21 17	22 05
0	18 01	18 24	18 49	19 23	20 14	21 05	21 56
S 10	17 45	18 08	18 34	19 08	20 00	20 53	21 46
20	17 28	17 52	18 19	18 52	19 45	20 40	21 36
30	17 08	17 34	18 04	18 34	19 28	20 25	21 24
35	16 56	17 24	17 56	18 23	19 18	20 17	21 17
40	16 43	17 14	17 47	18 11	19 07	20 07	21 09
45	16 28	17 01	17 38	17 56	18 53	19 55	21 00
S 50	16 09	16 47	17 27	17 38	18 37	19 41	20 49
52	16 00	16 40	17 23	17 30	18 29	19 34	20 44
54	15 50	16 32	17 17	17 20	18 20	19 27	20 38
56	15 39	16 24	17 12	17 10	18 11	19 19	20 32
58	15 25	16 15	17 06	16 58	18 00	19 09	20 25
S 60	15 10	16 05	17 00	16 44	17 47	18 59	20 17

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
30	02 35	02 30	11 57	13 11	00 45	01	
31	02 26	02 22	11 58	14 02	01 36	02	
1	02 17	02 12	11 58	14 53	02 28	03	●

DIRECTOR GENERAL'S OFFICE
OF MERCHANT OFFICE
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE
SUBJECT: SHIP'S STABILITY
DATE : 08th October 2013, 0900 hrs to 1200 hrs.

Time allowed **THREE** hours — Total Marks 180
Answer **ALL** questions — Pass Marks 60%
Formulae and intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches where ever considered prudent.

1) a) Explain why **trim** and **initial metacentric height** are important prior dry docking a vessel.

(05 marks)

b) A vessel displacing 12000 mt enters a dry dock with a clearance of 1.00 m over the blocks. Assuming the hydrostatic particulars remain constant, determine the following:

i) The drop in water level required before the vessel takes the blocks fore and aft, and the GM at this instant, and

(15 marks)

ii) The further drop in water level to reduce the GM to zero.

(10 marks)

Vessel's hydrostatic particulars are:

Draft entering Fwd	5.20 m	Aft	6.14 m
MCTC	110 mt	TPC	18
LCF	3.00 m aft of midships	KG	5.00 m
KM	5.24 m	Length	140 m

2) a) A vessel has a displacement of 13 000 t and a KG of 8.2 m in salt water. With the aid of Datasheet Q. 1 and Q. 2, determine whether the vessel complies with the stability requirements of the current load line rules.

(24 marks)

b) What are the methods of ensuring the seaworthiness of a vessel according the load line rules without drawing GZ curves and briefly explain them.

(06 marks)

3) a) The moments to be calculated around the aft perpendicular instead of taking around the LCF to calculate final draughts fwd and aft during cargo operations. Explain the reason for this.

b) Use Datasheet Q.1 "Hydrostatic Particulars". (05 marks)

The ship is floating at draughts 4.60 m fwd, 5.46 m aft in salt water. A total of 772 t of cargo is to be loaded in a position to keep draught aft constant. LBP is 146 m. Calculate each of the following:

i) The distance from AP to load the cargo;

ii) The final draught fwd. (15 marks)

(10 marks)

4) A box shaped vessel floating upright on an even keel in SW has the following particulars;

Length	144 m	breadth	20 m
Draught	8.5 m	KG	6.4 m

She has a midship compartment 24 m long with a middle line bulkhead extending the whole depth of the compartment. Calculate the angle of heel caused by bilging on one side compartment and the maximum draught after bilging.

(30 marks)

5) During the course of a voyage, the bulk cargo originally trimmed/ leveled within a hold, shifts to one side. Describe with the aid of diagrams, the effect that this shift of cargo would have on the curve of statical stability.

(30 marks)

6) a) Explain the purpose of constructing Bonjean Curves.

b) A box shaped barge 24 m long and 6 m wide has light displacement 120 t. Iron ore (SF 0.6) is loaded, 3 m high at the forward & after ends, slopping steadily to zero at the centre. Draw the SF and BM diagrams to scale. The cargo has no slope in the athwart ship direction. (05 marks)

(25 marks)

Datasheet Q. 1

Hydrostatic particulars

Draught m	Displacement t		TPC t		MCTC tm		KMt M	KB m	LCB foap m	LCF foap m
	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000				
7.00	14576	14220	23.13	22.57	184.6	180.1	8.34	3.64	70.03	67.35
6.90	14345	13996	23.06	22.50	183.0	178.5	8.35	3.58	70.08	67.46
6.80	14115	13771	22.99	22.43	181.4	177.0	8.36	3.53	70.12	67.57
6.70	13886	13548	22.92	22.36	179.9	175.5	8.37	3.48	70.16	67.68
6.60	13657	13324	22.85	22.29	178.3	174.0	8.38	3.43	70.20	67.79
6.50	13429	13102	22.78	22.23	176.8	172.5	8.39	3.38	70.24	67.90
6.40	13201	12879	22.72	22.17	175.3	171.0	8.41	3.33	70.28	68.00
6.30	12975	12658	22.66	22.11	173.9	169.6	8.43	3.28	70.32	68.10
6.20	12748	12437	22.60	22.05	172.5	168.3	8.46	3.22	70.35	68.20
6.10	12523	12217	22.54	21.99	171.1	167.0	8.49	3.17	70.38	68.30
6.00	12297	11997	22.48	21.93	169.8	165.7	8.52	3.11	70.42	68.39
5.90	12073	11778	22.43	21.87	168.5	164.4	8.55	3.06	70.46	68.43
5.80	11848	11559	22.37	21.82	167.3	163.2	8.59	3.01	70.50	68.57
5.70	11625	11342	22.32	21.77	166.1	162.1	8.63	2.95	70.53	68.65
5.60	11402	11124	22.26	21.72	165.0	161.0	8.67	2.90	70.57	68.73
5.50	11180	10908	22.21	21.66	163.9	160.0	8.71	2.85	70.60	68.80
5.40	10958	10691	22.15	21.61	162.9	158.9	8.76	2.80	70.64	68.88
5.30	10737	10476	22.10	21.56	161.8	157.9	8.81	2.74	70.68	68.95
5.20	10516	10260	22.05	21.51	160.8	156.9	8.86	2.69	70.72	69.02
5.10	10296	10045	22.00	21.46	159.8	155.9	8.92	2.63	70.75	69.09
5.00	10076	9830	21.95	21.41	158.8	154.9	8.98	2.58	70.79	69.16
4.90	9857	9616	21.90	21.36	157.9	154.0	9.06	2.53	70.82	69.23
4.80	9638	9403	21.85	21.32	156.9	153.1	9.13	2.48	70.86	69.29
4.70	9420	9190	21.80	21.27	156.0	152.2	9.22	2.43	70.90	69.35
4.60	9202	8978	21.75	21.22	155.1	151.3	9.30	2.38	70.93	69.42
4.50	8985	8766	21.70	21.17	154.2	150.5	9.40	2.32	70.96	69.48
4.40	8768	8554	21.65	21.12	153.3	149.6	9.49	2.27	71.00	69.55
4.30	8552	8344	21.60	21.07	152.4	148.7	9.60	2.22	71.04	69.62
4.20	8336	8133	21.55	21.02	151.5	147.8	9.71	2.17	71.08	69.68
4.10	8121	7923	21.50	20.97	150.6	146.9	9.83	2.12	71.12	69.74
4.00	7906	7713	21.45	20.93	149.7	146.0	9.96	2.07	71.15	69.81
3.90	7692	7505	21.40	20.88	148.7	145.1	10.11	2.01	71.18	69.88
3.80	7478	7296	21.35	20.83	147.8	144.2	10.25	1.96	71.22	69.94
3.70	7265	7088	21.30	20.78	146.8	143.3	10.41	1.91	71.25	70.00
3.60	7052	6880	21.24	20.72	145.9	142.3	10.57	1.86	71.29	70.07
3.50	6840	6673	21.19	20.67	144.9	141.3	10.76	1.81	71.33	70.14

THESE HYDROSTATIC PARTICULARS HAVE BEEN DEVELOPED WITH THE VESSEL FLOATING ON EVEN KEEL

Datasheet Q. 2

Tabulated KN values (in metres for even keel and fixed trim)

DISPLACEMENT — TONNE	ANGLE OF HEEL — DEGREES						
	12	20	30	40	50	60	75
15000	1.72	2.98	4.48	5.72	6.48	6.91	7.05
14500	1.73	2.98	4.51	5.79	6.58	6.95	7.08
14000	1.74	2.98	4.55	5.85	6.68	7.00	7.10
13500	1.75	2.99	4.58	5.90	6.73	7.08	7.13
13000	1.77	3.00	4.62	5.93	6.78	7.14	7.16
12500	1.78	3.03	4.63	5.98	6.83	7.18	7.18
12000	1.78	3.05	4.65	6.04	6.88	7.20	7.20
11500	1.80	3.12	4.70	6.10	6.93	7.25	7.22
11000	1.82	3.15	4.75	6.15	6.98	7.30	7.24
10500	1.83	3.19	4.79	6.18	7.02	7.35	7.27
10000	1.86	3.23	4.83	6.22	7.07	7.40	7.30
9500	1.93	3.28	4.91	6.25	7.11	7.45	7.35
9000	2.00	3.36	5.00	6.28	7.18	7.50	7.40
8500	2.05	3.43	5.04	6.32	7.20	7.55	7.43
8000	2.10	3.52	5.10	6.36	7.22	7.60	7.45
7500	2.17	3.62	5.18	6.38	7.24	7.65	7.46
7000	2.22	3.70	5.25	6.40	7.26	7.70	7.50
6500	2.32	3.85	5.35	6.43	7.27	7.70	7.51
6000	2.42	4.00	5.45	6.48	7.28	7.70	7.52
5500	2.57	4.15	5.55	6.53	7.29	7.69	7.51
5000	2.72	4.32	5.65	6.58	7.30	7.66	7.50

DIRECTORATE OF MERCHANT SHIPPING

GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE/MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT : NAVIGAION

DATE : 30th December 2013, 0900 hrs to 1200 hrs.

Time allowed **THREE** hours — Total Marks 180

Answer **ALL** questions — Pass Marks 70%

Formulae and intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches where ever consider prudent.

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1. A 6800 GT refrigerated cargo vessel chartered to carry fruit between ports in the southern and western Caribbean Sea and the East coast of the USA. The vessel has been laid up in the port or Falmouth (UK) and is to proceed to New York to load agricultural equipment for discharge in Caracas (Venezuela).

   (a) Describe the context and content of EACH of the following:
   - (i) Admiralty Weekly Notices to Mariners (08 marks)
   - (ii) Navarea warnings: (08 marks)
   - (iii) Coastal warnings. (07 marks)

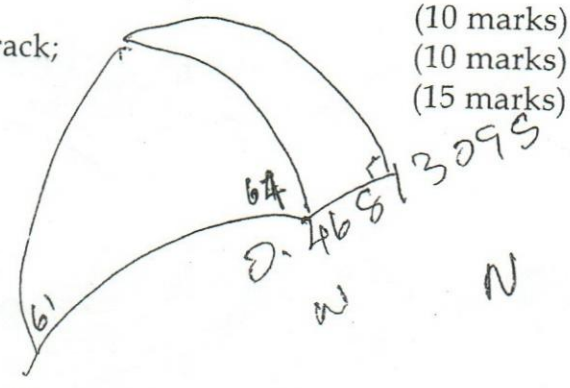
   (b) Vessels are required to carry charts and publications sufficient to allow planning of the ships intended voyage.
   State the publications required to be carried onboard a merchant ship for the vessel in question. (12 marks)

2. The vessel is due to depart from Falmouth, in ballast condition, on the 4th February. The departure and landfall positions for the trans-oceanic leg of the passage are as follows;

Departure Position	49° 47.0 N	006° 27.0' W (5 miles South of Bishop Rock)
Landfall Position	48° 20.0' N	073° 50.0' W (Approaches to New York)

With reference to the departure and landfall positions, calculate EACH of the following:

i. the great circle distance; (10 marks)
ii. the initial course on the great circle track; (10 marks)
iii. the position of the vertex; (15 marks)



295· 2558·99

74 ·12 N
63 53 E

3. A vessel is in the North Atlantic, at evening twilight, and is steaming on a course 224°T at 15 knots and is in DR position 46° 30'N 17° 40'W.

During this period the O.O.W. obtained stellar observations with the following results:

46 33·8 N
17 49·3 W

Time	Star	Azimuth	Intercept
1822	A	270°	5'.2 towards
1826	B	143°	7'.0 away
1832	C	175°	4'.4 away
1840	D	330°	6'.0 towards

The same DR was used in resolving each position line. Find by plotting, the vessel's Most Probable Position at 1830. (35 marks)

4. At 0600 hrs UT on the 25th September a vessel receives a request from MRCC Halifax to take part in a search and rescue (SAR) operation for 16 person life raft after the crew has abandoned the vessel following an explosion onboard.
   a) Outline factors to be considered when choosing a vessel to act as the On Scene Coordinator (OSC) during search and rescue operations. (10 marks)
   b) i) State the publications that should be consulted during a SAR operation. (07 marks)
      ii) Outline the information that is available to determine a search datum position, from the publications stated in Q4(b)(i). (08 marks)
   c) Explain with the aid of a sketch, the method used to determine a datum search position, assuming the distress position is known. (10 marks)

5. A vessel on a South Westerly course is making a passage through the TRS region of the Western South Pacific in March.
   a) Give details of a bridge routine which will ensure that the vessel does not encounter a storm unexpectedly. (10 marks)
   b) If a TRS is detected explain how the master may ascertain the vessel's position relative to the storm's path by onboard observations. (10marks)
   c) A TRS on a SSE track is reported abaft the starboard beam at a range of about 150nm and onboard observations reveal that the vessel is in the advance left quadrant. State the action to be taken by the master to avoid the worst of the storm. (10 marks)

6. (a) State the appropriate manning levels on the bridge, for each of the following situations in clear weather.
   i) Navigating through a ocean passage during dark hours.
   ii) Transiting through a Traffic Separation Scheme with dense traffic
   iii) Transiting through Suez canal with pilot onboard during dark hours (Each 06 marks)

   (b) Describe the content of master's night orders. (12 marks)

S. Weerabahu

DIRECTOR GENERAL'S OFFICE OF MERCHANT SHIPPING

MINISTRY OF PORTS & HIGHWAYS

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE
SUBJECT : SHIPBOARD OPERATIONS
DATE : 07th OCTOBER 2013, 0900 HRS TO 1200 HRS

Time Allowed: **THREE** hours Total Marks 180
Answer **ALL** Questions **Pass Marks 70%**
Formulae and all intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches where ever required.

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1. With regard to **Planned Maintenance System (PMS),**
a) Outline the concept of PMS and identify the requirement to have a such system onboard a vessel?

(10 Marks)

b) Describe the factors that you would be taken in to consideration prior preparing a PMS for deck machinery on a geared bulk carrier. **(10 Marks)**

c) Prepare a planned maintenance system for windlass and mooring winch **(05 marks each)**

2. With reference to **IMSBC Code,**
a) State the types of risk involved in solid bulk cargo? **(05 Marks)**
b) List down the information required prior accepting a solid bulk cargo and reasons for the same? **(05 Marks)**
c) How would you accept a cargo not listed in the IMSBC Code? **(08 Marks)**
d) Brief following
   i) Spontaneous Combustion
   ii) Dust Explosion
   iii) Volumetric heeling moment **(04 marks each)**

3. With reference to Prevention of **Marine Pollution,**
a) List down the categories of Garbage as mentioned in MARPOL Annex V and the methods of disposal of each category **(12 Marks)**
b) Explain the regulations and procedures that MARPOL has introduced in relation to Annex 1, 4 & 6

(04 marks each)

4) Write Short notes on followings;

a) IMDG Code
b) Energy Efficiency Design Index (EEDI)
c) Safe Recycling of Ships
d) Enhanced Survey Programme (ESP)
e) Docking Plan
f) IGC Code

(05 Marks each)

5) a) Describe the procedure and purpose of using **inert gas system** for the following operations.

i) Purging
ii) Loading
iii) Discharging
iv) Crude oil washing (COW)

(05 Marks Each)

b) Before commencing cargo operations at a tanker terminal, safety is ascertained using a **ship/shore safety check list**. Discuss its importance and relevance with the help of at least five items commonly use on a said check list.

(10 Marks)

6. a) With regard to the **Cargo Stowage & Securing (CSS) code**, State the general principles of cargo stowage and securing?

(05 marks)

b) What are the criteria for estimating the risk of cargo shifting **(05 marks)**

c) State the actions you will be taken in heavy weather to avoid excessive accelerations during carriage of cargo on deck? **(05 marks)**

d) List down the actions that can be taken to avoid cargo shifting. Use examples/ drawings to elaborate your answer

(15 marks)

March 2014 (Repeat)

1) a) Define the term Angle of loll. Explain how such a condition can develop on board. Propose the possible remedial action to improve the stability condition.

(08 marks)

b) M.V. Non Such, displacing 17,000 t, has the following data;

KG	8.55 m	FSM	2550 mt
KM	8.265 m	KB	4.331 m

The following table provides the KN values for the corresponding angles of heel;

Heel	0^0	5^0	10^0	15^0	20^0	30^0	40^0	60^0
KN	0	0.755	1.502	2.229	2.978	4.362	5.630	7.138

Find the angle of loll by constructing the GZ curve.

(22 marks)

2) M.V. Victory floating in salt water at a draught of 12 m forward and 13.2 m aft. How much cargo ca be loaded into No. 1 hold (HG 92 m forward), and into No. 9 hold (HG 72 m aft) in order to complete operations on an even keel draught of 14.8 m? Use the vessel particulars provided.

(30 marks)

3) A vessel having KG of 6.3 m, FSM of 2148 tm, KM of 7.2 m and displacement of 12,000 t has to load a transformer weighing 200 t using ship's crane, the head of which is 24 m above the keel. Find the following;

a) When the ship's crane picks up the transformer off the wharf with an outreach of 15 m to starboard what will be the resulting list?

(15 marks)

b) After the transformer is placed on the upper deck (KG 10 m), 7 m to starboard of the centerline what will be the final list on completion of the operation

(15 marks)

4) a) A load indicator on board always gives stress evaluations for sea and harbor conditions. What is the importance of knowing these two conditions?

(08 marks)

b) A box shaped vessel of 100 m length, 15 m beam is empty and afloat on an even keel. It has five identical compartments and displaces 1200 t. Bulk cargo is loaded and trimmed level as follows;

No. 1 – Nil, **No. 2** – 1500 t, **No. 3** – Nil, **No. 4** – 1500 t, **No. 5** – Nil
Draw the SF and BM curves to scale.

(22 marks)

5) a) Under SOLAS and Load Line Conventions what stability information is required to be provided to the Master of a vessel by the government of the flag state?

(20 marks)

b) Dynamical stability of a vessel is affected by a list developed due to transverse shift of cargo. Explain the statement.

(10 marks)

6) a) What is the purpose of carrying out an inclining experiment after constructing a vessel?

(08 marks)

b) A vessel initially upright is to carry out the inclining experiment and known to have following condition.
Displacement 5600 t KM 5.5 m

Following weights are placed on board;

Sundries & stores	165 t (KG 3.9 m)
Ballast	420 t, tank full (KG 2.96 m)
Bunker	145 t, tanks full (KG 3.4 m)
Fresh water	67 t, partially empty with a FSM of 1645 tm (KG 2.87 m)
Inclining weights	two weights 29 t each (KG 7.02 m)
Personal	0.28 t (KG 5.12 m)

Plumb lines are constructed with an effective vertical length of 6.96 m, the inclining weights are shifted 5.42 m transversely on each occasion and the mean horizontal deflection on the plumbing is 0.68 m.
Calculate the displacement and KG of the vessel in her light condition.

(22 marks)

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT : SHIP STABILITY
DATE : 05TH MARCH 2012 , 0900 Hrs to 1200 Hrs

Time allowed **THREE** hours
Answer **ALL** questions
Formulae and intermediate steps taken in reaching your answer should be clearly shown.
You may draw sketches wherever required.

Total Marks 180
Pass Marks 50%

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(01)A vessel , M.V.Victory of displacement 70,000 t has following data. KG – 9.41 m, FSM - 6300 tm, KM - 13.1 m.
Assume the angle of flooding is over 40 .
(a)Verify the compliance of the vessel with stability requirements under the LL Rules. (25 Marks)
(b)State the dynamical stability at 40 heel. (05 Marks)

(02)(a)Under SOLAS and Load Line Conventions what stability information is required to be provided to the Master of a vessel by the government of the flag state ? (20 Marks)
(b)Explain the purpose of the inclining experiment. What precautions are taken during the process in achieving accurate results ? (10 Marks)

(03)(a)Explain the precautions taken to avoid excessive stresses on a ship's structure during a sea voyage. (05 Marks)
(b)A box shaped vessel of 100m length and 15m beam has a light displacement of 1200tonnes. 3000tonnes of bulk cargo is loaded into its five identical holds and trimmed level. The cargo is distributed as follows.1500tonnes in holds No. 2 and 4. Holds No. 1 , 3 and 5 are kept empty. Draw the SF and BM diagrams to scale.

(04)(i)Define the terms (a)Bilging
(b)Permeability (03 Marks each)
(ii)A box shaped vessel of 200 m length and 20 m width is floating in salt water at drafts of 6 m forward and 8 m aft . No.2 LH , length 24m and extending the full breadth of the vessel has permeability of 70%. Its forward bulkhead is 30 m from the forward end of the vessel. Find the new drafts forward and aft if the LH gets bilged. (24 Marks)

Contd/.....2

(05)M.V.Victory floating in salt water at a draft of 12 m forward and 13.2 m aft. How much cargo can be loaded into No. 1 hold (HG 92 m forward), and into No.9 hold (HG 72m aft) in order to complete operations on an even keel draft of 14.8 m ?
Use the vessel particulars provided. (30 Marks)

(06)M.V.Vijay floats at drafts of 5 m forward and 7m aft with a KG of 7.64 m and FSM of 1086 tm in salt water. During the ebb tide, she sits on an uncharted rock 20 m abaft the forward perpendicular. The hull of the vessel remains intact. The tide is expected to fall further by 0.5 m . Find the following at low water. Use the vessel particulars provided.

(a)The force exerted on the hull by the rock. (10 Marks)
(b)The drafts forward and aft. (12 Marks)
(c)The virtual GM. (08 Marks)

Appendix III

Hydrostatic particulars of m.v. VICTORY

d	W sw	TPC	MCTC	HB	HF	KB	KM_T	KM_L
11.00	70941	68.58	1083.0	5.37F	1.96F	5.64	13.24	366
11.20	72315	68.74	1091.8	5.30F	1.72F	5.75	13.22	362
11.40	73693	68.91	1099.5	5.23F	1.47F	5.85	13.20	358
11.60	75074	69.07	1107.8	5.16F	1.22F	5.95	13.18	354
11.80	76458	69.24	1115.9	5.09F	0.98F	6.06	13.17	351
12.00	77845	69.40	1124.0	5.02F	0.74F	6.16	13.16	347
12.20	79237	69.56	1131.3	4.94F	0.53F	6.26	13.16	343
12.40	80633	69.72	1138.4	4.87F	0.32F	6.37	13.16	340
12.60	82032	69.88	1145.5	4.79F	0.12F	6.47	13.16	336
12.80	83434	70.03	1152.4	4.71F	0.08A	6.58	13.17	333
13.00	84839	70.19	1159.1	4.62F	0.27A	6.68	13.18	329
13.20	86246	70.34	1165.8	4.54F	0.46A	6.79	13.19	326
13.40	87657	70.49	1172.3	4.46F	0.64A	6.89	13.21	323
13.60	89070	70.63	1178.8	4.38F	0.81A	7.00	13.22	320
13.80	90485	70.78	1185.1	4.29F	0.98A	7.10	13.25	316
14.00	91904	70.92	1191.3	4.21F	1.14A	7.21	13.27	313
14.20	93324	71.06	1197.4	4.13F	1.29A	7.31	13.30	310
14.40	94747	71.19	1203.3	4.04F	1.44A	7.42	13.33	308
14.60	96173	71.32	1209.2	3.96F	1.58A	7.52	13.36	305
14.80	97600	71.45	1215.0	3.88F	1.72A	7.63	13.39	302
15.00	99030	71.57	1220.7	3.79F	1.84A	7.73	13.43	299

d = draft in metres, K = keel, H = amidships, LOA 245 m,

LBP 236 m, GT 42000 Tons, NT 28000 Tons

Light W 14000 t, Load W 98000 t, Deadweight 84000 t.

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

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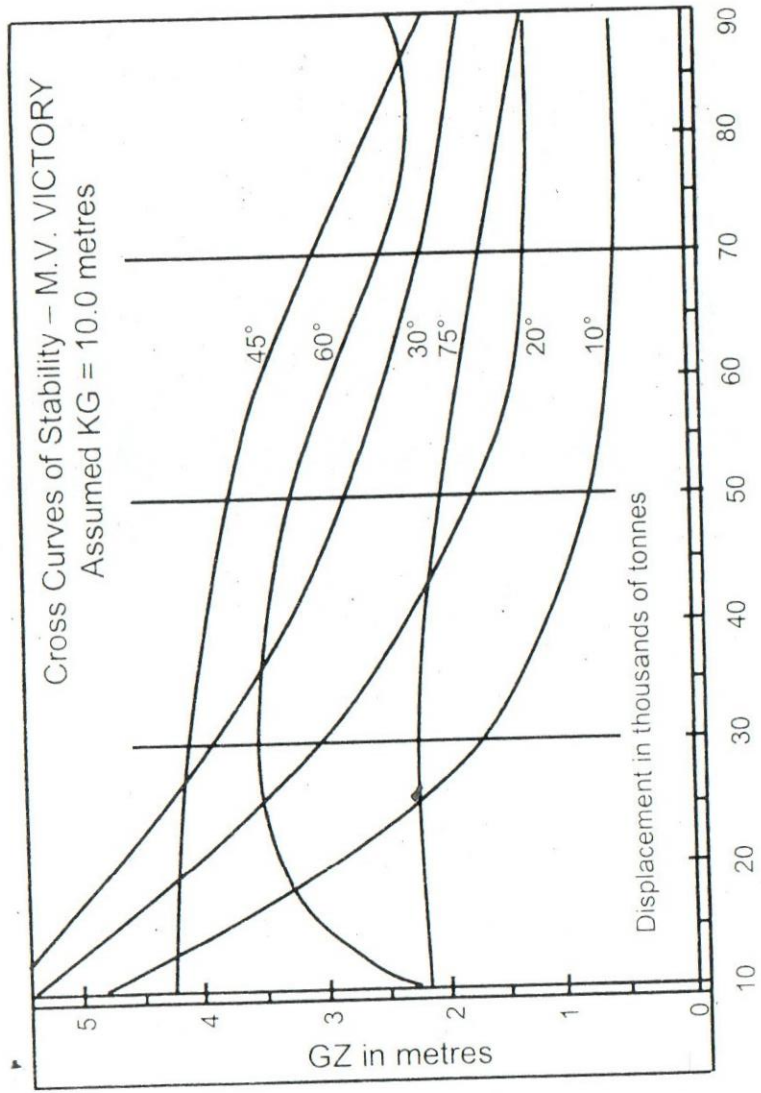
Use the vessel particulars provided. (30 Marks)

(06)M.V.Vijay floats at drafts of 5 m forward and 7m aft with a KG of 7.64 m and FSM of 1086 tm in salt water. During the ebb tide, she sits on an uncharted rock 20 m abaft the forward perpendicular. The hull of the vessel remains intact. The tide is expected to fall further by 0.5 m . Find the following at low water. Use the vessel particulars provided.

(a)The force exerted on the hull by the rock. (10 Marks)
(b)The drafts forward and aft. (12 Marks)
(c)The virtual GM. (08 Marks)



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11.80	76458	69.24	1115.9	5.09F	0.98F	6.06	13.17	351
12.00	77845	69.40	1124.0	5.02F	0.74F	6.16	13.16	347
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12.60	82032	69.88	1145.5	4.79F	0.12F	6.47	13.16	336
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13.20	86246	70.34	1165.8	4.54F	0.46A	6.79	13.19	326
13.40	87657	70.49	1172.3	4.46F	0.64A	6.89	13.21	323
13.60	89070	70.63	1178.8	4.38F	0.81A	7.00	13.22	320
13.80	90485	70.78	1185.1	4.29F	0.98A	7.10	13.25	316
14.00	91904	70.92	1191.3	4.21F	1.14A	7.21	13.27	313
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14.40	94747	71.19	1203.3	4.04F	1.44A	7.42	13.33	308
14.60	96173	71.32	1209.2	3.96F	1.58A	7.52	13.36	305
14.80	97600	71.45	1215.0	3.88F	1.72A	7.63	13.39	302
15.00	99030	71.57	1220.7	3.79F	1.84A	7.73	13.43	299

d = draft in metres, K = keel, H = amidships, LOA 245 m,

LBP 236 m, GT 42000 Tons, NT 28000 Tons

Light W 14000 t, Load W 98000 t, Deadweight 84000 t.

