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DIRECTORATE OF MERCHANT SHIPPING

MERCHANT SHIPPING SECRETARIAT

GOVERNMENT OF SRI LANKA

CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE (UNLIMITED)
SUBJECT : Leadership and team working skills
DATE : 28.04.2023

Time allowed **THREE** hours — Total marks : 100
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. Electronic devices capable of storing and retrieving are **NOT** allowed.

1) How would you describe the following?
   a) 'planning'
   b) 'operational action plan' with 3 examples.

(10 marks each)

2) Explain the meaning of 'situational awareness' along with shipboard examples.

(20 marks)

3) Discuss your opinion on the joint outcome of automation, complacency and boredom.

(20 marks)

4) Explain your understudying on the following along with short notes:
   a) ISM
   b) ISPS
   c) STCW
   d) ILO
   e) MLC

(04 marks each)

5) i) Write brief introductory notes on the following leadership styles, along with their pros & cons.
      a) Laissez-Faire
      b) Autocratic
      c) Participative
      d) Transactional
      e) Transformational

(03 marks each)

   ii) Recall your past on board experiences and give an example to each above relating to the incident.

(05 marks)

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CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE (UNLIMITED)
SUBJECT : Engine and control systems
DATE : 28.04.2023

Time allowed **THREE** hours | Total marks : 100
Answer **8 questions** including mandatory **question no 10** | Pass marks : 50%

Formulae and all intermediate steps taken in reaching your answer should be clearly shown. You may draw sketches wherever required. Electronic devices capable of storing and retrieving are **NOT** allowed.

1.

a) What is the different between four-stroke and two- stroke diesel engines?

(02 marks)

b) Briefly explain the functions of crankshaft and camshaft.

(02 marks)

c) Sketch and describe four-stroke valve timing diagram of a Diesel engine.

(06 marks)

d) Show the valve overlapping angle in above diagram.

(02 marks)

2.

a) What are the main advantages of having turbochargers on modern diesel engines?

(04 marks)

b) What is the purpose of auxiliary blowers installed in main engine scavenging system?

(02 marks)

c) Briefly explain with suitable sketches different types of scavenging systems for large two stroke diesel Engines.

(06 marks)

3.

a) With an aid of a sketch, show all the important boiler mountings installed in any type of marine boiler.

(06 marks)

b) Briefly explain the functions of 4 important mountings among them.

(04 marks)

c) How do we control the corrosion in the boiler?

(02 marks)

4.

a) Sketch and describe a fresh water generator widely used in marine industry.

(08 marks)

b) What is the purpose of keeping this water in specific tanks?

(02 marks)

c) How do you make this water into portable water?

(02 marks)

5.

a) What are the key features of Ship Energy Efficiency Management Plan?

(04 marks)

b) How to implement SEEMP?

(04 marks)

c) What are the methods and technologies used to reduce SOx Emissions from marine engines?

(04 marks)

6.

a) What are the functions of lubricating oil in diesel engines?

(03 marks)

b) Make a detailed sketch of a lubricating oil system of a diesel engine showing all important components.

(07 marks)

c) Explain how desired temperature is controlled in the system?

(02 marks)

7.

a) Draw and explain ship's AC power distribution system.

(06 marks)

b) Sketch three types of DC motors.

(03 marks)

c) State the characteristics of above motors.

(03 marks)

8.

a) With regards to steering system, name the main components which are included in the telemotor control system and their functions.

(04 marks)

b) Name main alarms and indications on steering gear system.

(04 marks)

c) What are the checks that should be carried out on steering system before leaving a port?

(04 marks)

9.

a) What is the meaning of a comfort zone with regards to air condition system?

(02 marks)

b) Make a detailed sketch of a ref. cycle and explain the function of each component.

(10 marks)

10. When taking indicator cards of a 6 Cylinder slow speed diesel engine, following information were obtained.

Cylinder No.	**1**	**2**	**3**	**4**	**5**	**6**
Area in mm2	3400	3300	3400	3050	3350	3400

Card length : 100 mm
Diameter of the cylinder : 990 mm
Piston stroke : 1800 mm
Spring constant : 40 KN/m^2 per mm
RPM : 90

(a) Calculate the power developed by each cylinder.

(10 marks)

(b) Total power developed by the engine

(02 marks)

(c) What will be the outcome, if engine continue to operate in this condition for an extended period?

(04 marks)

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CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE (UNLIMITED)
SUBJECT : Electronic Navigation Systems
DATE : 27.04.2023

Time allowed **THREE** hours | Total marks : 150
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. Electronic devices capable of storing and retrieving are **NOT** allowed.

1) Describe the principle of Electromagnetic distance measurement in GPS system.

(25 marks)

2) With aid of a block diagram, describe the LRIT System Components and their purpose.

