

(Paper Format)

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION (Management Level)

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 HOURS

PASS MARKS: 100

MAX. MARKS: 200

NOTES:

- 1. Question no. 1, 2, and 3 are compulsory. Attempt any FIVE questions out of SIX.**
 - 2. All questions carry equal marks i.e. 25 marks each.**
 - 3. Draw suitable sketches / diagram wherever considered necessary.**
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Q1. RADAR PLOTTING (NOT MORE THAN 3 TARGETS)

Q2. GYRO COMPASS (THEORY AND NUMERICAL)

Q3. MAGNETIC COMPASS (THEORY)

Q4. AUTO PILOT, COURSE RECORDER, ROTI

Q5. DOPPLER LOG, ELECTRO MAGNETIC LOG, ECHO SOUNDER

Q6. PERFORMANCE STANDARDS OF NAVIGATIONAL EQUIPMENT (ONLY FOR GPS, AIS, VDR, SVDR, ECHO SOUNDER, ROTI, SPEED AND DISTANCE INDICATOR, BNWAS)

Q7. ELECTRONIC POSITION FIXING SYSTEM

Q8. AIS, LRIT

Q9. VOYAGE DATA RECORDER, BNWAS

Please note that the above format is only an indicative of the examination paper. The candidates are advised to refer to detailed teaching syllabus and the course outline.

GOVERNMENT OF INDIA

PM PAPER

Date: - 17- Nov-2025

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

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Notes:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
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4. Draw suitable sketches / diagram wherever considered necessary.

Section – A

Q.1 Own course 070° (T) at 12 knots in reduced visibility.

Observations

Buoy X			Target Y			Target Z		
Time	Bearing	Range	Time	Bearing	Range	Time	Bearing	Range
1300	113 (T)	8.2 M	1300	162 (T)	10.2 M	1300	201 (T)	10.3 M
1318	102 (T)	3.8 M	1318	156 (T)	06.0 M	1318	201 (T)	07.0 M

Using a radar plot, find:

- a) CPA range and time of all three targets
- b) Course and speed of targets Y and Z
- c) When buoy X is abeam own vessel and it is decided to have a CPA of 2.0 M from targets Y and Z, what alteration of course is to be made under applicable COLREGS? All actions are assumed to be instantly and sufficient depth of water is available all around.

Q.2 A ship at anchor is heading 005°(G) in 76° 33' N latitude. What is her true heading in each of the following cases?

- a) Gyro is Damped in Azimuth
- b) Gyro is Damped in Tilt

Q.3 a) State the sequence of placing the correctors and the reasons for the same.

b) Explain how spheres increase Mean Directive Force at compass position. Justify your answer with diagrams.

Section – B

Q.4 Explain in detail, with sketch, the Control Unit of a PID auto-pilot. State the SOLAS requirements for the use of auto-pilot.

Q.5 a) List the factors that determine the choice of frequency to be used in an echo sounder.

b) Explain how Janus configuration helps to improve the accuracy of speed by Doppler log.

Q.6 Enumerate the IMO Performance Standards for the Rate of Turn Indicator (ROTI).

Q.7 a) Explain the different segments of GPS system and their salient features.

b) What is differential GPS? How does it improve the position fixing accuracy of GPS?

Q.8 a) What is the purpose of LRIT? Who are the authorized users of LRIT data and state the circumstances under which the information may be released to them?

b) State the interval of data transmission (transmission schedule) by AIS.

Q.9 What is a Voyage Data Recorder (VDR)? How does it work and what information does it record?

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1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
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4. Draw suitable sketches / diagram wherever considered necessary.

Q.1 Own Course 240° (T) at 15 knots in reduced visibility. Observes as follows:

Time	Target I	Target II
1000	314° (T) × 11.9 M	208.5° (T) × 10 M
1012	314° (T) × 8.3 M	211° (T) × 5.1 M

For each target, find CPA, TCPA, Course & Speed of targets. Aspect at 1012.

Own vessel desires to take action at 1016 Z by means of a single alteration of course or reduction of speed so that the CPA of either target will not be less than 2M.

Evaluate the possible alternatives and state which action is most preferable.

Q.2 A free gyroscope in Lat 50° N is initially set with its spin axis horizontal and pointing 30°E. Find the interval of time elapsed before the gyro is pointing in the meridian, and before the gyro axis is again horizontal.

Q.3 Explain the functions of the following correctors of magnetic compass:

- a) Vertical magnet
- b) Horizontal magnet
- c) Flinders bar

Q.4 Explain the basic controls of Auto-Pilot. Draw the basic auto helm diagram.

Q.5 a) On what principle the Electro-magnetic Log works?

b) Draw a block diagram of Electro-magnetic Log.

Q.6 State the IMO Performance Standards for the Automatic Identification System.

Q.7 What are the composition & significance of navigation data message transmitted by satellite vehicle?

Q.8 What is the purpose of AIS? What are the advantages and limitations of AIS?

Q.9 a) Enumerate the data that will be recorded by an approved VDR.

b) Describe the sequencing of alarms in BNWAS. What deviations are allowed in these sequencing?

GOVERNMENT OF INDIA

PM PAPER

Date: 06- Aug-2025

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

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MAX. MARKS: 200

Notes:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks i.e. 25 marks each.
4. Draw suitable sketches / diagram wherever considered necessary.

Q.1 Own course 240°(T) at 15 knots in reduced visibility.

Time	Target C Brg. (T)	Target C Range (M)	Target D Brg. (T)	Target D Range (M)
1000	314°	11.9 M	208°	10.0 M
1012	314°	08.3 M	211°	05.1 M

For each target, find:

- a) Range and time at CPA.
- b) Course and speed.
- c) Aspect at 1012 hrs.
- d) Evaluate alternatives if Master desires to alter at 1016 hrs to ensure CPA not less than 2 miles.
- e) State which action is most preferable.

Q.2 A vessel steers 168°(T) at 15.5 knots in 55°45' N latitude. Find Gyro course in each of the following cases:

- a) Gyro is 'Damped in Azimuth'.
- b) Gyro is 'Damped in Tilt'.

- Q.3 a) List the preparations and precautions necessary for swinging ship for compass adjustment.
b) Explain the occasion when an adjustment is necessary.

Section – B

- Q.4 a) Explain what determines the minimum and maximum depth recorded by an echo sounder. Give examples.
b) Briefly describe the function of the Proportional and Derivative control of the PID auto-pilot.

- Q.5 a) What are the various alarms and settings on an Echo sounder?
b) Explain how Doppler Log determines speed of vessel.

- Q.6 a) Differentiate between VDR & S-VDR.
b) What are different categories of AIS Messages?

- Q.7 a) Explain how the GPS uses carrier frequency to determine speed of the vessel?
b) List the various errors of GPS and explain any two of them.

- Q.8 a) Describe the purpose of LRIT including the data transmitted.
b) Difference between AIS & LRIT.

- Q.9 a) What is the purpose of BNWAS? How does the system monitor and alert personnel of watchkeeper disability?
b) Describe the construction and operational requirement for the protective storage unit in a VDR.

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Notes:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks i.e. 25 marks each.
4. Draw suitable sketches / diagram wherever considered necessary.

Q.1 In restricted visibility, own vessel on a course of $000^{\circ}(T)$ at 10 kts observes the following targets on her radar screen:

Sr No	Time	Bearing & Range (Target 1)	Bearing & Range (Target 2)
1	1000	$315^{\circ} \times 8'$	$000^{\circ} \times 11'$
2	1006	$315^{\circ} \times 7'$	$000^{\circ} \times 9.5'$
3	1012	$315^{\circ} \times 6'$	$000^{\circ} \times 8'$

a) Report the targets at 1012 hrs.

b) Analyze the above plot and basis that identify, in order to maintain a minimum CPA of 2 miles, which vessel is required to take action and what is that action. Any action taken will be effective from 1016.

Q.2 A ship is making good $270^{\circ}(T)$ while her gyro compass shows $265^{\circ}(G)$, in $54^{\circ}41' N$ latitude. She is required to make good $170^{\circ}(T)$ at 19 knots. What gyro course would you set on her auto-pilot?

(There is NO current and gyro compass has NO OTHER ERRORS)

Q.3 a) If a ship has $-PB$ and $+PC$, in which quadrant was she heading when built?

b) If DF on $N > DF$ on S , what coefficient is present and what is its sign?

c) If DF on $E > DF$ on W , what coefficient is present and what is its sign?

Q.4 a) With the aid of simple sketches, describe Proportional, Integral and Derivative control in an Auto-Pilot.

b) You are to alter course from 080° to 155° . With a neat sketch show how you would execute a constant radius turn of 2 nm.

Q.5 a) With the aid of a simple block diagram, describe the working of an Echo-Sounder.

b) Describe the principle and working of a Doppler Speed Log.

Q.6 What are the IMO Performance Standards for AIS? How does it help in keeping lookout at sea?

Q.7 a) Explain the various errors that might affect the accuracy of GPS fix and state the maximum error in position due to this.

b) Describe how DGPS enhances the accuracy of GPS position?

Q.8 a) Describe the purpose of LRIT including the data transmitted.

b) Difference between AIS & LRIT.

Q.9 a) What is the purpose of BNWAS? How does the system monitor and alert personnel of watchkeeper disability?

b) Describe the construction and operational requirement for the protective storage unit in a VDR.

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PM PAPER

Date: 09- May-2025

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TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks i.e. 25 marks each.
4. Draw suitable sketches / diagram wherever considered necessary.

Q.1 Own course 070° (T) at 12 knots in reduced visibility.

Radar observations:

Time	Target E Bearing	Target E Range	Target F Bearing	Target F Range
1630	063°(T)	12.0 M	128½°(T)	11.4 M
1642	063°(T)	08.4 M	137°(T)	08.5 M

Analyze the plot and state what alteration of course is to be made at 1648 to ensure CPA of 2 M.

Having taken this action, what would be the bearing and range off (from own ship) when it is at its CPA?

Q2. a) Explain the Course-Speed-Latitude error of a Gyro Compass and describe various methods used to correct the error.

b) The axis of a gyro-compass damped-in-tilt, uncorrected for speed-course error and damping error, points due north in latitude 61N, when making good a course of 345 and a speed of 20 Kts. On reaching latitude of 70N, course is required to be altered to 205(T) and speed is to be reduced to 15 Kts. Calculate the total error of the gyro compass and the gyro-course to steer in new latitude. (Assume that the gyro-compass does not have any other errors).

Q.3 Describe the deviation of standard magnetic compass which is caused by continuous athwartships horizontal soft iron in the vessel using suitable diagrams with respect to be following:

- i) Change in deviation due to a change in latitude of the vessel, and
- ii) Means and method used to correct such a deviation.

Q.4 a) List IMO performance standard for ROTI.

b) Describe the procedure to execute a constant radius turn with/without current.

Q.5 a) What are the various types of transducers used in Echo-sounders? Discuss the advantages and disadvantages of each.

b) Describe the various alarms and settings in Echo-sounders.

Q.6 a) Enumerate the IMO performance standards required for speed and distance indicator.

b) Explain the purpose of Transmitting Heading Device (THD).

Q.7 a) How does a GPS receiver determine the vessel's position?

b) What is GDOP & User Clock Bias?

Q.8 a) Explain the various setting of auto pilot for optimal performance.

b) State the entries to be made on course recorder for a voyage.

Q.9 a) Enumerate the performance standard for BNWAS.

b) Differentiate between AIS and LRIT.

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Notes:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
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4. Draw suitable sketches / diagram wherever considered necessary.

Q.1 Your vessel is navigating in a T.S.S in restricted visibility, steering a course of $150^{\circ}(T)$, speed 14 kts. The following radar observations were made:

Time	Target A Bearing & Range	Target B Bearing & Range
0100	$195^{\circ}(T) \times 6.0 \text{ nm}$	$341^{\circ}(T) \times 3.0 \text{ nm}$
0106	$195^{\circ}(T) \times 5.0 \text{ nm}$	$342.5^{\circ}(T) \times 2.75 \text{ nm}$
0112	$195^{\circ}(T) \times 4.0 \text{ nm}$	$344^{\circ}(T) \times 2.5 \text{ nm}$

- a) Report the situation at 0112.
- b) What action comprising a single alteration of course or speed would you take at 0115 with a performance delay of 06 minutes, so as to have a CPA of at least 1.5 nm with either target?
- c) At what time and distance will Target A pass you as a result of your action taken in (b)?

Q.2 a) Enumerate about steaming error, why it is caused, how it affects the setting position on a gyrocompass. In latitude $38^{\circ}N$, the damping error is $1.5^{\circ}E$. Calculate the total error of the same gyro compass when making good course $175^{\circ}(T)$ at a speed of 20 kts in latitude $50^{\circ}S$.

Q.3 A) Explain why and when Coefficient "A" & "E" are applicable to vessels.

b) State the rules governing the position of all correctors.

Q4 a) Explain the functions of ROTI.

b) Describe the working principle of automatic pilot system.

Q.5 a) Explain Janus configuration. What is necessary to have such arrangement in Doppler log?

Q6 A) What are advantages of Doppler log over Electro-magnetic log?

B) Briefly explain the performance standards of Echo sounder.

Q.7 a) How the vessel's position is obtained using GPS?

Q.8 a) What are the carriage requirements for AIS system as per IMO regulations?

b) What information is received by the AIS?

Q.9 What is the purpose of BNWAS? Explain the sequential operation of BNWAS with a block diagram.

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1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks i.e. 25 marks each.
4. Draw suitable sketches / diagram wherever considered necessary.

Q.1 Following targets are observed on radar screen by own vessel while steering 050° (T) x 12 kts, observing the following targets on her radar screen:

Sr No.	Time	Target 1 (Brg. & Dist.)	Target 2 (Brg. & Dist.)
1	1000	075° x 9'	085° x 7'
2	1012	073° x 6'	099° x 5.6'

If target 2 is observed to be a light vessel:

- a) Report the targets at 1012 hrs. Also find set and drift.
- b) Analyze the above plot and based on that, identify the appropriate action to take, in order to maintain a minimum CPA of 2 miles from all passing traffic. Any action taken will be effective from 1016.

Q.2 The auxiliary corrector of a gyro compass damped in tilt was inadvertently left at 'Zero Speed' & 'Zero Latitude'. The vessel was steering 030° by gyro at 18 knots in 48°N latitude and also made good a course of 030° (T). Find the gyro course steered by the vessel if she is making good a course of 060° (T) at a speed of 15 knots in 59°S latitude, with the auxiliary correctors still left to 'Zero' speed and latitude setting. (Assume there is no current throughout and also the gyro compass is not having any other errors).

- Q.3** a) Explain the method of placement of permanent correctors in magnetic compass for compensating the effect of P, Q, and R.
- b) Explain why a deviation curve made in one hemisphere and position cannot be used in the other hemisphere.

Q.4 With the help of a simple block diagram, explain the working of an Adaptive Auto-pilot.

- Q.5** a) With the aid of simple sketches, describe ranging and phasing in an Echo-Sounder.
- b) Describe the errors associated with a Doppler Speed Log.

Q.6 What is the purpose of the BNWAS? What are the IMO Performance standards for BNWAS?

Q.7 What are the working principles of GNSS? Explain the errors and alarms of GPS. Compare GPS, GALILEO, and GLONASS.

- Q.8** a) What are the differences between AIS and LRIT?
- b) Discuss why information derived solely from AIS should not be used for collision avoidance.

- Q.9** a) What is the purpose of the VDR? List the data saved by SVDR and VDR.
- b) What are the requirements for recording & storage of data for VDR installed after 01 Jul 14?

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3. Draw suitable sketches / diagram wherever considered necessary.

Q.1 Following targets are observed on radar screen by own vessel while steering 050° (T) x 12 kts, observing the following targets on her radar screen:

Sr No.	Time	Target 1 (Brg. & Dist.)	Target 2 (Brg. & Dist.)
1	1000	075° x 9'	085° x 7'
2	1012	073° x 6'	099° x 5.6'

If target 2 is observed to be a light vessel:

- a) Report the targets at 1012 hrs. Also find set and drift.
- b) Analyse the above plot and based on that, identify the appropriate action to take, in order to maintain a minimum CPA of 2 miles from all passing traffic. Any action taken will be effective from 1016.

Q.2 a) Explain with suitable sketches any one arrangement for making a free gyroscope into a North seeking gyro.

b) Damping error in lat. 40° S was observed to be 1.2° W. Calculate the damping error in latitude 25° N.

Q.3 On board a vessel Flinders bar was observed to be placed at an angle of 15° towards port side from fore and aft line; soft iron spheres were placed athwartship. Explain with suitable sketches the reason(s) for such an arrangement.

Q.4 a) Explain entries required to be made on the course recorder paper.

b) How will you adjust the setting of autopilot for optimum performance in moderate sea conditions?

Q.5 Discuss the various errors which the soundings shown by an Echo-Sounder may be subject to, including the reasons for the errors, methods of identification, and correction or elimination of the error.

Q.6 Enumerate the performance standards of BNWAS.

Q.7 Sketch a block diagram, describe and the function of the controls Weather adjustment, Counter rudder, Rudder limit, Rudder off-course alarm.

Q.8 Explain how the GPS determines the position of the observer and various errors of GPS.

Q.9 a) Difference between VDR & SVDR.

b) State the carriage requirements of BNWAS.

GOVERNMENT OF INDIA

PM PAPER

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2. Attempt any FIVE questions from Section B.
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Section A

Q.1 Own vessel is steering a course of 070° (T) at a speed of 12 knots in reduced visibility and observes the following radar bearing and range:

Time	Target A		Target B		Target C	
0000	086°	10.4 M	041°	10.5 M	000°	11.1 M
0006	088.5°	8.9 M	042.5°	8.8 M	000°	9.5 M
0012	092°	7.6 M	044.5°	7.3 M	000°	7.9 M

At 0012 a Racon signal identified Target A as a light vessel. Assess the situation at 0012 and find the direction and rate of current. What action would you take at 0018 with a performance delay of 6 minutes to ensure a minimum CPA of 2M from all targets? Justify your action and calculate the new CPA and TCPA of all targets.

Q.2 A vessel is fitted with "Damped in Azimuth" gyro compass steers 182° (G) at 27 knots in 55° 37'S latitude and makes good 174° (T). What will this gyro compass read when the ship makes good 344° (T) at 9.5 knots in 73°N Lat?

Q.3 How are Gaussian error and Retentive error caused? List the differences in deviation caused by each. What precautions are necessary when either of them may be present?

Q.4 a) Explain the function of the Proportional and Derivative Control of a PID Auto Pilot.

b) What factors are considered for choosing the radius of turn and how they affect the execution of the turn?

Q.5 a) Explain the effect of rolling, pitching, heaving of vessel on Fore-aft and Port, starboard speed indicated by Doppler log (Janus configuration).

b) Explain the factors considered for choosing the transmission frequency of an echo sounder.

Q.6 List out the functional requirements of a Speed and Distance Measuring Equipment (SDME) for installation onboard a ship.

Q.7 a) Discuss the improvements accomplished by DGPS. What are their limitations?

b) Write short notes on: i) GDOP

ii) Selective Availability

iii) GLONASS

Q.8 a) Briefly explain the system architecture of LRIT with special emphasis on the contents of DDP.

b) Explain the precautions and use of AIS for collision avoidance purposes.

Q.9 a) Draw a comparison between VDR and SVDR with respect to their carriage requirements and data recording.

b) Describe the sequencing of alarms in BNWAS. What deviations are allowed in these sequencing?

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3. Draw suitable sketches / diagram wherever considered necessary.

Q.1 Own vessel course 050° (T) & speed 12 knots. Following observations are made on the radar screen:

Time	Target "A"	Target "B"
0800	050° (T) x 9M	080° (T) x 6M
0806	050° (T) x 7M	087° (T) x 5M
0812	050° (T) x 5M	097° (T) x 4.1M

- i. Report both the targets at 0812.
- ii. At 0812, Target "A" and the own vessel decide to alter course to their respective stbd. If Target "A" alters course by 10° (stbd). Calculate the alteration required by the own vessel in order to comply with the master's standing order of two-mile CPA with all passing traffic (all actions effective immediately).
- iii. What will be the CPA and TCPA of Target "B" after alteration is made by own vessel?

Q.2 a) Explain the operating principle and care of gyro compasses of any make fitted on board any one of the vessels you have sailed.

b) A gyrocompass damped in tilt has a damping error of 1.2° in latitude 46°18'N. What will be its damping error in 42°S latitude?

Q.3 Describe the deviation of a standard magnetic compass on an upright vessel which varies directly as the cosine of the ship's course by compass using suitable diagrams with respect to the following:

- a) Cause and Sign
- b) Change in deviation due to changes in magnetic latitude of the ship
- c) Means and methods used to correct such a deviation

Q.4 Describe the use of Rate of Turn Indicator (ROTI). Explain, with the aid of a sketch, how you would plan and execute a course alteration of 75° with a turn radius of 2° using Radar, ROTI, Rudder Angle Indicator and Speed Log.