M.V. VIJAY

KN – Table

W	5°	10°	20°	30°	45°	60°	75°
6000	1.029	2.037	3.935	5.401	7.065	8.132	8.183
7000	0.953	1.890	3.717	5.247	7.041	8.185	8.322
8000	0.908	1.793	3.544	5.119	7.007	8.174	8.292
9000	0.875	1.724	3.415	5.012	6.962	8.106	8.254
10000	0.847	1.678	3.315	4.916	6.914	8.032	8.213
11000	0.827	1.642	3.241	4.843	6.863	7.957	8.166
12000	0.811	1.615	3.185	4.782	6.803	7.873	8.113
13000	0.798	1.595	3.153	4.733	6.741	7.788	8.057
14000	0.793	1.581	3.130	4.694	6.664	7.718	7.998
15000	0.794	1.575	3.110	4.657	6.580	7.645	7.941
16000	0.798	1.575	3.116	4.618	6.495	7.571	7.896
17000	0.793	1.577	3.127	4.580	6.408	7.495	7.854
18000	0.795	1.584	3.140	4.547	6.321	7.419	7.810
19000	0.802	1.601	3.134	4.510	6.237	7.341	7.766
20000	0.812	1.628	3.119	4.473	6.165	7.264	7.725

HYDROSTATIC TABLE OF M.V.'VIJAY'

DRAFT	W t in SW	TPC $t\,cm^{-1}$	MCTC $tm\,cm^{-1}$	AB m	AF m	KB m	KM_T m	KM_L m
3.0	5580	20.88	146.9	71.956	72.127	1.605	11.470	397.9
3.2	6000	21.07	149.6	71.968	72.141	1.710	11.030	375.8
3.4	6423	21.22	152.1	71.979	72.141	1.823	10.630	356.1
3.6	6849	21.36	154.1	71.990	72.141	1.931	10.274	339.1
3.8	7277	21.48	156.0	71.998	72.141	2.039	9.950	323.6
4.0	7708	21.60	157.8	72.008	72.127	2.147	9.660	309.9
4.2	8141	21.70	159.6	72.012	72.099	2.256	9.406	296.7
4.4	8576	21.80	161.3	72.015	72.056	2.367	9.182	285.0
4.6	9013	21.89	162.7	72.017	72.013	2.473	8.992	274.1
4.8	9451	21.97	164.3	72.016	71.970	2.576	8.828	263.9
5.0	9891	22.06	165.7	72.014	71.913	2.685	8.686	254.3
5.2	10333	22.14	167.1	72.011	71.842	2.789	8.566	245.4
5.4	10777	22.22	168.5	72.003	71.757	2.892	8.460	237.5
5.6	11223	22.30	169.9	71.990	71.671	2.998	8.374	229.9
5.8	11672	22.37	171.3	71.977	71.586	3.102	8.298	223.0
6.0	12122	22.45	172.9	71.960	71.472	3.205	8.234	217.2
6.2	12575	22.54	174.6	71.939	71.329	3.309	8.180	211.6
6.4	13030	22.64	176.4	71.914	71.172	3.413	8.136	206.6
6.6	13486	22.73	178.2	71.887	71.001	3.516	8.100	202.4
6.8	13943	22.83	180.3	71.856	70.802	3.620	8.076	198.4
7.0	14402	22.93	182.7	71.819	70.602	3.725	8.054	194.6

W displacement
A after perpendicular
K keel

Load W 19943 t
Light W 6000 t
DWT 13943 t
NT 5576 Tons

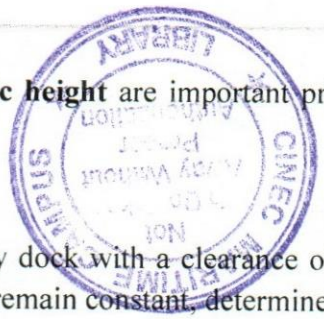
LOA 150.00 m
LBP 140.00 m
GT 10,000 Tons

DIRECTOR GENERAL'S OFFICE
OF MERCHANT OFFICE
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE
SUBJECT: SHIP'S STABILITY
DATE : 08th October 2013, 0900 hrs to 1200 hrs.

Time allowed **THREE** hours — Total Marks 180
Answer **ALL** questions — Pass Marks 60%
Formulae and intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches where ever considered prudent.



1) a) Explain why **trim** and **initial metacentric height** are important prior dry docking a vessel.

(05 marks)

b) A vessel displacing 12000 mt enters a dry dock with a clearance of 1.00 m over the blocks. Assuming the hydrostatic particulars remain constant, determine the following:

i) The drop in water level required before the vessel takes the blocks fore and aft, and the GM at this instant, and

(15 marks)

ii) The further drop in water level to reduce the GM to zero.

(10 marks)

Vessel's hydrostatic particulars are:

Draft entering Fwd	5.20 m	Aft	6.14 m
MCTC	110 mt	TPC	18
LCF	3.00 m aft of midships	KG	5.00 m
KM	5.24 m	Length	140 m

2) a) A vessel has a displacement of 13 000 t and a KG of 8.2 m in salt water. With the aid of Datasheet Q. 1 and Q. 2, determine whether the vessel complies with the stability requirements of the current load line rules.

(24 marks)

b) What are the methods of ensuring the seaworthiness of a vessel according the load line rules without drawing GZ curves and briefly explain them.

(06 marks)

3) a) The moments to be calculated around the aft perpendicular instead of taking around the LCF to calculate final draughts fwd and aft during cargo operations. Explain the reason for this.

(05 marks)

b) Use Datasheet Q.1 "Hydrostatic Particulars".
The ship is floating at draughts 4.60 m fwd, 5.46 m aft in salt water. A total of 772 t of cargo is to be loaded in a position to keep draught aft constant. LBP is 146 m. Calculate each of the following:

i) The distance from AP to load the cargo;

(15 marks)

ii) The final draught fwd.

(10 marks)

4) A box shaped vessel floating upright on an even keel in SW has the following particulars;

Length	144 m	breadth	20 m
Draught	8.5 m	KG	6.4 m

She has a midship compartment 24 m long with a middle line bulkhead extending the whole depth of the compartment. Calculate the angle of heel caused by bilging on one side compartment and the maximum draught after bilging.

(30 marks)

5) During the course of a voyage, the bulk cargo originally trimmed/ leveled within a hold, shifts to one side. Describe with the aid of diagrams, the effect that this shift of cargo would have on the curve of statical stability.

(30 marks)

6) a) Explain the purpose of constructing Bonjean Curves.

(05 marks)

b) A box shaped barge 24 m long and 6 m wide has light displacement 120 t. Iron ore (SF 0.6) is loaded, 3 m high at the forward & after ends, slopping steadily to zero at the centre. Draw the SF and BM diagrams to scale. The cargo has no slope in the athwart ship direction.

(25 marks)

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT : NAVIGATION
DATE : 06TH MARCH 2012 , 0900 Hrs to 1200 Hrs

Time allowed **THREE** hours
Answer **ALL** questions
Formulae and intermediate steps taken in reaching your answer should be clearly shown.
You may draw sketches wherever required.

Total Marks 200
Pass Marks 70%

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(01)With reference to data sheet D1 and worksheet W1 , given are the "Routes Across the Arabian Sea", presenting several tracks for vessels on passage from Colombo, Sri Lanka to Aden, South Yemen , during the various seasons. In mid July at the peak of the SW Monsoon a large high powered container vessel "M.V. Alfa" and a low powered bulk carrier " M.V. Bravo" depart Colombo to cross the Arabian sea bound for Suez. On work sheet W1,

(i)(a)Indicate the most recommended route for each vessel.
(b)Show the effects of wind and current on each vessel during the passage.
(c)While crossing which area do you expect to encounter most severe weather ?
(07 Marks each)

(ii)Explain the general factors that makes all the recommended routes indirect . (07 Marks)

(iii)Why is the route recommended for "M.V.Bravo " is so different from all other recommended routes. (07 Marks)

(02)A vessel of 35,000 tonnes displacement is fitted with all regulatory navigational aids. Further the vessel is fitted with GPS, AIS, ECDIS, LRIT and VDR. All equipment is maintained operational. The vessel's complement consists of Master, Three Deck Officers, Four Engineer Officers, One Electrician, Six GP Ratings and sufficient catering crew. Also the Engine room is operable on UMS mode with all regulatory alarms which permits single manning.

(i)What factors should the Master take into consideration when deciding upon the composition of Bridge and Engine room watches. (11 marks)

(ii)Propose appropriate manning arrangements for each of the following transits.
(a)During an ocean Passage in clear weather.
(b)Through a Traffic Separation Scheme with dense traffic.
(c)Through Suez Canal with pilot on board through the night (08 Marks each)

(03)A vessel departs from Sydney, Australia bound for Papeete in the Tuamotu Archipelago. The vessel

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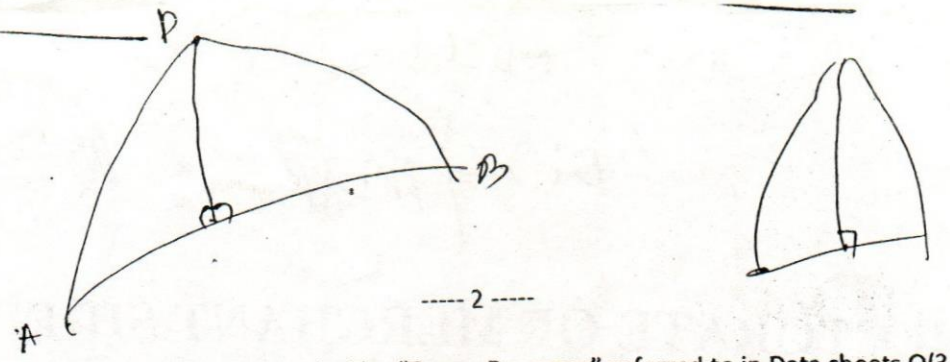


followed the routerecommended by "Ocean Passages" referred to in Data sheets Q(3)(a) and Q(3)(b). On passage several groups of islands and shoals are identified, including Macauley Island. The relevant way points are,

Departure position leaving Sydney	33° 50 'S , 151° 19 'E
Macauley Island	30° 14 'S, 178° 26'W
Way Point "A" approaching Papeete	22° 30' S, 158° 00'W

If the great circle distance between point "A" to Papeete is 560.4 miles, calculate each of the following.

(i) The total distance from Sydney to Papeete . (10 Marks)
(ii) The initial course when leaving Sydney. (10 Marks)
(iii) The position of the vertex . (10 Marks)
(iv) The distance off Macauley island , when crossing longitude 178 26' W (10 Marks)

(04) At 1742 hrs. a vessel in DR position 42° 54'N , 039° 30'W while proceeding on a course of 213° (T) at 16 knots in the North Atlantic, at 1742,following stellar observations were made.

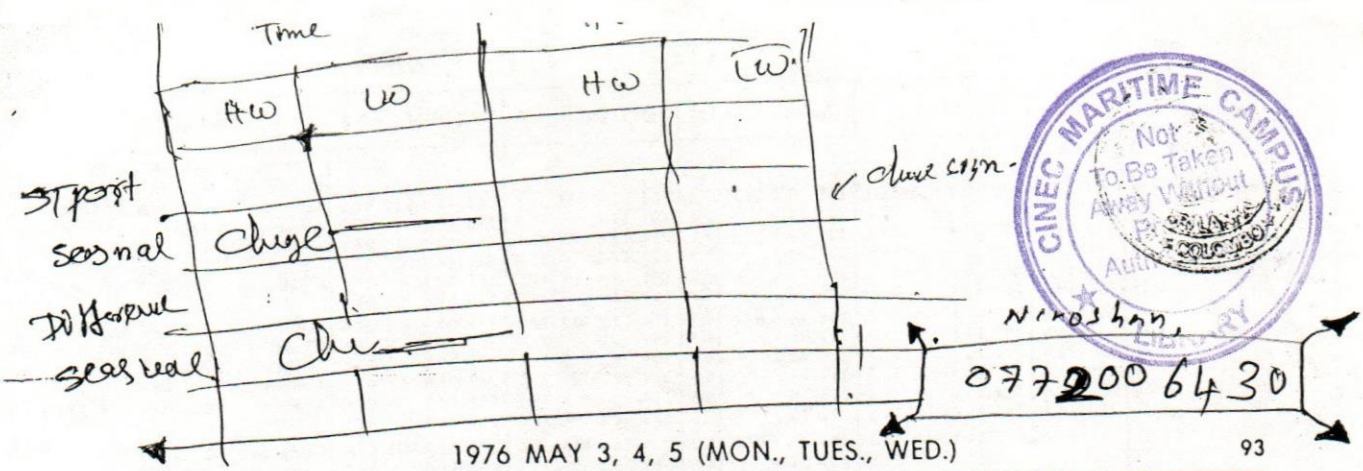
Star	"A"	"B"	"C"	"D"
Observed Time	1740	1750	1800	1805
Azimuth (T)	170°	119°	333°	025°
Intercept	2.5' T	1.5A	3.7A	10.5'A

All data above was determined by using the 1742 D.R. position. Find the vessel's most probable position at 1800 Hrs. (30 Marks)

(05) At 1040 hrs GMT on 06th March 2012, a vessel in the Mediterranean Sea sends a PAN message indicating that she is on fire and requests assistance. Presently she is heading for Marseille, France at 8 knots. Vessel's position at 1040 hrs 41 26'N , 006 28'E and the landfall position at Marseille is 43° 18' N , 005° 22' E. The call was answered by a fire fighting Tug in position 42° 05'N , 003° 54'E, capable of maintaining 13 knots.

(a) Find the course required by the tug to rendezvous as soon as possible. (15 Marks)
(b) What will be the best possible time to render assistance ? (10 Marks)

(6) A vessel is in D.R. Position 53° 12' N , 034° 08'W in the North Atlantic on a voyage from Norway to Boston, USA. At 2100 hrs GMT on 02nd May 1976 she was steaming on a steady course of 230° (T) at 17 knots. The Master being anxious about the vessel's position leaves instructions in the Night Orders that stellar observations should be made if possible, at Civic Twilight in the morning. Calculate the GMT of civil twilight on 03rd May 1976. (35 Marks)



G.M.T.	SUN G.H.A.	SUN Dec.	MOON G.H.A.	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
3 00	180 46.8	N15 38.8	139 11.8	10.6	N19 49.6	0.5	55.3
01	195 46.9	39.5	153 41.4	10.6	19 49.1	0.6	55.3
02	210 46.9	40.3	168 11.0	10.6	19 48.5	0.6	55.3
03	225 47.0	·· 41.0	182 40.6	10.6	19 47.9	0.8	55.3
04	240 47.1	41.7	197 10.2	10.5	19 47.1	0.9	55.3
05	255 47.1	42.5	211 39.7	10.5	19 46.2	1.0	55.4
06	270 47.2	N15 43.2	226 09.2	10.6	N19 45.2	1.1	55.4
07	285 47.3	44.0	240 38.8	10.5	19 44.1	1.2	55.4
08	300 47.3	44.7	255 08.3	10.5	19 42.9	1.3	55.4
M 09	315 47.4	·· 45.4	269 37.8	10.4	19 41.6	1.4	55.4
O 10	330 47.5	46.1	284 07.2	10.5	19 40.2	1.5	55.5
N 11	345 47.5	46.9	298 36.7	10.5	19 38.7	1.6	55.5
D 12	0 47.6	N15 47.6	313 06.2	10.4	N19 37.1	1.7	55.5
A 13	15 47.6	48.3	327 35.6	10.4	19 35.4	1.8	55.5
Y 14	30 47.7	49.1	342 05.0	10.5	19 33.6	2.0	55.5
15	45 47.8	·· 49.8	356 34.5	10.4	19 31.6	2.0	55.6
16	60 47.8	50.5	11 03.9	10.4	19 29.6	2.1	55.6
17	75 47.9	51.3	25 33.3	10.4	19 27.5	2.2	55.6
18	90 47.9	N15 52.0	40 02.7	10.4	N19 25.3	2.3	55.6
19	105 48.0	52.7	54 32.1	10.4	19 23.0	2.4	55.6
20	120 48.1	53.4	69 01.5	10.3	19 20.6	2.5	55.7
21	135 48.1	·· 54.2	83 30.8	10.4	19 18.1	2.6	55.7
22	150 48.2	54.9	98 00.2	10.4	19 15.5	2.8	55.7
23	165 48.2	55.6	112 29.6	10.3	19 12.7	2.8	55.7
4 00	180 48.3	N15 56.3	126 58.9	10.4	N19 09.9	2.9	55.8
01	195 48.4	57.1	141 28.3	10.3	19 07.0	3.0	55.8
02	210 48.4	57.8	155 57.6	10.3	19 04.0	3.1	55.8
03	225 48.5	·· 58.5	170 26.9	10.4	19 00.9	3.3	55.8
04	240 48.5	15 59.2	184 56.3	10.3	18 57.6	3.3	55.9
05	255 48.6	16 00.0	199 25.6	10.3	18 54.3	3.4	55.9
06	270 48.7	N16 00.7	213 54.9	10.4	N18 50.9	3.5	55.9
07	285 48.7	01.4	228 24.3	10.3	18 47.4	3.7	55.9
08	300 48.8	02.1	242 53.6	10.3	18 43.7	3.7	56.0
T 09	315 48.8	·· 02.9	257 22.9	10.3	18 40.0	3.8	56.0
U 10	330 48.9	03.6	271 52.2	10.3	18 36.2	3.9	56.0
E 11	345 48.9	04.3	286 21.5	10.4	18 32.3	4.1	56.0
S 12	0 49.0	N16 05.0	300 50.9	10.3	N18 28.2	4.1	56.0
D 13	15 49.1	05.7	315 20.2	10.3	18 24.1	4.2	56.1
A 14	30 49.1	06.5	329 49.5	10.3	18 19.9	4.3	56.1
Y 15	45 49.2	·· 07.2	344 18.8	10.3	18 15.6	4.5	56.1
16	60 49.2	07.9	358 48.1	10.3	18 11.1	4.5	56.2
17	75 49.3	08.6	13 17.4	10.3	18 06.6	4.6	56.2
18	90 49.3	N16 09.3	27 46.7	10.4	N18 02.0	4.7	56.2
19	105 49.4	10.0	42 16.1	10.3	17 57.3	4.8	56.2
20	120 49.4	10.8	56 45.4	10.3	17 52.5	4.9	56.3
21	135 49.5	·· 11.5	71 14.7	10.3	17 47.6	5.0	56.3
22	150 49.5	12.2	85 44.0	10.4	17 42.6	5.1	56.3
23	165 49.6	12.9	100 13.4	10.3	17 37.5	5.2	56.3
5 00	180 49.7	N16 13.6	114 42.7	10.3	N17 32.3	5.3	56.4
01	195 49.7	14.3	129 12.0	10.3	17 27.0	5.4	56.4
02	210 49.8	15.0	143 41.3	10.4	17 21.6	5.5	56.4
03	225 49.8	·· 15.8	158 10.7	10.3	17 16.1	5.6	56.4
04	240 49.9	16.5	172 40.0	10.4	17 10.5	5.7	56.5
05	255 49.9	17.2	187 09.4	10.3	17 04.8	5.8	56.5
06	270 50.0	N16 17.9	201 38.7	10.4	N16 59.0	5.8	56.5
W 07	285 50.0	18.6	216 08.1	10.3	16 53.2	6.0	56.5
E 08	300 50.1	19.3	230 37.4	10.4	16 47.2	6.1	56.6
D 09	315 50.1	·· 20.0	245 06.8	10.3	16 41.1	6.1	56.6
N 10	330 50.2	20.7	259 36.1	10.4	16 35.0	6.2	56.6
E 11	345 50.2	21.4	274 05.5	10.4	16 28.8	6.4	56.7
S 12	0 50.3	N16 22.2	288 34.9	10.4	N16 22.4	6.4	56.7
D 13	15 50.3	22.9	303 04.3	10.3	16 16.0	6.5	56.7
A 14	30 50.4	23.6	317 33.6	10.4	16 09.5	6.6	56.7
Y 15	45 50.4	·· 24.3	332 03.0	10.4	16 02.9	6.7	56.8
16	60 50.5	25.0	346 32.4	10.4	15 56.2	6.8	56.8
17	75 50.5	25.7	1 01.8	10.4	15 49.4	6.9	56.8
18	90 50.6	N16 26.4	15 31.2	10.4	N15 42.5	7.0	56.9
19	105 50.6	27.1	30 00.6	10.4	15 35.5	7.1	56.9
20	120 50.7	27.8	44 30.0	10.5	15 28.4	7.1	56.9
21	135 50.7	·· 28.5	58 59.5	10.4	15 21.3	7.2	57.0
22	150 50.8	29.2	73 28.9	10.4	15 14.1	7.4	57.0
23	165 50.8	29.9	87 58.3	10.4	15 06.7	7.4	57.0
	S.D. 15.9	d 0.7	S.D. 15.1		15.3		15.4

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 3	Moonrise 4	Moonrise 5	Moonrise 6
°	h m	h m	h m	h m	h m	h m	h m
N 72	////	////	01 24	□	□	05 58	08 10
N 70	////	////	02 13	03 33	05 06	06 51	08 39
68	////	00 17	02 43	04 44	05 56	07 24	09 00
66	////	01 36	03 06	05 21	06 27	07 48	09 17
64	////	02 11	03 23	05 47	06 50	08 06	09 30
62	00 14	02 36	03 38	06 07	07 09	08 22	09 42
60	01 25	02 55	03 50	06 24	07 24	08 34	09 51
N 58	01 57	03 11	04 00	06 37	07 37	08 45	10 00
56	02 20	03 24	04 09	06 49	07 48	08 55	10 07
54	02 39	03 35	04 18	07 00	07 58	09 03	10 14
52	02 54	03 45	04 25	07 09	08 07	09 11	10 20
50	03 06	03 54	04 31	07 18	08 14	09 17	10 25
45	03 32	04 12	04 45	07 35	08 31	09 32	10 37
N 40	03 51	04 27	04 56	07 50	08 45	09 44	10 46
35	04 06	04 39	05 06	08 02	08 56	09 54	10 54
30	04 19	04 49	05 15	08 13	09 06	10 03	11 01
20	04 39	05 06	05 29	08 31	09 24	10 18	11 13
N 10	04 54	05 20	05 42	08 47	09 39	10 31	11 24
0	05 07	05 32	05 53	09 02	09 53	10 44	11 34
S 10	05 18	05 43	06 05	09 17	10 07	10 56	11 44
20	05 28	05 54	06 17	09 33	10 22	11 09	11 55
30	05 37	06 06	06 31	09 51	10 39	11 24	12 07
35	05 42	06 12	06 39	10 02	10 49	11 33	12 14
40	05 47	06 19	06 48	10 14	11 01	11 43	12 22
45	05 52	06 27	06 58	10 29	11 14	11 55	12 31
S 50	05 58	06 36	07 11	10 47	11 30	12 09	12 42
52	06 00	06 41	07 17	10 55	11 38	12 15	12 47
54	06 03	06 45	07 23	11 04	11 47	12 23	12 53
56	06 06	06 50	07 31	11 15	11 56	12 31	12 59
58	06 08	06 55	07 39	11 27	12 07	12 40	13 06
S 60	06 11	07 02	07 48	11 41	12 20	12 50	13 14

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 3	Moonset 4	Moonset 5	Moonset 6
°	h m	h m	h m	h m	h m	h m	h m
N 72	22 38	////	////	□	□	03 14	02 47
N 70	21 46	////	////	02 06	02 19	02 19	02 17
68	21 14	////	////	00 55	01 29	01 46	01 55
66	20 51	22 24	////	00 18	00 57	01 21	01 37
64	20 33	21 47	////	24 33	00 33	01 02	01 23
62	20 18	21 21	////	24 14	00 14	00 47	01 11
60	20 05	21 01	22 34	23 59	24 33	00 33	01 00
N 58	19 55	20 45	22 00	23 46	24 22	00 22	00 51
56	19 45	20 31	21 36	23 34	24 12	00 12	00 44
54	19 37	20 20	21 17	23 24	24 03	00 03	00 36
52	19 30	20 09	21 02	23 16	23 56	24 30	00 30
50	19 23	20 01	20 49	23 08	23 49	24 24	00 24
45	19 09	19 42	20 23	22 51	23 33	24 12	00 12
N 40	18 58	19 27	20 04	22 37	23 21	24 01	00 01
35	18 48	19 15	19 48	22 25	23 10	23 52	24 32
30	18 39	19 05	19 35	22 14	23 01	23 45	24 26
20	18 25	18 48	19 15	21 57	22 45	23 31	24 16
N 10	18 12	18 34	19 00	21 41	22 30	23 19	24 07
0	18 00	18 22	18 47	21 26	22 17	23 08	23 58
S 10	17 49	18 10	18 36	21 12	22 04	22 57	23 50
20	17 36	17 59	18 25	20 56	21 49	22 44	23 40
30	17 22	17 47	18 16	20 38	21 33	22 30	23 30
35	17 14	17 41	18 11	20 27	21 23	22 22	23 24
40	17 05	17 34	18 06	20 15	21 12	22 13	23 17
45	16 55	17 26	18 01	20 01	20 59	22 02	23 08
S 50	16 42	17 16	17 55	19 44	20 44	21 49	22 58
52	16 36	17 12	17 52	19 35	20 36	21 43	22 54
54	16 29	17 08	17 50	19 26	20 28	21 36	22 49
56	16 22	17 03	17 47	19 16	20 19	21 28	22 43
58	16 14	16 57	17 44	19 04	20 08	21 20	22 37
S 60	16 04	16 51	17 41	18 50	19 56	21 10	22 30

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
3	03 07	03 10	11 57	15 14	02 49	04	
4	03 13	03 16	11 57	16 05	03 40	05	
5	03 19	03 21	11 57	16 56	04 30	06	

