



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 23° W 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. Annexure 1 – Examination Notes and Deviation Card
2. Annexure 2 – Altitude Correction Tables
3. Annexure 3 – Conversion of Arc to Time
4. Annexure 4 – Nautical Almanac – page 49; 1987 February 27, 28, March 1
5. Annexure 5 – Nautical Almanac – page 233; 1987 November 30, December 1, 2
6. Annexure 6 – Increments and Corrections 42m and 43m

SECTION A PRACTICAL CHART WORK**QUESTION 1**

At 09:30 a GPS fix gave the following position of the vessel:

Latitude $34^{\circ} 20' S$ Longitude $018^{\circ} 15' E$.

Speed through the water is 15 knots.

Current is estimated to set $100^{\circ} (T)$ at 2,0 knots.

The estimated leeway is 5° due to a NW'ly wind.

The Magnetic Variation is $23^{\circ} W$.

1.1 Plot the vessel's position on the Chart provided. (5)

1.2 What is the compass course to steer to the next alter course position

Latitude $34^{\circ} 01' S$ Longitude $018^{\circ} 15' E$

entering the traffic zone approaching Table Bay? (10)

1.3 Lay off the courses on the chart from this last position to the Pilot rendezvous position:

Green Point (Fl 10 s. 20 m 25 M) bearing $180^{\circ} (T) \times 1,6$ miles. (7)

1.4 What is the ETA at the Pilot rendezvous position? (3)
[25]

QUESTION 2

What is the distance off a lighthouse if the vertical sextant angle measured $3^{\circ} 20'$ and the height of the lighthouse was 270 metres?

[15]

QUESTION 3

At 15:00 a vessel steering $092^{\circ} (C)$ observed Cape Point Fl (2 + 1) 30 s 87 m 32 M bearing $042^{\circ} (C)$.

At 15:30 Cape Point Fl (2 + 1) 30 s 87 m 32 M was bearing $352^{\circ} (C)$. The vessel maintained a speed of 8,0 knots, and the current was known to be setting $290^{\circ} (T)$ at 1,8 knots.

Determine the position of the vessel at 15:30.

[20]

QUESTION 4

- 4.1 A vessel has a draught of 7,9 m. Calculate the height of the tide required for the vessel to pass over a shallow section of the channel with a depth of 8,8 m and minimum clearance under the keel of 2,5 m. (13)
- 4.2 The depths on the chart are measured from which plane of reference?
- 4.2.1 the seabed? **OR**
- 4.2.2 mean sea level? **OR**
- 4.2.3 chart datum? (1)
- 4.3 Explain the meaning of ebb tide. (2)
- 4.4 What two meteorological conditions can cause differences between predicted and actual tides? (4)
- [20]

QUESTION 5

- 5.1 Describe the characteristics of the following navigation lights:
- 5.1.1 Fl.G.2 s.5 M. (3)
- 5.1.2 VQ(6) + L Fl. 10 s. (4)
- 5.1.3 Q(3) 10 s. Bell (3)
- 5.2 If you are in position 34° 30' S 018° 30' E at night, what would be the visible characteristics of Cape Point lighthouse? (5)
- 5.3 North of Robben Island there is a submarine cable. How far, on either side of it, is anchoring and trawling prohibited? (3)
- 5.4 What is the height of the upper cable station on Table Mountain? (2)
- [20]

100 marks

SECTION B ASTRO-NAVIGATION**QUESTION 6**

On 27 February 1987 a ship was in DR position $29^{\circ} 43,0' N$; $069^{\circ} 27,0' W$. The sextant angle of the sun's lower limb was observed to be $40^{\circ} 41,8'$. At the time of the observation the chronometer read 14 h 42 m 48 s, and there was an error of 24 seconds fast on GMT.

The index error of the sextant was $1,0'$ off the arc; the height of eye of the observer was 6,1 m.

- 6.1 Determine the position line on which the ship was situated using the intercept method. (20)
- 6.2 From Question 6.1 above, schematically plot the DR position, azimuth and position line of the vessel on your Answer Book. (5)
- [25]

QUESTION 7

A vessel in DR position $26^{\circ} 00,0' S$; $011^{\circ} 00,0' E$ on 2 December 1987 was steering a compass course of 145° . The navigator observed the sun to set bearing 300° by compass. The magnetic variation in the vicinity of the vessel was given as $22\frac{1}{2}^{\circ} W$.

Calculate the following:

- 7.1 GMT and Zone Time of sunset at the vessel. (8)
- 7.2 The error of the vessel's compass at the time. (11)
- 7.3 The deviation of the compass for the vessel's heading. (3)
- 7.4 The true course being steered by the vessel. (3)
- [25]

50 marks

Total: 150 marks