

**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 5 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.
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**REQUIREMENTS**

Drawing instruments  
Chart SAN 3002

**ANNEXURES**

1. Examination Notes and Deviation Card
2. Altitude Correction Tables
3. Conversion of Arc of Time
4. Nautical Almanac – page 233, 1994 Nov 30, Dec 1, 2
5. Tide Tables – Simon's Town November 2007
6. Simon's Town Tides 2007

**SECTION A PRACTICAL CHARTWORK**

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

**QUESTION 1**

At 10h00 the vessel, steering a course  $341^{\circ}$  (T) at a speed of 7,0 knots, fixes her position with Cape Point Lt. bearing  $071^{\circ}$  (T)  $\times$  7,3 miles. The vessel is on course for the next waypoint alter course position with Slangkop Lt. bearing  $071^{\circ}$  (T)  $\times$  3,0 miles.

Using the Chart SAN 3002 provided, plot the 10h00 position.

- 1.1 What is the true course to steer to the next waypoint alter course position with Slangkop Lt. bearing  $071^{\circ}$  (T)  $\times$  3,0 miles, allowing for a current setting  $020^{\circ}$   $\times$  3,0 knots, and leeway of  $5^{\circ}$  due to a SW'ly wind. (8)
  - 1.2 Half an hour later at 10h30 Cape Point Lt. was observed bearing  $097^{\circ}$  (T)  $\times$  7,7 miles. What is the true set and drift of the vessel? (6)
  - 1.3 From the 10h30 position, what is the true course to steer to the waypoint allowing for the true set and drift established in Question 1.2 above, excluding leeway? (6)
- [20]**

**QUESTION 2**

At 13:00 a vessel is in position  $34^{\circ} 29' \text{ S } 018^{\circ} 41' \text{ E}$ . The vessel is required to pass 1,5 miles clear of Whittle Rock Racon Buoy.

The speed of the vessel is set at 12,0 knots.

The current is estimated to be setting  $225^{\circ}$  (T) at 3 knots.

- 2.1 Find the compass course to steer in order to pass 1,5 miles clear of Whittle Rock Buoy. (15)
  - 2.2 What is the estimated time that Whittle Rock Buoy will be abeam? (5)
- [20]**

**QUESTION 3**

Your vessel is in transit to Gordon's Bay, departure  $34^{\circ} 10' \text{ S } 018^{\circ} 50' \text{ E}$ , to Simon's Bay on a course  $269^{\circ}$  (T) at 8 knots.

At 20:00 you observe Whittle Rock Buoy bearing  $241^{\circ}$  (T).

At 20:30 you again observe Whittle Rock Buoy bearing  $227^{\circ}$  (T).

- 3.1 Plot the vessel's position at 20:30. (4)
- 3.2 There are some hazards on this passage that the Navigator needs to be aware of. Identify two of these hazards that will potentially interfere with the passage of your vessel, and state what action if any will be required. (6)
- 3.3 From the vessel's position at 20:30 (3.1) plot safe courses to maintain 0,5 miles clear of the identified hazards, making for the anchorage position in Simon's Bay 1,0 mile North of the harbour breakwater light "Oc. 11 M". (4)
- Chart (6)
- [20]**

**QUESTION 4**

- 4.1 The charted depth of a shoal off Simon's Town harbour is given 2,5 m.

The draught of your vessel is 2,8 m, and you are required to have an under-keel clearance of 1,0 m.

Find the earliest time on the morning rising tide of 25th November 2007 that your vessel may cross this shoal. (8)

- 4.2 Illustrate your answer by drawing a box shaped vessel, draft and UKC, charted depth, chart datum line and height of tide. (7)
- 4.3 What is the range and duration of tide at Simon's Town on the morning of 25th November 2007? (5)
- [20]**

**QUESTION 5**

- 5.1 A fishing vessel will transit from the Port of Cape Town to Hout Bay Harbour.

On the chart provided lay off suitable courses using the Inshore Traffic Zone commencing at WP1 being 0,5 mile North of Cape Town Breakwater and terminating at a WP 0,4 mile East of the Hout Bay Harbour entrance in position  $34^{\circ} 03' S$   $018^{\circ} 21,4' E$ .

The vessel has a draft of 5,0 metre. You are required to clear all navigation hazards by a minimum of 0,5 mile. (15)

- 5.2 Identify three reporting points on this passage (5.1) that are marked on the chart. (3)

- 5.3 What is the large-scale chart number you should use approaching Houtbaai, and that is indicated on the chart provided? (2)  
**[20]**

<b>100 marks</b>
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**SECTION B            ASTRO-NAVIGATION****QUESTION 6**

On 2 December 1994 at 05:30 (Local Time) the ship's position was determined from morning stars to be  $32^{\circ} 46,0' \text{ S } 017^{\circ} 50,0' \text{ E}$ .

Later in the morning the sun's lower limb was observed at meridian passage with a sextant altitude of  $77^{\circ} 56,2'$  to the north.

Sextant index error  $1,0'$  off the arc.  
Observer's height of eye  $12,0$  metres.

Determine the position of the vessel at meridian passage if she steamed from the 05:30 star position on a course of  $180^{\circ}$  at 9 knots.

**[25]****QUESTION 7**

On 1 December 1994 on board a vessel in estimated position  $32^{\circ} 00' \text{ S } 016^{\circ} 50' \text{ E}$  the setting sun was observed to be bearing  $323^{\circ}$  by compass while the ship's head was  $234^{\circ} \text{ (C)}$ .

The magnetic variation in the vicinity was  $22^{\circ} \text{ W}$ .

Determine the following:

- |     |  |             |
|-----|--|-------------|
| 7.1 | GMT and Zone time of sunset at the vessel.   | (8)         |
| 7.2 | The compass error.                           | (11)        |
| 7.3 | Deviation of the compass at that heading.    | (3)         |
| 7.4 | The true course being steered by the vessel. | (3)         |
|     |  | <b>[25]</b> |

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