## NAUTICAL SCIENCE: PAPER I

Time: 3 hours

## PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 4 pages and an Annexure Booklet of 6 pages $(i-v i)$. 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 Variation $24^{\circ} \mathrm{W}$ and the attached Deviation card throughout.
8. It is in your own interest to write legibly and 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 39 - 12, 13, 14 February 1987
5. Annexure 5 - Increments and corrections pages xxvi, increments for $48^{\mathrm{m}}$ to $49^{\mathrm{m}}$
6. Annexure 6 - Increments and corrections pages xxvii, increments for $50^{\mathrm{m}}$ to $51^{\mathrm{m}}$

## SECTION A PRACTICAL CHARTWORK

## QUESTION 1

At 08:00 a vessel fixed its position by GPS South of Kaap Hangklip as $34^{\circ} 30^{\prime} \mathrm{S} 018^{\circ} 50^{\prime} \mathrm{E}$, and heading for the next Way Point (WP) Whittle Rock Racon buoy bearing South $180^{\circ} \times 3,2$ miles.

- speed through the water is 15,0 knots
- current is estimated to set South $180^{\circ}(\mathrm{T})$ at 3 knots
- estimated leeway is $5^{\circ}$ due to a W'ly wind
1.1 Determine the true course to steer from this 08:00 position to the position North of Whittle Rock allowing for the estimated current and leeway.
1.2 Half an hour later at 08:30 the position of the vessel was fixed with Kaap Hangklip Light bearing $055^{\circ}(\mathrm{T}) \times 5,3$ miles.
Determine the actual set and drift over the past half hour.
1.3 What is the new true course to steer to the position North of Whittle Rock making allowance for the set and drift calculated in 1.2 above?

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

## 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.
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.
2.2 Prepare a table of Way Points or alter course positions and details of the courses

> and distances between WPs.
2.3 Calculate the total distance and time for the passage from Cape Town WP1 to the Simon's Town anchorage position. The vessel is expected to average 12 knots for the passage.

## QUESTION 3

A vessel steering North by Compass observes Slangkoppunt Lt. bearing $086^{\circ}$ (C), and at the same time Karbonkelberg Bn. $\Delta 652$ bearing $040^{\circ}$ (C).
What is the Compass course to steer to the beginning of the separation zone, position $34^{\circ}$ $00^{\prime} \mathrm{S} 018^{\circ} 16^{\prime}$ E, allowing an estimated $8^{\circ}$ leeway for a NW'ly wind?

## 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.
4.2 What is Chart Datum?

## QUESTION 5

5.1 What do the cardinal marks indicate on the Racon buoy at Whittle Rock in Valsbaai?
5.2 Describe the characteristics of Slangkoppunt Light House.
5.3 What is the year and number of the last most recent correction shown on Chart SAN3002?
5.4 What does the advisory note specifically say about the Submarine Cable North of Robben Island?
5.5 What is the scale of Chart SAN3002?

## SECTION B ASTRO-NAVIGATION

## QUESTION 6

At 08:45 (Local Time) on 13 February 1987 in DR position $25^{\circ} 00,0^{\prime} \mathrm{S} 040^{\circ} 00,0^{\prime} \mathrm{E}$, the Sun was observed bearing $108^{\circ}$ (C) when the ship's heading was $220^{\circ}$ (C).

### 6.1 What was the True heading of the ship at this time?

6.2 If the Magnetic Variation for the region is $22^{\circ} \mathrm{W}$, what is the deviation of the compass?

## QUESTION 7

On 12 February 1987 in DR position $30^{\circ} 00.0^{\prime} \mathrm{S} 011^{\circ} 30.0^{\prime}$ e the lower limb of the Sun was observed at Meridian Passage North of the observer at a sextant altitude of $73^{\circ} 11.7^{\prime}$.
$\begin{array}{ll}\text { Index error } & 0.5 \text { ' off the arc } \\ \text { Height of eye } & 12,0 \text { metres }\end{array}$
7.1 Determine the following:

### 7.1.1 The GMT and Zone Time of meridian passage

7.1.2 The vessel's latitude at meridian passage

### 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)
7.2.2 the Sun's Declination
7.2.3 the zenith position ( Z )
7.2.4 the position of the Sun (X)
7.2.5 the elevated pole (P)

