NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2020

NAUTICAL SCIENCE: PAPER I

Time: 3 hours 150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 4 pages and an Annexure Booklet of 6 pages (i–vi). Please check that your question paper is complete.
2. Answer **ALL** the questions in Sections A and B.
3. Begin the answer to each new question on a new page.
4. The use of scientific calculators is permitted.
5. Alphanumeric calculators and dictionaries are **NOT** permitted.
6. Nautical tables may be used.
7. Use Magnetic Variation 22° W, unless otherwise stated, and the Deviation Card, Annexure 1, throughout.
8. It is in your own interest to write legibly and to present your work neatly.

REQUIREMENTS

Drawing instruments
Graph paper
Chart SAN 3002

ANNEXURES

1. Examination Notes and Deviation Card
2. Altitude Correction Tables
3. Conversion of Arc of Time
4. Nautical Almanac, page 39, 1987 February 12, 13, 14
5. Increments and corrections, page xxvi, increments for 48^m to 49^m
6. Increments and corrections, page xxvii, increments for 50^m to 51^m

SECTION A PRACTICAL CHARTWORK

QUESTION 1

At 08:00 a vessel fixed its position by GPS as 34° 32' S 018° 50' E. The vessel was heading for the next Way Point 1 (WP1) Whittle Rock Racon Buoy bearing South 180° × 2,5 miles.

- Speed through the water is 12,0 knots,
- Current is estimated to set South 180° (T) at 3 knots,
- Estimated leeway is 3° due to a W'ly wind.

1.1 Determine the true course to steer from this 08:00 position to the WP1 allowing for the estimated current and leeway. (5)

1.2 At 08:30 the position of the vessel was fixed with Kaap Hangklip Light bearing 024° (T) × 6,5 miles. Determine the actual set and drift over the past half hour. (12)

1.3 What is the new true course to steer to WP1 making allowance for the set and drift calculated in Question 1.2 above? (8)

Note: Marks include all work done on the chart SAN 3002 provided. **[25]**

QUESTION 2

As the Navigating Officer, you are required to prepare a passage plan for a voyage from Cape Town to Simon's Town. Commence the passage from the first Way Point (WP1) in a position 2,5 miles North of the Cape Town Harbour Breakwater Light, and the final destination is an anchorage in position 1,4 miles North of Roman Rock Light.

You are required to adhere to the separation zones.

You are required to maintain a safe distance of 1,0 mile off all navigation hazards.

With the exception of the beginning and end WPs, the courses must not be closer than 1,0 mile outside the 30 meter depth (blue).

2.1 Lay off the courses on the chart with clear details of WPs and courses to steer. (15)

2.2 Prepare a table of Way Points or alter course positions and details of the courses and distances between WPs. The table should include the following headings:
- WP
- Position (range and bearing as well as latitude and longitude coordinates)
- Course
- Distance
- Time to the next WP at 10 knots
- Totals (15)

[30]

QUESTION 3

A vessel steering North by Compass observes Slangkoppunt Lt. bearing 086° (C), and at the same time the Radio Mast South of Slangkop bearing 118° (C).

What is the Compass course to steer to the beginning of the separation zone, position 34° 01' S 018° 15' E, allowing an estimated 8° leeway for a NW'ly wind?

[15]

QUESTION 4

4.1 Illustrate the relative positions of the Sun and Moon to the Earth and their effect on the Earth's periodic tides at each of the four phases of the Moon. Indicate when Spring and Neap tides occur. (12)

4.2 What is Chart Datum? (3)

[15]

QUESTION 5

5.1 What do the cardinal marks indicate on the Racon Buoy at Whittle Rock in Valsbaai? (4)

5.2 Describe the characteristics of Slangkoppunt Lighthouse. (6)

5.3 What is the year and number of the most recent Notices to Mariners and correction shown on Chart SAN3002? (2)

5.4 What does the advisory note specifically say about the Submarine Cable North of Robben Island? (2)

5.5 What is the scale of Chart SAN3002? (1)

[15]

100 marks

SECTION B ASTRO-NAVIGATION

QUESTION 6

At 08:45 (Local Zone Time) on 13 February 1987 in DR position 25° 00,0' S 040° 00,0' E, the Sun was observed bearing 108° (C) when the ship's heading was 220° (C).

6.1 What was the True heading of the ship at this time? (20)

6.2 If the Magnetic Variation for the region is 22° W, what is the deviation of the compass? (5)

[25]

QUESTION 7

On 12 February 1987 in DR position 30° 00,0' S 011° 30,0' E the lower limb of the Sun was observed at meridian passage North of the observer at a sextant altitude of 73° 11,7'.

Index error 0.5' off the arc
Height of eye 12,0 metres

7.1 Determine the following:

7.1.1 the GMT and Zone Time of meridian passage. (5)

7.1.2 the vessel's latitude at meridian passage. (15)

7.2 Illustrate your answer by means of a sketch on the plane of the celestial horizon showing the following:

- the celestial equator (Q) (1)
- the Sun's declination (1)
- the zenith position (Z) (1)
- the position of the Sun (X) (1)
- the elevated pole (P) (1)

[25]

50 marks

Total: 150 marks