G.M.T.	ARIES	VENUS −3.3		MARS +1.5		JUPITER −1.6		SATURN +0.4	
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
3 00	221 01.2	192 20.3	N10 21.2	106 18.1	N23 18.0	184 11.9	N13 33.3	101 41.1	N21 07.8
01	236 03.7	207 19.9	22.3	121 19.1	17.8	199 13.7	33.5	116 43.4	07.8
02	251 06.1	222 19.4	23.4	136 20.1	17.5	214 15.6	33.6	131 45.7	07.7
03	266 08.6	237 19.0	·· 24.5	151 21.1	·· 17.3	229 17.5	·· 33.8	146 48.0	·· 07.7
04	281 11.1	252 18.5	25.6	166 22.2	17.0	244 19.4	34.0	161 50.3	07.7
05	296 13.5	267 18.1	26.8	181 23.2	16.8	259 21.3	34.2	176 52.6	07.6
06	311 16.0	282 17.6	N10 27.9	196 24.2	N23 16.5	274 23.2	N13 34.4	191 54.9	N21 07.6
07	326 18.5	297 17.2	29.0	211 25.2	16.3	289 25.0	34.6	206 57.2	07.6
08	341 20.9	312 16.7	30.1	226 26.2	16.0	304 26.9	34.8	221 59.5	07.6
M 09	356 23.4	327 16.3	·· 31.2	241 27.2	·· 15.7	319 28.8	·· 35.0	237 01.8	·· 07.5
O 10	11 25.8	342 15.8	32.3	256 28.3	15.5	334 30.7	35.2	252 04.1	07.5
N 11	26 28.3	357 15.4	33.5	271 29.3	15.2	349 32.6	35.4	267 06.4	07.5
D 12	41 30.8	12 14.9	N10 34.6	286 30.3	N23 15.0	4 34.4	N13 35.6	282 08.7	N21 07.4
A 13	56 33.2	27 14.5	35.7	301 31.3	14.7	19 36.3	35.8	297 11.0	07.4
Y 14	71 35.7	42 14.0	36.8	316 32.3	14.5	34 38.2	35.9	312 13.3	07.4
15	86 38.2	57 13.6	·· 37.9	331 33.3	·· 14.2	49 40.1	·· 36.1	327 15.6	·· 07.4
16	101 40.6	72 13.1	39.0	346 34.4	14.0	64 42.0	36.3	342 17.9	07.3
17	116 43.1	87 12.7	40.1	1 35.4	13.7	79 43.9	36.5	357 20.2	07.3
18	131 45.6	102 12.2	N10 41.3	16 36.4	N23 13.4	94 45.7	N13 36.7	12 22.5	N21 07.3
19	146 48.0	117 11.8	42.4	31 37.4	13.2	109 47.6	36.9	27 24.8	07.2
20	161 50.5	132 11.3	43.5	46 38.4	12.9	124 49.5	37.1	42 27.1	07.2
21	176 53.0	147 10.9	·· 44.6	61 39.4	·· 12.7	139 51.4	·· 37.3	57 29.4	·· 07.2
22	191 55.4	162 10.4	45.7	76 40.5	12.4	154 53.3	37.5	72 31.6	07.1
23	206 57.9	177 10.0	46.8	91 41.5	12.2	169 55.2	37.7	87 33.9	07.1
4 00	222 00.3	192 09.5	N10 47.9	106 42.5	N23 11.9	184 57.0	N13 37.9	102 36.2	N21 07.1
01	237 02.8	207 09.1	49.0	121 43.5	11.6	199 58.9	38.0	117 38.5	07.1
02	252 05.3	222 08.6	50.2	136 44.5	11.4	215 00.8	38.2	132 40.8	07.0
03	267 07.7	237 08.1	·· 51.3	151 45.5	·· 11.1	230 02.7	·· 38.4	147 43.1	·· 07.0
04	282 10.2	252 07.7	52.4	166 46.6	10.9	245 04.6	38.6	162 45.4	07.0
05	297 12.7	267 07.2	53.5	181 47.6	10.6	260 06.4	38.8	177 47.7	06.9
06	312 15.1	282 06.8	N10 54.6	196 48.6	N23 10.4	275 08.3	N13 39.0	192 50.0	N21 06.9
07	327 17.6	297 06.3	55.7	211 49.6	10.1	290 10.2	39.2	207 52.3	06.9
08	342 20.1	312 05.9	56.8	226 50.6	09.8	305 12.1	39.4	222 54.6	06.9
T 09	357 22.5	327 05.4	·· 57.9	241 51.6	·· 09.6	320 14.0	·· 39.6	237 56.9	·· 06.8
U 10	12 25.0	342 05.0	10 59.0	256 52.6	09.3	335 15.9	39.8	252 59.2	06.8
E 11	27 27.5	357 04.5	11 00.1	271 53.7	09.1	350 17.7	40.0	268 01.5	06.8
S 12	42 29.9	12 04.0	N11 01.2	286 54.7	N23 08.8	5 19.6	N13 40.1	283 03.8	N21 06.7
D 13	57 32.4	27 03.6	02.3	301 55.7	08.5	20 21.5	40.3	298 06.1	06.7
A 14	72 34.8	42 03.1	03.4	316 56.7	08.3	35 23.4	40.5	313 08.4	06.7
Y 15	87 37.3	57 02.7	·· 04.5	331 57.7	·· 08.0	50 25.3	·· 40.7	328 10.7	·· 06.6
16	102 39.8	72 02.2	05.6	346 58.7	07.8	65 27.1	40.9	343 12.9	06.6
17	117 42.2	87 01.7	06.8	1 59.7	07.5	80 29.0	41.1	358 15.2	06.6
18	132 44.7	102 01.3	N11 07.9	17 00.8	N23 07.2	95 30.9	N13 41.3	13 17.5	N21 06.6
19	147 47.2	117 00.8	09.0	32 01.8	07.0	110 32.8	41.5	28 19.8	06.5
20	162 49.6	132 00.4	10.1	47 02.8	06.7	125 34.7	41.7	43 22.1	06.5
21	177 52.1	146 59.9	·· 11.2	62 03.8	·· 06.4	140 36.6	·· 41.9	58 24.4	·· 06.5
22	192 54.6	161 59.4	12.3	77 04.8	06.2	155 38.4	42.1	73 26.7	06.4
23	207 57.0	176 59.0	13.4	92 05.8	05.9	170 40.3	42.2	88 29.0	06.4
5 00	222 59.5	191 58.5	N11 14.5	107 06.8	N23 05.7	185 42.2	N13 42.4	103 31.3	N21 06.4
01	238 02.0	206 58.0	15.6	122 07.9	05.4	200 44.1	42.6	118 33.6	06.3
02	253 04.4	221 57.6	16.7	137 08.9	05.1	215 46.0	42.8	133 35.9	06.3
03	268 06.9	236 57.1	·· 17.8	152 09.9	·· 04.9	230 47.9	·· 43.0	148 38.2	·· 06.3
04	283 09.3	251 56.7	18.9	167 10.9	04.6	245 49.7	43.2	163 40.5	06.3
05	298 11.8	266 56.2	20.0	182 11.9	04.3	260 51.6	43.4	178 42.7	06.2
06	313 14.3	281 55.7	N11 21.1	197 12.9	N23 04.1	275 53.5	N13 43.6	193 45.0	N21 06.2
W 07	328 16.7	296 55.3	22.2	212 13.9	03.8	290 55.4	43.8	208 47.3	06.2
E 08	343 19.2	311 54.8	23.2	227 15.0	03.5	305 57.3	44.0	223 49.6	06.1
D 09	358 21.7	326 54.3	·· 24.3	242 16.0	·· 03.3	320 59.1	·· 44.1	238 51.9	·· 06.1
N 10	13 24.1	341 53.9	25.4	257 17.0	03.0	336 01.0	44.3	253 54.2	06.1
E 11	28 26.6	356 53.4	26.5	272 18.0	02.7	351 02.9	44.5	268 56.5	06.0
S 12	43 29.1	11 52.9	N11 27.6	287 19.0	N23 02.5	6 04.8	N13 44.7	283 58.8	N21 06.0
D 13	58 31.5	26 52.5	28.7	302 20.0	02.2	21 06.7	44.9	299 01.1	06.0
A 14	73 34.0	41 52.0	29.8	317 21.0	01.9	36 08.6	45.1	314 03.4	06.0
Y 15	88 36.4	56 51.5	·· 30.9	332 22.1	·· 01.7	51 10.4	·· 45.3	329 05.6	·· 05.9
16	103 38.9	71 51.1	32.0	347 23.1	01.4	66 12.3	45.5	344 07.9	05.9
17	118 41.4	86 50.6	33.1	2 24.1	01.1	81 14.2	45.7	359 10.2	05.9
18	133 43.8	101 50.1	N11 34.2	17 25.1	N23 00.9	96 16.1	N13 45.9	14 12.5	N21 05.8
19	148 46.3	116 49.7	35.3	32 26.1	00.6	111 18.0	46.0	29 14.8	05.8
20	163 48.8	131 49.2	36.4	47 27.1	00.3	126 19.8	46.2	44 17.1	05.8
21	178 51.2	146 48.7	·· 37.5	62 28.1	23 00.1	141 21.7	·· 46.4	59 19.4	·· 05.7
22	193 53.7	161 48.3	38.6	77 29.1	22 59.8	156 23.6	46.6	74 21.7	05.7
23	208 56.2	176 47.8	39.6	92 30.2	59.5	171 25.5	46.8	89 24.0	05.7
Mer. Pass.	h m 9 10.5	v −0.5	d 1.1	v 1.0	d 0.3	v 1.9	d 0.2	v 2.3	d 0.0

STARS		
Name	S.H.A.	Dec.
	° ′	° ′
Acamar	315 39.9	S40 24.0
Achernar	335 48.1	S57 21.3
Acrux	173 39.9	S62 58.4
Adhara	255 34.6	S28 56.7
Aldebaran	291 21.7	N16 27.6
Alioth	166 44.7	N56 05.3
Alkaid	153 20.4	N49 25.9
Al Na'ir	28 18.8	S47 04.3
Alnilam	276 14.9	S 1 13.2
Alphard	218 23.4	S 8 33.6
Alphecca	126 34.3	N26 47.6
Alpheratz	358 12.6	N28 57.5
Altair	62 35.3	N 8 48.3
Ankaa	353 43.5	S42 25.9
Antares	113 00.1	S26 22.8
Arcturus	146 20.8	N19 18.2
Atria	108 26.5	S68 59.0
Avior	234 29.5	S59 26.4
Bellatrix	279 02.2	N 6 19.6
Betelgeuse	271 31.7	N 7 24.1
Canopus	264 08.9	S52 41.3
Capella	281 16.1	N45 58.5
Deneb	49 50.4	N45 11.5
Denebola	183 01.9	N14 42.2
Diphda	349 24.1	S18 07.0
Dubhe	194 25.5	N61 52.8
Elnath	278 48.2	N28 35.2
Eltanin	90 58.7	N51 29.3
Enif	34 14.5	N 9 45.9
Fomalhaut	15 54.9	S29 44.7
Gacrux	172 31.5	S56 59.1
Gienah	176 20.8	S17 24.9
Hadar	149 26.9	S60 15.7
Hamal	328 32.6	N23 21.0
Kaus Aust.	84 20.5	S34 23.7
Kochab	137 17.7	N74 15.2
Markab	14 06.3	N15 04.6
Menkar	314 44.6	N 3 59.7
Menkent	148 40.1	S36 15.4
Miaplacidus	221 45.5	S69 37.6
Mirfak	309 20.8	N49 46.6
Nunki	76 32.6	S26 19.5
Peacock	54 03.0	S56 48.4
Pollux	244 01.9	N28 05.0
Procyon	245 29.0	N 5 17.0
Rasalhague	96 32.1	N12 34.5
Regulus	208 13.1	N12 04.9
Rigel	281 39.1	S 8 13.9
Rigil Kent.	140 29.1	S60 44.3
Sabik	102 44.2	S15 41.8
Schedar	350 12.8	N56 24.3
Shaula	96 59.4	S37 05.1
Sirius	258 58.5	S16 41.3
Spica	159 00.4	S11 02.4
Suhail	223 12.9	S43 20.6
Vega	80 57.6	N38 45.5
Zuben'ubi	137 36.0	S15 56.7

	S.H.A.	Mer. Pass.
	° ′	h m
Venus	330 09.2	11 12
Mars	244 42.1	16 52
Jupiter	322 56.7	11 39
Saturn	240 35.9	17 07

G.M.T.	ARIES	VENUS −3.3		MARS +1.5		JUPITER −1.6		SATURN +0.4	
	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
30 00	218 03.8	192 51.6	N 8 59.5	105 04.6	N23 35.6	181 56.3	N13 19.4	98 55.1	N21 09.7
01	233 06.3	207 51.2	9 00.6	120 05.6	35.4	196 58.2	19.6	113 57.4	09.7
02	248 08.7	222 50.8	01.8	135 06.7	35.1	212 00.1	19.8	128 59.7	09.7
03	263 11.2	237 50.4	·· 02.9	150 07.7	·· 34.9	227 02.0	·· 20.0	144 02.0	·· 09.7
04	278 13.6	252 49.9	04.0	165 08.7	34.7	242 03.9	20.1	159 04.3	09.6
05	293 16.1	267 49.5	05.2	180 09.7	34.4	257 05.7	20.3	174 06.7	09.6
06	308 18.6	282 49.1	N 9 06.3	195 10.8	N23 34.2	272 07.6	N13 20.5	189 09.0	N21 09.6
07	323 21.0	297 48.7	07.5	210 11.8	34.0	287 09.5	20.7	204 11.3	09.6
08	338 23.5	312 48.2	08.6	225 12.8	33.7	302 11.4	20.9	219 13.6	09.5
09	353 26.0	327 47.8	·· 09.8	240 13.8	·· 33.5	317 13.3	·· 21.1	234 15.9	·· 09.5
10	8 28.4	342 47.4	10.9	255 14.9	33.2	332 15.2	21.3	249 18.2	09.5
11	23 30.9	357 46.9	12.1	270 15.9	33.0	347 17.0	21.5	264 20.5	09.5
12	38 33.4	12 46.5	N 9 13.2	285 16.9	N23 32.8	2 18.9	N13 21.7	279 22.8	N21 09.4
13	53 35.8	27 46.1	14.4	300 17.9	32.5	17 20.8	21.9	294 25.1	09.4
14	68 38.3	42 45.7	15.5	315 18.9	32.3	32 22.7	22.1	309 27.4	09.4
15	83 40.8	57 45.2	·· 16.6	330 20.0	·· 32.0	47 24.6	·· 22.3	324 29.8	·· 09.3
16	98 43.2	72 44.8	17.8	345 21.0	31.8	62 26.5	22.5	339 32.1	09.3
17	113 45.7	87 44.4	18.9	0 22.0	31.6	77 28.3	22.7	354 34.4	09.3
18	128 48.1	102 43.9	N 9 20.1	15 23.0	N23 31.3	92 30.2	N13 22.9	9 36.7	N21 09.3
19	143 50.6	117 43.5	21.2	30 24.1	31.1	107 32.1	23.1	24 39.0	09.2
20	158 53.1	132 43.1	22.3	45 25.1	30.8	122 34.0	23.2	39 41.3	09.2
21	173 55.5	147 42.7	·· 23.5	60 26.1	·· 30.6	137 35.9	·· 23.4	54 43.6	·· 09.2
22	188 58.0	162 42.2	24.6	75 27.1	30.4	152 37.8	23.6	69 45.9	09.2
23	204 00.5	177 41.8	25.8	90 28.1	30.1	167 39.6	23.8	84 48.2	09.1
1 00	219 02.9	192 41.4	N 9 26.9	105 29.2	N23 29.9	182 41.5	N13 24.0	99 50.5	N21 09.1
01	234 05.4	207 40.9	28.0	120 30.2	29.6	197 43.4	24.2	114 52.8	09.1
02	249 07.9	222 40.5	29.2	135 31.2	29.4	212 45.3	24.4	129 55.1	09.1
03	264 10.3	237 40.1	·· 30.3	150 32.2	·· 29.2	227 47.2	·· 24.6	144 57.4	·· 09.0
04	279 12.8	252 39.6	31.5	165 33.2	28.9	242 49.0	24.8	159 59.8	09.0
05	294 15.2	267 39.2	32.6	180 34.3	28.7	257 50.9	25.0	175 02.1	09.0
06	309 17.7	282 38.8	N 9 33.7	195 35.3	N23 28.4	272 52.8	N13 25.2	190 04.4	N21 08.9
07	324 20.2	297 38.3	34.9	210 36.3	28.2	287 54.7	25.4	205 06.7	08.9
08	339 22.6	312 37.9	36.0	225 37.3	27.9	302 56.6	25.6	220 09.0	08.9
09	354 25.1	327 37.5	·· 37.1	240 38.3	·· 27.7	317 58.5	·· 25.8	235 11.3	·· 08.9
10	9 27.6	342 37.0	38.3	255 39.4	27.5	333 00.3	25.9	250 13.6	08.8
11	24 30.0	357 36.6	39.4	270 40.4	27.2	348 02.2	26.1	265 15.9	08.8
12	39 32.5	12 36.2	N 9 40.5	285 41.4	N23 27.0	3 04.1	N13 26.3	280 18.2	N21 08.8
13	54 35.0	27 35.7	41.7	300 42.4	26.7	18 06.0	26.5	295 20.5	08.8
14	69 37.4	42 35.3	42.8	315 43.4	26.5	33 07.9	26.7	310 22.8	08.7
15	84 39.9	57 34.9	·· 44.0	330 44.5	·· 26.2	48 09.7	·· 26.9	325 25.1	·· 08.7
16	99 42.4	72 34.4	45.1	345 45.5	26.0	63 11.6	27.1	340 27.4	08.7
17	114 44.8	87 34.0	46.2	0 46.5	25.7	78 13.5	27.3	355 29.7	08.6
18	129 47.3	102 33.6	N 9 47.4	15 47.5	N23 25.5	93 15.4	N13 27.5	10 32.0	N21 08.6
19	144 49.7	117 33.1	48.5	30 48.5	25.2	108 17.3	27.7	25 34.3	08.6
20	159 52.2	132 32.7	49.6	45 49.6	25.0	123 19.2	27.9	40 36.6	08.6
21	174 54.7	147 32.2	·· 50.7	60 50.6	·· 24.8	138 21.0	·· 28.1	55 38.9	·· 08.5
22	189 57.1	162 31.8	51.9	75 51.6	24.5	153 22.9	28.3	70 41.3	08.5
23	204 59.6	177 31.4	53.0	90 52.6	24.3	168 24.8	28.5	85 43.6	08.5
2 00	220 02.1	192 30.9	N 9 54.1	105 53.6	N23 24.0	183 26.7	N13 28.6	100 45.9	N21 08.5
01	235 04.5	207 30.5	55.3	120 54.7	23.8	198 28.6	28.8	115 48.2	08.4
02	250 07.0	222 30.1	56.4	135 55.7	23.5	213 30.5	29.0	130 50.5	08.4
03	265 09.5	237 29.6	·· 57.5	150 56.7	·· 23.3	228 32.3	·· 29.2	145 52.8	·· 08.4
04	280 11.9	252 29.2	58.7	165 57.7	23.0	243 34.2	29.4	160 55.1	08.3
05	295 14.4	267 28.7	9 59.8	180 58.7	22.8	258 36.1	29.6	175 57.4	08.3
06	310 16.9	282 28.3	N10 00.9	195 59.8	N23 22.5	273 38.0	N13 29.8	190 59.7	N21 08.3
07	325 19.3	297 27.9	02.0	211 00.8	22.3	288 39.9	30.0	206 02.0	08.3
08	340 21.8	312 27.4	03.2	226 01.8	22.0	303 41.7	30.2	221 04.3	08.2
09	355 24.2	327 27.0	·· 04.3	241 02.8	·· 21.8	318 43.6	·· 30.4	236 06.6	·· 08.2
10	10 26.7	342 26.5	05.4	256 03.8	21.5	333 45.5	30.6	251 08.9	08.2
11	25 29.2	357 26.1	06.6	271 04.9	21.3	348 47.4	30.8	266 11.2	08.1
12	40 31.6	12 25.6	N10 07.7	286 05.9	N23 21.0	3 49.3	N13 31.0	281 13.5	N21 08.1
13	55 34.1	27 25.2	08.8	301 06.9	20.8	18 51.2	31.1	296 15.8	08.1
14	70 36.6	42 24.8	09.9	316 07.9	20.5	33 53.0	31.3	311 18.1	08.1
15	85 39.0	57 24.3	·· 11.1	331 08.9	·· 20.3	48 54.9	·· 31.5	326 20.4	·· 08.0
16	100 41.5	72 23.9	12.2	346 09.9	20.0	63 56.8	31.7	341 22.7	08.0
17	115 44.0	87 23.4	13.3	1 11.0	19.8	78 58.7	31.9	356 25.0	08.0
18	130 46.4	102 23.0	N10 14.4	16 12.0	N23 19.5	94 00.6	N13 32.1	11 27.3	N21 08.0
19	145 48.9	117 22.5	15.5	31 13.0	19.3	109 02.5	32.3	26 29.6	07.9
20	160 51.3	132 22.1	16.7	46 14.0	19.0	124 04.3	32.5	41 31.9	07.9
21	175 53.8	147 21.6	·· 17.8	61 15.0	·· 18.8	139 06.2	·· 32.7	56 34.2	·· 07.9
22	190 56.3	162 21.2	18.9	76 16.1	18.5	154 08.1	32.9	71 36.5	07.8
23	205 58.7	177 20.8	20.0	91 17.1	18.3	169 10.0	33.1	86 38.8	07.8
Mer. Pass.	h m 9 22.3	v −0.4	d 1.1	v 1.0	d 0.2	v 1.9	d 0.2	v 2.3	d 0.0

STARS		
Name	S.H.A.	Dec.
	° ′	° ′
Acamar	315 39.9	S40 24.0
Achernar	335 48.1	S57 21.3
Acrux	173 39.9	S62 58.4
Adhara	255 34.6	S28 56.7
Aldebaran	291 21.7	N16 27.6
Alioth	166 44.7	N56 05.3
Alkaid	153 20.4	N49 25.9
Al Na'ir	28 18.8	S47 04.3
Alnilam	276 14.9	S 1 13.2
Alphard	218 23.4	S 8 33.6
Alphecca	126 34.3	N26 47.5
Alpheratz	358 12.7	N28 57.5
Altair	62 35.3	N 8 48.3
Ankaa	353 43.5	S42 26.0
Antares	113 00.2	S26 22.8
Arcturus	146 20.8	N19 18.2
Atria	108 26.6	S68 59.0
Avior	234 29.5	S59 26.4
Bellatrix	279 02.2	N 6 19.6
Betelgeuse	271 31.7	N 7 24.0
Canopus	264 08.8	S52 41.3
Capella	281 16.1	N45 58.5
Deneb	49 50.4	N45 11.5
Denebola	183 01.8	N14 42.1
Diphda	349 24.1	S18 07.0
Dubhe	194 25.5	N61 52.8
Elnath	278 48.2	N28 35.2
Eltanin	90 58.7	N51 29.3
Enif	34 14.6	N 9 45.9
Fomalhaut	15 54.9	S29 44.7
Gacrux	172 31.5	S56 59.1
Gienah	176 20.8	S17 24.9
Hadar	149 26.9	S60 15.7
Hamal	328 32.6	N23 21.0
Kaus Aust.	84 20.5	S34 23.7
Kochab	137 17.7	N74 15.1
Markab	14 06.3	N15 04.6
Menkar	314 44.6	N 3 59.7
Menkent	148 40.1	S36 15.4
Miaplacidus	221 45.4	S69 37.6
Mirfak	309 20.8	N49 46.6
Nunki	76 32.7	S26 19.5
Peacock	54 03.0	S56 48.4
Pollux	244 01.9	N28 05.0
Procyon	245 29.0	N 5 17.0
Rasalhague	96 32.1	N12 34.5
Regulus	208 13.1	N12 04.9
Rigel	281 39.1	S 8 13.9
Rigil Kent.	140 29.1	S60 44.3
Sabik	102 44.3	S15 41.8
Schedar	350 12.8	N56 24.3
Shaula	96 59.5	S37 05.1
Sirius	258 58.5	S16 41.3
Spica	159 00.4	S11 02.4
Suhail	223 12.9	S43 20.6
Vega	80 57.6	N38 45.5
Zuben'ubi	137 36.0	S15 56.7

	S.H.A.	Mer. Pass.
	° ′	h m
Venus	333 38.4	11 10
Mars	246 26.2	16 57
Jupiter	323 38.6	11 48
Saturn	240 47.6	17 18

G.M.T.	SUN GHA	SUN Dec.	MOON GHA	MOON v	MOON Dec.	MOON d	MOON H.P.
d h	° ′	° ′	° ′	′	° ′	′	′
30 00	180 41.5	N14 44.7	174 26.3	13.0	N16 19.1	5.9	54.2
01	195 41.6	45.4	188 58.3	12.8	16 25.0	5.8	54.2
02	210 41.7	46.2	203 30.1	12.9	16 30.8	5.7	54.3
03	225 41.8	·· 47.0	218 02.0	12.8	16 36.5	5.7	54.3
04	240 41.9	47.7	232 33.8	12.7	16 42.2	5.6	54.3
05	255 41.9	48.5	247 05.5	12.7	16 47.8	5.6	54.3
06	270 42.0	N14 49.3	261 37.2	12.7	N16 53.4	5.4	54.3
07	285 42.1	50.0	276 08.9	12.6	16 58.8	5.4	54.3
08	300 42.2	50.8	290 40.5	12.6	17 04.2	5.3	54.3
F 09	315 42.3	·· 51.5	305 12.1	12.6	17 09.5	5.2	54.3
R 10	330 42.3	52.3	319 43.7	12.5	17 14.7	5.2	54.3
I 11	345 42.4	53.1	334 15.2	12.4	17 19.9	5.1	54.3
D 12	0 42.5	N14 53.8	348 46.6	12.5	N17 25.0	5.0	54.4
A 13	15 42.6	54.6	3 18.1	12.4	17 30.0	4.9	54.4
Y 14	30 42.7	55.4	17 49.5	12.3	17 34.9	4.8	54.4
15	45 42.7	·· 56.1	32 20.8	12.3	17 39.7	4.8	54.4
16	60 42.8	56.9	46 52.1	12.3	17 44.5	4.7	54.4
17	75 42.9	57.6	61 23.4	12.2	17 49.2	4.6	54.4
18	90 43.0	N14 58.4	75 54.6	12.2	N17 53.8	4.5	54.4
19	105 43.0	59.2	90 25.8	12.2	17 58.3	4.4	54.4
20	120 43.1	14 59.9	104 57.0	12.1	18 02.7	4.4	54.4
21	135 43.2	15 00.7	119 28.1	12.1	18 07.1	4.3	54.5
22	150 43.3	01.4	133 59.2	12.0	18 11.4	4.1	54.5
23	165 43.4	02.2	148 30.2	12.0	18 15.5	4.2	54.5
1 00	180 43.4	N15 03.0	163 01.2	12.0	N18 19.7	4.0	54.5
01	195 43.5	03.7	177 32.2	11.9	18 23.7	3.9	54.5
02	210 43.6	04.5	192 03.1	11.9	18 27.6	3.9	54.5
03	225 43.7	·· 05.2	206 34.0	11.9	18 31.5	3.7	54.5
04	240 43.7	06.0	221 04.9	11.8	18 35.2	3.7	54.5
05	255 43.8	06.7	235 35.7	11.8	18 38.9	3.6	54.6
06	270 43.9	N15 07.5	250 06.5	11.7	N18 42.5	3.5	54.6
07	285 44.0	08.2	264 37.2	11.7	18 46.0	3.4	54.6
S 08	300 44.0	09.0	279 07.9	11.7	18 49.4	3.3	54.6
A 09	315 44.1	·· 09.8	293 38.6	11.6	18 52.7	3.3	54.6
T 10	330 44.2	10.5	308 09.2	11.7	18 56.0	3.1	54.6
U 11	345 44.3	11.3	322 39.9	11.5	18 59.1	3.1	54.6
R 12	0 44.3	N15 12.0	337 10.4	11.6	N19 02.2	3.0	54.7
D 13	15 44.4	12.8	351 41.0	11.5	19 05.2	2.8	54.7
A 14	30 44.5	13.5	6 11.5	11.4	19 08.0	2.8	54.7
Y 15	45 44.5	·· 14.3	20 41.9	11.5	19 10.8	2.7	54.7
16	60 44.6	15.0	35 12.4	11.4	19 13.5	2.6	54.7
17	75 44.7	15.8	49 42.8	11.4	19 16.1	2.5	54.7
18	90 44.8	N15 16.5	64 13.2	11.3	N19 18.6	2.5	54.7
19	105 44.8	17.3	78 43.5	11.3	19 21.1	2.3	54.8
20	120 44.9	18.0	93 13.8	11.3	19 23.4	2.2	54.8
21	135 45.0	·· 18.8	107 44.1	11.3	19 25.6	2.2	54.8
22	150 45.0	19.5	122 14.4	11.2	19 27.8	2.0	54.8
23	165 45.1	20.3	136 44.6	11.2	19 29.8	2.0	54.8
2 00	180 45.2	N15 21.0	151 14.8	11.1	N19 31.8	1.8	54.8
01	195 45.3	21.8	165 44.9	11.2	19 33.6	1.8	54.8
02	210 45.3	22.5	180 15.1	11.1	19 35.4	1.7	54.9
03	225 45.4	·· 23.2	194 45.2	11.1	19 37.1	1.5	54.9
04	240 45.5	24.0	209 15.3	11.0	19 38.6	1.5	54.9
05	255 45.5	24.7	223 45.3	11.1	19 40.1	1.4	54.9
06	270 45.6	N15 25.5	238 15.4	11.0	N19 41.5	1.3	54.9
07	285 45.7	26.2	252 45.4	10.9	19 42.8	1.2	54.9
08	300 45.7	27.0	267 15.3	11.0	19 44.0	1.1	55.0
S 09	315 45.8	·· 27.7	281 45.3	10.9	19 45.1	1.0	55.0
U 10	330 45.9	28.5	296 15.2	10.9	19 46.1	0.9	55.0
N 11	345 46.0	29.2	310 45.1	10.9	19 47.0	0.8	55.0
D 12	0 46.0	N15 29.9	325 15.0	10.8	N19 47.8	0.7	55.0
A 13	15 46.1	30.7	339 44.8	10.9	19 48.5	0.6	55.1
Y 14	30 46.2	31.4	354 14.7	10.8	19 49.1	0.5	55.1
15	45 46.2	·· 32.2	8 44.5	10.7	19 49.6	0.4	55.1
16	60 46.3	32.9	23 14.2	10.8	19 50.0	0.3	55.1
17	75 46.4	33.6	37 44.0	10.8	19 50.3	0.2	55.1
18	90 46.4	N15 34.4	52 13.8	10.7	N19 50.5	0.1	55.1
19	105 46.5	35.1	66 43.5	10.7	19 50.6	0.0	55.2
20	120 46.6	35.9	81 13.2	10.7	19 50.6	0.1	55.2
21	135 46.6	·· 36.6	95 42.9	10.6	19 50.5	0.2	55.2
22	150 46.7	37.3	110 12.5	10.7	19 50.3	0.3	55.2
23	165 46.7	38.1	124 42.2	10.6	19 50.0	0.4	55.2
	S.D. 15.9	d 0.8	S.D. 14.8		14.9		15.0