Q.5 a) What are the advantages of Doppler Log over Electro-Magnetic Log?

b) Explain the performance standards of an Echo Sounder.

Q.6 a) Explain the performance standards of S-VDR.

b) Explain the performance standards of BNWAS.

Q.7 a) Explain WGS 84 data and why GPS position cannot be used directly on certain navigational charts.

b) Describe how DGPS improves the operational accuracy of GPS.

Q.8 a) Explain how Doppler Log determines the speed of the vessel?

b) Differentiate between LRIT and AIS.

Q.9 a) State the purpose and functional requirements of VDR.

b) Explain the purpose and functional requirements of BNWAS.

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PM PAPER

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Notes:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
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4. Draw suitable sketches / diagram wherever considered necessary.

Section A

Q1. In thick fog, while on a course of $040^{\circ}(T)$ at 6 knots, a target was observed on the radar screen as follows:

Ships	Bearing	Range
Time	(T)	(M)
1600	060°	7.0
1612	$059\frac{1}{2}^{\circ}$	5.0

Find: a) CPA range and time

b) Course and speed of target

At 1615, own ship's engines were stopped. If a head reach of 0.6M is expected in 15 minutes, predict the new CPA range and time.

Q.2 A vessel sails along the meridian from $44^{\circ}S$ to $75^{\circ}S$ in 86.06 hours using her 'Damped in Tilt' Gyro Compass (eccentricity being $1/36$) & FIVE days later returned back to her original location in 77.97 hours using her 'Damped in Azimuth' Gyro compass.

Find the Gyro course steered on EACH Leg.

Q.3 a) List the preparations and precautions necessary for swinging the ship for compass adjustments.

b) With the help of a neat sketch explain how soft iron spheres increase mean directive force at compass position.

Section B

Q.4 Discuss the significance of the wheel over point (WOP). Explain the procedure to determine the WOP for a mid-size vessel, executing a course alteration of 60° , keeping a radius of 1.5 miles from a visually available island/target.

Q.5 Explain how Janus configuration of Doppler Log achieve accepted level of accuracy of calculated speed of the vessel (without derivation of formulae). What other errors, if any, are minimized by using Janus configuration?

Q.6 State the IMO performance standards for the echo sounder.

Q.7 Discuss the purpose of all the Data, Codes and messages that are transmitted by GPS satellites.

Q.8 a) Discuss the limitations of AIS. What precautions must be borne in mind before using AIS data?

b) With respect to LRIT, discuss the function of the Application Service Provider.

Q.9 a) What are the performance standards of a BNWAS with regard to the Reset Function and Modes of Operation?

b) While differentiating between VDR and S-VDR enumerate the data recorded by both.

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PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. All questions in Section A are compulsory. Attempt any FIVE questions from Section B.
2. All questions carry equal marks i.e. 25 marks each.
3. Draw suitable sketches / diagram wherever considered necessary.

SECTION – A

Q1. Own course $325^{\circ}(\text{T})$ at 6 knots in reduced visibility:

Time	Target G		Target H	
	Bearing	Range	Bearing	Range
0840	329.5°T	11.6M	019°T	14.2M
0850	332°T	10.3M	019°T	12M
0900	335°T	8.9M	019°T	9.8M
0910	339°T	7.6M	019°T	7.6M

If target G is known to be a light-vessel, find

- a) Set and rate of current
- b) Course and speed of target H
- c) CPA range and time of both targets
- d) The course alteration to be made at 0920, so that target H will have a CPA of 2M to port of own ship.
- e) After altering course, when target H bears $270^{\circ}(\text{T})$, find what course should be steered to pass target G to port, with CPA of 1.0M.
- f) When would target G be at its new CPA of 1M?

Q.2 a) A vessel with a gyro compass damped in tilt (damping ratio $1/40$), sails on a course of 200°T with a speed of 15 knots in latitude $30^{\circ}27'\text{N}$. Calculate the course to steer to account for the expected error if the compass is uncorrected.

b) Explain the controlling of a free gyroscope by gravity control.

Q.3 Explain the permanent magnetism of the ship, its effect on the compass and how it is compensated.

SECTION – B

Q.4 What are the advantages and disadvantages of constant rudder angle turn and constant radius turn. Discuss navigational situations where constant radius turn is to be used and show with a neat sketch how wheel over point is to be plotted on the chart. How will you monitor such a turn?

Q.5 a) Explain the errors of echo sounder.

b) Explain what determines the minimum and maximum depth that can be recorded by an echo sounder. Give examples.

Q.6 a) Enumerate the IMO performance standards for speed and distance indicator.

b) Explain the purposes of Transmitting Heading Device (THD)?

Q.7 Discuss the purpose of the GPS Navigation message. Explain Dilution of Precision and the various DOPs.

Q.8 a) Discuss the limitations of AIS. What precautions must be borne in mind before using AIS data?

b) With respect to LRIT, discuss the function of the Application Service Provider.

Q.9 What are the carriage requirements for VDR & S-VDR? What are the procedures/ requirements for annual testing of the VDR equipment?

----- X—X -----

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. All questions in Section A are compulsory. Attempt any FIVE questions from Section B.
2. All questions carry equal marks i.e. 25 marks each.
3. Draw suitable sketches / diagram wherever considered necessary.

SECTION – A**Q1.** Own course $240^{\circ}(T)$ at 15 knots in reduced visibility:

Target C			Target D	
Time	Brg. (T)	Range (M)	Brg. (T)	Range (M)
1000	314°	11.9	$208\frac{1}{2}^{\circ}$	10.0
1012	314°	08.3	211	05.1

For each target, find:

- a) Range and time at CPA
- b) Course and Speed.
- c) Aspect at 1012.

Master of own ship desires to take action at 1016 hrs, by means of a single alteration of course or reduction of speed so that the CPA of either target will be not less than 2.0 M.

- d) Evaluate the possible alternatives.
- e) State which action is most preferable?

Q.2 A ship at anchor, is heading $005^{\circ}(G)$ in $76^{\circ} 33'N$ latitude. What is her true heading in each of the following cases?

- a) The Gyro Compass was 'Damped in Azimuth'.
- b) The Gyro Compass was 'Damped in Tilt'.

Q.3 a) List the preparations and precautions necessary for swinging the ship for compass adjustment.

(15 marks)

b) Explain the occasion when an adjustment is necessary?

(10 marks)

SECTION – B**Q.4** Explain in detail, with sketch, the 'Control Unit' of a PID auto-pilot. State the SOLAS requirements for the use of auto-pilot.**Q.5** a) List the factors that determine the choice of frequency to be used in an echo sounder.

b) Explain how 'Janus' Configuration helps to improve the accuracy of the speed by Doppler log?

Q.6 Enumerate the IMO Performance Standards for the Rate of Turn Indicator (ROTI).**Q.7** a) Explain how the GPS uses the carrier frequency to determine the speed of the vessel?

b) List the various errors of GPS and explain any two of them.

Q.8 a) What is the purpose of LRIT? Who are the authorized users of LRIT data and state the circumstances under which the information may be released to them?

b) State the interval of data transmission (transmission schedule) by AIS.

Q.9 a) Explain how the VDR assists in accident investigation? What are the carriage requirements of VDR / SVDR?

b) Describe the working of BNWAS.

GOVERNMENT OF INDIA

PAPER 2

Date: - 14th-May-2024

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks i.e. 25 marks each.
4. Draw suitable sketches / diagram wherever considered necessary.

Section A

Q1. Own Course $325^{\circ}(T)$ at 6 knots in reduced visibility.

TIME	Target 1 (Brg & Dist)		Target 2 (Brg & Dist)	
	BEARING	RANGE	BEARING	RANGE
0840	$329\frac{1}{2}^{\circ}(T)$	11.6 M	$019^{\circ}(T)$	14.2 M
0850	332°	10.3 M	019°	12.0
0900	335°	08.9	019°	09.8
0910	339°	07.6	019°	07.6

If target G is known to be a Light vessel, find:

- a) Set and Rate of current.
- b) Course and Speed of target H.
- c) CPA range and time of both targets.
- d) The course alteration to be made at 0920, so that target H will have a CPA of 2.0 M to port of own ship.
- e) After altering course, when target H bears $270^{\circ}(T)$, find what course should be steered to pass target G to port, with a CPA of 1.0 M.
- f) When would target G be at its new CPA of 1.0 M?

Q.2 Performance test of a stationery gyro compass gave the following readings:

First extreme swing to one side – 060° at 13h 50m 03s.

Next extreme swing to one side – 350° at 14h 36m 32s.

Next extreme swing to one side – 011° at 15h 15m 22s.

The gyro compass finally settled at a reading of 006° . Calculate the damping factor, percentage damping and the theoretical settling position. State if the test was satisfactory.

Q.3 a) In port of Chennai, your vessel is alongside and the flinders bar of your ships magnetic compass is removed. Values of Deviation remain unchanged. Vessel is shifted to another berth and the flinders bar is replaced in the casing. Value of deviation is observed to be different. Analyse and discuss the reasons for the change in value of Deviation. (15 marks)

b) Sketch the sets of Nine Soft Iron rods. (10 marks)

Section B

Q.4 Show with a neat sketch how you will execute a controlled radial turn? Discuss navigational situations where control radial steering is to be used. What are the factors need to be considered when planning a controlled radial turn? How will you monitor a controlled radial turn?

Q.5 a) What are the various types of transducers used in Echo-Sounders? Discuss the advantages and disadvantages of each.

b) Describe the various alarms and settings in Echo-Sounders.

Q.6 a) Describe with neat sketch PID controls of Auto Pilot.

b) List the IMO performance standards for Echo sounders.

Q.7 a) Describe the main sources of errors of GNSS and their expected approximate values, in the position obtained from GNSS.

b) List the IMO performance standards for Echo sounders.

Q.8 What are the carriage requirements for AIS? Differentiate between Type A and Type B AIS. What are the mandatory testing requirements of AIS?

Q.9 Write short notes as:

i) S-VDR

ii) VDR

iii) BNWAS

-----X—X-----

GOVERNMENT OF INDIA

PAPER 2

Date: - 1st-Feb-2024

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks i.e. 25 marks each.
4. Draw suitable sketches / diagram wherever considered necessary.

Section A

Q1. Following targets were observed while own vessel was on a course of $45^{\circ}(T)$ doing 15 kts.

Sr. No.	Time	Target 1 (Brg & Dist)	Target 2 (Brg & Dist)
1	0800	$045^{\circ} \times 12'$	$090^{\circ} \times 10'$
2	0806	$045^{\circ} \times 12'$	$090^{\circ} \times 10'$
3	0812	$045^{\circ} \times 8'$	$090^{\circ} \times 7'$

- a) Report the targets at 0812 hrs
- b) At 0812 own vessel alters course to maintain CPA of 2 miles from both targets. What is the new course assuming action taken is effective instantly and is taken at 0812.

Q.2 a) A ship with gyro compass uncorrected for Damping & Steaming errors steers $205^{\circ}(T \& G)$ from position A in lat $58^{\circ}S$ to B in lat $62^{\circ}S$. Determine the speed of the ship & course to steer from position B to A with gyro compass uncorrected. (Pc: Pd = 40:1)

b) Explain Damping error in a Gyro Compass & derive its formula.

Q.3 Explain the Earth's Magnetism & the ship's magnetism. How does Earth's Magnetism & Ship's magnetism affect ship's magnetic compass? Use suitable sketches / diagrams.

Section B

Q.4 a) Own vessel course is $015^{\circ}(T) \times 12$ kts. After 6 miles on the present course, vessel has to alter course to $08^{\circ}(T)$. Show by neat sketch how will you execute this as a constant radius. With radius of turn 2.5 miles.

Q.5 a) What is 'Ranging' in an echo sounder? With a neat sketch, explain the 'Phasing' arrangement in an echo sounder.

b) List the errors of a Doppler log. Explain any two of them.

Q.6 List the performance standards of: a) Rate of turn indicator b) Speed of distance indicator

Q.7 a) What errors reduce the accuracy of the GPS fixes. How are these errors accounted for the compensated.

b) What is differential GPS?

Q.8 With respect to LRIT system explain the following: i) Purpose of LRIT system ii) LRIT system architecture & operation iii) Data Transmitted iv) Authorized receivers of LRIT data.

Q.9 a) Explain the operational sequence of indicators & alarms in a Bridge Navigational Watch alarm system.

b) What are the advantages of Voyage Data Recorders?

GOVERNMENT OF INDIA

PAPER 1

Date: - 1st-Feb-2024

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks i.e. 25 marks each.
4. Draw suitable sketches / diagram wherever considered necessary.

Section A

Q1. Own vessel is sailing on a course of $160^{\circ}(T)$ by gyro compass, making speed through water of 12.0 Knots by E.M. log, on a coastal passage in thick fog. The following observations were made in the 12NM range on the radar. Long range scanning showed no other targets in the 24NM range.

Time	Targets: X	Y	Z
1830	$090.0^{\circ}(T) \times 11.1\text{NM}$	$176.0^{\circ}(T) \times 10.4\text{NM}$	$131.0^{\circ}(T) \times 10.5\text{NM}$
1836	$090.0^{\circ}(T) \times 09.5\text{NM}$	$178.5^{\circ}(T) \times 08.9\text{NM}$	$132.5^{\circ}(T) \times 08.8\text{NM}$
1842	$090.0^{\circ}(T) \times 07.9\text{NM}$	$182.0^{\circ}(T) \times 07.6\text{NM}$	$134.5^{\circ}(T) \times 07.3\text{NM}$

- a) Make a report of your observation at 1842
- b) At 1845, target “Y” is identified as a light house. What additional information is now available to you?
- c) Master’s orders are CPA to be not less than 2.0 NM. What action can you take at 1848, if your action will take 4 minutes to be executed (Performance Delay)?
- d) Justify that the action you have taken is in compliance with International Regulations for Preventing Collisions at Sea.

Q.2 a) On voyage from Lat 58 N to Lat 62 N, the course steered was observed to be course made good.

- i) Determine the speed of the ship
 - ii) Determine the course to steer by the same compass on the return passage if the ratio of Damping and Control precession is 1:40.
- b) Describe settling error of Gyro Compass.

Q.3 a) Explain the deviations appearing on Easterly and Westerly headings during the voyage and how they are corrected.

- b) How coefficient D is calculated and corrected.

Section B

Q.4 From your present position, while steering 015 by Gyro at 16.7 kts the Alteration point is 7 n.m. away and the next course to steer is 087. Show by a neat plot the execution of a radial turn if the Rate of turn is to be 12 *per minute.

Q.5 a) Explain how the Doppler shift can be used to measure the speed of the ship?

b) Explain how Janus configuration mitigates error of a Doppler log.

Q.6 W.r.t. GPS describe:

i) Orbital parameters of satellites

ii) How a receiver selects the satellites and determines its own position

iii) Contents of a Navigation message.

Q.7 a) Compare and Contrast AIS with LRIT.

b) Performance standards of BNWAS.

Q.8 a) Information obtained solely from AIS should not be relied for safe navigation of ship. Discuss.

b) Enumerate the data of Ship's VDR has to record.

Q.9 Explain the functions of the following controls of an Auto Pilot:

i) Yaw control

ii) Rudder Control

iii) Counter Rudder

----- X—X -----

GOVERNMENT OF INDIA

PM PAPER

Date: - 6th-Nov-2023

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks i.e. 25 marks each.
4. Draw suitable sketches / diagram wherever considered necessary.

Section A

Q1. Own Course $070^{\circ}(T)$ at 12 knots in restricted visibility.

Target E			Target F	
Time	BEARING	RANGE	BEARING	RANGE
1630	$063^{\circ}(T)$	12.0 M	$128\frac{1}{2}^{\circ}(T)$	11.4 M
1636	063°	10.2	$132\frac{1}{2}^{\circ}$	09.9
1642	063°	08.4	137°	08.5

Analyse the plot and state what alteration of course is to be made at 1648 to ensure that the CPA range of E is 2M. Having taken this action, what would be the bearing and range of F (from own ship) when E is at its CPA?

Q.2 a) A vessel fitted with a gyro damped in tilt steams a straight Rhumb line course from position "P" ($46^{\circ} 30'N$ $170^{\circ} 10'E$) and arrive at position "Q" ($50^{\circ} 10' N$, $179^{\circ} 45'W$) after steaming for 12 hours. State: What is the required Gyro course to be steered by the vessel from P to reach Q?

b) Define: i. Gyroscopic inertia ii. Settling Error

Q.3 Explain the sequence and reason of placing the various correctors. Also explain the "Tentative method" used for compass adjustment.

Section B

Q.4 a) What are the SOLAS requirements in respect of autopilot?

b) State various settings of autopilot for the optimal performance in different weather conditions. What are the various alarm settings?

Q.5 a) What are the various types of transducers used in Echo-sounders? Discuss the advantages and disadvantages of each.

b) Describe the various alarms and setting in Echo sounders?

Q.6 a) Enumerate the IMO performance standards required for speed and distance indicator.

b) Briefly describe the outline of GLONASS and GALILEO.

Q.7 a) Explain the various errors that might affect the accuracy of a GPS fix and state the maximum error in position due to these.

b) Describe how DGPS enhances the accuracy of GPS positions.

Q.8 a) What is AIS? Explain the various parts of AIS message and transmission schedule?

b) Write a short note on LRIT? State the authorized receivers of LRIT data?

Q.9 a) Explain the modules of Voyage Data Recorder (VDR) and the procedure for saving and retrieval of data in case of any incident.

b) Enumerate the carriage requirements and function of BNWAS.

----- X—X -----

GOVERNMENT OF INDIA

AM PAPER

Date: - 6th-Nov-2023

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks i.e. 25 marks each.
4. Draw suitable sketches / diagram wherever considered necessary.

Section A

Q1. Own ship, capable of doing 14 knots, is on a Course of 202° (T) at 6 knots in reduced visibility and observes the following on her radar screen:

Target A			Target B	
Time	BEARING	RANGE	BEARING	RANGE
0700	$029\frac{1}{2}^{\circ}$ (T)	5.0 M		
0706			315° (T)	11.0 M
0712	027° (T)	4.4 M		
0718			315° (T)	9.3 M
0724	024° (T)	3.8 M		
0730			315° (T)	7.7 M

Analyse the situation at 0730 Hrs and state with reasons, what would be the most suitable action to take.

Q.2 a) Explain with suitable sketches any one arrangement for making a free gyroscope to a North seeking gyro. (15 Marks)

b) A ship with gyro compass uncorrected for Damping & Steaming errors 210° (T & G) from a position A in Lat 58° S to B in Lat 65° S. Determine the speed of the ship & course to steer from position B to A with Gyro Compass uncorrected. (Pc: Pd = 40:1) (10 Marks)

Q.3 i) What is the effect of continuous athwartship horizontal soft iron beams on the standard magnetic compass? Explain in detail using appropriate diagram.

ii) Explain the type of corrector and the procedure used to compensate for deviation of the compass due to above cause stating the benefits of the corrector.

Section B

Q.4 a) Show with a neat sketch how you will execute a controlled radial turn?

b) Discuss navigational situation where control radial steering is to be used. What are the factors need to be considered when planning a controlled radial turn?

c) How will you monitor a controlled radial turn?

Q.5 a) Describe the principle and working of Echo Sounder with the help of a neat diagrams.

b) List and explain various errors associated with this equipment.

Q.6 Enumerate the performance and working of Echo Sounder with the help of a neat diagrams.

a) GPS

b) BNWAS

Q.7 a) With the help of diagram, explain how a fix is obtained by GPS onboard.

b) Explain the principle and contribution of DGPS for accurate position fixing.

Q.8 a) Describe the purpose and working principle of AIS and LRIT

b) State the information displaced on AIS screen and data transmitted by LRIT.

Q.9 Write short notes on:

a) S-VDR

b) VDR

c) BNWAS

----- X—X -----

GOVERNMENT OF INDIA

Date: - 1st-Aug-2023

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks i.e. 25 marks each.
4. Draw suitable sketches / diagram wherever considered necessary.

Section A

Q1. a) Explain the Course-Speed-Latitude error of a Gyro Compass and describe various methods used to correct the error.

b) The axis of a gyro-compass damped-in-tilt, uncorrected for speed-course error and damping error, points due north in latitude 61°N , when making good a course of 345° and a speed of 20 Kts. On reaching latitude of 70°N , course is required to be altered to $205^{\circ}(\text{T})$ and speed is to be reduced to 15 Kts. Calculate the total error of the gyro compass and the gyro-course to steer in new latitude. (Assume that the gyro-compass does not have any other errors).

Q.2 Describe the deviation of standard magnetic compass which is caused by continuous athwartships horizontal soft iron in the vessel using suitable diagrams with respect to following:

- i) Change in deviation due to change in course of the vessel, and
- ii) Means and method used to correct such a deviation.