(25 marks)

3) With aid of a block diagram, show the internal parts and the instruments connected to AIS.

(25 marks)

4) You are on board a vessel at Istanbul where H was recorded to be 13 A/m and Z = 15 A/m whilst the value of Coefficient C was (+) 7^0 and that due to Induced C was (-)2^0.

a) Determine the total deviation due to Coefficient C on a heading of 050^0 off Cape Town where H = 18 A/m and Z = (-)20 A/m.

(12 marks)

b) With aid of a sketch explain **any one** of the following:
(i) construction of a compass bowl.
(ii) H/E correcting system.

(04 marks)

c) (i) With regard to ship's magnetic compass, explain **any one** out of the following
and how it could be rectified A, C, and E.

(03 marks)

(ii) Explain what is Lambda, Mu and their use.

(03 marks)

(iii) When correcting or adjusting a ship's magnetic compass, explain why the final correctors recommended are permanent horizontal magnets?

(03 marks)

5) a) Explain any top-heavy method of a gravity control gyroscope by using suitable sketches.

(10 marks)

b) Describe how to determine the direction of precession on the above gyroscope.

(05 marks)

c) Draw the path taken by the north end of a controlled gyro situated in NH or SH, indicating relevant vectors.

(10 marks)

6) a) List ten IMO requirements on the performance standard of a Gyro Compass

(10 marks)

b) Name errors of the Gyro compass and describe any two of them indicating how to minimize them.

(10 marks)

c) Explain why controlled gyro should be damped to use it as a Gyro compass

(05 marks)

MERCHANT SHIPPING SECRETARIAT
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CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE (UNLIMITED)
SUBJECT : Meteorology
DATE : 26.04.2023

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

1) Write short notes on following:
   a) Ice found near New Foundland
   b) International Ice Patrol
   c) Multiyear Pack Ice
   d) Ice Limits in North Pacific
   e) Tabular type Ice bergs

(06 marks each)

2)
   a) Describe Buys Ballot law.

(05 marks)

   b) Explain why it should not be used in certain places.

(05 marks)

   c) Explain with reasons how you use Buys Ballot Law to find the direction of the centre of a TRS.

(20 marks)

3)
   a) A vessel trading in North Atlantic received a weather analysis chart (weather analysis chart is provided) and at the time of receiving it, the position of the vessel is latitude 60° 00' N, Longitude 020° 00' W and her course is 225°. Describe the weather forecast for the next few hours.

(20 marks)

   b) Calculate the surface wind speed at following positions. (In the Analysis chart Geostrophic Wind Scale – Geostrophic wind speed in knots)
      i. $50^0\ 00^0$N, $030^0\ 00^0$W
      ii. $40^0\ 00^0$N, $040^0\ 00^0$W

(05 marks each)

4)

a) What are the optimum conditions for a Tropical Revolving Storm to form.
(15 marks)

b) Describe the actions you would take once a TRS is confirmed in the vicinity.
(15 marks)

5)

a) Describe Wind drift, Gradient and upwelling currents.
(15 marks)

