(Paper Format)

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

FUNCTION: NAVIGATION

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours PASS MARKS: 140 MAX. MARKS: 200

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. **All questions carry equal marks.**
3. Use Chart No. --------Nautical Almanac 1992, Deviation card no. ----, Variation -----, ship's speed ----- knots and Height of eye of the observer ---- if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

Part A

Q. 1 Chart Work problems

Q. 2 Chart Work problems

Q. 3 Execution of Passage Plan

Part B

Q. 4 Great Circle/ Composite Great Circle

Q.5 Simultaneous/ Staggered observations

Q.6 Determine position line by celestial observations

Or

Determine position line by celestial observations

Part C

Q. 7 Star suitable for observation (magnitude)/ Star identification

Q.8 Twilights/ Kepler's Law/ Circumpolar bodies/ PZX Triangle.

Q.9 Projections (Gnomonic/ Mercator)

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.

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GOVERNMENT OF INDIA

PM Paper **Date: - 15th Jan-2025**

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. **5048** and Nautical Almanac for 1992. Deviation Card No.2, Variation 4^{O}E, ship's speed 12 kts. Height of eye of the observer 10m, if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Luminous Range Diagram as necessary.

PART – A

Q.1) Hook Head Lt. (50° 7.3'N, 006° 55.8'W) and Coninbeg Lt. Vessel (52° 2.4'N, 006° 39.3'W) were on reciprocal bearings. Vertical Sextant Angle of Hook Head Lt. was 16'. Tide was 1.5 meters below MHWS and I.E. of sextant was 1.6' off the arc. Find the vessel's position. From this position find the course to steer to arrive at a position 3 miles due south off Mine Head Lt. (51° 59.6'N, 007° 35.2'W). Current set in northerly direction @ 2 Knots and southerly wind was causing a leeway of 3°.

Q.2) On a course of 056° (T) at 0750 hrs. Bally Cotton Is. Lt. (51° 49.5'N, 007° 59'W) bore 314° (T). At 0820 hrs the same light bore 268° (T) and at 0905 hrs Mine Head Lt. House (51° 59.6'N, 007° 35.2'W) bore 354° (T). If current set 100° (T); find CMG, SMG, Rate of current and the ship's position at all three timings.

Q.3) Briefly comment on following in a Passage Plan:

(a) What are Tidal streams, how & where would you find the details of these?

(b) Route to be followed in restricted visibility.

(c) Navigation in heavy traffic/strong currents.

(d) Process of calling additional assistance for watchkeeping.

PART – B

Q.4) A vessel at Tokyo (35° 39' N 139° 47' E) intends to sail due east for one day (speed 16 knots, clocks advanced by one hour), then on a great circle track to San Francisco (37° 48' N 122° 24' W). Find the maximum latitude arrived during the Great Circle passage.

Q.5) Vessel steering a course of 135° T at 24 knots in DR Lat 47° 38'N, Long 030° 17' W, obtains the following observations worked using the above DR:

Time	Body	Azimuth	Intercept
1848	Venus	257° (T)	6.6' towards
1852	Sirius	140° (T)	2.5' away
1906	Dubhe	028° (T)	4.8' away

Find position of the vessel at 1900.

Q.6) A morning sight of the Sun taken at 0832 (Zone -4) on 11th October 1992 gave a position, through which the PL passed, of 39° 25' S, 062° 17' E. Using an estimated speed of 19 knots on a course of 261° (T), find the GMT and Zone Time of the Sun's meridian passage and the DR at this time.

PART – C

Q.7 On 14th October 1992, Star Vega bore 270° (T) to an observer in latitude 46° 30' N. At that instant, another star bore 000° (T) with true altitude 30° 12'. Find the SHA and Declination of that star.

Q.8 (a) What conditions must be satisfied for twilight to last all night?

(b) Calculate the limiting latitudes within which an observer would have nautical twilight throughout the night, when the Sun had a declination of 17° N.

Q.9 (a) Find by Mercator principle, the position arrived if the starting position was 36° 48'N 085° 53'W, course 241° (T), and distance sailed is 1897 miles.

(b) Describe Mercator Projection.

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GOVERNMENT OF INDIA

AM Paper **Date: - 15th Jan-2025**

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. **5047**, Nautical almanac 1992, Deviation card No. 3, Variation 2^{O} W, ship's speed 12 knots. Height of eye of the observer 12m if not mentioned in the questions.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous Range Diagrams are necessary.

PART – A

Q.1) a) A vessel at anchor off Foreland Point observes the following:

- Foreland Point Lt. (51° 15'N 003° 47'W) – 190° (G)
- Nash Point Lt. (51° 24'N 003° 33'W) – 070° (G)
- Scar weather Point Lt. vsl. (51°27'N 003°56'W) – 320° (G)

Find the vessel's position and the Gyro error.

b) From the above position, set Gyro course so as to have Helwick Lt. Vsl. (51°31'N 004° 25'W) right ahead when 6 miles off with current setting East at 3 knots. Find the steaming time when Helwick Lt. Vsl. will be right ahead? (Use 12 knots engine speed).

Q.2) A vessel Steering compass course observes the following bearings at 1900 hrs:

- Govan's Head Point (37) (51° 35.8'N, 004° 55.4'W) – 257° C
- Caldey Is. Lt. (51° 37.9'N, 004° 41.0'W) – 077° C
- St. Govan Lt. Vessel (51° 30.6'N, 004° 59.7'W) – 30° on starboard bow.

At 1930 hrs finds the same Lt. Vessel 60° on her starboard bow. Find the position of the vessel at 1900 hrs and the compass course steered by the vessel.

Q.3) In position at 1800 hrs a vessel observed Lundy Island South Lt. (51°09'N 004° 39'W) bearing 050° (T), distance 6 miles off. Find the true course to steer to bring the same abeam on port side at 1830 hrs. (Ship's speed 10 knots) From 1830 hrs. Position, find the Gyro Course (Error 2° High) and the engine speed required to reach Bideford Pilot Station (51° 05'N 004° 15'W) at 2030 hrs. Counteracting the current setting 045°(T) at 2 knots.

PART – B

Q.4) A vessel intends to steam a Great Circle track from 50° 04' N 005° 45' W to 47° 34' N 052° 40' W. Find the distance, initial course to set & position of the midpoint along the track.

Q.5) A vessel took two simultaneous observations on GMT 16th Jan 1992 23h 40m 02s. The first observation of Venus which was east of the observer's meridian gave sextant altitude of 19° 40.5'. The second observation of Moon which was South of the observer (Azimuth 180°) gave Sextant altitude of the upper limb 82° 11.8'. The index error of the sextant was 1.2' off the arc & the height of eye of observer 31 m. Find the position of the vessel.

Q.6) A vessel in DR 49° 30' S 069° 14' E took a star sight & obtained intercept of 9.5' towards bearing 056°. After this sight vessel steered 144° (T) for 35 miles and obtained another intercept of 8.2' towards and azimuth 324°. Find vessel's position at second observation if the DR used for calculating second observation was obtained by applying the run on ITP position.

PART – C

Q.7) In the southern hemisphere, the meridian altitude of a star above and below the pole was 63° 12' and 17° 46' respectively, both times bearing South. Find the latitude of observer and the declination of the star.

Q.8) On a certain day the Sun's RA was 05h 57m 04s when the GHA Aries was 343° 54.3'. If the Obliquity of the ecliptic was 23° 27' find the Sun's GP.

Q.9) (a) Explain Gnomonic chart with diagrams and its advantages and disadvantages.
(b) Write short note on Nautical scale.
(c) Write short note on Plan charts.

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GOVERNMENT OF INDIA

Date: - 8th Oct-2024 **PM Paper**

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. **5056** and Nautical Almanac for 1992. Deviation Card No.1, Variation 6^{O}W, ship's speed 12 kts. Height of eye of the observer 10m, if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Luminous Range Diagram as necessary.

PART – A

Q.1) The following bearings of Bill of Portland light (50° 30.8'N, 002° 27.4'W) were observed by a ship. At 1000 hrs 325°(T), at 1030 hrs; 355°(T) and at 1100 hrs, 025°(T). If in above duration she had steered a course of 258°T and current set N'ly. Find her course and speed made good and rate of the current experienced.

Q.2) At 1030 hrs, a ship observes the horizontal sextant angle between Hope's Noe (50° 274.8'N, 003° 29'W) and Berry Head (50° 24'N, 003° 29'W) to be 30°. She then steers a course of 200°(T) at a reduced speed of 10 Kts. At 1130 hrs, the range of Start Point (50° 13.5'N, 003° 38.8'W) was observed to be 10° on radar. Find the position of vessel at 1130 hrs and her course and speed made good, if current set 020°(T) @ 3 Kts.

Q.3) Plan a safe passage from Needles pilot boarding ground (50° 38'N, 001° 39'W) to Exmouth Pilots (50° 36'N, 003° 21.5'W). Way points / courses/ distances are to be shown on the chart as well as on the answer sheets.

PART – B

Q.4) Find the course and distance along a composite track from A in position 41° 00'S 168 00'W to B 55° 00'S 68° 00'W. Limiting latitude being 55° 00'S.

Q.5) Using DR of 12°20'N, 180°, simultaneous observation of two stars gave following results:

Star 'X': Azimuth 220°(T), observed Longitude 179°55'E.

Star 'Y': Azimuth 305°(T), intercept 3 miles towards.

Find the position of the vessel.

Q.6) i) On 4th May 1992 at ship in DR 35° 43.5'N, 144° 12.3'E, the sextant altitude of Suns LL was 46° 56.7' when the GMT showed 03d 23h 27m 18s. If IE was 1.2' off the arc and HE was 12.5m, find the direction of the PL and a position through which it passes using Intercept method. Draw a diagram in the plane of rational horizon.

ii) Without working out the sight, find what longitude will an observer get if the above sight was calculated using Long by chron method.

PART – C

Q.7 On 28th April 1992, in DR 30°25'N, 000°10'W, find the 1st and 2nd Magnitude Stars and Planes which are available for Ex-Meridian observations and the beginning of Nautical Twilight in the evening.

Q.8 a) Write short notes on Transverse Mercator Projection.

b) For a stationery observer, the amplitude of the setting Sun was W 15°S when the observer's latitude was 26°S. Find:

i) Declination of Sun

ii) Altitude of the sun when it crosses the observers prime vertical

Q.9 Construct a Mercator Chart covering an area between 02° N & 02° S and between 003° E & 002° W, so an appropriate scale at the equator.

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GOVERNMENT OF INDIA

AM Paper **Date: - 8th Oct-2024**

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. **5072**, Nautical almanac 1992, Deviation card No. 2, Variation 1^{O} W, ship's speed 12 knots. Height of eye of the observer 15m if not mentioned in the questions.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous Range Diagrams are necessary.

PART – A

Q.1) While steering a course of 092°(C). A vessel last sights Kullagrund White light (55°17'N 013°20'E) on the port beam when meteorological visibility was 2 miles only. Find the vessel's position. After 2 hrs of steaming observed position was 55°14.9'N 014°03.5'E. Find: a) Set and rate of current

b) Compass course to steer to pass Sandhammeren light (55°24'N 014°12'E) 3 miles on the port side.

c) time when Sandhammeren light will be first sighted. Assume visibility and current to be same throughout.

Q.2) A v/l steering a westerly course observes Utklippan Lt. (55° 57'N, 15° 41'E) at a bearing of 057°(T) and 8' off. After running 16 miles by engines on her course Hano Lt. Gp fl (56°01'N, 14°51'E) bore 328°(T) and after running another 8' by engines, it bore true north.

Find: a) Vessel's position at the time of final bearing

b) Course and speed made good c) Set and rate of current.

Q.3) At 1830 hrs, a vessel in DR 55°45'N 016°30'E took simultaneous observation of two stars, Star X brg 280°(T) intercept 2 miles away Star Y brg 230°(T) intercept 3 miles towards. Find the position of the vessel and from this position find the course to steer at 12 knots so that Olands Sodra Grund light will be right ahead when 10 miles off, contracting current setting 260° at 3.6 knots. What time would you expect the light to be right ahead. Later it so happened that light was right ahead 10 miles off at 1945. What was the actual current experienced by the vessel.

PART – B

Q.4) Calculate the distance along the composite great circle route from 43°20'S 146°30'E to 34°54'S 073°15'W so that the vessel does not south of 45°S. Also calculate the Great Circle distance.

Q.5) At 1130 while the GHA of sun was 154° W & Dec 20°N, its true altitude was 89°42' Sun approximately bore NNW from ship. Vessel then steamed for 6h at 12 kts, CO 22°T. Intercept of 2' towards & azimuth N80°E was obtained then. Find the position of ship at 2nd observation. The posn used for 2nd sight was 19°00'N 154°45'W.

Q.6) On 10th October 1992 at ship in DR Longitude 142°10'E, sextant altitude of Polaris was 41°10' at GMT 19h 41m 28s. At the same time sextant altitude of Denebola was 16°36'. H.E. 20m, I.E. Nil. Find the position of the vessel.

PART – C

Q.7) On 30th November 1992, PM in DR 45°33'(N), 91°15'(E), what stars of 1st and 2nd magnitude of planets will be within 45° of hour angle from the observer's meridian?

Q.8) a) State / explain the 1st and 2nd laws of Kepler's of planetary motion along with diagrams.

b) Find the sidereal period of Jupiter if the mean distance of Jupiter is 483.9 Million miles from sun, using 3rd law of Kepler.

Q.9) a) On a Mercator Chart, 1° of longitude is represented by 6cm. What is the natural scale in latitude 55°N?

b) By how many times is Venus brighter than Star Sirius on 23rd August 1992?

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GOVERNMENT OF INDIA

Date: - 11th July-2024 **PM Paper**

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. **5048** and Nautical Almanac for 1992. Deviation Card No.3, Variation 2^{O}W, ship's speed 12 kts. Height of eye of the observer 12m, if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Luminous Range Diagram as necessary.

PART – A

Q.1) A container vessel dropped Pilot at Cork Harbour Pilot station (51^{O} 45'N, 008^{O} 15'W) at 1000 hrs, plan a passage to joint East bound Traffic Lane (TSS) off Tuskar Rocks, taking into account tidal stream data at 'H', ship's speed 16 kts, HW at KOBH 0600 (Spring tide), ship's draft 12m, all navigational equipments are in working condition. Courses, way points, distances etc to be plotted on chart and same to be written in the answer script.

Q.2) A vessel steering 242^{O} (G) at 12 kts sees Williamstown Lt (51^{O}56.6'N, 007^{O} 50.5'W) AS FLR between 1924 and 2012 hrs. At 2200 hrs 'Cork racon' (51^{O} 42.9'N, 008^{O} 14.5'W) was abeam 8.6 miles off. At 2200 hrs she altered course to 180^{O}(G) and engine speed reduced to 9 kts. Find the position of the vessel at 1924 hrs and her estimated position of the vessel at 2300 hrs. Current remained same throughout GE:30(L).

Q.3) At 0400 hrs Ballyna courty Lt. Ho. (52^{O} 04.7'N, 007^{O} 33'W) bore 314^{O}(T), Radar distance 5 NM. Vessel then sailed on a certain course at a speed 10 kts with current setting 000^{O}(T) at 3 kts, southerly wind causing a Lee way of 5^{O}. At 0500 hrs Vessel altered course to 112^{O} (T) to pass Connin beg Lt. vessel (52^{O} 02.5'N, 006^{O} 39'W) bearing 356^{O}(T), distance 5 NM.

Find i) Course steered from 0400 hrs to 0500 hrs ii) Time when Connin beg Lt. Vsl will be abeam on her Port side. Current, wind and E, Spd remained same throughout.

PART – B

Q.4) Find the initial course, final course and GC distance form 75^{O} 45'N, 030^{O} 46'E to 40^{O} 00'N, 110^{O} 15'E.

Q.5) At 0300 hrs on a vessel steering a course of 334^{O}(T) at 15 knots, a Light-house in position 12^{O}48'N, 074^{O} 54'E, was observed to be bearing East, 40 miles off. At 0600 hrs, following observations were made:

Star Betelgeuse	Az 080^{O}(T)	Intercept 2'(T)
Polaris	Az 001^{O}(T)	Observed Latitude 13^{O} 40'N

Find the position of vessel at 0600 hrs.

Q.6) On 12th Spet'92 in DR Longitude 072^{O} 20'E, the sextant meridian altitude of star Aldebaran was 31^{O}10.2' bearing North of observer. If H.E. was 18m and I.E. 3.2' off the arc, find the latitude, direction of PL and the GMT of its meridian passage.

PART – C

Q.7) On 21st July'92, PM at ship in DR 20^{O}N 75^{O}E, which stars and planets of 1st & 2nd Magnitude within 20^{O} of the observer's meridian suitable for observation.

Q.8) i) Explain why duration of twilight with change of latitude.

ii) Write a short note on UTM projection.

Q.9) Find the distance between two points on a Mercator chart between Point 'A' in position 42^{O}N, 100^{O}E and Point 'B' in position 38^{O}N, 095^{O}E. The chart is made on a scale of 1:60000000 at Latitude 36^{O}N.

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GOVERNMENT OF INDIA

AM Paper **Date: - 11th July-2024**

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. 5047, Nautical almanac 1992, Deviation card No. 1, Variation 2^O W, ship's speed 12 knots. Height of eye of the observer 12m if not mentioned in the questions.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous Range Diagrams are necessary.

PART – A

Q.1) A vessel Steering a certain course observes following bearings at 1900 hrs.

Govan's Head Point (37) (51^O 35.8'N, 004^O 55.4'W) : 257^O(C)

Caldey Is Lt. (51^O 37.9'N, 004^O 41'W) : 077^O(C)

Same time i.e. at 1900 hrs St. Govan Lt. Vessel (51^O 30.6'N, 004^O 59.7'W) was observed 30^O on Starboard bow. At 1930 hrs finds the same Lt. vessel 60^O on her Starboard bow. Find the position of the vessel at 1900 hrs and course steered by the vessel. E Spd 12 kts.

Q.2) A vessel was at anchor in position 51^O 11.0'N, 004^O 49.4'W. At 2300 hrs, she picked up her anchor and sailed on a course 131^O(T). At 2320 hrs South Lundy Island Light was first sighted and at 2350 hrs North Lundy Island Light was just obscured. Find, CMG, SMG, Engine speed and position of the vessel at 2350 hrs, if current was setting Sw'ly at 3 kts throughout.

Q.3) A general cargo ship having a draft of 9.5m drops pilot at Bristol Pilot Grounds (51^O 21'N, 003^O 19'W) in gale force winds and is bound for Bideford Fairway (51^O 05'N, 004^O 16.4'W). Vessel is equipped with Radar, ARPA, AIS, GPS and Echo Sounder & Doppler Log. Plan a safe passage for the intended voyage. Vessel should be kept at least four miles away from the coast during the passage. Plot your courses on the chart, with clear marking of courses and distance and course alteration point for each leg of passage. Write the synopsis of passage planning in the answer sheet.

PART – B

Q.4) A vessel sails along the Great Circle Track in Northern Hemisphere changing her longitude by 33^O49'. Her initial course was 319^O22.8'(T) and her Final Course was 298^O49.7'(T).

Find: a. The Great Circle Distance she sailed.

b. The Latitudes of departure & arrival positions.

Q.5) Using DR of $12^{O}20'N$, 180^{O} simultaneous observations of two stars gave following results:

Star 'X' : Azimuth 220^{O}(T), Observed Longitude $179^{O}55'E$.

Star 'Y' : Azimuth 305^{O}(T), Intercept 3 miles towards.

Find the position of vessel.

Q.6) Compute the sextant altitude & find the LMT on 1st September 1992, of star ALDEBARAN, when it is on the observer's meridian, at DR $55^{O}18'N$, $142^{O}10'W$. Given: H.E. 13.3m, I.E. 0.6' off the arc.

PART – C

Q.7) In latitude $50^{O}S$, when declination of Sun is $10^{O}N$. Calculate the following:

a) L.A.T. of the Sunset b) Duration of Civil Twilight

Q.8) On 28th April 1992, in DR $30^{O}25'N$, $000^{O}10'W$, find the 1st and 2nd Magnitude Stars & Planets which are suitable for Ex Meridian observation at the beginning of Nautical-Twilight in the evening.

Q.9) a) With the help of a suitable sketch, explain what is a Transverse Mercator Projection, its properties and its usage.

b) What is the Conformal or Orthomorphic property of a Chart which is used for marine navigation?

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GOVERNMENT OF INDIA

Date: - 2nd April-2024 **Paper 2**

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. **5056** and Nautical Almanac for 1992. Deviation Card No.3, Variation as per chart, ship's speed 12 kts. Height of eye of the observer 10m, if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Luminous Range Diagram as necessary.

PART – A

Q.1) At 0200 hrs straight Pt. Lt. (50^O 36.6'N & 003^O 21.7'W) bore 300^O(T) when the vessel crossed 30 m contour. Find the ships position, from this position find the course to steer to pass bill of Portland Lt. (50^O 31'N, 002^O 27'W) 9' off port. Engine speed 12 kts, vessel experiencing a NE'ly wind causing a leeway of 5^O current setting 180^O(T) x 2 Kts.

Also find the time & position, when the vessel will pass bill of Portland light 9' off. Engine speed 9 kts.

Q.2) Vessel in position 50^O15'N 003^OW at 2000 hrs, find the course to steer to first sight Bill of Portland Lt right ahead counteracting a tidal stream running at D. At what time & position the above Lt will be first sighted. HW at Devenport at 2330 hrs at Spring tide. HE 9m, Met Visibility 2M, Engine speed 12 kts.

Q.3) Plan a passage from deep sea pilot station (50^O 25.2' N, 003^O 27'W) to port land Harbour (50^O 35' N, 002^O 26' W). Your vessel is fitted with Radar, GPS, Gyro, Echosounder. Courses, distances, Way points, no go areas etc to be clearly marked on chart and write on answer sheet. Draft of your vessel 12 mtrs maximum Engine speed 14 kts.

PART – B

Q.4) A vessel in position 35^O 18' N 110^O 35'E has to reach pilot boarding station located 25 miles south of a lighthouse in position 46^O 40'N 175^O 45'W so that at no time the latitude exceeds 46^O 15'N. Find the shortest steaming time at a speed of 15 kts.

Q.5) At 1800 hrs in DR 34^{O} 26'N 143^{O} 38'W a sight gave PL 040^{O} / 220^{O}. After running for one hour another DR was obtained by applying a course of 125^{O}T at 12 Kts. This DR was used to calculate another sight which gave T. Az 060^{O} and intercept 5' towards. Calculate the position of the ship at 1900 hrs.

Q.6) On 22nd Sept' 92 AM at ship in DR 46^{O} 17'S the sextant altitude of the Sun's LL was 29^{O} 25' at GMT 22d 19h 33m. IE 3.0' off the arc, HE 11m. The ship then steamed 300^{O}T for 45^{O} when the meridian altitude of the sun's LL was 43^{O} 57.9' North of the observer. Find the ship's position at the time of meridian altitude.

PART – C

Q.7) On 21st July'92, in DR 20^{O}N 075^{O}E, PM at ship, which stars and planets of 1st & 2nd magnitude within 20^{O} of the observer's meridian will be suitable for observation at the end of civil twilight.

Q.8) An unknown star rose bearing 123^{O}T and when bearing East had a true altitude 24^{O} 30'. Find the Lat and Decl.

Q.9) i) What is Gnomonic Projection? How do you transfer a Great Cricle track from Gnomonic chart to a Mercator Chart?

ii) What are the conditions necessary for the twilight to last the whole night.

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GOVERNMENT OF INDIA

Paper 1 **Date: - 2th April-2024**

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. 5072, Nautical almanac 1992, Deviation card No. 3, Variation 2^O W, ship's speed 12 knots. Height of eye of the observer 15m if not mentioned in the questions.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous Range Diagrams are necessary.

PART – A

Q.1) A vessel while steering a course of 232^O(T) observes the following bearings of Utklippan Lt. (55^O 57'N 015^O 42'E), 1900: 282^O(T), 1930: 311^O(T), 2015: 023^O(T). If the current is known to be setting 020^O(T), find the position of the vessel at 1900 and 2015 hrs. Also find the course and speed made good.

Q.2) While steering 349^O(T), SVANERE lighthouse (55^O 08'N 15^O 10'E) was sighted at 2000 hrs, the visibility was restricted to 5' only and the current was setting 278^O(T) x 3 knots. At 2100 hrs, due to failure of main engine vessel stopped instantaneously. At 2300 hrs, HAMMERODDE light (55^O 18'N 14^O 47'E) was sighted. If the current had been constant throughout, find the vessel's position at 2300 hrs.

Q.3) A vessel was South of Dueodde Lt Ho. (54^O 59.5'N 015^O 04.8'E) and echosounder showed 0m. The vessel is a deep draft tanker and has to pick up Pilot off Kullargrund Lt Ho (55^O 18'N 013^O 19.4'E) at designated Pilot stn. Plan your passage and describe various Navigational Publications/ Equipment you would use for this passage.

PART – B

Q.4) A vessel is to sail from 41^O 30'S 073^O 00'W to 41^O 20'S 174^O 54'E. Find the difference in distance if the vessel sails Rhumb line and if she sails along composite track with limiting latitude 50^OS.

Q.5) At 1530 ship's time on a vessel in DR position 15^{O} 20'S 179^{O} 50'W an observation of the sun's bearing 260^{O}T gave observed Long 179^{O} 55'W. The vessel then sailed on a course of 265^{O}T at 15 kts. At 1900Hrs an observation of Venus gave an intercept of 4' Away and azimuth of 165^{O}T. If observation of Venus was calculated using DR obtained by allowing run on DR latitude and observed longitude at 1530 hrs. Find ship's position at 1900 hrs.

Q.6) On 20th July 1992, in DR 32^{O} 12.5'N 095^{O} 30'W, the sextant meridian altitude of the Moon's UL was 61^{O} 58.7'. If IE was 2.1' off the arc & HE was 12m. Find Observer's latitude and GMT of Meridian passage.

PART – C

Q.7) On 21st July'92, PM at ship in DR 20^{O}N 75^{O}E, which stars and planets of 1st & 2nd magnitude within 20^{O} of the observer's meridian suitable for observation.

Q.8) Vessel in position 46^{O} 05'N 22^{O} 20'W observer's the true altitude of a body to be 34^{O} 31' when it is on the prime vertical west of the meridian. Calculate the GP of the body.

Q.9) i) Explain why duration of twilight varies with change of latitude.
ii) Write a short note on UTM projection.

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

GOVERNMENT OF INDIA

Date: - 12th Jan-2024 **Paper 2**

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. **5047** and Nautical Almanac for 1992. Deviation Card No.2, Variation as per chart, ship's speed as per question. Height of eye of the observer 12m, if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Luminous Range Diagram as necessary.

PART – A

Q.1) While steering 060^{O}(T) at 12 knots in meteorological visibility of 2NM, a vessel bound for Carmarthen Bay last sighted St. Gowan Lt. (51^{O} 30.5'N, 004^{O} 59.5'W) at 2200 Hrs. At 2245 Hrs/ Caldey Island Lt (51^{O} 38'N, 004^{O} 41'W) first became visible. The current was known to set 330^{O}(T) at 3 knots. Determine the ship's position at 2200 hrs and 2245 hrs.

Q.2) While steering 300^{O}(T) at 14 kts observed Caldey is Lt (51^{O} 38'N, 004^{O} 41'W) bore 340^{O}(T) at 1200 hrs. At 1250 hrs Old castle hd (65) Pt (51^{O} 38.2'N, 004^{O} 47'W) bore 000^{O}(T) and at 1310 hrs Stack Pole Hd Point (51^{O} 37'N, 004^{O} 53.6'W) bore 000^{O}(T) x 6.7'. Find the following:

i) Position of the vessel 1200 hrs ii) CMG, SMG iii) Set and Rate of current.

Q.3) A general cargo ship having a draft of 9.5m drops pilot at Bristol Pilot Grounds (51^{O} 21'N 003^{O} 19'W) in gale force winds and is bound for Bideford Fairway (51^{O} 21'N 004^{O} 16.4'W). Vessel is equipped with Radar, ARPA, AIS GPS and Echo Sounder & Doppler Log. Plan a safe passage for the intended voyage. Vessel should be kept at least four miles away from the coast during the passage. Plot your courses on the chart, with clear marking of course and distance and course alteration point for each leg of passage. Write the synopsis of passage planning in the answer sheet.

PART – B

Q.4) Find the final course and distance along the composite circle track from A in position 51^{O} 20'N 010^{O} 00'E to B in position 52^{O} 00'N 55^{O} 00'E, the limiting latitude being 53^{O}00'N.

Q.5) In DR position 60^{O} 41'N, 052^{O} 27'W the celestial observation of a heavenly body gave an intercept of 2.1' away from azimuth of 225^{O}(T). At the same time, an ex-mer alt gave an obs. lat of 60^{O} 36.2'N & an azimuth of 357^{O}(T). Find the position of the ship.

Q.6) From the following information regarding stellar observations, find the position at 1900. Ship's course and speed, 132^{O}T 25 knots. DR 48^{O}38.7'N, 30^{O}17.2'W (used in each calculation).

1	Time	1848	Venus	Az 258^{O}T	Int 6.7'T
2		1853	Sirius	141^{O}T	2.4'A
3		1905	Dubhe	027^{O}T	4.9'A

PART – C

Q.7) On 21st July 1992, in DR 20^{O}00'N, 075^{O}00'E, which stars and planets of first & second magnitude within 30^{O} (of hour angle) of the observer's meridian will be available for observation at the end of PM civil twilight?

Q.8) A stationary vessel makes the following observation of a STAR: when LHA = 270^{O}, altitude was 45^{O}. When at maximum Azimuth, altitude was 60^{O} and brg was 045^{O}(G). Find the obs. Lat. and declination of the STAR and the gyro error.

Q.9) Construct a Mercator chart covering 20^{O}N to 25^{O}N and 080^{O}E to 085^{O}E to a natural scale of 1:1000000 in Lat 22^{O}N.

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

GOVERNMENT OF INDIA

Paper 1 **Date: - 12th Jan-2024**

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. 5048, Nautical almanac 1992, Deviation card No. 3, Variation 2^{O} W, ship's speed 12 knots. Height of eye of the observer 12m if not mentioned in the questions.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous Range Diagrams are necessary.

PART – A

Q.1) A vessel at anchor South of YSTAD observed the following compass bearings: -

Sandhammaren (55^{O} 24'N, 014^{O} 40'E)	067^{O}C
Ystad (South) (55^{O} 25'N, 013^{O} 49'E)	010^{O}C
Abbekas (55^{O} 23'N, 013^{O} 36'E)	320^{O}C

Find the vessel's position and compass error.

Q.2) A vessel steering a course of 260^{O}T observed Olands Sodra Grund ltd. (56^{O} 04.3' N, 016^{O} 41'E) bearing 010^{O}T at 0400 hours. Again at 0500 hours, the same light bore 040^{O}T. At 0615 hours, Utklippan Lt. (55^{O} 57' N, 015^{O} 42' E) bore 351^{O}T if the current was setting 300^{O}T, find the following:

a) Position of the ship at 0400 hours and 0615 hours

b) Course and speed made good

c) Rate of the current

Q.3) A loaded VLCC has been ordered to anchor & await orders in position 52^{O} 09.9' N, 006^{O} 19.9' W in 44 meters depth of water. If she is presently located at 51^{O} 32'N, 006^{O} 07' W, plan in detail a passage appropriates to her loaded state, hours of darkness, present state of moderate visibility & southerly gale winds.