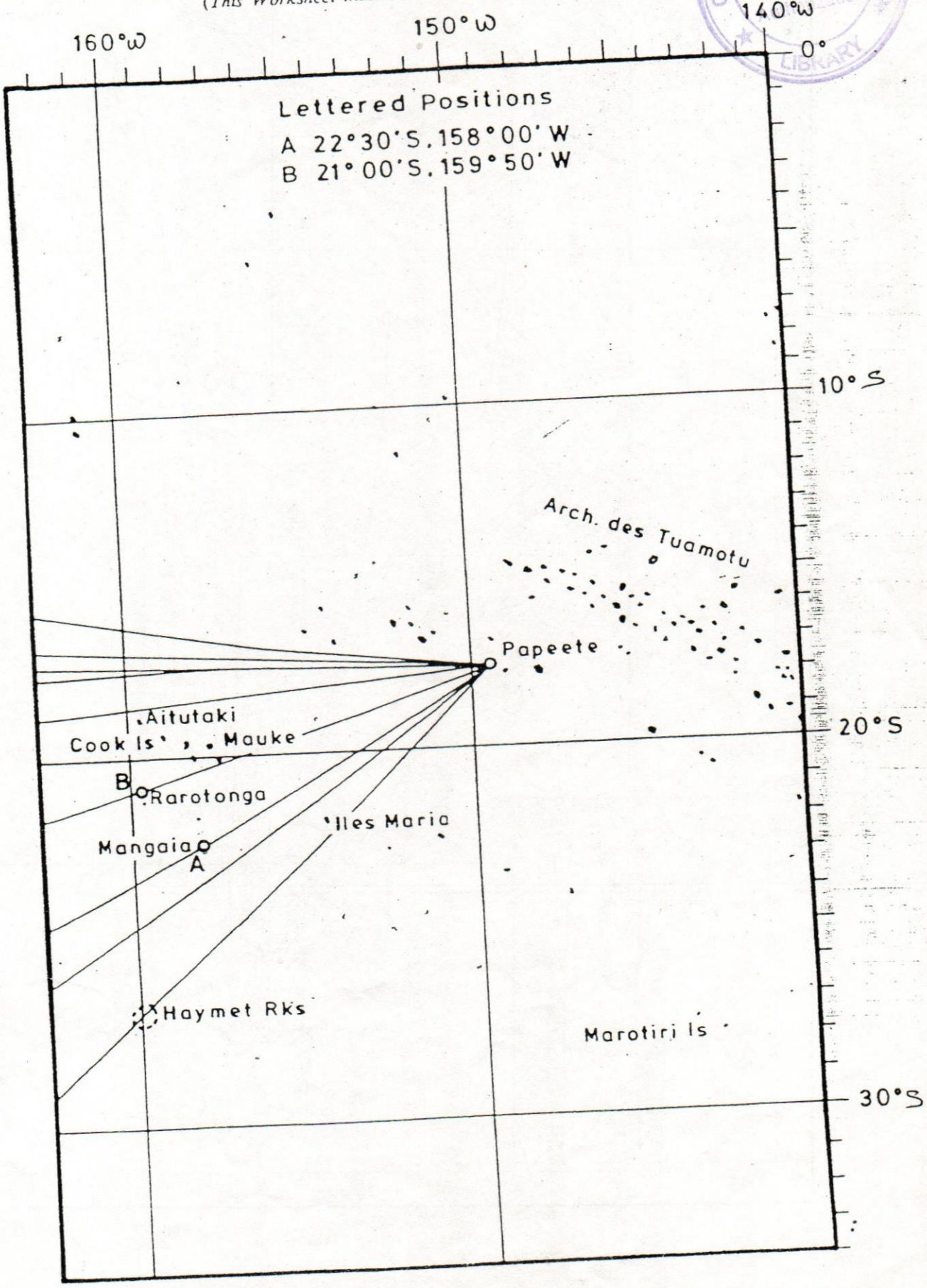
Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 30	Moonrise 1	Moonrise 2	Moonrise 3
°	h m	h m	h m	h m	h m	h m	h m
N 72	////	////	01 52	02 06	□	□	□
N 70	////	////	02 31	02 50	02 49	02 53	03 33
68	////	01 07	02 57	03 19	03 32	03 57	04 44
66	////	01 55	03 17	03 41	04 01	04 32	05 21
64	////	02 25	03 33	03 59	04 23	04 58	05 47
62	00 59	02 47	03 47	04 14	04 41	05 18	06 07
60	01 42	03 05	03 58	04 26	04 55	05 34	06 24
N 58	02 10	03 19	04 08	04 36	05 08	05 48	06 37
56	02 31	03 32	04 16	04 46	05 19	06 00	06 49
54	02 47	03 42	04 24	04 54	05 28	06 10	07 00
52	03 01	03 52	04 30	05 01	05 37	06 19	07 09
50	03 13	04 00	04 36	05 08	05 45	06 28	07 18
45	03 37	04 17	04 49	05 22	06 01	06 45	07 35
N 40	03 55	04 31	05 00	05 34	06 14	07 00	07 50
35	04 10	04 42	05 09	05 44	06 26	07 12	08 02
30	04 22	04 52	05 17	05 53	06 36	07 22	08 13
20	04 41	05 08	05 31	06 09	06 53	07 41	08 31
N 10	04 55	05 21	05 43	06 22	07 08	07 57	08 47
0	05 07	05 32	05 54	06 35	07 23	08 12	09 02
S 10	05 18	05 43	06 04	06 48	07 37	08 27	09 17
20	05 27	05 53	06 16	07 01	07 52	08 43	09 33
30	05 36	06 04	06 29	07 17	08 10	09 01	09 51
35	05 40	06 10	06 36	07 26	08 20	09 12	10 02
40	05 45	06 17	06 45	07 37	08 32	09 25	10 14
45	05 49	06 24	06 55	07 49	08 45	09 39	10 29
S 50	05 54	06 32	07 07	08 04	09 02	09 57	10 47
52	05 56	06 36	07 12	08 11	09 10	10 05	10 55
54	05 58	06 40	07 18	08 19	09 19	10 15	11 04
56	06 01	06 45	07 25	08 28	09 29	10 26	11 15
58	06 03	06 50	07 32	08 37	09 41	10 38	11 27
S 60	06 06	06 55	07 41	08 49	09 54	10 52	11 41

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 30	Moonset 1	Moonset 2	Moonset 3
°	h m	h m	h m	h m	h m	h m	h m
N 72	22 09	////	////	□	□	□	□
N 70	21 28	////	////	23 25	25 02	01 02	02 06
68	21 00	22 58	////	22 42	23 58	24 55	00 55
66	20 39	22 04	////	22 14	23 23	24 18	00 18
64	20 23	21 33	////	21 52	22 58	23 52	24 33
62	20 09	21 10	23 05	21 35	22 38	23 32	24 14
60	19 58	20 52	22 16	21 20	22 22	23 15	23 59
N 58	19 48	20 37	21 48	21 08	22 08	23 01	23 46
56	19 39	20 24	21 26	20 57	21 56	22 49	23 34
54	19 32	20 13	21 09	20 48	21 46	22 39	23 24
52	19 25	20 04	20 55	20 40	21 37	22 29	23 16
50	19 19	19 55	20 43	20 32	21 29	22 21	23 08
45	19 05	19 38	20 18	20 16	21 11	22 03	22 51
N 40	18 55	19 24	20 00	20 03	20 57	21 49	22 37
35	18 45	19 13	19 45	19 52	20 45	21 36	22 25
30	18 37	19 03	19 33	19 42	20 35	21 26	22 14
20	18 24	18 47	19 14	19 26	20 17	21 07	21 57
N 10	18 12	18 33	18 59	19 11	20 01	20 51	21 41
0	18 00	18 22	18 47	18 58	19 46	20 36	21 26
S 10	17 50	18 11	18 36	18 44	19 31	20 21	21 12
20	17 38	18 01	18 27	18 30	19 16	20 05	20 56
30	17 25	17 50	18 18	18 13	18 58	19 46	20 38
35	17 17	17 44	18 14	18 04	18 47	19 35	20 27
40	17 09	17 37	18 09	17 53	18 35	19 23	20 15
45	16 59	17 30	18 04	17 40	18 21	19 08	20 01
S 50	16 47	17 21	17 59	17 24	18 04	18 50	19 44
52	16 41	17 17	17 57	17 17	17 56	18 42	19 35
54	16 35	17 13	17 55	17 09	17 47	18 32	19 26
56	16 28	17 08	17 53	17 00	17 36	18 21	19 16
58	16 21	17 04	17 50	16 50	17 25	18 09	19 04
S 60	16 12	16 58	17 48	16 38	17 11	17 55	18 50

Day	SUN Eqn. of Time 00ʰ	SUN Eqn. of Time 12ʰ	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	
30	02 46	02 50	11 57	12 46	00 23	01	
1	02 54	02 57	11 57	13 34	01 10	02	●
2	03 01	03 04	11 57	14 24	01 59	03	

WORKSHEET Q.3 (b)

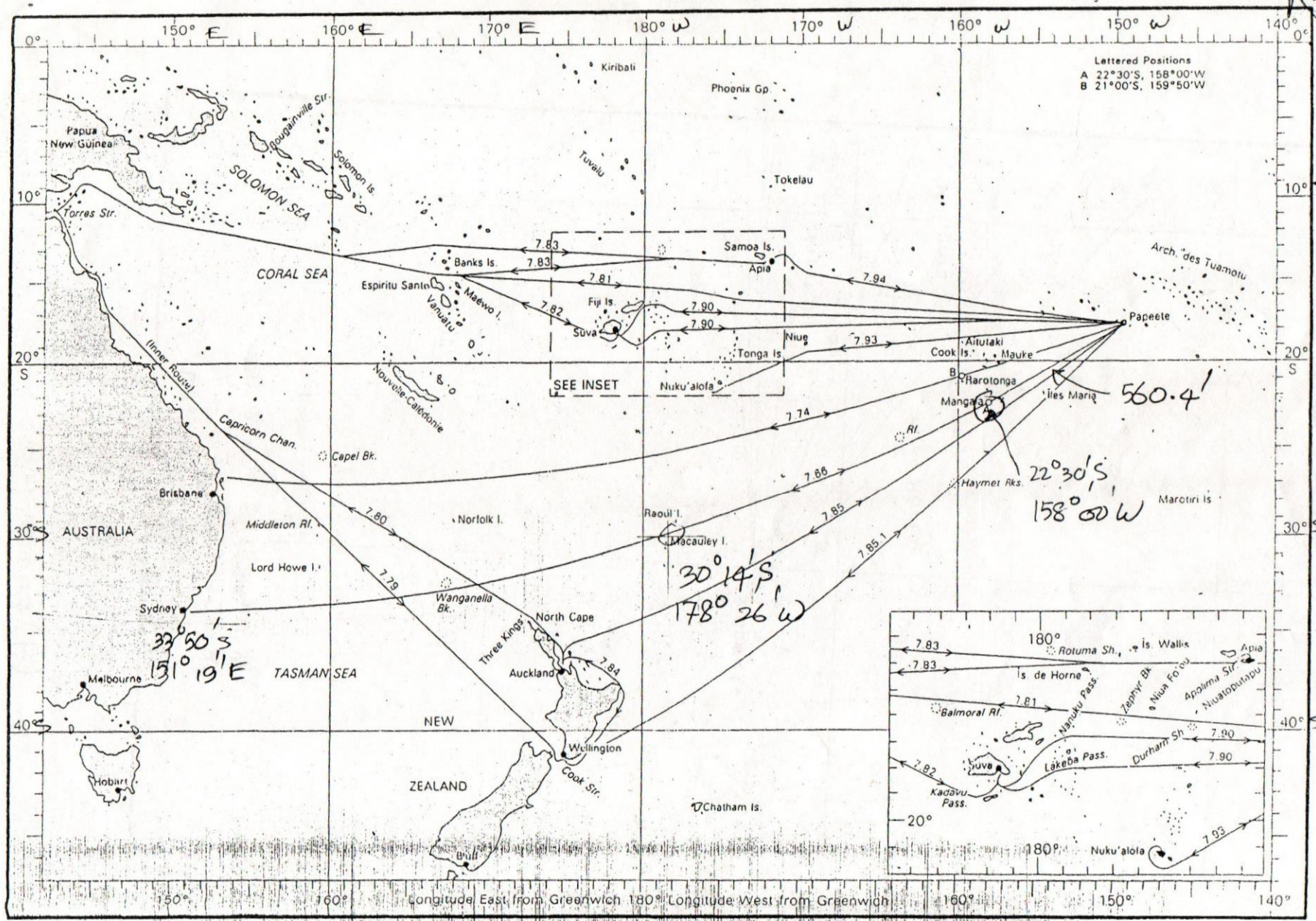
(This Worksheet must be returned with your answer book)



Candidate's Name U.A.K.T. WEERASINGHA NT 111/2248/N

Examination Centre .....

JAIASHEET Q3 (a)



560.4'

22°30'S, 158°00W

30°14'S, 178°26W

33°50'S 151°19'E

(7.79) ROUTES—Torres Strait ⟷ New Zealand. Papeete ⟷ Australia and New Zealand.

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE: CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE
SUBJECT: NAVIGATION
DATE : 27 TH AUGUST 2012, 0900 HRS TO 1200 HRS

Time Allowed : THREE hours
Answer ALL Questions
Total Marks 200
Pass marks 70%
Formulae and all intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches where ever required.

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1. A full powered vessel ,voyage speed 18.5 knots is required to make passage from cape town to Singapore in January via sunda straits. Departing cape town at 0600 hrs standard time on 14 January.
The Master intends to follow the recommended route. i.e :

(i) Cape town to position A – Rhumb line distance 175 miles
(ii) From 'A' in 36^0 45′ S, 19^0 00′ E –by Rhump line to 'B' in 33^0 45′ S, 36^0 30′ E
(iii) From 'B' in 33^0 45′ S, 36^0 30′ E – by Great Circle track to 'C' in 06^0 30′ S, 105^0 00′ E
(iv) From 'C' the entrance to the Sunda straits . Distance 523 miles to Singapore.

(a) On Worksheet Q.1 (c) (of the south Indian ocean) show the Indian ocean currents and prevailing winds for this time of the year and any other weather related phenomena.
(10 Marks)

(b) List the main publications to be consulted prior to departure indicating the information to be obtained from each .
(10 Marks)

(c) Calculate each of the followings ;

(i) The total distance from cape town to Singapore by the recommended route **(15 Marks)**
(ii) The ETA Singapore in Standard Time. **(05 Marks)**

2. On 15th May, at 2130 GMT a bulk carrier is in position 31^0 18′ N , 69^0 26′ W and a seaman suffers an injury which requires immediate attention.
At the same time , a passenger vessel is in position 29^0 42′ N , 65^0 14′ W , steaming on a course of 260^0 T at 23 knots. It has been agreed to rendezvous at sunrise next day and that the passenger vessel will maintain her present course and speed.

Calculate EACH of the following:
(a) The GMT of Sunrise;
(10 Marks)

(b) The Rendezvous Position; **(15 Marks)**

(c) The Course and Speed required by the bulk carrier to rendezvous at sunrise. **(10 Marks)**

3 (a) Draft a set of Master's Standing orders for action when approaching an area of restricted Visibility **(10 Marks)**

(b) A 10000 TEU Container Vessel has a Master, Three navigating Officers, Six Seaman and Bridge Engine Controls.

State the Bridge watch level for Each of the following situations;

(i) Clear Visibility – Open Ocean **(05 Marks)**

(ii) Clear Visibility – Coasting, dense traffic; **(05 Marks)**

(iii) Restricted Visibility – Coasting, dense Traffic. **(05 Marks)**

4 A vessel on a South westerly course is making a passage through the TRS region of the Western South pacific in March;

(a) Give details of a bridge routine that will best ensure that the vessel does not encounter such a Storm unexpectedly. **(10 Marks)**

(b) If a TRS is detected, explain how the Master may ascertain the vessel's position relative to the Storm path by onboard observations. **(10 Marks)**

(c) A TRS on a south southeasterly track is reported abaft the starboard beam at a range of about 150 miles and onboard observation place the vessel in the advance left quadrant.
State the action should be taken by the Master to avoid the worst of the storm. **(10 Marks)**

5 At Civil twilight on the morning of 16 th December 1999, the followings observations were made on board a vessel in DR , 04^0 20′ N , 142^0 12′ E while steering a course of 120^0 (T) at 15.0 knots.

Time	Star	True Bearing	True Alt.	Calc Alt.
0527	Altair	070^0	29^0 42.9'	29^0 40.0'
0530	Arcturus	172^0	30^0 12.2'	30^0 14.6'
0532	Procyon	190^0	21^0 18.0'	21^0 20.8'
0536	Rigel	218^0	29^0 16.0'	29^0 19.7'

(i) Find the Position of the vessel at 0530 hrs. **(22 Marks)**

(ii) What could you propose with regard to the accuracy of the observations **(08 Marks)**

6. (a) At 1530 LMT on 13 August 1995 , the officer of the watch of a vessel in position 27^0 24' S , 039^0 17' W make observation of the sun for the purposes of checking compass errors.
He obtains the following bearings – 303.5^0 G , 327^0 C , if variation is 22^0 W . Find EACH of the following:

(i) The gyro compass error; **(05 Marks)**

(ii) The error on the magnetic compass **(10 Marks)**

(iii) The deviation for the direction of the ships head. **(05 Marks)**

(b) (i) When checking compass error by the Amplitude method , state with reason the correct position of the sun in relation to the visible horizon. **(10 Marks)**

(ii) Explain, why in high latitudes the observation of the sun for checking compass error by the Amplitude method is unreliable. **(10 Marks)**

Set (4) (4)

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE/MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT : NAVIGATION
DATE : 05TH APRIL 2010 , 0900 Hrs to 1200 Hrs

Time allowed **THREE** hours — Total Marks 200
Answer **ALL** questions — Pass Marks 70%
Formulae and intermediate steps taken in reaching your answer should be clearly shown.
Sketches may be made wherever considered necessary.

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(01)An ocean going tug is chartered to tow a large vessel from Mumbai (India) to Aden during the peak of the South West Monsoon. It has been agreed that the tug should maintain an average speed of 6 – 8 knots during the tow.

(i)Define low powered vessels as given in the Ocean Passages for the World. (05 Marks)
(ii)On worksheet Q(01) with reference to Datasheet Q(01)(a) plot clearly the most recommended route for the tug under tow. (06 Marks)
(iii)State the reasons for recommending the track you present in above (ii) (06 Marks)
(iv)With reference to both Datasheets Q(01)(a) and Q(01)(b) list the anticipated hazards which should be considered when planning the passage under tow. (12 Marks)
(v)Indicate clearly on worksheet Q(01)the general area where the most severe weather conditions may be encountered during the South West Monsoon. (06 Marks)

(02) On 05th April 1999, at 2130 GMT, on board a cargo vessel in position 31° 18' N , 069° 26' W , a crew Member suffers an accident which requires urgent medical attention. At this time a passenger vessel is in position 29° 42' N , 065° 14' W was steaming on a course 260° (T) at 23 knots. It was agreed between the two Masters to rendezvous at sunrise next morning (06th April), and that the passenger vessel to maintain her present course and speed.
Calculate each of the following.
(i)The GMT of sunrise on 05th April 1999 10h 28m 26s (06 Marks)
(ii)The rendezvous position 28°50.18'N 070°50.38'W (15 Marks)
(iii)The course and speed required by the cargo vessel for the planned rendezvous at sunrise. 206° (T) 12.7 kts (14 Marks)

Contd/....2

(03)A vessel is to make passage by composite great circle from Auckland (New Zealand), to Panama.
Departure position off Auckland 36° 36' S , 174° 49' E.
Landfall position off Panama 07° 00' N , 080° 00' W.
Extra distance to cover under pilotage and coasting is 230 miles.
Calculate each of the following.

(i)The total distance from Auckland to Panama. (08 Marks)
(ii)The initial course on passage. (12 Marks)
(iii)The position of the Vertex. (14 Marks)
(iv)The Longitude in which the track crosses the equator (06 Marks)

(04)A vessel trades regularly to the Baltic, where during the winter months, heavy sea ice accretion may be experienced. Describe the additional problems the Master has to encounter due to the winter conditions with regard to each of the following.

(i)Maintaining navigational accuracy. (14 Marks)
(ii)The reliability of the navigational equipment and the electronic navigational aids. (07 Marks)
(iii)The use of floating navigational marks. (07 Marks)
(iv)The use of sectored leading lights. (07Marks)

(05)A vessel is in the South Pacific, in the vicinity of Fiji Islands during the cyclone season.

(i)State the first visible sign that will usually alert the Master that a cyclone may be in the vicinity, explaining its significance. (04 Marks)
(ii)If no shore forecasts are available, state how the Master can, while in the Southern Hemisphere, determine his position in relation to the direction of the cyclone's path. (07 Marks)
(iii)Present weather conditions in the vicinity was observed as follows,

*Heavy swell from the NE
*Rapidly falling barometer
*Wind SE, freshening and slowly backing

If the vessel's present course is 210°(T), state any action which you as Master might consider advisable to take in view of the weather conditions anticipated, giving reasons for any action proposed. (12 Marks)
(iv)Several hours later, wind steadies from SSE and then begins to veer towards the South with the barometer still falling. Subsequent to the action which you may have taken in (iii)above, make a thorough analysis of the current situation, and state any further action you may propose to be taken. (12 Marks)

(06)(i)List the publications that are required to be carried by merchant vessels which proceed to sea, as listed in the Annual Summary of Notices to Mariners. (10 Marks)
(ii)Outline the type of information contained in each of the categories of Marine Notices currently in use. (10 Marks)

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION
GRADE : **CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE**

SUBJECT : **SHIP STABILITY**

DATE : **06TH April 2004 , 0900 hrs to 1200 hrs.**

Time allowed THREE hours — Total Marks 180
Answer ALL questions — **Pass Marks 50%**
Formulae and all intermediate steps taken in reaching your answer should be clearly shown . You may draw sketches wherever required .

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(1)(a)Outline the importance of a shipboard stress finding installation , giving the details of the inputs and the outputs obtained.

(08 Marks)

(b)A box shaped vessel of 120 m in length , displaces 1800 tonnes in her light Condition. She is subdivided into six compartments of equal length which are to be loaded and level stowed as follows .

Holds No. 1 and No. 6 600 tonnes each
Holds No. 3 and No. 4 500 tonnes each
Holds No. 2 and No. 5 to remain empty

Produce the curves of Shearing Forces and Bending Moments for the vessel Indicating the values .

(22 Marks)

(2)(a)With regard to the inclining experiment ,
(i)What is the purpose of the experiment ?
(ii)What precautions should you take before and during the process ?

(05 Marks each)

(b)Following are the results of an inclining test performed . Calculate the KG of the vessel in its lightship condition . Known data as follows. KM – 8.1 m , Present displacement of the vessel 5400 tonnes which includes , inclining weight of 25 tonnes at KG – 7.94 m , fuel oil 50 tonnes at KG – 2.3 m and FSM – 640 tonne metres . The inclining weight was moved 14 m transversely producing a deflection of 27 cm in a plumbline of 9.0 m length .

(20 Marks)

Contd/.....02

(3)(a)Define the terms "Stowage Factor" and "Permeability" in respect of cargoes and cargo spaces . (05 Marks each)

(b)A box shaped vessel of 144 m in length has a beam of 20 m and floats at an even keel draft of 8.5 m in salt water . A midships compartment of 24 m in length has a middle line bulkhead extending the whole depth of the compartment . Calculate the angle of heel caused by bilging on one side and the maximum Draft after bilging . (KG – 6.4 m)

(20 Marks)

(4)(a)Explain how windage area and the beam of a vessel relate to its dynamical stability . (10 Marks)

(b)Using the following formula and data sheet provided determine the heeling lever caused by the wind .

$$\text{Heeling Lever} = \frac{0.165 \times 10^{-4} V^2 \Sigma C_s A Z}{\Delta}$$

A vessel displacing 14000 tonnes floating at an even keel draft of 6.0 m is facing a wind of 55 knots on its hull , deck house and six deck cranes . Details of windage area as given below .

Portion of the vessel	Projected lateral area	Centre of area above W/L
Hull	400 m^2	3.00 m
Deck Superstructure	200 m^2	8.00 m
One Crane	10 m^2	8.00 m

(20 Marks)

(5)(a)Define the following with regard to dry docking ,

(i)Critical Moment
(ii)Critical Period
(iii)Critical Instant

(04 Marks each)

(b)A vessel due to be dry docked has the following data available .

Displacement 11,000 KG 7.70 m KM 8.20 m
Length (BP) 168 m MCTC 130 LCF Amidships
Initial draft 3.25 m foreward , 6.69 m aft .

To adjust the trim for the dry dock the vessel fills a Double Bottom tank of 270 tonnes having a KG of 1.2 m and LCG of 159 m foreward of AP . Calculate the following ,

(i)Trim of the vessel when entering the dry dock .
(ii)GM when the vessel takes the blocks overall .

(09 Marks each)

Contd/....3

The Ministry of Shipping and Shipping Development
MERCHANT SHIPPING DIVISION

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT : SHIPBOARD OPERATIONS
DATE : 22 ND MAY 2000 , 0900 hrs. TO 1200 hrs.

Time allowed THREE hours. Total Marks 180
Answer ALL questions. Pass Marks 70 %
Formulae and all intermediate steps taken in reaching your answer should be clearly shown . Sketches to be shown whenever necessary .

(1)(a)In terms of load ranges involved what will you define as a heavy lift ? (06 Marks)

(b)Compare a Derrick and a Crane with their advantages and disadvantages . (12 Marks)

(c)Enumerate the characteristics associated with a rig of Stulken Mast and derrick used for handling heavy lifts. (12 Marks)

(2)(a) Discuss the standard procedure adopted in inspection of cargo holds prior to loading of cargo on a General Cargo / Bulk Vessel . (10 Marks)

(b)Explain in detail the circumstances under which the formation of
(i)Cargo sweat (ii)Ship's sweat
could be expected . (14 Marks)

(c)What is meant by hygroscopic and non-hygroscopic cargos ? (06 Marks)

(3)(a)Explain in detail the nature of hazards that could be expected during a voyage when carrying a cargo of iron ore . (15 Marks)

(b)What safety measures and limits you will consider for a concentrated solid bulk cargo in deciding whether such carriage by sea is safe ? What documentation is mandatory before loading ? . (15 Marks)

Contd..../2

(4)(a)On board an Oil Tanker how does a build up of Static Electricity take place ? Successful prevention of such occurrence is achieved on board today , explain . (15 Marks)

(b)What is the Principle used in an Inert Gas system on board a tanker and what are the benefits achieved by having such an installation ? (15 Marks)

(5)With regard to the IMDG code,

(a)What is the objective of such a Code ? (05 Marks)

(b)What are the salient features in a DG declaration ? (08 Marks)

(c)With regard to a hazardous commodity what information could you extract from the relevant page for that material ? (09 Marks)

(d)How will you go about placing hazardous cargo suitably on board in accordance with the Code ? (08 Marks)

(6)Under MARPOL 73/78 ,

(a)What are the Certificates required to be carried on board a Tanker ? (12 Marks)

(b)How discharge of oil from Machinery Spaces to be controlled in all types of vessels when (i) within a special area ?
(ii) out of a special area ? (18 Marks)

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

(5)

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT : SHIPBOARD OPERATIONS
DATE : 22ND AUGUST 2011 , 0900 Hrs to 1200 Hrs

Time allowed **THREE** hours — Total Marks 180
Answer **ALL** questions — **Pass Marks 70%**
Formulae and intermediate steps taken in reaching your answer should be clearly shown.
You may draw sketches wherever required.

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(01)With reference to the IMDG Code ,

(i)Marine pollutants vary depending on their severerity of polluting ability. How do you identify this quality of a particular cargo once the package is placed on board ?

(ii)Some cargos carry a major risk and a subsidiary risk. What does this mean to you ? How will you handle an emergency involving a cargo of this nature while knowing above condition ?

(iii)Treatment of casualties due to IMDG cargo contamination is made quite easy today. How could this situation was achievable in comparison with the older practices ?

(10 Marks each)

(02)With regard to the Merchant Shipping Grain Regulations (85) explain,

(i)What capabilities should a vessel possess and prove before embarking on a loaded voyage with regard to her stability ?

(ii)Explain the derivation of the heeling arm due to grain shift and what parameters applied to evaluate seaworthiness of the vessel ?

(iii)When a vessel finds herself in danger due to grain shift, what could be done to improve the situation?

(10 Marks each)

(03)With reference to solid bulk cargoes,

(i)Briefly explain the following,

TML , MC , Angle of Repose , Flow State , Moisture Migration

(03 Marks Each)

(ii)Explain in detail,

The test procedure for cargoes, which may liquefy as per the BC Code.

(15 Marks)

Contd/....2

(04)Briefly explain the purpose and objectives of establishing the following Conventions. Indicate what repercussions in the industry called for their creation .

(i)Protocol on Port State Control
(ii)STCW 1978/1995/2010(Including Manila amendments)
(iii)IMDG Code through SOLAS
(iv)ISPS Code through SOLAS
(v)International Tonnage Convention 1969
(vi) MLC 2006

(05 Marks each)

(05)Under MARPOL 73/78 , subsequent Protocols and amendments,

(i)What Certification should be carried on board as per each Annexure as of today ? (10 Marks)
(ii)What is the status of the Government of Sri Lanka with regard to obligations and responsibilities towards implementation of each Annexure ? (10 Marks)
(iii)Briefly explain how "Old Tankers" are planned to be phased out and the replacement be done with "Double Skinned" vessels with projected time frames. (10 Marks)

(06)With special consideration to Load Line Convention,

(i)What items will be of your interest when preparing the vessel for renewal of Load Line Certificate? (10 Marks)
(ii)The flag administration has issued the current certificate to the vessel. They have no facility to handle this survey at the present location of the vessel. Explain in detail how this type of situations are handled in ship operation. (20 Marks)

Rp. Copy 1/11/11

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE: CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE
SUBJECT: SHIPBOARD OPERATIONS
DATE : 03RD SEPTEMBER 2012, 0900 HRS TO 1200 HRS

Time Allowed: **THREE** hours — Total Marks 180
Answer **ALL** Questions — **Pass Marks 70%**
Formulae and all intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches where ever required.

1(a). With regard to dry docking, what documentation and plans are most Likely to be readily available? **(06 Marks)**

(b) State the preparation and precautions you would adopt for entry in to a dry Dock. **(08 Marks)**

(c) Explain in brief ''what is the Docking plan''? **(05 Marks)**

(d) List the standard items to be checked at the dry docking. **(06 Marks)**

(e) What do you know about extended dry docking? **(05 Marks)**

2. (a) What do you understand by the term **''Risk Assessment''** ? **(05 Marks)**

(b) Based on the findings of the risk assessment ,suggest your appropriate control measure to be put in place on entering in to a dangerous enclosed or confined space. **(10 Marks)**

(c) Explain in brief the procedure on completion of permit to work **(05 marks)**

(d) With regard to a collision at sea, suggest a line of action you would adopt. **(10 Marks)**

3. Write short note on followings;

a) SOPEP
b) Ballast water Management Plan
c) Shipboard Energy Efficient Management Plan
d) Bulk carrier Access Manual
e) Enhance Survey Programme
f) Cargo Securing Manual **(05 Marks each)**

Contd..../2

4. a) **"Seaworthiness of a vessel"** what does this mean to you? **(05 Marks)**

b) How does a flag state delegate its responsibilities in issuing of the various? Certificates to vessel? **(09 Marks)**

c) What are the advantages achieved by introducing the harmonized system of Surveys? **(08 Marks)**

d) What are the certificates carried on board a merchant vessel other than a Passenger vessel when engaged in lawful trading? **(08 marks**

5. Briefly explain the purpose and objectives of establishing the following conventions and by whom they were introduced. Also indicate who are exempted from compliance in each case.

i. FAL Convention 1965
ii. STCW 1978 convention as amended 2010
iii. SOLAS 1974 and subsequent amendments
iv. MARPOL 73/78, subsequent protocols and amendments
v. Tonnage Convention 1969
vi. UNCLOS

(05 Marks each)

6. With reference to the IMDG code,

(a) How will you identify the following categories of cargoes? Illustrate with labels. Explain the properties and dangers involved when carrying each of them.