Q.3 Own course $240^{\circ}(\text{T})$ at 15 knots in reduced visibility:

Target C			Target D	
Time	Brg. (T)	Range (M)	Brg. (T)	Range (M)
1000	314°	11.9	$208\frac{1}{2}^{\circ}$	10.0
1004	314°	10.7	209°	08.4
1008	314°	09.5	210°	06.8
1012	314°	08.3	211°	05.1

For each target, find:

- a) Range and time of CPA
- b) Course & Speed
- c) Aspect at 1012, Master of own ship desires to take action at 1016, by means the CPA of either target will be not less than 2.0 M.
- d) Evaluate the possible alternatives
- e) State which action is most preferable?

Section B

Q.4 a) With the aid of simple sketches describe Proportional, Integral and Derivative control in an Auto-Pilot.

(15 Marks)

b) You have to alter course from 080° to 155° . With a neat sketch show how you would execute a Constant Radius Turn of 2 nm.

(10 Marks)

Q.5 a) With the aid of a simple block diagram, describe the working of an Echo-Sounder.

(10 Marks)

b) Describe the principle and working of a Doppler Speed Log?

(10 Marks)

Q.6 What are the IMO Performance Standards for AIS? How does it help in keeping lookout at sea?

Q.7 a) How does a GPS receiver determine the vessel's position? (15 Marks)

b) In ECDIS, what is the difference between ENC and SENC? (5 Marks)

c) What are the options for updating an ECDIS? (5 Marks)

Q.8 a) With the aid of a block diagram describe how an LRIT message is transmitted? (10 Marks)

b) What is the purpose and what are the benefits of AIS? (15 Marks)

Q.9 a) What is the purpose of BNWAS? How does the system monitor and alert personnel of Watchkeeper disability? (15 Marks)

b) Describe the construction and operational requirement for the protective storage unit in a VDR. (10 Marks)

----- X—X -----

GOVERNMENT OF INDIA

Date: - 9th -May-2023

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks i.e. 25 marks each.

Section A

Q1. Following targets were observed while own vessel was on a course of $045^{\circ}(T)$ doing 15 kts.

Sr. No.	Time	Target 1 (Brg. & Dist.)	Target 2 (Brg. & Dist.)
1	0800	$045^{\circ} \times 12'$	$090^{\circ} \times 10'$
2	0806	$045^{\circ} \times 10'$	$090^{\circ} \times 8.5'$
3	0812	$045^{\circ} \times 8'$	$090^{\circ} \times 7'$

- a) Report the targets at 0812 hrs.
- b) At 0812 own vessel alters course to maintain a minimum CPA of 2 miles from both targets. What is the new course assuming any action taken is effective instantly and is taken at 0812.

Q.2 a) Explain with suitable sketches how a free gyroscope is converted into a north seeking device.

b) For a gyro damped in tilt find the total gyro error while steering $060^{\circ}(G)$ in latitude $40^{\circ} S$ at a speed of 15 knots. Given that $P_d: P_c = 1/40$.

Q.3 On board a vessel flinders bar was observed to be placed at an angle of 15° towards port side from fore and aft line, soft iron spheres were placed athwartship. Explain with suitable sketches the reason (s) for such an arrangement.

Section B

Q.4 What are the advantages and disadvantages of constant rudder angle turn and constant radius turn. Discuss navigational situations where constant radius turn to be used and show with a neat sketch how wheel over point is to be plotted on the chart. How will you monitor such a turn.

Q.5 Write the principle of Echo-sounder with a block diagram. Describe the errors are associated with an Echo sounder.

Q.6 What are the legal status and limitations of ECDIS? Write the advantages of ECDIS over paper chart.

Q.7 Write in brief all the errors may be experienced with GPS, Compare GPS with GLONAS.

Q.8 a) Explain how the AIS work?

b) Explain the functions of LRIT?

Q.9 a) Detail the SOLAS regulation requirements for VDR.

b) Detail the SOLAS requirements for BNWAS.

-----X—X-----

GOVERNMENT OF INDIA

Date: - 1st -Feb-2023

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. Question no. 1, 2 and 3 are compulsory. Attempt any five questions out of six.
2. Attempt any FIVE questions from Section B.
3. Draw suitable sketches / diagram wherever considered necessary.

Q1. Your vessel steering $180^{\circ}(T)$ at 12 kts in restricted visibility observes following targets.

TIME	TARGET X	TARGET Y	TARGET Z
	Degs (T)	Degs (T) NM	Degs (T) NM
1006	200 x 10.5	250 x 9.0	355 x 3.0
1009	200 x 9.0	250 x 8.3	355 x 3.0
1012	200 x 7.7	251 x 7.5	355 x 3.0

- a) Make a full report at 1012 hrs.
- b) Master of own ship decides to pass all targets with a min CPA of 1.5 M taking action at 1015 hrs and the vessel is known to take 6 min to settle on new courses (performance delay). Explain what single action should the Master take as per ROR.

Q.2 a) Explain what is Steaming Error, why it is caused & how it affects the settling position of a gyro compass? (10 marks)

b) In latitude $32^{\circ}N$, the Damping Error is $1.2^{\circ}E$. Calculate the total error of the same gyro compass when making good a course of $315^{\circ}(T)$ at a speed of 18 knots in latitude $48^{\circ}S$. (15 marks)

Q.3 Onboard your vessel you notice that the deviation curve of magnetic compass has an easterly bias i.e. deviation values more easterly than westerly as vessel is swung around in 360° . Analyse and discuss in detail the cause(s) of such a deviation curve.

Q.4 a) Show how you will plan a Constant radial turn of 70° . Indicate turn line and wheel over line. Derive all formulas used.

b) Explain the various setting of auto pilot for optimal performance.

Q.5 a) On what principle the Electro-magnetic Log works?

b) Describe the “Janus” configuration of Doppler speed log and its working principle?

Q.6 a) Enumerate the IMO Performance Standards for Echo Sounder?

b) List the performance standard of GPS receiver equipment?

Q.7 a) Describe the main sources of errors of GNSS and their expected approximate values in the position obtained from GNSS.

b) Describe dilution of GDOP & HDOP used in GNSS.

Q.8 What are the carriage requirements for AIS? Differentiate between Types – A and Types – B AIS. What are the mandatory testing requirements of AIS?

Q.9 a) Explain the modules of Voyage Data Recorder (VDR) and the procedure for saving and retrieval of data in case of any incident?

b) Enumerate the carriage requirements and functions of BNWAS?

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. All question in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks i.e. 25 marks each.

SECTION – A**Q1.** Own course 275°(T) at 18 knots.

Time	Bearing	Range
1500	235° (T)	12.0 M
1506	235° (T)	10.0M
1512	235° (T)	08.0 M

Find:

- a) CPA range and time
- b) Course and speed of target
- c) Aspect at 1512.

At 1514, the target is identified as a vessel not under command. Captain of own ship decides to alter course at 1515 so as to ensure a CPA range of 2 M.

- d) Find the course alternation required to let the target pass ahead of own ship and hence
- e) The new CPA time.
- f) Find the course alternation required to make the target pass astern of own ship and hence
- g) The new CPA time
- h) State which action (d) or (f) to in accordance with ROR?

Q.2 On board your vessel, you have noticed that soft iron spheres are attached to the binnacle in relative slewed direction that is 280° - 100°.

- a) Analyze and discuss in detail the reason(s) for such an arrangement.
- b) What would have been the ship's heading on which maximum deviation would have occurred prior to "The Flinder's bar correction" made by compass adjuster?

Q.3 Ship sails at 1400 hrs from position 430N, 0580 30'W to pick up pilot at 1900 hrs in position 440N, 0600W. The current has been setting 180°(T) at 1.5 Kt, throughout. The ship is fitted with sperry gyro, which is uncorrected for damping and N-S speed error. If the damping ratio is 1/40, calculate the gyro course and the ship's speed, which need to maintained, to reach pilot station in time.

SECTION – B

Q.4 With the help of simple diagrams, explain the Proportional, Derivative and Integral Controls of the Auto-Pilot systems.

Q.5 a) Explain, where necessary with the help of neat diagram:

- i) Ranging
- ii) Phasing of an echo sounder
- b) What is, with respect to the echo sounder?
- i) Cross noise
- ii) Aeration
- iii) Pythagoras error

Q.6 a) Enumerate the IMO Performance Standards for Rate of Turn Indicator (ROTI).

b) Explain the functioning of each module of the Voyage Data Recorder. (VDR)

Q.7 a) Describe how a GNSS receiver on the ship selects the satellites and determines the ship's position, course and speed made good?

b) What are the factors affecting accuracy of GNSS.

Q.8 a) What is AIS? Explain the various parts of AIB message and transmission schedule?

b) Write a short note on LRIT? State the authorized receivers of LRIT data?

Q.9 a) What is the purpose of VDR? What data are recorded on it?

b) Write a short note on BNWAS?

GOVERNMENT OF INDIA

Date: - 12th-Oct-2022

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. Question no. 1, 2 and 3 are compulsory. Attempt any five questions out of six.
2. All questions carry equal marks i.e. 25 marks each.
3. Draw suitable sketches / diagram wherever considered necessary.

Q1. Following targets were observed while own vessel was on a course of $000^{\circ}(T)$ doing 15 kts.

S. No.	Time	Target 1 (Brg. & Dist.)	Target 2 (Brg. & Dist.)
1	0800	$180^{\circ} \times 8'$	$000^{\circ} \times 10'$
2	0806	$180^{\circ} \times 7.5'$	$000^{\circ} \times 8.5'$
3	0812	$180^{\circ} \times 7'$	$000^{\circ} \times 6'$

- a) Report the targets at 0812 hrs
- b) To maintain a minimum CPA of 2 miles, if any action is to be taken by own v/l. Any action taken is effective instantly and is taken at 0812.

Q.2 Onboard your vessel, you have noticed that “The Flinder’s bar” is attached to the binnacle in a relative – slewed direction 015° instead of usual direction of ship’s head.

- a) Analyse and discuss in detail the reason(s) for such an arrangement. (15)
- b) What would have been the ship’s heading on which maximum deviation would have occurred prior to “The Flinder’s bar correction” made by compass adjuster. (10)

Q.3 a) With reference to marine gyro compass, briefly explain the following:

- i) Drifting
 - ii) Tilting
 - iii) Gyroscopic Precession. (5 x 3 = 15)
- b) A gyrocompass damped in tilt has a damping error of $2.8^{\circ}W$ in latitude of $58^{\circ}S$. What will be the Damping error of the same gyro in $30^{\circ}N$ latitude? (10)

Q.4 Explain how will you plan a turn of 60° using rate of turn indicator on a VLCC of 3,00,000 tons DWT.

Q.5 a) What are the various types of transducers used in Echo-sounders? Discuss the advantages and disadvantage of each. (15)

b) Describe the various alarms and settings in Echo-sounders? (10)

Q.6 a) Enumerate the IMO performance standards required for speed and distance indicator. (13)

b) Explain the IMO performance standards for BNWAS. (12)

Q.7 a) Explain the various errors that might affect the accuracy of GPS fix and state the maximum error in position due to these. (15)

b) Describe working principle of DGPS and its limitations. (10)

Q.8 a) Explain the working of AIS and its transmission schedule? (15)

b) Explain the various parts of AIS messages? (10)

Q.9 a) Briefly explain the purpose and functioning of VDR? (15)

b) List all the data’s recorded in a VDR and SVDR? (10)

GOVERNMENT OF INDIA

Date: - 6th-Sept-2022

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. All questions in section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks i.e. 25 marks each.

Q1. Own Course is 112° (T) at 9 knots in reduced visibility.

Time	TARGET X		TARGET Y	
	Brg.	Range	Brg.	Range
1500	126° (T)	10.3 M	149° (T)	8.1 M
1510	126° (T)	9.2 M	150.5° (T)	6.7 M
1520	125° (T)	8.1 M	153.5° (T)	5.3 M

For each target, find:-

- a) CPA range, Time and Bearing
- b) Course and Speed
- c) Aspect at 1520. It is required to take action at 1530 by means of a single action – alteration of course or reduction of speed – so that the CPA of either target will be atleast 2.0 M.
- d) Evaluate all the possible alternatives and
- e) State which of the action is preferable under the circumstances.

Q.2 At 00h 00m 00s GMT in latitude, 45.0° S and longitude 000.0° , spin axis of a free gyroscope is pointing 120° (T). At what time it will point 270° (T) on the same day?

Q.3 With help of suitable sketches, show clearly how ship's magnetic co-efficient "D" is created. How the error is corrected?

Q.4 Explain with a neat block diagram the working of an auto pilot.

Q.5 Explain the principle and working of an Echo sounder. What factors determine its minimum & maximum range? What are the errors associated with this equipment.

Q.6 The performance standards of the Voyage Data Recorder equipment have been revised with effect from 01st July 2014. List these performance standards highlighting the changes which have been brought.

Q.7 Explain the Ground, Space & user segments and also the working and operation of the Global Positioning System.

Q.8 a) Briefly explains system architecture of LRIT with special emphasis on the contents of DDP.
b) Explain the precautions and use of AIS for collision avoidance purposes.

Q.9 What is the function of VDR? Draw a block diagram showing all the inputs to VDR. What all information are likely to be available from the VDR record?

GOVERNMENT OF INDIA

Date: - 5th-July-2022

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. Question no. 1, 2 and 3 are compulsory. Attempt any five questions out of six.
2. All questions carry equal marks i.e. 25 marks each.
3. Draw suitable sketches / diagram wherever considered necessary.

Q1. Following targets were observed on radar in restricted visibility. Own vessel was on a course of $000^{\circ}(T)$ doing 15 kts.

S. No.	Time	Target 1 (Brg. & Dist.)	Target 2 (Brg. & Dist.)
1	0800	$090^{\circ} \times 11.0'$	$270^{\circ} \times 10.0'$
2	0812	$090^{\circ} \times 7.5'$	$270^{\circ} \times 8.0'$

- a) Report the targets at 0812 hrs.
- b) Own vessel decides to take single action at 0812 so as to have a min. CPA of 2 miles from both targets. State the alternatives available and explain which one is most suited in this situation.

Q.2 a) Explain the basic properties of a free gyroscope. (10 Marks)

b) In latitude $30^{\circ} N$, while steering 045° at certain speed, transit bearing of a pair of light houses was observed as 135° (T & G). What shall be the gyro transit bearing of another pair of lighthouse true bearing 60° , in latitude $30^{\circ} S$ while steering a course of 315° and same speed. Given that damping ratio = $1/40$. (15 Marks)

Q.3 On board a vessel with constant $2^{\circ}E$ deviation on all headings, following permanent corrector magnets were observed as placed in compass binnacle.

- i) Corrector magnet in F & A direction with Blue fwd and Red aft.
- ii) Corrector magnet in athwartship direction with Red on Starboard and Blue on port. Explain with suitable sketches.

- a) What could be the reason for placement of correctors in above manner? (20 Marks)
- b) What could be the reason for constant deviation on all headings? (05 Marks)

Q.4 Explain with the aid of a sketch how you would plan and execute a turn using Radar, Rate of turn indicator, Rudder angle indicator and speed log.

- Q.5 a)** Describe the principle and working of echo sounder with the help of a neat diagram? (15)
- b) List and explain various errors associated with this equipment? (10)

- Q.6 a)** Enumerate the IMO performance standards of GNSS? (13)
- b) State the IMO Performance standards of VDR? (12)

Q.7 Write short notes on GPS.

- i) Working principle (8)
- ii) Various segments (8)
- iii) Method adapted to measure the time of propagation of signal from satellite to receiver. (9)

- Q.8 a)** Describe the purpose and working principle of AIS? (15)
- b) State the information displayed on AIS Screen and data transmitted by LRIT? (10)

- Q.9 a)** Differentiate between VDR & SVDR? (15)
- b) Explain the working requirements of BNWAS. (10)

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. All questions in section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks i.e. 25 marks each.

Section - A

Q1. Own course $070^{\circ}(T)$ at 12 knots in reduced visibility.

Target E			TARGET F	
Time	Bearing	Range	Bearing	Range
1630	$063^{\circ}(T)$	12.0 M	$128 \frac{1}{2}^{\circ}(T)$	11.4 M
1642	063°	08.4	137°	08.5

Analyze the plot and state what alteration of course is to be made at 1648 to ensure that the CPA range of E is 2 M. Having taken this action, what would be the bearing and range of F (from own ship) when E is at its CPA?

Q.2 A ship is making good $270^{\circ}(T)$ while her gyro compass shows $265^{\circ}(G)$, in $54^{\circ} 41'N$ latitude. She is required to make good $170^{\circ}(T)$ at 19 knots. What gyro course would you set on her auto pilot? [There is NO CURRENT & this gyro compass has NO OTHER ERRORS].

- Q.3** a) If a ship has a – PB and +PC, in which quadrant was she heading when built?
 b) If DF on N > DF on S, what coef is present and what is its sign?
 c) If DF on E > DF on W, what coef and its sign is indicated?

Section - B

- Q.4** a) List IMO performance standard for ROTI.
 b) Describe the procedure to execute a constant radius turn with / without current?

- Q.5** a) What are the various types of transducers used Echo sounders? Discuss the advantages and disadvantages of each.
 b) Describe the various alarms and settings in Echo-sounders?

- Q.6** a) Enumerate the IMO performance standards required for speed and distance indicator.
 b) Explain the purpose of Transmitting Heading Device (THD)?

- Q.7** a) Explain the various errors that might affect the accuracy of GPS fix and state the maximum error in position due to this.
 b) Describe how DGPS enhances the accuracy of GPS position?

- Q.8** a) Explain the various setting of auto pilot for optimal performance.
 b) State the entries to be made on course recorder for a voyage.

- Q.9** a) Enumerate the performance standard for BNWAS.
 b) Differentiate between AIS and LRIT.

GOVERNMENT OF INDIA

Date: - 3rd-March-2022

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. Question no. 1, 2 and 3 are compulsory. Attempt any five questions out of six.
2. All questions carry equal marks i.e. 25 marks each.
3. Draw suitable sketches / diagram wherever considered necessary.

Q1. Own ship course 135T speed 8 kts in restricted visibility observes the flwg targets:

TIME	TARGET A	TARGET B	TARGET C
	Degs (T) NM	Degs (T) NM	Degs (T) NM
0600	130 X 7.6	140 X 8.0	248 X 3.3
0607.5	130 X 5.8	141 X 7.8	260 X 3.3
0615	130 X 4.0	142 X 7.6	273 X 3.4

- a) Make a full report at 0615
- b) What single action as per ROR must the Master make at 0618 (effective immediately) in order to pass all targets with a minimum CPA of 1.5nm.

Q.2 a) A vessel fitted with a gyro damped in tilt steams a straight Rhumb line course from position 'P' ($46^{\circ} 30'N$ $179^{\circ} 10'E$) and arrives at position 'Q' ($50^{\circ} 10'N$, $179^{\circ} 45'W$) after steaming for 12 Hours. State: What is the required Gyro course to be steered by the vessel from P to reach Q? (15 Marks)

- b) Define (i) Gyroscopic inertia (10 Marks)
- ii) Settling Error

Q.3 a) What do you understand by Gaussian Error & Retentive Error? Explain with diagram. (10 Marks)

- b) At Antofagasta, Chile. Ship was lying on a heading of 270° . Maximum deviation was found $3^{\circ}E$. If the permanent magnetism was corrected using Fwd & Aft Corrector magnets, state the possible reasons for getting this deviation & how the deviation can be corrected. (15 Marks)

Q.4 a) Compare the merits & demerits of Constant Rudder Angle Turn and Constant Radius Turn. (10 Marks)

- b) With a neat diagram, explain the execution of a controlled radius turn to starboard by an angle of 50° of radius 2 miles. (15 Marks)

Q.5 a) Briefly explain the effect of density, temperature and pressure on velocity of sound and the accuracy of depth indication by Echo Sounder. (13 Marks)

- b) Explain why Janus Configuration is required? (12 Marks)

Q.6 List the Performance Standards of BNWAS?

Q.7 a) Briefly explains by C/A code & P code? (15 Marks)

- b) Explain how a DGPS station provides more accurate fix than obtained by a normal GPS fix? (10 Marks)

Q.8 a) Briefly explains the working of LRIT? (13 Marks)

- b) Compare AIS & LRIT over various operation related issues? (12 Marks)

Q.9 a) Explain the different modules of VDR and how it can be used for incident investigation? (13 Marks)

- b) State the different stages of alarms as mentioned in the performance standard of BNWAS. (12 Marks)

GOVERNMENT OF INDIA

Date: - 11th-January-2022

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. Question no. 1, 2 and 3 are compulsory. Attempt any five questions out of six.
2. All questions carry equal marks i.e. 25 marks each.
3. Draw suitable sketches / diagram wherever considered necessary.

Q1. In restricted visibility, own vessel on a course of 000° (T) x 10 kts observes following targets on her radar screen.