PART – B

Q.4) Find the initial course and distance by composite G.C. sailing from Lat 42^{O} 53' S, Long:- 147^{O} 20'E to Lat 52^{O} 43'S Long 072^{O} 43' W, with a limiting Lat 52^{O} 43' S. Find also the latitude where G.C. track cuts the Longitude 160^{O}E.

Q.5) At 1530 hrs ship's time on a vessel in DR position 15^{O} 20'S 179^{O} 50'W an observation of sun bearing 260^{O}T gave observed longitude 179^{O} 55'W. The vessel then sailed on a course of 265^{O}T at 15 kn. At 1900h an observation of Venus gave an intercept of 4' away and azimuth of 165^{O}T. If observation of Venus was calculated using DR obtained by allowing run on DR latitude and observed longitude at 1530 hrs. Find ship's position at 1900 hrs.

Q.6) On GMT 16th Jan 1992, 23h 39m 38s, an observer from a vessel observed two simultaneous observation as follows:-

i) True Altitude of Venus 19^{O} 37.8', East of the meridian.

ii) Sextant Altitude of Moon's UL 83^{O} 25.6', Azimuth South.

Find the position of the vessel at this time (I.E: 2.1' on the arc, HE = 12m).

PART – C

Q.7) For an observer the Sun had a GHA of 240^{O}38' and SHA 251^{O} 20' when it attained the altitude 069^{O} 30', bearing North. Find the position of the observer.

Q.8) a) In what latitude will one minute of the Longitude scale on a Mercator chart equal to 2.5 minutes of the Longitude scale.

b) If Magnitude of star 'X' is -2.5 and it is 3 times brighter than star 'Y'. Find the magnitude of star 'Y'.

Q.9) a) How to transfer a Great Circle track from a Gnomonic Chart to a Mercator Chart.

b) What are the conditions necessary for:

i) Twilight to last whole night ii) Night/ Darkness for 24 hrs.

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

GOVERNMENT OF INDIA

Date: - 4th Oct-2023 **Paper 2**

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. **5072** and Nautical Almanac for 1992. Deviation Card No.2, Variation 6^O ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Luminous Range Diagram as necessary.

PART – A

Q.1) At 2000 hrs., a vessel drops pilot at Simrishamn pilot station (55^O 33.5'N 014^O 24'E) and steers a course of 071^O(T) at 9 knots with the meteorological visibility being 5 miles. The vessel is to proceed to Karlsham pilot station (56^O 08'N 014^O 54'E). The Master decides to alter course when Simrishamn Lt. (Isp. WRG 6s) obscures (last seen). After altering course, she is to pass Hano Lt. {Gr. Fl.(3) 15s} in position 56^O 01'N 014^O 51'E 3 miles on the port side. If the current is known to be setting 120^O(T) at 2 knots, find the time and position when:

i) Vessel alters course towards Hano lt:

ii) Hano Lt. is sighted.

Q.2) A vessel steering course 258^O (T) observes UTKLIPPAN Lt. house (55^O 57'N 15^O 45'E) to bear 285^O(T) at 2100 hrs, 297^O(T) at 2120 hrs, and 034^O(T) at 2150 hrs. The current was estimated to set 304^O(T). Find the vessel's position at 2150 hrs, the course made good and the rate of current.

Q.3) A vessel at anchor South of YASTAD observed the following compass bearings:

Sandhammaren (55^O 24'N. 14^O 10'E)	067^OC
Yastad (South) (55^O 25'N. 13^O 49'E)	010^OC
Abbekas (55^O 23'N. 13^O 16'E)	320^OC

Find the vessel's position and compass error. From this position, plan a passage to reach the VTS off OLAND'S SODRA GRUND (56^O 04'N, 16^O 41'E) via KARLSHARMM (56^O 10'N, 14^O 52'E) where she has to go for discharging a small parcel of cargo.

PART – B

Q.4) A vessel sails from Port a located on the Greenwich meridian in a certain North latitude. After travelling a distance of 3000 miles along a perfect great circle track, she reaches another port B at the equator on a course of S 60^OW. Calculate the initial course and the longitude arrived.

Q.5) At 1530 ship's time on a vessel in DR 15^O 20'S 179^O 50'W an observation on the sun's bearing 260^OT gave observed Long 179^O 55'W. The vessel then sailed on a course of 265^OT at 15 Kts. At 1900 hrs an observation of Venus gave an intercept of 4' Away and azimuth 165^OT. If observed of Venus was

calculated using DR obtained by allowing run on DR Latitude and observed Long at 1530 Hrs. Find the ship's position at 19000 Hrs.

Q.6) On 17th Jan'92, AM at ship in DR 45^{O} 02'S 036^{O} 42'E, the sextant altitude of Jupiter near the meridian was 37^{O} 06.8' when the chron error 01m 06s slow showed 01h 26m 14s. H.E. 12m, I.E. 0.6' off the arc. Find the direction of the PL and the position through which it passes.

PART – C

Q.7) What stars and planets of magnitude 1 & 2 will cross the meridian of the observer in DR 60^{O}N 45^{O}W on 28th April'92 above the pole between 1700 Hrs & 1800 Hrs LMT.

Q.8) On 30th April '92 at GMT 03H 18M 00S a vessel in DR Posn. 30^{O}N 000^{O} 00' observer's a star brg. 270^{O} at altitude 40^{O}. Identify the star.

Q.9) i) What are the conditions necessary for the twilight to last the whole night, continuous daylight or continuous darkness.
ii) Write a short note on Gnomonic Projection.

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GOVERNMENT OF INDIA

Paper 1 **Date: - 4th Oct-2023**

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. 5056, Nautical almanac 1992, Deviation card No. 2, Variation 6^O ship's speed 12 knots and Height of eye of the observer 15m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous Range Diagrams are necessary.

PART – A

Q.1) At 0800 a vessel is in position with Bill of Portland bearing 330^O(T) distance 4 miles by radar. Find course to steer from 0800 hrs at 12 knots to pass Start point (50^O 13.3'N, 003^O 38.3'W) 6 miles off when closed. The current in the area is setting 300^O at 2 knots and wind is E'ly causing leeway of 2^O. Later at 1130 hrs it was found that Start point was abeam of vessel at distance of 5 miles. If leeway was correctly estimated find the actual current experienced by the vessel.

Q.2) While steering course 270^O(T) at 12 knots. Bill of Portland light bore 329^O, 000^O and 042^O at 2250 hrs, 2315 hrs and 2345 hrs respectively. If the current was setting at 3.5 knots, find:

i) SMG

ii) Position at 2250 hrs

iii) Position at 2345 hrs

iv) SET of current.

Q.3) At 2000 hrs in DR position 50^O 00'N, 002^O 00'W a star sight gave an intercept of 2' (towards) with an azimuth of 321^O(T) on a course of 266^O(T). The visibility reduced to 5 miles thereafter. Later on Eastern Channel Light Buoy (49^O 59'N, 002^O 29'W) was first sighted at 2100 hrs. Current is estimated to set at 151^O (T) x 1.5 knots. Find vessel's position at 2100 hrs. Current is estimated to set at 151^O (T) x 1.5 knots. Find vessel's position at 2100 hrs and also find CMG and SMG.

PART – B

Q.4) Observer X in position 33^O 24'S 142^O 24'E and observer Y in position 39^O 36'S 112^O 42'W move towards each other along a GC track. X moves at 13.5 knots and Y moves at 14.5 knots. Determine the position where they will meet.

Q.5) Find the position at 0630 hrs from the following information:

Ship's course 124^{O} Speed 16 knots, 0612 hrs Star X azimuth 152^{O} T Intercept 3.8 miles away. DR used 38^{O} 50'N 031^{O} 05'W. At 0630 hrs Star Y azimuth 073^{O}T intercept 1.7 miles towards DR used 38^{O} 50N 031^{O} 05'W.

Q.6) At 1130 while the GHA of the Sun was 154O 00' and Declination was 20O 00'N in true altitude was 89^{O} 42'. Sun approximately bore NNW from the ship. Vessel steamed for 6 hours at 12 knots course 220^{O}T. A star sight gave intercept 2' towards azimuth N 80^{O}E. The DR used for the second sight was 19^{O} 00'N 154^{O} 45'W. Find the ship's position at second observation.

PART – C

Q.7) a) Write the procedure for construction of Polar Gnomonic chart.

b) A Mercator chart is bounded by Parallels of Latitude 32^{O}S and 36^{O}S and meridians 124^{O}W and 128^{O}W has natural scale of 1:1,000,000 in Latitude 34^{O}S. Determine the latitude and longitude of intersection point of the diagonals and length (in mm) of diagonals.

Q.8) On 29th Nov 1992 at GMT 09h 42m 20s, ship position DR 35^{O} 30'S 067^{O} 20'W through a break in the cloud, observed the sextant altitude of a star bearing 317^{O}T to be 39^{O} 26.4'. If IE was 2.5' off the arc and HE was 12m identify the star?

Q.9) a) Star 'X' is observed to be 25 times brighter than star 'Y'. if the magnitude of star 'Y' is 2.4, calculate the magnitude of star 'X'. (13 Marks)

b) Calculate the duration of twilight for an observer in latitude 28^{O}15'S during the summer solstice. (12 Marks)

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GOVERNMENT OF INDIA

Date: - 11th July-2023 **Paper 2**

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. **5072** and Nautical Almanac for 1992. Deviation Card No.3, Variation 2^{O}W, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Luminous Range Diagram as necessary.

PART – A

Q.1) A vessel observes Christianso Island Main Light (55^{O} 19.2' N, 015^{O} 11.6'E) bear 270^{O}(T) x 5 miles off at 1930 hours. Find the course to steer to have Hano Light (56^{O} 00.8'N, 014^{O} 51'E) 4 points on port bow when it is 12 miles off. At 2130 hours while on this course at a speed of 14 knots the echo sounder recorded a sounding of 10m below keel (ship's draft even keel 8.5m, height of tide 1.5m). Find the set and rate of current.

Q.2) A vessel steering course 005^{O} (T) at 12 knots observes bearings of Dueodde light to be 224^{O}(C) and Svaneke light as 290^{O}(C) at 2200 hrs. The current in the area was setting 082^{O} (T) at 3 knots. After sailing for 35 minutes the compass bearings of Svaneke and Chritiano North Light were 226^{O}(C) and 324^{O}(C) respectively. Find CMG, SMG, position at 2200 hrs and 2235 hrs.

Q.3) A vessel steering 130^{O}(T) observes Kuala Grund Racon (55^{O} 18'N, 13^{O} 20'E) bearing 072^{O} (T) at 2100 hrs. At 2120 hrs the same light bore 044^{O}(T) and at 2150 hrs it bore 352^{O}(T). Find the vessel's position at 2150 hrs, the Course made good and the rate of current if current set 080^{O}(T).

PART – B

Q.4) A ship to sail along a composite track from 45^{O} 33'S, 054^{O} 47'E to 43^{O} 12'S, 134^{O} 56'E. The ship is not to proceed south of latitude 50^{O}S. Find the initial and final courses and total distance along the composite track.

Q.5) In D.R. position 44^{O} 45'N, 045^{O} 22'W at 0836 hrs on a course of 245^{O}T at 15 kts, following results was obtained from stellar observations:

i) Star X: 0724 hrs intercept 0.5 Towards, AZ 300^{O}T.

ii) Star Y: 0730 hrs intercept 2.2 Towards, AZ 261^{O}T

Find the ships position at 0730 hrs.

Q.6) From the following information, complete the sextant altitude to be set for an observation of Polaris: DR lat 37^{O}58'N, DR long 052^{O} 30'E, LHA Y 71^{O}53.9', Month January, HE 11.5m, IE 1'ON the arc.

PART – C

Q.7) On 5th May 1992, in DR longitude 111^{O} 09.6'E an observation of the Sun at meridian passage gave latitude 19^{O} 22.7'N. The vessel then sailed 86 miles on a course of 055^{O}(T) where through a break in the clouds a star was observed bearing 083^{O}(T) and sextant altitude was observed to be 44^{O} 25'. If IE 1.1' ON, HE 28m, and GMT 12h 34m 12s, identify the star.

Q.8) In north latitude, a star is observed to be on the Prime Vertical 4h 10m after passing the observer's meridian 2h 32m later it sets. Find the observer's latitude.

Q.9) a) With suitable sketches, explain the Conditions necessary for the following to occur:

i) Twilight to last whole night,

ii) Continuous day light,

iii) Heavenly Body to reach Observer's Zenith

b) Find the interval of time between successive transits of Venus over the same meridian on 5th March 1992.

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

GOVERNMENT OF INDIA

Paper 1 **Date: - 10th July-2023**

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. 5056 (Start Point to the needles), Nautical almanac 1992, Deviation card No. 2, Variation as per chart, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use luminous Range Diagrams are necessary.

PART – A

Q.1) At 2100 hrs, a ship observes the horizontal angle between Kingswear Light (50^O 21'N, 003^O 34'W) and Start point Lt. (50^O 13'N, 003^O 38'W) to be 50^O. It then steers a course of 210^O(T). At 2130 hrs, start point fixed Red Light was last visible. Find the ship's position at 2130 hrs, assuming no current.
From this position set course to have Channel Lt v/l (49^O 55'N, 002^O 55'W) right ahead when 9 miles off with current setting 030^O(T) at 3 Kts. At what time would the Channel Lt. v/l be sighted right ahead.

Q.2) At 0800 hrs, Anvil Pt. Light House was 7 miles off and 0906 hrs. Bill of Portland Light was 8 miles off. Vessel steered 260^O(T). Engine speed 9 Kts, during this interval. The current was setting 185^O(T) at one knot. Find:

a) Ship's position at 0800 hrs

b) Ship's position at 0906 hrs

c) Course made good by her in this period.

Q.3) Plan a safe passage from Needles pilot boarding ground (50^O 38'N, 001^O 39'W) to Exmouth Pilots (50^O 36'N, 003^O 21.5'W). Way point/ courses/ distances are to be shown on the chart as well as on the answer sheets.

PART – B

Q.4) Calculate the Initial Course, the Final Course & Distance along the composite track from 36^O 20'S, 139^O 40'S to 38^O 10'S, 120^O 00'W, with a limiting latitude of 44^O 30'S. Also, find the latitude where the track crosses the 180^O meridian.

Q.5) At 0600 h in DR 52^O 21'N, 027O 50'W an observation of Star A on the meridian gave the ship's latitude as 52^O 26.1'N. Another star B at 0605 h and third sight at 0610 of star C worked using original DR gave intercepts of 5.0' towards Az 045^O(T) and 3.0' towards Az 300^O(T) respectively. If the ship steering a Northerly Course at 12 kts. Find her position at 0600 h.

Q.6) On 30th Nov.1992, a vessel in DR longitude 170^{O} 20'E, observed the sextant meridian altitude of the star Canopus below the pole as 13^{O} 06'. If the I.E. of sextant was 3' on the arc and H.E. 12m, find:

a) The Latitude of observer

b) LMT of lower meridian passage of star.

PART – C

Q.7) On 29th November 1992, PM in DR 46^{O} 23' (N), 92^{O} 45' (E), what stars of 1st and 2nd magnitude or planets will be within 45^{O} of angle from the observer's meridian?

Q.8) A star rose bearing S 80^{O} E for an observer in latitude 20^{O} S. What will be its true altitude four Hours after rising?

Q.9) Describe:

a) Universal transverse Mercator

b) Mercator Projection

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GOVERNMENT OF INDIA

Date: - 6th April-2023

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. 5048 and Nautical Almanac for 1992.
4. Variation 7^O W; Deviation Card No: 2, Height of eye: 10m, ship's speed 10 knots if not mentioned in the question.
5. Positions of the landmarks are approximate and are for identification only.
6. Luminious Range Diagram may be provided if required.

SECTION – A

Q.1) While steering 285^OC Ballycotton Island light (51^O 49.5' N 007^O 59'W) was last sighted in visibility of 5 miles. H.E. = 8m. After one hour, in clear visibility, Roche's point lt. (51^O 47'N 008^O 15'W) changed from white to red, current setting 140^O T at 3 knots. Leeway due to Northerly wind was 4^O. Calculate course and speed made good and both positions.

Q.2) Own ship in position 51^O 30'N 007^O 00'W. Another ship is stopped in position 52^O 00'N 007^O 10'W and drifting. Current in the area is setting SE at 2 knots. Calculate compass course to steer, engine speed and course & speed made good of own ship to meet the other ship after four hours. Also calculate the meeting position.

Q.3) While navigating in St. George's channel TSS, an oil tanker with maximum draft of 18 m observes Tusker rock racon (52^O 12'N 006^O 12'W) bearing 250^O T x 4.4 miles at 2200 hrs. From this position, prepare a detailed plan for a safe passage to reach a position 6 miles due south of Old Head of Kinsale light. Courses have to be plotted with clear markings on the chart and relevant notes for the bridge team.

SECTION – B

Q.4) Find the initial course, final course and GC distance from 70^O 45'N, 030^O 46'E to 40^O 00'N, 110^O 15'E.

Q.5) At 0300 hrs, on a vessel steering a Course of 334^O(T) at 15 knots, a Light – House in position 12^O 48' N, 074^O 54' E, was observed to be bearing East, 40 miles off. At 0600 hrs, following observations were made:

Star Betelgeuse	Az 080^O (T)	Intercept 2^O(T)
Polaris	Az 001^O (T)	Observed Latitude 13^O 40' N

Find the position of vessels at 0600 hrs.

Q.6) On 12th Sept.'92 in DR Longitude 072^{O} 20'E, the sextant meridian altitude of star. Aldebaran was 31^{O} 10.2' bearing North of Observer. If H.E. was 18m and I.E. 3.2' off the arc, find the Latitude, Direction of PL and the GMT of its Meridian Passage.

SECTION – C

Q.7) On 16th Jan 1992 ship in DR 20^{O} N 075^{O}E, which stars of 1st and 2nd magnitude will be within 15^{O} of the observer's meridian. Which of them will be available for observation and which can be used for ex-m observation? The observation is to be made at the end of PM civil twilight.

Q.8) a) What conditions are necessary for a solar eclipse to occur?
b) Describe Kepler's third law.

Q.9) Find the distance between two points on a Mercator chart between Point 'A' in position 42^{O}N, 100^{O}E and point 'B' in position 38^{O}N, 095^{O}E. The chart is made on a Scale of 1:6000000 at Latitude 36^{O}N.

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GOVERNMENT OF INDIA

Date: - 6th April-2023 **Paper 1**

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. 5072 (Falsterbo to Oland). Nautical almanac 1992, Deviation card No. 1, Variation 2^O W, ship's speed 12 knots and Height of eye of the observer 12m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

PART – A

Q.1) At 1100 hours a vessel observes 'Svartgrund' buoy (55^O 14.2' N, 014^O 15.2'E) 3 miles to NE with her engines under repairs.

At 1300 hours the engines were started at a slow speed of 6 knots. Set course now to have 'Hammerode' Lt. Ho. (55^O 17.9' N, 014^O 46.6'E) right ahead when 4 miles away. When will this light house will be at right ahead? Current in this area is known to set north at 3 knots.

Q.2) A vessel anchored off Ystad observes the followings bearings:

Abbekas Lt. (56^O 23'N, 013^O 37'E) 298^O(C)

Ystad South Lt. (55^O 25'N, 013^O 49'E) 009^O(C)

Kasebarga Lt. (55^O 23'N, 014^O 04'E) 078^O(C)

Find the position of the ship and compass error if it was the same for all three observations. From this position, find the compass course to steer to pass Hammerodde light (55^O 18'N, 014^O 47'E) at a distance of 2 miles, countering a current setting 060^O(T) x 2 knots and a strong N'ly wind causing a leeway of 5^O.

Q.3) Your ship, maximum speed 16 knots, a large tanker in ballast, max draft 11m, is equipped with state of the art bridge equipment in good working order, is scheduled to reach off 'Falsterbo' Racon (55^O 18.5'N, 012^O 39.6'E), after dropping her pilot in position 56^O 07.8' N, 014^O 53.0'E on completion of the dry docking.

Make a passage plan if visibility is moderate & southerly gales with rains is the prevailing weather.

PART – B

Q.4) A vessel at Tokyo (35^O 39'N 139^O 47'E) intends to sail due east for one day (speed 16 knots, clocks advanced by one hour), then on a great circle track to San Francisco (37^O 48'N 122^O 24'W). Find the maximum latitude arrived during the Great Circle passage.

Q.5) In DR 170^{O} 20'E on 30th Nov 1992, the sextant meridian altitude of star Canopus below the pole was observed to be 13^{O}06'. H.E. 12m, IE 3' on the arc.
Calculate the: a) Latitude of observer
b) L.M.T. of lower meridian passage of Canopus.

Q.6) A morning sight of the Sun taken at 0832 (zone -4) on 11th October 1992 gave a position, through which the PL passed of 39^{O} 25'S, 62^{O} 17'E. Using an estimated speed of 19 knots on a course of 261^{O}(T), find the GMT and Zone time of the Sun's meridian passage and the DR at this time.

PART – C

Q.7) On 29th November 1992, at ship in DR 25^{O} 30'S 107^{O} 20'W, through a break in the cloud, Sextant altitude of a star bearing 276^{O}(G) error 2^{O}(L) was found to be 35^{O} 05', at GMT 29d 11h 29m 20s. If IE was 2.5' off the arc and HE was 12m, identify the star.

Q.8) a) Explain why, a Sidereal Day is about 4 minutes shorter than a Solar Day?
b) Find the latitude in which the period of night is twice the period of daylight when the Sun's declination is 22^{O} 40'S.

Q.9) A Mercator chart has a scale of 1:3000000 at latitude 36^{O}S.
Calculate the length of Rhumb Line, millimeters, on this chart from position 32^{O}S, 179^{O}55'E to position 37^{O}S, 175^{O}15'W.

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GOVERNMENT OF INDIA

Date: - 4th Jan-2023

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. Use Chart No. 5056 (Start point to The Needles). Deviation Card No. 2; HE 10m; Engine Speed 12 knots if not mentioned in the questions.
2. Luminous range diagram may be provided if necessary.
3. Use Admiralty Tide Tables for 1992.
4. Positions of landmarks are approximate and are to be used for identification only.
5. Attempt all questions in Part A and any two in Part B.

PART – A

Q.1) A vessel steering 084^{O}C allowing for a current setting 234^{O}T at 2.4knots observed Berry Head Lt. (50^{O} 24'N 003^{O} 29'W) bearing 348^{O}C and Start Pt. Lt. (50^{O} 13'N 003^{O} 38'W) bearing 245^{O}C. Find the vessel's positions and estimate the relative bearing and distance off Bill of Portland Lt. (50^{O} 30.8'N, 002^{O} 27.4'W) on first sighting. Meteorological visibility is estimated to be 5 miles.

Q.2) At 0830 hrs, Anvil Pt. Light House (50^{O} 35.5'N, 001^{O} 57.6'W) was 7 miles off and at 0936 hrs. Bill of Portland Light was 8 miles off. Vessel steered a course of 260^{O} (T) during this interval and the engine speed was 9 Knots during this interval. The current was setting 185^{O}(T) at 1 knot. Find:

a) Ship's position at 0830 hrs

b) Ship's position at 0936 hrs.

c) Course made good by her in this period.

Q.3) Plan a passage from Needles Channel Pilot stn to 5nm East of Start Point, considering the ship's Draft to be 15m & using the Traffic Separation Scheme.

PART – B

Q.4) Find the Initial & Final course and distance along the composite track from 36^{O} 50'S, 13^{O} 40'W to 44^{O} 40'S, 146^{O} 12'E. The track is not to exceed latitude 51^{O}S.

Q.5) Using DR of 40^{O}S, 120^{O}E, three stellar observations gave following results:

Star 'A': Azimuth 270^{O}(T), Intercept 2' Away;

Star 'B': Azimuth 060^{O}(T), Intercept 2' Towards;

Star 'C': Azimuth 350^{O}(T), Intercept 3' Away.

Find the position of vessel if it is assumed that same error is equally applicable to all three observations / calculations.

Q.6) At about Noon on 16th June 1992, a sight of Sun south of the Observer gave True Altitude 89° 48.8', at GMT 16d 13h 14m 48s. The vessel then steered 342°(T) for 34 miles when a point of land in position 24° 34'N, 018° 27'W was sighted bearing 034°(T). Find the position of the vessel at the time of the second observation.

PART – C

Q.7) On 1st March'92 in Lat 30°N, 75° 30'E. Find the 2nd Magnitude stars which will cross 20° of observer's meridian and suitable for observation at the beginning of civil twilight.

Q.8) a) Explain why, a Sidereal Day is about 4 minutes shorter than a Solar Day?
b) Find the latitude in which the period of night is twice the period of daylight when the Sun's declination is 22° 40'S.

Q.9) a) Explain Gnomonic Chart with diagrams and its advantages & disadvantages.
b) Write a short note on Nautical Scale.
c) Write a short note on Plan Charts.

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GOVERNMENT OF INDIA

Date: - 2nd Nov-2022

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any 2 questions from Section C.
2. All questions carry equal marks (25).
3. Use Chart No.5072, Nautical Almanac 1992, Deviation card no. 2, Variation: As per chart, ship's speed 12 knots Height of eye of the observer 10m if not mentioned in question.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Luminous Range Diagram as necessary.

PART – A

Q.1) A v/l steering a westerly course observes Utklippan Lt. (55^O 57' N, 15^O 41'E) at a bearing of 057^O(T) and 8' off. After running 16 miles by engines on her course Hano Lt. Gp fl 3 (56^O 01'N, 14^O 51'E) bore 328^O (T) and after running another 8 by engines, it bore true north. Find: a) Vessel's position at the time of final bearing? b) Course and Speed made good c) Set and Rate of current.

Q.2) A vessel steering 130^O(T) observes Kuala Grund Racon (55^O 18'N, 13^O 20'E) bearing 072^O(T) at 2100 hrs. At 2120 hrs the same light bore 044^O(T) and at 2150 hrs it bore 352^O(T). Find the vessel's position at 2150 hrs, the course made good and the rate of current if current set 080^O(T).

Q.3) List five reasons for planning a passage.
Discuss precautions during a) Landfall b) Waiting at an anchorage.

PART – B

Q.4) A vessel intending to sail on a Great Circle Track from position Lat 42^O 24' S, Long 147^O 41'E to position Lat 52^O 25'S, Long: 072^O 27' W decides to make a composite sailing limiting the maximum latitude to 52^O 25'S. Calculate the difference in the distance that the vessel has to steam.

Q.5) At 1750 hrs a star sight gave an intercept of 5.1' towards & azimuth 133^O(T). At 1812 hrs another sight gave azimuth 051(T) and intercept 1.9' away. Both the intercepts were calculated using 1800 DR position 21^O 12'S, 31^O 13'W. Find the position of the vessel at 1800 hrs if the vessel was steaming a course of 298^O(T) at 20 kts.

Q.6) On 28th April 1992, AM at ship in DR 10^{O} 04'S, 128^{O} 01'w, the sextant altitude of MOON's UL was 47^{O} 53' at 14h 33m 32s GMT. If HE was 22m and IE was 4.8' on the arc. Find the direction of PL and a position through which it this P/L will pass.

Q.7) At the end of PM civil twilight on 16th June 1992, find out the stars and planets of First & Second magnitude while will be within 15^{O} of the observer's meridian.
Also find which of them will be available for observation. The DR position of the observer is 20^{O} 10'N, 075^{O} 15'E.

Q.8) a) Explain Keplers law of planetary motion.
b) With suitable sketch explain various types of eclipses.

Q.9) a) Explain Gnomonic Chart with diagrams and its advantages & disadvantages.
b) Write a short note on Natural Scale.
c) Write a short note on Plan Charts.

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GOVERNMENT OF INDIA

Date: - 15th Sept-2022

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any 2 questions from Section C.
2. All questions carry equal marks (25).
3. Use Chart No.5056, Nautical Almanac 1992.
4. Variation: As per chart, Deviation Card No. 2, Height of eye: 12m, ship's speed 12 knots if not mentioned in question.
5. **Positions of landmarks are approximate and are for identification only.**
6. Luminous Range Diagram may be provided if required.

SECTION – A

Q.1) While steering a course of 275^{O} (T) at 2000 hours Bill of Portland Light (50^{O} 30.8' N 02^{O} 27' W) bore 000^{O} (T), 5 miles off. At 2030 hrs it bore 045^{O} (T), 7 miles off. Find the vessel's EP at 2100 hrs. At 2100 hrs the vessel was stopped for 1.5 hrs for main engine repairs. From 2230 hrs position, find the compass course to steer to reach Exmouth Pilot Station (50^{O} 36'N 003^{O} 22'W) assuming the wind and current remain same throughout. Given: N'ly wind, Leeway 3^{O}.

Q.2) a) At 0600 hrs, Start Point Lt. (50^{O} 13.2'N 03^{O} 38.7'W) was 5 miles off on the radar and at 0700 hrs. Berry Head Lt. (50^{O} 23.9'N 03^{O} 28.8'W) was 5 miles off on the radar. During this period if the vessel made good a course of 025^{O}(T) and the current was setting 336^{O}(T) at 3 knots, find the true course steered and the vessel's position at 0600 hrs and 0700 hrs.

b) From 0700 hrs position find the compass course to steer and adjust the engine speed so as to arrive Exmouth pilot station (50^{O} 36'N 03^{O} 22' W) at 0800 hrs if the current set and rate remains the same throughout.

Q.3) Plan passage from Needles Channel pilot station to 5NM east of Start Point, considering the ship's draft to be 15 m and using traffic separation scheme.

SECTION – B

Q.4) Find the Initial & Final course and distance along the composite track from 36^{O} 50'S, 13^{O} 40'W to 44^{O} 40'S, 146^{O} 12'E. The track is not to exceed latitude 51^{O}S.

Q.5) Using DR of 40^{O}S, 120^{O}E, three stellar observations gave following results:

Star 'A': Azimuth 270^{O}(T), Intercept 2' Away,
Star 'B': Azimuth 060^{O}(T), Intercept 2' Towards,
Star 'C': Azimuth 350^{O}(T), Intercept 3' Away.

Find the position of vessel if it is assumed that same error is error is equally applicable to all three observations / calculations.

Q.6) On 1st May'92, PM at Ship, in DR 19^{O} 54' S, 179^{O} 58'W, the sextant altitude of Jupiter was 52^{O} 38.5' at GMT 02d 06h 20m 42s. If I.E. was 0.2' off the Arc and HE 17m, find the Observed Longitude and direction of PL.

SECTION – C

Q.7) On 1st March '92 in Lat 30^{O}N, 75^{O} 30'E. Find the 2nd Magnitude stars which will cross 20^{O} of observer's meridian and suitable for observation at the beginning of civil twilight.

Q.8) a) What are the most suitable times for making AM and PM Stellar Observations? Explain with suitable sketches.
b) The rising sun had amplitude of E30^{O}N, when on prime vertical its true altitude was 48^{O}. Calculate the observer's latitude.

Q.9) With suitable diagram, explain in details the characteristics of UTM Coordinate System. Where is this projection used?

