



**NAUTICAL SCIENCE: PAPER I**

Time: 3 hours

150 marks

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**PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY**

1. This question paper consists of 4 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  $24^{\circ}$  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.

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**REQUIREMENTS**

Drawing instruments  
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 163, 1987 August 17, 18, 19
5. Annexure 5 – Increments and Corrections  $4^m$ ,  $5^m$
6. Annexure 6 – Increments and Corrections  $50^m$ ,  $51^m$
7. Annexure 7 – Predicted tides Knysna, December 2007

**SECTION A PRACTICAL CHARTWORK****QUESTION 1**

A vessel is approaching Cape Town on a compass course  $158^\circ$  (C) at 05:00 and the observed position is Robben Island Lt. bearing  $142^\circ$  (C)  $\times$  11,5 miles. Using the Chart SAN 3002 provided, plot the position and determine the following:

- 1.1 The compass course to steer to the next alter course position, Robben Island Lt. bearing  $043^\circ$  (T)  $\times$  4,9', given:
- speed through the water is 10 knots
  - current is estimated to be setting  $170^\circ$  (T) at 2 knots
  - estimated leeway from a Westerly wind is  $7^\circ$
- (15)
- 1.2 From this last alter course position, what is the true course to steer to arrive at the pilot rendezvous position north of Green Point Lighthouse? Plot the course on the chart.
- (5)  
**[20]**

**QUESTION 2**

- 2.1 Your vessel has anchored in Simon's Bay. The following horizontal sextant angles were observed between:
- Simonsberg  $\Delta$  546 and Else Pk.  $\Delta$  303 is  $75^\circ$   
Else Pk.  $\Delta$  303 and Kalkbaaiberg  $\Delta$  515 is  $43^\circ$
- What is the position of the vessel in terms of range and bearing of Roman Rocks Light?
- (15)
- 2.2 Apart from Roman Rocks Light, identify three other salient points on the chart to monitor your anchorage position.
- (3)
- 2.3 Name two navigation instruments on the bridge that you could use to monitor your vessel's position whilst at anchor.
- (2)  
**[20]**

**QUESTION 3**

A vessel steering  $150^\circ$  (C) observed at 10:00 Cape Point Lt. bearing  $070^\circ$  (C).

At 11:00 Cape Point Lt. was observed bearing  $010^\circ$  (C). The vessel maintained a course  $150^\circ$  (C) and engine speed of 7 knots throughout. The current was known to set  $270^\circ$  (T) at 1,0 knot.

Determine the vessel's position at 11:00.

**[20]**

**QUESTION 4**

- 4.1 The draught of your vessel is 2,62 m and you are required to navigate through Knysna Heads with a minimum chart depth of 2,5 m.

What is the earliest time on a rising tide on the afternoon of Tuesday 25 December 2007 that your vessel may transit with an under-keel clearance of 1,5 m? (16)

- 4.2 During which phases of the moon do the following occur?

4.2.1 Spring tide (2)

4.2.2 Neap tide (2)

**[20]**

**QUESTION 5**

- 5.1 Describe the characteristics of Kaap Hangklip Lighthouse (Lat 34° 32,2' S Long 018° 49,7' E). (5)

- 5.2 Cape Point Lighthouse is observed bearing 000° (T) × 6,0M. What characteristics would this light show from this position? (5)

- 5.3 Select a safe anchorage position in Table Bay for a container vessel carrying hazardous cargo and a deep draught of 13 m.

Mark the position on the Chart SAN 3002 provided, and write down on your Answer Book the bearing and range off the Main Breakwater Lt. (Fl. G. 2s 5M). (7)

- 5.4 How many metres are there in one nautical mile? (2)

- 5.5 If a ship at anchor is 9 cables away from a buoy, how far is this in nautical miles? (1)

**[20]**

**100 marks**

**SECTION B            ASTRO-NAVIGATION****QUESTION 6**

On 19 August 1987 at 09:52 LMT in DR position  $28^{\circ} 00' S$   $015^{\circ} 10' E$  the Sun was observed to bear  $069^{\circ}$  (C) when the vessel was heading  $340^{\circ}$  (C).

- 6.1    What is the true heading of the vessel at this time? (15)
- 6.2    If the magnetic variation is  $23^{\circ} W$ , what is the deviation of the compass for this heading? (10)
- [25]**

**QUESTION 7**

On 18 August 1987 in DR position  $29^{\circ} 32' N$   $069^{\circ} 30' W$  the lower limb of the Sun was observed at meridian passage south of the observer at a sextant altitude of  $72^{\circ} 51,2'$ .

The index error of the sextant was  $1,5'$  off the arc, and the observer's height of eye was  $12,5m$ .

- 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:
- 7.2.1    The celestial equator (Q) (1)
- 7.2.2    The Sun's declination (1)
- 7.2.3    The zenith position (Z) (1)
- 7.2.4    The position of the Sun (X) (1)
- 7.2.5    The elevated pole (P) (1)
- [25]**

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| <b>50 marks</b> |
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**Total: 150 marks**