Sr.No.	Time	Target 1 (Brg. & Dist.)	Target 2 (Brg. & Dist.)
1	1000	315° x 8'	000° x 11'
2	1006	315° x 7'	000° x 9.5'
3	1012	315° x 6'	000° x 8'

- a) Report the targets at 1012 hrs
- b) Analyze the above plot and basis that identify in order to maintain a min. CPA of 2 miles, which vessel is required to take action and what is that action. Any action taken will be effective from 1016.

Q.2 a) Explain the Course-Speed Latitude error of a Gyro Compass.

- b) The axis of a gyro-compass damped in tilt, uncorrected for speed-course error and damping error, points due north in latitude 61° N, when making good a course of 345° and a speed of 20 Kts. On reaching latitude of 70° N, course is required to be altered to 205° (T) and speed is to be reduced to 15 Kts. Calculate the total error of the gyro compass and the gyro-course to steer in new latitude. (Assume that the gyro compass does not have any other errors).

Q.3 Describe the deviation of standard magnetic compass which is caused by continuous athwartships horizontal soft iron in the vessel suitable diagrams with respect to following:

- i) Change in deviation due to change in course of the vessel
- ii) Means and method used to correct such a deviation.

Q.4 a) With the aid of simple sketches describe Proportional, Integral and Derivative control in an Auto-Pilot. (15 Marks)

- b) You are to alter course from 080° to 155° . With a neat sketch show how you would execute a Constant Radius Turn of 2 nm. (10 Marks)

Q.5 a) With the aid of a simple block diagram, describe the working of an Echo Sounder. (15 Marks)

- b) Describe the principle and working of a Doppler Speed Log? (10 Marks)

Q.6 What are the IMO performance standards for AIS? How does it help in keeping lookout at sea? (25 Marks)

Q.7 a) How does a GPS receiver determine the vessels position? (15 Marks)

- b) What is GDOP & User Clock Bias? (10 Marks)

GOVERNMENT OF INDIA

Date: - 2nd-November-2021

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. Question no. 1, 2 and 3 are compulsory. Attempt any five questions out of six.
2. All questions carry equal marks i.e. 25 marks each.
3. Draw suitable sketches / diagram wherever considered necessary.

Q1. Your vessel is navigating in a T.S.S. in restricted visibility, steering a courses of 150(T) speed 14 kts. The following radar observations were made:

Time	Target A	Target B
0100	195 (T) x 6.0 nm	341 (T) x 3.0 nm
0106	195 (T) x 5.0 nm	342.5 (T) x 2.75 nm
0112	195 (T) x 4.0 nm	344 (T) x 2.5 nm

- a) Report the situation at 0112
- b) What action comprising of a single alteration of course or speed would you take at 0115 with a performance delay of 06 minutes, so as to have a CPA of at least 1.5nm with either targets.
- c) At what time & distance will Target A pass you beam as a result of your actions taken in (b) above.

Q.2 Enumerate about steaming error, why is it caused, how it effects the settling position on a gyrocompass. In latitude 38°N, the damping error is 1.5°E. Calculate the total error of the same gyro compass when making good course 315°(T) at a speed of 20 kts in latitude 50°S.

Q.3 Explain the functions of the following correctors of magnetic compass

- a) Vertical magnet
- b) Horizontal magnet
- c) Finders bar

Q.4 a) Explain the functions of ROTI?

b) Describe the working principle of automatic pilot system.

Q.5 Explain Janus configuration? What is necessity to have such arrangement in Doppler Log?

Q.6 a) Briefly explain the performance standards of Echo Sounder.

b) What are advantages of Doppler log over Electro magnet log?

Q.7 What are the composition & significance of navigation data message transmitted by satellite vehicle?

Q.8 What are the carriage requirements for AIS system as per IMO regulations? What information is received by the AIS?

Q.9 a) Enumerate the data that will be recorded by an approve VDR.

b) Describe the sequencing of alarms in BNWAS. What deviations are allowed in these sequencing?

GOVERNMENT OF INDIA

Date: - 9th-September-2021

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. Question no. 1, 2 and 3 are compulsory. Attempt any five questions out of six.
2. All questions carry equal marks i.e. 25 marks each.
3. Draw suitable sketches / diagram wherever considered necessary.

Q1. Own Course 240° (T) at 15 knots in reduced visibility. Observes as follows:

Time	Target I	Target II
1000	314 (T) x 11.9 M	208.5 (T) x 10 M
1012	314 (T) x 8.3 M	211 (T) x 5.1 M

For each target, find: a) CPA, TCPA, Course & Speed of targets, Aspect at 1012. Own vessel desires to take action at 1016, by means of a single alteration of course or reduction of speed so that the CPA of either target will be not less than 2M. Evaluate the possible alternatives and state which action is most preferable.

Q.2 A free gyroscope in Lat 50° N is initially set with its spin axis horizontal and pointing 30° . Find the interval of time elapsed before the gyro is pointing in the meridian and before the gyro axis is again horizontal.

Q.3 a) Explain why and when co-efficient 'A' & 'E' are applicable to vessel.
b) State the rules governing the position of all correctors.

Q.4 Explain the basic controls of Auto-Pilot. Draw the basic auto helm diagram.

Q.5 a) On what principle the Electro-magnetic Log works?
b) Draw a block diagram of Electro-magnetic Log.

Q.6 State the IMO performance Standards for the Automatic Identification System.

Q.7 How the vessel's position is obtained using GPS?

Q.8 What is the purpose of AIS? What are the advantage and limitations of AIS?

Q.9 What is the purpose of BNWAS? Explain the sequential operation of BNWAS with a block diagram.

----- X—X -----

GOVERNMENT OF INDIA

Date: - 10th-August-2021

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. Question no. 1, 2 and 3 are compulsory. Attempt any five questions out of six.
2. All questions carry equal marks i.e. 25 marks each.
3. Draw suitable sketches / diagram wherever considered necessary.

Q1. Own vessel is steering a course of 070 deg (T) at a speed of 12 knots in reduced visibility observes the following radar bearings and range.

Time	Target A		Target B		Target C	
0000	086°	10.4 M	041°	10.5 M	000°	11.1 M
0006	088.5°	8.9 M	042.5°	8.8 M	000°	9.5 M
0012	092°	7.6 M	044.5°	7.3 M	000°	7.9 M

At 0012 a Racon signal identified target A as a light vessel. Assess the situation at 0012 and find the direction and rate of current. What action would you take at 0018 with a performance delay of 6 minutes to ensure a minimum CPA of 2 M from all targets? Justify your action and calculate the new CPA and TCPA of all targets.

Q.2 A vessel is fitted with 'Damped in Azimuth' gyro compass steers 182°(G) at 27 knots in 55° 37'S latitude and makes good 174°(T). What will this gyro compass read when the ship makes good 344°(T) at 9.5 knots in 73°N lat?

Q.3 How are 1) Gaussin error and 2) Retentive errors caused? List the differences in deviation caused by each. What precautions are necessary when either of them may be present?

Q.4 a) Explain the function of the Proportional and Derivative Control of a PID Auto Pilot.
b) What factors are considered for choosing the radius of turn and how they affect the execution of the turn?

Q.5 a) Explain the effect of rolling, pitching, heaving of vessel on Fore-aft and port-starboard speed indicated by Doppler log (Janus configuration).
b) Explain the factors considered for choosing the transmission frequency of an Echo Sounder.

Q.6 List out the functional requirements of a Speed and Distance Measuring Equipment (SDME) for installation on board a ship.

Q.7 a) Discuss the improvements accomplished by DGPS. What are their limitations?
b) Write short notes on: i) GDOP ii) Selective Availability iii) GLONASS

Q.8 a) Briefly explain the system architecture of LRIT with special emphasis on the contents of DDP.
b) Explain the precautions and use of AIS for collision avoidance purposes.

Q.9 a) Draw a comparison between VDR and SVDR with respect to their carriage requirements and data recording.
b) Describe the sequencing of alarms in BNWAS. What deviations are allowed in these sequencing?

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. Question no. 1, 2 and 3 are compulsory. Attempt any five questions out of six.
2. All questions carry equal marks i.e. 25 marks each.
3. Draw suitable sketches / diagram wherever considered necessary.

Q1. Your vessel steering 180 degs (T) at 12 knots in restricted visibility observes on targets:

Time	Target 'X' Degs (T) NM	Target 'Y' Degs (T) NM	Target 'Z'
1006	200 X 10.5	250 X 9.0	355 X 3.0
1009	200 X 9.0	250 X 8.3	355 X 3.0
1012	200 X 7.7	250 X 7.5	355 X 3.0

- a) Full report for 1012 hrs.
- b) Master of own ships instruction is to pass all targets with a min CPA of 1.5 M taking action at 1015 hrs and the vessel is known to take 6 minutes to settle on new course (performance delay). Explain what single action you would take in compliance with ROR (1974 as mentioned).

Q.2 a) Three consecutive extreme readings of a gyro compass while its area is describing the spiral are:

1000 hrs	320°
1050 hrs	015°
1125 hrs	355°

Determine the following:

- i) Damping Factor
 - ii) Percentage damping
 - iii) Period of compass
 - iv) Settling position of compass
- b) Explain setting error of gyro compass.

Q.3 a) Explain angle of dip.

b) Explain followings for coefficient D: i) Cause of Coefficient.

Q.4 Your ship steering 160° at 18.8 knots from present position the alteration point is 6' away. The test courses is 235°. Master wants the rate of turn not to exceed 10° per minute. Show by neat sketch:

- a) Reference point to execute a constant radial turn.
- b) Radius of turn
- c) The distance to set on VRM to identify helm over point
- d) If the current is known to be setting 000 x 4 knots determine the new reference point.

Q.5 a) How does a E.M. log determine the ships speed. As a OOW which log would you prefer for speed indication, Doppler or E.M. Discuss the reason.

b) Briefly explain various errors associated with echo sounder.

Q.6 a) What are performance standards for Doppler log?

b) Explain the performance standards of BNWAS?

Q.7 a) Compare and contrast GPS and GLONASS.

b) How does a DGPS assist in enhancing the accuracy of a GPS obtain position?

Q.8 a) Compare and contrast AIS and LRIT.

b) Describe the purpose and working of BNWAS.

Q.9 a) Explain the difference between VDR and SVDR.

b) Enumerate the IMO performance standards of echo sounder.

-----X-----X-----

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. All Question in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks i.e. 25 marks each.

SECTION A

Q1. Own vessel course 050° (T) & speed 12 knots. Following observations made on the radar screen.

Time	Target 'A'	Target 'B'
0800	050° (T) x 9M	080° (T) X 6 M
0806	050° (T) x 7M	087° (T) X 5 M
0812	050° (T) x 5M	097° (T) X 4.1 M

- i) Report both the targets at 0812.
- ii) At 0812 target 'A' and own vessel decided to alter course to their respective stbd. If target 'A' alters course by 10° (stbd). Calculate the alteration required by own vessel in order to comply with the masters standing order of two mile CPA with all passing traffic (all actions effective immediately).
- iii) What will be the CPA and TCPA of target 'B' after alteration is made by own vessel?

Q.2 a) Explain the operating principle and care of gyro compass of any make fitted on board any one of the vessels you have sailed.

b) A Gyrocompass damped in tilt has a damping error of 1.2° in latitude $46^{\circ} 18' N$. What will be its damping error in $42^{\circ} S$ latitude.

Q.3 a) Explain the method of placement of permanent correctors in magnetic compass for compensating the effect of P, Q and R.

b) Explain why a deviation curve made in one hemisphere and position cannot be used in the other hemisphere.

SECTION - B

Q.4 Describe the use of Rate of Turn Indicator. Explain with the aid of a sketch how you would plan and execute a course alteration of 75° with a turn radius of 2 'using Radar', ROTI, Rudder Angle Indicator and Speed log.

Q.5 a) What are the advantages of Doppler Log over Electro – Magnetic Log?

b) Explain the performance standards of an Echo Sounder?

Q.6 a) Explain the performance standard of S-VDR.

b) Explain the performance standards of BNWAS.

Q.7 What are the working principle of GNSS? Explain errors and alarms of GPS. Compare GPS, GALILEO and GLONASS.

Q.8 a) Explain how Doppler Log determines the speed of the vessel?

b) Differentiate between LRIT and AIS.

Q.9 a) State the purpose and functional requirements of VDR.

b) Explain the purpose and functional requirements of BNWAS.

GOVERNMENT OF INDIA

Date: - 6th-Nov-2020

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. Question no. 1, 2 and 3 are compulsory. Attempt any five questions out of six.
2. All questions carry equal marks i.e. 25 marks each.
3. Draw suitable sketches / diagram wherever considered necessary.

Q1. Following targets are observed on radar screen by own vessel while steering $050^{\circ}(T)$ x 12 kts observes following targets on her radar screen.

Sr. No.	Time	Target 1 (Brg. & Dist.)	Target 2 (Brg. & Dist.)
1	1000	$075^{\circ} \times 9'$	$085^{\circ} \times 7'$
2	1012	$073^{\circ} \times 6'$	$099^{\circ} \times 5.6'$

If target 2 is observed to be a light vessel

- a) Report the targets at 1012 hrs. Also, find set and drift.
- b) Analyze the above plot and basis that identify the appropriate action to take, in order to maintain a min CPA of 2 miles from all passing traffic. Any action taken will be effective from 1016.

Q.2 The auxiliary corrector of a gyro compass damped in tilt was inadvertently left at 'Zero Speed' & 'Zero Latitude'. The vessel was steering 030° by gyro at 18 knots in $48^{\circ}N$ Latitude and also made a good course of $030^{\circ}(T)$. Find the gyro course steered by the vessel if she is making good a course of $060^{\circ}(T)$ at a speed of 15 knots in $59^{\circ}S$ latitude with the auxiliary correctors still left to 'Zero' speed and latitude setting. (Assume there is no current throughout and also the gyro compass is not having any other errors).

Q.3 Describe the deviation of standard magnetic compass on an upright vessel which varies directly as cosine of ship's course by compass using suitable diagrams with respect to following:

- i) Cause and sign
- ii) Change in deviation due to change in magnetic latitude of the ship, and
- iii) Means and method used to correct such a deviation.

Q.4 With the help of a simple block diagram explain the working of an Adaptive Auto-Pilot.

Q.5 a) With the aid of simple sketch & describe ranging and phasing in an Echo- Sounder (15 Marks)

b) Describe the errors associated with a Doppler Speed Log? (10 Marks)

Q.6 What is the purpose of the BNWAS? What are the IMO Performance Standards in BNWAS.

Q.7 a) Explain and why GPS position cannot be used directly on certain navigational charts.

(15 Marks)

b) Describe how DGPS improves the operational accuracy of GPS.

(10 Marks)

Q.8 a) What are the differences between AIS and LRIT?

(15 Marks)

b) Discuss why information derived solely from AIS should not be used for collision avoidance.

(10 Marks)

Q.9 a) What is the purpose of the VDR? List the data saved by SVDR and VDR.

(15 Marks)

b) What are the requirements for recording & storage of data for VDR installed after 01 July 14?

(10 Marks)

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. Question no. 1, 2 and 3 are compulsory. Attempt any five questions out of six.
2. All questions carry equal marks i.e. 25 marks each.
3. Draw suitable sketches / diagram wherever considered necessary.

Q1. In thick fog, while on a course of 040° (T) at 6 knots, a target was observed on the radar screen as follows:

Ships	Bearing	Range
Time	(T)	(M)
1600	060°	7.0
1612	$059\frac{1}{2}^{\circ}$	5.0

Find: (a) CPA range and time.

(b) Course and speed of target.

At 1615, own ship's engines were stopped. If a head reach of 0.6M is expected in 15 minutes, predict the new CPA range and time.

Q.2 A vessel sails along the meridian from 44°S to 75°S in 86.06 hours using her 'Damped in Tilt' Gyro Compass (eccentricity being $1/36$) & FIVE days later returned back to her original location in 77.97 hours using her 'Damped in Azimuth' Gyro compass. Find the Gyro course steered on Each leg.

Q.3 a) List the preparations and precautions necessary for swinging the ship for compass adjustments.

b) With the help of a neat sketch explain how soft iron spheres increase mean directive force at compass position.

Q.4 Discuss the significance of the wheel over point (WOP). Explain the procedure to determine the WOP for a mid-size vessel, executing a course alteration of 60° , keeping a radius of 1.5 miles from a visually available island/ target.

Q.5 Explain how Janus configuration of Doppler Log achieves accepted level of accuracy of calculated speed of the vessel (without derivation of formulae). What other errors, if any are minimized by using Janus configuration?

Q.6 State the IMO Performance Standards for the Echo Sounder.

Q.7 Discuss the purpose off all the Data, Codes and Messages that are transmitted by GPS satellites.

Q.8 a) Discuss the limitations of AIS. What precautions must be borne in mind before using AIS data?

b) With respect to LRIT, discuss the function of the Application Service Provider.

Q.9 a) What are the performance standards of a BNWAS with regard to the Reset Function and Modes of Operation?

b) While differentiating between VDR and S-VDR enumerate the data recorded by both.

GOVERNMENT OF INDIA

Date: - 4th-Nov-2019

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. Question no. 1, 2 and 3 are compulsory. Attempt any five questions out of six.
2. All questions carry equal marks i.e. 25 marks each.
3. Draw suitable sketches / diagram wherever considered necessary.

Q1. Own course $070^{\circ}(T)$ at 12 knots in reduced visibility.

Target E			Target F	
Time	Bearing	Range	Bearing	Range
1630	$063^{\circ}(T)$	12.0 M	$128\frac{1}{2}^{\circ}(T)$	11.4 M
1642	063°	08.4	137°	08.5

Analyze the plot and state what alteration of course is to be made at 1648 to ensure that the CPA range of E is 2M. Having taken this action, what would be the bearing and range of F (from own ship) when E is at its CPA?

Q.2 a) Explain the steaming error of a gyro compass & how it affects the settling position of the compass?

b) Steaming error is 2° on the equator. Allowing for the same speed & course what will the steaming error in latitude $36^{\circ}52'$?

Q.3 Explain the causes of deviations appearing on E & W during the voyage & how they are compensated.

Q.4 a) List out the entries you will make on course recorder during the course of entire voyage.

b) Show how will you plan a constant radius turn 70° . Indicate turn line & wheel over.

Q.5 Describe the Doppler log W.R.T. i) Principle of working ii) Errors.

Q.6 State the IMO Performance Standards for the Automatic Identification System.

Q.7 Write notes on:

- i) Space segment of GPS ii) Navigational message and iii) Orbital error.

Q.8 a) Write short notes on LRIT? State the authorized receivers of LRIT data.

b) Explain the following modes of operation of the AIS:-

- i) Assigned mode and ii) Polled Mode.

Q.9 a) Write short notes on BNWAS.

b) Explain the performance standards of S-VDR.

GOVERNMENT OF INDIA

Date: - 1st-Aug-2019

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. All question in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks i.e. 25 marks each.

SECTION 'A'

Q1. In restricted visibility, own vessel on a course of 000° (T) x 10 kts observes following targets on her radar screen.

S. No.	Time	Target 1 (Brg. & Dist.)	Target 2 (Brg. & Dist.)
1	1000	$315^{\circ} \times 8'$	$000^{\circ} \times 11'$
2	1006	$315^{\circ} \times 7'$	$000^{\circ} \times 9.5'$
3	1012	$315^{\circ} \times 6'$	$000^{\circ} \times 8'$

- a) Report the targets at 1012 hrs.
- b) Analyze the above plot and basis that identify, in order to maintain a min. CPA of 2 miles, which vessel is required to take action and what is that action. Any action taken will be effective from 1016.

Q.2 a) Explain with suitable sketches basic properties of a free gyroscope. (10)

b) A vessel fitted with gyro damped in tilt steers 240° (G) at a speed of 15 knots in 30° S latitude. What will be the total gyro error? Given that damping ratio = $1/40$ (15)

Q.3 On board a vessel with constant 1° W deviation on all headings, following permanent corrector magnets were observed as placed in compass binnacle.

- i) Corrector magnet in F & A direction with Red fwd and Blue aft.
- ii) Corrector magnet in athwartship direction with Blue on Starboard and Red on port.

Explain with suitable sketches,

- a) What could be the reason for placement of correctors in above manner? (20)
- b) What could be the reason for constant deviation on all headings? (05)

SECTION 'B'

Q.4 a) Derive a relation between speed of vessel and radius of turn.

b) Explain the function of each control provided on the auto-pilot panel.

Q.5 a) What are the various types of transducers used in echo sounder? Discuss their advantages & disadvantages?

b) Differentiate between the speeds indicated by the Doppler and EM logs.

Q.6 State the IMO Performance Standards for the Automatic Identification System.

Q.7 Write notes on:

- i) Space segment of GPS ii) Navigational message and iii) Orbital error.

Q.8 Explain the following modes of operation of the AIS:-

- i) Autonomous and Continuous mode ii) Assigned mode and iii) Polled mode.