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GOVERNMENT OF INDIA

Date: - 4th Aug-2022

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any 2 questions from Section C.
2. All questions carry equal marks.
3. Use Chart No.5047, Nautical Almanac 1992. Deviation Card No. 3, Variation 6^{O}W, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use luminous range diagram as necessary.

Part – A

Q.1) At 1600 hr, while steering 031^{O}C, Lundy Island South lt. (51^{O} 10'N 004^{O} 39'W) bore 353^{O}C. At 1620 hrs, it bore 285^{O}C and at 1720 hrs. Bull point lt. (51^{O} 12'N 004^{O} 12'W) bore 126^{O}C. Current set 250^{O}T. Calculate the three positions. CMG, SMG and rate of current.

Q.2) At 0400 hrs, ship is 8.5 miles north of Lundy Island North lt. (51^{O} 12'N 004^{O} 40.5'W). Calculate compass Course to steer and ETA Bristol pilot station (51^{O} 21'N 003^{O} 19'W). Use spring range tidal information given on the chart for high water at Avonmouth at 1000 hrs.

Q.3) Foreland point lt. bore 157^{O}G at 5 miles and Nash point lt. is 12 miles off. From this position calculate Gyro CTS to first sight Helwick. lt. v/l 30^{O} on starboard bow in visibility of 2 miles.

PART – B

Q.4) A vessel is to sail from position 41^{O} 30'S 073^{O} 00'W to 41^{O} 20'S 174^{O} 54'E. Find the difference in distance if the vessel sails Rhumb line and if she sails along composite track with limiting latitude 50^{O}S.

Q.5) On 29th November 1992 at GMT 06H 16M 00S. The true altitude of Sun was 89^{O} 26'. The vessel was on a course of 270^{O}(T) at speed of 22.5 knots. Exactly four minutes later, the true altitude of the Sun was again 89^{O} 26'. Find the position of vessel at the time of second observation if the Sun passed south of observer at the time of meridian passage.

Q.6) On the morning of 1st Dec 1992 in long 065^{O} 34'E, the sextant altitude of the polestar was 23^{O} 01', at 01h 00m 24s chronometer time. (Error 1m 10s slow). If IE was 1.2' off the arc and HE 17m, find the direction of the PL and the position through which it passes.

PART – C

Q.7) On 20th January 1992, at the end of PM Civil Twilight in DR 30^{O} N, 75^{O}E:
a) List Planets and stars of magnitude 1 & 2 which are within 30^{O} of observer's meridian.
b) Which of these are suitable for ex-meridian observation?

Q.8) a) What effect has the Equation of Time on the length of forenoon and afternoon?
b) Discuss the Calendar in use at present.

Q.9) a) Under what conditions would Venus be visible before sunrise? Explain why Venus cannot be seen at midnight in navigable latitudes.
b) What do you understand by the terms Apogee and Perigee?

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GOVERNMENT OF INDIA

Date: - 12th July-2022

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any 2 questions from Section C.
2. All questions carry equal marks.
3. Use Chart No.5056, Nautical Almanac 1992. Deviation Card No. 1, Variation 6^{O}W, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use luminous range diagram as necessary.

Part – A

Q.1) The following bearings of Bill of Portland light (50^{O} 30.8' N, 002^{O} 27.4' W) were observed by a ship. At 1000 hrs.: 325^{O}(T) at 1030 hrs.: 355^{O} (T) and at 1100 hrs.: 025^{O} (T). If in above duration she had steered a course of 258^{O}(T) and current set N'ly. Find her course and speed made good and rate of the current experienced.

Q.2) At 1030 hrs, a ship observes the horizontal sextant angle between Hope's Nose (50^{O} 274.8'N, 003^{O} 29'W) and Berry Head (50^{O} 24'N, 003^{O} 29'W) to be 30^{O}. She then steers a course of 200^{O}(T) at a reduced speed of 10 Kts. At 1130 hrs, the range of Start Point (50^{O} 13.5'N, 003^{O} 38.8'W) was observed to be 10' on radar. Find the position of vessel at 1130 hrs and her course and speed made good, if current set 020^{O} (T) @ 3 Kts.

Q.3) Plan a safe passage from Needles pilot heading ground (50^{O} 38'N, 001^{O} 39'W) to Exmouth Pilots (50^{O} 36'N, 003^{O} 21.5'W). Way points Courses distances are to be shown on the chart as well as on the answer sheet.

PART – B

Q.4) Find the course and distance along a composite track from A in position 41^{O} 00'S 168^{O} 00'W to B 55^{O} 00'S 68^{O} 00'W. Limiting latitude being 55^{O} 00'S.

Q.5) Using DR of 12^{O} 20' N, 180^{O} simultaneous observation of two stars gave following results?

Star 'X': Azimuth 220^{O}(T), Observed Longitude 179^{O} 55'E.

Star 'Y': Azimuth 305^{O}(T), Intercept 3 Miles Towards.

Find the position of vessel.

Q.6) i) On 4th May 1992, at ship in DR 35^{O} 43.5'N, 144^{O} 12.3'E, the sextant altitude of Suns LL was 46^{O} 56.7' when the GMT showed 03d 23h 27m 18s. If IE was 1.2' off the arc and HE was 12.5m, find the direction of the PL and a position through which it passes using Intercept method. Draw a diagram in the plane of rational horizon.

ii) Without working out the sight, find what longitude will an observer get if the above sight was calculated using Long by Chron method.

PART – C

Q.7) On 28th April 1992, in DR 30^{O} 25'N, 000^{O} 10'W, find the 1st and 2nd Magnitude Stars and Planets which are suitable for Ex-Meridian observations at the beginning of Nautical Twilight in the evening.

Q.8) a) Write short notes on Transverse Mercator Projection.

b) For a stationery observer, the amplitude of the setting Sun was W 15^{O}S when the observer's latitude was 26^{O}S.

Find: i) Declination of Sun

ii) Altitude of the sun when it crosses the observers prime vertical.

Q.9) Construct a Mercator Chart covering an area between 02^{O}N & 02^{O}S and between 003^{O}E & 002^{O}W, to an appropriate scale at the equator.

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GOVERNMENT OF INDIA

Date: - 2nd June-2022

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any 2 questions from Section C.
2. All questions carry equal marks.
3. Use Chart No.5047, Nautical Almanac 1992. Deviation Card No. 2, Variation as per chart, ship's speed 16 knots and Height of eye of the observer 10 m if not mentioned in the question.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use luminous range diagram as necessary.

Part – A

Q.1) A navigator on the bridge (HE 17m) of a vessel steering a course of 055^O (T) at 14 knots by engines observes Lundy Island South Lt. (51^O 09' N, 004^O 39' W) for the first time at 2130 hours, meteorological visibility was 5 miles & was last seen at 2206 hours. If the current was setting 350^O(T) at 4 knots, find:

a) Both positions of the vessel. b) Course & speed made good.

Q.2) Steering 100^O(T) at 14 knots, a vessel at 1416 hours, observes Bull Pt. Lt. Ho. (51^O 12'N 004^O 12'W) 30^O on starboard bow. This angle had double in 27 minutes. At 1510 hours this light house was abeam. Current is known to set 330^O(T). Find the time, bearing & distance from Scarweather Lt. V/l. (51^O 26.8'N, 003^O 56.2'W) when the Bull point light house would dip if HE is 6m.

Q.3) A vessel completes loading of iron ore from a VLOC in trans-shipment and is waiting for orders in position 51^O 36.6' N, 004^O 49.5' W. She received orders at 1500 hours to immediately proceed to Bristol pilot station. (51^O 20.9'N, 003^O 19.1'W).

What route would you recommend for this vessel with 12m draft and seagoing speed of 10 knots if the visibility is poor due heavy rain & strong southerly gales are prevailing. This ship has all the modern navigational equipment.

Plot your recommended courses & alteration points on the chart and record details in the answer script, also include all plot your recommended courses & alteration points on the chart and record details in the answer script, also include all details as you would do it for your own vessel.

PART – B

Q.4) A vessel sails along Great Circle Track from 20^{O} 46'N, 037^{O} 40'W to 36^{O} 30' N, 052^{O} 50'E. Calculate her course & her position when she had 1000 miles distance to go.

Q.5) On 1st May 1992, in DR latitude 15^{O} 46' S, 064^{O} 12'E as simultaneously observation of three starts at 0545 hrs gave the following results:

Capella	Az 023^{O}(T)	intercept: 4.2M Towards
Canopus	Az 147^{O}(T)	intercept: 5.2M Away.
Fomalhaut	Az 244^{O}(T)	intercept: 0.8M away.

Find the position of the ship at 0545 Hrs.

Q.6) On 27th Feb. 1992, AM at ship in DR 38^{O} 40' S, 153^{O} 21' W, the sextant altitude of the MOON's UL was 66^{O} 26' at 16^{h} 40^{m} 32^{s} GMT. If HE was 18m and IE was 1.9' on the arc. Find the co-ordinates of the ITP and the direction of the PL.

PART – C

Q.7) a) Star 'X' has magnitude of -1 & star 'Y' has magnitude of 0 (zero). Which of the two is brighter and by how many times?

b) What do you understand by the magnitude of a heavenly body? How is the magnitude of a star useful to a navigator?

Q.8) a) Explain Keplers law of planetary motion.

b) With suitable sketch explain various types of eclipses.

Q.9) a) Write short note on Gnomonic projection.

b) Find by Mercator principle, the position arrived if the starting position was 36^{O} 48'N, 085^{O} 53'W, course 241^{O}(T) and distance sailed is 1897 miles.

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GOVERNMENT OF INDIA

Date: - 5th May-2022

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any 2 questions from Section C.
2. All questions carry equal marks.
3. Use Chart No.5048: (Ireland – South Coast – Old Head of Kinsale to Tuskar Rock), Nautical Almanac 1992, Deviation card No. 4, Variation 7^O Ship's speed 10 knots and Height of eye of the observer 10m if not mentioned in the questions.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use luminous range diagram as necessary.

Part – A

Q.1) Hook Head Lt. (50^O 7.3'N, 006^O 55.8'W) and Coninbeg Lt. Vessel (52^O 2.4'N, 006^O 39.3'W) were on reciprocal bearings. Vertical Sextant Angle of Hook Head Lt. was 16'. Tide was 1.5 meters below MHWS and I.E. of sextant was 1.6' off the arc. Find the vessel's position. From this position find the course to steer to arrive at a position 3 miles due south off Mine Head Lt. (51^O 59.6'N, 007^O 35.2'W). Current set in northerly direction @ 2 Knots and southerly wind was causing a leeway of 3^O.

Q.2) At 0812 hours, **'Hook Head' Lt. Ho.** (52^O 07.4'N, 006^O 55.8'W) bore 292^O(C) & **'Coningbeg' Lt. V/l.** (52^O 02.4'N, 006^O 39.4'W) bore 170^O (C) when she was on 182^O (T) at 9 knots in SE'ly gales through current setting 250^O(T) at 3 knots.
Later, maintaining same course & speed **'Hook Head' Lt. Ho.** Dipped at 1014 hours. Find the compass error & position of the ship at both times. (HE 12 m & Leeway is 8^O).

Q.3) a) Passage planning uses ship's resources by way of time, extra workload, efforts, checks record keeping, compliance, monitoring etc. Why is it still worth it? Justify.
b) Your ship (A), maximum speed 16 knots, has to catch-up with another vessel (B) that is steering a course of 216^O(T) at 9 knots. Set your course to rendezvous 'B' if she lies 102 miles from 'A' in 334^O(T) direction. How long will it take you to reach her?

PART – B

Q.4) A vessel at Tokyo (35^O 39'N, 139^O 47'E) intends to sail due east for one day (speed 16 knots, clocks advanced by one hour), thence on a great circle track to San Francisco (37^O 48'N, 122^O 24'W). Find the maximum latitude arrived during the Great Circle Passage.

Q.5) Vessel steering a course of 135^OT at 24 knots in DR Lat 47^O 38'N, Long 030^O 17'W, obtain the following observations worked using the above DR.

Time	Body	Azimuth	Intercept
1848	Venus	257^O(T)	6.6' towards
1852	Sirius	140^O(T)	2.5' away
1906	Dubhe	028^O(T)	4.8' away.

Find position of the vessel at 1900.

Q.6) A morning sight of the Sun taken at 0832 (Zone-4) on 11th October 1992 gave a position, through which the PL passed, of 39^O 25'S, 62^O 17'E. Using an estimated speed of 19 knots on a course of 261^O(T), find the GMT and Zone Time of the Sun's meridian passage and the DR at this time.

PART – C

Q.7) On 29th November 1992, at ship in DR 25^O 30'S 107^O 20'W, through a break in the cloud sextant altitude of a star bearing 276^O(G) error 2^O(L) was found to be 35^O 05', at GMT 29d 11h 29m 20s. If IE was 2.5' off the arc and HE was 12m, identify the star.

Q.8) a) Explain why, a Sidereal Day is about 4 minutes shorter than a Solar Day?

b) Find the latitude in which the period of night is twice the period of daylight when the Sun's declination is 22^O40'S.

Q.9) a) A Mercator chart is to be made to a scale of 1/1000,000 in lat 60^OS. Calculate the distance on that chart between each meridian and each parallel of latitude for the area 29^OS to 31^OS and 80^OE to 82^OE.

b) If the orbital period of planet Mercury is 88 days, calculate the distance between Mercury and Earth when Mercury is in inferior conjunction with the Sun. The distance between Earth and Sun is 93 x 10^6 miles.

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GOVERNMENT OF INDIA

Date: - 11th March-2022

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No.5056 (Ireland – South Coast – Old Head of Kinsale to Tuskar Rock), Nautical Almanac 1992, Deviation Card No. 4, Variation 7^O, ship's speed 10 knots and height of eye of the observer 10m, if not mentioned in the question.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use luminous range diagram as necessary.

Part – A

Q.1) Steering 170^O(T) at 14 knots, a vessel drops her pilot while 6 miles away from **'Berry Head'** Lt. (50^O 24.0'N 003^O 28.9' W) at 2151 hours. At 2230 hours, **'Start Pt'** Lt. (50^O 13.3'N 003^O 38.5' W) bore 240^O (T). Find the position of the ship at 2230 hours, CMG & SMG. ***[4 Knots current sets in 060^O (T) direction in this area].***

Q.2) At 1030 hours, while steering 075^O(T) at 12 knots through current setting 255^O (T) at 4 knots, a vessel leaves **'E Channel Racon'** (49^O 59.0'N 002^O 29.0'W) four points on port quarter at 4 miles.

At 1130 hours she increases her speed to 16 knots & sets course to have **'Anvil Point'** Lt. Ho. (50^O 35.5'N 001^O 57.5' W) right ahead when 12 miles away.

Find:

a) What course is she steering after 1130 hours?

b) Time & position when **Anvil Point** light house would be right ahead.

Q.3) a) List the sources/ publications to gather information prior to making an 'across ocean' passage plan. Also list the contents of any **ONE** such publication.

b) What precautions are required to be observed while navigating in any TSS, especially for a large ship such as a VLCC?

PART – B

Q.4) A vessel intending to sail on a great circle track from 39^O 20'S 110^O 10'E to 44^O 30'S 046^O 20'W decides to make a composite to sailing with a limiting latitude of 62^OS. Find the extra distance sailed.

Q.5) In DR lat $17^{O}41'S$ long 179^{O} 50'E an intercept of 12.2' (Towards) at an Azimuth of 081^{O}(T) was obtained by stellar observation. Vessel then steered a course of 124^{O}(T) for a distance of 80 miles through a current setting 221^{O}(T) drift 12 miles, when the meridian altitude of Sun gave observed latitude $018^{O}40'S$. Find the position of the vessel at the time of second observation.

Q.6) A morning sight of the Sun taken at 0901 (Zone - 7) on 11th October 1992 gave a position through which the PL passed of 17^{O} 15' N, 109^{O} 17' E. Using an estimated speed of 13 knots on a course of 330^{O} (T), find the altitude to be set on a sextant for a meridian altitude of Sun's Lower Limb. Given I.E.: 1' (ON) the arc and H.E.: 41m.

PART – C

Q.7) On 14th October 1992, Star Vega Bore 270^{O}(T) to an observer in latitude 46^{O} 30'N. At that instant another star bore 000^{O}(T) with true altitude $30^{O}12'$. Find the SHA and Declination of that star.

Q.8) a) What conditions must be satisfied for twilight to last all night?

b) Calculate the limiting latitude within which an observer would have nautical twilight throughout the night, when the Sun had a declination of 17^{O}N.

Q.9) a) Find by Mercator principle, the position arrived if the starting position was $36^{O}48'$N $085^{O}53'$W, course 241^{O}(T) and distance sailed is 1897 miles.

b) Describe Mercator Projection.

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GOVERNMENT OF INDIA

Date: - 4th January-2022

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No.5048, Nautical Almanac 1992, Deviation card No. 2, Variation 4^O E Ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the questions.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use luminous range diagram as necessary.

Part – A

Q.1) Hook Head Lt. (50^O 7.3'N, 006^O 55.8'W) and Coninbeg Lt. Vessel (52^O 2.4'N, 006^O 39.3'W) were on reciprocal bearings. Vertical Sextant Angle of Hook Head Lt. was 16'. Tide was 1.5 meters below MHWS and I.E. of sextant was 1.6' off the arc. Find the vessel's position. From this position find the course to steer to arrive at a position 3 miles due south off Mine Head Lt. (51^O 59.6'N, 007^O 35.2'W). Current set in northerly direction @ 2 Knots and southerly wind was causing a leeway of 3^O.

Q.2) On a course 056^O(T) at 0750 hrs, Bally Cotton is Lt. (51^O 49.5'N, 007^O 59'W) bore 314^O(T). At 0820 hrs the same light bore 268^O(T) and at 0905 hrs Mine Head Lt. House (51^O 59.6'N, 007^O 35.2'W) bore 354^O (T). If current set 100^O(T), find CMG, SMG. Rate of current and the ship's position at all the three timings.

Q.3) Briefly comment on following in a Passage Plan:

a) What are Tidal streams, how & where would you find the details of these

b) Route to be followed in restricted visibility.

c) Navigation in heavy traffic / strong currents.

d) Process of ceiling additional assistance for watch keeping.

PART – B

Q.4) A vessel at Tokyo (35^O 39'N, 139^O 47'E) intends to sail due east for one day (speed 16 knots, clocks advanced by one hour), thence on a great circle track to San Francisco (37^O 48'N, 122^O 24'W). Find the maximum latitude arrived during the Great Circle Passage.

Q.5) Vessel steering a course of 135^{O}T at 24 knots in DR Lat 47^{O} 38'N, Long 030^{O} 17'W, obtain the following observations worked using the above DR.

Time	Body	Azimuth	Intercept
1848	Venus	257^{O}(T)	6.6' towards
1852	Sirius	140^{O}(T)	2.5' away
1906	Dubhe	028^{O}(T)	4.8' away.

Find position of the vessel at 1900.

Q.6) A morning sight of the Sun taken at 0832 (Zone-4) on 11th October 1992 gave a position, through which the PL passed, of 39^{O} 25'S, 62^{O} 17'E. Using an estimated speed of 19 knots on a course of 261^{O}(T), find the GMT and Zone Time of the Sun's meridian passage and the DR at this time.

PART – C

Q.7) On 14th October 1992, Star Vega Bore 270^{O}(T) to an observer in latitude 46^{O} 30'N. At that instant another star bore 000^{O}(T) with true altitude 30^{O}12'. Find the SHA and Declination of that star.

Q.8) a) What conditions must be satisfied for twilight to last all night?

b) Calculate the limiting latitude within which an observer would have nautical twilight throughout the night, when the Sun had a declination of 17^{O}N.

Q.9) a) Find by Mercator principle, the position arrived if the starting position was 36^{O}48'N 085^{O}53'W, course 241^{O}(T) and distance sailed is 1897 miles.

b) Describe Mercator Projection.

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GOVERNMENT OF INDIA

Date: - 12th November-2021

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No.5056 (Start point to the needles), Nautical almanac 1992, Deviation card No. 3., Variation as per chart, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use luminous range diagram as necessary.

Part – A

Q.1) At 0900 hrs while steering 300^{O}(T) at 12 kts East Channel Racon Buoy bore 180^{O}(T) x 5 n.m. At 0930 hrs vessel A/Co to starboard and reduced speed to 10 kts and maintained same speed throughout thereafter. At 1030 hrs vessel A/Co to 050^{O}(T). At 1100 hrs Bill of Portland (50^{O} 31'N, 002^{O} 27'W) bore North. If current is expected to set Easterly at 2 kts, find vessel's position at 1100 hrs and course between 0930 hrs and 1030 hrs.

Q.2) A vessel is steering 000^{O}(T) at 12 kts and experiencing current setting 270^{O}(T) at 3 kts. At 0600 hrs using position Lat:- 50^{O} 00'N, Long 001^{O} 40'W observation of star 'X' gave intercept 2.0' towards with AZ 330^{O}(T). At 0630 hrs observation of star 'Y' gave intercept 1.1' away from AZ 040^{O}(T), position used for calculation was 0600 hrs DR run up taking into account course, speed, current and drift. Determine the ship's position at 0630 hrs and her E.P. at 0700 hrs, assuming current to be the same.

Q.3) A vessel is sailed from 'Tor Bay' off Brixham (50^{O}25.4'N, 003^{O} 30.5' W) at 1200 hrs. She is bound for 'Portland Harbour' (50^{O} 35'N, 002^{O} 26.5'W). She has working radar, echo sounder, VHF and GPS. Plan your passage if Northerly gales and moderate visibility. Write the synopsis in answer sheet in details taking into account tidal stream data (spring tide) if HW at DEVEN PORT at 1000 hrs.

PART – B

Q.4) Find the initial course, final course and distance along the composite circle track from position 'A' Lat:- 45^{O}54'S Long:- 170^{O}45.0'E to position 'B' 49^{O}06.0'S, Long 075^{O}50'W, Limiting Latitude 55^{O}S.

Q.5) At 1800 hrs in DR 34^{O} 26'N 143^{O} 38'W a sight gave PL 040^{O} / 220^{O}. After running for one hour another DR was obtained by applying a course of 125^{O}T at 12 Kts. This DR was used to calculate another sight which gave T. Az 060^{O} and intercept 5' Towards. Calculate the position of the ship at 1900 Hrs.

Q.6) At 0803 hrs an observer on a vessel steering 336^{O}(T) at 14 kts found the True Alt of the sun to be 89^{O} 29.2', bearing SE'ly. Decln of Sun 13^{O} 26'S, GHA 304^{O} 51.2', GHA 304^{O} 51.2'. At 1012 hrs, a Lt house in position 12^{O} 18' S, 54^{O} 45' E was detected by radar at a range 23 n.m. Find the vessel's position at the time of second observation i.e. at 1012 hrs.

PART – C

Q.7) On 1st of March 1992 AM in DR 30° 30' S, 179° 58' W, find the first and second magnitude stars which will cross observer's meridian above the pole and above the rational horizon, between 0518 hrs and 0600 hrs LMT.

Q.8) An observer in Northern Hemisphere in July observes Sun to bear 060°(T) at Theoretical sun rise. Decln of Sun 22°30'N. Vessel steered 210°(T) dist 100' till sun set. Decln changed by 5'. Calculate bearing of the bearing of the Sun at Theoretical Sun Set.

Q.9) a) Write short notes on Transverse Mercator Projection.
b) For a stationary observer, the amplitude of the setting sun was W 20°S when the observer's latitude was 25°N.
Find: i) Declination of Sun
ii) Altitude of the sun when it crosses the observer's prime vertical.

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GOVERNMENT OF INDIA

Date: - 3rd September-2021

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No.5072 Nautical almanac 1992, Deviation card No. 3,, Variation 2^{O}W as per chart, ship's speed 12 knots and Height of eye of the observer 15m if not mentioned in the questions.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use luminous range diagram as necessary.

Part – A

Q.1) A vessel steering 255^{O}(T) at 12 knots, observes Olands Sudra Grund Lt. (56^{O} 04'N, 016^{O} 41'E) bearing 005^{O}(T) at 2000 hrs and 040^{O}(T) and 2100 hrs. At 2215 hrs Utklippan Lt. (55^{O} 57'N, 015^{O} 42'E) bore 355^{O} (T). If the current during the above period was setting 239^{O}(T). Find:

i) Position of ship at 2000 hrs, 2100 hrs and 2215 hrs

ii) CMG and SMG and

iii) Rate of current.

Q.2) At 1000 hrs while steering 300^{O}(T), the vessel observed Sandhemaran Lt. Ho. (55^{O}23.5'N, 014^{O}11.5'E) bearing 30^{O} on her starboard bow and at 1025 hrs abeam. From this position, find compass course to steer to pass Kullagrund Lt. Ho. (55^{O} 18'N, 013^{O} 20'E) 5 miles off to starboard counteracting a current estimated to set South at 3 knots and leeway of 3^{O} caused by southerly wind.

Q.3) A 2200 hrs vessel dropped pilot at Simrishamn pilot station (55^{O} 34' N, 014^{O} 24'E). She intends to join the West bound lane of TSS off falseterbore Racon (55^{O} 18.5'N, 012^{O}39.5'E). Plot safe course on chart with draft 10 m and UKC of 2.0m throughout, GPS not working, gale force winds expected during the passage. Plan your passage giving details of what equipment and landmarks you would use.

PART – B

Q.4) Find the GC distance, from 06^{O}15'N, 078^{O}25'W to 48^{O}56'S 178^{O}35'E. Also find the course of the vessel as it crosses the equator on the GC track.

Q.5) In DR position 39^{O}39'N 130^{O}47'E an observation of the Sun gave an intercept 4' towards, bearing 160^{O}(T). A second observation using latitude 39^{O}09'N gave a longitude of 130^{O}47'E, bearing 200^{O}(T). Find the ships position at the second observation, if during the interval the ship ran 196^{O}(T) x 20 miles and 186^{O}(T) X 18 miles.

Q.6) Using DR Latitude of 00^{O} 02'N, an Observed Longitude of 000^{O} 03'E was obtained. When the same sight was worked using DR Latitude of 00^{O} 03' S, the observed Longitude of 000^{O} 02'W was obtained.

Find the Azimuth of the body, if it was East of the Observer's Meridian.

PART – C

Q.7) On 29th November 1992, AM at ship, in DR 25° 30'S, 107° 20'W, the sextant altitude of an unidentified star bearing 278° (T) was 35°10.3'. GMT 29d 11h 29m 20s. I.E.2.8'. On the Arc, H.E. 12 m, Identify the star.

Q.8) a) Why Stars rise, culminate and set earlier than seen each day.
b) The rising Sun had amplitude of E 30°N. When on the prime vertical its true altitude was 43°. Calculate the observer's latitude.

Q.9) a) What is Gnomonic Chart projection? What are its advantages and disadvantages?
b) Describe Transverse Mercator projection.

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GOVERNMENT OF INDIA

Date: - 6th July-2021

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No.5072 (Falsterbo to Oland), Nautical almanac 1992, Deviation card No.3, Variation 2^{O}W, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use luminous range diagram as necessary.

Part – A

Q.1) At 1800 hrs from DR position lat 55^{O} 03' N long 016^{O} 28'E, a vessel obtains an intercept of 2' towards on an Azimuth of 009^{O}. She was steering a course of 330^{O}T at 12 Kts. Thereafter the visibility became poor. If the current in the area is 060^{O}(T) at 2 Kts, when and what should be her next alteration of course so as to pass 6 miles on the northern side of Christiano Island Main Light (Lat 55^{O} 19.2' N Long 015^{O} 11.6'E).

Q.2) A vessel observes Christianso Light (55^{O} 19.2'N, 015^{O} 11.6'E) bear 270^{O}(T) 5 miles off at 1900 hours. Find the course to steer to have Hano Light (56^{O} 00.8 N, 014^{O} 51' E) 4 points on port bow when it is 12 miles off. At 2100 hours while on this course at a speed of 11 knots the echo sounder recorded a sounding of 10m below keel (ship's draft even keel 9.0m, height of tide 2m). Find the ship's position at 2100 hours and set and rate of current.

Q.3) A vessel at anchor South of YASTAD observed the following compass bearings:

Sandhammaren (55^{O} 24' N, 14^{O} 10'E)	067^{O}C
Yastad (South) (55^{O} 25' N, 13^{O} 49'E)	010^{O}C
Abbekas (55^{O} 23' N, 13^{O} 16'E)	320^{O}C

Find the vessel's position and compass error. From this position, plan a passage to reach the VTS off OLAND's SODRA GRUND (56^{O} 04'N, 16^{O} 41'E) via KARLSHAMM (56^{O} 10' N, 14^{O} 52' E) where she has to go for discharging a small parcel of cargo.

PART – B

Q.4) A vessel has to sail along a Great Circle track from 23^{O} 20'S, 042^{O} 40'W to 33^{O} 30'S, 017^{O}50'E. Determine Initial Course, Final Course & G.C. If you had adopted Rhumb Line sailing how much additional distance you would have travelled.

Q.5) In DR position 20^{O} 46' N, 002^{O} 55'W on a course of 318^{O}T at 16 kts, following results was obtained from stellar observation using the same DR for all observations:
i) Star A: 0820 hrs intercept 1.7' away
ii) Star B: 0830 hrs intercept 1.9' towards, AZ 350^{O}T.
Find the ship's position at 0830 hrs.

Q.6) a) In DR 20^{O}S, 175^{O}E on 19th January 1992 on a ship, the sextant altitude of Sun's UL west of the meridian was 57^{O} 10' when GMT was 19th Jan 02h 52m 24s. I.E. was 1.5' off the arc & H.E. was 12m. Calculate the intercept & direction of P/L.

b) Without working out the sight, find what longitude will an observer get if the above sight was calculated using Long by Chron, Method.

PART – C

Q.7) To a stationary observer, if the amplitude of Sun was E 10^{O}N in the morning and at the time of meridian passage its true altitude south of the observer was 80^{O}. Calculate the observer's latitude.

Q.8) Find the duration of PM Civil Twilight on the longest day (of Southern Hemisphere) in latitude 30^{O} 40'N.

Q.9) a) Explain the following terms:

i) Natural Scale ii) DMP

b) The distance between 2 points on a Mercator charts in latitude 32^{O} 30'N was 22 miles. How many minutes of longitude can be placed?

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GOVERNMENT OF INDIA

Date: - 4th March-2021

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No.5118 (Singapore strait and eastern approaches), Nautical almanac 1992, Deviation card No.1, Variation 2^O, ship's speed 12 knots and Height of eye of the observer 12m if not mentioned in the question.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use luminous range diagram as necessary.

Part – A

Q.1) Your vessel is South East of Merapas Island ($00^O55.7'$ $104^O55.7'$E) and steering a course of 352^O(G) when the following bearings were observed. Gyro error = 2^O(H).

0930 hrs	Merapas 1st South tip	292^OG
0950 hrs	Merapas 1st South tip	262^OG
1010 hrs	Merapas 1st South tip	227^OG
1010 hrs	Merapas is (01^O 02.8'N 104^O50.0'E)	284^OG

Find i) Position at 1010hrs
ii) CMG
iii) Set and rate if current between 0930 hrs and 1010 hrs.