(i) Fumigated cargo transport Unit (ii) CTU with elevated temperature

(12 Marks)

(b) If your vessel is to carry packaged dangerous cargo, what documentation would you seek before accepting same on board? **(08 Marks)**

(c) What are the general procedure you would adopt before accepting hazardous cargo on board ? **(10 Marks)**

DIRECTOR GENERAL'S OFFICE OF MERCHANT SHIPPING

MINISTRY OF PORTS & HIGHWAYS

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE
SUBJECT : SHIPBOARD OPERATIONS
DATE : 07th OCTOBER 2013, 0900 HRS TO 1200 HRS

Time Allowed: **THREE** hours — Total Marks 180
Answer **ALL** Questions — **Pass Marks 70%**
Formulae and all intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches where ever required.

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1. With regard to **Planned Maintenance System (PMS)**,
a) Outline the concept of PMS and identify the requirement to have a such system onboard a vessel? **(10 Marks)**
b) Describe the factors that you would be taken in to consideration prior preparing a PMS for deck machinery on a geared bulk carrier. **(10 Marks)**
c) Prepare a planned maintenance system for windlass and mooring winch **(05 marks each)**

2. With reference to **IMSBC Code**,
a) State the types of risk involved in solid bulk cargo? **(05 Marks)**
b) List down the information required prior accepting a solid bulk cargo and reasons for the same? **(05 Marks)**
c) How would you accept a cargo not listed in the IMSBC Code? **(08 Marks)**
d) Brief following
   i) Spontaneous Combustion
   ii) Dust Explosion
   iii) Volumetric heeling moment **(04 marks each)**

3. With reference to Prevention of **Marine Pollution**,
a) List down the categories of Garbage as mentioned in MARPOL Annex V and the methods of disposal of each category **(12 Marks)**
b) Explain the regulations and procedures that MARPOL has introduced in relation to Annex 1, 4 & 6

(04 marks each)

4) Write Short notes on followings;

a) IMDG Code
b) Energy Efficiency Design Index (EEDI)
c) Safe Recycling of Ships
d) Enhanced Survey Programme (ESP)
e) Docking Plan
f) IGC Code **(05 Marks each)**

5) a) Describe the procedure and purpose of using **inert gas system** for the following operations.

i) Purging
ii) Loading
iii) Discharging
iv) Crude oil washing (COW) **(05 Marks Each)**

b) Before commencing cargo operations at a tanker terminal, safety is ascertained using a **ship/shore safety check list**. Discuss its importance and relevance with the help of at least five items commonly use on a said check list. **(10 Marks)**

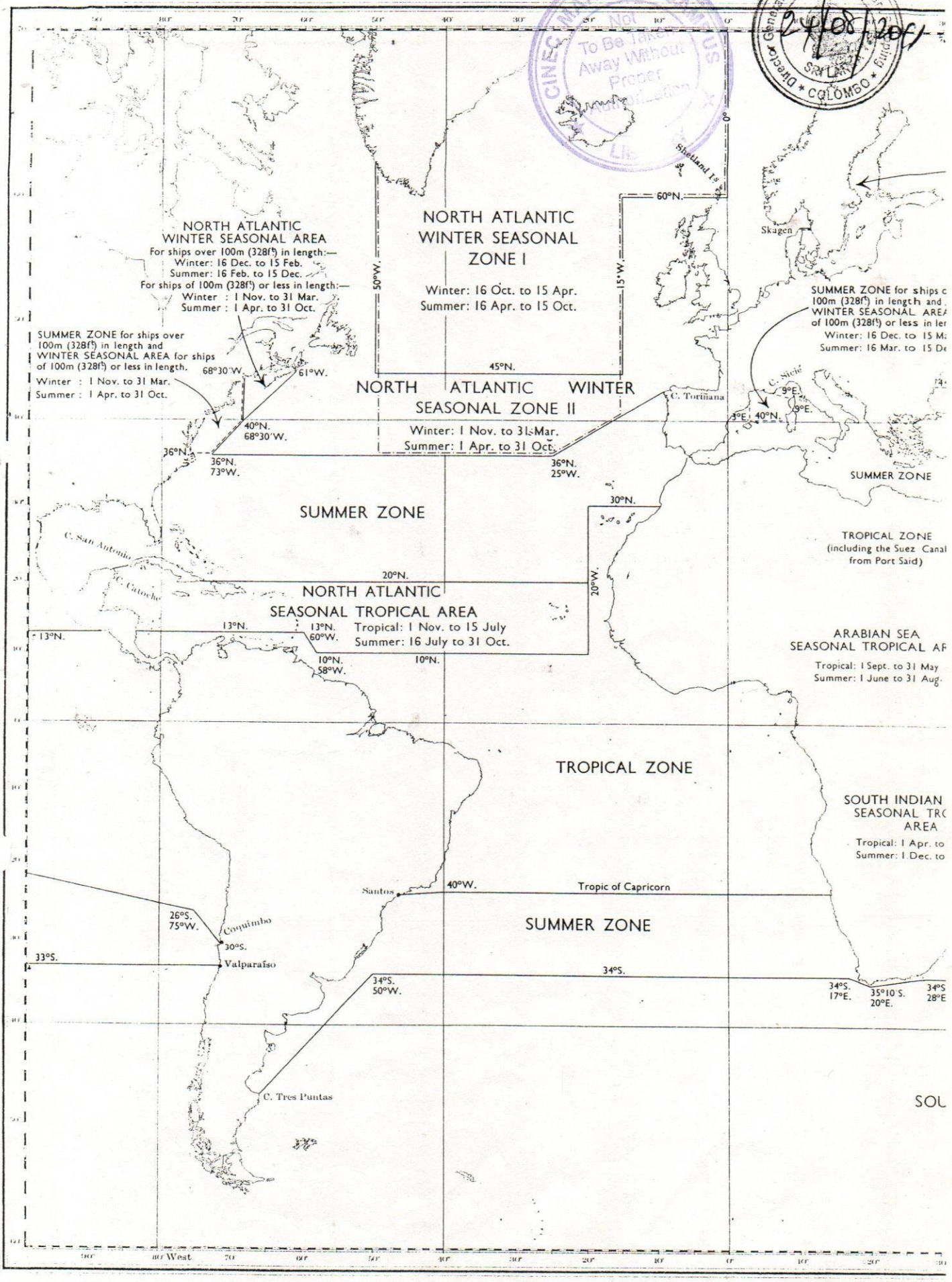
6. a) With regard to the **Cargo Stowage & Securing(CSS) code**, State the general principles of cargo stowage and securing? **(05 marks)**

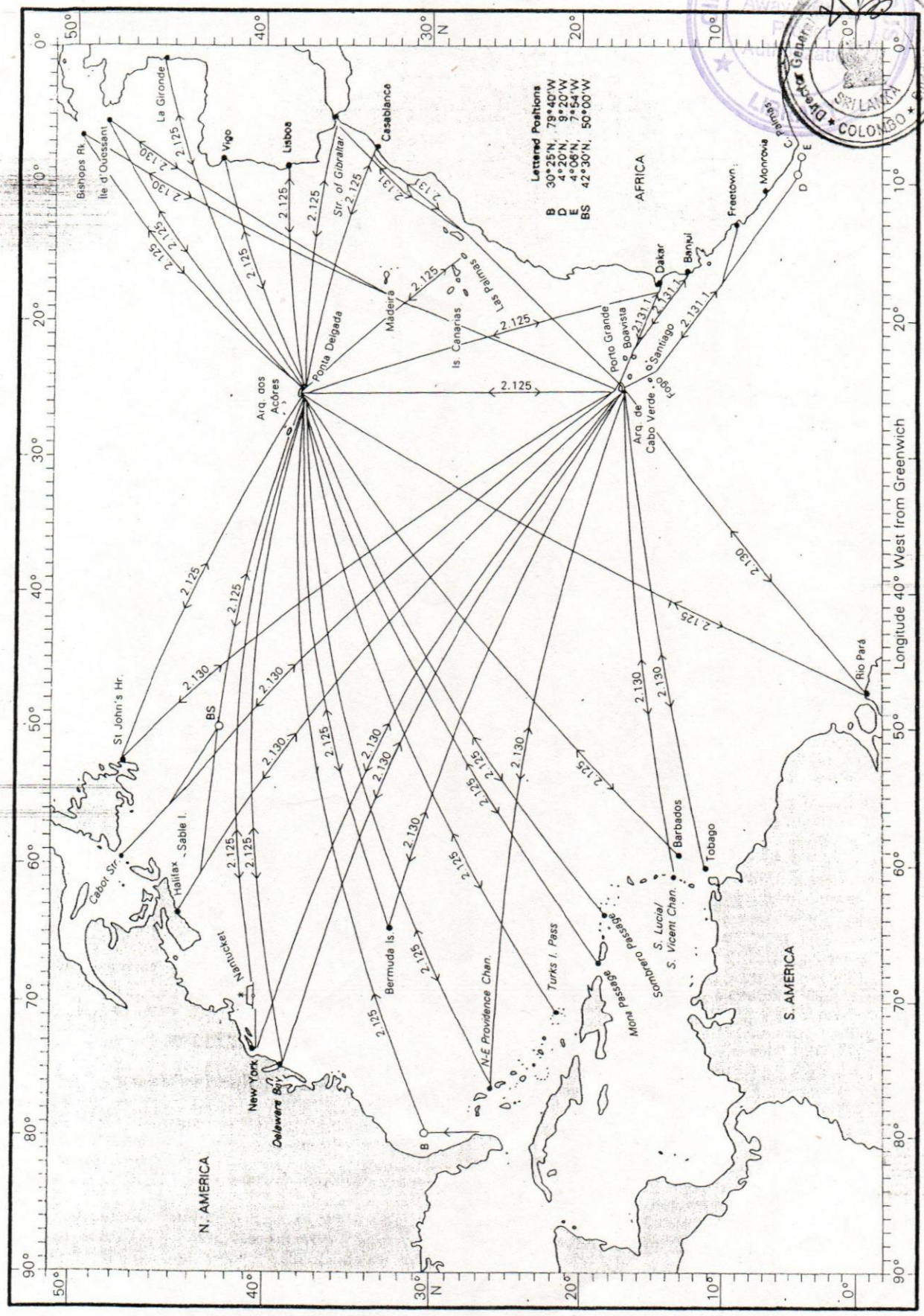
b) What are the criteria for estimating the risk of cargo shifting **(05 marks)**

c) State the actions you will be taken in heavy weather to avoid excessive accelerations during carriage of cargo on deck? **(05 marks)**

d) List down the actions that can be taken to avoid cargo shifting. Use examples/ drawings to elaborate your answer **(15 marks)**

Q (1) a


NORTH ATLANTIC WINTER SEASONAL AREA
For ships over 100m (328ft) in length:—
Winter: 16 Dec. to 15 Feb.
Summer: 16 Feb. to 15 Dec.
For ships of 100m (328ft) or less in length:—
Winter : 1 Nov. to 31 Mar.
Summer : 1 Apr. to 31 Oct.
SUMMER ZONE for ships over 100m (328ft) in length and WINTER SEASONAL AREA for ships of 100m (328ft) or less in length.
Winter : 1 Nov. to 31 Mar.
Summer : 1 Apr. to 31 Oct.
68°30'W.
61°W.
40°N.
68°30'W.
36°N.
36°N.
73°W.
NORTH ATLANTIC WINTER SEASONAL ZONE I
Winter: 16 Oct. to 15 Apr.
Summer: 16 Apr. to 15 Oct.
50°W.
15°W.
60°N.
45°N.
NORTH ATLANTIC WINTER SEASONAL ZONE II
Winter: 1 Nov. to 31 Mar.
Summer: 1 Apr. to 31 Oct.
36°N.
25°W.
Shetland Is.
Skagen
C. Tortiana
SUMMER ZONE for ships c
100m (328ft) in length and
WINTER SEASONAL AREA
of 100m (328ft) or less in le
Winter: 16 Dec. to 15 M
Summer: 16 Mar. to 15 D
C. Sicié
9°E.
9°E.
3°E. 40°N.
SUMMER ZONE
SUMMER ZONE
30°N.
20°W.
C. San Antonio
C. Catoche
20°N.
NORTH ATLANTIC SEASONAL TROPICAL AREA
Tropical: 1 Nov. to 15 July
Summer: 16 July to 31 Oct.
13°N.
13°N.
60°W.
10°N.
58°W.
10°N.
TROPICAL ZONE
(including the Suez Canal from Port Said)
ARABIAN SEA SEASONAL TROPICAL AR
Tropical: 1 Sept. to 31 May
Summer: 1 June to 31 Aug.
TROPICAL ZONE
SOUTH INDIAN SEASONAL TRO AREA
Tropical: 1 Apr. to
Summer: 1 Dec. to
Santos
40°W.
Tropic of Capricorn
SUMMER ZONE
26°S.
75°W.
Coquimbo
30°S.
33°S.
Valparaíso
34°S.
34°S.
50°W.
34°S.
17°E.
35°10'S.
20°E.
34°S
28°E
C. Tres Puntas
SOU
80° West



(2.130) ROUTES to and from Ponta Delgada and Porto Grande.

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT : NAVIGATION
DATE : 24TH August 2011 , 0900 Hrs to 1200 Hrs

Time allowed **THREE** hours — Total Marks 200
Answer **ALL** questions — **Pass Marks 70%**
Formulae and intermediate steps taken in reaching your answer should be clearly shown.
You may draw sketches wherever required.

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(01) On 20th February a vessel departs Charleston, South Carolina, U.S.A. bound for Vigo in northern Spain. On departure the vessel's Winter load line mark is immersed by an equivalent of 125 tonnes dead weight. The Master is advised to achieve the quickest possible passage while complying with the Load Line regulations. With reference to Data Sheet Q (1)a & b , the relevant way points are ,
Departure position off Charleston 32° 47' N , 079° 56' W
Arrival position off Vigo 42° 14"N , 008° 40' W
The vessel consumes 21 tonnes of fuel and water for a day when steaming at service speed of 14.5 knots. If the vessel maintains her service speed during the passage throughout calculate the minimum legal distance from Charleston to Vigo .

(35 Marks)

(02) A vessel bound from the West Indies to Cape Town, was steering 127° (T) at 20 knots. At 0600 on ship , in D.R. 24° 35' S , 003° 24' W under cloudy conditions the following stellar observations were made. The same D. R. position was used to calculate all four position lines.

Ship's Time	Star	Azimuth	Intercept
0554	A	285°	2' towards
0603	B	262°	1.5' towards
0615	C	044°	4' away
0624	D	167°	10' towards

Find the vessel's most probable position at 0615 hrs. ship's time.

(30 Marks)

(03) In late September , a loaded container vessel in position 26° 30' N , 121° 20' E bound through the Straits of Taiwan heading for Hong Kong received confirmation that the tropical typhoon reported in position 21° 30' N , 117° 15' E has recurved on to a NE course at 25 knots.
(a) On worksheet Q(3) plot,

Contd/...2

(i)The two quoted positions and the alternative tracks a typhoon in the area may follow.
(ii)Three possible options the vessel could take in order to avoid the storm centre .
(06 marks each)

(b)(i)Discuss the advantages and disadvantages of following of each alternative tracks you have proposed.
(ii)State which of these tracks should be taken by the prudent Master giving reasons for his choice. (09 Marks each)

(c)State three reasons why dangerous Semi-circle is so named in a Tropical Cyclone.
(05 Marks)

(4)A vessel trading regularly to the Baltic , where , in the winter months , sea ice accretion may be experienced. Describe the other repercussions that the above winter conditions may cause with regard to each of the following,

(i)The maintenance of navigation accuracy (15 Marks)
(ii)The reliability in performance standards of the navigational instruments and electronic nav-aids. (08 Marks)
(iii)The use of floating navigation marks (07 Marks)
(iv)The use of sectored leading lights (05 Marks)

(5)A vessel off the Canadian coast , heading for Halifax, Nova Scotia steaming at 9 knots has caught fire and sends off a distress message at 1600 GMT on 23rd August 1976. The distress alert was intercepted by a fire fighting tug in the vicinity and headed on a course to reach the casualty to render assistance at her best available speed of 14 knots. The relevant positions at 1600 GMT noted as follows. Casualty in 42° 06' N , 059° 17' W , Tug in 41° 15' N , 60° 32' W , Halifax Pilot Station 44° 38' N , 063 35' W . Required to calculate each of the following,

(i)The course required of the tug to rendezvous with the casualty, as soon as possible. (20 Marks)
(ii)The rendezvous time , GMT. (08 Marks)
(iii)The amount of daylight remaining after rendezvous . (07 Marks)

(6)At 1840 GMT , 28th April 1976 a vessel in position 62° 16' N , 002° 35' E , bound for Aberdeen, Scotland Was steering 035° (T) at 17 knots. The Master's night orders included the instruction that star sights, if available , should be obtained at Civil Twilight next morning.

(a)Calculate the GMT of Civil Twilight next morning.
(b)Calculate the vessel's D.R. position at Civil Twilight.

(15 Marks each)

Class II

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT : SHIP STABILITY
DATE : 30TH JULY 2010 , 0930 Hrs to 1230 Hrs

Time allowed **THREE** hours — Total Marks 180
Answer **ALL** questions — **Pass Marks 50%**
Formulae and intermediate steps taken in reaching your answer should be clearly shown.
You may draw sketches wherever required.

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(01)(a)Explain why the trim is subjected to change when a vessel moves from one density of water to another. (10 Marks)

(b)A vessel floating in salt water has the following particulars.

Displacement - 18,000t LBP - 220m LCB - 100m Foward of the aft perpendicular
LCF - 120m forward of the aft perpendicular , MCTC - 200, TPC - 23
Draft Forward - 7.85m , Aft - 8.55m
The vessel has two bunker tanks. The forward tank has its centroid 205m forward of the AP and the After tank has its centroid 75m forward of the AP.
Calculate the following,

(i)The amount of fuel to transfer between the bunker tanks in order to arrive alongside at a fresh water berth on an even keel. (12 Marks)

(ii)The arrival draft forward and Aft. (08 Marks)

(02)(a)What is the purpose of carrying out the inclining experiment when a vessel is launched ? (08 Marks)

(b) A vessel initially unright is to carry out the inclining experiment and known to have following condition. Displacement–5600t , KM - 5.5m
Following weights are placed on board,
Sundries and Stores–165t / KG - 3.9m Ballast - 420t / KG - 2.96m (tank full)
Bunker - 145t / KG–3.4m(tanks full) Fresh Water–67t / KG–2.87m (tank partially filled with a FSM of 1645 TM), Inclining experiment weights - 58t / KG - 7.02m
Personnel 0.28t / KG - 5.12m .
Plumb lines are constructed with an effective vertical length of 6.96m , the inclining weights are shifted 5.42m transversely on each occasion and the mean horizontal deflection on the plumbing is 0.68m .
Calculate the displacement and KG of the vessel in her light condition. (22 Marks)

Contd/..2

(O3)(a)If the calculated Metacentric height during dry docking of a vessel is found to be inadequate, explain the practical measures that can be taken to remedy this situation, prior to dry docking. (06 Marks)

(b)(i) A vessel being dry docked for the purpose of refitting of a lost rudder has the following particulars on entry to the dock. Displacement - 13,000t , KG - 8.50m , KM - 8.80m MCTC - 170 , LCF - 76.0m forward of AP , Draft forward - 4.80 m , Aft - 6.70m in salt water. Calculate the GM at the Critical instant, as the dock is being emptied. (14 Marks)

(ii)While in the dry dock the rudder weighing 28 t , KG - 3.20m is fitted in position at the after perpendicular. Calculate the GM at the critical instant as the dock is being refilled. (10 Marks)

(O4)A vessel may be described as "Initially Unstable" , " Stiff " or "Tender" . Assuming a vessel at a same draft on different occasions has the above characteristics .

(a)Illustrate the three possible GZ curves on the same axis and explain. (15 Marks)

(b)State the inherent properties associated with each of these conditions. (15 Marks)

(O5)(a)Define "Dynamical Stability" (06 Marks)

(b)The righting lever of a vessel displacing 9500t is as follows

Heel	0^0	10^0	20^0	30^0	40^0
GZ	0	0.04	0.14	0.40	0.55

Calculate each of the following.

(i)Dynamical stability at 40^0 (16 Marks)

(ii)The residual dynamical stability at 40^0 if the vessel is subjected to a steady wind heeling moment of 380 tm. (08 Marks)

(O6)A box shaped vessel has length 72m breadth 10m and is floating in fresh water at an even keel draft of 3m. She has six evenly divided compartments . No. 2 and No. 5 are completely full of oil containing 144 t in each tank.

(a)Draw the load , SF and BM curves and estimate their maximum values. (20 Marks)

(b)Find the SF and BM at a point 10m from forward. (10 Marks)

JEROME

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

Sept 2

GRADE : CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT : SHIP STABILITY

DATE : 07TH APRIL 2010 , 0900 Hrs to 1200 Hrs

Time allowed THREE hours — Total Marks 180
Answer ALL questions. — Pass Marks 50%
Formulae and intermediate steps taken in reaching your answer should be clearly shown.
You may draw sketches wherever required.

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(01)(a)What are the basic criteria to be satisfied by a vessel to proceed to sea with a cargo of grain under the statutory Grain Regulations ? (08 Marks)

(b)A vessel is to load grain of S.F. 1.39 M^3/t in several compartments to finish with a total displacement of 13250 tonnes. Prior to taking cargo the vessel had a KG of 8.5m. The list of compartments to be loaded are as follows.

Hold	Grain Space (M)	KG(m)	LCG(m)FoAP	Horizontal Heeling Moment(M)
No.1 LH(Full)	2215	5.08	114.5	659.5
No.2LH(Full)	4672	4.95	90.0	850.0
No.3 (Full)	1536	4.94	51.7	770.0
No.4 (Full)	3454	4.95	23.9	760.0
No.2TD(Full)	1675	10.79	115.5	659.0

94 Nov

NO.3 TD is loaded to an ullage of 2.8m (Refer data sheet Q(01)(b)(i))
Compare the final condition of the vessel with data sheet Q(01)(b)(ii) for maximum permissible heeling moments and conclude whether the vessel complies with the minimum requirements under the statutory Grain Regulations. (22 Marks)

(02)A vessel with 12000 tonnes displacement enters a drydock with a clearance of 1.0m over the blocks. Entering drafts read 5.20m forward and 6.14m aft. Other details provided as follows. MCTC – 110, TPC – 15 , LCF – 3.00m aft of midships, KG – 5.00m , KM – 5.24m , LOA – 140m.
Determine the following.
(a)The drop in water level required before the vessel takes the blocks forward and aft.
(b)GM at this instant.
(c)Further drop in water level required to reduce the GM to zero.
Consider all hydrostatic data remain unchanged. (30 Marks)

Cont'd 2

(03)(a)Explain the advantages of having a shipboard stress finding installation, giving the details of inputs and the outputs obtained. (08 Marks)

(b)A box shaped vessel having 72m length is 9m in breadth. She is floating on even keel with a draft of 3.0m in fresh water. The vessel is divided into 6 even compartments longitudinally. No.1 , 3 and 5 compartments are loaded with 150 tonnes of oil in each .

(i)Draw the load , SF , and BM curves and estimate their maximum values. (15 Marks)

( )ind the SF and BM values at a point 30m from foreward. (07 Marks)

(04)(a)Define the terms,

(i)Bilging

(ii)Permeability

(05 Marks each)

(b)A box shaped vessel 150m long and 16m wide floats in salt water at an even keel draft of9.00m. It has a longitudinal watertight bulkhead on its centerline and DB tanks 1.2m high, KG is 6.00m And FSM 900 tm. A hold 12m long locate on the port side, having a permeability of 30% is bilged. nd the resulting list.

(20 Marks)

(05)(a)The trim of a vessel changes when the vessel moves into water of different density. Analyze the statement.

(10 Marks)

(b)A vessel is about to enter a river port over a bar where the maximum depth of water is 9.20m. She has to maintain a clearance of 0.5m and at present she draws 8.40m foreward and 9.0m aft. How much ballast water she should discharge from the after peak whose LCG is 103m aft of midships in order to trim the vessel to a safe condition for river transit.

Following data is provided. MCT – 125 , TPC 25 , LCF – amidships and Length 212m.

Also find the final draft foreward.

(20 Marks)

(06)A vessel with a displacement of 15000 tonnes , KG – 7.4m and FSM – 2300 tm is listed 4° to port side. The vessel has to discharge a locomotive weighing 150 tonnes from a position 10m starboard of the Centerline with a KG of 12m. Find the resultant list on completion of the operation.

(30 Marks each)

DATASHEET Q (01) (b) (i)

VOLUMETRIC HEELING MOMENTS OF PARTLY FILLED COMPARTMENTS

ULLAGE DATUM: Top of Hatch-Side Coaming at its Mid-Length

COMPARTMENT No: 3TD (NO C.L. DIVISION)

ULLAGE m	VOLUME OF GRAIN m^3	HORIZONTAL HEELING MOMENT m^4	Kg of GRAIN m
0.25	1686	593	11.24
0.50	1668	659	11.19
0.75	1649	746	11.13
1.00	1628	864	11.07
1.25	1607	1016	11.01
1.50	1510	1176	10.94
1.75	1416	1372	10.98
2.00	1324	1577	10.82
2.25	1232	1799	10.75
2.50	1144	2017	10.69
2.75	1059	2218	10.63
3.00	970	2388	10.59
3.25	883	2512	10.55
3.50	800	2579	10.50
3.75	714	2575	10.45
4.00	633	2500	10.39
4.25	550	2362	10.31
4.50	467	2155	10.21
4.75	384	1908	10.10
5.00	302	1592	9.98
5.25	222	1239	9.81
5.50	143	848	9.56
5.75	64	380	9.27
5.95	0	0	8.70

ULLAGE FOR MAXIMUM HORIZONTAL MOMENT

3.60	764	2580	10.49

DATASHEET Q. (01)(b)

TABLE OF MAXIMUM PERMISSIBLE MAIN HEELING MOMENTS (tm)

Displacement tonne	FLUID KG (metres)									
	6.50	6.60	6.70	6.80	6.90	7.00	7.10	7.20	7.30	7.40
14 500	6141	5820	5499	5179	4858	4537	4217	3896	3575	3255
14 000	5957	5647	5338	5028	4719	4409	4099	3790	3480	3171
13 500	5924	5625	5327	5028	4730	4431	4132	3834	3535	3237
13 000	5934	5647	5359	5072	4784	4497	4209	3922	3634	3347
12 500	5891	5614	5338	5062	4785	4509	4232	3956	3679	3403
12 000	5857	5591	5326	5061	4795	4630	4265	[illegible]	[illegible]	[illegible]
11 500	5893	5639	5385	5130	4876	4622	4368	4113	3859	3605
11 000	5944	5701	5457	5214	4971	4728	4484	4241	3998	3755
10 500	5948	5716	5484	5251	5019	4787	4555	4323	4090	3858
10 000	5940	5719	5498	5276	5055	4834	4613	4392	4171	3950
9500	5961	5751	5541	5331	5121	4911	4701	4491	4281	4071
9000	6027	5828	5629	5430	5231	5032	4833	4634	4435	4236
8500	6127	5939	5751	5563	5375	5187	4999	4811	4623	4435
8000	6210	6033	5856	5679	5502	5325	5148	4971	4795	4618
7500	6252	6087	5921	5755	5589	5423	5257	5091	4926	4760
7000	6343	6189	6034	5879	5724	5569	5415	5260	5105	4950
6500	6550	6406	6262	6118	5975	5831	5687	5543	5400	5256
6000	6832	6699	6566	6434	6301	6168	6035	5903	5770	5637
5500	7120	6998	6877	6755	6633	6512	6390	6268	6147	6025
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6877	6767	6656	6546	6435	6325

SHIP STABILITY

DATASHEET Q3 (ii)

N.B. This Datasheet must be returned with your examination answer book

HYDROSTATIC PARTICULARS

DRAUGHT m	DISPLACEMENT t		TPC t		MCTC tm		KM_T m	KB m	LCB foap m	LCF foap m
	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000	SW RD 1.025	FW RD 1.000				
7.00	14576	14220	23.13	22.57	184.6	180.1	8.34	3.64	70.03	67.35
6.90	14345	13996	23.06	22.50	183.0	178.5	8.35	3.58	70.08	67.46
6.80	14115	13771	22.99	22.43	181.4	177.0	8.36	3.53	70.12	67.57
6.70	13886	13548	22.92	22.36	179.9	175.5	8.37	3.48	70.16	67.68
6.60	13657	13324	22.85	22.29	178.3	174.0	8.38	3.43	70.20	67.79
6.50	13429	13102	22.78	22.23	176.8	172.5	8.39	3.38	70.24	67.90
6.40	13201	12879	22.72	22.17	175.3	171.0	8.41	3.33	70.28	68.00
6.30	12975	12658	22.66	22.11	173.9	169.6	8.43	3.28	70.32	68.10
6.20	12748	12437	22.60	22.05	172.5	168.3	8.46	3.22	70.35	68.20
6.10	12523	12217	22.54	21.99	171.1	167.0	8.49	3.17	70.38	68.30
6.00	12297	11997	22.48	21.93	169.8	165.7	8.52	3.11	70.42	68.39
5.90	12073	11778	22.43	21.87	168.5	164.4	8.55	3.06	70.46	68.43
5.80	11848	11559	22.37	21.82	167.3	163.2	8.59	3.01	70.50	68.57
5.70	11625	11342	22.32	21.77	166.1	162.1	8.63	2.95	70.53	68.65
5.60	11402	11124	22.26	21.72	165.0	161.0	8.67	2.90	70.57	68.73
5.50	11180	10908	22.21	21.66	163.9	160.0	8.71	2.85	70.60	68.80
5.40	10958	10691	22.15	21.61	162.9	158.9	8.76	2.80	70.64	68.88
5.30	10737	10476	22.10	21.56	161.8	157.9	8.81	2.74	70.68	68.95
5.20	10516	10260	22.05	21.51	160.8	156.9	8.86	2.69	70.72	69.02
5.10	10296	10045	22.00	21.46	159.8	155.9	8.92	2.63	70.75	69.09
5.00	10076	9830	21.95	21.41	158.8	154.9	8.98	2.58	70.79	69.16
4.90	9857	9616	21.90	21.36	157.9	154.0	9.06	2.53	70.82	69.23
4.80	9638	9403	21.85	21.32	156.9	153.1	9.13	2.48	70.86	69.29
4.70	9420	9190	21.80	21.27	156.0	152.2	9.22	2.43	70.90	69.35
4.60	9202	8978	21.75	21.22	155.1	151.3	9.30	2.38	70.93	69.42
4.50	8985	8766	21.70	21.17	154.2	150.5	9.40	2.32	70.96	69.48
4.40	8768	8554	21.65	21.12	153.3	149.6	9.49	2.27	71.00	69.55
4.30	8552	8344	21.60	21.07	152.4	148.7	9.60	2.22	71.04	69.62
4.20	8336	8133	21.55	21.02	151.5	147.8	9.71	2.17	71.08	69.68
4.10	8121	7923	21.50	20.97	150.6	146.9	9.83	2.12	71.12	69.74
4.00	7906	7713	21.45	20.93	149.7	146.0	9.96	2.07	71.15	69.81
3.90	7692	7505	21.40	20.88	148.7	145.1	10.11	2.01	71.18	69.88
3.80	7478	7296	21.35	20.83	147.8	144.2	10.25	1.96	71.22	69.94
3.70	7265	7088	21.30	20.78	146.8	143.3	10.41	1.91	71.25	70.00
3.60	7052	6880	21.24	20.72	145.9	142.3	10.57	1.86	71.29	70.07
3.50	6840	6673	21.19	20.67	144.9	141.3	10.76	1.81	71.33	70.14

THESE HYDROSTATIC PARTICULARS HAVE BEEN DEVELOPED WITH THE VESSEL FLOATING ON EVEN KEEL

Candidate's Name.....