Q.9 What are the carriage requirements for VDR & S-VDR? What are the procedures / requirements for annual testing of the VDR equipment?

----- X—X -----

GOVERNMENT OF INDIA

Date: - 6th-May-2019

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. Question no. 1, 2 and 3 are compulsory. Attempt any five questions out of six.
2. All questions carry equal marks i.e. 25 marks each.
3. Draw suitable sketches / diagram wherever considered necessary.

Q1. Following targets are observed on radar screen by own vessel while steering 050° (T) x 12kts observes following targets on her radar screen.

S. No.	Time	Target 1 (Brg. & Dist.)	Target 2 (Brg. & Dist.)
1	1000	075° x 9'	085° x 7'
2	1012	073° x 6'	099° x 5.6'

If target 2 is observed to be a light vessel.

- a) Report the targets at 1012 hrs. Also find set and drift.
- b) Analyze the above plot and basis that identify the appropriate action to take, in order to maintain a min. CPA of 2 miles from all passing traffic. Any action taken will be effective from 1016.

Q.2 a) Explain with suitable sketches any one arrangement for making a free gyroscope to a North seeking gyro. (15 Marks)

b) Damping error in lat. 40° S was observed to be 1.2° W. Calculate the damping error in latitude 25° N. (10 Marks)

Q.3 On board a vessel flinders bar was observed to be placed at an angle of 15° towards port side from fore and aft line; soft iron spheres were placed athwartship. Explain with suitable sketches the reason (s) for such an arrangement. (25 Marks)

Q.4 a) Explain entries required to be made on the course recorder paper. (15 Marks)

b) How will you adjust the settling of a auto pilot for optimum performance in moderate sea condition. (10 Marks)

Q.5 Discuss the various errors which the soundings showing by an Echo—Sounder may be subject to including the reasons for the errors, methods of identification, and correction or elimination of the error.

Q.6 Enumerate the Performance standards of BNWAS.

Q.7 Sketch a block diagram describe and the function of the controls – Weather adjustment, counter rudder, rudder limit, and rudder, off course alarm.

Q.8 Explain how the GPS determine position of the observer and various errors of GPS.

Q.9 a) Difference between VDR & SVDR. (15 Marks)

b) State the carriage requirements of BNWAS (10 Marks)

GOVERNMENT OF INDIA

Date: - 4th-Feb-2019

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours
MARKS: 200

PASS MARKS: 100

MAX.

Notes:

1. All question in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks i.e. 25 marks each.

SECTION A

Q1. While on a course of $133^{\circ}(T)$ at 12 knots in restricted visibility, a target was observed on the radar screen as follows:

Time	Bearing	Range
1400	$149^{\circ}(T)$	6.0 M
1412	$155^{\circ}(T)$	3.2 M

- a) Find the CPA range, time and bearing. If at 1412, the target was identified visually as lighthouse, state
- b) The course and speed of own ship through the water
- c) The course and speed of own ship over ground
- d) The set and rate of current
- e) The alteration of course to be made, at 1414, to pass the lighthouse to port with a CPA of 2M.
- f) Having made the alternation as required in (e), when should the own ship resume her original course to obtain CPA range of 1.5M?
- g) When would the desired CPA of 1.5 M occur?

Q.2 Ship sails at 1400 hrs from position $43^{\circ}N, 058^{\circ}30'W$ to pick up pilot at 1900 hrs in position $44^{\circ}N, 060^{\circ}W$. The current has been setting $180^{\circ}(T)$ at 1.5 knot, throughout. The ship is fitted with Sperry gyro, which is uncorrected for damping and N-S speed error. If the damping ratio is $1/40$, calculate the gyro course and the ship's speed, which need to be maintained, to reach the pilot station in time.

- Q.3** a) What type of magnetic compass would you chose for a new ship where should it be placed?
b) What is the function of Finders bar and how does it act?
c) Why is the ship swung and compass compensated instead of being swung and deviation noted on each heading?

SECTION 'B'

Q.4 Show with a neat sketch how you will execute a Controlled Radial Turn? Discuss navigational situations where control radial steering is to be used. What are the factors need to be considered when planning a controlled radial turn? How will you monitor a controlled radial turn?

- Q.5** a) What are the various types of transducers used in Echo-sounders? Discuss the advantages and disadvantages of each.
b) Describe the various alarms and settings in Echo-sounders?

- Q.6** a) Enumerate the IMO performance standards required for speed and distance indicator.
b) Explain the purpose of Transmitting Heading Device (THD)?

- Q.7** a) Explain the various errors that might affect the accuracy of GPS fix and state the maximum error in position due to these.
b) Describe how DGPS enhances the accuracy of GPS position?

Contd....

Q.8 a) Explain how the AIS work?

b) Explain the functions of LRIT?

Q.9 a) Detail the SOLAS regulation requirements for VDR.

b) Detail the SOLAS requirements for BNWAS.

----- X-X -----

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GOVERNMENT OF INDIA

Date: - 2nd-Nov-2018

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. All question in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks i.e. 25 marks each.

SECTION A

Q1. Following targets were observed while own vessel was on a course of $045^{\circ}(T)$ doing 15 kts.

S. No.	Time	Target 1 (Brg. & Dist.)	Target 2 (Brg. & Dist.)
1	0800	$045^{\circ} \times 12'$	$090^{\circ} \times 10'$
2	0806	$045^{\circ} \times 10'$	$090^{\circ} \times 8.5'$
3	0812	$045^{\circ} \times 8'$	$090^{\circ} \times 7'$

- a) Report the targets at 0812 hrs.
- b) At 0812 own vessel alters course to maintain a minimum CPA of 2 miles from both targets. What is the new course assuming any action take is effective instantly and is taken at 0812.

Q.2 a) Explain with suitable sketches how a free gyroscope is converted into a north seeking device (10)

b) For a gyro damped in tilt find the total gyro error while steering $060^{\circ}(G)$ in latitude $40^{\circ} S$ at a speed of 15 knots. (15)

Given that $P_d : P_c = 1/40$

Q.3 On board a vessel flinders bar was observed to be placed at an angle of 15° towards port side from fore and aft line; soft iron spheres were placed athwartship. Explain with suitable sketches the reason(s) for such an arrangement. (25)

SECTION 'B'

Q.4 What are the advantages and disadvantages of constant rudder angle turn and constant radius turn. Discuss navigational situations where constant radius turn is to be used and show with a neat sketch how wheel over point is to be plotted on the chart. How will you monitor such a turn. (25)

Q.5 a) Explain phasing with reference to an Echo Sounder. (13)

b) Explain how Doppler Log determines speed of vessel. (12)

Q.6 a) Differentiate between VDR & SVDR (13)

b) What are different categories of AIS message? (12)

Q.7 a) Explain the different segments of GPS system and their salient features. (13)

b) What is differential GPS? How it improves the position fixing accuracy of GPS (12)

Q.8 a) Explain the precautions to be taken into account w.r.t. AIS (13)

b) State the entries to be made on course recorder for a voyage. (12)

Q.9 a) Enumerate the performance standard for BNWAS (13)

b) Differentiate between AIS and LRIT (12)

GOVERNMENT OF INDIA

Date: - 8th-AUG-2018

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. All question in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks i.e. 25 marks each.

SECTION A

Q1. Own course 070° (T) at 12 knots in reduced visibility.

	Target E		Target F	
Time	Bearing	Range	Bearing	Range
1630	063° (T)	12.0 M	$128\frac{1}{2}^{\circ}$ (T)	11.4 M
1642	063°	08.4	137°	08.5

Analyze the plot and state what alteration of course is to be made at 1648 to ensure that CPA range of E is 2 M. Having taken this action, what would be the bearing and range of F (from own ship) when E is at its CPA?

Q.2 A ship is making good 270° (T) while her gyro compass shows 265° (G), in $54^{\circ}41'N$ latitude. She is required to make good 170° (T) at 19 knots. What gyro course would you set on her auto pilot?
(There is NO CURRENT & this gyro compass has NO OTHER ERRORS).

- Q.3** a) If a ship has a –PB and +PC, in which quadrant was she heading when built?
b) If DF on N > DF on S what coef. is present and what is its sign?
c) If DF on E > DF on W, what coef. and its sign is indicated?

SECTION 'B'

- Q.4** a) List IMO performance standard for ROTI (10)
b) Describe the procedure to execute a constant radius turn with / without current. (15)

- Q.5** a) What are the various alarms and setting on an Echo sounder. (13)
b) Explain how Doppler Log determines speed of vessel. (12)

- Q.6** a) Differentiate between VDR & SVDR (13)
b) What are different categories of AIS message. (12)

- Q.7** a) Explain the different segments of GPS system and their salient features. (13)
b) What is differential GPS? How it improves the position fixing accuracy of GPS. (12)

- Q.8** a) Explain the various setting of auto pilot for optimal performance (13)
b) State the entries to be made on course recorder for a voyage. (12)

- Q.9** a) Enumerate the performance standard for BNWAS (13)
b) Differentiate between AIS and LRIT (12)

GOVERNMENT OF INDIA

Date: - 3rd-May-2018

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 Hours

PASS MARKS: 100

MAX. MARKS: 200

Notes:

1. All question in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks i.e. 25 marks each.

SECTION A

Q1. While on a course of 122 deg (T) at 15 kts in restricted visibility following observations were made

Buoy X			Target Y			Target Z		
Time	Bearing	Range	Time	Bearing	Range	Time	Bearing	Range
1300	113 (T)	8.2 M	1300	162 (T)	10.2 M	1300	201 (T)	10.3 M
1318	102 (T)	3.8 M	1318	156 (T)	06.0 M	1318	201 (T)	07.0 M

Using a radar plot, find

- a) CPA range and time of all three targets
- b) Course and speed of targets Y and Z
- c) When buoy X is abeam own vessel and it is decided to have a CPA of 2.0M from targets Y and Z what alteration of course is to be made under applicable COLREGS? All actions are assumed to be instantly effective and sufficient depth of water is available all around.

Q.2 A vessel steers 168⁰(T) at 15.5 knots in 55⁰35'N latitude. Find what is her Gyro course in each of the following cases:

- a) Gyro is 'Damped in Azimuth'
- b) Gyro is 'Damped in Tilt'

Q.3 a) State the sequence of placing the correctors and the reason for the same.

b) Explain how spheres increase Mean Directive force at compass position. Justify your answer with diagrams.

SECTION B

Q.4 a) Explain what determines the minimum and maximum depth that can be recorded by an echo sounder. Give examples.

b) Briefly describe the function of the 'Proportional' and 'Derivative' control of the PID auto pilot.

Q.5 a) What is 'Ranging' in an echo sounder? With a neat sketch, explain the 'Phasing' arrangement in an echo sounder.

b) List the errors of a Doppler log. Explain any two of them.

Q.6 List the performance standards of (a) Rate of turn indicator (b) Speed & distance indicator.

Q.7 a) What errors reduce the accuracy of the GPS fixes. How are these errors accounted for or compensated.

b) What is Differential GPS?

Q.8 Explain the principle, operation & data transmitted by the Automatic Identification System. What is its purpose & usefulness?

Q.9 What is a Voyage Data Recorder? How does it work & what information does it record?

X—X



GOVERNMENT OF INDIA
FIRST MATE OF A FOREIGN GOING SHIP PHASE II
FUNCTION: NAVIGATION
PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

Code BD

HN 05/118

TIME: 3 HOURS

PASS MARKS: 100

MAX MARKS: 200

Notes:

1. All question in Section A are compulsory
2. Attempt any FIVE questions from Section B.
3. All question carry equal marks i.e 25 marks each.

Section A

Q1. Following targets were observed while own vessel was on a course of 045° (T) doing 15 kts.

S.No	Time	Target 1 (Brg. & Dist)	Target 2 (Brg & Dist)
1	0800	$045^{\circ} \times 12'$	$090^{\circ} \times 10'$
2	0806	$045^{\circ} \times 10'$	$090^{\circ} \times 8.5'$
3	0812	$045^{\circ} \times 8'$	$090^{\circ} \times 7'$

- a) Report the targets at 0812hrs
- b) At 0812 own vessel alters course to maintain CPA of 2 miles from both targets. What is the new course assuming any action taken is effective instantly and is taken at 0812

- Q.2 a) A ship with gyro compass uncorrected for Damping & Steaming errors steers 205° (T & G) from position A in lat 58° S to B in lat 62° S. Determine the speed of the ship & course to steer from position B to A with gyro compass uncorrected. (Pc: Pd = 40: 1)
- b) Explain Damping error in a Gyro Compass & derive its formula

Q.3 Explain the Earth's Magnetism & the Ship's Magnetism. How does Earth's Magnetism & Ship's magnetism affect Ship's Magnetic Compass? Use suitable sketches / diagrams

Section B

Q.4 a) Own vessel course is 015° (T) x 12kts. After 6 miles on the present course, vessel has to alter course to 035° (T). Show by neat sketch how will you execute this as a constant radius With radius of turn 2.5 miles

Q.5 Explain the principle and working of an Echo sounder. What factors determine its minimum & maximum range? What are the errors associated with this equipment

Q.6 The performance standards of the Voyage Data Recorder equipment have been revised with effect from 01st July 2014. List these performance standards highlighting the changes which have been brought

Q.7 Explain the Ground, Space & user segments and also the working and operation of the Global Positioning System

Q.8 With respect to LRIT system explain the following (i) Purpose of LRIT system (ii) LRIT system architecture & operation (iii) Data Transmitted (iv) Authorized receivers of LRIT data

Q.9 a) Explain the operational sequence of indications & alarms in a Bridge Navigational Watch alarm System

b) What are the advantages of Voyage Data Recorders?



07/11/17

GOVERNMENT OF INDIA
FIRST MATE OF A FOREIGN GOING SHIP PHASE II
FUNCTION: NAVIGATION
PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

Code BC
MM (Pr)

TIME: 3 HOURS

PASS MARKS: 100

MAX MARKS: 200

Notes:

1. All question in Section A are compulsory
2. Attempt any FIVE questions from Section B
3. All questions carry equal marks i.e 25 marks each

Section A

Q1. Following targets were observed while own vessel was on a course of 000° (T) doing 15 kts.

S.No	Time	Target 1 (Brg. & Dist)	Target 2 (Brg & Dist)
1	1000	$180^{\circ} \times 8'$	$000^{\circ} \times 10'$
2	1006	$180^{\circ} \times 7.5'$	$000^{\circ} \times 8.5'$
3	1012	$180^{\circ} \times 7'$	$000^{\circ} \times 6'$

- a) Report the targets at 1012hrs
- b) Determine action to be taken so as to maintain CPA of 2 miles. Any action taken is effective instantly and is taken at 1012hrs

Q.2 a) Your ship is anchored at position 54° N 060° E and Gyro error is found to be 2° Low. Find out the course to steer for making good a course of 158° (T), if ships speed is 16 kts & in lat 40° N

A) 24° E

- b) Explain Steaming error in a Gyro Compass. Derive the formula for steaming error if the vessel is steering north easterly course

Q.3 Explain Coefficient B & the deviation it causes on various headings. What is the correction procedure for compensating this coefficient?

Section B

Q.4 a) What are the settings & controls present on the autopilot equipment. Explain how these settings enable the navigator to effectively control ships heading.

- b) Explain Constant radius turn & constant rate turn. What is the significance of wheel over line & wheel over point?

Q.5 a) Write short notes on Doppler log i) Janus Configuration ii) Ground track & Water track speed

- b) Explain the principle & working of Electromagnetic log with the help of a diagram

Q.6 a) Differentiate between VDR & SVDR

- b) What Contents of Dynamic & static message of AIS

Q.7 a) What is Selective Availability and how does it affect the accuracy of a position by GPS.

- b) Briefly describe the Glonass and Galileo system of satellite navigation

Q.8 a) State the operational frequencies of AIS. What is 'Pseudo' AIS and what are the operational requirements of AIS

- b) With respect to LRIT, write short notes on (i) CSP (ii) ASP and (iii) LRIT coordinator?

Q.9 a) What purpose does the VDR seek to achieve and also state the data that is recorded by VDR and S-VDR?

- b) State the carriage requirements of BNWAS and the modes in which it operates



GOVERNMENT OF INDIA
FIRST MATE OF A FOREIGN GOING SHIP PHASE II
FUNCTION: NAVIGATION
PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

Code BG

TIME: 3 HOURS

PASS MARKS: 100

MAX MARKS: 200

Notes:

1. All question in Section A are compulsory
2. Attempt any FIVE questions from Section B
3. All questions carry equal marks i.e 25 marks each

Section A

Q1. i) Own vessel course $135^\circ T$, speed 8 knots

The following radar rainges and bearings were taken

Time	Ship A	Ship B	Light vessel C
0600	$130^\circ X$ 7.6 M	$140^\circ X$ 8.1 M	$248^\circ x$ 3.3 M
0607 $\frac{1}{2}$	$130^\circ X$ 5.8 M	$141^\circ X$ 7.8 M	$264^\circ x$ 4.0 M
0615	$130^\circ X$ 4.0 M	$142^\circ X$ 7.6 M	$273^\circ x$ 4.9 M

i) Find for targets A and B:

- a) Nearest approach and time it will occur
- b) Speed and course
- c) Aspect at 0615 hrs

ii) What is the set and rate of the current?

iii) What action would you take out of the following options and why?

- a) Stand on
- b) Alter boldly to starboard
- c) Reduce speed
- d) Stop the ship

Q.2 a) Explain steaming error of a Gyro compass and how it affects the settling position of the Compass?

b) Steaming error of a Gyro on the equator is 2° . Allowing for the same speed and course, what will be the steaming error in Latitude $36^\circ 52'$?

Q. 3 a) Explain the causes of deviations appearing on E. and W. during the voyage and how they are compensated?

b) With the help of figures, show what beneficial effects the soft iron spheres provide in addition to correction of quadrantal deviations

Section B

Q.4 a) What do you understand by controlled radial steering

b) Your ships course is $040^\circ (G)$ & speed 12 knots. After 5n.m. on the present course, as per the passage plan, you have to alter course to $105^\circ (G)$. Show by neat sketch, how you will execute a constant radial turn, if the radius of turn is to be 1.5'. Also mark the wheel over point assuming ships length 240 mtrs. (use radar plotting sheet)

Q.5 a) Enumerate the IMO performance standards of Gyro compass

b) Describe the 'Janus' configuration of Doppler speed log and its working principle

Q.6 a) Briefly explain the performance standards of Gyro compass

b) Enumerate the functions of adaptive automatic pilot systems

Q.7 a) How does the GPS determine the position of the user?

b) What are the contents of the GPS Navigational message?

Q.8 a) Explain the various parts of AIS Message and transmission schedule

b) What is LRIT ? Explain the working principle of LRIT

Q.9 a) What are the different levels of alarms in BNWAS?

b) Briefly explain the VDR and S-VDR?

sa) what are the various types of transducers in E/S. Ad/Disad of each



GOVERNMENT OF INDIA
FIRST MATE OF A FOREIGN GOING SHIP PHASE II
FUNCTION: NAVIGATION
PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

Code BA

TIME: 3 HOURS

PASS MARKS: 100

MAX MARKS: 200

Notes:

1. All question in Section A are compulsory
2. Attempt any FIVE questions from Section B
3. All questions carry equal marks i.e 25 marks each

Section A

Q1. Own course 0700(T) at 12 knots in restricted visibility

Target E			Target F	
Time	Bearing	Range	Bearing	Range
1630	0630(T)	12.0 M	128.50 (T)	11.4 M
1642	0630(T)	08.4	1370(T)	08.5

Analyse the plot and state what alteration of course is to be made at 1648 to ensure that the CPA range of E is 2 M. Having taken this action, what would be the bearing and range of F (from the own ship) when E is at its CPA?

Q.2 A vessel sails along the meridian from 60° S to 53° S in 21 hours using her 'Damped in Tilt' Gyro Compass & a day later returned back to her original location steaming back in 15 hours using her 'Damped in Azimuth' Gyro compass. Find the Gyro course she steering on each of the leg

- Q.3 a) Describe Retentive and Gaussian error and precautions to be taken for same
 b) Describe the precautions to be taken when swinging the vessel for correcting Magnetic Compass

Section B

Q.4 Explain how a constant radius turn is planned. What are the different ways of monitoring the progress of the vessel along the curved segment of the track while executing the turn?

- Q.5 a) Explain the principle & working of the Doppler speed log
 b) Explain the errors associated with the Echo Sounder equipment

- Q.6 (a) List down the Performance Standards for Ship borne Global Positioning System (GPS) receiver equipment
 b) Explain various controls (settings & alarms) provided on the auto pilot equipment

- Q.7 a) How does a GPS receiver determine the vessel's position?
 b) Describe the working & contribution of Differential GPS in increasing the accuracy of GPS fixes

- Q.8 a) What are the inherent limitations of the Automatic Identification System?
 b) What information is communicated by the LRIT equipment? Who are the authorized receivers of this information? How is LRIT system different from AIS?