Q.2) During the evening twilight in DR position of 01^O 50' N, 104^O 30' E, star 'Rigel' (azimuth 080^O T) at 1800 hours, gave the ship's longitude as 104^O 23'E. Ship was steering 125^O(T) at 10 knots.
At 2100 hours 'Horsburgh' Lt. was observed to bear 260^O(T). If the current is known to set 210^O(T) at 2 knots, find the ship's position at 1800 & 2100 hours. What is the course & speed made good?

Q.3) A vessel completes loading in STS operations at 1830 hours to her summer draft of 19.5 meters in 01^O00'N, 104^O 12.0'E. She is to discharge this cargo at Chennai, India. Plan a safe passage for her through the TSS on chart 5118 keeping in mind full safety standards / requirements / recommendations for a vessel of this type & size. Plot courses & alteration points on the chart and record details in the answer script.

PART – B

Q.4) A vessel intending to sail on a great circle track from $39^O20'$S $110^O10'$E to $44^O30'$S $046^O20'$W decides to make a composite sailing with a limiting latitude of 62^OS. Find the extra distance sailed.

Q.5) In DR Lat $17^O41'$S long $179^O50'$E an intercept of 12.2' (Towards) at an Azimuth of 081^O(T) was obtained by stellar observation. Vessel then steered a course of 124^O(T) for a distance of 80 miles through a current setting 221^O(T) drift 12 miles, when the meridian altitude of Sun gave observed latitude $018^O40'$S. Find the position of the vessel at the time of second observation.

Q.6) A morning sight of the Sun taken at 0901 (zone -7) on 11th October 1992 gave a position, through which the PL passed, of 17° 15'N, 109° 17'E. Using an estimated speed of 13 knots on a course of 330°(T), find the altitude to be set on a sextant for a meridian altitude of Sun's Lower Limb. Given I.E.:1' (ON) the arc and H.E.: 41m.

PART – C

Q.7) On 14th October 1992, Star Vega bore 270°(T) to an observer in latitude 46°30'N. At that instant another star bore 000°(T) with true altitude 30°12'. Find the SHA and Declination of that star.

Q.8) a. What conditions must be satisfied for twilight to last all night?
b. Calculate the limiting latitudes within which an observer would have nautical twilight throughout the night, when the Sun had a declination of 17°N.

Q.9) a. What is Mercator chart? What are its advantages and disadvantages to a mariner?
b. What is the Conformal property of a chart which is used for marine navigation?

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GOVERNMENT OF INDIA

Date: - 14th December-2020

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No.5047 Nautical almanac 1992, Deviation card No.3. Variation 2°W, ship's speed 12 knots and Height of eye of the observer 12m if not mentioned in the questions.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use luminous range diagram as necessary.

Part – A

Q.1) At 0530 hrs, a vessel was in position with Lundy Island South bearing 030°(T) and 6' off. She steered a certain compass course and her engine speed was 9 Knots. After one hour she altered her course to due north and increased her engine speed to 12 knots. At 0700 hrs, the bearing of Lundy Island North was observed to 120°(T). The current in the area was setting 330°(T) at 3.5 kts. Find her position at 0700 hrs and initial course steered by the vessel.

Q.2) At 1500 hrs on a vessel steering 080°(T), Porteymon Point (43) (51° 31.5' N, 004° 13' W) bore 030°(T). At 1530 hrs it was due north and at 1600 hrs it bore 330°(T). Determine course and speed made good and the rate of current if the current was setting south.

Q.3) A vessel observes the following compass bearings:

Scarweather Lt. v/l (51° 27'N, 003° 56' W) - 296°(C)
Porthcawal point Lt. House (51° 28'N, 003° 42'W) - 006°(C)
Nash Point Lt. House (51° 24'N, 003° 33'W) - 092°(C)

Find the ship's position. From this position lay courses to reach Swansea Pilot Point if the ship's draft is 12 meters.

PART – B

Q.4) A vessel intends to sail on a Composite track from position 35° 40'N, 141° 00'E to a position in 37° 48'N, 122° 40'W, with a limiting latitude of 45°N.

Find:

a) The initial course. (7)
b) The final course. (8)
c) The longitudes of points where the track meets and leaves the Limiting – Latitude parallel. (10)

Q.5) Using DR of 00°04'N, 179°57'E, two simultaneous observations of stars gave following results:
Star 'X': Azimuth 120°(T), Observed Longitude 179°58'W,
Star 'Y': Azimuth 200°(T), Intercept 2' Away.
Find the position of vessel.

Q.6) Compute the sextant altitude & find the LMT on 1st September 1992, of star ALDEBARAN, when it is on the observer's meridian, at DR 55° 18'N, 142°10'W.
Give: H.E. 13.3m, I.E.0.6' off the arc.

PART – C

Q.7) With suitable sketches, where possible, write short notes on the following:
a) Synodic Period of Moon, (12)
b) Conditions necessary for an Annular Solar Eclipse to occur. (13)

Q.8) Find the duration of PM Civil Twilight on the longest day (of Southern Hemisphere) in Latitude $30^{O}40'N$.

Q.9) A Mercator Chart has a scale of 1:3000000 at latitude of $36^{O}S$.
Calculate the length of Rhumb Line, in millimeters, on this chart from position $32^{O}S$, 179^{O} 55' E to position $37^{O}S$, 175^{O} 15' W.

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GOVERNMENT OF INDIA

Date: - 15th October-2020

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No.5047 (Bristol channel), Nautical almanac 1992, Deviation card No.2. Variation 6^{O}W, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the questions.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use luminous range diagram as necessary.

Part – A

Q.1) A vessel while steering a course 034^{O}(T) observes Lundy Island South Lt. (51^{O} 09'N 004^{O} 39'W) for the first time at 2000 hrs. The visibility at this time was 5 miles. The light was obscured at 2036 hrs. If the current was setting 338^{O} (T) at 3 knots, find:

a) Position of the vessel at 2036 hrs.

b) Course & speed made good.

Q.2) At 0600 hrs, UTC on 2nd Feb. 1972, a vessel anchored at Carmarthen Bay observes the following:

Watch Tower	(51^{O} 42'N 004^{O}20'W)	..... 045^{O}(C)
Rhossili Down Tr. (189)	(51^{O} 35'N 004^{O}17'W)	..... 118^{O}(C)
Helwick Lt. Vessel	(51^{O} 31'N 004^{O}25'W)	..... 180^{O}(C)

Find the (a) Compass error (b) Position of the vessel.

Q.3) A vessel having a draft of 11m drops pilot at Bristol Pilot Grounds (51^{O}21'N 003^{O} 19'W) in gale force winds and is bound for Swansea (51^{O} 32'N 003^{O} 57'W) while the vessel is equipped with ARPA, Echo Sounder, Doppler Log. She is also experiencing steering problems. In view of the above, plan a safe passage for the intended voyage.

PART – B

Q.4) Initial Position 47^{O} 25'S 006^{O} 10'E. Final Position 18^{O} 30'S 063^{O} 16'E. Find the midway position on the Great Circle track.

Q.5) Following simultaneous stellar observations were calculated using the DR 25^{O} 40' N 140^{O} 10'E

Star X	Obs long 140^{O} 15'E	Az 115^{O}T
Star Y	Intercept 2' Towards	Az 240^{O}T
Polaris	Ob lat 25^{O} 38'N	Az 001^{O}T

Find vessel's position.

Q.6) On 6st March 1992, PM at a ship in D. R. Longitude 070^{O} 45'W, the following simultaneous observation were made:

First observation: Sextant Meridian altitude of star Vega North of observer was found to be 51^{O} 11.2'. Height of Eye 15m, Index Error 0.4' off the arc.

Second observation: Sextant altitude of the Moon's LL using the same sextant was 17^{O} 48' at GMT 06^{D} 23^{H} 10^{M} 30^{S}. Find the position of the vessel.

PART – C

Q.7) On 30th April, 1992. PM in DR 49^{O} 15' (N), 29^{O} 15' (W), what stars of 1st and 2nd magnitude or planets will be within 30^{O} of hour angle from the observers meridian?

Q.8) Calculate the period of nautical twilight for an observer in Latitude 30^{O} N Decl. 20^{O} N.

Q.9) i) Explain why duration of twilight varies with change of latitude.
ii) Write short note on UTM projection.

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GOVERNMENT OF INDIA

Date: - 10th Jan-2020

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No.5072 (Falsterbo to the Needles) Nautical almanac 1992, Deviation card No.3.
4. Variation 2^{O}W, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the questions.
5. **Positions of the landmarks are approximate and are for identification only.**
6. Use luminous range diagram as necessary.

Part – A

Q.1) A vessel anchored off Y Stad observes the following bearings:

Abbekas Lt. (55^{O} 23' N, 13^{O} 37' E)	298^{O}(C)
Y stad South Lt. (55^{O} 25' N, 013^{O} 49' E)	009^{O}(C)
Kasebarga Lt. (55^{O} 23' N, 14^{O} 04' E)	078^{O}(C)

Find the position of the ship and compass error if it was the same for all three observations. From this position, find the compass course to steer to pass Hammerodde light (55^{O} 18'N, 14^{O} 47' E) 2 miles off, counteracting a current setting 060^{O}(T) x 2 knots and a strong N'ly wind causing a leeway of 5^{O}.

Q.2) A vessel observes Christianso Island Main Light (55^{O} 19.2' N, 015^{O} 11.6' E) bear 270^{O}(T) x 5 miles off at 1930 hours. Find the course to steer to have Hano Light (56^{O} 00.8' N, 014^{O} 51' E) 4 points on port bow when it is 12 miles off. At 2130 hours while on this course at a speed of 14 knots the echo sounder recorded a sounding of 10m below keel (ship's draft even keel 8.5 m, height of tide 1.5 m). Find the ship's position at 2130 hours and set and rate of current.

Q.3) A vessel steering 130^{O} (T) observed Kuala Grund Racon (55^{O} 18' N, 013^{O} 20' E) at 1900 hrs bearing 072^{O}(T). At 1920 hrs, the same light bore 044^{O}(T) and at 1950 hrs, it bore 352^{O}(T). If the current was setting 080^{O}(T). Find:-

a) Course Made Good & Rate of Current.
b) Ship's Position at the time of final bearing.

From this position plan a passage to reach the VTS off OLAND's SODRA GRUND (56^{O} 04' N, 016^{O} 41' E).

PART – B

Q.4) A ship is on Great Circle track from 47^{O} 24' (S), 006^{O} 12' (E) to 18^{O} 36' (S), 063^{O} 18' (E). Find the Great Circle distance, initial course, position of vertex and the latitude where. Great circle track cuts 10^{O}E longitude.

Q.5) A morning sight of the Sun taken at 0850 hours ship's time on 1st September 1992 using a DR of 26^{O} 20'S, gave an observed longitude of 165^{O} 06'E. Using an estimated speed of 18 knots on a course of 120^{O}(T), Calculate:-

a) Ship's time of Sun's Meridian Passage,
b) Sextant altitude to set for LL of Sun for meridian passage time.
(Given: Ship's Time = GMT + 11 hours, H.E. = 18m, I.E. = 2′ off the arc)

Q.6) On 1st May 1992 D.R. 250 N, 1170 W, at 06h 15m 00s Local Mean Time, the sextant altitude of star FOMALHAUT near the meridian was $35^{O}22'$.
Calculate the latitude through which the position line passes and the direction of P/L. (Given I.E. of sextant 1.5' on the Arc, H.E. 15 m).

PART – C

Q.7) A ship in DR 52^{O}S, 080^{O} 45' W, on 28th February 1992, find the first magnitude stars that will cross the observer's meridian above & below the pole & below the pole & which will be above the observer's rational horizon, during PM nautical twilight.

Q.8) To an observer in latitude 30^{O}N, a star bore 135^{O}(T) with true altitude of 65^{O}. At the same instant another star bore 135^{O}(T) with true altitude of 15^{O}. Calculate the difference in SHA of the two stars.

Q.9) Describe:
a) The Mercator projection, and
b) Gnomonic Projection

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GOVERNMENT OF INDIA

Date: - 1st Oct-2019

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No.5056 (Start point to needles) Nautical almanac 1992, Deviation card No.3, Variation as per chart, ship's speed 12 knots & Height of eye of the observer 10m if not mentioned in the question.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use luminous range diagram as necessary.

Part – A

Q.1) At 0200 hrs straight Pt. Lt. (50^O 36.6'N & 003^O 21.7'W) bore 300^O(T) when the vessel crossed 30m contour. Find the ship's position. From this position find the course to steer to pass Bill of Portland Lt.. (50^O 31'N, 002^O 27'W) 9' off port. Engine speed 12kts, vessel experiencing a NE'ly wind causing a leeway of 5^O, current setting 180^O(T) x 2 kts. Also find the time & position, when the vessel will pass bill of Portland light 9' off. Engine Speed 9kts.

Q.2) Vessel in position 50^O 15'N 003'W at 2000 hrs, find the course to steer to first sight Bill of Portland Lt. right ahead counteracting a tidal stream running at D. At What time & position the above Lt will be first sighted. HW at Devenport at 2330 hrs at Spring tide. HE 9m. Met. Visibility 2M, Engine speed 12 kts.

Q.3) A vessel drawing a draft of 16m drops pilot at Needles Channel (50^O 38'N 1^O 39'W) in gale force winds and is bound for Tor Bay (50^O 25'N, 30^O 28'W). The vessel is also experiencing steering problem on account of a damage rudder stock. The vessel is equipped with the following:

1. Radar with ARPA
2. Echo Sounder
3. ROTI
4. Doppler Log

Plan a safe passage

PART – B

Q.4) A vessel in position 35^O 18'N 110^O 35'E has to reach pilot boarding station located 25 miles south of a lighthouse in position 46^O 40'N 175^O 45'W so that at no time the latitude exceeds 46^O 15'N. Find the shortest steaming time at a speed of 15 kts.

Q.5) On 15th June 1992 at GMT 12h 05m, the true altitude of Sun was found to be 89^O 55. At the same time, a point of land in position 23^O 26.5 N', 001^O 15'W bore 320^O(T). Find position of vessel, sun pass north of observer.

Q.6) On 22nd Sept '92 AM at ship in DR 46^O 17'S the sextant altitude of the Sun's LL was 29^O 25' at GMT 22d 19h 33m, IE 3.0' off the arc, HE 11m. The ship then steamed 300^OT for 45' when the meridian altitude of the sun's LL was 43^O 57.9' North of the observer. Find the ship's position at the time of meridian altitude.

PART – C

Q.7) On 21st July 1992 in DR 20°N 75°E, PM at ship, which stars and planets of 1st & 2nd Magnitude within 20° of observers meridian will be suitable for observation at the end of civil twilight.

Q.8) An unknown star rose bearing 123°T and when bearing East had a true altitude 24°30'. Find the Lat and Decl.

Q.9) i) What is Gnomonic Projection? How do you transfer a Great Circle track from the Gnomonic Chart to a Mercator Chart?
ii) What are the conditions necessary for the twilight to last the whole night?

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GOVERNMENT OF INDIA

Date: - 5th July-2019

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use chart No.5048 (Old head of Kinsale to Tuskar rock) Nautical almanac 1992, Deviation card No.1, Variation 2^O, ship's speed 12 knots & Height of eye of the observer 12m if not mentioned in the question.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use luminous range diagram as necessary.

Part - A

Q.1) The followings celestial observations are made using D.R. Position $51^O30'N\ 007^O30'W$.

0600 hrs Star Spica Az 020^O(T) intercept 1.5' away.
0615 hrs Star Alioth Az 310^O(T) intercept 2.0' Towards.

The ship was steering 040^O(T) at 12 kts. Determine the followings:

a) The position of the vessel at 0615 hrs.
b) The course that she should steer from her 0615 hrs position so that coningbeg light vessel ($52^O02.3'N\ 006^O39.4'W$) will bear four points on her port bow when it is 10NM away.
c) The time when she will be a beam of the light vessel.

Q.2) Awaiting order while adrift, a vessel at 1700 hours observes '**Ballycotton Island**' light (51^O 49.5' N, 007^O 59.0' W) to bear 051^O (G), '**Roche's Point**' light (51^O 47.6' N, 008^O 15.3' W) 334^O (G) and '**Cork Racon**' buoy (51^O 42.9' N, 008^O 15.4'W) bears 231^O (G).
At 2000 hours she receives instructions to proceed to position **4** miles **NW** of '**Kinsale B**' platform (51^O 21.6' N, 008^O 01.1'W) for loading next cargo. Find the gyro course to steer if the ship's speed is 8 knots and the current here sets **SW** at **2** knots. Give your **ETA**.

Q.3) A loaded VLCC has been ordered to anchor & await orders in position 52^O 09.9' N, 006^O 19.9' W in 44 meters depth of water.
If she is presently located at 51^O 32' N, 006^O 07' W, plan in detail a passage appropriate to her **loaded state**, hours of **darkness**, present state of **moderate visibility** & southerly **gale** winds.

PART - B

Q.4) Find the initial course, final course and distance along the composite circle track in the following case:

From		To		Max
Latitude	Longitude	Latitude	Longitude	Latitude
45^O 54.0' S	$170^O45.0'E$	49^O 06.0'S	075^O 50.0'W	55^OS

Q.5) At 1103 an observer on a vessel steering 336^OT at 14 knots found the true altitude of the Sun to be 89^O 29.2', bearing SE'ly. (Dec Sun $13^O26'S$, GHA Sun 304^O 51.2'). Later at 1312 hrs a point of land in position 12^O 18'S, 054^O 45'E was detected by radar at a range of 23 miles. Find vessel's position at time of 2nd observation.

Q.6) On 21st September 1992, in EP 20^O 50's 062^O 30'E, the observed altitude of Star Capella near the meridian was 23^O 07.1' at GMT 21d 01h 15m 10s. If HE was 10m, find the direction of PL and the latitude where it cuts the DR Longitude.

PART - C

Q.7) On 15th June 1992, in position 20^{O}N 75^{O}E, which stars and planets of 1st & 2nd Magnitude will be within 15^{O} of observers meridian? Which of them can be used for ex-meridian observation? The observation is to be made at the end of PM Civil Twilight.

Q.8) The rising Sun had an amplitude of E30^{O}N. When on the prime vertical, its true altitude was 43^{O}. Calculate observer's latitude.

Q.9) What is Gnomonic Projection? State the properties of gnomonic charts and their limitations.

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GOVERNMENT OF INDIA

Date: - 02nd April-2019

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use chart No.**5056** Nautical almanac **1992**, Deviation card no. **2**, Variation as per chart, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

Part - A

Q.1) To an observer on the bridge (HE 16m) 'Straight Pt.' (50^O 36.5'N 003^O 21.6'W) dipped right stern at 1400 hours. Find the Time, position & distance off when 'Bill of Portland' Lt. Ho. (50^O 30.8'N 002^O 27.4'W) would be closest.
[She is steering 120^O (T) at 14 knots by engines & current sets 030^O (T) at 3 knots].
Give her position of 1400 hours as well.

Q.2) A vessel passes 'E Channel Racon (49^O 59.0' N 002^O 29.0' W) 7 miles to NW at 0900 hours, engine speed is 15 knots. At this time (0900 hours) course was altered to let 'Anvil Pt.' Lt. Ho. (50^O 35.6'N 001^O 57.5'W) cross the bow when 10 miles away, allowing for current setting 300^O (T) at 4.5 knots.
Her noon position was 50^O 30' N, 002^O 00' W. What is the actual current prevailing in this area?
Where was she located at 0900 hours?

Q.3) A low powered vessel (maximum speed 7 knots, draft 11 m) enters your chart 5056 in location 49^O57.0'N, 003^O 15'W at 1100 hours. Her echo sounder is working & she has only one working radar. Plan her passage to 'Exmouth' Pilot Station 50^O 35.8'N 003^O 21.6'W. List all the precautions for this stretch keeping her special status in mind. Weather: E'ly gales, Light Drizzle, visibility poor to moderate.

PART - B

Q.4) Find the initial and final course and distance along composite circle track from 45^O54'S 170^O 45'E to 49^O06'S 075^O50'W on a great circle track with limiting latitude of 55^O.

Q.5) At 0830h in DR 48^O30'N 024^O20'W an observation of sun gave an intercept of 4' towards an azimuth of 100^OT. Ship's course and Speed were 250^OT 14kts respectively. Later at 1130h a second observation of the sun on a bearing of 175^OT gave an intercept of 3' away having run up the DR position for calculation. Required ship's position at 1130 and also at noon.

Q.6) A morning site of the Sun taken at 09:01 hrs (Zone - 07) on 11 Oct 1992, gave a position through which the PL passed of 17^O 15'N & 109^O 17'E. Using an estimated 13 knots on a course of 330^O(T). Find the altitude to be set on a sextant for a meridian altitude of Sun's Lower Limb. Given I.E.: 1'(ON) the arc and H.E.: 41m.

PART - C

Q.7) At the beginning of AM nautical twilight on 4th March 1992 in DR 20^ON 065^OE, find which Stars and Planets of 1st magnitude will be within 30^O of hour angle from the observer's meridian.

Q.8) A circumpolar star with LHA 270^O has an altitude of 45^O 10' and later on reaching maximum azimuth for the same position of the observer, it had an altitude of 50^O06'. Find the declination of the star.

Q.9) i) Explain why duration of twilight varies with change of latitude.
ii) Write a short note on Universal Transverse Mercator projection.

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GOVERNMENT OF INDIA

Date: - 04th Jan-2019

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use chart No.**5047** Nautical almanac **1992**, Deviation card no. **3**, Variation as per chart, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use luminous range diagram as necessary.

Part - A

Q.1) While steering 300^{O}(T) at 14 kts observed Caldey is Lt (51^{O} 38'N, 004^{O} 41'W) bore 340^{O}(T) at 1200 hrs. At 1250 hrs Old castle hd(65) Pt (51^{O} 38.2'N, 004^{O} 47'W) bore 000^{O}(T) and at 1310 hrs Stack Pole Hd Point (51^{O} 37'N, 004^{O} 53.6' W) bore 000^{O}(T) x 6.7'. Find the following:

i) Position of the vessel 1200 hrs ii) CMG, SMG iii) Set and Rate of current.

Q.2) A ship steered 020^{O}(T) at 12kts. Following bearings were obtained on North Lundy Light (Lat 51^{O} 12.5'N, Long 064^{O} 40'W), 2100 hrs:- 083^{O}(T), 2130hrs 121^{O}(T), 2148 hrs 139^{O}(T). At 2130 hrs same light house was 8.4n.m. off. If the current remained same throughout, find the Course to steer and engine speed to reach Port Talbot Pilot station (51^{O} 29' N; 004^{O} 00'W) at 0100 hrs next day.

Q.3) A vessel drawing 10m draft has to proceed from Port Talbot Pilot Station (51^{O} 29'N, 004^{O} ´W) to Avon mouth Pilot station (51^{O}21'N, 003^{O} 19'W). During this passage, visibility was restricted due to fog to 2n.m. Plan your passage giving details of what and marks and bridge equipment you would use. Course, distances, way points, no go areas to be marked clearly on chart and written on answer script.

PART - B

Q.4) Find the final course and distance along a composite track from A in position 41^{O}00'S 168^{O}00'W to B 55^{O}00'S 68^{O}00'W. Limiting latitude being 55^{O}00'S.

Q.5) On 10th Oct 1992 at ship in Dr 142^{O} 10' E sextant altitude of polaries was 41^{O} 10' at GMT 19h 41m 28s. At the same time true altitude of star Denebola was 16^{O}25'. Find the position of the vessel at the time of second observation.

Q.6) At about noon on 16th June 1992, a sight of Sun South of the Observer gave True Altitude 89^{O}48.8', at GMT 16d13h14m48s. The vessel then steered 342^{O}(T) for 34 miles when a point of land in position 24^{O}34'N, 018^{O}27'W was sighted bearing 034^{O}(T). Find the position of the vessel at the time of the second observation.

PART - C

Q.7) On 19th January 1992, in DR position 40^{O} 28'S, 170^{O} 34'W, find which stars of magnitude 2 and brighter will be available for observation, below the pole, between 1800 LMT and 1900 Hrs LMT.

Q.8) To a stationary observer, the true altitudes of a star when on the meridian at the Upper transit was 80^{O} 09' bearing south, and lower transit was 11^{O} 45', bearing north. Calculate its true altitude when on the Prime vertical.

Q.9) a) On a Mercator chart, 1^{O} of longitude is represented by 6cm. What is the natural scale in latitude 55^{O}N?

b) By how many times is Venus brighter than Star Sirius on 23rd August 1992?

GOVERNMENT OF INDIA

Date: - 03rd Oct-2018

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use chart No.**5056** Nautical almanac **1992**, Deviation card no. **2**, Variation 4°W, ship's speed 10 knots and Height of eye of the observer 10m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

Part - A

Q.1) At 2100 hr., while steering 208°C with leeway of 4° due to Nly wind, Berry Head lt. (50° 24'N 003° 29'W) bore 237°C, at 2130 hrs. it bore 256°C and at 2212 hr it bore 340°C. At 2212 hr, Start Pt. lt. (50° 13'N 003° 38'W) bore 228°C. Calculate CMG, SMG and the three positions. From last Position calculate compass CTS to pass 5 miles off Start Pt. lt. allowing for current experienced by no leeway. Also calculate time and bearing of light when it will be abeam.

Q.2) While steering 007°C, following sights are taken using DR 50° 00'N 001° 40'W:
0600 hr. --- T. Az. 330° --- Intercept 2' (T)
0630 hr. --- T. Az. 040° --- Intercept 1.4' (A)
Current set 270° T at 3 knots. Calculate CMG & SMG and both positions. From position at 0700 hr. Calculate compass CTS and CMG to sight Needles lt. (50° 39.7'N 001° 35'W) 12 miles right ahead, allowing for same current.

Q.3) At anchorage at 2000 hr., Anvil Pt. lt. (50° 35.5' N 001° 57'W) bore 237°C, Handfast Pt. (50° 38.5' 001° 55'W) bore 264°C, and Occ. WRG lt. (50° 41.5'N 001° 56' W) bore 302°C. Calculate Position and Deviation of compass. From here plan a passage to reach Brixham deep-sea pilot station (50° 24'N 003' 22.5°W). Spring high water at Devonport at 2200 hr.

PART - B

Q.4) Find the initial course, GC distance and vertex of a Great Circle track from A: 15°00'N, 035°00'E to B: 40°00'N, 075°00'E.

Q.5) While steering a course of 090°(T) at 20 knots, the following celestial observations were obtained and worked out using a DR of 19°56'N 045°41'E and following results were obtained.

Time	Object	Intercept	Azimuth
1809	Venus	0.6'T	239°(T)
1818	Altair	5.4'T	270°(T)
1822	Deneb	4.4'T	315°(T)

Find the position of the vessel at 1815.

Q.6) On 30th November 1992, a vessel in DR 24°55'N, 129°30'W, the True Altitude, Declination and GHA of the Sun east of the meridian was 29°25' ; 21°46.4'S ; 89°50' respectively at 0730 ship's time. Calculate the Intercept and PL. From the ITP point the vessel sailed 030°(T) x 16 knots. Compute the altitude to be set on the sextant for a meridian altitude observation of Sun's UL, given IE 2.1' ON the arc, HE 15m, Ship's time GMT – 0830.

PART - C

Q.7) In latitude 50°S, when Declination of Sun is 10N. Calculate the followings:
a) L.A.T. of the Sunset,
b) Duration of civil Twilight.

Q.8) a) Explain with suitable sketches why sun is above the sensible Horizon and Moon is below the Sensible Horizon at the time of Sun rise and Moon rise.
b) Star 'A' has a magnitude of -0.8 and it is 30 times brighter than Star 'B'. Find the Magnitude of Star 'B'.

Q.9) a) With the help of suitable sketch, explain what is Transverse Mercator Projection, its properties and its properties and its usage.
b) What is the Conformal or Orthomorphic property of a chart which is used for marine navigation?

GOVERNMENT OF INDIA

Date: - 05th July-2018

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use chart No.**5056** Nautical almanac **1992**, Deviation card no. **3** and variation as per chart Ship Speed 12 knots Height of eye of the observer 10m if not mentioned in the question.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use luminous range diagram as necessary.

Part - A

Q.1 In meteorological visibility of 5 NM, a vessel steering a course of 075^O(T) at 13 knots last sights start point light house (50^{O}13.4'N 003^O 38.4'W) at 0245 hrs on her port quarter and at 0515 hrs first sights the Bill of Portland light (50^{O}30.8'N 002^O 27.4'W) on her port bow. If the current is known to be setting 300^O(T) at 2 knots and the strong southerly gale is causing a leeway of 5^O. Determine the following:
a) Ship's position at 0245 hrs and 0515 hrs b) The course and speed made good

Q.2 At 0800 hours your vessel has just dropped pilot at Exmouth pilot station (50^O 35.8' N 003^O 21.6' W) and has to be rendezvous with another vessel which is in position East channel Racon Buoy bearing 140^O (T) x 5.4 NM and steering 255^O (T) at 6 knots. If the current is expected to set NW'ly at 2 knots throughout, determine the following:
a) Course to steer to make the earliest rendezvous b) Time and position of rendezvous

Q.3 a) Describe the factors to be considered while planning a passage from Kobe (Japan) to Los Angeles (USA)
b) List the publications to be referred for above passage planning.
c) Prepare a model passage plan projecting the important elements to be included in the plan.

PART - B

Q.4 A vessel is to sail along a Great Circle track from 23^O 20'S, 042^O 40'W to 33^O 30'S, 017^O 50'E. Divide the G.C. track into 3 equal parts & find position of the points dividing the track.

Q.5 Following simultaneous stellar observation was calculated using DR 25^O 40' N 140^O 10'E:

Star X	Obs. Long. 140^O 15'E	Azimuth 115^O (T)
Star Y	Intercept 2' (T)	Azimuth 240^O (T)
Polaris	Obs. Lat. 25^{O}38' N	Azimuth 001^O (T)

Find vessel's position.

Q.6 a) In DR 20^O S, 175^O E, on 19th January 1992 on a ship, the sextant altitude of Sun's UL west of the meridian was 57^O 10' when GMT was 19th Jan 02h 52m 24s. I.E. was 1.5' off the arc & H.E. was 12m. Calculate the intercept & direction of P/L.
b) Without working out the sight, find what longitude will an observer get if the above sight was calculated using Long. By Chron method.

PART – C

Q.7 On 15th June 1992 during PM twilight on ship in position DR Lat 36° 10'N Long 047° 00'W the sextant altitude of unknown star bearing 227¾ (T) was 61°02', Index Error (IE) = 0.5' on the arc, Height of Eye (HE) = 6.5m at GMT 22h 43m 45s. Identify the star.

Q.8 The change in azimuth of the sun between rising and crossing the prime vertical of a stationary observer is 38°. If the declination of the sun is 23°27'S. Find the observer's latitude and also the change of hour angle of the sun during this period.

Q.9 a) Explain the change in the duration of twilight with the latitude of an observer.
b) What is the Julian calendar? Why was the Gregorian adjustment made to his calendar?

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69B

GOVERNMENT OF INDIA
FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 HOURS **PASS MARKS: 140** **MAX MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C
2. All questions carry equal marks
3. Use Chart No. 5056 Nautical almanac 1992, Deviation card No. 1, Variation 6°W, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question
4. Positions of the landmarks are approximate and are for identification only
5. Use luminous range diagram as necessary

PART – A

Q.1 The following bearings of Bill of Portland light (50° 30.8'N, 002° 27.4'W) were observed by a ship. At 1000 hrs : 325° (T), at 1030 hrs. : 355° (T) and at 1100 hrs.: 025° (T). If in above duration she had steered a course of 258° T and current set N'ly, find her course and speed made good and rate of the current experienced.