Examination Centre.....

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE :CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT : SHIP'S STABILITY.
DATE : 22nd May 2007

Time allowed THREE hours — Total Marks 200
Answer **ALL** questions — Pass Marks 50%
Formulae and intermediate steps taken in reaching your answer should be clearly shown.
You may draw sketches wherever considered necessary.
Marks for each question are shown in brackets.

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(1) (a) While a vessel is being dry docked , explain why the period from stern first touching the blocks till the vessel bodily sits on the blocks is considered dangerous. Propose the measures you could adopt to maintain the vessel safe during this period. **(11)**

(b) A vessel displacing 12,000 tonnes enters a dry dock with a clearance of 1.0m over the blocks. Following data was known. At the time of entering the dry dock , draft foreward - 5.2m , aft – 6.14m , MCT – 110 . TPC – 18 , LCF – 3.0 aft of midships , Length – 140m , KG - 5.0m , KM – 5.24m . Assuming that the hydrostatic data remain constant determine the following.

(i) The drop in water level required before the vessel takes the blocks bodily.
(ii)The GM at the instant of taking the blocks.
(iii)The further drop in water level before the GM reduces to zero.

(08 each)

2) (a) The trim of a vessel changes when the vessel moves into water of different density. Justify the above statement. **(10)**

(b) Your vessel is about to enter a river port over a bar where the maximum depth of water is 9.2m. She must have a clearance of 0.5m and at present she is floating at 8.4m foreward and 9.0m aft. Find the quantity of ballast water you should discharge from the Afterpeak whose LCG is 103m aft of midships, in order to trim the vessel to a safe condition for the river transit. Following data is provided.. MCT – 125 , TPC – 25 , LCF – amidships and Length - 212m . **(15)**

(c)Also find the final draft foreward. **(10)**

Contd/.....2

3) (a) Explain the functions of a shipboard stress finding installation , giving the details of its inputs and outputs. **(10)**

(b) A box shaped vessel of 144m in length , displaces 2000 tones in her light condition. She is subdivided into six compartments of equal length which are to be loaded and level stowed as follows.

Holds	No. 01	and No. 06	500 tonnes each
Holds	No. 03	and No. 04	400 tonnes each
Holds	No. 02	and No. 05	remains empty

Produce the curves of SF and BM for the vessel indicating the values. **(25)**

35

4) (a) Define dynamical Stability. **(15)**

(b) By using the formula ,

$$\text{Heeling Lever} = \frac{0.165 \times 10^{-4} V^2 \Sigma C_s A Z}{\Delta}$$

WH | 3

Determine the heeling lever caused by a 60 knot wind on a vessel's hull , deck superstructure and four cranes, when displacing 12,000 tonnes when, floating at an even keel draft of 7.0m. Following dimensions available,

Portion of vessel	Projected Lateral Area	Centre of Area above W/L
Hull	300 m^2	4.00 m
Deck Superstructure	250 m^2	9.00 m
Each crane	13 m^2	7.50 m **(15)**

30

5) (a) With regard to the inclining experiment,

(i)What is the purpose of the experiment ?

(ii)What precautions should you take before and during the process ?

(05 each)

I | 2

(b) Following results were reached after an inclining experiment. The inclining weight was moved 14m transversely producing a deflection of 27cm in a plumbline of 9.0m length. Known data as follows. KM – 8.1m . Present displacement of the vessel 5400 tonnes including the inclining weight of 25 tonnes at KG - 7.94m , fuel – 50 tonnes at KG - 2.3m and free surface moment - 640 tonne metres. **(20)**

30

Find the KG in lightship condition?

6) (a) Define the terms "Stowage Factor" and "Permeability" in respect of cargoes and cargo spaces. **(10)**

B | 6

(b) A box shaped vessel of 144m, with a beam of 20m floats at an even keel draft of 8.5m in salt water. A midships compartment of 24m in length has a middle line bulkhead extending the whole depth of the compartment. Calculate the angle of heel caused by bilging on one side and the maximum draft after bilging. KG – 6.4m . **(25)**

35

35+3
25+1
35+1
140

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE :CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT : SHIP'S STABILITY.
DATE : 07th April 2006

Time allowed THREE hours — Total Marks 200
Answer **ALL** questions — Pass Marks 50%
Formulae and intermediate steps taken in reaching your answer should be clearly shown.
You may draw sketches wherever considered necessary.
Marks for each question are shown in brackets.

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(1) A boxed shaped vessel 100 m long x 20 m wide x 12 m deep is floating in salt water on an even keel at 6 m draft. A forward compartment is 10 m long, 12 m wide and extend from the outer bottom to a water tight flat, 4 m above the keel. The compartment contains cargo of permeability 25 %. Find the new drafts if this compartment is bilged.

(35)

2) a) A vessel being drydocked for the purpose of refitting of a lost rudder has the following particulars on entry to the dry dock.
Displacement 13 000 tonne Drafts; Fwd = 4.80 m, Aft = 6.70 m in salt water.
KG 8.50 m KM 8.80 m MCTC 170 LCF 76.00 m forward of AP

Calculate the GM at the critical instant as the dock is being emptied (15)

b) While in the dry dock, the rudder weighing 28 tonne, KG 3.20 m is fitted in position at the aft perpendicular.
Calculate the GM at the critical instant as the dock is being refilled. (20)

3) A vessel is floating upright with the following particulars.

Displacement 10180 tonne KM 9.60 m

A locomotive weighing 120 tonne is to be loaded using the vessel's heavy lift from a position 18.0 m to port of the vessel's centerline. KG of derrick head is 21.0 m

a) Calculate the maximum allowable KG prior to loading in order to limit the list to a maximum of 6 degrees during the loading operation. (20)

b) Using the KG calculated in Q.3(a), determine the final angle of list if the locomotive is stowed in a position, KG 2.50 m, 4.00 m to port of the vessel's centerline. (15)

4) Ship 'A', KG 8.20 m is floating at an even keel draft of 6.80 m in salt water. With the aid of the data sheets Q.4(a), tabulated KN values and Q.4(b), Hydrostatic particulars, compare the ship's stability value with those required by the current Load Line Rules. (35)

5) (a) Show by means of suitable sketches how beam and freeboard affects the shape of the GZ curve. (15)

(b) Draw two curves of statical stability on the same axis to illustrate;

- Departure condition
- Arrival condition

Explain the reasons for the differences between the two curves. (15)

6) A vessel is floating in salt water at drafts Fwd 3.80 m; Aft 6.40 m. A total of 2400 tonne of cargo is to be loaded.

Space is available in No. 02 (Lcg 100 m foap) and in No. 04 (Lcg 54 m foap).

Length B.P. 136 m LCF 67 m foap TPC 21.8 MCTC 150

(a) Calculate the weight of cargo to load in each space in order to finish with a trim of 1.0 m by the stern. (15)

(b) Determine the final draft fwd and aft. (15)

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : **CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE**

SUBJECT : **NAVIGATION**

DATE : **04TH April 2005 , 0900 hrs to 1200 hrs.**

Time allowed THREE hours — Total Marks 200

Answer ALL questions — **Pass Marks 70%**

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

---

(1)A vessel loaded with vulnerable deck cargo departs Yokohama (Japan) 35° 04'N, 139° 43'E , bound for Los Angeles (California , USA) 33°40'N , 118° 21'W , with a restriction in her Charter Party limiting her maximum latitude as 42°N . The Master decides to take the shortest route while complying with the Charter Party . Calculate the total distance covered from Yokohama to Los Angeles allowing an extra distance of 29.5' miles in pilotage waters .

(35 Marks)

(2)(a)When observing a compass error by Sun's Amplitude , what factors should be of concern to the observer for his accuracy , in relation to the visible horizon ?

(07 Marks)

(b)Why the Amplitude method is considered unreliable in higher Latitudes for the purpose of checking Compass error .

(07 Marks)

(c)At 1540 LMT , on 14 th August 1999 , an observer in D.R. Lat. 27° 18'S , Long. 038° 47'W used the Sun to check the compass error .He obtained the following bearings , 321.5° (C) and 303° (G) . the Variation was 23° W. Calculate the following ,

(i)Gyro Compass error

(08 Marks)

(ii)Magnetic Compass error

(07 Marks)

(iii)Deviation for the direction of the ship's head

(06 Marks)

Contd...../ 02

(3)A vessel is in the South Pacific in the vicinity of Fiji Islands during the cyclone season .

(i)State the first visible sign that will alert the Master of a developing cyclone in the vicinity , explaining its significance . (05 Marks)

(ii)In the absence of shore based transmissions , how the Master can , when in the Southern Hemisphere , determine his position in relation to the direction of a cyclone's path . (10 Marks)

(iii)Present weather conditions near Fiji Islands was observed as follows. Heavy swell from NE , rapidly falling barometer , wind SE , freshening and slowly backing . If the vessel was steering 210 (T) state any action the Master may consider , in view of the weather conditions. Give reasons for all actions proposed . (10 Marks)

(iv)Few hours later the wind steadies from SSE and then begins to veer towards the South , barometer still falling . In the light of any action initiated in above (iii) , make a thorough assessment of the present situation and state any further action which might be necessary . (10 Marks)

(4)A vessel is in the North Atlantic during a voyage undertaken from Northern Europe to the United States . At 2100 GMT on 09th May 1999 , in D. R. Position 53 12 'N , 034 08'W steaming on a steady course of 230 (T) At 17 knots . Master being anxious about fixing his vessel's position left instructions in his Night Orders to make stellar observations at Civil Twilight in the next morning .

Calculate the GMT of Civil Twilight on next morning . (25 Marks)

(5)Several Merchant vessels are involved in a Search and Rescue operation in the open ocean .

(a)List the governing factors which should be taken into account to decide which vessel's Master should be assigned with the role of Co-ordinator Surface Search (C.S.S.) (10 Marks)

(b)Two vessels are engaged in a parallel search steaming 295 (T) at 10 knots . The assisting vessel has a maximum speed of 12 knots and is presently 1.5 miles on the starboard beam of the C.S.S. vessel . At 1400 hrs. , the visibility deteriorated and the sea condition compelled the vessels to increase the track spacing to 4.0' miles , with the assisting vessel still on the same relative bearing from the C.S.S. . The assisting vessel is required to be at her new station as quickly as possible . Assuming that any alteration of course and speed will be instantly effective , find the following .

(i)New course of the assisting vessel . (13 Marks)

(ii)The ETA at her new station . (12 Marks)

Contd/.....3

(6)(a)Derive the formula ,

$$MCTC = \frac{W \times GM}{L \times 100}$$

(08 Marks)

(b)A vessel of 8500 tonnes displacement has a TPC of 10 tonnes . MTC 1 cm = 100 tonne metres and the centre of floatation is amidships. She is completing loading under coal tips . Hold Nos. 2 and 3 are full but space is available in Hold No. 1 (Centre of gravity 50 m foreward of midships) . The present drafts are 6.5 m foreward , and 7.0 m aft . The load draft of the vessel is 7.1 m . Find how much cargo to be loaded into each of the end holds so that the vessel will sink down to the load draft on an even keel .

(22 Marks)

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : **CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE**

SUBJECT : **SHIP STABILITY**

DATE : **07 TH JUNE 2001** , 0900 hrs. TO 1200 hrs.

Time allowed THREE hours. Total Marks 200

Answer ALL questions. **Pass Marks 50 %**

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

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(1)(a)Define the following .

(i)Statical Stability

(ii)Dynamical Stability

(iii)Angle of Flooding

(iv)Righting Lever (03 Marks each)

(b)Explain how a list developed due a transverse shift of cargo effects the dynamical stability of the vessel . (08 Marks)

(c)A vessel with a small negative metacentric height has developed an angle of loll. Draw up a righting lever curve for the vessel giving all details . (10 Marks)

(2)(a)Before dry docking if you find your calculated metacentric height is inadequate what practical measures you would take to remedy the situation (09 Marks)

(b)A vessel displacing 14000 tonnes is dry docked with a clearance of 0.50 M over the blocks . Following data was known . At the time of entering draft of the vessel foreward 5.35 M and aft 6.77 M .MCT 120 ,TPC 22 ,LCF 4.00M aft of midships , Length 150 M , KG 6.25 M , KM 6.4 M . Assuming that the hydrostatic data remaining constant determine the following .

(i)The drop in water level required before the vessel takes the blocks fore and aft .

(ii)The GM at the instant of taking the blocks .

(iii)The further drop in water before the GM reduces to zero .

(07 Marks each)

(3)A box shaped barge of length 120 M has a light displacement of 1440 tonnes . It is divided into six compartments of equal length . Cargo is leveled and stowed in them as follows .

Contd.../2

No. 1	-	300 t.	No. 4	-	200 t.
No. 2	-	Nil	No. 5	-	200 t
No. 3	-	300 t.	No. 6	-	200 t.

Draw up sheering forces and bending moments diagram for the condition . state their maximum values and the points at which they would occur .

(30 Marks)

(4)(a)With regard to the inclining experiment

(i)What is the purpose of the experiment ?

(ii)What precautions should be taken before and during the process ?

(05 Marks each)

(b)From the following results of an inclining test calculate the KG the vessel in the lightship condition .Known data as follows . KM 8.1 M , present displacement 5400 tonnes , which includes the following . Inclining weight 25 tonnes with KG 7.94 M , Fuel Oil 50 tonnes with KG 2.30 M and FSM 640 tonne metres . The inclining weight was moved 14.0 M transversely producing a deflection of 27 cm in a plumbline of length 9.0 M . (20 Marks)

(5)(a)Define the term " Permeability ". (05 Marks)

(b)A box shaped vessel of 144 M in length has a beam of 20 M and is floating on an even keel at 8.5 M draft . She has a midship compartment of 24 M in length with a middle line bulkhead extending the whole depth of the compartment . Calculate the angle of heel caused by bilging on one side , and the maximum draft after bilging . (KG 6.4 M) (20 Marks)

(6)(a)Explain why a vessel laden to the same draft behaves differently during various voyages having different natural rolling periods ? (10 Marks)

(b)Identify stiff and tender condition of a vessel laden to same draft . Give specimen GZ curves and discuss their different rolling characteristics .

(20 Marks)

(7)A ship of 8500 tonnes displacement has a TPC of 10 tonnes . MCT 1 cm = 100 tonne metres and the centre of floatation is amidships . She is completing loading under coal tips . Hold Nos. 2 and 3 are full but space is available in hold No.1 (centre of gravity 50 M foreward of midships) and in hold No. 4 (centre of gravity 45 M aft of midships) . The present drafts are 6.5 M foreward and 7.0 M aft . The load draft of the vessel is 7.1 M . Find how much cargo to be loaded into each of the end holds so that the vessel will sink down to the load draft on an even keel .

(25 Marks)

(6)On 17th August 1999 , at 2130 hrs. GMT , on board a cargo vessel in position 31 12' N , 069 26' W an accident resulted an injury to a seaman which required urgent medical attention . At this time a passenger vessel was in position 29 42' N , 065 14' W , steaming on a course of 260 (T) , at 23 knots . It was agreed between the Masters to rendezvous at sunrise next morning and that the passenger vessel maintains her present course and speed . Calculate the following ,

(i)GMT of Sunrise (11 Marks)

(ii)the rendezvous position (12 Marks)

(iii)the course and speed required by the cargo vessel to achieve rendezvous at sunrise . (12 Marks)

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : **CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE**

SUBJECT : **SHIPBOARD OPERATIONS**

DATE : **23rd June 2004 , 0900 hrs. TO 1200 hrs.**

Time allowed THREE hours. Total Marks 180

Answer ALL questions. **Pass Marks 70 %**

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

---

(1)With regard to the new IMDG Code ,

(a)How do you grade the Marine Pollutants and explain the ways and means of identifying same once a package is placed on board ? (10 Marks)

(b)What do you understand by the following columns in the Dangerous Goods list ?

(i)Limited Quantities (ii)Subsidiary Risk (06 Marks each)

(c)The treatment of casualties should be done symptomatically . What does this statement mean to you and what difference does is make compared with the previous practice ?

(08 Mark s)

(2)A rig of topping lift and a lifting purchase is used to hoist a load of eight tonnes . The configuration of the derrick and the rig is provided in diagram Q .2 . With the aid of the rope table calculate the following .

(a)Tension on A , B , C and D . (24 Marks)

(b)Thrust at the derrick heel . (06 Marks)

(3)With reference to Grain Regulations explain ,

(a)What are the minimum criterion to comply for a vessel to set out to sea with a consignment of grain ?

(b)How the heeling arm due to grain shift is derived and what are the parameters for the vessel to remain seaworthy ?

(c)What action you could take to improve the situation if the vessel is found not complying with the requirements therein ?

(10 Marks each)

Contd/....2

(4)(a)Explain the following abbreviated terms .

(i)ISO
(ii)FCL / LCL
(iii)CTU
(iv)IBC
(v)CSC (03 Marks each)

(b)Discuss the Integral method and the Clip on method of reefer containers .
(08 Marks)

(c)Compare the advantages and disadvantages of unitized cargo handling against general cargo handling .
(07 Marks)

(5)(a)Explain how you would prepare your vessel for the Load Line Certificate renewal survey . (12 Marks)

(b)If the Flag State has no facility to handle this survey at the current location of the vessel what procedure will be adopted for carrying out the survey and issuing of the certificate ? (08 Marks)

(c)A following displacements respectively.

Season	Displacement
Tropical	20695
Summer	20530
Winter	20365

She loads in South Africa for an intended voyage to the United Kingdom during the month of December . The vessel consumes 60 tonnes of fuel and 35 tonnes of FW/Stores daily . The voyage duration is 14 days'. Calculate the maximum tonnage the vessel can carry while complying to the Load Line Regulations. Use data sheet Q.5 for hydrostatic particulars .
(10 Marks)

(6)With regard to the tanker operations answer the following .

(a)Define (i)White Oil (ii)Black Oil (iii)Flash Point (iv)Ignition Point (v)Bonding
(03 Marks each)

(b)What are the precautions you would adopt to avoid an accidental discharge of oil into the sea during cargo operations . (08 Marks)

(c)If any unintended spillage takes place how will you proceed in reporting and recording such incident ? (07 Marks)

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE :CHIEF MATE/MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT : OPERATIONAL SAFETY
DATE : 30th December 2013, 0900 hrs to 1200 hrs.

Time allowed **THREE** hours — Total Marks 180
Answer **ALL** questions — Pass Marks 70%
Formulae and intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches where ever consider prudent.

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01) Translocation of sea water by vessels made critical environmental problems in some of the coastal states.

a) Ballast water taken from one country cannot be discharged in another country without exchange/treatments. Explain such exchange/treatment as introduced by BWMS.
(12 Marks)

b) Explain the hazards that may arise when complying with above exchange methods.
(18 Marks)

02) a) State the COW regulations under MARPOL. (06 Marks)

b) Explain what is meant by Load on Top. (08 Marks)

c) What are the measures to be taken, before starting and during the COW operation? (08 Marks)

d) Name the parts of an IG system
(08 Marks)

03) Write short notes on;
i) Emergency Towing Booklet
ii) SEEMP
iii) Risk Rating Factor(RF)
iv) Ship Sanitation Control Exemption Certificate (SSCEC)
v) Condition of Class

(06 Marks each)

31-12-1989

04) With reference to the IMDG code

a) Describe the following terms

i) Subsidiary Risk

ii) PSN

iii) Stowage Category

(04 Marks Each)

b) What are the items to be checked when taking hazardous cargo on board?

(12 Marks)

c) Outline the requirements for transporting hazardous cargo in package form.

(06 Marks)

05) With reference to the grain code

a) State the stability criteria which are required according to grain code to carry grain in bulk.

(12 Marks)

b) Describe the measures to be taken to avoid grain shift.

(06 Marks)

c) Briefly explain the following

i) FMP

ii) Importance of angle of Repose information

iii) Importance of moisture content information

(04 Marks each)

06) With regard to timber deck cargo;

i) State the hazards that are to be considered while carrying timber deck cargo.

(05 Marks)

ii) Explain why the GM is allowed to reduce when carrying timber on deck according to the Timber Code.

(05 Marks)

iii) Outline the actions to be taken during the voyage on a vessel loaded with Timber as deck cargo.

(10 Marks)

iv) What are the recommended stability criteria for carrying Timber deck cargo?

(10 Marks)

14

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION
GRADE : **CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE**

SUBJECT : **SHIPBOARD OPERATIONS**

DATE : **05TH April 2004, 0900 hrs to 1200 hrs.**

Time allowed THREE hours — Total Marks 180
Answer ALL questions — **Pass Marks 70%**
Formulae and all intermediate steps taken in reaching your answer should be clearly shown . You may draw sketches wherever required .

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(1) A rig of topping lift and a lifting purchase is used to hoist a load of ten tonnes . The installation is featured in diagram Q(1) , provided to you. With the aid of rope tension table and block diagram calculate the following .

(a)Tension on A , B , C and D (06 Marks each)

(b)Thrust at the heel of the derrick (06 Marks)

(2)(a)Explain with suitable sketches how beam and freeboard is related to the behaviour of a vessel in a seaway. How is it reflected in the shape of the GZ curve ? (12 Marks)

(b)A vessel of 12840 tonnes displacement with a KM of 9.6 m has to load two lifts , each weighing 60 tonnes, at KG of 14.0 m and 8.0 m respectively on either side of the centerline . The vessel has to use her own gear whose head is 24.0 m above the keel and maximum reach is 18.0 m from the centerline . What should be the maximum KG of the vessel before commencing the operation to have a list of not more than six degrees during the entire process. Consider the inboard weight being loaded first .

(18 Marks)

(3)(a)Some large vessels are liable to experience high sheering forces and longitudinal bending moments. How could you justify the above statement ?

(10 Marks)

(b)Explain with suitable diagrams the general structural arrangements incorporated in the designing of such vessels to minimize the effects of the stresses involved . (20 Marks)

Contd...../ 02

(4)With reference to Tanker operations ,

(a)Explain how a build up of static electricity can occur during a discharging operation of crude oil .

(b)What measures and precautions are adopted to prevent and eliminate such a build up causing accidents ?

(c)Explain what are the main features of a shipboard oil pollution emergency plan . (10 Marks each)

(5)(a)During assignment of freeboard to a vessel , what are the criterion taken into consideration for the application of the deductions (in making the allowances) ? Explain at least five of the deductions . (20 Marks)

(b)What is the link between the Classification Societies and the Flag State? Could any party do without the other ? (10 Marks)

(6)(a)Explain in detail ,

(i)Ship's sweat

(ii)Cargo sweat

(b)When carrying general cargo on board ventilation plays a major role in preservation of cargo . Analyze this statement.

(c)How do you categorize hygroscopic and non-hygroscopic cargoes ? (10 Marks each)

Class II

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT : SHIPBOARD OPERATIONS

DATE : 07th December 2010 , 0900 Hrs to 1200 Hrs

Time allowed **THREE** hours — Total Marks 180
Answer **ALL** questions — **Pass Marks 70%**
Formulae and intermediate steps taken in reaching your answer should be clearly shown.
You may draw sketches wherever required.

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(01) a) With reference to Merchant Shipping Grain Regulations (85), describe how the heeling arm is derived (15 Marks)

b) State the minimum intact stability criteria required by the above Regulations (05 Marks)

c) Explain how the adverse effect of the vertical shift of grain surface may be compensated (10 Marks)

(02) a) Give details of the stability data required to be supplied to ships under the LL rules 1968 (15 Marks)

b). At a certain draught the stability of a vessel complies in every respect with the 1968 Load Line Rule. At another draught the vessel does not comply. Assuming the GM is the same in both cases discuss full why this should be so. (15 Marks)

(03) a). A rig of Topping lift and lifting purchase is used to hoist a load of 10 tonnes the configuration of the derrick and the rig is provided in diagram Q3 with the aid of the rope table calculate the following

(i). Tension on A, B, C and D (06 Marks Each)
(ii). Trust at the derrick heel (06 Marks)

Contd/....2

(04) a). Describe how a vessel overtaking another vessel of a similar size in a narrow channel is likely to be affected by interaction in each of the following situations;

(i) When the bow of the overtaking vessel is close to the stern of the vessel being overtaken (05 Marks)

(ii) When the bow of the two vessels are abreast (05 Marks)

b). Describe the measures each of the vessel can take in order to reduce effect of interaction (20 Marks)

(05) With regards to the inclining experiment

a). State its purpose (05 Marks)

b) Describe the procedure to be followed and the precautions to be taken before and after the experiment (15 Marks)

c). List the circumstances under which the experiment is required (10 Marks)

(06) With reference to tanker operations answer the following.

a). Explain how a build up of static electricity can occur during a discharging operation of crude oil (10 Marks)

b). What are the methods applied to prevent such a build up and precautions adopted to eliminate possible accidents ? (10 Marks)

c). Explain the main futures of a Shipboard Oil Pollution Emergency Plan (10 Marks)

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT : SHIPBOARD OPERATIONS
DATE : 29th JULY 2010 , 0930 Hrs to 1230 Hrs

Time allowed **THREE** hours
Answer **ALL** questions
Total Marks 180
Pass Marks 70%
Formulae and intermediate steps taken in reaching your answer should be clearly shown.
You may draw sketches wherever required.

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(01)With reference to tanker operations,

(a)Explain how Cavitation and Gassing up can occur. (10 Marks)

(b)Explain in detail an Inert Gas system on board a tanker with particular reference to, the inherent properties the gas should possess for the choice and how the risks associated are eliminated/minimized . (20 Marks)

(02)With reference to the IMDG Code,

(a)Explain following situations,

(i)You have received a package with two classes of placards placed.

(ii)Same package displays a further label reading severe marine pollutant. (10 Marks)

(b)Explain the following terms in the DG list,

(i)Limited Quantities

(ii)Packing (10 Marks)

(c)As per the EMS schedule casualties are treated symptomatically. Explain what this statement means to you. (10 Marks)

(03)With regard to trading Certificates on board a vessel,

(a)Why most often the Certificate of Registry of a vessel is issued by the Flag State and the other trading Certificates are issued by Class Societies , explain. (13 Marks)

(b)What benefits are brought about by Harmonizing surveys on board ? Emphasize from both angles , ship owner and seafarer. (10 Marks)

(c)What main differences could you highlight in the trading certificates of a Tanker and a Passenger Vessel. (07 Marks)

Contd/....2

(04)With regard to BC Code ,

(a)Define hygroscopic and non-hygroscopic cargoes. (05 Marks)

(b)Explain how you could determine (by a simple practical method) wether the moisture content in the cargo presented is within allowable limits (10 Marks)

(c)Briefly explain the following terms,

(i)Transportable Moisture Content

(ii)Moisture Migration

(iii)Angle of Repose

(05 Marks each)

(05)(a)Some large vessels are liable to experience high sheering forces and longitudinal bending moments . How could you justify the above statement ? (10 Marks)

(b)Explain with suitable diagrams , the general structural arrangements incorporated in the designing of such vessels to minimize the effects of stresses involved. (20 Marks)

(06)Briefly explain the purpose and objectives of establishing the following Conventions. By whom they were introduced and also indicate who are exempted from compliance in each case.