Q.9 What is the purpose of Bridge Navigational Watch Alarm System? Explain the operational sequence of indication & alarms of BNWAS

ALL MENTIONED 'D' in COURSES TO BE CONSIDERED AS DEGREES

D. J. Jain
21/17



REVISED BY FAX

GOVERNMENT OF INDIA
FIRST MATE OF A FOREIGN GOING SHIP PHASE II
FUNCTION: NAVIGATION
PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

Code BF

TIME: 3 HOURS

PASS MARKS: 100

MAX MARKS: 200

Notes:

1. All question in Section A are compulsory
2. Attempt any FIVE questions from Section B
3. All questions carry equal marks i.e 25 marks each

Section A

Q1. Own ship on a course of 020° (T) at a maximum speed of 12 knots observes a 'fishing vessel' as follows:

Time	Bearing	Range
1630	330° (T)	6.5m
1642	330° (T)	4.5m

Report target 1642 hrs?

Master of own ship decides to pass ahead of the target with a CPA of 1.0 M, by taking a single action at 1645. State the possible actions?

Q.2 Assuming that the peripheral speed of the Earth is 540 knots in 54° N latitude, find the error of the gyro compass when making good a course of 175° (T) at 21 knots in the Indian Ocean (latitude $29^{\circ} 42' S$). If the gyro compass was:

- a) Damped in Azimuth
- b) Damped in Tilt

Q. 3 a) In port of Houston, your vessel is alongside and the Flinders bar of your ships Magnetic Compass is removed. Values of Deviation remain unchanged. Vessel is shifted to another berth and the Flinders Bar is replaced in the casing. Value of Deviation is observed to be different. Analyze and discuss the reasons for the change in value of Deviation
 b) Draw a labeled diagram of Compass Binnacle

Section B

Q.4 a) Discuss advantages and disadvantages of constant rudder angle turn and constant radius turn

b) Show with a neat sketch, how will execute a controlled radius turn to starboard by an angle of 75° of radius 1.5 miles

Q.5 Write short notes on the following;

- a) Doppler Shift
- b) Pseudo AIS
- c) Geocentric Coordinate system PZ 90

Q.6 a) List the performance standards of an Auto pilot

b) Briefly explain the effect of density, temperature and pressure on velocity of sound and the accuracy of depth indication by Echo Sounder

Q.7 a) Describe how a GNSS receiver on the ship selects the satellites and determines the ship's position, course and speed made good?

b) What are the factors affecting accuracy of GNSS

Q.8 What are the carriage requirements for AIS? Differentiate between 'Type-A and Type-B AIS. What are the mandatory testing requirements of AIS?

Q.9 Write short notes as:

- i) S-VD R ii) VDR iii) BNWAS

-----XXX-----



GOVERNMENT OF INDIA
FIRST MATE OF A FOREIGN GOING SHIP PHASE II
FUNCTION: NAVIGATION
PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

Code AZ

TIME: 3 HOURS

PASS MARKS: 100

MAX MARKS: 200

Notes:

1. All question in Section A are compulsory
2. Attempt any FIVE questions from Section B
3. All questions carry equal marks i.e 25 marks each

Section A

Q1. While on a course of 320 (T) at 6 knots in reduced visibility following radar observation of two targets are made as follows:

Target G			Target H		
Time	Bearing	Range	Time	Bearing	Range
0840	330 (T)	11.0 M	0840	019 (T)	12.0 m
0910	339 (T)	07.6 M	910	019 (T)	07.6 M

If target G is known to be a light vessel, find

- a) Set and rate of current
- b) Course and speed of target H
- c) CPA range and TCPA of both targets
- d) The course alteration to be made at 0920, so that target H will have a CPA of 2.0 M to port of own ship
- e) After altering course when target H bears 270 deg (T), find what course should be steered to pass the target G to port with a CPA of 1.0 M
- f) When would target G be at its new CPA of 1.0M?

Q.2 a) Explain with suitable sketches Steaming Error of Gyro compass (15 Marks)

b) For a gyro damped in tilt find the total gyro error while steering 060° (G) in latitude 30° S at a speed of 15 knots (Ratio of pd:pc = 1:40) (10 Marks)

Q.3 a) What is the function of Flinder's Bar & Soft Iron Spheres?

b) Explain how ship's permanent magnetism (components P, Q & R) compensated using correctors

Section B

Q.4 a) Give a general description of the Rate of Turn Indicator (ROTI) and the precautions to take while using ROTI.

b) Explain, with sketch, the function of the Proportional Control of the Auto Pilot system

Q.5 a) Explain with suitable sketch, how change in trim effects the accuracy of speed indicated by Doppler log

b) State the factors that affect the propagation characteristics of the acoustic wave in an echo sounder

Q.6 State the Performance Standards of Echo Sounder

Q.7 a) Explain the 'Space' and 'Control' segment of GPS

b) List the sources of errors of the system and explain

i) Orbital and ii) HDOP errors

Q.8 a) Explain the various data transmitted by AIS and the transmission schedule

b) With respect to LRIT write notes on (i) ASP (ii) Data center and (iii) LRIT Co-ordinator

Q.9 a) List the difference between the data transmitted by VDR and SVDR

b) State the carriage requirements of BNWAS



GOVERNMENT OF INDIA

FIRST MATE OF A FOREIGN GOING SHIP (PHASE - II)

FUNCTION: NAVIGATION (Management Level)

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 HOURS

PASS MARKS: 100

MAX. MARKS: 200

NOTES:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks. i.e. 25 marks each.

SECTION - 'A'

- Q.1 In restricted visibility, following observation were made on radar screen by own vessel steering a course of 070° (T) at 12 kts.

TIME	Target - A		Target - B	
	BRG	RANGE	BRG	RANGE
0030	063° (T)	12.0'	128.5° (T)	11.4'
0036	063° (T)	10.2'	132.5° (T)	09.9'
0042	063° (T)	08.4'	137° (T)	08.5'

- a) Report both targets at 0042 hrs.
- b) At 0048 hrs master of own V/L decided to take action by single alteration of course to ensure that the CPA of target 'A' is 2M. State the best suitable alteration of course in such situation.
- c) Having taken this action what would be the bearing & range of 'B' when 'A' is at its CPA?
- Q.2 A ship with gyro compass uncorrected for Damping & Steaming errors, steers 200° (T & G) from position 'A' in latitude 60° S to 'B' in latitude 64° S. Determine the speed of the ship, and course to steer from position 'B' to 'A' with gyro compass uncorrected. ($P_c : P_d = 40 : 1$)

- Q.3 a) In port of Mumbai, your vessel is alongside and the Flinders bar of your ship's Magnetic Compass is removed. Values of Deviation remain unchanged. Vessel is shifted to another berth and the Flinders Bar is replaced in the casing. Value of Deviation is observed to be different. Analyse and discuss the reasons for the change in value of Deviation. (15 Marks)
- b) Draw a Labeled diagram of Compass Binnacle. (10 Marks)

SECTION - 'B'

- Q.4 a) Your ship's Course is 350° (G), & Speed 16 Knots. After 4 n.m. on the present Course, as per the passage plan, you have to alter course to 290° (G). Show by neat sketch, how you will execute a constant radial turn, if the Radius of turn is to be 2'.

Contd.....2....

b) From the maneuvering diagram, Advance is known to be 3 cables. Determine the setting of your VRM (Radar) to identify the wheel over point. (USE RADAR PLOTTING SHEET) (25 Marks)

~~Q. 5~~ a) Discuss various errors associated with echo sounder. (15 Marks)

b) State the working Principle of Electro-Magnetic log & state the errors associated with this navigational aid. (10 Marks)

~~Q. 6~~ a) Discuss the Errors in the GPS obtained position. (20 Marks)

b) List the performance standards of GPS equipment. (5 Marks)

~~Q. 7~~ Briefly explain:

- a) Explain the performance standards of BNWAS ? Auto Pilot
b) Ranging and Phasing in Echo Sounder

~~Q. 8~~ a) State the contents of Navigation & Static message of AIS. (20 Marks)

b) State Indian Administration criteria for carriage of AIS on ships trading on Indian coast. (5 Marks)

~~Q. 9~~ a) Discuss the purpose of, and Performance requirements of BNWAS. (15 Marks)

b) List the information that needs to be recorded in VDR and S-VDR. (10 Marks)



May 2016

GOVERNMENT OF INDIA

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION (Management Level)

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 HOURS

PASS MARKS: 100

MAX. MARKS: 200

NOTES:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions out of six from Section B.
3. All questions carry equal marks. i.e. 25 marks each.

SECTION - 'A'

Q. 1 Own Course 230° (T) x 15 knots.

Target	X	Y	Z
Time			
0000	$300^{\circ} \times 8.9'$	$164^{\circ} \times 06.4'$	$182^{\circ} \times 10.8'$
0020	$311^{\circ} \times 5.5'$	$138^{\circ} \times 04.0'$	$174^{\circ} \times 06.0'$

Find the range at CPA of target X, target Z

Q. 2 Derive an expression for steaming error of a Gyro compass.
A vessel is steaming at 20 knots on a northerly course in latitude 60° . Find the steaming error of Gyro.

Q. 3 Own Course 325° (T) x 6 knots in reduced visibility.

Target G			Target H	
Time	Brg.	Range	Brg.	Range
0840	329.5°	11.6	019°	14.2
0850	332°	10.3	019°	12.0
0900	335°	08.9	019°	09.8
0910	339°	07.6	019°	07.6

If target G is known to be light vessel, find

- a) Set and rate of current.
- b) Course and speed of Target H.
- c) CPA range & time of both targets.
- d) The course alteration to be made at 0920, so that target H will have a CPA of 2.0m

SECTION - 'B'

Q. 4 Describe the procedure for turning a vessel using constant radius turn technique clearly indicating following :

- i) Methods of marking a wheel over position and wheel over line.
- ii) Methods of monitoring and controlling a vessel's track during the turn.
- iii) Correction in the position of WOP when the set and rate of the current is known .
- iv) Drive the formula to calculate the rate of turn when radius and speed of the vessel during the turn is given.

Q. 5 a) What are the various types of transducers used in Echo – Sounders ?
Discuss the advantage and disadvantage of each.

b) Describe the various alarms and settings in Echo – Sounders?

Contd.....2....

63/5/16-82

--- 2 ---

Q. 6 ✓ a) Enumerate the IMO performance standards of GPS.

✓ b) Briefly describe the outline of GLONASS.

Q. 7 ✓ a) Describe the main sources of errors of GNSS in the position obtained from GNSS.

✓ b) Explain the various setting of ^{auto} audio-pilot for optimal performance.

Q. 8 ✓ a) What is AIS ? Explain the various parts of AIS message and transmission schedule.

✓ b) Write a short note on LRIT.

Q. 9 ✓ a) Explain VDR and SVDR. What data is required to be provided by them?

✓ b) Explain the IMO performance standards for BNWAS.

May 2016

80
24/5/16**Amendment to question paper****GOVERNMENT OF INDIA****FIRST MATE OF A FOREIGN GOING SHIP (PHASE - II)****FUNCTION: NAVIGATION (Management Level)****PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS**

SECTION - 'A'

Note: Candidates can attempt either Q. 1 or Q.3 (pertaining to radar plotting) and Q.3 A which is added now is compulsory.

Add Q.3 A as follows: (compulsory)

Q.3 A. (I) Explain the method of placement of permanent correctors in magnetic compass for compensating the effect of P, Q and R? (15 Marks)

(II) Explain why a deviation curve made in one hemisphere and position can not be used in the other hemisphere? (10 Marks)


Capt. Santoshkumar Darokar
Nautical Surveyor-cum-Dy. DG (Tech)

03/05/2016



GOVERNMENT OF INDIA

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

FUNCTION: NAVIGATION (Management Level)

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 HOURS

PASS MARKS: 100

MAX. MARKS: 200

NOTES:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks. i.e. 25 marks each.

SECTION - 'A'

- Q. 1 At 'X' ($H=24A/m$, $Dip=66^\circ$) following coefficients were found:
 $A=+3.2^\circ$, $B=+14^\circ$ ($IB=+18^\circ$), $C=+3^\circ$ ($PC=-10^\circ$), $D=-6^\circ$ & $E=0^\circ$.
 At 'Y' ($H=16A/m$, $Dip=-26^\circ$) how will you place the Flinders bar here?
 Calculate the residual deviation on a heading of 213° at 'Y' after the F/bar has been properly placed.

- Q. 2 During a performance test the following peaks were observed,
 $A=083^\circ$, $B=039^\circ$ and $C=054^\circ$,
 Calculate the settling position and the percentage of damping.

- Q. 3 Own vessel course 112° (T) at 9 Knots in reduced visibility.

Time	Target X		Target Y	
	Bearing	Range	Bearing	Range
1500	126° (T)	10.3 M	149° (T)	8.1 M
1510	125.5° (T)	9.2 M	150.5° (T)	6.7 M
1520	125° (T)	8.1 M	153.5° (T)	5.3 M

For each target find.

- a) CPA range, time and bearing
- b) Course and speed
- c) Aspect at 1520.

It is required to take action at 1530 by means of a single action – alteration of course or speed – so that the CPA of either target will be at least 2.0 M

- (d) Evaluate all the possible alternatives and
- (e) State, with reasons, which of these actions is preferable, under the circumstances.

SECTION - 'B'

- Q. 4 Calculate the value of λ from the following observations:

Ship's Head Magnetic Deviation Time for 15 Vibration

N	6° W	43 Secs
E	10° W	33 Secs.
S	8° E	35 Secs.
W	9° E	37 Secs.
Ashore		35 Secs.

Contd.....2....

- Q. 5 With reference to gyro compass:
 a) Differentiate between ballistic deflection and ballistic tilt?
 b) Explain first and second rolling error.
- Q. 6 a) With reference to the echo sounding system explain the importance of its performance with regard to siting position?
 b) What is 'ranging' and 'Phasing' of an echo sounder.
 Draw and explain the above.
- Q. 7 a) What are the advantages of an ECDIS over conventional paper charts?
 b) Differentiate between raster and vector charts.
 c) How are ECDIS charts corrected?
- Q. 8 What is the purpose of a voyage data recorder? Explain the different modules of the VDR?
- Q. 9 a) Discuss various errors of GPS derived position.
 b) What are the common controls provided on an auto pilot? Write briefly about each of them.

1/2/10

(15)

(10)

(12)

(12)

49

Q. 1

50
 + 49
 + 20

 119

GOVERNMENT OF INDIA**FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)****FUNCTION: NAVIGATION (Management Level)****PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS****NOTES:**

1. The question number 1 in section A & question number 4 in section B to be replaced as follows.

SECTION A

Q1. Onboard your vessel, you have noticed that soft iron spheres are attached to the binnacle in relative slewed directions that is 280 degrees – 100 degrees

- a) Analyze and discuss in detail the reason (s) for such arrangement.
b) What would have been the ship's heading on which maximum deviation would have occurred prior to soft iron corrections made by compass adjuster?

SECTION B

Q4. a) Enumerate the IMO Performance Standards for Rate of Turn Indicator (ROTI).

(10 Marks)

b) Describe the procedures to execute a constant radius turn with /without current.

(15 Marks)

~~Signature~~
01.02.2018

(CANDIDATE TO TAKE 30 MINS ADDITIONAL PI.)

~~Signature~~ 01.02.2018



GOVERNMENT OF INDIA

FIRST MATE OF A FOREIGN GOING SHIP (PHASE - II)

FUNCTION: NAVIGATION (Management Level)

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 HOURS

PASS MARKS: 100

MAX. MARKS: 200

NOTES:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks. i.e. 25 marks each.

SECTION - 'A'

Q. 1 While steering a course of $185^{\circ}(T)$ at 18 knots, the following were made on the radar screen:

TIME	TARGET A	TARGET B
0300	$130^{\circ}(T) \times 11.5 \text{ M}$	$165^{\circ}(T) \times 10.0 \text{ M}$
0306	$129.5^{\circ}(T) \times 9.5 \text{ M}$	$162^{\circ}(T) \times 8.1 \text{ M}$
0312	$129.0^{\circ}(T) \times 7.5 \text{ M}$	$158^{\circ}(T) \times 6.4 \text{ M}$

- a) Make a full report of the target A at 0312 hrs.
- b) If target B is confirmed as a light vessel in position, find the set & drift and also the course and speed made good by own ship.
- c) What will be the CPA & TCPA of both the targets if the own ship alters course by 30° to starboard at 0312 hrs, considering instant action.

- Q. 2**
- a) Explain what is Steaming error, why it is caused; how it affects the setting position of a gyro compass? (10 Marks)
 - b) In latitude $32^{\circ}N$, the Damping error is $1.2^{\circ}E$. Calculate the total error of the same gyro compass when making good a course of $315^{\circ}(T)$ at a speed of 18 knots in latitude $48^{\circ}S$. (15 Marks)

- Q. 3** State the functions of the following correctors of the magnetic compass:
- a) Flinders bar;
 - b) S.I. Sphere;
 - c) Vertical magnet;
 - d) Horizontal magnet

SECTION - 'B'

- Q. 4** Show with a neat sketch how you will execute a Constant Radial Turn? How will you monitor a controlled radial turn?

Contd...2...

- Q. 5** a) Describe the principle and working of Echo Sounder with the help of a neat diagram? (13 marks)
b) List and explain various errors associated with this equipment? (12 marks)

- Q. 6** a) Briefly explain the performance standards of BNWAS? (13marks)
b) Enumerate the functions of Adaptive automatic pilot systems? (12 marks)

- Q. 7** a) Describe the main sources of errors of GNSS and their expected approximate values, in the positions obtained from GNSS.
b) Explain the various setting of auto pilot for optimal performance.

- Q. 8** a) What are the carriage requirements for AIS?
b) Briefly explain the working of LRIT?

- Q. 9** a) Explain the working of the VDR fitted on board your last vessel?
b) In the context of VDR what are your duties in the event of a non catastrophic and catastrophic event.



GOVERNMENT OF INDIA.

FIRST MATE OF A FOREIGN GOING SHIP (PHASE - II)

FUNCTION: NAVIGATION (Management Level)

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 HOURS

PASS MARKS: 100

MAX. MARKS: 200

NOTES:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions out of six from Section B.
3. All questions carry equal marks. i.e. 25 marks each.

SECTION - 'A'

Q. 1 The following observation of targets A & B were made when steering 175 at 12 knots during reduced visibility.

Target 'A' Target 'B'

Time

0700	168° T X 12.0'	233.5° T X 11.4'
0706	168° T X 10.2'	236.5° T X 9.9'
0712	168° T X 8.4'	242° T X 8.5'

a] Find the course and speed of the targets, the time, range and relative bearing of the targets at CPA.

b] Find the alteration of course to be made at 0718 hrs, in order to avoid target A and such that the CPA of the target B will be $\frac{1}{2}$ miles to the port of own vessel.

c] Find the time & range of each target at CPA following the alteration of course at 0718 hrs. Assume any alteration of course to have immediate effect.

Q. 2 Assuming that the peripheral speed of the Earth is 540 knots in 54° N latitude, Find the error of the gyro compass when making good a course of 175° [T] at 21 knots in the Indian Ocean [latitude 29° 42' S], If the gyro compass was:

a] Damped in Azimuth

b] Damped in Tilt

[25 Marks]

Q. 3 Onboard your vessel, you have noticed that soft iron spheres are attached to the binnacle in relative slewed direction that is 280° - 100°

a] Analyze and discuss in detail the reason [s] for such an arrangement.

b] What would have been the ship's heading on which maximum deviation would have occurred prior to soft iron corrections made by compass adjuster?

[25 Marks]

SECTION - 'B'

Q. 4 a] Explain how will you plan and execute a turn of 70° using Rate of Turn Indicator [RTI] on a VLCC of 2,70,000 tons DWT, If the radius of turn is to be two miles.

b] Briefly explain the methods of monitoring the turn?

Contd.....2....

Handwritten signature and date 05/01

- Q. 5** a) Explain, where necessary with the help of a neat diagram:
i) Ranging ii) Phasing of an echo sounder. [10 Marks]
b) What is, with respect to the echo sounder?
i) Cross noise ii) Aeration iii) Pythagoras error [15 Marks]
- Q. 6** a) List the performance standards of an Auto pilot. [13 Marks]
b) Briefly explain the effect of density, temperature and pressure on velocity of sound and the accuracy of depth indication by Echo Sounder. [12 Marks]
- Q. 7** a) Describe the system configuration and satellite segment of the GPS system.
b) Explain the reason why although 24 satellites are provided in the GPS system, only a minimum of three or four satellites are required for position determination.
- Q. 8** a) Compare and Contrast AIS vis-à-vis LRIT. [20 Marks]
b) Discuss why information available from AIS solely, should not be used by OOW for collision Avoidance. [5 Marks]
- Q. 9** a) State the IMO performance standards of VDR & S-VDR. [15 Marks]
b) Explain the working requirements of BNWAS. [10 Marks]



Panel of 2
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AT
6/5
06/05/15

GOVERNMENT OF INDIA

FIRST MATE OF A FOREIGN GOING SHIP (PHASE - II)

FUNCTION: NAVIGATION (Management Level)

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 HOURS

PASS MARKS: 100

MAX. MARKS: 200

NOTES:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions out of six from Section B.
3. All questions carry equal marks, i.e. 25 marks each.