Q.2 At 1030 hrs., a ship observes the horizontal sextant angle between Hope's Nose (50° 27.8'N, 003° 29'W) and Berry Head (50° 24'N, 003° 29'W) to be 30°. She then steers a course of 200° (T) at a reduced speed of 10 Kts. At 1130 hrs. the range of Start point (50° 13.5'N, 003° 38.8'W) was observed to be 10' on radar. Find the position of vessel at 1130 hrs and her course and speed made good. if current set 020° (T) @ 3 Kts.

Q.3 Plan a safe passage from Needles pilot boarding ground (50° 38'N, 001° 39'W) to Exmouth Pilots (50° 36'N, 003° 21.5'W). Way points/ courses / distances are to be shown on the chart as well as on the answer sheets.

PART – B

Q.4 Find the final course and distance along a composite track from A in position 41°00'S 168°00'W to B 55°00'S 68°00'W. Limiting latitude being 55°00'S.

Q.5 Using DR of 12°20' N, 180°, simultaneous observations of two stars gave following results :
Star 'X' : Azimuth 220° (T), Observed Longitude 179°55' E ;
Star 'Y' : Azimuth 305° (T), Intercept 3 Miles Towards.
Find the position of vessel.

Q.6 From the following information, compute the sextant altitude to be set for an observation of Polaris: DR lat 37°58'N DR long 052°30'E, LHA ♈ 71°53.9', Month January, HE 11.5m, IE 1' ON the arc.

PART – C

Q.7 On 28th April 1992, in DR 30°25'N, 000°10' W, find the 1st and 2nd Magnitude Stars and Planets which are suitable for Ex Meridian observations at the beginning of Nautical Twilight in the evening.

Q.8 a) With suitable sketches, explain the Conditions necessary for the following to occur:

i) Twilight to last whole night; (5)
ii) Continuous day light : (5)
iii) Heavenly Body to reach Observer's Zenith. (5)

b) Find the interval of time between two successive transits of Venus over the same meridian on 5th March 1992. (10)

Q.9 Construct a Mercator Chart covering an area between 02^0N & 02^0S and between 003^0E & 002^0W, to an appropriate scale at the equator.

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$\sin PM = \cos(90-LB) \cdot \cos(90-PB)$

$\frac{\sin 35^0}{\sin 35^0} = \sin LB$

$\sin(90-LB) = \sin 47°29.2' \times \cos 35'$

$90-LB = 37°8.9'$

MP -

tan Co =

GOVERNMENT OF INDIA

Date: - 04th Jan-2018

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use chart No.**5047** Nautical almanac **1992**, Deviation card no. **3**, variation 6^{O}W, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use lumunious range diagram as necessary.

Part - A

Q.1 At 1600hr, while steering 031^{O}C, Lundy Island South Lt. (51^{O}10'N 004^{O}39'W) bore 353^{O}C. At 1620 hr at bore 285^{O}C and at 1720 hr. Bull point lt (51^{O}12'N 004^{O} 12'W) bore 126^{O}C. Current set 250^{O}T. Calculate the three positions CMG, SMG and rate of current.

Q.2 At 0400 hr, ship is 8.5 miles north of Lundy Island North lt (51^{O} 12'N 004^{O} 5'W). Calculate compass course to steer and ETA Bristol pilot station (51^{O} 21'N 003^{O} 19'W). Use spring range tidal information given on the chart for high water at Avonmouth at 1000hr.

Q.3 Foreland point lt. bore 157^{O}G at 5 miles and Nash Point. It is 12 miles off from this position calculate Gyro CTS to first sight Helwick lt v/l 30^{O} on starboard bow in visibility of 2 miles.

PART - B

Q.4 A vessel is to sail from position 41^{O}30 S 073^{O}00'W to 41^{O}20'S 174^{O}54'E. Find the difference in distance if the vessel sails Rhumb line and if she sails along composite track with limiting latitude 50^{O}S.

Q.5 On 29th November 1992 at GMT 06H 16M 00S, the true altitude of Sun was 89^{O}26. The vessel was on a course of 270^{O}(T) at a speed of 22.5 Knots. Exactly four minutes later, the true altitude of the Sun was again 89^{O}26. Find the position of vessel at the time of second observation of the Sun passed would of observer at the time of meridian passage.

Q.6 On 10th October 1992 at ship in DR Longitude 142^{O}10 E, sextant altitude of Polaris was 41^{O}10 at GMI 19h 41m 28s. At the same time sextant altitude of Denchola was 16^{O}36. H.E. 20m, I.E. Nil. Find the position of vessel.

PART – C

Q.7 On 20th January 1992, at the end of PM Civil Twilight in DR 30°N, 75°E.

a) List Planets and Stars of magnitude 1 & 2 which are within 30 of observer's meridian.

b) Which of these are suitable for Ex-meridian observation?

Q.8 a) What effect has the Equation of Time on the length of forenoon and afternoon?

b) Discuss the Calendar in use at present.

Q.9 a) On a Mercator chart, 1st of longitude is represented by 6cm. What is the natural scale in latitude 55°N?

b) By how many times is Venus brighter than Star Sirius on 23rd August 1992?

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66B

GOVERNMENT OF INDIA
FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 HOURS | PASS MARKS: 140 | MAX MARKS: 200

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C
2. All questions carry equal marks
3. Use Chart No. 5047 Nautical almanac 1992, Deviation card No. 3, Variation 2°W, ship's speed 12 knots and Height of eye of the observer 12m if not mentioned in the question
4. Positions of the landmarks are approximate and are for identification only
5. Use luminous range diagram as necessary

PART – A

Q.1 At 1000 hrs , a vessel steering 210° (T) speed 8 Knots , observes Caldey Island light (51° 37' N, 004° 40' W) at a radar range of 4 miles. After one hour St. Gowan Light vessel (51° 30.5' N, 004° 59.3' W) is found to be at a radar range of 5 miles. Determine the vessel's positions at 1100 hrs. Given current set 150° (T) at 2 Knots throughout.

Q.2 At 2000 hrs Bull Point (51° 12' N, 004° 12' W) bore 087° (T) from a vessel. At 2020 hrs Lundy Island South bore 278°(T) and at 2040 hrs Hartland Point Light (51° 01.3' N, 004° 31.5' W) bore 155°(T). Find the position of vessel at 2040 hrs if the current was setting 198°(T) throughout. Also find the rate of current and her course made good.

Q.3 A vessel observed St. Gowan Light vessel (51° 30.5' N, 004° 59.3' W) to bear 260° (C). At the same time St Gowan Head (51° 35.5' N, 004° 55.5' W) bore 300° (C) and Caldey Island Light (51° 38' N, 004° 41' W bore 045° (C). Find the vessel's position and from there plan a passage to reach Bristol Pilot Station, north of Break Sea Light Float (51° 20' N 003° 19' W).

PART – B

Q.4 A vessel sets out from position 45°56'S 005°15'W on a GC track heading 261°(T). If she sailed a total of 2800 miles, find her arrival position and heading.

Q.5 In DR 35°N 060°E, while steering 270°(T) x 20 knots, the following observations were obtained

Time	Object	Intercept	Azimuth
1754	Star A	4'T towards	110°(T)
1812	Star B	2'T towards	180°(T)

Find the position of the vessel at 1800

Q.6 At about noon on 16th June 1992, a sight of Sun South of the Observer gave True Altitude 89°48.8', at GMT 16d13h14m48s. The vessel then steered 342°(T) for 34 miles when a point of land in position 24°34'N, 018°27'W was sighted bearing 034°(T). Find the position of the vessel at the time of the second observation.

PART – C

Q.7) On 23rd August'92 in DR 34° 30' S, 003° 30' W, at about 1800 Hrs at ship, the sextant altitude of a star through a break in the cloud was 45° 26', when chronometer (error 03 minutes fast) showed 06H 20M 20S. H.E. 10m, I.E. 2'.0 on the arc. Gyro bearing (Error 1° Low) was 290° (G).
Identify the star.

Q.8 A star bore 065° (T) when rising and later, when it bore 090° (T) its true altitude was 42°. Find the observer's latitude.

Q.9 A Mercator Chart is to be made to a scale of 1/1200, 000 in latitude 40°N. Calculate the distance on that chart between each meridian and each parallel of latitude for the area 39° N to 41° N and 45° E to 47° E.

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09/10/22

FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 HOURS **PASS MARKS: 140** **MAX MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C
2. All questions carry equal marks
3. Use Chart No. 5056 Nautical almanac 1992, Deviation card No. 2, Variation as per chart, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question
4. **Positions of the landmarks are approximate and are for identification only**
5. Use luminous range diagram as necessary

PART – A

Q.1 A vessel was located 4 miles SE of 'Bill of Portland' Lt. Ho. (50° 30'N, 002° 27'W) at 0830 hours steering a certain course at 9 knots.
At 1000 hours she increased her speed to 12 knots & altered her course to 090° (T). One hour later 'Anvil Point' Lt. Ho. (50° 35' N, 001° 57'W) was 12.5 miles away on the radar just as she altered her course to 180° (T). Find the true course steered between 0830 hours & 1000 hours and the time & position when 'Anvil Pt. Lt. Ho. would 'Dip
[Wind 'N', Leeway 10°, HE 14 m & Current 'S' at 4 knots]

Q.2 A vessel steering 282°(T) for Exmouth pilot station (50° 36'N, 003° 22'W) in restricted visibility of 2M, sights Bill of Portland light at 1900Hrs., and same light goes out of sight at 2000Hrs. If the current was estimated to set 020°(T) at 2 knots, find the position at 2000Hrs. Also find the course and speed to Exmouth pilot station to arrive at 2300Hrs, if the set and rate of current remain same

Q.3 (a) You are bound for Lisbon, portugal (IN ATLANTIC OCEAN) Plot your intended route (for the area covered under this chart – 5056) for reporting to VTS if your deep sea pilot, after clearing the dover straits channel has left by the chopper in position (50° 30' N, 001° 40'W). Your ship is a modern VLCC with 21m draft, fitted with all the navigational equipment/gear, all in good working order. The visibility is moderate & strong N'ly winds prevail at this time of the year
(b) List the precautions that you feel can improve the navigational safety of this intended voyage

PART – B

Q.4 A composite great circle track from 33° 02'S 071° 51'W to 41° 42'S 175° 10'E joins and leaves the limiting latitude of 50° 00'S in longitudes 128° 47'W and 143° 13'W respectively. Calculate the total distance on this track

Q.5 Find the position of vessel at 1800hrs from the following observations:
a. At 1754 Star X, Az 125° (T) x 5' (T)
b. At 1812 Star Y, Az 175° (T) x 3' (A)
DR used for both the observations; 30° N, 30° E, Course 205° (T) x 12 knots

Q.6 On 30th Nov 1992, DR Lat 16° S 088° 30'W at GMT 15h 50m 20s, the sextant altitude of the Sun's LL east of the meridian was 62° 50'. IE is 2.5'on the arc and HE 12m. Find the PL and the Longitude through which it passes

PART – C

Q.7 On 21st July 1992 PM at ship in DR 50° N 75° E, Find the 3rd magnitude stars and brighter that will cross observer's inferior meridian and will be above the rational horizon from end of civil twilight to end of nautical twilight

Q.8 (a)State and explain Keppler's Laws of Planetary motion
(b) If the sun rose at 0525LAT in lat 35°N, then find the LAT (in AM) when the sun will be on the observer's prime vertical, east of the observer. Given Declination of Sun is 20°N

Q.9 (a) Write short notes on Gnomonic projections
(b) Write short notes on Universal Transverse Mercator projections

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GOVERNMENT OF INDIA

Date: - 11th July-2017 (Batch 2)

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use chart No.**5048** Nautical almanac 1992, Deviation card no. 2, H-E 10 m and variation 7^{O}W. Ship speed 10 knots Height of eye of the observer 10m if not mentioned in the question.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use lumunious range diagram as necessary.

Part - A

Q.1 A Container ship with maximum draft of 9.0 m drops pilot at Waterford harbor pilot station (52^{O} 9.2' N 006^{O} 58' W) in moderate winds and is bound for Liverpool through St. George's channel TSS. Vessel is equipped with Radar, ARPA, AIS, GPS and Echo Sounder & Doppler Log Plan a safe passage from pilot station for joining the NE bound lane of St. George's channel TSS. Plot your course on the chart, with clear marking of course and distance and course alteration point for each leg of passage. Write the synopsis for passage planning in the answer sheet.

Q.2 While steering 285^{O}C Ballycotton Island light, (51^{O} 49.5' N 007^{O} 59' W) was last sighted in visibility of 5 miles. HE: 8m. After one hour, in clear visibility, Roche's point it. (51^{O} 47' N 008^{O} 15' W) changed from white to red, current set 140^{O}T at 3 knots. Leeway due to Northerly wind was 4^{O}. Calculate course and speed made good and both positions.

Q.3 Own ship is in position 51^{O} 30' N 007^{O} 00' W, Another ship is stopped in position 52^{O} 00' N 007^{O} 10' W and drifting. Current in the area is setting SE at 2 knots. Calculate compass course to steer, engine speed, and course and speed made good of own ship to meet the other ship after 4 hours. Also calculate the meeting position.

PART - B

Q.4 A vessel in position Lat 42^{O} 53' S; Long 147^{O} 20' E is bound for a port in posn. Lat 52^{O} 43' S, Long 072^{O} 43'W. The Master wishes tto follow a great circle track on this passage, however a weather report received before departure strongly advise all ships not to go south of latitude 52^{O} 43' S. Calculate the difference in the distance that the vessel has to steam if the Master follows the advise in weather report.

The master follows the weather advisory and the vessel departs at 1500hrs on the 10 June (Zone – 9 ½), Speed 14 knots. Calculate the ETA at the arrival port assuming Zone time (+5).

Q.5 From the following information, Calculate the longitude in which is the position line cuts the DR Latitude:

Dead reckoning (DR)	: 00^{O} 22'N: 060^{O} 12'W on 30th April 1992
GMT	: 13h 00m 50s
Sext. alt of Sun's upper limb (UL)	: 44^{O} 13.0'
Index Error (I.E.)	: 3.0' OFF the arc
Height of Eye (H.E.)	: 20 meters

Q.6 An observer on a ship steering course of 205^{O} (T) at speed of 16 knots obtained the following data from observations. Find the position of vessel at 1830 hrs.

Time	Stellar body	Intercept	Azimuth
1820 hrs	Star X	2.2' Towards	167 (T)
1824 hrs	Star Y	4.5' Towards	081 (T)
1833 hrs	Star Z	0.8 Away	237 (T)

(A Position in Lat 34^{O} 27' N; Long 76^{O} 42' E was used in all calculations)

PART - C

Q.7 On 10^{th} Oct'92 AM, a ship is in DR 42^{O} 10'N 170^{O} 10' E. Find 1^{st} & 2^{nd} magnitude stars that will cross observers meridian from beginning of Nautical twilight to the beginning of civil twilight.

Q.8 a) Explain Kepler's laws of planetary motion?
b) With suitable sketch explain various types of eclipses.

Q.9 a) What will be the distance between two points in Mercator chart in lat 46^{O} 30' S. If the d'long between them is 01^{O} 45'. The natural scale of chart is 1:500,000
b) Write short notes on Gnomonic projection.

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GOVERNMENT OF INDIA
FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

6/7/17

TIME: 3 HOURS **PASS MARKS: 140** **MAX MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C
2. All questions carry equal marks
3. Use Chart No. 5118 Nautical almanac 1992, Deviation card No. 2, Variation 2°W, ship's speed 10 knots and Height of eye of the observer 12m if not mentioned in the question
4. Positions of the landmarks are approximate and are for identification only
5. Use luminous range diagram as necessary

PART – A

Q.1 At 2100 hrs., a ship in position (01° 50'N, 104° 50'E) wishes to steer a course to raise Horsburgh Lt v/l (01° 19.8'N, 104° 24.5'E) right ahead with current setting 290° (T) at 2 Kts. If the meteorological visibility in the area is 5', what should be her compass course and at what time would the light be expected to be right ahead?
If at 0012 hrs, she obtains a DGPS fix in position lat 01° 21.8'N & long 104° 22.8'E, find the actual set and rate of current.

Q.2 Using DR position of 2° N & 105° E, a vessel gets a celestial fix with star Altair Azimuth 300° (T) Intercept 3.5' Away and star Capella Azimuth 245° (T) Intercept 2.0" Towards. If 4 hrs before, gyrocompass repeater bearings of T. Berakit light house (01° 13.2'N, 104° 34.7'E) was 176° G and of Horsburg light house (01° 19.8'N, 104° 24.5'E) was 214° G, find the set and drift of current experienced in last 4 hrs. Her autopilot setting had been steady on 062° (G) during the period. Given Gyro Error 2° High.

Q.3 Plan a westbound safe passage commencing from position Latitude 01° 09.8'N, Longitude 104° 12'E, towards India through the Singapore strait TSS. Your ship's draft is 19 meters. Way points/ courses / distances are to be shown on the chart as well as the answer sheets.

PART – B

Q.4 A vessel is to sail from 41°30'S073°00'W to 41°20'S174°54'E. Find the difference in distance if the vessel sails Rhumb line and if sh sails along composite track with limiting latitude 50°S.

Q.5 On 23rd August'92, PM at ship, in DR 35° 10' N, 078° 50' W, the observed true altitude of star ALIOTH was 41° 12'.1 at GMT 00h 25m 18s. At the same time another star bearing North gave observed latitude of 35° 13' N.
Find the position of vessel.

Q.6 On 29th Nov.'92, in DR 36° 08' S, 096° 40' E, the sextant altitude of the Moon's upper limb near the meridian was 68° 53'.7 at 09h 18m 24s chronometer time (05m 01s slow). If I.E. was 0.2' off the arc and H.E. was 14m, find the direction of P/L and a position through which it passes.

PART – C

Q.7 Name stars which might be suitable for observing a meridian altitude during morning twilight on January 5th 1992 in D.R 30°00'N 41°30'W. I.E 1.5'on the arc. H.E 20m. Calculate the approximate sextant altitude of one such star as a guide for setting the sextant and state its GMT of transit.

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Q.8 a) Explain the following terms
i) Elongation
ii) Quadrature
b) The rising sun had amplitude of E30°N, when on the prime vertical its true altitude was 43°. Calculate the observer's latitude.

Q.9 a) What is a gnomonic projection? How do you transfer a Great circle track from a gnomonic to a Mercator chart?
b) How would a circle of radius 600miles on the Earth's surface, with its centre in latitude 60°S appear on a Mercator chart?

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GOVERNMENT OF INDIA

Date: - 10th Jan-2017 (Batch 2)

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use chart No.**5048** Nautical almanac 1992, Deviation card no. 3, variation 2^{O}W, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use lumunious range diagram as necessary.

Part - A

Q.1 A vessel at anchor South of YSTAD observed the following compass bearings:-

Sandhammaren (55^{O} 24' N, 014^{O} 40' E)	067^{O} C
Ystad (South) (55^{O} 25' N, 013^{O} 49' E)	010^{O} C
Abbekas (55^{O} 23' N, 013^{O} 36' E)	320^{O} C

Find the vessel's position and compass error.

From this position, plan a safe passage to join the North east bound lane of TSS off OLANDS SODRA GRUND (56^{O} 04'N 016^{O} 41'E). Course and distance for each leg of passage, course alteration points, etc to be marked on the chart and to be written in the answer sheet.

Q.2 A vessel steering a course of 260^{O} T observed Olands Sodra Grund ltd. (Latitude 56^{O} 04.3' N, longitude 016^{O} 41'E) bearing 010^{O} T at 0400 hours. Again at 0500 hours, the same light bore 040^{O} T. At 0615 hours, Utklippan Lt. (latitude 55^{O} 57' N, longitude 015^{O} 42' E) bore 351^{O} T. if the current was setting 300^{O} T, find the following:

a) Position of the ship at 0400 hours and 0615 hours

b) Course and speed made good

c) Rate of the current

Q.3 A Vessel observes Christianso Island Main Light (55^{O} 19.2' N 015^{O} 11.6'E) bearing 270^{O} (T), 5 miles off at 2030 hours. Find the course to steer to have Hano Light (56^{O} 00.8' N 014^{O} 51'E), 4 points on port bow when it is 12 miles off. At 2230 hours, while on this course at a speed of 14 knots, the echo sounder recorded a sounding of 10m below keel (ship's draft: 8.0m even keel, height of tide 1m). Find the ship's position at 2230 hours and set and rate of current.

PART - B

Q.4 Find the Initial course. Final course and the Great circle distance from Lizard point (49^{O} 50'N 005^{O} 12'W) to Barbados (1.3^{O} 06'N 059^{O} 20'W)

Q.5 At 1530h ship's time on a vessel in DR position 15^{O}20'S 179^{O}50'W an observation of sun bearing 260^{O}T gave observed longitude 179^{O}55'W. The vessel then sailed on a course of 265^{O}T at 15 kn. At 1900h an observation of venus gave an intercept of 4' away and azimuth 165^{O}T. If observation of Venus was calculated using DR obtained by allowing run on DR latitude and observed longitude at 1530 h. Find ship's position at 1900h.

Q.6 a) In DR position 30^{O} 06'S, 038O 45'W, on 21st July1992, sextant altitude of Moon's upper Limb was found to be 39^{O} 30' when GMT was 09h 20m 49s. IE:3.5' on the arc, HE:15m. Using "longitude by chronometer" method, find the direction of position line and the position through which it passes.

b) On 29th November 1992, at GMT 11h 29m 20s in DR 25^{O} 36'S 107^{O} 20'W, the sextant altitude of star 'Rigel' was 35^{O} 07.8'. If HE was 12m and IE: 0.8' on the arc, find the direction of the PL, and the intercept.

SECTION – C

Q.7 On 14th Oct.92 AM at ship in DR 42^{O} 10' N 170^{O} 10'E, find 1st & 2nd magnitude stars that will cross observes meridian from beginning of Nautical twilight to the beginning of civil.

Q.8 a) A star when on meridian above the pole bore North with a true altitude of 70^{O} 04' and when on meridian below the pole it bore North with a true altitude of 22^{O} 05'. Calculate observer's latitude and the star's declination.

b) If the Sideral period of Venus is 224.7 days, find its maximum elongation.

Q.9 a) Briefly describe Universal Transverse Mercator chart projection and its uses.

b) What are the conditions necessary for the twilight to last whole night, continuous darkness?

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GOVERNMENT OF INDIA

Date: - 10th April-2017 (Batch 1)

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use chart No.**5048** Nautical almanac 1992, Deviation card no. 3, variation 2^{O}W, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use lumunious range diagram as necessary.

Part - A

Q.1 A vessel in Dead Reckoning Position (DR) 51^{O} 26.20N 35.7'W at 1830hrs, steering a course of 100 (T) at speed of 18 knots observes the following:-

At 1821 hrs – Star A – Intercept 4.0' Away Az 210^{O}

At 1842 hrs – Star B – Intercept 2.0' Towards with Az 120^{O}

A Position in Lat 51^{O} 30' N; Long 007^{O} 30'W was used in calculating at the Star sight. Find the following:

a) The positing of the vessel at 1830 hrs

b) The course to steer from the position at 1830 to have Hood Head light; (52^{O} 07.5' N 006^{O} 55.8' W) right ahead at first sighting if the estimated visibility is 5 miles. HE = 28 meters

c) Time when the Hook Head light would be first sighted.

d) Time & distance off will Mine Head light will be abeam on this course.

Q.2 A vessel steering a course of 245 (T) at speed of 12kts observes Conningbeg light vessel Lat 52^{O} 02.5'N; Long 006^{O} 39.5'W) to bear 275 (T) of 2000 hrs, 299 (T) at 2020 hrs and 359 (T) at 2050 hrs. The current in the area estimated to set in the direction of 205^{O}. Find the vessel at 2050hrs, the course made good, the speed made good and the rate of the current experienced.

Q.3 Your vessel in ballast is at anchor in position Lat 52^{O} 05'N; Long 007^{O} 25.6' W. Plan a safe sea passage from this position to Cork harbor pilot station (51^{O} 45'W 008^{O} 15.2'W). Plot course on the chart and mark the alteration points clearly. Way points, course and distance on each leg of passage to be shown on the chart and in the answer sheet. Maximum draft of 10m & speed of 12knots to be assumed, GPS is not working, Strong easterly gale force wind reported in the approaches to Cork harbor. If ETD 2130hrs on 14 sept, what report would you send to Corks pilots.

PART - B

Q.4 Find the composite track distance from Hobart (42^{O} 53'S, 147^{O} 20'E) to Cape Pillar (52^{O} 43' S 072^{O} 43'W) with a limiting latitude of 53^{O} S. Also, find the initial course.

Q.5 In DR 17^{O} 15' N 087^{O} 12'E, stellar observation of three stars at 0545hrs yielded the following position lines:
Star X: Az 058^{O} T Intercept 0.7' Away
Star Y: Az 132^{O} T Intercept 4.2' Away
Star X: Az 206^{O} T Intercept 1.7' Away

Q.6 On 22nd of September 1992 AM in DR latitude 46O 17'S, the sextant altitude of the Sun's LL was 29^{O} 25' at 22d 19h 33m 51s GMT, IE 3.0' off the arc, HE 11m. The ship then steamed 300 T for 45 M when the sextant meridian altitude of the Sun's LL was 43^{O} 57.9', north of the observer. Find the ship's position at the time of meridian altitude.

SECTION – C

Q.7 A ship in DR 52^{O} S, 080^{O} 45' W, on 28th February 1992. Find the first magnitude star that will cross the observer's meridian above & below the pole & which will be above the observer's rational horizon, during PM nautical twilight.

Q.8 A star rose bearing S 80^{O} E for an observer in latitude 20^{O} S. What will be its true altitude four hours after rising?

Q.9 Draw a Polar Gnomonic Chart to suitable scale for latitudes from pole downwards to 60^{O} N for a sphere of diameter 100cms, and on this chart show the following:-
a) Great Circle Track from position 60^{O} N, 120^{O} W to position 70^{O}N, 130^{O} E.
b) Composite Track between above two positions, with limiting latitude of 70^{O} N

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GOVERNMENT OF INDIA
FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 HOURS **PASS MARKS: 140** **MAX MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C
2. All questions carry equal marks
3. Use Chart No. 5072 Nautical almanac 1992, Deviation card no. 3, Variation 2°W, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question
4. **Positions of the landmarks are approximate and are for identification only**
5. Use luminous range diagram as necessary

PART – A

Q.1 A vessel on a course of 255° (T) at 12 knots observes Olands Sudra Grund Lt. (56° 04'N, 016°41'E) bearing 005° (T) at 2000hrs and 040°(T) at 2100hrs.
At 2215hrs, Utklippan lt. (55° 57'N, 015° 42'E) bore 355° (T). If the current during the above period was setting 239° (T) Find i) Position of ship at 2000hrs, 2100hrs & 2215Hrs ii) CMG & SMG iii) Rate of Current

Q.2 At 1800 hrs a tanker is 355° (T) at 20nm of a Cargo vessel and is steering 112° (T) at 12kts. The Cargo vessel is steering a course of 090° (T) at 12 kts. Find the minimum dist they will pass and also find the time that they will be closest to each other

Q.3 At 2200 hrs vessel dropped pilot at SIMRISHAMN Pilot Station (55° 34'N, 014° 24'E). She intends to join the west bound lane of TSS off Falsterbore Racon (55° 18.5'N, 012° 39.5'E). Plot safe courses on chart with draft 10m and UKC of 2.0m throughout. Plan your passage giving details of what equipment and landmarks you would use

PART – B

Q.4 A vessel intending to sail on a Great Circle Track from position Lat 42° 24' S Long 147° 41' E to position Lat 52°25' S Long 072° 27' W decides to make a composite sailing limiting the maximum latitude to 52° 25' S. Calculate the difference in the distance that the vessel has to steam.
If the vessel departs at 1600 hrs on the 11 June (Zone -9.5) maintaining 15 knots, what will be her ETA at the arrival port assuming Zonetime (+5.5)?

Q.5 At 1750 hrs a star sight gave an intercept of 5.1' towards & azimuth 133° (T). At 1812 hrs another sight gave azimuth 051° (T) and intercept 1.9' away. Both the intercepts were calculated using 1800 DR position 21° 12' S 31° 13' W. Find the position of the vessel at 1800 hrs if the vessel was steaming a course of 298° (T) at 20 knots

Q.6 On a vessel the true altitude of Sun East of meridian was observed to be 12° 21.2' at GMT 22 July 1992, 16h 15m 26s. At the same time the Sextant Meridian altitude of the Moon's upper limb was 54° 47.4' south of the observer. Calculate the position of the vessel at that instant if the Index error was 2.3' on the arc and height of eye 25 m

PART – C

Q.7 At the end of PM civil twilight on 16th June 1992, find out the stars and planets of First & Second magnitude which will be within 15° of the observer's meridian.
Also find which of them will be available for observation. The DR position of the observer is 20° 10' N 075° 15' E.

Q.8 (a) The Sun was sighted at an azimuth of 270° (T) at an altitude of 42° 24' by an observer. The declination of the Sun was 12° 13' S and the GHA was 070° 30'. Find the position of the observer

(b) On 23rd August 1992, find out which of the four planets Venus, Mars, Jupiter & Saturn was the brightest and how many times brighter than the least bright planet

Q.9 (a) You are planning a Great Circle passage on your vessel. Explain the procedure to transfer the GC track from a Gnomonic chart to a Mercator chart.

(b) Define (i) Meridional Parts (ii) Natural Scale of a chart

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GOVERNMENT OF INDIA

Date: - 10th Jan-2017 (Batch 2)

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours PASS MARKS: 140 MAX. MARKS: 200

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use chart No.**5056** Nautical almanac 1992, Deviation card no. 3, variation 2^{O}W, ship's speed 12 knots and Height of eye of the observer 25m if not mentioned in the question.
4. **Positions of the landmarks are approximate and are for identification only.**
5. Use lumunious range diagram as necessary.

Part - A

Q.1 A vessel steering 085^{O} (T) at 12 knots last sights on her port quarter Start point light house (50^{O} 13.4'N 003^{O} 38.4'W) at 0245hrs in met visibility of 5 nm, and at 0515hrs first sights the Bill of Portland light (50^{O} 30.8'N 002^{O} 27.4'W) on her port bow. If the current is known to be settings 310^{O} (T) at 2 knots and the strong Southerly gale is causing 5^{O} leeway. Determine the ship's position at 0245 hrs and 0515 hrs and the course and speed made good.

Q.2 A vessel is SE of Berry Head light (50^{O} 24'N 003^{O} 29'W) while Steering a course of 017^{O} (G) at 12 knots when the following bearings were observed 0930 hrs Berry Head light 292^{O} (G), 0950 hrs 262^{O} (G) and 1010 hrs 227^{O} (G) same time at 1010 hrs Straight point lt. bears 355^{O} (G). Find the position at 1010 hrs, Course made good and set and drift of the current between 0930 hrs and 1010 hrs.