(i)FAL Convention

(ii)STCW as amended 1995

(iii)SOLAS 1974 and subsequent amendments

(iv)MARPOL 73/78 , subsequent Protocols and Amendments

(v)Tonnage Convention

(vi)Load Line Conventions

(05 Marks each)

ND class III
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DIRECTOR GENERAL'S OFFICE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA
CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : OFFICER IN CHARGE OF A NAVIGATIONAL WATCH ON SHIPS OF
(i) 500 GT OR MORE (UNLIMITED)
(ii) LESS THAN 3000 GT ON NEAR COASTAL VOYAGE

SUBJECT : OPERATIONAL SAFETY

DATE : 11th August 2014, 1300 hrs to 1600 hrs.

Time allowed **THREE** hours — Total Marks 180

Answer **ALL** questions — Pass Marks 60%

Formulae and intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches where ever consider prudent.

01

I) define the followings:

a) Breaking Stress b) Safe Working Load (03 marks each)

II) Sketch and show how a luff tackle could be used to

a) Advantage.

b) Disadvantage (03 marks each)

III) A weight of 75t has to be lifted using a Threefold purchase rigged to disadvantage. Calculate the Minimum size of the steel wire rope (6x24 construction) that should be used in this purchase Consider the factor of safety to be 5 and allow 12% per sheave for friction. Consider the rig is weightless. (18 marks)

02)

I) Define the following terms related to solid bulk cargoes.

a) Angle of repose
b) Flow moisture point
c) Moisture migration
d) Transportable moisture limit (05 marks each)

II) Explain the Potential hazards associated with the carriage of Solid Bulk Cargoes?

(10 marks)

03)

I) what is ISM Code and its objective? (12 marks)

II) Describe the purpose of the Contingency plans for shipboard emergencies and give 5 examples?

(08 marks)

III) What are the Key and Critical shipboard operations? (10 marks)

04)

I) Sketch and Explain the "Free flow System "on Oil tanker. (15 marks)

II) Discuss the advantages and disadvantages of above system. (05 marks)

III) State the advantages of crude oil washing over water washing. (05 marks)

IV) Explain the purpose of Inert Gas System on an Oil tanker. (05 marks)

05)

I) what affect does ballast water have on the environment? (10 marks)

II) List the data, should a Ballast Water Management System record? (08 marks)

III) Briefly describes the ILO's Maritime Labour Convention, 2006 (MLC, 2006)? (12 marks)

06) Successful transportation of Refrigerated Cargoes on conventional reefer ships are depend on the several factors. If those factors are incomplete, inadequate, contradictory, or wrong, then problems can be expected. For the shipper, there is the risk of loss of cargo. For the carrier, there is the risk of a claim even if the goods are undamaged.

I) Explain three major steps to ensure the correct preparation of a cargo space for loading refrigerated cargoes on a conventional reefer ships. (15 marks)

II) Describe the monitoring and documenting required when carrying a conventional reefer cargo (09 marks)

III) List the precaution that should be taken during the discharge of a conventional reefer cargo to ensure its final delivery in good condition. (06 marks)

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION
GRADE : **CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE**

SUBJECT : **SHIPBOARD OPERATIONS**
DATE : **22nd April 2004 , 0900 hrs. TO 1200 hrs.**

Time allowed THREE hours. Total Marks 180
Answer ALL questions. **Pass Marks 70 %**
Formulae and all intermediate steps taken in reaching your answer should be clearly shown . You may draw sketches where ever required .

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(1)With regard to the IMDG Code ,

(a)The IMDG Code became mandatory for compliance from 01st January 2004 . The IMDG Blue Books existed since 1965 but they were only recommendatory . What made this achievement possible ?

(14 Marks)

(b)The previous IMDG Code books were cumbersome and difficult to understand. Justify this statement by a comparison with the new volumes .

(16 Marks)

(2)Under MARPOL 73/78 and subsequent Protocols and amendments ,

(a)What certification should be available on board on a trading vessel ?

(10 Marks)

(b)What are the obligations and responsibilities of the Government of Sri Lanka towards implementation of each Annexure of MARPOL 73/78 as amended .

(10 Marks)

(c)Compare the main structural differences of an "Old Tanker" with that of a "New Tanker" as specified . Discuss the details of time specifications and the limitations of authority of a contracting Government .

(10 Marks)

(3)With regard to the BC Code ,

(a)Define the following ,

(i)Angle of Repose
(ii)Moisture Content
(iii)TML
(iv)Flow State
(v)Moisture Migration

(03 Marks each)

Contd/....2

(3)Continued ,

(b)What are the relevant documentation requirements for the carriage of concentrated Bulk Cargo on board a purpose built vessel ?

(07 Marks)

(c)What are the precautions adopted while loading and during carriage of such cargo ?

(08 Marks)

(4)(a)The Flag State of your vessel is taking the ultimate responsibility in all matters concerning the compliance with the National and International instruments for the purpose of maintaining the seaworthiness of the vessel. Discuss how the Sri Lanka flag Administration discharges and delegates its responsibilities for the vessels flying its flag .

(10 Marks)

(b)What convenience was brought in by Harmonizing the Surveys and the Certification system on board ?

(10 Marks)

(c)What main differences could you highlight between a regular passenger ferry and a "Special Trade Passenger Vessel" ?

(06 Marks)

(5)Under the ISPS Code ,

(a)Explain the methodology adopted for effective compliance and documentation procedure (i)Onboard a Cargo vessel
(ii)At a shore facility(a port) (10 Marks each)

(b)Draw up a Security plan for a vessel departing from a port after spending few days for cargo work . Assume that chief officer is given the responsibility of SSO .

(10 Marks)

(6)(a)With reference to the Grain Regulations , state the minimum intact stability criteria required for a vessel to proceed to sea.

(10 Marks)

(b)A vessel of displacement 10,500 tonnes , KG – 6.50m loads grain cargo of Stowage Factor 1.53 M /t as given below .

Contd/.....3

(6)Continued,

Hold	Weight (Tonnes)	KG (m)	TransverseVHM M
1	3500	7.2	1200
2	4800	7.4	1650
3	4100	7.5	2000
4	3200	7.5	1110

KG = 7.039
GHM = 8395.4 ?
heel = 8° 29.3'?

The values of KG are the volumetric centroids of the spaces .

(i)Demonstrate whether the vessel complies with the current grain Regulations. (25 Marks)

(ii)Calculate the approximate angle of heel due to the assumed grain shift. (05 Marks)

Extract from the maximum allowable Grain Heeling Moment Table given below . Values given in meter tonnes .

KG	6.8	6.9	7.0	7.1	7.2
Displacement					
25500	5660	5450	5245	5040	4840
26000	5600	5400	5200	5000	4800
26500	5500	5360	5165	4970	4775

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION
GRADE : **CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE**

SUBJECT : **SHIP STABILITY**

DATE : **06TH April 2004 , 0900 hrs to 1200 hrs.**

Time allowed THREE hours — Total Marks 180
Answer ALL questions — **Pass Marks 50%**
Formulae and all intermediate steps taken in reaching your answer should be clearly shown . You may draw sketches wherever required .

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(1)(a)Outline the importance of a shipboard stress finding installation , giving the details of the inputs and the outputs obtained.

(08 Marks)

(b)A box shaped vessel of 120 m in length , displaces 1800 tonnes in her light Condition. She is subdivided into six compartments of equal length which are to be loaded and level stowed as follows .

Holds No. 1 and No. 6 600 tonnes each
Holds No. 3 and No. 4 500 tonnes each
Holds No. 2 and No. 5 to remain empty

Produce the curves of Shearing Forces and Bending Moments for the vessel Indicating the values .

(22 Marks)

(2)(a)With regard to the inclining experiment ,
(i)What is the purpose of the experiment ?
(ii)What precautions should you take before and during the process ?

(05 Marks each)

(b)Following are the results of an inclining test performed . Calculate the KG of the vessel in its lightship condition . Known data as follows. KM – 8.1 m , Present displacement of the vessel 5400 tonnes which includes , inclining weight of 25 tonnes at KG – 7.94 m , fuel oil 50 tonnes at KG – 2.3 m and FSM – 640 tonne metres . The inclining weight was moved 14 m transversely producing a deflection of 27 cm in a plumbline of 9.0 m length .

(20 Marks)

Contd/.....02

(3)(a)Define the terms "Stowage Factor" and "Permeability" in respect of cargoes and cargo spaces . (05 Marks each)

(b)A box shaped vessel of 144 m in length has a beam of 20 m and floats at an even keel draft of 8.5 m in salt water . A midships compartment of 24 m in length has a middle line bulkhead extending the whole depth of the compartment . Calculate the angle of heel caused by bilging on one side and the maximum Draft after bilging . (KG – 6.4 m)

(20 Marks)

(4)(a)Explain how windage area and the beam of a vessel relate to its dynamical stability . (10 Marks)

(b)Using the following formula and data sheet provided determine the heeling lever caused by the wind .

$$\text{Heeling Lever} = \frac{0.165 \times 10^{-4} V^2 \Sigma C_s A Z}{\Delta}$$

A vessel displacing 14000 tonnes floating at an even keel draft of 6.0 m is facing a wind of 55 knots on its hull , deck house and six deck cranes . Details of windage area as given below .

Portion of the vessel	Projected lateral area	Centre of area above W/L
Hull	400 m^2	3.00 m
Deck Superstructure	200 m^2	8.00 m
One Crane	10 m^2	8.00 m

(20 Marks)

(5)(a)Define the following with regard to dry docking ,

(i)Critical Moment
(ii)Critical Period
(iii)Critical Instant

(04 Marks each)

(b)A vessel due to be dry docked has the following data available .

Displacement 11,000 KG 7.70 m KM 8.20 m
Length (BP) 168 m MCTC 130 LCF Amidships
Initial draft 3.25 m foreward , 6.69 m aft .

To adjust the trim for the dry dock the vessel fills a Double Bottom tank of 270 tonnes having a KG of 1.2 m and LCG of 159 m foreward of AP .
Calculate the following ,

(i)Trim of the vessel when entering the dry dock .
(ii)GM when the vessel takes the blocks overall .

(09 Marks each)

Contd/....3

(6)(a)Derive the formula ,

$$MCTC = \frac{W \times GM}{L \times 100}$$

(08 Marks)

(b)A vessel of 8500 tonnes displacement has a TPC of 10 tonnes . MTC 1 cm = 100 tonne metres and the centre of floatation is amidships. She is completing loading under coal tips . Hold Nos. 2 and 3 are full but space is available in Hold No. 1 (Centre of gravity 50 m foreward of midships) . The present drafts are 6.5 m foreward , and 7.0 m aft . The load draft of the vessel is 7.1 m . Find how much cargo to be loaded into each of the end holds so that the vessel will sink down to the load draft on an even keel .

(22 Marks)

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : **CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE**

SUBJECT : **SHIP STABILITY**

DATE : **21st April 2004, 0900 hrs. TO 1200 hrs.**

Time allowed THREE hours. Total Marks 200

Answer ALL questions. **Pass Marks 50 %**

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

---

(1)(a)If the calculated Metacentric height during dry docking of a vessel is found to be inadequate , explain the practical measures that can be taken to remedy this situation , prior to dry docking .

(10 Marks)

(b)A ship due to be dry docked has the following particulars .
KG – 12.10m , KM – 12.30m , Displacement – 44000 t
Length BP – 210m , Draft Foreward – 10.38m & Aft – 11.80m ,
LCF – 95.0m forward of after perpendicular , MCTC – 500
Calculate the effective GM when taking the blocks fore and aft assuming that the blocks have no declivity .

(20 Marks)

(2)(a)How do you arrive at the formula

$$MCTC = \frac{W \times GM}{L \times 100}$$

(10 Marks)

(b)A vessel of LBP 220m has completed cargo with the following drafts and hydrostatic particulars.
LCF – 121m foreward of the aft perpendicular , MCTC – 1300 ,
TPC – 75 , Draft Foreward – 15.60m & Aft – 16.20m .
She has to complete bunkers and sail with a maximum draft of 16.0m .The Following partially filled bunker tanks are situated with centroids 192m and 90m foreward of the aft perpendicular respectively .
Calculate the following ,
(i)Maximum amount of bunkers to be loaded (10 Marks)
(ii)Weights to go into each slack tank so that the vessel sails on even keel .
(Assume the hydrostatic particulars remain constant)

(15 Marks)

Contd.../2

(3)(a)What are the advantages you achieve by having a shipboard stress finding installation ?

(10 Marks)

(b)A box shaped vessel of 120m in long , 15m wide , light displacement 1200 tones , has five identical holds .3000 tonnes of bulk cargo is loaded and trimmed level into the No.2 and No.4 holds equally . Draw the curves of SF and BM for the vessel indicating the values.

(25 Marks)

(4)(a)With regard to the inclining experiment,

(i)Why a vessel has to undergo such an experiment ?

(ii)What are the precautions taken before undertaking this process ?

(05 Marks each)

(b)A vessel initially upright is to carry out the inclining experiment and is in the following condition . Displacement – 5600 t , KM – 5.50m .

Total weights on board during the experiment ,

Sundries and stores - 165 t , KG – 3.9m ,

Ballast - 420 t , KG – 2.96m , Tanks full

Bunkers - 145 t , KG – 3.4m , Tanks full

Fresh water – 67 t ,KG – 2.87m , Tank partially filled with a FSM of 1645tm

Inclining experiment weights 58 t , KG – 7.02m ,

Personnel 0.28 t , KG – 5.12m .

Plumb lines were constructed with an effective vertical length of 6.96m.

The inclining weights were shifted 5.42m transversely on each occasion and the mean horizontal deflection of the plumbing was 0.68m .

Calculate the vessel's light displacement and the light KG .

(20 Marks)

(5)(a)Define the terms ,

(i)Bilging

(ii)Permeability

(05 Marks each)

(b)A box shaped vessel 150m long and 16m wide floats in salt water at an even keel draft of 9.0m . It has a longitudinal water-tight bulkhead on its centre line and DB tanks 1.2m high . KG is 6.0m and FSM = 900 tm . A hold 12.0m long , on the port side , having a permeability of 30% gets bilged. Find the resulting list .

(25 Marks)

(6)(a)Explain how a vessel laden to the same draft behaves differently during various voyages having different natural rolling periods ?

(15 Marks)

(b)Identify "Stiff" and "Tender" conditions of a vessel laden to same draft . Produce specimen GZ curves and discuss their different rolling Characteristics .

(20 Marks)

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DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION
GRADE : CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT : **SHIP STABILITY**
DATE : **13 th May 2003** , 0900 hrs. TO 1200 hrs.

Time allowed THREE hours. Total Marks 200
Answer ALL questions. **Pass Marks 50 %**
Formulae and all intermediate steps taken in reaching your answer should be clearly shown .You may draw sketches where ever required .

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(1)(a)Derive the formula

$$MCTC = \frac{W \times GM}{L \times 100}$$

(08 Marks)

(b)A ship of 100m length ,has a MTC 1 cm. 300 tonnes-m. She requires further 1200 tonnes of cargo to complete the loading and at present floats at a draft of 5.7m forward , 6.4m aft. She loads 600 tonnes of cargo in a space whose centre of gravity is 3m forward of amidships. Upon loading the drafts read 6m forward , 6.7m aft. The remaining cargo of 600 tonnes is to be loaded in No.1 Hold (centre of gravity 43m forward of amidships) and in No.4 Hold (centre of gravity 37 m aft of amidships). Find the amount of cargo that must go into each hold so that the vessel completes with an aft draft of 6.8m.

(22 Marks)

(2)(a)Discuss why a positive GM alone will not indicate you of the stability and the survival capability of a ship in a seaway.

(10 Marks)

(b)Ship "X" has a displacement of 14000 tonnes and a KG of 8.2 m. Using Data Sheets Q 2 (b)(i) [Tabulated KN values] and Q 2 (b)(ii) [Hydrostatic Particulars] determine whether vessel complies with the stability criterion as per the currently applicable Load Line Rules. 8.00 m

(20 Marks)

(3)(a)Outline the importance of a shipboard stress finding installation , giving the details of inputs and the outputs obtained .

(10 Marks)

Contd.../2

(3)Continued ../ ....

(b)A box shaped vessel of 120m in length , displaces 1440 tonnes in her light condition . She is subdivided into six compartments of equal length which are to be loaded and level stowed as follows .

Holds No. 1 and No. 6	500 tonnes each
Holds No. 3 and No. 4	400 tonnes each
Holds No. 2 and No. 5	to remain empty

Produce the curves of SF and BM for the vessel indicating the values.

(20 Marks)

(4)(a)Prior to drydocking a vessel if you find your calculated metacentric height is inadequate what action you would take to remedy the situation ?

(09 Marks)

(b)A vessel displacing 14000 tonnes is drydocked with a clearance of 0.5m over the blocks . Following data was known . At the time of entering , draft of the vessel forward 5.35m and aft 6.77m . MCT – 120 , TPC – 22 , LCF – 4m aft of midships , Length – 150m , KG – 6.25m , KM – 6.4m . Assuming that the hydrostatic data remaining constant determine the following .

(i)The drop in water level required before the vessel takes to blocke fore and aft .

(ii)The GM at the instant of taking the blocks.

(iii)The further drop in water before the GM reduces to zero .

(07 Marks each)

(5)(a)With regard to the inclining experiment ,

(i)What is the purpose of the experiment ?

(ii)What precautions should you take before and during the process ?

(05 Marks each)

(b)Following are the results of an inclining test performed. Calculate the KG of the vessel in its lightship condition. Known data as follows.KM – 8.1m , present displacement 5400 tonnes , which includes the following. Inclining weight 25 tonnes with KG – 7.94m , fuel iol 50 tonnes with KG - 2.3m and FSM – 640 tonne metres . The inclining weight was moved 14m transversely Producing a deflection of 27 cm in a plumbline of length 9.0m .

(20 Marks)

(6)(a)Define the terms " Stowage Factor " and "Permeability" in respect of cargoes and cargo spaces . (05 Marks each)

(b)A box shaped vessel of 144m in length has a beam of 20 m and floats at an even keel draught of 8.5 m in salt water . A midships compartment of 24m in length has a middle line bulkhead extending the whole depth of the compartment . Calculate the angle of heel caused by bilging on one side . and the maximum draft after bilging. (KG- 6.4m)

(20 Marks)

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION
GRADE : **CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE**

SUBJECT : **SHIP STABILITY**
DATE : **07 th May 2002** , 0900 hrs. TO 1200 hrs.

Time allowed THREE hours. Total Marks 200
Answer ALL questions. **Pass Marks 50 %**
Formulae and all intermediate steps taken in reaching your answer should be clearly shown .You may draw sketches where ever required .

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(1)A vessel with a displacement of 14212 tonnes , KG - 7.4 m and FSM - 2026 tm is listed four degrees to port side . The vessel has to discharge a locomotive weighing 112 tonnes from a position 8 m starboard of the centreline with a KG of 12 m . Find the resultant list on completion of the operation .

(30 Marks)

(2)(a)Explain how windage area and the beam of the vessel relate to its dynamical stability .

(10 Marks)

(b)Using the following formula and data sheet Q (2)

$$\text{Heeling Lever} = \frac{0.165 \times 10^{-4} V^2 C_s A Z}{\Delta}$$

A vessel displacing 14000 tonnes at an even keel draft of 6.00 m is facing a 55 Knot wind on its hull , deck house and six deck cranes .
Details of windage area given below .

Portion of the vessel	Projected lateral area	Centre of area above W/L
Hull	400 m^2	3.00 m
Deck Superstructure	200 m^2	8.00 m
One Crane	10 m^2	8.00 m

Determine the heeling lever caused by the wind .

(25 Marks)

(3)(a)Discuss (i)Critical Moment
(ii)Critical period , of a vessel during drydocking .

(10 Marks)

Contd.../2

(3)Continued ../ ....

(b)A vessel has following data .

Displacement – 36000 tonnes , TPC - 34 , MCTC - 220
LBP - 184 m , LCB - 80 m foap. , LCF 90 m foap.
She is floating at an even keel draught of 7.93 m in salt water and proceeds to a dock where the water is of R.D. 1.003 .
Calculate the following ,

(i)The trim of the vessel when entering the dock .
(ii)The draught aft on arrival . (10 Marks each)

(4)A vessel could be termed "Initially Unstable " , " Stiff " or "Tender " at various instances although she is loaded to the same draught at each occasion .

(a)Discuss with illustrations the three possible GZ curves on the same axis corresponding to each instance .
(b)Evaluate the inherent properties associated with each condition .

(15 marks each)

(5)(a)Explain why a loading computer showing longitudinal stresses differentiates between seagoing and harbour conditions .

(10 Marks)

(b)A box shaped vessel has a length of 72 m and a breadth of 10 m is floating in fresh water at an even keel draught of 3.0 m . She has six evenly divided compartments . No. 2 and No. 5 are completely full of oil containing 144 t. in each tank . For the loaded condition evaluate the following ,

(i)Sheering Forces curve
(ii)Bending Moments curve
(iii)SF and BM values at a point 10 m from forward .

(30 Marks)

(6)(a)Define the terms " Stowage Factor " and "Permeability" in respect of cargoes and cargo spaces . (05 Marks each)

(b)A box shaped barge with a length of 30 m and a breadth of 9m floats at an even keel draught of 3.0 m in fresh water . An amidships compartment on the centreline with dimensions 9.0m x 9.0m x 4.0m is bilged . The compartment is loaded with cargo of Stowage Factor 2.5 m^3/T and a non-permeable density of 2T/ m^3. Calculate the new draught of the vessel .

(25 Marks)

The Ministry of Shipping and Shipping Development
MERCHANT SHIPPING DIVISION

CERTIFICATE OF COMPETENCY EXAMINATION
GRADE : CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT : SHIP STABILITY
DATE : 24 TH MAY 2000 , 0900 hrs. TO 1200 hrs.

Time allowed THREE hours. Total Marks 180
Answer ALL questions. Pass Marks 50 %
Formulae and all intermediate steps taken in reaching your answer should be clearly shown . Sketches to be shown whenever necessary .

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(1)(a)Derive the formula

$$MCTC = \frac{W \times GM}{L \times 100}$$

(08 Marks)

(b)A ship of 100m in length , has a MTC 1 cm. 300 tonnes-m. She requires further 1200 tonnes of cargo to complete the loading and at present floats at a draft of 5.7m. forward , 6.4m. aft. She loads 600 tonnes of cargo in a space whose centre of gravity is 3m. forward of amidships. Upon loading the drafts read 6m forward , 6.7m aft. The remaining cargo of 600 tonnes is to be loaded in No. 1 Hold (centre of gravity 43m. forward of amidships) and in No. 4 Hold (centre of gravity 37m. aft of amidships) . Find the amount of cargo that must go into each hold so that the vessel completes with an aft draft of 6.8m.

(22 Marks)

(2)(a)Define the following with regard to dry docking ,

(i)Critical Moment
(ii)Critical Period
(iii)Critical Instant

(12 Marks)

(b)A vessel due to be dry docked has the following data available.

Displacement 11000 KG 7.70 m KM 8.20 m
Length $_{BP}$ 168 m MCTC 130 LCF Amidships
Initial Draft 3.25 m forward , 6.69 m aft.
To adjust the trim for the dry dock the vessel fills a Double Bottom tank of 270 tonnes having a KG of 1.2 m and LCG of 159 m forward of AP.
Calculate the following ,

(i)Trim of the vessel when entering the dry dock .
(ii)GM when the vessel takes the blocks overall .

(18 Marks)

Contd...../ 2

(3)(a)Discuss why a positive GM alone will not indicate you of the stability and the survival capability of a ship in a seaway .

(10 Marks)

(b)Ship "X" has a displacement of 14000 tonnes and a KG of 8.2 m .Using Data sheets Q3(i)[Tabulated KN values] and Q3(ii)[Hydrostatic Particulars] determine whether the vessel complies with the stability criteria as per the currently applicable Load Line Rules.

(20 Marks)

(4)(a)Define dynamical stability .

(10 Marks)

(b)By using the following formula ,

$$\text{Heeling Lever} = \frac{0.165 \times 10^{-4} V^2 \Sigma C_p A Z}{\Delta}$$

determine the heeling lever caused by a 60 knot wind on a vessel's hull , deck superstructure and four cranes when displacing 12000 tonnes when floating at an even keel draft of 7.0 m .

Following dimensions available .

Portion of vessel	Projected Lateral Area	Centre of Area above W/L
Hull	300 m^2	4.00 m
Deck Superstructure	250 m^2	9.00 m
Each crane	13 m^2	7.50 m

(20 Marks)

(5)(a)Outline the purposes of a shipboard stress finding installation , giving the details of the input and output obtained .

(10 Marks)

(b)A box shaped vessel of 120 m in length , displaces 1440 tonnes in her light condition . She is subdivided into six compartments of equal length which are to be loaded and level stowed as follows .

Holds No. 1 and No. 6 500 tonnes each
Holds No. 3 and No. 4 400 tonnes each
Holds No. 2 and No. 5 remain empty

Produce the curves of SF and BM for the vessel indicating the values.

(20 Marks)

(6)(a)Define the terms , (i)Bilging (ii)Permeability

(05 Marks each)

(b)A box shaped vessel of 120 m in length extends to 12 m in breadth . She has a compartment of 12 m in length at the fore end. The compartment extends to the extreme breadth of the vessel and has a permeability of 60% .The vessel is floating at an even keel draft of 6.0 m and has a KG of 5.8 m . Calculate the forward and aft drafts if the said compartment is bilged .

(20 Marks)

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : (i)CHIEF MATE/MASTER ON SHIPS OF 500 GT OR MORE
(ii)MASTER ON SHIPS OF LESS THAN 3000 GT ON NCV

SUBJECT : NAVIGATION
DATE : 11TH APRIL 2011 , 0900 Hrs to 1200 Hrs

Time allowed **THREE** hours — Total Marks 200
Answer **ALL** questions — Pass Marks 70%
Formulae and intermediate steps taken in reaching your answer should be clearly shown.
Sketches may be made wherever considered necessary.

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(01)A vessel leaves Trondheim, in Northern Norway, bound for Boston, U.S.A. She intends to follow the route recommended by Ocean Passages for the world. From the Trondheim Pilot Station off the Norwegian coast by Rhumb Line to a position 10 miles South of the Faeroe Islands (Foroyer) – route 2.63.1 refers, thence Great Circle to position BS (Banks South), SE of Newfoundland, (Data sheets Q1), thence Rhumb Line to Boston Pilot Station.
The relevant way points are as follows,

* Trondheim Pilot Station 63° 15' N , 007° 37' E
* 10 miles South of Faeroe Islands 61° 14' N , 006° 40' W
* B.S. southeast of Newfoundland 42° 30' N , 050° 00' W
* Boston Pilot Station 42° 20' N , 070° 46' W

(a)Calculate the total distance between the two pilot stations. (25 Marks)
(b)If the vessel departs the Trondheim Pilot Station at 1000 Summer Time on 11th April (1998) and maintains 17 knots during passage, find the ETA at Boston Pilot, Local Standard Time. (10 Marks)

(02)A vessel is required to make a passage through an area where pack ice and ice accretion may be encountered. Describe the problems that may be experienced with regards to each of the following.
(a)The maintenance of navigational accuracy (10 Marks)
(b)The performance of navigational instruments and electronic navigational aids (10 Marks)
(c)The use of floating navigational aids (10 Marks)
(d)The use of sectored leading lights. (05 Marks)

Contd/....2

(03) A vessel in the North Atlantic on passage from Norway to Boston , U.S.A. At 2100 GMT on 11th April 1998 vessel is in D.R. position 53° 12' N, 034° 08'W, steaming on a steady course of 230°(T) at 17 knots. The Master being anxious about his vessel's position, leaves instructions in his Night Orders that stellar observations should be made if possible, at Civil Twilight next morning.
Calculate the GMT of Civil Twilight on 12th April 1998. (30 Marks)

(04) On 18th May 1998 at 2130 GMT, a cargo vessel was in position 31° 18' N , 069° 26'W and seaman on board suffers an accident which requires urgent medical attention. At this time a passenger vessel is in position 29° 42' N , 065° 14' W , steaming on a course of 260°(T) at 23 knots. It was agreed between the two Masters to rendezvous at sunrise next morning , and that the passenger vessel will maintain her present course and speed.
Calculate each of the following.