SECTION - 'A'

- Q. 1** Own Vessel Course 050° (T) & speed 12 knots. Following observations made on the radar screen

Time Hrs.	Target 'A'	Target 'B' Light vessel
0800	050° (T) x 9 M	080° (T) x 6 M
0806	050° (T) x 7 M	087° (T) x 5 M
0812	050° (T) x 5 M	097° (T) x 4.1 M

- i. Report both the targets at 0812
- ii. At 0812 target 'A' and own vessel decided to alter course to their respective stbd., if target 'A' alters course by 10° (Stbd.) calculate the alteration required by own vessel in order to comply with the masters standing order of two mile CPA with all passing traffic. (all actions effective immediately)
- iii. What will be the CPA and TCPA of target 'B' after alteration is made by own vessel? (25 Marks)

- Q. 2** a) Explain the operating principle and care of Gyro Compass of any make fitted on board any one of the vessels you have sailed? (13 Marks)

- b) A Gyrocompass Damped in tilt has a Damping error of 1.2° in latitude $46^\circ 18' N$. What will be its Damping error in $42^\circ S$ Latitude? (12 Marks)

- Q. 3** a) Explain the method of placement of permanent correctors in magnetic compass for compensating the effect of P, Q and R? (15 Marks)

- b) Explain why a deviation curve made in one hemisphere and position can not be used in the other hemisphere? (10 Marks)

SECTION - 'B'

- Q. 4** Describe the use of Rate of Turn Indicator. Explain with the aid of a sketch how you would plan and execute a course alteration of 75° with a turn radius of 2' using Radar, ROTI, Rudder Angle Indicator and Speed log. (25 Marks)

- Q. 5** a) What are the advantages of Doppler Log over Electro - Magnetic Log? (13 Marks)

- b) Explain the performance standards of an Echo Sounder? (12 Marks)

Contd.....2....

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PAGE 2 OF 2

AT

12/06/15

Q. 6 State the IMO performance standard to be satisfied by:

- a) Distance measuring instruments
- b) ~~Echo-sounder~~ *ENWAS*

12

Q. 7 With reference to GPS

- a) Explain why the range obtained by GPS receiver is a Pseudo Range. Despite true range unknown how does GPS receiver determines the position?
- b) How does a differential GPS work to enhance position fixing accuracy?

17

Q. 8 a) Compare AIS with LRIT over various operation related issues?

- b) List the entries you will make on course recorder during the course of entire voyage?

12

Q. 9 a) Explain VDR and SVDR. What data is required to be provided by them?

- b) Briefly describe the IMO performance standards for VDR & SVDR?



GOVERNMENT OF INDIA

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PAGE 1 of 2

FIRST MATE OF A FOREIGN GOING SHIP (PHASE - II)

FUNCTION: NAVIGATION (Management Level)

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 HOURS

PASS MARKS: 100

MAX. MARKS: 200

NOTES:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions out of six from Section B.
3. All questions carry equal marks. i.e. 25 marks each.

SECTION - 'A'

Q. 1 From a vessel steering 110° T at 14 knts, The following radar bearings and ranges were obtained in restricted visibility:

<u>Target 'A'</u>			<u>Target 'B'</u>		<u>Target 'C'</u>	
Time	Bearing	Range	Bearing	Range	Bearing	Range
1418	120° T	11.6'	136° T	9.9'	237° T	3.1'
1424	120° T	9.8'	136° T	8.5'	246.5° T	2.6'
1430	120° T	8.1'	136° T	7.1'	261° T	2.2'

a) Plot each target and find the following for each target:

i) C.P.A ii) TCPA iii) Course iv) Speed v) Aspect

b) At 1438 the observing ship altered course 60° to starboard. Find each of the following:

- i) The new CPA and TCPA of Target A.
- ii) The new CPA and TCPA of target C.

c) Explain the action taken by the observing ship according to Col regs 1972 as amended.

Q. 2 Explain with suitable diagrams the following with reference to ship's vertical soft iron:

a) The change in the deviation of the compass due to change in magnetic latitude and hemisphere.

b) The type of corrector for correction of deviation due to induced magnetism in vertical soft-iron.

Q. 3 a) With reference to marine gyro compass, briefly explain the following:

- i) Drifting
- ii) Settling Error
- iii) Gyroscopic Precession.

(15 Marks)

b) A gyrocompass damped in tilt as a damping error of 2.8° W in latitude of 58° S. What will be the Damping error of the same gyro in 30° N latitude?

(10 Marks)

Contd.....2....



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Page 2 of 2

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SECTION - 'B'

✓ Q. 4 Show how will you plan a Constant Radial turn of 70° . Indicate turn line and wheel over line. Derive all formulas used.

✓ Q. 5 Describe Doppler Log w.r.t

- i) Principle of working
- ii) Errors

✗ Q. 6 What are the performance standards for:
a) Speed Log b) AIS c) VDR

✓ Q. 7 Describe the space segment of GPS in detail. How do the various error affect the position fix.

Q. 8 (a) State the IMO Performance standards of VDR & S-VDR.

✓ b) ~~Explain the working requirements of BNWAS.~~

WHAT IS LRIT? EXPLAIN WORKING PRINCIPLE OF LRIT.

Q. 9 a) State the various requirements for the voice data recorder capsule.

✓ b) Enumerates the performance standard for BNWAS.



GOVERNMENT OF INDIA

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

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MAX. MARKS: 200

NOTES:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions out of six from Section B.
3. All questions carry equal marks. i.e. 25 marks each.

SECTION - 'A'

- Q. 1** Own course 070° (T) at 12 knots in restricted visibility observes following on her radar screen:

Target E

Target F

Time	Bearing	Range	Bearing	Range
1630	063° (T)	12.0 M ✓	080° (T)	11.4 M
1636	063°	10.2	080°	09.0
1642	063°	08.4 ✓	080°	08.5

Analyze the plot and state, what alteration of course is to be made at 1648 hrs to ensure a minimum CPA of 2 miles.

- Q. 2** Ship sails at 1200 hrs from position 43°N , $058^{\circ} 30'\text{W}$ to pick up pilot at 1700 hrs in position 44°N , 060°W . The current has been setting 180° (T) at 1.0 knot, throughout. The ship is fitted with Sperry gyro, which is uncorrected for damping and N-S speed error. If the damping ratio is $1/40$, calculate the gyro course and the ship's speed, which need to be maintained, to reach the pilot station in time.
- Q. 3** a) How is Gaussing error and retentive error caused? List the differences in deviation caused by each. What precautions are necessary when either of them may be present? (15 Marks)
b) With the help of sketch, show the effects of the soft iron spheres in addition to correction of Quadrantal deviations. (10 Marks)

SECTION - 'B'

- Q. 4** Show with a neat sketch how you will execute a Controlled Radial Turn? Discuss navigational situations where control radial steering is to be used. What are the factors need to be considered when planning a controlled radial turn? How will you monitor a controlled radial turn?
- Q. 5** a) Explain, where necessary with the help of a neat diagram:
(i) Ranging (ii) Phasing of an echo sounder.
b) What is, with respect to the Echo sounder?
(i) Cross noise (ii) Aeration (iii) Pythagoras error

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- Q. 6** a) Describe the main sources of errors and their expected approximate values, in the position obtained with GPS (Without DGPS)
b) Explain the principle of DGPS. How does DGPS contribute to the Integrity of the position? What is the accuracy of DGPS fix?
- Q. 7** a) Enumerate the IMO Performance Standards for BNWAS.
b) Explain the functioning of each module of the Voyage Data Recorder (VDR).
- Q. 8** a) Explain how Doppler Log determines the speed of the vessel?
b) Differentiate between LRIT and AIS.
- Q. 9** With the help of simple diagrams explain the Proportional, derivative and Integral Controls of the Auto-pilot system.

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GOVERNMENT OF INDIA

FIRST MATE OF A FOREIGN GOING SHIP (PHASE - II)

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MAX. MARKS: 200

NOTES:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions out of six from Section B.
3. All questions carry equal marks. i.e. 25 marks each.

SECTION - 'A'

- Q. 1** (i) Own vessel course 135° T, speed 8 knots.
The following radar ranges and bearings were taken.

Time	Ship A	Ship B	Light vessel C
0600	130° x 7.6 M	140° x 8.1 M	248° x 3.3 M
0607½	130° x 5.8 M	141° x 7.8 M	264° x 4.0 M
0615	130° x 4.0 M	142° x 7.6 M	273° x 4.9 M

Find for targets A and B: -

- (a) Nearest approach and time it will occur;
- (b) Speed and course;
- (c) Aspect at 0615.
- (ii) What is the set and rate of the current?
- (iii) What action would you take out of the following options and why?
 - (a) Stand on;
 - (b) Alter boldly to starboard;
 - (c) Reduce speed;
 - (d) Stop the ship.

(25 Marks)

- Q. 2** a) Explain the operating principle and care of Gyro Compass of any make fitted on board any one of the vessels you have sailed? (13 Marks)

- b) A Gyro compass Damped in tilt has a Damping error of 1.2° in latitude $46^{\circ}18' N$. What will be its Damping error in $42^{\circ} S$ Latitude? (12 Marks)

- Q. 3** a) Explain the principle of magnetic compass.

- b) State the rules governing the position of all correctors.

Contd.....2....

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SECTION - 'B'

- Q. 4** a) Your ship's Course is 010° (G), & Speed 12 Knots. After 6 n.m. on the present Course, as per the passage plan, you have to alter course to 082° (G). Show by neat sketch, how you will execute a constant radial turn, if the Radius of turn is to be 2'.
- b) From the maneuvering diagram, Advance is known to be 4 cables. Determine the setting of your VRM (Radar) to identify the wheel over point.
- c) If the current is setting 340° at 2 Knots, determine the "new reference point" for executing the Turn. (USE RADAR PLOTTING SHEET) (25 Marks)
- Q. 5** a) Describe what is meant by the "Doppler effect".
- b) Describe how in a typical Doppler log system, Jannus configuration of transducers enhances the accuracy of the indicated speed.
- Q. 6** a) Explain the performance standards of S.VDR?
- b) Explain briefly what is meant by 'Phasing' of an echo sounder.
- Q. 7** a) Explain how a GPS receiver determines ship's position. (15 Marks)
- b) Explain how DGPS enhances the position accuracy. (10 Marks)
- Q. 8** a) Describe the purpose and working principle of AIS and LRIT? (15 Marks)
- b) State the information displayed on AIS Screen and data transmitted by LRIT? (10 Marks)
- Q. 9** a) Explain how the BNWAS work?
- b) Explain the IMO performance standards for BNWAS.



Manindra Patwar

GOVERNMENT OF INDIA

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MAX. MARKS: 200

NOTES:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks. i.e. 25 marks each.

SECTION - 'A'

- Q. 1** Own Vessel Course 050° (T) & speed 12 knots. Following observations made on the radar screen

Time Hrs.	Target 'A'	Target 'B' Light vessel
0800	050° (T) x 9 M	080° (T) x 6 M
0806	050° (T) x 7 M	087° (T) x 5 M
0812	050° (T) x 5 M	097° (T) x 4.1 M

- i. Report both the targets at 0812
 - ii. At 0812 target 'A' and own vessel decided to alter course to their respective stbd., if target 'A' alters course by 10° (Stbd.) calculate the alteration required by own vessel in order to comply with the masters standing order of two mile CPA with all passing traffic. (all actions effective immediately)
 - iii. What will be the CPA and TCPA of target 'B' after alteration is made by own vessel? (25 Marks)
- Q. 2** a) Explain how is transmission of ship's heading from the master gyro to repeaters effected?
- b) A Gyro damped in azimuth had the corrector for speed and latitude set at 0 (zero). The ship at 18 knots in latitude 32° South was on course 321° (G). What is the Gyro transit bearing of a set of lights, if the charted transit bearing was 177° (T).
- Q. 3** a) Explain the causes of deviations appearing on E. and W. during the voyage and how they are compensated? (13 Marks)
- b) With the help of figures, show what beneficial effects the soft iron spheres provide in addition to correction of quadrantal deviations. (12 Marks)

SECTION - 'B'

- Q. 4** a) What are the SOLAS requirements in respect of autopilot?
- b) State various settings of autopilot for the optimal performance in different weather conditions. What are the various alarm settings?

Contd...2...

- Q. 5** a) Describe the principle and working of echo sounder with the help of a neat diagram? (13 Marks)
b) List and explain various errors associated with this equipment? (12 Marks)
- Q. 6** a) Describe with neat sketch PID controls of Auto pilot. (15 Marks)
b) List the IMO performance standards for Echo sounder. (10 Marks)
- Q. 7** a) Describe the main sources of errors of GNSS and their expected approximate values, in the position obtained from GNSS. (13 Marks)
b) Explain the principle and contribution of DGPS for accurate position fixing. (12 Marks)
- Q. 8** a) What is AIS? Explain the various parts of AIS message and transmission schedule? (13 Marks)
b) Write a short note on LRIT? State the authorized receivers of LRIT data? (12 Marks)
- Q. 9** a) Explain the modules of Voyage Data Recorder (VDR) and the procedure for saving and retrieval of data in case of any incident? (13 Marks)
b) Enumerate the carriage requirements and functions of BNWAS? (12 Marks)



GOVERNMENT OF INDIA

FIRST MATE OF A FOREIGN GOING SHIP (PHASE - II)

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TIME: 3 HOURS

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MAX. MARKS: 200

NOTES:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions out of six from Section B.
3. All questions carry equal marks. i.e. 25 marks each.

SECTION - 'A'

- Q. 1 i) Speed own ship 8 knots, course 135° T.
The following radar ranges and bearing were taken.

Time	Ship A	Ship B	Light vessel C
0600	130° 7.6 M	140° 8.1 M	248° 3.3 M
0607½	130° 5.8 M	141° 7.8 M	264° 4.0 M
0615	130° 4.0 M	142° 7.6 M	273° 4.9 M

Find for targets A and B

- a) Nearest approach and time it will occur;
- b) Speed and course;
- c) Aspect at 0615.

What is the set and rate of the current?

- ii) What action would you take and justify your action.

- Q. 2 The axis of a gyro-compass damped-in tilt, uncorrected for speed-course error and damping error, points due north in latitude 61° N, when making good a course of 345° (T) and speed of 20 kts.

On reaching latitude of 70° N, course is required to be altered to 205° (T) and the speed is to be reduced to 15 kts. Calculate the combined speed - course and damping error on the new course, and also the gyro - compass to steer then. (Assume the gyro compass does not have any other errors)

- Q. 3 a) Derive the expression for a Steaming Error on a marine gyro compass for a vessel on a South Westerly Course. (10 Marks)

b) A vessel on a certain course at the equator had a Steaming Error of 1° (High). In another latitude when ship was on the same course, speed, gyro bearings of two object in - transit gave an error of 2° H. Assuming there were no other errors, find the latitude at the second instant. (15 Marks)

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Page 2 of 2

Dr. P. M. Foster

SECTION - 'B'

Q. 4 a) Describe the procedure to execute a constant radius turn without current, using ROTI.

b) Detail various settings of the auto-pilot for optimal performance.

Q. 5 a) Enumerate the IMO performance standards for Echo Sounder ?

b) Describe the 'Janus' configuration of Doppler speed log and its working principle ?

Q. 6 Explain the performance standards of
i) BNWAS ii) Echo Sounder.

Q. 7 a) Explain the various errors that might affect the accuracy of GPS fix.

b) Describe working principle of DGPS and its limitations.

Q. 8 a) Compare AIS with LRIT over various operation related issues?

b) List the entries you will make on course recorder during the course of entire voyage?

Q. 9 a) Explain the modules of Voyage Data Recorder (VDR).

b) Enumerate the carriage requirements and functions of BNWAS?

Q. 6 a) Explain setting and alarms of course recorder
b) Differentiate the data recorded of VDR & SVDR.



GOVERNMENT OF INDIA

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

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TIME: 3 HOURS

PASS MARKS: 100

MAX. MARKS: 200

NOTES:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks. i.e. 25 marks each.

SECTION - 'A'

- Q. 1 ✓ Own ship on a course of 020° (T) at a maximum speed of 12 knots observes a 'fishing vessel' as follows:
- | Time | Bearing | Range |
|------|-------------------|-------|
| 1630 | 330° (T) | 6.5 m |
| 1642 | 330° (T) | 4.5m |
- Report target 1642 hrs?
Master of own ship decides to pass ahead of the target with a CPA of 1.0 M, by taking a single action at 1645. State the possible actions? (25 Marks) ✓
- Q. 2 ✓ Assuming that the peripheral speed of the Earth is 540 knots in 54° N latitude, find the error of the gyro compass when making good a course of 175° (T) at 21 knots in the Indian Ocean (latitude $29^{\circ} 42'$ S), If the Gyro Compass was: ✓
- a) Damped in Azimuth
 - b) Damped in Tilt
- (25 Marks)
- Q. 3 a) In port of Houston, your vessel is alongside and the Flinders bar of your ships Magnetic Compass is removed. Values of Deviation remain unchanged. Vessel is shifted to another berth and the Flinders Bar is replaced in the casing. Value of Deviation is observed to be different. Analyze and discuss the reasons for the change in value of Deviation. (15 Marks) ✓
- b) Draw a Labeled diagram of Compass Binnacle. (10 Marks) ✓

SECTION - 'B'

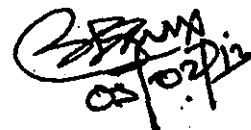
- Q. 4 ✓ With the help of simple diagrams explain the Proportional, Derivative and Integral Controls of the Auto-pilot system. (25 Marks) ✓
- Q. 5 a) Explain, where necessary with the help of a neat diagram: ✓
- i) Ranging ✓
 - ii) Phasing of an echo sounder. (10 Marks)
- b) What is, with respect to the echo sounder? ✓
- i) Cross noise ✓
 - ii) Aeration ✓
 - iii) Pythagoras error (15 Marks)
- Q. 6 a) Enumerate the IMO Performance Standards for Rate of Turn Indicator (ROTI). (10 Marks) ✓
- b) Explain the functioning of each module of the Voyage Data Recorder (VDR). (15 Marks) ✓

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- Q. 7** ✓ What is the working principle of GNSS? Explain errors and alarms of GPS. (25 Marks)
 ✓ Compare GPS, GALILEO and GLONASS.
- Q. 8** ✓ a) Explain how Doppler Log determines the speed of the vessel? (13 Marks)
 ✓ b) Differentiate between LRIT and AIS. (12 Marks)
- Q. 9** a) State the IMO Performance standards of S-VDR. (13 Marks)
 b) Explain the purpose and functional requirements of BNWAS. (12 Marks)

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GOVERNMENT OF INDIA

FIRST MATE OF A FOREIGN GOING SHIP (PHASE - II)

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NOTES:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks. i.e. 25 marks each.

SECTION - 'A'

- Q. 1** While on a course of 133° (T) at 12 knots in restricted visibility, a target was observed on the radar screen as follows:

Time	Bearing	Range
1400	149° (T)	6.0 M
1412	155° (T)	3.2 M

- a) Find the CPA range, time and bearing. *0-7 1425 232*
- If at 1412, the target was identified visually as lighthouse, state
- b) The course and speed of own ship through the water. *183 12*
- c) The course and speed of own ship over ground. *142 1425*
- d) The set and rate of current. *025 x 3.1*
- e) The alteration of course to be made, at 1414, to pass the lighthouse to port with a CPA of 2 M. *211*
- f) Having made the alternation as required in (e), when should the own ship resume her original course to obtain a CPA range of 1.5 M? *1424*
- g) When would the desired CPA of 1.5 M occur? *1430* (25 Marks)

- Q. 2** Ship sails at 1400 hrs from position 43° N, $058^\circ 30'$ W to pick up pilot at 1900 hrs in position 44° N, 060° W. The current has been setting 180° (T) at 1.5 knot, throughout. The ship is fitted with Sperry gyro, which is uncorrected for damping and N-S speed error. If the damping ratio is $1/40$, calculate the gyro course and the ship's speed, which need to be maintained, to reach the pilot station in time. *195 206.7* (25 Marks)

- Q. 3**
- a) What type of magnetic compass would you choose for a new ship and where should it be placed? (10 Marks)
 - b) What is the function of the Flinders bar and how does it act? (8 Marks)
 - c) Why is the ship swung and compass compensated instead of being swung and deviation noted on each heading? (7 Marks)

SECTION - 'B'

- Q. 4**
- a) List IMO performance standards for ROTI. (10 Marks)
 - b) Describe the procedure to execute a constant radius turn with / without current. (15 Marks)

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Q. 5 a) Describe the principle and working of echo sounder with the help of a neat diagram? (13 Marks)

b) List and explain various errors associated with this equipment? (12 Marks)

Q. 6 a) Enumerate the IMO performance standards of GNSS? (13 Marks)

b) Briefly describe the outline of GLONASS and GALILEO? (12 Marks)

Q. 7 Explain the following: (25 Marks)

a) Datum Shift

b) Contents of navigation message

c) Regulation regarding the use of auto pilot

Q. 8 a) Describe the purpose and working principle of AIS and LRIT? (15 Marks)

b) State the information displayed on AIS Screen and data transmitted by LRIT? (10 Marks)

Q. 9 a) Explain the modules of Voyage Data Recorder (VDR) and the procedure for saving and retrieval of data in case of any incident? (13 Marks)

b) Enumerate the carriage requirements and functions of BNWAS? (12 Marks)



GOVERNMENT OF INDIA

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

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PASS MARKS: 100

MAX. MARKS: 200

NOTES:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks. i.e. 25 marks each.