Q.3 A vessel while steering 355^{O} (T) at 12 knots and using DR position of 50^{O} 00'N 001^{O} 40'W makes the following stellar observations: 0600hrs – Intercept 2.0' (T). Azimuth 330^{O} (T) Star Altair, 0630 hrs – Intercept 2.2' (A) Azimuth 060^{O} (T) Star Vega. Current setting 270^{O} (t) at 3 knots. Determine the position at 0630 hrs and E.P. at 0700 hrs. Find the course to steer from 0700 hrs E.P. to see the Needles light house 50^{O} 39.7'N 001^{O} 35'W right ahead when it is 12 nm off if the current is same.

PART - B

Q.4 A vessel intends to sail from 40^{O} 30'S 179^{O} 30'E to its destination in 55^{O} 63' W on the shortest possible track but not exceeding 55'S parallel of latitude at any time. Calculate the total distance vessel needs to steam and the initial & final courses.

Q.5 A vessel in DR 21^{O} 54' S 092^{O} 29' E took a star sight & obtained intercept of 9.4' towards bearing 121^{O}. After this sight vessel steered 248^{O} (T) for 35 miles and obtained another intercept of 5.7' away and azimuth 219^{O}. Find vessel's position at second observation if the DR used for calculating second observation was obtained by applying the run on initial DR position.

Q.6 At 0915 hours ship's time on 01st Sep 1992 a morning sight of the sun gave an observed longitude of 164^{O} 46' E. The sight was calculated using DR latitude 26^{O} 16' S. The vessel then steamed on a course of 145^{O} (T) with a speed of 22 kts. Calculate (a) Sun's meridian passage time as per ship's clocks and (b) altitude to be set on the sextant (I.E 1.7' on the arc) for meridian passage observation of the Sun's upper limb. The ship's clocks are 11 hours ahead of GMT and the HE is 37 m.

SECTION – C

Q.7 The sextant altitude of an unidentified star was found to be 43O 11.1' when it was bearing 080^{O} (T). The observation was made at GMT 19th Jan 1992 at 07h 33m 44s. The vessel was in DR 00^{O} 03' N 170^{O} 51' E. Find the star. (Given HE of observer is 18m & I.E. 1.3' off the arc).

Q.8 Jupiter has an orbit of 11.86 years; calculate the distance between Earth & Jupiter when Jupiter is in conjunction with the Sun.

Q.9 (a) Find observer's position if Altitude of sun is 44^{O} 10' when bearing 090^{O} True and its declination at that instant is 11^{O} 13' N and GHA Sun is 0^{O} 06.3'

(b) What is the Julian calendar? Why was the Georgian adjustment made to this calendar?

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GOVERNMENT OF INDIA
FIRST MATE OF A FOREIGN GOING SHIP (PHASE – I)
FUNCTION: NAVIGATION (Management Level)
PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 HOURS **PASS MARKS: 140** **MAX MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C
2. All questions carry equal marks
3. Use Chart No. 5047 Nautical almanac 1992, Deviation card no 3, Variation 2°W, ship's speed 12 knots and Height of eye of the observer 12m if not mentioned in the question
4. **Positions of the landmarks are approximate and are for identification only**
5. Use luminous range diagram as necessary

PART – A

Q.1 (a) A vessel at anchor off Foreland Point observes the following:
Foreland Point Lt. (51° 15'N 003° 47'W) 190° (G)
Nash Point Lt. (51° 24'N 003° 33'W) 070° (G)
Scar weather Point Lt. vsl. (51°27'N 003°56'W) 320° (G)
Find the vessel's position and the Gyro error

(b) From the above position, set Gyro course so as to have Helwick Lt. Vsl. (51°31'N 004° 25'W) right ahead when 6 miles off with current setting East at 3 knots. Find the steaming time when Helwick Lt.vsl. will be right ahead? (Use 12knots engine speed)

Q.2 A vessel Steering compass course observes following bearings at 1900hrs
Govan's Head Point (37) (51° 35.8'N, 004° 55.4'W) 257°©
Caldey Is. Lt. (51° 37.9'N, 004° 41.0'W) 077° ©
St. Govan Lt. Vessel (51° 30.6'N, 004° 59.7'W) 30° on starboard bow
At 1930hrs finds the same Lt. Vessel 60° on her starboard bow. Find the position of the vessel at 1900hrs and the compass course steered by the vessel

Q.3 In position at 1800 hrs a vessel observed Lundy Island South Lt. (51°09'N 004° 39'W) bearing 050° (T), distance 6 miles off. Find the true course to steer to bring the same abeam on port side at 1830hrs. (Ship's speed 10 knots) From 1830 hrs Position, find the Gyro Course (Error 2° High) and the engine speed required to reach Bideford Pilot Station (51° 05'N 004° 15'W) at 2030 hrs. Counteracting the current setting 045°(T) at 2 knots

PART – B

Q.4 If a Vessel sails on Rhumb line from 43°25' S 074°40' W to 42°30' S 176°25' E there is no current and if she sails along a composite track between these positions, she is expected to get 1.4 kts opposing current throughout. Find the difference in steaming time if Vessel's steaming speed is 14 kts and limiting lat is 50° S

Q.5 At 1800 hrs on a certain day DR position of a vessel was 22° 37' N 028° 47' W. At 1750 hrs Star A gave an intercept 5.1' towards and azimuth 129° (T). At 1813 Star B gave an intercept 2.1' away and azimuth 048° (T). Both the sights were worked using 1800 DR position. Find the position of the vessel at 1800 hrs if vessel was steaming on a course of 293° (T) at a speed of 22 kts

Q.6 A vessel took two simultaneous observations on GMT 16th Jan 1992 23h 40m 02s. The first observation of Venus which was east of the observer's meridian gave sextant altitude of 19° 40.5'. The second observation of Moon which was South of the observer (Azimuth 180°) gave Sextant altitude of the upper limb 82° 11.8'. The index error of the sextant was 1.2' off the arc & the height of eye of observer 31 m. Find the position of the vessel

04/oct/16

PART – C

Q.7 In position 38° 12' N 119° 38' E find the stars of 1st and 2nd magnitude & planets crossing observer's meridian & his inferior meridian between 1800-1900 ship's time (time zone – 0800 h) on 13 Sept 1992

Q.8 For an observer the Sun had a GHA of 240° 38' and SHA 251° 20' when it attained the maximum altitude for the day, which was 69° 30', bearing North. Find the position of the observer

Q.9 (a) a) What do you understand by conical projections? Why are they used?
b) What are the conditions necessary for
a) the twilight to last whole night and
b) night / darkness for 24 hours?

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GOVERNMENT OF INDIA

Date: - 4th Oct-2016 (PM)

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours PASS MARKS: 140 MAX. MARKS: 200

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use chart No.**5048** (Ireland-South Coast – Old Head of Kinsale to Tuskar Rock); Nautical almanac 1992, Deviation card No.2, Variation as per chart, speed 12 knots and Height of eye of the observer 10m.
4. Positions of the landmarks are approximate and are for identification only.
5. Use lumunious range diagram as necessary.

Q.1 While steering a course of 073^0T, Mine head LT Ho (51^0 59'N 007^0 36'W) was observed to bear 025^0T at 2000h at 2020h it bore 345^OT and at 2040h it bore 293^0T. The current was estimated to set 028^0T. Find the vessel's position at 2020h and 2040h. What must be steered to make good 073^0T?

Q.2 At 2000h in DR position $51^0$41'N 007^0 15'W, a star sight gave an intercept of 1.3M towards with an azimuth of 142^0T on a course of 288^0T. The visibility reduced to 5M thereafter, Bally Cotton is Lt. (51^0 50'N 007^0 59'W) was first sighted at 2130h. Find the vessel's position at 2130h (height of eye to be 15M in this question, set and rate being $000^0$2 Knots).

Q.3 At 1900h a vessel drawing 11m observes Conningbeg Lt. Vl. ($52^0$3'N 006^0 39'W) bearing due East at distance 3M. She is proceeding towards Tuskar Rock Lt. (52^0 12'N $006^0$12'W). (4M due SSW of it). The visibility being 3-4 miles. Taking into account the tides in the area, plan a safe passage and state clearly the precautions to be taken when undertaking the passage. High water springs at port to which tidal streams are referred to was 3 hours ago. The radar, gyro compass and echo sounder are available and operational. (Safe speed adopted by master is 8kn).

SECTION – B

Q.4 On a vessel, using DR 10^0 26' (N) 059^0 50' (E), simultaneous celestial observations of different stars gave following results:

STAR	RESULT	AZIMUTH
Polaris	Obs. Lat 10^0 27' N	AZ 001^0(T)
X	Obs. Long 059^0 46' E	AZ 069^0(T)
Y	INT 1.2' AWAY	AZ 150^0(T)

Find the position of Vessel at the time of observation and also calculate the Index error, which was not applied in the original calculation (assume that there is no other error).

Q.5 On 22nd July 1992, the true altitude of the Sun East of meridian was 10^0 02.3' at GMT 22d 16h 12m 13s, at the same time sextant meridian altitude of the Moon's L.L., South of the observer was 53^0 40.7'. Calculate the position of the vessel at that instant. Given 1.E. 2.5' "off the Arc" – H.E.

Q.6 On 30th Nov' 1992 DR Lat 15^0 S 090^0 45'E the back angle. Observation of Sun's LL east of meridian gave Sextant altitude of 117^0 11.6' 1.E. 2.8' on the arc, HE 12m, when chron showed 03h 54m 32s (Error = 01m 31s fast). Find the PL and position through which it passes. The vessel then sailed on a course of 125^0(T) till meridian passage that day (run 30 miles). Compute the altitude to be set on the same sextant for a meridian altitude observation.

SECTION – C

Q.7 On 29th Nov 1992, AM at ship in DR $25^0$30'S, $107^0$15'W', in cloudy weather, the sextant altitude of unknown star was $35^0$10.3', Azimuth 278^0 when the GMT showed 29d 11h 29m 20s. If IE was 2.8' on the arc and HE was 12m. Identify the star.

Q.8 Find the sidereal period of venus if the mean distance of Venus is 67.3 Million miles from sun, using 3rd law of kepler.

Q.9 To a stationery observer, a star bore 000^0T with a true altitude of 75^0 32'. After about 12 hrs, the same star bore 180^0T with a true altitude 22^0 36'. Calculate the observer's latitude and declination of star.

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GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. 5047; (Bristol Channel) Nautical almanac 1992, Deviation card No. 1, Variation 2°W , ship's speed 12 knots and Height of eye of the observer 12m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION A

Q.1. (a) A vessel at anchor off Foreland Point observes the following:

Foreland Point Lt. (51° 15'N 003° 47'W)	190° (G)
Nash Point Lt.(51° 24'N 003° 33'W)	070° (G)
Scar weather Point Lt. vsl. (51°27'N 003°56'W)	320° (G) .

Find the vessel's position and the Gyro error.

(b) From the above position, set Gyro course so as to have Helwick Lt. Vsl. (51°31'N 004° 25'W) right ahead when 6 miles off with current setting East at 3 knots. Find the steaming time when Helwick Lt.vsl. will be right ahead? (Use 12knots engine speed).

Q.2. In position at 1800 hrs a vessel observed Lundy Island South Lt. (51°09'N 004° 39'W) bearing 050° (T), distance 6 miles off. Find the true course to steer to bring the same abeam on port side at 1830hrs. (Ship's speed 10 knots) From 1830 hrs. Position, find the Gyro Course (Error 2° High) and the engine speed required to reach Bideford Pilot Station (51° 05'N 004°15'W) at 2030 hrs. Counteracting the current setting 045°(T) at 2knots.

Q.3. A general cargo ship having a draft of 11 m drops pilot at **Bideford Fairway** (51° 05' N, 004° 16.4'W) in gale force winds and is bound to pick up her next pilot from **Bristol Pilot Grounds** (51° 21' N, 003° 19' W). Plot your courses on the chart, with clear marking of course & distance & course alteration points for each leg of the passage & give synopsis of passage planning in the answer sheet.

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SECTION B

Q.4 A vessel on voyage is doing a composite track from a position 40^0S 100^0W to 55^0S 180^0 with limiting Latitude 55^0S. Find the total distance and initial course.

Q.5 At 1800 hrs on a certain day DR position of a vessel was 22° 37' N 028° 47' W. At 1750 hrs Star A gave an intercept 5.1' towards and azimuth 129° (T). At 1813 Star B gave an intercept 2.1' away and azimuth 048° (T). Both the sights were worked using 1800 DR position. Find the position of the vessel at 1800 hrs if vessel was steaming on a course of 293° (T) at a speed of 22 kts.

Q.6 At 0600 hours Minicoy Lt. House ($08^0$16'N 073^0 20'E) bore 004^0 C error 4^0W, distance 12 miles. Course was then altered to 315^0C, error 1^0W, speed 16 knots. At 0930 hours Sun's sight gave observed longitude 072^0 30'E using DR latitude, azimuth was 122^0(T). Vessel continued on the same course and speed. At 1230 hours meridian altitude of sun gave observed latitude $09^0$28.6'N. Find the observed Noon position. (Consider effect of wind and current remained same throughout the passage)

SECTION C

Q.7 On 10th Oct 1992 PM a ship is in DR position 22□11'N 150□12'E. Find the 1st and 2nd magnitude stars that will cross the observer's meridian at nautical twilight.

Q.8 a)State/Explain the 1st and 2nd laws of Kepler's Planetary motion alongwith Diagrams

b) Find the distance of Venus from Sun, if the sidereal period of Venus is 224.7 days, using 3rd law of Kepler.

Q.9a) What do you understand by conical projections? Why are they used?

b) What are the conditions necessary for

i) the twilight to last whole night

ii) night / darkness for 24 hours?

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GOVERNMENT OF INDIA

06.04.2016

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. **5048** (Ireland-South Coast- Old Head of Kinsale to Tuskar Rock); Nautical almanac 1992, Deviation card No.4, Variation 7°W ship's speed 10 knots and Height of eye of the observer 10m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION – A

Q. 1) At 1900 hours, in DR Position 51° 47'N, 007° 03.0'W, observed longitude obtained from star 'A' was 006° 58.0'W, azimuth 210° (T) while star 'B' gave an intercept of 6 miles 'away', azimuth 160°(T). Find the ship's position at 1900 hours.
Set course at 1900 hours to have' Mine Head' Lt. (51° 59.5' N, 007° 35.2'W) right ahead when 12 miles away.
Estimate the time to have 'Mine Head' to light to your North-West.
(Engine Spd. 16 knots, Current 200°(T) @ 4 knots)

Q. 2) At 0812 hours, 'Hook Head' Lt.Ho. (52° 07.4'N 006° 55.8'W) bore 292° (C) & 'Coningbeg' Lt. v/l. (52° 02.4'N 006° 39.4'W) bore 170° (C) when she was on 182°(T) at 9 knots in SE'ly gales through current setting 250°(T) at 3 knots. ~~Later same~~

Q. 3 a) Passage planning uses ship's resources by way of time, extra workload, efforts, checks, record keeping, compliance, monitoring etc. Why is it still worth it? Justify.

b) Your Ship (A), maximum speed 16 knots, has to catch-up with another vessel (B) that is steering a course of 216°(T) at 9 knots. Set your course to rendezvous 'B' if she lies 102 miles from "A" in 334°(T) direction. How long will it take you to reach her?

Later Maintaining same course and speed Hook head lighthouse dip at 1014 hrs. Find Compass error and Position of the Ship at both times

HE 12 mtrs Leeway 8°,

Contd...2...

3614-PM

SECTION - B

Q. 4 A vessel has to sail along a Great Circle track from 23°20'S, 042° 40'W to 33°30' S, 017°50'E. Divide the G.C. track into three equal parts & find the positions of the points dividing the track.

Q. 5 Following simultaneous stellar observations were calculated using the DR 25°40'N, 140° 10'E:

Star X	obs. Long. 140°15'E	Azimuth 115° (T);
Star Y	Intercept 2' (T)	Azimuth 240°(T);
Polaris	Obs. Lat. 25°38'N	Azimuth 001°(T).

Find the Vessel's Position.

Q. 6 a. Find the position line and position through which it passes, in the following cases:
DR 28° 25'N 027° 25'W. Sext. Alt of Polaris 27° 45', I.E. 1.0' off the arc. H.E. 16m, Month-March GHA Y 276° 14.4'.

b. On 12th Sept 1992 in DR Long 072° 20'E, the sextant meridian altitude of the star ALDEBRAN was 31° 10.2' North of the observer. If IE 3.2' off the arc and H.E was 18m, Find the latitude and the PL and state the GMT of meridian passage.

SECTION - C

Q. 7 Name stars which might be suitable (16th ↪) for observing a meridian altitude during morning twilight on January 8th 1992 in D.R. 30° 00'N , 41° 30' W, I.E. 1.5' on the arc. H.E. 20m. Calculate the approximate sextant altitude of one such star as a guide for setting the sextant and state its GMT of transit.

Q. 8 A Star rose bearing S80°E for an observer in latitude 20°S. What will be its true altitude four hours after rising?

Q. 9 Draw a Polar Gnomonic chart to suitable scale for latitudes from pole downwards to 60°N for a sphere of diameter 100 cms, and on this chart show the following:
a) Great Circle Track from position 60°N, 120°W to position 70°N, 130°E;
b) Composite Track between above two positions, with limiting latitude of 70°N

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06.04.2016

GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. 5072 and admiralty Tide Tables for 1992.
4. Engine speed : 12 knot, H.E: 15 meters, Variation: 3^0 W, Deviation Card No: 3
5. Positions of landmarks are approximate and are of identification only.
6. Luminous Range Diagram may be provided if required

SECTION – A

Q. 1 While steering 105^0 (C) at 2000, Hammerodde Light ($55^018'N; 014^047'E$) bore 165^0 (C) . The vessel continued on her course and speed and at 2030, Hammerodde, Lt. was bearing 205^0(C). At 2110, CHRISTIANSO ISLAND Lt. (55^0 19.2'N; 015^0 11.3'E) bore 190^0(C). Current was estimated to be setting 075^0(T). Find:

I) Ship's Position at 2000 and at 2110.

II) Course and speed made good from 2000 to 2110.

III) Rate of Drift of Current.

Q. 2 From a vessel steering 035^0(T), during Evening Twilight following celestial observations were made using D.R. Position : Lat:$55^015'N$; Long: $016^000'E$

At 1800, VENUS- True Azimuth 115^0(T), Intercept 3' Away

At 1820, Jupiter – True Azimuth 055^0 (T), Intercept 5' Towards

If the current was estimated to be setting 120^0(T) at 5 knots, find ship's position at 1820. From this position, find the true course to steer in order to First Sight UTKLIPPAN Light – Fl.15 SEC, 31m 24M Right Ahead in prevailing visibility of 5 miles if the current remained the same.

Q. 3 At 1000 while steering 300^0(T), the vessel observed SANDHEMARAN Lt.Ho. ($55^023.5'N$; $014^011.5'E$) bearing 30^0 on her starboard Bow and at 1025 From this position, find the compass course to steer to pass KULLAGRUND Lt. Ho.(55^0 18'N; $013^020'E$) 5 miles off to starboard counteracting a current estimated to set SOUTH at 3 knots and Leeway of 3^0 caused by southerly wind.

She was abeam.

Contd...2...

26/04-AM

SECTION – B

Q. 4 Find the final course and distance along the composite track from A in Lat 42°00'S Long 170°00'E to B in Lat 56°00S' Long 070°00'W, the limiting latitude being 56°00'S.

Q. 5 An observer on a ship steering 205°T at 20 knots obtained the following results from stellar observations. A.C.P of 20°N,30°E was used in all calculations . Find the observed position at 1800.

1. 1754 140°T 4.0' Towards
2. 1812 200°T 3.0' Towards

Q. 6 On 29th November 1992, vessel in DR 26° 25'N : 130° 30'W, the True Altitude, Declination and GHA of Su-East of Meridian were 27° 50; 21° 36.4'S;89°49.4' respectively. Calculate the intercept and direction of PL. From the ITP point the vessel sails on a course of 040°(T) at 16 knots. Compute the altitude to be set on the same sextant for a meridian altitude observation of Sun's UL. Given I.E = 3.0' on the arc, HE= 12m, Ship's Time GMT-0830

SECTION – C

Q. 7 On 21st Jul 1992, in DR 20°00'N 075°00'E, which stars and planets of first & second magnitude within 30°(of hour angle) of the observer's meridian will be available for observation at the end of PM civil twilight?

Q. 8 If the distance between Venus & Sun is 0.723 times the distance from Earth to Sun, Find the sidereal period of Venus

Q. 9 a) What are the Kepler's laws of Planetary motion?
b) What conditions are necessary for a Solar eclipse to occur?

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26/04/2016

GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use **Chart No. 5056; (Start point to The Needles)** Nautical almanac 1992, Deviation card No. 2, Variation as per chart, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION A

Q. 1 At 2100 hrs., a ship observes the horizontal angle between Kingswear Light (50^0 21'N, $003^0$34'W) and start point Lt. ($50^0$13'N, $003^0$38'W) to be 50^0. It then steers a course of 210^0 (T). At 2130 hrs, start point fixed Red light was last visible. Find the ship's position at 2130 hrs. assuming no current.
From this position set course to have Channel Lt V/l ($49^0$55'N,002^0 55'W) right ahead when 9 miles off with current setting 030^0 (T) at 3kts.
At what time would the channel Lt. V/l be sighted right ahead.

Q. 2 At 0800 hrs. Anvil Pt. Light House was 7 miles off and at 0906 hrs. Bill of Portland Light was 8 miles off. Vessel steered 260^0(T), Engine speed 9 knots. During this interval, the current was setting 185^0 (T) at one knot. Find:

a) Ship's position at 0800 hrs.
b) Ship's position at 0906 hrs
c) Course made good by her in this period.

Q. 3 The following bearings were observed by a ship
Hope's Nose ($50^0$27.8'N,003^0 28.8'W) : 260^0 (C)
The Ness ($50^0$32.2'N, 003^0 29.8'W): 301^0 (C)
Straight point ($50^0$36.4'N,003^0 21.7'W) : 003^0 (C)
The position was plotted with the above bearings assuming no error for the compass. However it results in a cocked hat. Resolve the cocked hat and from the .
Position thus obtained, lay courses to reach Needles Pilot Boarding Ground.

Contd...2/-

SECTION – B

Q. 4 Calculate the initial course, the Final course & Distance along the composite track from $36^0 20'S, 139^0 40'E$ to $38^0\ 10'S, 120^0\ 00'W$, with a limiting latitude of $44^0 30'S$. Also find the latitude where the track crosses the 180^0 meridian.

Q. 5 Following simultaneous stellar observations were calculated using the DR $25^0\ 40'N$, $140^0 10'E$:

Star X	Obs.Long.$140^0 15'E$	Azimuth 115^0 (T);
Star Y	Intercept 2' (T)	Azimuth 240^0 (T);
Polaris	Obs. Lat. $25^0\ 38'N$	Azimuth 001^0 (T).

Find Vessel's position

Q. 6 On 30th Nov. 1992, a vessel in DR longitude 170^0 20E observed the sextant meridian altitude of the star Canopus below the pole as $13^0 06'$.
If the I.E. of the sextant was 3' on the arc and H.E. 12m, Find:
a) The latitude of observer;
b) LMT of lower meridian passage of star.

SECTION – C

Q. 7 On 29th Nov 92 AM at ship in DR Lat.$25^0 30'S$, Long 107^0 20'W, through a break in the cloud, Sextant altitude of a star bearing 276^0G error 2^0L was found to be $35^0 05'$, when GMT was 29th 11h 28m 00s. If IE was 2.5' off the arc, H.E was 12m, Identify the star.

Q. 8 Construct a Mercator chart graticule with natural scale at 36^0N as 1: ten lakh. Latitude range 32^0 to 35^0. Longitude range from 75^0E to 79^0E. What is the diagonal size of chart in cenitmetres?

Q. 9 Explain
a) Keppler's Laws of planetary Motion
b) Transverse Mercator Projection

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GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. **5048** (Ireland-South Coast- Old Head of Kinsale to Tuskar Rock); Nautical almanac 1992, Deviation card No.2, Variation: 7° W, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION A

Q.1 At 1900 hr., while steering 062° C, Bally cotton Island lt. (51° 49.5' N 007° 59' W) bore 320° C. At 1930 hr. it bore 274° C and at 2015 hr. Mine Head lt. (51° 59.5' N 007° 35' W) bore 000° C. Current set 101° T. Calculate course and speed made good, rate of current and the three positions.

Q.2 While steering 285° C Bally cotton Island lt. was last sighted in visibility of 5 miles. HE 8m. After one hour, in clear visibility, Roche's Point lt. (51° 47' N 008° 15' W) changed from white to red. Current set 140° T at 3 knots. Leeway 4° due to Northerly wind. Calculate course and speed made good, and both positions.

Q.3 Own ship is in position 51° 30' N 007° 00' W. Another ship is stopped in position 52° 00' N 007° 00' W and drifting. Current in the area is setting SE at 2 knots. Calculate compass course to steer, engine speed, and course and speed made good of own ship to meet the other ship after 4 hours. Also calculate the meeting position.

...CONT 2...

SECTION B

Q.4 On a vessel, using DR 10^0 26′ (N) 059^0 50′ (E), simultaneous celestial observations of different stars gave following results:

STAR	*RESULT*	*AZIMUTH*
Polaris	***Obs. Lat 10^0 27′ N***	***AZ 001^0(T)***
X	Obs. Long 059^0 46′ E	AZ 069^0(T)
Y	INT 1.2′ AWAY	AZ 150^0 (T)

Find the position of Vessel at the time of observation ~~and also calculate the Index error, which was not applied in the original calculation (Assume that there is no other error)~~.

Q.5 A vessel sails from port A located on Greenwich meridian in certain North latitude. After traversing a distance of 3000M along a perfect great circle track, she reaches another port B at Equator on a course of S60^0W. Calculate the initial course and the longitude arrived. Also calculate the position of vertex of the great circle track.

Q.6 Using the DR Lat. 12^0 02′ (N), Long. 170^0 05′ (W), an observation of Sun gave intercept 3.0′ Away, Az 065^0 (T). It was realized later that index error of 2.0′ on the arc was wrongly applied as 2.0′ off the arc and the chronometer error of 16s slow was not applied in the original calculation. Calculate the correct intercept.

SECTION C

Q.7 a) A star when on meridian above the pole bore North with a true altitude of 70° 04′, and when on meridian below the pole it bore North with a true altitude of 22° 05′. Calculate observer's latitude and the star's declination.

b) If the Sidereal Period of Venus is 224.7 days, find its maximum elongation.

Q.8 a) Explain the effect of latitude on the duration of twilight, with suitable sketches.

b) On the longest day in Northern hemisphere, an observer in Southern hemisphere notices that the duration of night is 3 times the period of daylight. Find the latitude of the observer.

Q.9 On 28th February 92, PM at ship in DR $52^0$00′ S, $080^0$45′ W, find the 1st magnitude stars that will cross observer's meridian above and below pole during nautical twilight and are suitable for observation.

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6/1.16 pm

GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

Amendment of Q.6 & Q.4,

Kindly replace Q.6 with question given below:

Q.6. On 22nd of September 1992 AM in DR latitude 46° 17' S, the sextant altitude of the Sun's LL was 29° 25' at 22d 19h 33m 51s GMT, IE 3.0' off the arc, HE 11m. The ship then steamed 300 T for 45 M when the sextant meridian altitude of the Sun's LL was 43° 57.9', north of the observer. Find the ship's position at the time of meridian altitude.

Q.4. The last line to read as:

"Find the position of vessel at the time of observation".

Remaining part of question to be ignored.

06.01.2016

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GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use **Chart No. 5072; (Falsterbo to Oland)** Nautical almanac 1992, Deviation card No. 2, Variation 1^0W , ship's speed 12 knots and Height of eye of the observer 15m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION – A

Q.1 While steering course of 092° (C), A vessel last sights Kullagrund White light (55°17'N 013°20'E) on the port beam when meteorological visibility was 2 miles only. Find the vessel's position. After 2 hrs of steaming observed position was 55°14.9'N 014°03.5'E. Find (a)set and rate of current (b)compass course to steer to pass Sandhammeren light (55°24'N 014°12'E) 3 miles on the port side (c) time when Sandhammeren light will be first sighted. Assume visibility and current to be same throughout.

Q.2 A vessel steering course 005°(T) at 12 knots observes bearings of Dueodde light to be 224°(C) and Svaneke light as 290°(C) at 2200 hrs. The current in the area was setting 082°(T) at 3 knots. After sailing for 35 minutes the compass bearings of Svaneke and Christiano North light were 226° (C) and 324° (C) respectively. Find CMG, SMG, positions at 2200 hrs and 2235 hrs.

Q.3 At 1500 hrs vessel in DR pos 55° 05'N 016°00'E observes the sun to bear 220°(T) giving intercept of 2 miles towards. The vessel then steers course of 020°(T).The current was estimated to set 270°(T)at 2 knots.The main engine stopped from 1600 hrs to 1800 hrs and from 1800 hrs vessel resumed her course and speed . At 2000 hrs Utklippan light was first sighted when the visibility was estimated to be 10 miles. Find the vesels position at 2000 hrs and set a course for Olands Sodra Grund TSS. (HE 20m. eng speed 13 knots)

SECTION – B

Q.4 A vessel sails from Port A located on the Greenwich meridian in a certain North latitude. After traveling a distance of 3000 miles along a great circle track, she reaches another port B at the equator on a course of S 60°W. Calculate the initial course and the longitude arrived.

Contd...2...

Dt. 06-10-15

Q.5 At 1530 ship's time on a vessel in DR 15° 20'S 179° 50'W an observation of the sun's bearing 260°T gave observed Long 179° 55'W. The vessel then sailed on a course of 265°T at 15Kts. At 1900Hrs an observation of Venus gave an intercept of 4' Away and azimuth 165°T. If observation of Venus was calculated using DR obtained by allowing run on DR Latitude and observed Long at 1530Hrs. Find the ship's position at 1900 Hrs. (25)

Q.6 On 17TH Jan '92, AM at ship in DR 45° 02'S 036° 42'E the sextant altitude of Jupiter near the meridian was 37° 06.8' when the GMT was 17^{D} 01^{H} 27^{M} 20^{S}. H.E. 12m, I.E. 0.6' off the arc. Find the direction of the PL and the position through which it passes. (25)

SECTION – C

Q.7 On 30th April, 1992, PM, in DR 49° 15' (N), 29°15' (W), what stars of 1st and 2nd magnitude or planets will be within 30° of hour angle from the observers meridian? (25)

Q.8 a) Explain Civil, Nautical and Astronomical twilights along with diagrams.
b) Find the sidereal period of Venus if the mean distance of Venus is 67.3 million miles from Sun, using 3rd law of kepler.

Q.9 i) Explain with diagrams why is twilight longer in higher latitudes..
Ii)Write a short note on Gnomonic Projection..