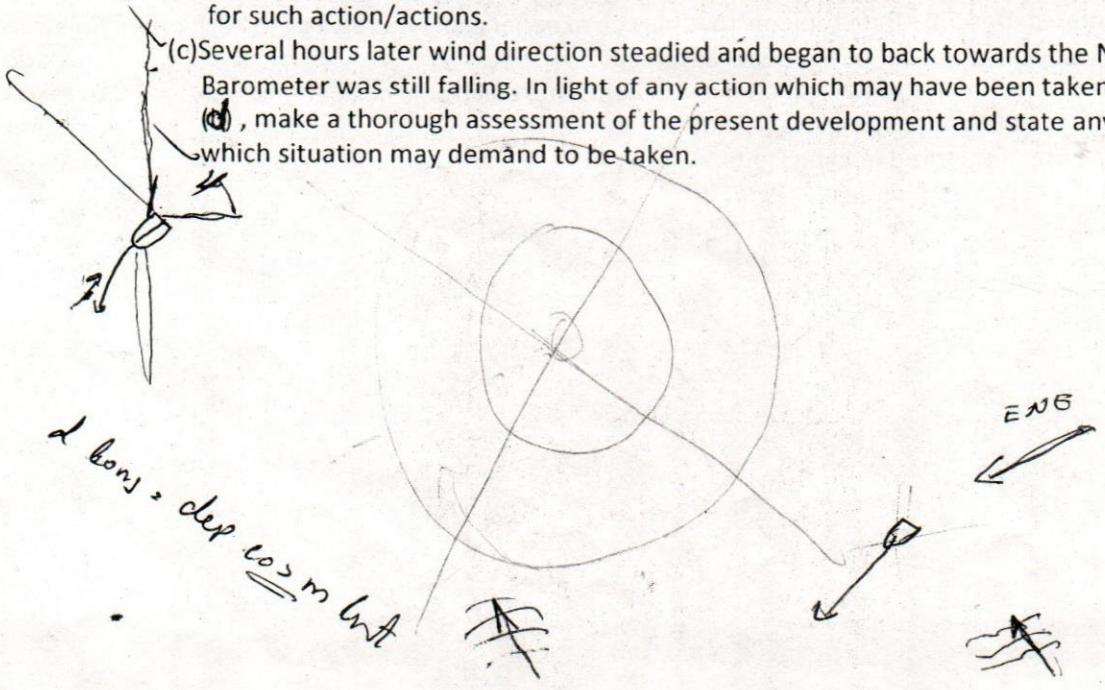
(a) The GMT of sunrise next morning. (08 Marks)
(b) The rendezvous position. (12 Marks)
(c) The course and speed to be kept by the cargo vessel to rendezvous at sunrise. (10 Marks)

(05) At 1540 LMT , on 14th August 1998 , the Officer of the Watch (OOW) of a vessel in position 27° 18' N, 038° 47'W made an observation of the Sun to check the ship's compass errors. He obtained the Following bearings. 321.5°(C), 303°(G). Variation is 23°W , find each of the following.

(a)(i) The Gyro Compass error. (10 Marks)
(ii) The error on the Magnetic Compass. (06 Marks)
(iii) The deviation for the direction of the ship's head. (06 Marks)
(b)(i) When checking the Compass error by the Amplitude method, state the correct position of the Sun, in relation to the visible horizon, giving reasons to your answer. (07 Marks)
(ii) Amplitude method is unreliable for checking compass error when in high Latitudes, explain why ? (06Marks)

(06) A vessel is located in the vicinity of a Tropical Cyclone , in the North Atlantic , to the North of West Indies .

(a) State how the Master can, by his observations onboard alone, determine his position in relation to the direction of the storm's path. (15 Marks)
(b) Present weather observed onboard is as follows.
Heavy swell from SSE , Rapidly falling barometer ,Wind ENE , freshening , slowly veering Eastwards. If the vessel's present course is 220°(T) , state any action which the Master might consider advisable to make, in view of the present weather conditions giving reasons for such action/actions. (10 Marks)
(c) Several hours later wind direction steadied and began to back towards the North , while Barometer was still falling. In light of any action which may have been taken under above (b) , make a thorough assessment of the present development and state any further action which situation may demand to be taken. (10 Marks)



DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT : SHIP STABILITY
DATE : 23RD AUGUST 2011 , 0930 Hrs to 1230 Hrs

Time allowed **THREE** hours — Total Marks 180
Answer **ALL** questions — **Pass Marks 50%**
Formulae and intermediate steps taken in reaching your answer should be clearly shown.
You may draw sketches wherever required.

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(01)(a)Before dry docking if you find the calculated Metacentric height is inadequate to withstand the sequence of events ahead, what practical measures could be proposed to improve and remedy the situation ? Explain. (10 Marks)

(b)A vessel before being dry docked has the following particulars.
KG – 12.10m , KM – 12.30m , Displacement – 48,000t , Length BP – 210m ,
Draft forward 10.38m & Aft – 11.80m, LCF – 95.0m forward of after perpendicular.
MCTC – 500 tm . Calculate the effective GM when taking the blocks fore and aft assuming that the blocks are placed without declivity.

(20 Marks)

(02)(a)With regard to the inclining experiment,
(i)Why a vessel has to undergo such an experiment ?
(ii)What are the precautions taken before the process is initiated ?

(05 Marks each)

(b) A vessel initially upright is to carry out the inclining experiment . Following particulars are Known. Displacement – 6000t , KM - 5.5m .
Following known weights are on board during the experiment.,
Sundries and Stores – 175t , KG - 3.9m Ballast - 460t , KG - 2.96m (tanks full)
Bunkers - 144t , KG – 3.4m(tanks full) Fresh Water – 64t . KG – 2.87m (tank partially filled with a FSM of 1645 TM), Inclining experiment weights - 58t , KG - 7.02m
Personal effects 0.28t / KG - 5.12m .
Plumb lines are constructed with an effective vertical length of 7.00m.The inclining weights were shifted 6.00m transversely on each occasion and the mean horizontal deflection of the plumbing was 0.70m .
Calculate the vessel's light displacement and the KG. (20 Marks)

Contd/.....2

(03)(a)Explain how a vessel is subjected to various stresses while underway in a seaway.

(08 Marks)

(b) A box shaped vessel 100m long, 15m wide, has a light displacement of 1200t.The vessel has five identical holds divided along its length. 1500 t of bulk cargo is loaded and trimmed level in each hold , namely in No.2 and No.4.Draw the SF and BM diagrams to scale.

(22 Marks)

(04)A vessel may be described as " Initially Unstable " , " Stiff " or " Tender " .
Assuming a vessel at a same draft on different occasions has the above characteristics .
(i)Illustrate the three possible GZ curves on the same axis and explain. (15 Marks)
(ii)State the inherent properties associated with each of these conditions. (15 Marks)

(05)(i)Define " Dynamical Stability " (06 Marks)
(ii)Analyze the compliance with Load Line rules under the given condition.
M.V. Victoty displacing 85,000 t , KG – 10.68m , FSM 6761 tm , state the dynamical stability at 30 heel. Assume the angle of flooding is over 40 .

(24 Marks)

(06)(i)Define the terms "Bilging " and "Permeability"

(10) Marks)

(ii)A vessel of 150m in length and 14m in width is box shaped and floating at an even keel draft of 8.0m in salt water. The aftermost compartment, 18m long and 14m wide is full of cargo with a permeability of 30%. Find the new drafts forward and aft if this compartment is bilged.

(20 Marks)

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION
GRADE : CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT : **SHIP STABILITY**
DATE : **26 th September 2001** , 0900 hrs. TO 1200 hrs.

Time allowed THREE hours. Total Marks 200
Answer ALL questions. **Pass Marks 50 %**
Formulae and all intermediate steps taken in reaching your answer should be clearly shown .You may draw sketches where ever required .

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(1)(a)With suitable illustrations define the following .
(i)Actual angle of flooding
(ii)Potential angle of flooding
(iii)Angle of deck edge immersion . (05 Marks each)

(b)Vessel ' A ' with a KG of 8.20 m , is floating at an even keel draft of 6.8 m in salt water . With the aid of Data sheets Q . 1(a) Tabulated KN values and Q . 1(b) Hydrostatic Particulars , compare the ships' stability criteria for compliance with the current Load Line rules .
(10 Marks)

(2)(a)While a vessel is being dry docked , explain why the period from stern first touching the blocks till the vessel bodily sits on the blocks is cosidered dangerous . How you will maintain your vessel safe during this period ?
(09 Marks)

(b)A vessel displacing 12000 tonnes enters a dry dock with a clearance of 1.0 M over the blocks . Following data was known . At the time of entering draft forward 5.2 m , aft 6.14 m , MCT 110 , TPC 18 , LCF 3.0M aft of midships , Length 140 m , KG 5.0 m , KM 5.24 m . Assuming that the hydrostatic data remaining constant determine the following .
(i)The drop in water level required before the vessel takes the blocks fore and aft .
(ii)The GM at the instant of taking the blocks .
(iii)The further drop in water level before the GM reduces to zero .
(07 Marks each)

(3)(a)A container ship with a large lateral windage area may heel significantly

Contd.../2

(3)Continued ../ ....

when subjected to a strong beam wind . Discuss how the effects will be shown on a curve of statical stability . (12 Marks)

(b)With reference to the given GZ values at the indicated angles of heel for a vessel of 12500 tonnes calculate the following .

Heel	0	15	30	45	60	75	90
GZ	0	0.65	0.037	0.47	0.17	0.28	0.66

What will be the angle of heel when a force of 47 Kg/m acts on the lateral windage area of 4926 m of the vessel . The centroid of the windage area is 10 m above the upright waterline and draft is 6.6 M .

(18 Marks)

(4)(a)A vessel having a light displacement of 3000 tonnes has KG of 5.5 m ,and a KM of 7.0 m . The following weights are then loaded .

5000 tonnes of cargo at KG 5.0 m
2000 tonnes of cargo at KG 10.0 m
700 tonnes of fuel oil of R. D. 0.96

The fuel oil is taken into the double bottom tanks No. 2 , 3 & 5 which leaves the first slack and both latter filled completely . The vessels then sails on a 20 days passage consuming 30 tonnes of fuel oil per day . On arrival at the destination No. 2 & 3 tanks were found empty . Remainder of fuel was in No. 5 tank .Dimensions of the tanks are given as follows .

No. 2 , 15 x 15 x 1 m
No. 3 , 22 x 15 x 1 m
No. 5 , 12 x 15 x 1 m

Assume that the KM is constant and the KG of fuel oil in every case is at half the depth of the tank .Find the value of vessel's GM at the departure on arrival .

(30 Marks)

(5)(a)The trim of a vessel changes when the vessel moves into water of different density . Justify the above statement .

(10 Marks)

Contd./.....3

TO - Capt Herath

M C N Fernando

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : **CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE**

SUBJECT : **NAVIGATION**

DATE : **20th April 2004 , 0900 hrs. TO 1200 hrs.**

Time allowed THREE hours. Total Marks 200

Answer ALL questions. **Pass Marks 70 %**

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

0495

(1)Morning at ship , using D.R. of 0530 hrs., 20° 10'S , 155° 46'E , an observer made the following observations . The vessel was steering 248° (T) at a speed of 15.5 Knots . Same D. R. was used for all observations .

	Time	Bearing	True Alt.	Intercept
Star A	0524	268° (T)	56° 10'	1'.1 Towards
Star B	0532	329° (T)	25° 22'	2'.5 Towards
Star C	0540	155° (T)	37° 52'	2'.5 Away
Star D	0549	097° (T)	61° 13'	7'.0 Away

(a)Fix the vessel at 0530 hrs. ship's time (25 Marks)

(b)Reason out the confidence of the observer and the accuracy of the above observations. (10 Marks)

0504

(2)A vessel was steering 075° (T) at 15 Knots , in D. R. position 21° 00'S , 170° 00'W whilst she was following a recommended track 7.74 on a voyage from Brisbane (Australia) to Papeete (in the Tuamota Archipelago). Data sheet Q.2 refers. The Master received of an approaching Tropical Revolving Storm in position 17° 20'S , 154° 00'W which was heading 260° (T) at 12 Knots.

(a)On work sheet Q 2 (Pacific Ocean and adjacent Seas) plot the positions and the tracks of both, the vessel and the storm . (09 Marks)

Wind is now from SSE and freshening , also slowly backing as pressure falls.

(b)What should be the Master's most appropriate action , in view of the present weather conditions ? Reason out the action and indicate the course to be steered . (13 Marks)

Contd...../ 2

(2)Continued,
Few hours later, wind steadies on SE , and commences to veer slowly , pressure falling force further strengthening .

(c)Under the new development what would be the most prudent action by Master to save the vessel from damage. Give reasons for the intended action.
(13 Marks)

(3)A vessel departs Guam Island (North Pacific) bound for a landfall position approaching Panama . It was decided to follow the most direct route indicated in data sheet Q.3 . The Northern extremity of Brooks Banks is close to the intended route. Following positions are known.
Departure position near off Guam 13° 30' N , 144° 45'E .
Landfall position near Panama (G) 07° 00'N , 080° 00'W .
Northern Extremity of Brooks Banks 24° 55'N , 166° 12'W .
Required to calculate the following ,
(a)Total distance along the shortest route from Guam to way point (G)
(18 Marks)
(b)The position of the Vertex (09 Marks)
(c)The closest approach to the Northern extremity of Brooks Banks when crossing Longitude 166° 12'W (08 Marks)

(4)A vessel whilst on passage from Hudson Bay (Canada) , steering a South Easterly course heading towards the Mediterranean , following observations were made for the purpose of checking the accuracy of the compass . date and time at ship was 14 th June 1976 , 2330 hrs. , chronometer read 03h 28m 29s correct on GMT . D. R. position of the vessel 61° 12'N , 58° 42' W . Compass bearing of the star Capella was 034°(C) and 000°(G) , Variation was known to be 37° W . Required to find the following .
(i)True bearing of star Capella . (10 Marks)
(ii)The error on the Gyro Compass . (08 Marks)
(iii)The deviation of the Magnetic Compass for the direction of ship's head . (07 marks)

(5)At 1830 hrs. GMT on 15 th May 1976 on board a cruise vessel in position 38° 26' N , 052° 44'W , steaming at 24 Knots was heading for a landfall off New York , position 40° 45'N , 74° 00'W . At this time the Master received a PANPAN from another vessel in position 36° 50'N , 58° 25'W indicating that she was in need of urgent medical assistance .

Contd..../3

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : **CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE**

SUBJECT : **SHIP STABILITY**

DATE : **21st April 2004, 0900 hrs. TO 1200 hrs.**

Time allowed THREE hours. Total Marks 200

Answer ALL questions. **Pass Marks 50 %**

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

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(1)(a)If the calculated Metacentric height during dry docking of a vessel is found to be inadequate , explain the practical measures that can be taken to remedy this situation , prior to dry docking .

(10 Marks)

(b)A ship due to be dry docked has the following particulars .
KG – 12.10m , KM – 12.30m , Displacement – 44000 t
Length BP – 210m , Draft Foreward – 10.38m & Aft – 11.80m ,
LCF – 95.0m forward of after perpendicular , MCTC – 500
Calculate the effective GM when taking the blocks fore and aft assuming that the blocks have no declivity . (20 Marks)

(2)(a)How do you arrive at the formula

$$MCTC = \frac{W \times GM}{L \times 100}$$

(10 Marks)

(b)A vessel of LBP 220m has completed cargo with the following drafts and hydrostatic particulars.
LCF – 121m foreward of the aft perpendicular , MCTC – 1300 ,
TPC – 75 , Draft Foreward – 15.60m & Aft – 16.20m .
She has to complete bunkers and sail with a maximum draft of 16.0m .The Following partially filled bunker tanks are situated with centroids 192m and 90m foreward of the aft perpendicular respectively .
Calculate the following ,
(i)Maximum amount of bunkers to be loaded (10 Marks)
(ii)Weights to go into each slack tank so that the vessel sails on even keel .
(Assume the hydrostatic particulars remain constant)

(15 Marks)

Contd.../2

(3)(a)What are the advantages you achieve by having a shipboard stress finding installation ? (10 Marks)

(b)A box shaped vessel of 120m in long , 15m wide , light displacement 1200 tones , has five identical holds .3000 tonnes of bulk cargo is loaded and trimmed level into the No.2 and No.4 holds equally . Draw the curves of SF and BM for the vessel indicating the values.

(25 Marks)

(4)(a)With regard to the inclining experiment,

(i)Why a vessel has to undergo such an experiment ?

(ii)What are the precautions taken before undertaking this process ?

(05 Marks each)

(b)A vessel initially upright is to carry out the inclining experiment and is in the following condition . Displacement – 5600 t , KM – 5.50m .

Total weights on board during the experiment ,

Sundries and stores - 165 t , KG – 3.9m ,

Ballast - 420 t , KG – 2.96m , Tanks full

Bunkers - 145 t , KG – 3.4m , Tanks full

Fresh water – 67 t ,KG – 2.87m , Tank partially filled with a FSM of 1645tm

Inclining experiment weights 58 t , KG – 7.02m ,

Personnel 0.28 t , KG – 5.12m .

Plumb lines were constructed with an effective vertical length of 6.96m.

The inclining weights were shifted 5.42m transversely on each occasion and the mean horizontal deflection of the plumbing was 0.68m .

Calculate the vessel's light displacement and the light KG .

(20 Marks)

(5)(a)Define the terms ,

(i)Bilging

(ii)Permeability (05 Marks each)

(b)A box shaped vessel 150m long and 16m wide floats in salt water at an even keel draft of 9.0m . It has a longitudinal water-tight bulkhead on its centre line and DB tanks 1.2m high . KG is 6.0m and FSM = 900 tm . A hold 12.0m long , on the port side , having a permeability of 30% gets bilged. Find the resulting list .

(25 Marks)

Contd/...3

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT : SHIP STABILITY
DATE : 30TH JULY 2010 , 0930 Hrs to 1230 Hrs

Time allowed **THREE** hours — Total Marks 180
Answer **ALL** questions — **Pass Marks 50%**
Formulae and intermediate steps taken in reaching your answer should be clearly shown.
You may draw sketches wherever required.

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(01)(a)Explain why the trim is subjected to change when a vessel moves from one density of water to another. (10 Marks)

(b)A vessel floating in salt water has the following particulars.

Displacement - 18,000t LBP - 220m LCB - 100m Foward of the aft perpendicular
LCF - 120m forward of the aft perpendicular , MCTC - 200, TPC - 23
Draft Forward - 7.85m , Aft - 8.55m
The vessel has two bunker tanks. The forward tank has its centroid 205m forward of the AP and the After tank has its centroid 75m forward of the AP.
Calculate the following,

(i)The amount of fuel to transfer between the bunker tanks in order to arrive alongside at a fresh water berth on an even keel. (12 Marks)

(ii)The arrival draft forward and Aft. (08 Marks)

(02)(a)What is the purpose of carrying out the inclining experiment when a vessel is launched ? (08 Marks)

(b) A vessel initially unright is to carry out the inclining experiment and known to have following condition. Displacement–5600t , KM - 5.5m
Following weights are placed on board,
Sundries and Stores–165t / KG - 3.9m Ballast - 420t / KG - 2.96m (tank full)
Bunker - 145t / KG–3.4m(tanks full) Fresh Water–67t / KG–2.87m (tank partially filled with a FSM of 1645 TM), Inclining experiment weights - 58t / KG - 7.02m
Personnel 0.28t / KG - 5.12m .
Plumb lines are constructed with an effective vertical length of 6.96m , the inclining weights are shifted 5.42m transversely on each occasion and the mean horizontal deflection on the plumbing is 0.68m .
Calculate the displacement and KG of the vessel in her light condition. (22 Marks)

Contd/..2

(03)(a)If the calculated Metacentric height during dry docking of a vessel is found to be inadequate, explain the practical measures that can be taken to remedy this situation, prior to dry docking. (06 Marks)

(b)(i) A vessel being dry docked for the purpose of refitting of a lost rudder has the following particulars on entry to the dock. Displacement - 13,000t , KG - 8.50m , KM - 8.80m MCTC - 170 , LCF - 76.0m forward of AP , Draft forward - 4.80 m , Aft - 6.70m in salt water. Calculate the GM at the Critical instant, as the dock is being emptied. (14 Marks)

(ii)While in the dry dock the rudder weighing 28 t , KG - 3.20m is fitted in position at the after perpendicular. Calculate the GM at the critical instant as the dock is being refilled. (10 Marks)

(04)A vessel may be described as "Initially Unstable" , " Stiff " or "Tender" . Assuming a vessel at a same draft on different occasions has the above characteristics .

(a)Illustrate the three possible GZ curves on the same axis and explain. (15 Marks)

(b)State the inherent properties associated with each of these conditions. (15 Marks)

(05)(a)Define "Dynamical Stability" (06 Marks)

(b)The righting lever of a vessel displacing 9500t is as follows

Heel	0^0	10^0	20^0	30^0	40^0
GZ	0	0.04	0.14	0.40	0.55

Calculate each of the following.

(i)Dynamical stability at 40^0 (16 Marks)

(ii)The residual dynamical stability at 40^0 if the vessel is subjected to a steady wind heeling moment of 380 tm. (08 Marks)

(06)A box shaped vessel has length 72m breadth 10m and is floating in fresh water at an even keel draft of 3m. She has six evenly divided compartments . No. 2 and No. 5 are completely full of oil containing 144 t in each tank.

(a)Draw the load , SF and BM curves and estimate their maximum values. (20 Marks)

(b)Find the SF and BM at a point 10m from forward. (10 Marks)

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE :(i)CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE
(ii)CHIEF MATE / MASTER ON SHIPS OF LESS THAN 3000GT ON NCV

SUBJECT : SHIP STABILITY
DATE : 18TH DECEMBER 2012 , 0900 Hrs to 1200 Hrs

Time allowed **THREE** hours — Total Marks 180
Answer **ALL** questions — Pass Marks 50%
Formulae and intermediate steps taken in reaching your answer should be clearly shown.
You may draw sketches where ever considered prudent.

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01. (a)A Loadicator on board always gives stress evaluations for sea and harbor conditions. What is the importance of knowing these two conditions ? (08 Marks)

(b)A box shaped vessel of 100m length, 15m beam is empty and afloat on an even keel. It has five identical compartments and displaces 200 t. Bulk cargo is loaded and trimmed level as follows, No. 1 – Nil, No. 2 – 1500 t, No. 3 – Nil, No. 4 – 1500 t, No. 5 – Nil. Draw the SF and BM curves to scale. (22 Marks)

02. (a)Define the term Angle of Loll. Explain how such a condition can develop on board. Propose the possible remedial action to improve the stability condition. (08 Marks)

(b)M.V. Non Such, displacing 17,000 t, has the following data. KG–8.55m, FSM–2550 tm, KM – 8.265m, KB – 4.331 m. Also the following KN values for the corresponding angles of heel.

Heel	0	5	10	15	20	30	40	60
KN	0	0.755	1.502	2.229	2.978	4.362	5.630	7.138

Find the angle of loll by constructing the GZ curve. (22 Marks)

03. (a)Define the term bilging and the effects on a vessel as a result. (08 Marks)

(b)A box shaped vessel 200m long, 20m wide is afloat in SW at drafts of 6m foreward and 8m aft. No.4 Lower hold, 24m long and 20m wide has 70% permeability. Its foreward bulkhead is 30m from the foreward end of the vessel. If this hold is bilged find the new drafts foreward and aft. (22 Marks)

Contd/....2

(04)A vessel having KG – 6.3m, FSM – 2148 tm, Displacement – 12000 t has to load a transformer weighing 200 t using ship's crane, the head of which is 24m above the keel. Find the following.

(a)When the ship's crane picks up the transformer off the wharf with an outreach of 15m to starboard what will be the resulting list? (15 Marks)

(b)After the transformer is placed on the upper deck (KG – 10m), 7m to starboard of the centerline what will be the final list on completion of the operation? (15 Marks)

(5)(a)The trim of a vessel changes when the vessel moves into water of different density. Analyze this statement. (10 Marks)

(b)A vessel is about to enter a river port over a bar where the maximum depth of water is 9.20m. She has to maintain a clearance of 0.5m . Currently she draws 8.4m foreward and 9.0m aft. How much ballast water she should discharge from after peak (LCG – 103m aft of midships) in order to trim the vessel to a safe condition for river transit.
Following data available, MCT - 125, TPC – 25 , LCF – amidships and Length – 212m.
Also find the final draft foreward. (20 Marks)

(6)(a)Define the following,

(i)Statical Stability
(ii)Dynamical Stability
(iii)Angle of Flooding
(iv)Righting Lever (03 Marks each)

(b)Dynamical stability of a vessel is effected by a list developed due to transverse shift of cargo. Explain. (08 Marks)

(c)A vessel with a small negative metacentric height has developed an angle of loll. Draw up a righting lever curve for the vessel giving all details. (10 Marks)

DIRECTORATE OF MERCHANT SHIPPING
GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE :CHIEF MATE / MASTER ON SHIPS OF 500 GT OR MORE

SUBJECT : NAVIGATION.
DATE : 06th April 2006

Time allowed THREE hours — Total Marks 200
Answer **ALL** questions — Pass Marks 70%
Formulas and intermediate steps taken in reaching your answer should be clearly shown.
You may draw sketches wherever considered necessary.
Marks for each question are shown in brackets.

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(1) A vessel is required to make passage from Cape Town, Republic of South Africa, to New York, USA.
Departure position off Cape Town 33^0 53' S ; 018^0 26' E
Pilot Station off New York 40^0 28' N; 073^0 50' W.

The vessel departs Cape Town, on a Great Circle track, at 1000 Standard time on 20 April 1976, and maintains the vessel's service speed of 16.5 knots throughout the passage.
Calculate each of the following;

a) The total distance cape Town to New York - Departure position to New York pilot station. (15)

b) The vessel's ETA New York Pilot, Standard time. (10)

(2) A vessel is required to make a passage through an area where pack ice and ice accretion may be encountered. Describe the problems that may be experienced with regards to each of the following.

a) the maintenance of navigational accuracy; (10)

b) the performance of navigational instruments and electronic navigational aids (10)

c) the use of floating navigation aids (10)

d) the use of sectored leading lights (5)

3) You are requested to rendezvous and stand by another vessel which has been damaged by fire. The damaged vessel is heading for port on a course of 210^0 (T) at a speed of 6 knots. The radar bearing and range of this vessel from you is 115^0 (T), distance 16 miles. Your orders are to take up station on the damaged vessel 1 mile off her starboard quarter on a bearing of 135^0 relative to his ships head. Own vessel's maximum speed is 14 knots.

Obtain;

a) The course to steer to rendezvous, (10)

b) The time taken to reach the on station position, (10)

c) The bearing at which you would expect to sight the vessel if the visibility is 5 miles. (10)

4) A vessel is on passage from Hudson Bay, Canada, steering a steady southerly course for the Mediterranean. For the purpose of checking the compass errors, the following observations were made:

Time and date at ship 2330, 14 June 1976.

Chronometer reading 03 h 28 m 29 s correct on GMT.

DR position 61^0 12' N; 58^0 42' W

Compass bearings of star Capella are 034^0 C, 000^0G, Variation 37^0 W.

a) Find each of followings;

(i) the true bearing of star Capella; (15)

(ii) the error on the gyro compass; (05)

(iii) the deviation on the magnetic compass for the direction of the ship's head. (05)

b) Several hours later, the Sun rose and amplitude observations elicited following results:

Gyro compass error 1.7^0 Low

Deviation on magnetic compass 4.7^0 East

State, with reasons, the reliance that should be placed on the information obtained from these observations. (10)

THE PRESIDENTIAL SECRETARIAT
MERCHANT SHIPPING DIVISION

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : OFFICER IN CHARGE OF A NAVIGATIONAL WATCH ON SHIPS OF ,

(a) 500 GT OR MORE

(b) LESS THAN 3000 GT

SUBJECT : COASTAL NAVIGATION

DATE : 16 TH JUNE 1999 , 0900 hrs. TO 1200 hrs.

Time allowed THREE hours — Total Marks 150

Answer all questions — Pass Marks 70 %

Positions given are only for the guidance of candidates .

Clearly show the formulae used and the intermediate steps taken in reaching your answers.

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(1) (a)Give the chart symbols for the following as given in Chart 5011.

(i)Reporting point within a traffic controlled area

(ii)Prohibited area for through traffic showing its extremities

(iii)Recommended track for deep draft vessels

(iv)An inshore traffic zone

(v)Mangroves

(4 Marks each)

(b)The horizontal sextant angle between Ile D'Ouessant Light and Ile De Seine Light house was observed to be 066°.Find the vessel's position.

Ile D'Ouessant Lt. 48° 27'N , 005° 07' W

Ile De Seine Lt. 48° 03'N , 004° 52' W

(10 Marks)

(2) Find the available depth of water at 1000 hrs. on 17 th June 1999 at Rosyth harbour (Scotland) at a charted depth of 20 m.

(20 Marks)

Contd..../2

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(3)A vessel in position with Le Havre Light float (49° 30'N, 000° 10'W)Brg.291°(T) distance 5.6 miles at 1200 hrs. has to proceed to Dover (51° 07' N , 001° 19' E) The vessel draws 9.5m and steams at 16 knots.
Find the following.
(a)Position at 1200 hrs. (5 Marks)
(b)True courses and distances to steer to reach the destination .Give reasons for choosing your proposed track. (25 Marks)
(c) ETA at Dover (5 Marks)
(d) True course to steer between Greenwich Light Float (50° 24.5' N, 000° 00') and Basurelle Lt. Buoy (50° 33' N , 000° 58' E) if the vessel experienced a current of 180°(T) at the rate 4 knots during that leg . (5 Mark

(4)A vessel steering 254°(T) , speed 18 knots observed Catherine Point Light House (50° 35' N , 001° 18'W) to bare 028°(G) at 1900 hrs..One hour later Bill of Portland Light (50° 32' N , 002 28' W) bore 339°(G) .If the Gyro compass was 2°H find the following .
(a) Position of the vessel at 2000 hrs. (10 Marks)
(b)True course and speed made good. (10 Marks)
(c)Set and Drift experienced . (10 Marks)

254 028 339
-24 -2 -2
026 337

(5)A vessel read the vertical sextant angle of Lizard Point (49° 58' N, 005° 12' W) to be 45.0' at 0900 hrs. HE was 18m and the IE of the sextant was 2.0' on the arc. From this position the vessel has to proceed to Berry Head Pilots boarding ground (50° 25.5' N , 003° 25' W) . The vessel has a speed of 14 knots and she experienced a set and drift of 060 (T) @ 4 knots until passing Start Point.
Find the following.
(a)Position of the vessel at 0900 hrs.(disregard the height of tide) (5 Marks)
(b)Compass courses and distances to steer on each leg to reach Berry Head (Use deviation card No. 1) (20 Marks)
(c)ETA at destination . (5 Marks)

45.0'

Ht of Lizard 40m

309 335°(T)

24 Tue