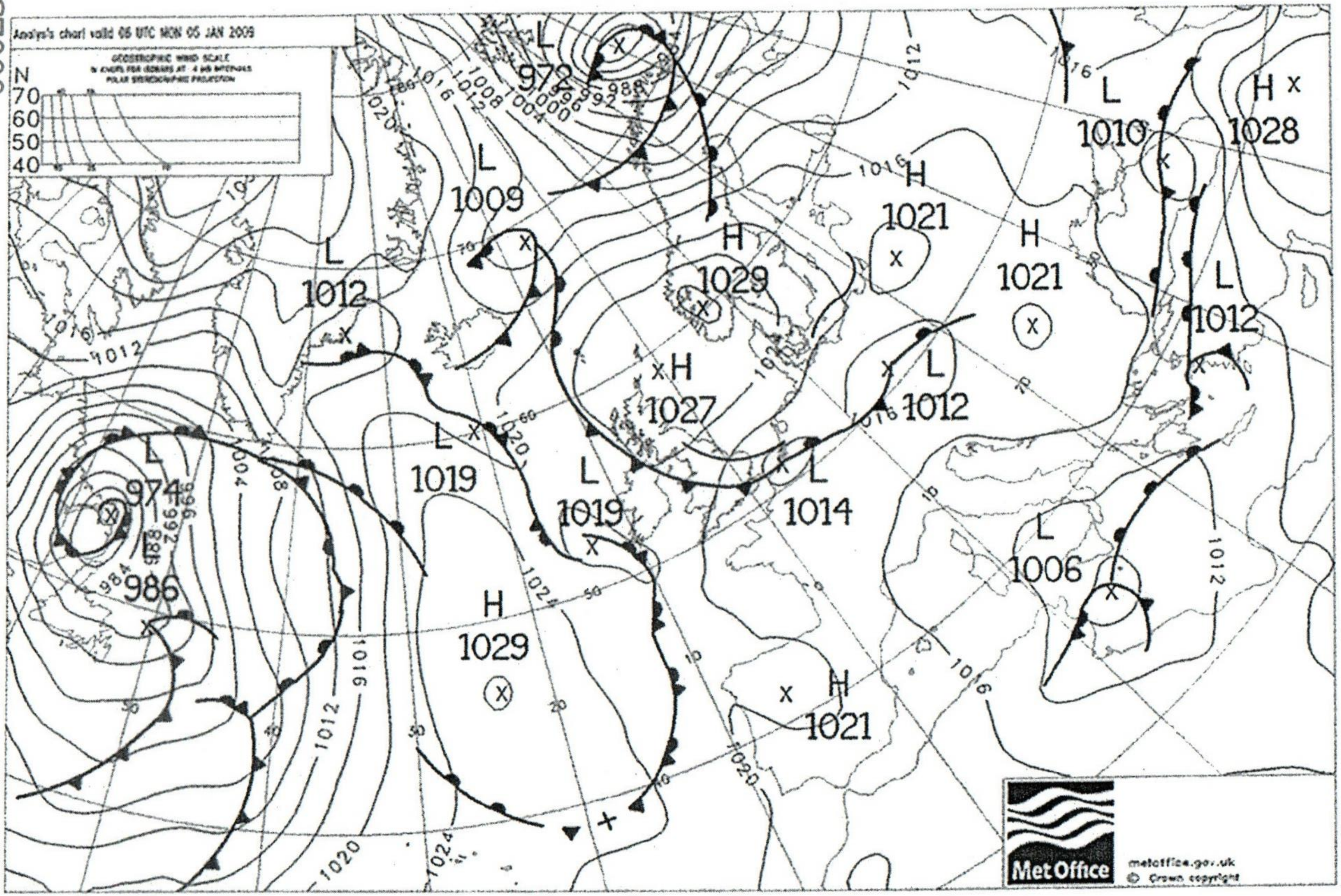
b) Mark in the provided map the prominent currents in the Atlantic.
(15 marks)

6)

a) Explain the formation of a front.
(15 marks)

b) Describe the weather associated with warm, cold and occluded fronts.

(05 marks each)


Analysis chart valid 06 UTC MON 05 JAN 2009
GEOSTROPHIC WIND SCALE
N
70
60
50
40
L 972
L 1009
L 1012
H 1021
H 1029
H 1021
L 1010
H 1028
L 1012
H 1027
L 1012
L 974
986
L 1019
L 1019
L 1014
L 1006
H 1029
H 1021
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MERCHANT SHIPPING SECRETARIAT
GOVERNMENT OF SRI LANKA
CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE (UNLIMITED)
SUBJECT : Ship Construction
DATE : 25.04.2023

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)

a) Discuss the areas of corrosion and reasons leading to it, in cargo spaces of following types of ships:
   i. Crude oil carrier (05 marks)
   ii. Bulk carrier (05marks)
   iii. General cargo ship (04marks)

b) What are preventive methods used in crude oil tankers to reduce corrosion? (03marks)

c) What are the effects, if this corrosion is allowed to continue unchecked in tankers? (03marks)

2)

a) Explain the following in relation to sliding watertight doors positioned below the water line which are used while at sea:
   i. Methods available for closing and opening.
   ii. What are the occasions that these doors will be opened & close?

(04 marks each)

b) As a chief officer, explain to a new crew member how to pass safely through a hydraulically operated watertight door.

(12 marks)

3)

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

(12 marks)

b) What are the advantages offered by similar construction to affect the following?

i. safety
ii. cargo containment
iii. stability
iv. effective maintenance of strength members of hull (06 marks)

c) what materials are used in construction of inner most linings of such tanks and the important property considered in selecting such material.

(02 marks)

4) Structural degradation of a ship's hull generally increases in proportion to the ships age and damage to the structure can occur at any time in the life of the ship.

a) In relation to above indicate 04 reasons for structural degradation and damage of ship structure.

(06 marks)

b) As a result of above, how can they lead to failure of material?

(07 marks)

c) Discuss the areas most susceptible for degradation and corrosion in a general cargo ship.

(07 marks)

5)

a) With reference to the activated fin stabilizers;

i. Make a simplified sketch of the essential features and explain how the rolling reduction is achieved.

(04 marks)

ii. Explain how it operates.

(04 marks)

iii. What are the reasons for using passing tanks are used on larger ships?

(03 marks)

b) Sketch & describe Bilge keel and the answer should include the;

i. construction
ii. purpose
iii. position
iv. method of attachment and
v. how to attend repairs in the event of damage (09 marks)

6)

a) Sketch 4 types of weld joints and explain the application of such weld joints in relation to ship construction.