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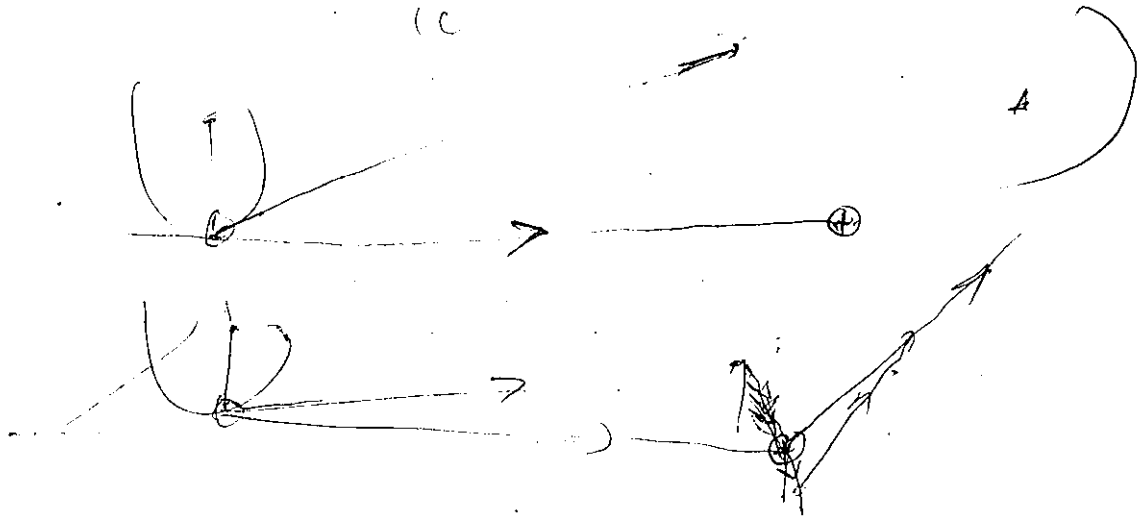

06/6/15 PM

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GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. 5047; (Bristol Channel) Nautical almanac 1992, Deviation card No. 1, Variation 2^0W , ship's speed 12 knots and Height of eye of the observer 12m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION A

Q. 1 A vessel was stopped and anchored in an emergency in position 51^0 05'N 004^0 35' W. At 2000 hrs it sailed from this position on a course of 273^0 (G). At 2030 hrs North Lundy Is. Light (51^0 12' N, 004^0 40.5'W) was observed for the first time and at 2100 hrs South Lundy Is. Light (51^0 09.5'N, 004^0 39'W) was just obscured. If the gyro error was 2^0 (L), find:

a) The vessel's position at 2100 hrs.

b) Set and rate of current.

Q. 2 At 0800 hrs a vessel observes Foreland Pt. Lt. Ho. (51^0 14.5'N, 003^0 47'W) to bear 157^0 (G) and 5 miles off by radar. At the same time Nash Pt. Lt. Ho. (51^0 24'N, 003^0 33'W) was observed to be 12 miles off by radar. From above position set Gyro course to first sight Helwick Lt. V/I. (51^0 30.5'N, 004^0 26'W) 30^0 on starboard bow in prevailing meteorological visibility of 2 miles. Also find Gyro Error.

Q. 3 High water springs at Avon Mouth was at 0700 hrs on 10th August. On the same day ship's position at 0800 hrs was 51^0 40'N, 004^0 30'W. From this position, plot courses on the chart to reach Port Talbot pilot station (51^0 29'N 004^0 W). Keep at least 4 miles away from the coast. Maximum draft of the vessel is 13.0 meters. Use tidal stream data on chart to calculate ETA. Wheel-over positions, courses and distances to be clearly marked in Chart.

SECTION B

Q. 4 Find the initial course and distance on the great circle track from 58° 42'N 005° 00'W to 32° 34'N 064° 30'W. Also find the latitude of the point where the great circle cuts the meridian 15° W.

Contd...2...

Q. 5 On 1st May, 1992 in DR latitude 15° 46'S 064° 12'E a simultaneous observation of three stars at 0545 hrs gave the following results:-

Capella: Az: 023°T Intercept: 4.2 M Towards
Canopus: Az: 147°T Intercept: 5.2 M Away
Fomalhaut: Az: 244°T Intercept: 0.8 M Away

Find the position of ship at 0545 hrs?

Q. 6 A morning sight of the Sun taken at 0850 hours ship's time on 1st Sept' 92 using DR latitude of 26° 20' S, gave on observed longitude of 165° 06' E. Using an estimated speed of 18 knots on a course of 120° (T), calculate:

a) Ship's time of Sun's meridian passage;

b) Sextant altitude to set for lower limb of Sun for meridian passage time. (Given: Ship's Time = GMT+11 hours; H. E. = 18m; I. E= 2' off the arc)

SECTION C

Q. 7 On 20th Jan 92 AM, at ship in DR 25° 28' (S) 107° 14' (E) the sextant altitude of an unidentified star bearing 214° (T) was observed to be 35° 42.8' when GMT was 21h 29m 24s. If HE was 31m and index error was 2.2' off the arc, identify the star.

Q. 8 On 30th Nov. 1992, a vessel in DR Longitude 170° 20' E, observed the sextant meridian altitude of the star Canopus, below the pole, as 13° 06'. If the I. E. of sextant was 3' on the arc and H. E. 12m, find:

a) The latitude of observer; and

b) LMT of lower meridian passage of star.

Q. 9 a) Describe Universal Transverse Mercator projection.

b) Duration of twilight varies with change in Latitude. Explain.

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ADDITIONAL BATCH II (A-M)

PAGE 1 of 2

GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. 5047; (Bristol Channel) Nautical almanac 1992, Deviation card No. 1, Variation 2^0W , ship's speed 12 knots and Height of eye of the observer 12m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION A

Q. 1 At 0800 hrs a vessel observes Foreland Pt. Lt. Ho. (51^0 14.5′ N 003^0 47′ W) to bear 157^0 (G) and 5 miles off by radar. At the same instant Nash Pt. Lt. Ho. (51^0 24′ N, 003^0 33′ W) was observed to be 12 miles off by radar. From above position set Gyro course to first sight Helwick Lt. V/L (51^0 30.5′ N, 004^0 26′ W) 30^0 on starboard bow in prevailing meteorological visibility of 2 miles. Also find Gyro Error.

Q. 2 In position at 2000 hrs a vessel observed Lundy Island South Lt. (51^0 09′ N, 004^0 39′ W) bearing 045^0 (T); distance 7 miles off. Find the true course to steer to bring the same light abeam on port side at 2030hrs. From 2030 hrs position, find the Gyro Course (Error 2^0 High) and the engine speed required to reach Bideford Pilot Station (51^0 05′ N, 004^0 15′ W) at 2230 hrs counteracting the current setting 035^0 (T) at 2 knots.

Q. 3 Plan a detailed passage for a vessel drawing 18 meters from swan sea pilot to Bristol pilot Station in restricted visibility & spring tide.

SECTION B

Q. 4 At 0803 hrs an observer on a vessel steering 336^0 T at 14 knots found the true altitude of the sun to be 89^0 29.2′, bearing S.E'ly. (Dec. Sun 13^0 26′ S., GHA Sun 304^0 51.2′).
Later, at 1012 hrs, a point of land in position 12^0 18′ S., 54^0 45′ E was detected by radar at a range of 23 miles. Find the vessel's position at the time of the later observation.

Contd...2...

Q. 5 a) Find the position line and position through which it passes, in the following cases:
DR 28^0 25′ N 027^0 25′ W. Sext. alt of Polaris 27^0 45′, I.E. 1.0′ off the arc. H.E. 16m, Month – march GHA Y 276^0 14.4′.
b) On 12^{th} Sept 1992 in DR Long 072^0 20′ E, the sextant meridian altitude of the star ALDEBRAN was 31^0 10.2′ N of the observer. If IE 3.2′ off the arc and H.E. was 18m. Find the latitude and the PL and state the GMT of meridian passage.

Q. 6 Find the initial course, final course, and distance along the composite circle track in the following case:

From		To		Max
Latitude	Longitude	Latitude	Longitude	Lat.
45^0 54.0′ S	170^0 45.0′ E	49^0 06.0′ S	075^0 50′ W	55^0 S

SECTION C

Q. 7 On 23^{rd} August 1992 in DR 34^0 30′ S, 3^0 30′ W at PM at ship, the sextant altitude of a star through a break in the cloud was measured as 45^0 26′ when GMT was 23^D 18^{th} 17^M 20^S. If I.E. was 2′ on the arc, HE 10m and the true bearing of star was 291^0, identify the star.

Q. 8 a) On Tropic of cancer the upper meridian altitude of a star is 3 times the lower meridian altitude. Find the declination.
b) In what latitude will period of night be half of the period of daylight if declination of sun is 23^0 05′ N.

Q. 9 a) Differentiate between Mercator & Gnomonic chart.
b) Explain the procedure of preparing a Marcator chart from Lat 24^0 S to Lat 28^0 S and longitude 178^0 E 178^0 W using a scale of 1:1000000 at Lat 26^0 S.

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GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use **Chart No. 5056** Nautical almanac 1992, Deviation card No. 2, Variation as per chart, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION – A

Q. 1 At 1000 hrs. a vessel was in position 50° 19'N, 2° 08'W. Find the compass course to steer to pass 2 miles off anvil Pt. Lt. Ho. (55° 35'N, 1° 58'W). Make allowance for any tidal streams you may expect to experience at 'H' and estimate the time of arrival off Anvil Pt. Vessel steaming at 9 knots. H.W. at Devenport at 1200 hrs and it is spring tide.

Q. 2 At 2000 hrs. in DR position 50° N 002° W, a star sight gave an intercept of 2.0' towards with an azimuth of 321° (T) on a course of 266° (T). The visibility reduced to 5 miles thereafter. Eastern Channel light buoy (49° 59' N, 002° 29'W) was first sighted at 2100 hrs. Find the vessel's position at 2100 hours if the current was estimated to set at 151° T x 1.5 knots.

Q. 3 a) Describe in brief various stages of passage plan.

b) What is tabular form of passage plan (passage planning summary)

SECTION – B

Q.4 a) Calculate the distance along the composite great circle route from 43°30'S 147°20'E to 33°44'S 072°10'W so that the vessel does not go south of 45°S. Also calculate the Great Circle distance.

Q.5 In the DR position 22° 30' S, 088° 40' E, an observation of star gave an intercept of 10' towards with a bearing of 117° T. The ship then ran 254°(T) for 27 mls, when a second observation gave an intercept 3.8' mls AWAY with a bearing of 226° T. DR used for 2nd observation was obtained by allowing run on initial DR position. Find the position at the time of the second observation.

....cont page 2.....

Q.6 On 29th April, 1992, PM in DR 51° 18′ (N), 148°35′ (E), the Sextant altitude of Polaris was 51° 05.6′ and bearing 000° at GMT time 29d 18h 20m 20s. HE was 12.7m and IE 2.7′ ON the arc. Find the direction of the PL and latitude where it cuts the DR longitude. Also find the deviation of compass if variation was 2° W.

SECTION – C

Q.7 On 29th November, 1992, PM in DR 46° 23′ (N), 92°45′ (E), what stars of 1st and 2nd magnitude or planets will be within 45° of hour angle from the observer's meridian ?

Q.8 a) State/explain the 1st and 2nd laws of Kepler's of Planetary motion along with diagrams.
b) Find the distance of Venus from Sun if the sidereal period of Venus is 224.7 days, using 3rd law of Kepler.

Q.9 a) What are the conditions necessary :
i) For twilight to last whole night ? ii) for continuous darkness ?
b) Write short note on Traverse Mercator projection with sketch.

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GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use **Chart No. 5118; (Singapore Strait and Eastern Approaches)** Nautical almanac 1992, Deviation card No. 2, Variation as per chart , ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION A

Q. 1 A vessel chartered for STS operations completes loading operations at 1830 hrs to her summer draft of 19.5 meters in 01° 09.8'N 104° 12.0' E. she is to discharge this cargo at Chennai, India.
Plan a safe passage through the west /WSW / WNW / lanes of the TSS on chart 5118. Plot courses & alteration points on the chart and record details in the answer script.

Q. 2 On a fast container ship bound for Singapore, steering 297° (T) at 21.0 knots 'P. Merapas' Lt. Ho. (00° 56' N 104° 55.2'E) bears 240° (T) at 1048 hours. Its bearing was 170° (T) at 1112 hours. Finally at 1200 hours, 'T. Berakit' Lt. Ho. (01° 13.2' N 104° 34.6'E) was abeam to port at 9 miles when the vessel decided to alter her course for the TSS. If SW'ly gales are causing 10° leeway find the ship's position of 1048 hours & the current experienced. What has been her CMG & SMG on this leg?

Q. 3 At 0615 hours in 01° 50'N, 105° 00' E DR, Venus, azimuth 030° (T), gave the observed longitude as 104° 53.6' E. The vessel was steering 245° (T) at 13 knots. At 0845 hours, bearings by gyro compass of 'Bukit Tuatau' peak (~~00° 9.6'N, 104° 15'E~~) was 212° (G) and that of 'Bukit Gemoh' peak (~~00° 45.2'N, 104° 11.5'E~~) was 292° (G). Find the ship's position at 1100 & the gyro error.
(Take current as 127° (T) @ 2.8 knots throughout)
PS- This gyro compass at time shows unusual error.

01°31'(N) 104°16'(E)

01°45'(N) 104°11.5'(E)

SECTION – B

Q. 4 Find the Great circle distance & Intial course, from 10° 25'S, 090° 12'E to 39° 27'N, 055° 10'E. Also calculate the longitude in which the GC track crosses the equator & the course then.

Contd...2/-

Q. 5 On 3rd Sep-92 at ship in DR 20° N179° 179° 30'E observed two stars as given below at Ship's time 0505 hrs (ST=GMT + 12hrs). Ship's course 132(T) ~~(T) @ 25kts~~ @ 25 kts

Star	AZ	INT
A	051 (T)	2.5' (T)
B	124 (T)	2.2' (A)

Find i) Ship's position at 0505 hrs.
ii) Ship's time for Sun's meridian passage if the ship did not alter her clocks.

Q. 6 On GMT 22d 16h 25m13s, Sep-92, a vessel near the International Date line took two simultaneous observations with two sextants having same equipment error. IE 1.2's off the arc, HE 19m.
i) Moon UL, Sextant Altitude 32° 13.3'.
ii) Venus, Sextant Altitude 48° 00.7', Az 180 (T)

Find the position of vessel at this time.

SECTION – C

Q. 7 On 30th November 1992 PM at ship in Lat. 40° 00'N long.138° 15' W. Find the stars & planets upto magnitude 3.0 that are between meridian & 1hr. East of meridian above the pole, suitable for observation.

Q. 8 a) Explain i) Magnitude of Celestial Body
b) Calcuate the duration of twilight 40° N 45°S latitudes on a summer solistice day.

Q. 9 a) How to transfer a Great Circle track from a Gnomonic to a Mercator Chart.

b) What will be the dimensions of a Mercator Chart in (cm) constructed for the coordinates 20°S140°E to 20°N140°W. Given Natural scale 1/10,000,000 in Lat 20°N.

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GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use **Chart No. 5056; (Start point to The Needles)** Nautical almanac 1992, Deviation card No. 3, Variation as per chart, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION A

Q. 1 At 1800 hours while on 300° (T) at 14 knots, a vessel finds 'E Channel Racon' (49° 59.0' N 002° 29.0' W) & 'Channel Lt. V/L.' (49° 54.5' N 002° 55.4' W) to be same distance away on her radar. Two hours later FR light at the 'Start Pt.' Lt. Ho. (50° 13.3' N 003° 38.4' W) becomes visible when the light house was a 5 miles away on the radar.
Find CMG, SMG & her position at 1800 hrs.
(Current is known to set 250° (T) at 3 knots)

Q. 2 At 1300 hours in thick fog, a tug sets her course as 140° (T) at reduced Speed of 7 knots from a position 6 miles west of 'Bill of Portland' Lt. Ho. (50° 30.8' N 002° 27.3' W).
A coaster at 1400 hours drops her pilot at 'Needles Channel' pilot Station (50° 37.85' N, 001° 38.9' W) & is heading to cross the English Channel. These two collided at 1800 hours. Find:

a) The course steered & engine speed of the coaster.
b) Position which they collided.
[Current sets NE at 2 knots throughout]

Q. 3 A low powered container feeder vessel with full deck load of containers is located at 'Tor Bay' (50° 25.4' N, 003° 30.5' W) off Brixham. She is bound for 'Portland Harbour' (50° 35' N, 002° 26.5' W).
She has one working radar, echo sounder & VHF. Plan your passage if northerly gales & moderate visibility due to light rain are prevailing.

SECTION – B

Q. 4 A vessel intends to steam a Great circle track from 50° 04'N 005° 45'W to 47° 34'N; 052° 40'W. Find the distance, Initial course to set & position of The midpoint along the track.

Contd..2/-

Q. 5 At 0900 hrs in DR 22° 12'N; 074° 50'W an observation of Sun gave long 074° 46'W, Az 080° (T). At 1145 hrs, Sun's Meridian True Altitude obtained was 89° 40' south of observer. Sun's declination during Meridian Altitude was 22°N. Find the vessel's Noon position, if the vessel was steering 280° (T) @ 12kts throughout.

Q. 6 On GMT 16-Jan-92, 23h39m38s, a vessel tool two simultaneous observations as follows:

i) True Altitude of Venus 19° 37.8', East of Meridian.

ii) Sextant Altitude of Moon's UL 83° 25.6', Azimuth South.

Find the position of the vessel at this time. (IE 2.1 on the arc, HE 12m)

SECTION – C

Q. 7 a) During morning twilight an unknown star bore South with Altitude 40° 20'.
During evening twilight at LST 03h34m24s, the same star bore North with Altitude 13° 08'. Identify the star.

b) On 1st Dec'92 between Jupiter & Canopus, which one was brighter & how many times was it brighter than the other.

Q. 8 a) Explain the Transverse Mercator Projection and Universal transverse Mercator System.

b) Explain the procedure of preparing a Mercator chart Lat 24° S to Lat 28° S and longitude 178° E to 178° W using a scale of 1:1000000 at Lat 26° S.

Q. 9 a) Define Kelper's Law of planetary motion.
b) What are the conditions necessary for the twilight to last whole night?

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A-M Page 1 of 2

GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:
1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. **5048** (Old Head of Kinsale to Tuskar Rock); Nautical almanac 1992,
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION – A

Q. 1 A vessel in Dead Reckoning Position (DR) 51° 26.2′ N 007° 35.7′ W at 1830 hrs, steering a course of 100(T) at speed of 18 knots observes the following:

46m 23M

at 1821 hrs - Star A- Intercept 4.0′ Away with Az 210°
at 1842 hrs - Star B- Intercept 2.0′ Towards with Az 120°

A position in Lat 51° 30′ N;Long.007° 30′ W was used ~~as the in~~ chaseroosn in calculating the Star sight. Find the following

a) The position of the vessel at ~~1800~~ 1830 hrs.
b) The course to steer from the position at 1830 to have Hook Head light; (52° 07.5′ N 006° 55.8′ W) right ahead at first sighting if the estimated visibility is 5 miles. Height of eye (HE) = 28meters
c) Hook Head light would be first sighted.
d) Time ~~when the~~ distance off will Mine Head light will be abeam on this course. Time and distance

Q. 2 A vessel steering a course of 245 (T) at speed of 12 kts observes Conningbeg light vessel (Let 52° 02.5′ N; Long 006° 39.5′ W) to bear 275 (T) at 2000 hrs, 299 (T) at 2020 hrs and 359 (T) at 2050 hrs. The current in the area estimated to set in the direction of 205°. Find the vessel at 2050hrs, the course made good, the speed made good and the rate of the current experienced.

Q. 3 Your vessel in ballast is at anchor in position Lat 52° 05′ N; Long007° 25.6′ W. Plan a safe sea passage from this position to Crok harbour pilot station (51° 45′W 008° 15.2′ W). Plot courses on the chart and mark the alteration points clearly. Way points, course and distance on each leg of passage to be shown on the chart and in the answer sheet. Maximum draft of 10m, & Speed of 12 knots to be assumed, GPS is not working, Strong easterly gale force wind reported in the approaches to Cork harbor. If ETD is 2130 hrs on 14 sept, what would you send to Cork pilolts.

60 – 12
20:50 50 – 10 kt

Contd...2...

SECTION – B

Q. 4 A vessel in position Lat 42° 53′ S; Long 147° 20′ E is bound for a port in posn. Lat 52° 43′ S; Long 072° 43′ W. The Master wishes to follow a great circle track on this passage. However a weather report received before departure strongly advises all ships not to go south of latitude 52° 43′ S. Calculate the difference in the distance that the vessel has to steam if the Master follows the advise in weather report.

The master Follows the weather advisory and, the vessel departs at 1500hrs on the 10 June (Zone -9½), Speed 14 knots.Calculate the ETA at the arrival port assuming Zone time (+5) Zone -530

Q. 5 From the following information, Calculate the longitude in which is the position line cuts the DR latitude:

Dead reckoning (DR)	:	00° 22′ N; 060° 12′ W on 30th Apr 1992
GMT	:	13h 00m 50s
Sext. alt of Sun's upper limit (UL)	:	44° 13.0′
Index Error (I.E.)	:	3.0′ OFF the arc
Height of Eye (H.E.)	:	20meters

Q. 6 An observer on a ship steering course of 205° (T) at speed of 16 knots obtained the following Data from observations. A Position in Lat34° 27′ N; Long 76° 42′ E was used in all calculations. Find the position of vessel at 1830 hrs.

Time	StellarBody	Intercept	Azimuth
1820hrs	Star X	2.2′ Towards	167 (T)
1824hrs	Star Y	4.5′ Towards	081 (T)
1833hrs	Star Z	0.8′ Away	237 (T)

SECTION - C

Q. 7 On 15th June 1992, during PM twilight on ship in position DR Lat 36° 10′ N Long 047° 00′ W, the sextant altitude of an unknown star bearing 227¾ (T) was 61° 02′, Index Error(IE)= 0.5′ on the arc, Height of Eye (HE)= 6.5m at GMT 22h 43m 45s. Identify the star.

Q. 8 The change in azimuth of the sun between rising and crossing the prime vertical of a stationary observer is 38°. If the declination of the sun is 23° 27′ S. find the observer's latitude and also the change of hour angle of the sun during this period.

Q. 9 a) Explain the change in the duration of twilight with the latitude of an observer.
b) What is the Julian calendar? Why was the Gregorian adjustment made to this calendar?

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July - 14

PAGE 1

GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION (A-M)

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. 5047; (Bristol Channel) Nautical almanac 1992, Deviation card No. 1, Variation 2°W , ship's speed 12 knots and Height of eye of the observer 12m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION A

Q. 1 At 2100 hours St Govan's Head (51° 35.6' N 004° 55' W) bore 330° (C) and St. Gowan's Light vessel (51° 30.5' N 005° W) bore 250° (C) and distance from Caldey Island light (51° 38' N 004° 41' W) was 9.0 NM. Find the course to steer at 12 knots to have Helwick light vessel (51° 31' N 004° 25' W) right ahead when it 8 miles off, current setting South at 4 knots. Also find the time when Helwick Light vessel will be abeam.

Q. 2 'SCARWEATHER' LT. V/l (51° ~~19.9'~~ 26.5' N, 003° 56.0' W) bore 350° (T) x 5 miles at 1955 hours from your ship while proceeding on 280° (T) at 18 knots.

At 2100 hours 'HELWICK' LT. V/L (51° 30.5' N, 004° 25.6' 39.0' W) was abeam to starboard (1 mile off) & just then the course was altered to 240° (T) & speed reduced to 15 knot.

Find:

a) Time when 'LUNDY ISLAND (SOUTH) LT.' will shut off.

b) Position of the vessel at this time.

Q. 3 A General cargo ship having a draft of 9.5 m drops pilot at Bristol Pilot Grounds (51° 21'N 003° 19'W) in gale force winds and is bound for Bideford Fairway (51° 05'N 004° 16.4'W). Vessel is equipped with Radar, ARPA, AIS, GPS, and Echo sounder & Doppler Log. Plan a safe passage for the intended voyage. Vessel should be kept at least four miles away from the coast during the passage. Plot your courses on the chart, with clear marking of course and distance and course alteration point for each leg of passage. Write the synopsis of passage planning in the answer sheet.

Contd...2...

PAGE 2

(A-M)

SECTION B

Q. 4 A vessel intending to sail on a great circle track from 37°N 123°12′ W to 36° 00′ N 141° 30′ E decides to make a composite sailing with a limiting latitude of 45°N. Find the extra distance sailed.

Q. 5 DR position of the vessel at 0600hrs 20°15′S 030° 36′W. Vessel was steaming on course of 302°T at speed 20 knots. At 0551h star 'X' gave azimuth 135°T intercept 4.3′ towards. At 0612h star 'Y' gave azimuth 056° T intercept 1.5′ away. Both sights were worked by using 0600 DR. Find the ship's position at 0600 hrs from the above stellar observation?

Q. 6 On 21st July 92 AM at ship in DR 30° 26′ N 066° 10′W true altitude of Moon on the meridian bearing South was 68° 48.6′. After steaming a course of N 56° E for 27 miles observed altitude of Sun's LL was 12° 34.8′ at GMT 10 h 41m 16s. Find the position of vessel at the time of second observation. Given H.E. = 20m.

SECTION C

Q. 7 On 20th Jan 92 AM, at ship in DR 25° 28′ (S) 107° 14′ (E) the sextant altitude of an unidentified star bearing 214° (T) was observed to be 35° 42.8′ when GMT was 21h 29m 24s. If HE was 31m and index error was 2.2′ off the arc, identify the star.

Q. 8 On 30th Nov. 1992, a vessel in DR Longitude 170° 20′ E, observed the sextant meridian altitude of the star Canopus, below the pole, as 13° 06′. If the I. E. of sextant was 3′ on the arc and H. E. 12m, find:

a) The latitude of observer; and

b) LMT of lower meridian passage of star.

Q. 9 a) Describe Universal Transverse Mercator projection.

b) Duration of twilight varies with change in Latitude. Explain.

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07/7/14

PAGE 1

GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. **5048** (Ireland-South Coast- Old Head of Kinsale to Tuskar Rock); Nautical almanac 1992, Deviation card No.4, Variation 7° W, ship's speed 10 knots and Height of eye of the observer 10m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION – A

Q. 1 A vessel steering 242° (G) at 12 knots, sees 'Williamstown' Lt. (51° 56.6'N, 007° 50.5'W) as Fl. R between 1924 & 2012 hours. At 2200 hours 'Cork Racon' (51° 42.9'N 008° 14.6'W) was abeam at 5 miles.

At 2200 she altered course to 180° (G) & engine speed was reduced to 9 knots. Give your EP for 2330 hours to Kinsale – B West platform (51° 21.6'N 008° 01.0'W).

(Gyro Error 3° (L)

Q. 2 At 0812 hours, 'Hook Head' Lt.Ho. (52° 07.4'N 006° 55.8'W) bore 292° © & 'Coningbeg' Lt. v/l. (52° 02.4'N 006° 39.4'W) bore 170° © when she was on 182° (T) at 9 knots in SE'ly gales through current setting 250° (T) at 3 knots.

Later, maintaining same course & speed 'Hook Head' Lt. Ho. Dipped at 1014 hours. Find the compass error & position of the ship at both times. (HE 12m & Leeway is 8°).

Q. 3 a)Passage planning uses ship's resources by way of time, extra workload, efforts, checks, record keeping, compliance, monitoring etc. Why is it still worth it? Justify.

b) Your ship(A), maximum speed 16 knots, has to catch-up with another vessel (B) that is steering a course of 216° (T) at 9 knots. Set your course to rendevous 'B' if she lies 102 miles from 'A' in 334° (T) direction. How long will it take you to reach her?

B

A

B

Contd...2...

Page 2 (A.M) Dated 9/July/14

SECTION – B

Q. 4 A vessel departing from Phillippines (10°N/125° E) to Chile (32° 30'S, 073° W) loaded upto summer marks. The southern limit of summer loadline is 33° S beyond which the winter loadline. Starts. Calculate the shortest distance the vessel has to steam so as to keep herself in the Summer Zone throughout by limiting the maximum latitude to 32° 30'S. Also calculate the ETA Chile in Chilian time if the ETD is 26 Apr 2013 1600 phillippines time. (Phillippines time = GMT + 8 hrs, Chile time = GMT – 4 hrs, spd 15 kts).

Q. 5 On 2nd March 92, AM at ship a Sun sight calculated using DR 20° 32'N gave obs. Long 60° 34'E and Az. 100° (T). The vessel then steamed 49 miles on a course of 120° (T) till meridian passage. Compute the altitude to be set on the sextant for meridian passage of Sun's LL. Give I.E 2.2' On the Arc, HE=24m. Also find the position of V/L if the actual sextant meridian altitude of sun was 62° 18.0' and bearing south.

Q. 6 a) On 30th April 1992 at ship in DR 33° 56'S, 039° 45'W, the sextant altitude of Star Sirius was 55° 10.0', when GPS showed GMT 30d21h02m00s. Find the direction of PL and the longitude where it crosses the DR lat. (IE 1.2' off the arc, HE 18m)
b) On 31st August 1992 in DR 60° 06'N 066° 18'W sextant altitude of planet Mars was 41° 32.4' at GMT 31d08h15m02s. If HE was 10m, IE was 2.1' on the arc, calculate the direction of the PL and the intercept.

SECTION - C

Q. 7 On 13th Oct. 1992 in latitude 62° 30'N, Star Vega bore 270° (T) and at the same time an unknown star bore North with altitude 34° 00'. Identify the unkown star.

Q. 8 a) Define Nautical twilinght & the conditions necessary for 'Nautical twilight' all night.
b) Find the observer's position if the Sun's maximum altitude on that day was 74° 10' bearing North. Sun's SHA was 140° 54.7' & GHA was 270° 43'.

Q. 9 a) How to transfer a Greater Circle track from a Gnomonic to a Mercator Chart.
b) What will be the dimensions of a Mercator Chart in (cm) constructed for the coordinates 20° S 140° W. Given Natural scale 1/10,000,000 in Lat 20° N.

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GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use **Chart No. 5072; (Falsterbo to Oland)** Nautical almanac 1992, Deviation card No. 3, Variation 2^0W, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION – A

Q. 1 A vessel at anchor South of YSTAD observed the following compass bearings:

Sandhammaren (55^0 24′ N, 014^0 40′ E)	067^0 C
Ystad (South) (55^0 25′ N, 013^0 49′ E)	010^0 C
Abbekas (55^0 23′ N, 013^0 36′ E)	320^0 C

Find the vessel's position and compass error.

From this position, plan a safe passage to join the North east bound lane of TSS off OLANDS SODRA GRUND (56^0 04′ N, 016^0 41′ E). Course and distance for each leg of passage, course alteration points, etc. to be marked on the chart and to be written in the answer sheet.

Q. 2 A vessel steering a course of 260^0 T observed Olands sodra Grund Lt. (latitude 56^0 04.3′ N, longitude 016^0 41.2′ E) bearing 010^0 T at 0400 hours. Again at 0500 hours, the same light bore 040^0 T. At 0615 hours, Utklippan Lt. (latitude 55^0 57′ N, longitude 015^0 42′ E) bore 351^0 T. If the current was setting 300^0 T, find the following:

a) Position of the ship at 0400 hours and 0615 hours.
b) Course and speed made good.
c) Rate of the current.