SECTION - 'A'

Q. 1 Vessel own course 325° (T) at 6 kts in reduced visibility:

Time	Target - A		Target - B	
	Bearing	Range	Bearing	Range
0840	329.5° (T)	11.6M	019° (T)	14.2M
0910	339° (T)	7.6M	019° (T)	7.6M

If the target A is known to be light vessel, calculate the following:

- a) Set and rate of current
 - b) Course and speed of Target B
 - c) CPA range and time of both targets
 - d) Find the course alteration to be made at 0920hrs, so that target B will have a CPA of 2.0 nautical miles to port of own vessel.
 - e) After course alteration, when target B bears 270° (T), find the course to be steered to pass target A to port, with a CPA of 1.0 nautical mile.
- Q. 2** a) Explain how is transmission of ship's heading from the master gyro to repeaters effected?
- b) A Gyro damped in azimuth had the corrector for speed and latitude set at 0 (zero). The ship at 18 knots in latitude 32° South was on course 321° (G). What is the Gyro transit bearing of a set of lights, if the charted transit bearing was 177° (T).
- Q. 3** a) Explain the principle of magnetic compass.
- b) State the rules governing the position of all correctors.

SECTION - 'B'

- Q. 4** Show with a neat sketch how you will execute a Controlled Radial Turn? Discuss navigational situations where control radial steering is to be used. What are the factors need to be considered when planning a controlled radial turn? How will you monitor a controlled radial turn?
- Q. 5** a) What are the various types of transducers used in Echo-sounders? Discuss the advantages and disadvantages of each.
- b) Describe the various alarms and settings in Echo-sounders?

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Q. 6 a) Enumerate the IMO performance standards required for speed and distance indicator.

b) Explain the purpose of Transmitting Heading Device (THD)?

Q. 7 a) Explain the various errors that might affect the accuracy of a GPS fix and state the maximum error in position due to these.

b) Describe how DGPS enhances the accuracy of GPS positions?

Q. 8 a) Briefly explain the purpose and functioning of VDR?

b) Explain the functions of Adaptive auto-pilot?

Q. 9 a) Explain how the AIS work?

b) Explain the IMO performance standards for BNWAS.



GOVERNMENT OF INDIA

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – II)

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MAX. MARKS: 200

NOTES:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions out of six from Section B.
3. All questions carry equal marks. i.e. 25 marks each.

SECTION - 'A'

Q. 1 Own course 275° (T) at 18 knots.

Time	Bearing	Range
1500	235° (T)	12.0 M
1506	235° (T)	10.0 M
1512	235° (T)	08.0 M

- Find: a) CPA range and time.
b) Course and speed of target
c) Aspect at 1512

At 1514, the target is identified as a vessel *not under command*. Captain of own ship decides to alter course at 1515 so as ensure a CPA range of 2 M.

d) Find the course alternation required to let the target pass ahead of own ship and hence (e) the new CPA time.

f) Find the course alternation required to make the target pass astern of own ship and hence (g) the new CPA time.

h) State which action (d) or (f) is in accordance with ROR? (25 Marks)

Q. 2 The spinning axis of a gyro compass damped in tilt uncorrected for damping & steaming errors pointing due north in Lat 61° S, while making good a course of 165° (T) at 20.6 Kts. What will be the direction of axis when making good a course of 345° (T) at 13.3 Kts in Lat 61° N. $344-12(E)$ (25 Marks)

Q. 3 Onboard your vessel, you have noticed that soft iron spheres are attached to the binnacle in relative slewed direction that is $280^{\circ} - 100^{\circ}$

a) Analyze and discuss in detail the reason(s) for such an arrangement.

b) What would have been the ship's heading on which maximum deviation would have occurred prior to soft iron corrections made by compass adjuster? (25 Marks)

SECTION - 'B'

Q. 4 a) Discuss advantages and disadvantages of constant rudder angle turn and constant radius turn.

b) Show with a neat sketch, how you will execute a controlled radius turn to starboard by an angle of 75° of radius 1.5 miles. (25 Marks)

Q. 5 Write short notes on following;

a) Doppler Shift

b) Pseudo AIS

c) Geocentric Coordinate system PZ 90

(25 Marks)

Contd.....2....

Dayfest 1/13

- Q. 6 a) List the performance standards of an Auto pilot. (13 Marks)
b) Briefly explain the effect of density, temperature and pressure on velocity of sound and the accuracy of depth indication by Echo Sounder. (12 Marks)

- Q. 7 a) How does the GPS determine the position of the user? (15 Marks)
b) What are the contents of the GPS Navigational message? (10 Marks)

- Q. 8 a) Explain the various parts of AIS Message and transmission schedule. (12 Marks)
b) What is LRIT? Explain the working principle of LRIT. (13 Marks)

- Q. 9 a) What are the different levels of alarms in BNWAS? (12 Marks)
b) Briefly explain the VDR and S-VDR? (13 Marks)



Prado
GOVERNMENT OF INDIA

FIRST MATE OF A FOREIGN GOING SHIP (PHASE - II)

FUNCTION: NAVIGATION (Management Level)

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 HOURS

PASS MARKS: 100

MAX. MARKS: 200

NOTES:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks. i.e. 25 marks each.

JAN/2012

SECTION - 'A'

✓ Q. 1 At position 'P' ($H=24$ A/m, Dip = -40°) with the ship upright and heading north the deviation at a well-placed compass was $4^\circ E$. (Coefficients A & E are zero). When the ship heeled 5° to starboard, on the same course, the deviation was $1^\circ W$. The deviation due to heeling error was then removed with a vertical magnet 50 cms. below the compass.

At 'Q' ($H=30$ A/m, Dip = $+50^\circ$) heading north and heeled 10° to port the deviation was observed to be $8^\circ E$. How the magnet should be readjusted to correct to heeling error.

✓ Q. 2 Ship sails at 1200 hrs from position $43^\circ N$, $058^\circ 30' W$ to pick up pilot at 1700 hrs in position $44^\circ N$, $060^\circ W$. The current has been setting 180° (T) at 1.0 knot, throughout. The ship is fitted with Sperry gyro, which is uncorrected for damping and N-S speed error. If the damping ratio is $1/40$, calculate the gyro course and the ship's speed, which need to be maintained, to reach the pilot station in time.

✓ Q. 3 A vessel steering a course of 105° (T) at 12 knots observes the targets as follows:

Time (hrs)	Target I	Target II	Target III
1000	075° (T) x 13'	105° (T) x 10'	285° (T) x 5'
1006	075° (T) x 10.5'	105° (T) x 9'	285° (T) x 6'
1012	075° (T) x 8'	105° (T) x 8'	285° (T) x 7'

Make a report at 1012 hrs. At 1016 hrs master of own vessel decides to take a single action to have a minimum CPA range of 2 nautical miles with all targets. If the vessel had a performance delay of 4 minutes, advise master for the necessary action.

Contd.....2....

SECTION - 'B'

Q.4 The following deviations were observed in an uncorrected compass:

Compass Course	NE	SE	NW
Deviation	10° (E)	3° (E)	8°(W)

Spheres were then placed athwart-ship 46 cms apart and coefficient B and C were correctly compensated. The deviation, when heading NE was then 2° (E). Assuming coefficient A is nil, how the spheres will be repositioned?

Q. 5 Describe any method of converting a free gyroscope into a gyro compass. State the method of control with which you have been familiar.

Q. 6 a) Explain Inter-cardinal Rolling Error. Show how it is taken care of by the Gyro Compass manufacturer with respect to any gyro compass.
b) Describe the procedure for planning & executing a major alteration of course in a narrow channel by means of constant radius turn.

Q.7 Describe the principle of Doppler Log. Explain the use of Janus configuration. What is the need for speed input from Doppler log for Radar when GPS gives more accurate speed?

Q.8 Write short notes on:-

- (i) Type-A and Type-B Automatic Identification System (AIS)
- (ii) Voyage Data Recorder (VDR) and SVDR.

Q.9 Describe the IMO performance standards for ECDIS. Differentiate between Raster charts and vector charts. How the ECDIS charts are corrected?



GOVERNMENT OF INDIA

FIRST MATE OF A FOREIGN GOING SHIP (PHASE - II)

FUNCTION: NAVIGATION (Management Level)

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 HOURS

PASS MARKS: 100

MAX. MARKS: 200

NOTES:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks, i.e. 25 marks each.

SECTION - 'A'

Q. 1 A vessel was swung and the following deviations were observed. NE: 6° E, SE: 3° E, SW: 4° E, NW: 7° W. The spheres were then secured in place in the athwart-ship line with their centres 60 cms apart. The deviation on NE was then observed to be 3.5° E. What alteration should be made in the position of the spheres to correct for Coefficient D? Assume A & E nil. Also state the residual deviations on the inter cardinal headings after the spheres have been correctly positioned.

Q. 2 If the damping error is 1° E in Lat. 35° N, calculate the combined damping and course and speed error when steering 346° (T) at 16 knots in Lat. 52° S.

Q. 3 Own course 240° (T) at 15 knots in reduced visibility.

Time	Target C		Target D	
	Brg (T)	Range (M)	Brg (T)	Range (M)
1000	314°	11.9	208.5°	10.0
1004	314°	10.7	209°	08.4
1008	314°	09.5	210°	06.8
1012	314°	08.3	211°	05.1

For each target, find:

- a) Range and time at CPA.
- b) Course and speed
- c) Aspect at 1012.

Master of own ship desires to take action at 1016, by means of a single alteration of course or reduction of speed so that the CPA of either target will be not less than 2.0 M.

- d) Evaluation the possible alternatives
- e) State which action is most preferable?

SECTION - 'B'

- Q. 4** a) State the principle underlying the deflector method of compass adjustment.
b) Describe the method of obtaining table of deviation / deviation curve?

Contd.....2....

- Q. 5** a) Trace the path of the north end of a 'Damped in Azimuth' gyro compass located in 25° North latitude before it settles down. Show all the applicable forces on this trace.
b) Explain why a Gyro Compass never settles in a horizontal position unless the gyro is located at the equator.
- Q. 6** Explain how will you plan a turn of 70° using Rate of Turn Indicator on a VLCC of 3,50,000 tons DWT. Describe the formula used.
- Q. 7** a) Describe the working principle of Doppler Speed log?
b) Describe the IMO performance standards for speed log?
- Q. 8** a) Explain the purpose and limitations of AIS?
b) Describe the types of messages and time interval in AIS?
c) List out the data recorded on VDR and S-VDR.
- Q. 9** Briefly explain:
a) Errors and alarms of GPS
b) Ranging and Phasing in Echo Sounder



GOVERNMENT OF INDIA

MAY 2012

FIRST MATE OF A FOREIGN GOING SHIP (PHASE - II)

FUNCTION: NAVIGATION (Management Level)

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 HOURS

PASS MARKS: 100

MAX. MARKS: 200

NOTES:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions from Section B.
3. All questions carry equal marks. i.e. 25 marks each.

SECTION - 'A'

Q. 1 Vessels own course 325° (T) at 6 kts in reduced visibility:

Target - A

Target - B

Time	Bearing	Range	Bearing	Range
0840	329.5° (T)	11.6M	019° (T)	14.2M
0855	334° (T)	9.6M	019° (T)	10.9M
0910	339° (T)	7.6M	019° (T)	7.6M

If the target A is known to be a light vessel, calculate the following:-

- a) Set and rate of current
 - b) Course and speed of Target B
 - c) CPA range and time of both targets
 - d) Find the course alteration to be made at 0920hrs, so that target B will have a CPA of 2.0 nautical miles to port of own vessel.
 - e) After course alteration, when target B bears 270° (T), find the course to be steered to pass target A to port, with a CPA of 1.0 nautical mile.
 - f) Time for target-A to have new CPA of 1.0 nautical mile.
- Q. 2 a) On a voyage from Latitude 30° N to 36° N, 'Latitude corrector switch' of Gyro Compass of your ship Damped in Tilt, was non-functional. Average speed of the ship for the voyage was 14 Knots. The Course steered was 030° . Gyro Error was observed to be NIL.
Determine the Total error on the Gyro expected when steering a Course of 050° , in Latitude 45° S at 17 Knots. (20 Marks)
- b) Explain "Settling Error" of a Gyro Compass. (5 Marks)
- Q. 3 a) Explain the probable cause for change in value of Variation for Terrestrial Magnetism.
- b) Describe the effects of Gaussing error & Errors due to sub-permanent magnetism on Ships magnetic compass during process of Compass adjustment.

SECTION - 'B'

- Q. 4 a) Your ships Course is 350° (G), & Speed 16 Knots. After 4 n.m. on the present Course, as per the passage plan, you have to alter course to 290° (G). Show by neat sketch, how you will execute a constant radial turn, if the Radius of turn is to be 2'.

Contd.....2.....

b) From the maneuvering diagram, Advance is known to be 3 cables. Determine the setting of your VRM (Radar) to identify the wheel over point. (USE RADAR PLOTTING SHEET) (25 Marks)

Q. 5 a) Discuss various errors associated with echo sounder. (15 Marks)

b) State the working Principle of Electro-Magnetic log & state the errors associated with this navigational aid. (10 Marks)

Q. 6 a) Discuss the Errors In the GPS obtained position. (20 Marks)

b) List the performance standards of GPS equipment. (5 Marks)

Q. 7 a) Discuss optimum settings for steering a ship on Auto. (20 Marks)

b) Entries to be made on the Course recorder paper from commencement to end of the voyage. (5 Marks)

Q. 8 a) State the contents of Navigation & Static message of AIS. (20 Marks)

b) State Indian Administration criteria for carriage of AIS on ships trading on Indian coast. (5 Marks)

Q. 9 a) Discuss the purpose of, and Performance requirements of BNWAS. (15 Marks)

b) List the information that needs to be recorded in VDR and S-VDR. (10 Marks)



GOVERNMENT OF INDIA

FIRST MATE OF A FOREIGN GOING SHIP (PHASE - II)

FUNCTION: NAVIGATION (Management Level)

PAPER: NAVIGATIONAL AIDS INCLUDING COMPASS

TIME: 3 HOURS

PASS MARKS: 100

MAX. MARKS: 200

NOTES:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions out of six from Section B.
3. All questions carry equal marks. i.e. 25 marks each.

SECTION - 'A'

Q. 1 Own Vessel Course 050° (T) & speed 12 knots. Following observations made on the radar screen

Time Hrs.	Target 'A'	Target 'B' Light vessel
0800	050° (T) x 9 M	080° (T) x 6 M
0806	050° (T) x 7 M	087° (T) x 5 M
0812	050° (T) x 5 M	097° (T) x 4.1 M

- i. Report both the targets at 0812
- ii. At 0812 target 'A' and own vessel decided to alter course to their respective stbd., if target 'A' alters course by 10° (Stbd.) calculate the alteration required by own vessel in order to comply with the masters standing order of two mile CPA with all passing traffic. (all actions effective immediately)
- iii. What will be the CPA and TCPA of target 'B' after alteration is made by own vessel? (25 Marks)

Q. 2 a) Explain the operating principle and care of Gyro Compass of any make fitted on board any one of the vessels you have sailed? (13 Marks)

b) A Gyrocompass Damped in tilt has a Damping error of 1.2° in latitude $46^\circ 18' N$. What will be its Damping error in $42^\circ S$ Latitude? (12 Marks)

Q. 3 a) Explain the method of placement of permanent correctors in magnetic compass for compensating the effect of P, Q and R? (15 Marks)

b) Explain why a deviation curve made in one hemisphere and position can not be used in the other hemisphere? (10 Marks)

SECTION - 'B'

Q. 4 a) What do you understand by controlled radial steering? (10 Marks)

b) Your ships Course is 040° (G), & Speed 12 Knots. After 5 n.m. on the present Course, as per the passage plan, you have to alter course to 105° (G). Show by neat sketch, how you will execute a constant radial turn, if the Radius of turn is to be 1.5'. Also mark the wheel over point assuming ships length 240mtrs. (Use Radar Plotting sheet) (15 Marks)

Contd.....2....

- Q. 5** a) Enumerate the IMO performance standards for Echo sounder?(13 Marks)
b) Describe the 'Janus' configuration of Doppler speed log and its working principle? (12 Marks)
- Q. 6** a) Briefly explain the performance standards of Gyro Compass? (13 Marks)
b) Enumerate the functions of Adaptive automatic pilot systems? (12 Marks)
- Q. 7** a) Describe the main sources of errors of GNSS and their expected approximate values, in the position obtained from GNSS. (13 Marks)
b) Explain the principle and contribution of DGPS for accurate position fixing. (12 Marks)
- Q. 8** What are the carriage requirements for AIS? Differentiate between Type-A and Type-B AIS. What are the mandatory testing requirements of AIS? (25 Marks)
- Q. 9** Write short notes as:
(i) S-VDR (ii) VDR (iii) BNWAS (25 Marks)



GOVERNMENT OF INDIA

FIRST MATE OF A FOREIGN GOING SHIP (PHASE - II)

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TIME: 3 HOURS

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MAX. MARKS: 200

NOTES:

1. All questions in Section A are compulsory.
2. Attempt any FIVE questions out of six from Section B.
3. All questions carry equal marks. i.e. 25 marks each.

SECTION - 'A'

- Q. 1 (i) Own vessel course 135° T, speed 8 knots.
The following radar ranges and bearings were taken.

Time	Ship A	Ship B	Light vessel C
0600	130° x 7.6 M	140° x 8.1 M	248° x 3.3 M
0607½	130° x 5.8 M	141° x 7.8 M	264° x 4.0 M
0615	130° x 4.0 M	142° x 7.6 M	273° x 4.9 M

Find for targets A and B: -

- (a) Nearest approach and time it will occur; $0-0632, 3.7-0903$
 (b) Speed and course; $203 \times 6.4, 144 \times 5.6$
 (c) Aspect at 0615. $71^{\circ}, 166^{\circ}$
 (ii) What is the set and rate of the current? $107^{\circ} \times 1.6'$
 (iii) What action would you take out of the following options and why?
 (a) Stand on;
 (b) Alter boldly to starboard;
 (c) Reduce speed;
 (d) Stop the ship.

(25 Marks)

- Q. 2 a) Explain steaming error of a Gyro compass and how it affects the settling position of the Compass? (10 Marks)

b) Steaming error of a Gyro on the equator is 2° . Allowing for the same speed and course, what will be the steaming error in Latitude $36^{\circ} 52'$? (15 Marks) 2.499°

- Q. 3 a) Explain the causes of deviations appearing on E. and W. during the voyage and how they are compensated? (13 Marks)

b) With the help of figures, show what beneficial effects the soft iron spheres provide in addition to correction of quadrantal deviations. (12 Marks)

SECTION - 'B'

- Q. 4 Describe the use of Rate of Turn Indicator. Explain with the aid of a sketch how you would plan and execute a course alteration of 75° with a turn radius of 2' using Radar, ROTI, Rudder Angle Indicator and Speed log. (25 Marks)

- Q. 5 a) What are the advantages of Doppler Log over Electro - Magnetic Log? (13 Marks)

b) Explain the performance standards of an Echo Sounder? (12 Marks)

Contd.....2.....

- Q. 6** a) Explain the performance standards of S-VDR? (13 Marks)
b) Explain, briefly, what is meant by 'Phasing' of an echo so... (12 Marks)
- Q. 7** a) Describe how a GNSS receiver on the ship selects the satellites and determines the ship's position, course and speed made good? (15 Marks)
b) What are the factors affecting accuracy of GNSS. (10 Marks)
- Q. 8** a) What is AIS? Explain the various parts of AIS message and transmission schedule? (13 Marks)
b) Write a short note on LRIT? State the authorised receivers of LRIT data? (12 Marks)
- Q. 9** a) What is the purpose of VDR? What data are recorded on it? (13 Marks)
b) Write a short note on BNWAS? (12 Marks)