(12 marks)

b) What is Welding Procedure Specification, or qualified welding procedure?

(08 marks)

7)

a) Sketch a vent suitable for a double bottom fuel tank and name the components.

(05marks)

b) With reference to double bottom fuel tanks:

i. state why weighted cocks are fitted to the tank sounding pipes;

ii. state the purpose of air pipes;

(03 marks each)

c) State the design features incorporated on air pipe vents with respect to EACH of the following:

i. Heavy weather

ii. Fire

iii. Bunkering

(03 marks each)

8)

a) Explain the routine steps for surface preparation and painting of hull under water area of an existing ship in dry dock. Your answer should include the reason for each activity.

(10 marks)

b) What are the regulatory requirements to be satisfied in under water coatings

(03 marks)

c) What are the parties involved and how they help in achieving the expected PERFORMANCE STANDARDS FOR PROTECTIVE COATINGS (PSPC) for dedicated ballast tanks?

(07 marks)

9)

a) With the aid of a sketch explain the strengthening method of a transverse cargo hold bulk head in a crude oil carrier.

(06 marks)

b) List five terms that describe the conditions that is related to hull distortion.

(05 marks)

c) State the **advantages** and **disadvantages** of using following materials in ship construction

i. Steel
ii. Aluminum
iii. FRP (fiber reinforced plastics)

(03 marks each)

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CERTIFICATE OF COMPETENCY EXAMINATION

GRADE : CHIEF MATE ON SHIPS OF 500 GT OR MORE (UNLIMITED)
SUBJECT : Business & Law
DATE : 24.04.2023

Time allowed **THREE** hours — Total marks : 130
ANSWER ALL QUESTIONS IN ALL PARTS — 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.

Part I

A vessel of following particulars to Copper concentrate in bulk at Puerto Santa Cruz, Argentina to Montreal, Spain. After completion of loading the vessel is to take sufficient bunkers at Buenos Aires, Argentina to safe reach Montreal, Spain.

Puerto Santa Cruz, to Buenos Aires 3 days all in summer.
Buenos Aires to Montreal, Spain 19 Days, 5 days summer, 11 Days Tropical and rest in Summer respectively.

Summer DWT	: 48260MT
Tropical DWT	: 49220MT
Winter DWT	: 47300MT
Light ship	: 6750MT
Constant	: 360MT
F/O ROB	: 180MT
F/W ROB	: 100MT

F/O Consumption: 24MT/Day
F/W Consumption: 10t/Day

Maintain 5 days reserve of fuel and fresh water for voyages over 10 days, otherwise 3 days reserve of fuel and fresh water to be maintained at all times. Calculate the following:

a) Maximum cargo intake at Puerto Santa Cruz
b) Minimum F/O and F/W intake at Buenos Aires

(25 marks)

Part II

2) With reference to owner ship and ship registration explain the following:
   a) Briefly explain what is meant by National Registries.

(07 marks)

   b) Briefly explain what is CSR and what happen to CSR when change of Owner, Owners details, flag and ships name.

(08 marks)

3) a) What are the vessel certificates coming under HSSC?

(07 marks)

   b) Explain in brief surveys required to carry out as per HSSC.

(08 marks)

4) United Nations Conference on the Law of the Sea commonly known as UNCOLOS is an intergovernmental treaty, developed to describe rights and liabilities of individual states of concerned sea areas. With regard to UNCOLOS sketch and describe briefly Baseline, Territorial sea, Contiguous sea, EEZ and continental shelf.

(15 marks)

Part III

5) Vessel 'A' was at a designated anchorage in Labamba waiting for a berth. Vessel 'B' collided with the anchored vessel 'A' while passing through the area. Vessel 'B' continued on her passage without stopping or exchanging information with the Vessel 'A'. Discus the means available for the owner of the vessel 'A' to recover the losses incurred.

(15 marks)

6) A container vessel ran aground in Singapore straits due to a navigational error of the duty officer. The ship owner managed to re-float her safely with the aid of salvors under LOF 2020. No cargo damages or damages to the vessel, but the shipowner is liable for the salvage expenses. Explain whether there in a general average act.

(15 marks)

7) The Hague Visby rules states that the carrier shall be bound, before and at the beginning of the voyage, to exercise due diligence to make the ship seaworthy. Explain in detail how you would exercise due diligence to ensure a safe loading, carriage and discharge of cargo as a chief officer.

(15 marks)

8) Briefly describe the meaning of the following clauses used in charterparties:
   a) Cancelling clause
   b) Lay time & demurrage clause
   c) War risk clause
   d) Clause paramount
   e) Bunker clause

(03 marks)