Q. 3 A vessel observes Christianso Island Main Light (55^0 19. 2′ N 015^0 11.6′ E) bearing 270^0 (T), 5 miles off at 2030 hours. Find the course to steer to have Hano Light (56^0 00.8′ N 014^0 51′ E), 4 points on port bow when it is 12 miles off. At 2230 hours, while on this course at a speed of 14 knots, the echo sounder recorded a sounding of 10m below keel (ship's draft: 8.0m even keel, height of tide 1m). Find the ship's position at 2230 hours and set and rate of current.

SECTION – B

Q. 4 A vessel has to sail along a Great Circle track from $23^020'$ S, $042^040'$W to $33^030'$ S, $017^050'$ E. Divide the G.C. track into three equal parts & find the positions of the points dividing the track.

Contd...2...

Q. 5 Following simultaneous stellar observations were calculated using the DR 25^0 40'N, 140^0 10'E :

Star X	Obs. Long. $140^0$15' E	Azimuth 115^0 (T);
Star Y	Intercept 2' (T)	Azimuth 240^0 (T);
Polaris	Obs. Lat. $25^0$38' N	Azimuth 001^0 (T).

Find vessel's position.

Q. 6 a) In DR 20^0 S, 175^0 E, on 19th January 1992 on a ship, the sextant altitude of Sun's UL west of the meridian was 57^0 10' when GMT was 19th Jan. 02h 52m 24s. I.E. was 1.5' off the arc & H.E. was 12m. Calculate the intercept & direction of P/L. (15)

b) Without working out the sight, find what longitude will an observer get if the above sight was calculated using Long. by Chron. method. (10)

SECTION – C

Q. 7 A ship in DR 52^0 S, 080^0 45' W, on 28th February 1992. Find the first magnitude star that will cross the observer's meridian above & below the pole & which will be above the observer's rational horizon, during PM nautical twilight.

Q. 8 A star rose bearing S80^0 E for an observer in latitude 20^0 S. What will be its true altitude four hours after rising?

Q. 9 Draw a Polar Gnomonic chart to suitable scale for latitudes from pole downwards to 60^0 N for a sphere of diameter 100 cms, and on this chart show the following:
a) Great Circle Track from position 60^0 N, 120^0 W to position 70^0 N, 130^0 E;
b) Composite Track between above two positions, with limiting latitude of 70^0 N.

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GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use **Chart No. 5118; (Singapore Strait and Eastern Approaches)** Nautical almanac 1992, Deviation card No. 2, Variation as per chart , ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION A

Q. 1 Plan a safe passage from Tanjung Pelapas Pilot Station (01° 15′ N 103° 32′ E) to Singapore Eastern Boarding Grand Bravo (EB) (01° 16′ N 103° 57.5′ E) using Singapore Strait TSS. Your vessel is an oil tanker in fully loaded condition. Maximum draft is 15.8 meters. Plot Courses on the chart and mark the alteration points clearly. Way points, Course and distance for each leg to be shown on the chart and in the answer sheet.

Q. 2 A vessel observes the following:

Tanjing Balai Lt Ho.	(00° 59.7′ N, 103° 26.7′ E)	290° (C)
Takong Kecil Lt	(01° 06′ N, 103° 42.9′ E)	049° (C)
Kar Melvil Lt	(00° 51.8′ N, 103° 36.7′ E)	189° (C)

The position was plotted with the above bearings assuming no error for the compass. Find position of the vessel & compass error. Variation is as per chart.

Q. 3 At 2000 hrs a stellar observation gave vessel's position as (01° 50′ N, 104° 50′ E). Find compass course to steer to raise Horsburgh Light House (01° 19.8′ N, 104° 24.5′ E) right ahead. The current was setting NW' ly X 2.2 kts. The visibility was 5 miles. Height of eye: 12m.
At 2312 hrs using radar, vessel's position was found to be (01° 21.8′ N, 104° 22.8′ E). Find actual set and drift of current.

SECTION – B

Q. 4 Find the initial course, final course and the distance along the composite track from Vancouver to Hawaii between the positions 48° 20′N, 125° 00′W and 21°15′N, 157°25′W, with a ceiling latitude of 48° 20′ N?

Contd...2/-

Q. 5 At 0600 hours Minicoy Lt. House (08° 16′ N 073° 20′ E) bore 004° C error 4° W, distance 12 miles. Course was then altered to 315° C, error 1° W, speed 16 knots. At 0930 hours Sun's sight gave observed longitude 072° 30′ E using DR latitude, azimuth was 122° (T). Vessel continued on the same course and speed. At 1230 hours meridian altitude of Sun gave observed latitude 09° 28.6′ N. Find the observed Noon position.
(Consider effect of wind and current remained same throughout the passage)

Q. 6 a) On 1st May 1992, PM at ship in DR 19^0 54′ S 179^0 58′ W, the sextant altitude of JUPITER was 52^0 38.5′ at GMT 02d 06h 20m 42s. If IE was 0.2′ off the arc and HE was 17m, find the direction of the PL and a position through which it passes.

b) In DR 31^0 40′ N 031^0 30′ E, compute the sextant altitude of pole star on 21st July, 1992 PM at GMT 17h 34m. (HE 16m, IE 1.7′ on the arc).

SECTION – C

Q. 7 On 19th Jan.′ 92 in DR 40° 28° S, 170° 34′ W, find which stars of magnitude 2 and brighter will be available for observation, below the pole, between 1800 Hrs LMT and 1900 Hrs LMT.

Q. 8 a) Find the LMT of lower meridian of star Canopus on 2nd March 1992 in DR 51° 30′ S, 100° 34′ W.
b) If distance between Mars and Sun is 1.524 times the distance from the earth to the sun then find Sidereal period of Mars?

Q. 9 a) What is Gnomonic Projection? How do you transfer a Great Circle track from a gnomonic chart to a Mercator Chart?
b) How do you find the scale of iongitude from the scale of latitude? What are Routeing charts?

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GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. **5048** (Ireland-South Coast- Old Head of Kinsale to Tuskar Rock); Nautical almanac 1992, Deviation card No.4, Variation 7° W, ship's speed 10 knots and Height of eye of the observer 10m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION – A

Q. 1 At 1900 hr. while steering 062° C, Bally cotton Island Lt. (51° 49.5′ N 007° 59′ W) bore 320° C. At 1930 hr. it bore 274° C and at 2015 hr. Mine Head Lt. (51° 59.5′N 007° 35′ W) bore 000° C. Current set 101° T. Calculate course and speed made good, rate of current and the three positions.

Q. 2 At 0600 hrs a vessel was in position 52° 00′ N 007° 15′ W. From this position vessel set the courses to steer to pass 10′ off Coningbeg Lt Vessel (52° 02′ N 006° 40′ W). For some reason the vessel has to steam at slow speed 6kts for first half an hour, thereafter vessel resumes her full engine speed of 12kts. Also state the time when Coningbeg Lt Vessel will be abeam. Current setting 090° @ 3.2 knots throughout the period.

Q. 3 While navigating in St. George's channel TSS, an oil tanker with maximum draft of 18 meter observes tusker rock racon (52° 12′ N, 006° 12′ W) bearing 250° T x 4.4 miles at 2200 hrs. From this position, plan your safe passage to reach a position 6 miles due south of 'Old head of Kinsale' light. Courses have to be plotted on the chart, with clear marking of course and distance, for each leg of passage. Also No-go areas, distance to go and course alteration points should be clearly marked on the chart.

SECTION - B

Q. 4 A vessel sails from port A located on Greenwich meridian in certain North latitude. After traversing a distance of 3000M along a perfect great circle track, she reaches another port B at Equator on a course of S60°W. Calculate the initial course and the longitude arrived.

Contd...2...

Q. 5 In DR position 34° 27′ N, 076° 42′ E on a course of 205° T at 16 knots, following results were obtained from stellar observations:
i) 1820 hrs intercept 2.3′ towards Az. 167° T
ii) 1824 hrs intercept 4.6′ towards Az. 081° T
iii) 1834 hrs intercept 0.9′ away Az. 237° T
Find the ship's position at 1830 hrs.

Q. 6 a) On 2nd March 1992 in DR 32° 12′ S 100° 24′ E, the sextant altitude of Venus East of the meridian was 18° 05′ when the GPS showed GMT as 01d 22h 32m 58s. If the HE was 10m and IE 1.3′ off the arc, find the direction of the PL and the position through which it passes.

b) In DR long. 052° 30′ E in December 1992 when GHA Aries was 019° 23.9′, the sextant altitude of Polaris was 38° 40.4′. IE: 2.2′ off the arc. HE: 11.7m, find the direction of PL and the position through which it passes.

SECTION - C

Q. 7 On 03rd March 92, PM at ship in DR 52° 00′ S, 080° 45′ W, find the 1st magnitude stars that will cross observer's meridian above and below pole during nautical twilight and are suitable for observation.

Q. 8 a) Explain the effect of latitude on the duration of twilight, with suitable sketches.
b) On the longest day in Northern hemisphere, an observer in Southern hemisphere notices that the duration of night is 3 times the period of daylight. Find the latitude of the observer.

Q. 9 Describe:
a) The Transverse Mercator projection and
b) Gnomonic Projection.

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GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. **5048** (Ireland-South Coast- Old Head of Kinsale to Tuskar Rock); Nautical almanac 1992, Deviation card No.2, Variation 7° W, ship's speed 10 knots and Height of eye of the observer 10m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION – A

Q. 1 A Container ship with maximum draft of 9.0 m drops pilot at Waterford harbour pilot station (52° 9.2′ N 006° 58′ W) in moderate winds and is bound for Liverpool through St. George's channel TSS. Vessel is equipped with Radar, ARPA, AIS, GPS, and Echo sounder & Doppler Log. Plan a safe passage from pilot station for joining the NE bound lane of St. George's channel TSS. Plot your courses on the chart, with clear marking of course and distance and course alteration point for each leg of passage. Write the synopsis of passage planning in the answer sheet.

Q. 2 While steering 285° C Ballycotton Island light. (51° 49.5′ N 007° 59′ W) was last sighted in visibility of 5 miles. HE: 8m. After one hour, in clear visibility, Roche's point it. (51° 47′ N 008° 15′ W) changed from white to red. Current set 140° T at 3 knots. Leeway due to Northerly wind was 4°. Calculate course and speed made good, and both positions.

Q. 3 Own ship is in position 51° 30′ N 007° 00′ W. Another ship is stopped in in position 52° 00′ N 007° 10′ W and drifting. Current in the area is setting SE at 2 knots. Calculate compass course to steer, engine speed, and course and speed made good of own ship to meet the other ship after 4 hours. Also calculate the meeting position.

SECTION - B

Q. 4 Find the composite track distance from Hobart (42° 53′ S, 147° 20′ E) to Cape Pillar (52° 43′ S, 072° 43′ W) with a limiting latitude of 53° S. Also find the initial course.

Q. 5 In DR 17° 15′ N 087° 12′ E, stellar observation of three stars at 0545hrs yielded the following position lines:

Star X:	Az 058° T	Intercept 0.7′ Away
Star Y:	Az 132° T	Intercept 4.2′ Away
Star Z:	Az 206° T	Intercept 1.7′ Away

Find the position of the ship at 0545 hrs?

Contd...2...

09/07/13

Q. 6 On 22nd of September 1992 AM in DR latitude 46° 17′ S, the sextant altitude of the Sun's LL was 29° 25′ at 22d 19h 33m 51s GMT, IE 3.0′ off the arc, HE 11m. The ship then steamed 300° T for 45M when the sextant meridian altitude of the Sun's LL was 43° 57.9′, north of the observer. Find the ship's position at the time of meridian altitude.

SECTION - C

Q. 7 On 14th Oct. 92 AM at ship in DR 42° 10′ N 170° 10′ E find 1st & 2nd magnitude stars that will cross observers meridian from beginning of Nautical twilight to the beginning of civil twilight.

Q. 8 a) A star when on meridian above the pole bore North with a true altitude of 70° 04′ and when on meridian below the pole it bore North with a true altitude of 22° 05′. Calculate observer's latitude and the star's declination.

b) If the Sidereal period of Venus is 224.7 days, find its maximum elongation.

Q. 9 a) Briefly describe Universal Transverse Mercator chart projection and its uses.

b) What are the conditions necessary for the twilight to last whole night, continuous daylight or continuous darkness?

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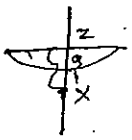
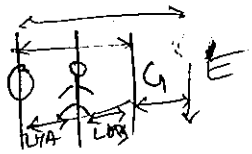


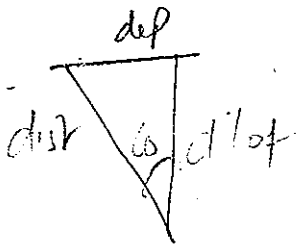


GHA = long W + LHA.

GHA -

~~GHA~~ +

LHA - GHA + long E



KAMESH CLASS

GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use **Chart No. 5072; (Falsterbo to Oland)** Nautical almanac 1992, Deviation card No. 3, Variation 2^0W , ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION – A

Q. 1 At 1900 hrs vessel dropped pilot off KARLSHAMN harbour (56^0 08′ N 014^0 53′ E). From this position, plan a safe passage to join the North east bound lane of TSS off OLANDS SODRA GRUND (56^0 04′ N, 016^0 41′ E). Plot the courses on the chart to join the TSS from KARLSHAMN pilot station keeping an under keel clearance of 2.0 m throughout. Maximum draft of the vessel is 9.8 mtr. Course and distance for each leg of passage, distance to go, alteration points and danger areas near the passage to be marked on the chart. Write the abstract of passage plan in the answer sheet.

Q. 2 Vessel anchored south of 'YSTAD' observes the following:

Abbekas Light	(55^0 23′ N, 013^0 37′ E)	298^0 (C)
YSTAD south	(55^0 25′ N, 013^0 49′ E)	009^0 (C)
Kasebarga Light	(55^0 23′ N, 014^0 04′ E)	078^0 (C)

Find the position of the vessel and compass error if it was same for all 3 observations? From this position, find a compass course to steer to pass Hammerrodde light (55^0 18′ N, 014^0 47′ E), 2 miles off, counter acting a current setting 060^0 (T) X 2 knots and strong N'ly wind causing a leeway of 5^0.

Q. 3 At 1900 hours from the DR position latitude 55^0 03′ N, longitude 016^0 28′ E; a vessel obtains an intercept of 2′ Away on an Azimuth of 189^0 T. She was steering a course of 330^0 T at 12 knots. Thereafter visibility becomes poor and her radar was functioning only up to 6 miles range. If current was setting 060^0 T at 2 knots, when and what should be her next alteration of course so as to pass 6 miles on the northern side of Christianso Light. (Latitude 55^0 19.3′ N, longitude 015^0 11.5′ E).

SECTION – B

Q. 4 A vessel is to sail from 41^0 30′ S 073^0 00′ W to 41^0 20′ S 174^0 54′ E. If the Vessel sails Rhumb line there is no current and if she sails along composite track she is expected to get 1.5 kts opposing current throughout. Find the difference in steaming time if V/L's steaming speed is 12 kts and limiting lat is 50^0 S.

Contd...2...

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Q. 5 Celestial observations calculated using DR latitude 40^0 00′ N, longitude 060^0 00′ W gave results as follows:

STAR	TIME	AZIMUTH	INTERCEPT
Star X	0520hrs.	035^0 T	2.5′ Towards
Star Y	0530hrs.	160^0 T	Nil
Star Z	0540hrs.	280^0 T	3.0′ Towards

If the vessel was steaming a course of 090^0 T at 12 knots, find the position of vessel at 0530 hours. (If cocked hat is formed while plotting above observations then find the approximate position of the vessel at 0530hrs, assuming uniform error in all three observations).

Q. 6 On 10th Oct. 1992 at ship in DR position 142^0 10′E sextant altitude of Polaris was 41^0 10′ at GMT 19h 41m 28s. At the same time sextant altitude of Denebola was 16^0 36′. Find the position of vessel at the time of observation. Given HE= 20m. IE: Nil.

SECTION – C

Q. 7 On 2nd May 1992 at Ship in DR 43^0 50′ S 102^0 40′ E the sextant altitude of an unidentified star bearing 350^0 (T) was 17^0 29.6′ at G.M.T 10h 54m 20S. If I.E. was 3.6′ off the arc and H.E. was 22m, Identify the star.

Q. 8 a) With suitable sketch describe the difference between Gnomonic and Transverse Mercator projection.

b) Define Kepler's laws of planetary motion?

Q. 9 a) Explain, why Moon is not suitable for amplitude observation.

b) What is conformal property of a chart? Why is it required for charts used for navigation purposes?

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GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. 5047; (Bristol Channel) Nautical almanac 1992, Deviation card No. 3, Variation 2^0W , ship's speed 12 knots and Height of eye of the observer 12m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION A

Q. 1 A vessel was stopped and anchored in an emergency in position 51^0 05'N 004^0 35' W. At 2000 hrs it sailed from this position on a course of 273^0 (G). At 2030 hrs North Lundy Is. Light (51^0 12' N, 004^0 40.5'W) was observed for the first time and at 2100 hrs South Lundy Is. Light (51^0 09.5'N, 004^0 39'W) was just obscured. If the gyro error was 2^0 (L), find:

a) The vessel's position at 2100 hrs.

b) Set and rate of current.

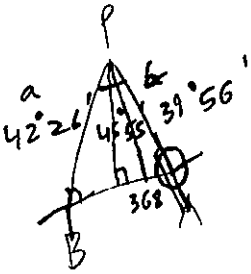
Q. 2 At 0800 hrs a vessel observes Foreland Pt. Lt. Ho. (51^0 14.5'N, 003^0 47'W) to bear 157^0 (G) and 5 miles off by radar. At the same time Nash Pt. Lt. Ho. (51^0 24'N, 003^0 33'W) was observed to be 12 miles off by radar. From above position set Gyro course to first sight Helwick Lt. V/I. (51^0 30.5'N, 004^0 26'W) 30^0 on starboard bow in prevailing meteorological visibility of 2 miles. Also find Gyro Error.

Q. 3 High water springs at Avon Mouth was at 0700 hrs on 10th August. On the same day ship's position at 0800 hrs was 51^0 40'N, 004^0 30'W. From this position, plot courses on the chart to reach Port Talbot pilot station (51^0 29'N 004^0 W). Keep at least 4 miles away from the coast. Maximum draft of the vessel is 13.0 meters. Use tidal stream data on chart to calculate ETA. Wheel-over positions, courses and distances to be clearly marked in Chart.

Contd...2...

SECTION B

Q. 4 A vessel is steaming along a great circle track from Land's End 50° 04'N, 005° 45.0'W to ST. John's New Foundland 47° 34.0'N, 052° 40.0'W. Find the latitude and longitude of a point 368 miles from the starting position.



Q. 5 At 1800 hrs in DR 34° 26' N 143° 38' W a sight gave PL 040° / 220°. After running for one hour another DR was obtained by applying a course of 125° T at 12 knots. This DR was used to calculate another sight which gave T. Az. 060° and intercept 5' towards. Calculate the position of the ship at 1900 hrs?

Q. 6 a) On 22nd September 1992 AM, vessel in DR position 32° N 165° W, the sextant altitude of the Moon's UL was 44° 49.3' when GPS showed 16h 25m 13s GMT. IE: 1.2' off the arc and HE: 19m. Find the direction of the PL and the Longitude in which it cuts the DR Lat.

b) In DR position 60° 14'N 092° 29'E sextant altitude of star Arcturus was 24° 59' (IE: Nil) at 12h 51m 31s GMT on 22nd Sept. 1992. Calculate intercept & direction of PL (HE 15.8m).

SECTION C

Q. 7 On 15th June 1992, in position 20° 00'N, 075° 00'E, which all stars and planet of 1st and 2nd magnitude will be within 15° of the observer's meridian. Which of them will be available for observation and which can be used for ex-meridian observation? The observation is to be made at the end of PM civil twilight.

Q. 8 a) What is a gnomonic chart projection? What are its advantages and disadvantages?

b) What conditions are necessary for a solar eclipse to occur?

c) Describe Kepler's third law.

Q. 9 a) If the sun's declination was 15° 30'N and increasing, calculate the Sun's sidereal hour angle (SHA). Assume the obliquity of ecliptic is 23° 26.7'.

b) If Jupiter has an orbit of 11.86 years, calculate the distance between Earth and Jupiter when Jupiter is in opposition with the Sun.

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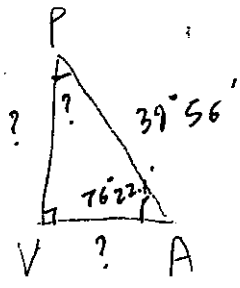

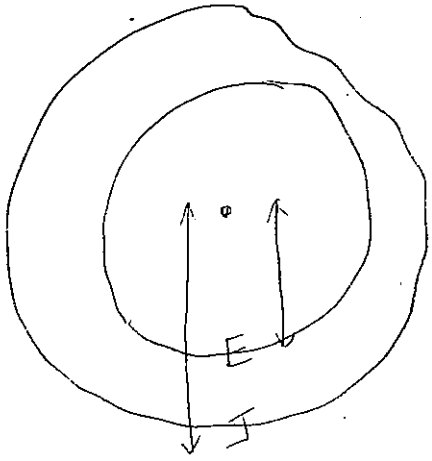

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GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use Chart No. 5047; (Bristol Channel) Nautical almanac 1992, Deviation card No. 2, Variation 6^0W , ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION A

Q. 1 At 2100 hrs. a vessel in position 3 miles due North of Horse Shoe Rocks buoy (51° 15'N 004° 13.5'W), experiencing a current setting NW' ly direction, steams as follows:-

2100 – 2120 Course steered unknown
2120 – 2150 Course steered 070° (T)
2150 – 2205 Course steered 340° (T)

At the end of this steaming, she observes Scar Weather Lt. Vessel (51° 27'W 003° 57'W) bearing 100° (T) distance 10 miles. Find,

a) Course steered from 2100 to 2120 hrs.
b) Rate of the drift of current

Q. 2 Following Compass Bearings were observed by a vessel at anchor. Find her actual position & the error of this heading.

'CALDY ISLAND LT.'
(51° 37.9' N, 004° 41.1' W) - 027° (C)

'HELWICK LT. V/L.'
(51° 30.5' N, 004° 25.6'W) - 079°(C)

'ST. GOVAN'S HEAD PT. (37)'
(51° 35.8' N, 004° 55.4' W) - 342° (C)

Q. 3 A vessel drawing 10m draft has to proceed from Port Talbot Pilot Station (51°29'N 004°W) to Avon mouth Pilot Station (51°21'N, 003°19'W). During this passage, visibility restricted to 2 miles due to fog. Plan your passage giving details of what equipment and landmarks you would use.

Contd...2...

SECTION B

Q. 4 Find the initial course and distance on the great circle track from 58° 42'N 005° 00'W to 32° 34'N 064° 30'W. Also find the latitude of the point where the great circle cuts the meridian 15° W.

Q. 5 On 1st May, 1992 in DR latitude 15^0 46'S 064^0 12'E a simultaneous observation of three stars at 0545 hrs gave the following results:-

Capella: Az: 023^0 T intercept: 4.2 M Towards
Canopus: Az: 147^0T intercept: 5.2 M Away
Fomalhaut: Az: 244^0T intercept: 0.8 M Away

Find the position of ship at 0545 hrs?

Q. 6 A morning sight of the Sun taken at 0850 hours ship's time on 1st Sept' 92 using DR latitude of 26° 20' S, gave on observed longitude of 165° 06' E. Using an estimated speed of 18 knots on a course of 120° (T), calculate:

a) Ship's time of Sun's meridian passage;

b) Sextant altitude to set for lower limb of Sun for meridian passage time. (Given: Ship's Time = GMT+11 hours; H. E. = 18m; I. E= 2' off the arc)

SECTION C

Q. 7 For a stationery observer, true altitude of an unknown star when bearing south was 14°11.2'. 1 hour and 07 minute later, true altitude of star Betelgeuse (SHA 271° 17', Declination. 07°24.5'N) when bearing North was 47°25.5'. Identify the unknown star.

Q. 8 Define geographical Position. Calculate the Geographical Position of Sun at Greenwich Sidereal Time 09h 21m 40s, given SHA true Sun 280° 10' and obliquity of Ecliptic 23° 26.7'.

Q. 9 a) Discuss Mercator chart is a 'Mathematical Projection' & not a Perspective Projection.

b) What do you understand by the Orthomorphic or Conformal property of a chart?

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GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use **Chart No. 5056; (Start point to The Needles)** Nautical almanac 1992, Deviation card No. 3, Variation as per chart, ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION A

Q. 1 In meteorological visibility of 5 NM, a vessel steering a course of 075° (T) at 13 knots last sights Start point light house (50° 13.4′ N 003°38.4′W) at 0245hrs on her port quarter and at 0515 hrs first sights the Bill of Portland light (50° 30.8′N 002° 27.4′W) on her port bow. If the current is known to be setting 300°(T) at 2 knots and the strong Southerly gale is causing a leeway of 5°. Determine the following:

a) Ships position at 0245 hrs and 0515 hrs.
b) The course and speed made good.

Q. 2 At 0800 hours your vessel has just dropped pilot at Exmouth pilot station (50° 35.8′N 003° 21.6′ W) and has to rendezvous with another vessel which is in position East channel Racon Buoy bearing 140° (T) x 5.4 NM and steering 255° (T) at 6 knots. If the current is expected to set NW'ly at 2 knots throughout, determine the following:

a) Course to steer to make the earliest rendezvous.
b) Time and position of rendezvous.

Q. 3 a) Describe the factors to be considered while planning a passage from Kobe (Japan) to Los Angeles (USA).
b) List the publications to be referred for above passage planning.
c) Prepare a model passage plan projecting the important elements to be included in the plan.

SECTION – B

Q. 4 Find the initial course, final course and the Great Circle distance from Lizard point (49° 50′ N 005° 12′ W) to Barbados (13° 06′ N 059° 20′ W)?

Contd...2/-

Q. 5 At 1530h ship's time on a vessel in DR position 15°20'S 179°50'W an observation of Sun bearing 260° T gave observed longitude 179° 55'W. The vessel then sailed on a course of 265° T at 15kn. At 1900h an observation of Venus gave an intercept of 4' away and azimuth 165°T. If observation of Venus was calculated using DR obtained by allowing run on DR latitude and observed longitude at 1530h, Find ships position at 1900h.

Q. 6 a) In DR position 30° 06' S, 038° 45' W, on 21st July, 1992, Sextant altitude of Moon's upper Limb was found to be 39° 30' when GMT was 09h 20m 49s. IE: 3.5' on the arc, HE: 15m. Using "longitude by chronometer" method, find the direction of position line and the position through which it passes.

b) On 29th November. 1992, at GMT 11h 29m 20s in DR 25° 36'S 107°' 20'W, the sextant altitude of star 'Rigel' was 35° 07.8'. If HE was 12m and IE: 0.8' on the arc, find the direction of the PL, and the intercept.

SECTION – C

Q. 7 On 10th Oct' 92 AM a ship is in DR 42° 10' N 170° 10' E. Find 1st & 2nd magnitude stars that will cross observers meridian from beginning of Nautical twilight to the beginning of civil twilight.

Q. 8 a) A star rose bearing S 80° E for an observer in latitude 20° S. What will be the true altitude of the star 4 hours after rising?
b) Write short notes on Gnomonic projection?

Q. 9 a) Explain Kepler's laws of planetary motion?
b) With suitable sketch explain various types of eclipses.

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GOVERNMENT OF INDIA

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

FUNCTION: NAVIGATION (Management Level)

PAPER: TERRESTRIAL & CELESTIAL NAVIGATION

TIME: 3 Hours **PASS MARKS: 140** **MAX. MARKS: 200**

Notes:

1. All questions in section A & B are compulsory. Answer any two questions from Section C.
2. All questions carry equal marks.
3. Use **Chart No. 5118; (Singapore Strait and Eastern Approaches)** Nautical almanac 1992, Deviation card No. 2, Variation as per chart., ship's speed 12 knots and Height of eye of the observer 10m if not mentioned in the question.
4. Positions of the landmarks are approximate and are for identification only.
5. Use luminous range diagram as necessary.

SECTION A

Q. 1 At 1500 hrs T. Berakit light house (01° 13.2′ N 104° 34.7′ E) bore 165° (T) and Horsburg light house (01° 19.8′ N 104° 24.5′ E) bore 226° (T). The vessel then steered 048° (T) at 10 knots and at 1900 hrs using DR position 02° 00′ N 105° 00′ E observed the following stellar P/L's
Star X Azimuth 300° (T) Intercept 3.5′ (Away)
Star Y Azimuth 245° (T) Intercept 2.0′ (Towards)
Determine
a) Ships position at 1900 hrs
b) Set and rate of current

Q. 2 A vessel at anchor on a steady heading observes the following compass bearings:

P. Jangkat	(00° 58.0′ N, 103° 42.8′ E)	104° (C)
Kar Melvil Lt	(00° 51.8′ N, 103° 36.7′ E)	181° (C)
Tanjun Balai Lt	(00° 59.7′ N, 103° 26.7′ E)	284° (C)

Determine the ships position and the deviation of the compass on that heading, if the magnetic variation is 0.5° east.

Q. 3 Your vessel is an oil tanker in ballast condition anchored at Singapore OPL off Eastern Johor strait (EJ) pilot station. Max draft 8.5 Mtr. Master received an order to proceed to Karimun (Indonesia) transshipment anchorage area for STS operation. Plan a safe passage from Eastern Johor strait pilot station (01° 17.7′ N 104° 06.4′ E) to Karimun transshipment anchorage area (01° 03′ N 103° 31′ E) using Singapore strait TSS. Plot courses on the chart and mark the alteration points clearly. Way points, Course and distance for each leg to be shown on the chart and in the answer sheet.

Contd...2/-

SECTION – B

Q. 4 Calculate the initial course, final course and distance along the composite track from 37^0 40′ N 141^0 E to 36^0 48′ N 122^0 40′ W with a limiting latitude of 42^0 N?

Q. 5 On 6th March 1992, PM at ship, in DR longitude 070^0 45′ W, the following simultaneous observations were made, First observation: Sextant Meridian altitude of star Vega North of observer was found to be 51^0 11.2′. Height of Eye 15m, Index Error 0.4′ off the arc.
Second observation: Sextant altitude of the Moon's LL using the same sextant was 17^0 48′ at GMT 23h 10m 30s. Find the position of the vessel.

Q. 6 A morning sight of the sun taken at 0900 hours ship's time on 16th June 1992 using a DR of 26^0 16′ N gave an observed longitude of 074^0 46′W. Using an estimated speed of 15 knots on a course of 258^0 (T), find:
a) Ship's time of Sun's meridian passage;
b) The computed sextant altitude of Sun's lower limb for this time.
(H.E.12, meters, I.E. 3′ on the arc, Ship's time = GMT – 5hours).

SECTION – C

Q. 7 What stars and planets of magnitude 2 & 3 will cross the observer's meridian above the pole, in position 40^0 N 030^0 E, on 23rd August 1992 between 0500 & 0600 hours LMT?

Q. 8 To an observer, the true altitudes of a star when on the meridian at upper and lower transits were 80^0 09′ S and 11^0 45′ N respectively. Calculate its true altitude when on the Prime vertical?

Q. 9 a) Write short notes on Transverse Mercator Projection?
b) Explain why duration of twilight varies with change in latitude?

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