NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2023

NAUTICAL SCIENCE: PAPER I

Time: 3 hours 150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 5 pages and an Annexure Booklet of 7 pages (i–vii). 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 17° 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
Chart SAN 3002

ANNEXURES

1. Examination Notes and Deviation Card
2. Altitude Correction Tables
3. Conversion of Arc to Time
4. Nautical Almanac – 1987 MAY 4, 5, 6, page 93
5. Increments and Corrections 44^m & 45^m, page xxiv
6. Increments and Corrections 48^m & 49^m, page xxvi
7. Predicted Hourly Tides SALDANHA November 2007, page 99

SECTION A PRACTICAL CHARTWORK

Note: Marks include all work done on the Chart 3002 provided.

QUESTION 1

A vessel approaching Table Bay from the north at 11:00 is in position 34° 44' S 018° 10' E (WP1).

1.1 What is the true course to steer to WP2 at 34° 52,4' S 018° 18,8' E? (2)
Plot the positions and the course on the chart. (6)

1.2 Determine the true course to steer from WP1 to WP2 if the speed of the vessel is 8 knots; the current is estimated to be setting 090° (T) at 2 knots; and the leeway is estimated to be 2° due to a W'ly wind. (8)

1.3 Lay off the course to the destination WP3: 34° 52,4' S 018° 26,1' E. (2)

1.4 What will the ETA be if the vessel does an average speed of 6 knots from the 11:00 position to arrival (WP3)? (2)

[20]

QUESTION 2

Your vessel is lying approximately 3 miles west of Hout Bay. Two horizontal sextant angles were taken as follows:

Between Hangberg (.330) and Chapman's Peak (.592) – 64º
Between Chapman's Peak (.592) and Slangkop light – 70º.

Determine your position in terms of latitude and longitude.

[20]

QUESTION 3

At 15:00 your vessel was steering 138° (C) in a southwesterly wind. At that time a compass bearing was taken of Cape Point light which was 089° (C).

At 16:00 a second bearing was taken of Cape Point light which was 349º (C).

The engine speed was 10 knots and the current was estimated to be setting 040° (T) at 2 knots.

3.1 Plot the vessel's position at 16:00. (14)

3.2 What is the true bearing and range of Cape Point light at 16:00? (1)

[15]

QUESTION 4

Your vessel is due to sail from Saldanha on the rising tide during the afternoon of 25 November 2007.

The vessel must cross a sandbank with a charted depth of 6,7 meters beneath the keel.

The draught of your vessel is 6,5 meters and you require a minimum of 2 meters beneath the keel.

4.1 When is the earliest you will be able to cross the sandbank? (5)

4.2 Illustrate your calculation, clearly showing details of the vessel hull in relation to the depth of water and Chart Datum. (10)

4.3 'The main force that causes tides comes from the gravitational force of the Moon.'

Is this statement TRUE or FALSE? (3)

4.4 Complete the following statement:

'About … days after Full and New Moon … Tides occur.' (2)

[20]

QUESTION 5

5.1 From the 'Tidal Streams' table on Chart 3002, determine the direction and rate of the tidal stream east of Robben Island in position 33º 48,5' S; 018º 26,3' E one hour before H. W. Springs. (5)

5.2 Describe the characteristics of the following lights:

5.2.1 Slangkop Light. (5)

5.2.2 Green Point Light. (5)

5.2.3 Kalkbaai Breakwater Light. (3)

5.3 Describe the characteristics of the Robben Island foghorn. (2)

5.4 There is a 'Replenishment Area' to the West of Table Bay. What does the Note say about this area? (3)

5.5 What do the Chart Notes say about Vessel Traffic Services procedures? (2)

[25]

100 marks

SECTION B ASTRO-NAVIGATION

QUESTION 6

What is the ship's zone time of sunrise on 5 May 1987 for a vessel in position 26° 30' S 140° 08' W?

[10]

QUESTION 7

What is the Local Hour Angle and the declination of the sun on 6 May 1987 at 16:45 (E) in position 38° 20' S 079° 20' E?

[12]

QUESTION 8

On 4 May 1987 the lower limb of the sun was observed at meridian passage to the south of the observer with a sextant altitude of 48° 12,0'.

Calculate the latitude of the observer if the longitude was 002° 12' E.

The observer's height of eye was 7,3 m and the index error was 2,1' ON the arc.

[20]

QUESTION 9

9.1 In the Northern Hemisphere, which months of the year do the following occur?

9.1.1 the shortest day;

AND

9.1.2 the shortest night. (2)

9.2 Name the three correctable errors of the sextant. (3)

9.3 The Hour Angle is defined as 'the angle between the observer's meridian and the meridian of the celestial body'. It is always measured EASTWARD from the observer's meridian.

Is this statement TRUE or FALSE? (3)

[8]

50 marks

Total: 150 marks