NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

DEPARTMENT OF LAND AND SPATIAL SCIENCES

QUALIFICATIONS: BACHELOR OF GEOMATICS	
QUALIFICATIONS CODES: 07BGEO	**QUALIFICATION LEVEL:** Level 7 - 07BGEO
COURSE CODE: ODC721S	**COURSE NAME:** Geodesy
DATE: November 2024	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER:	**Dr J. Odumosu**
MODERATOR:	**Dr K. Owolabi**

INSTRUCTIONS

1. Answer all question.
2. Write clearly and neatly.
3. Marks will be deducted for poor writing, spelling and grammatrical errors.
4. Number the answers clearly.
5. Make sure your Student Number is on the EXAMINATION BOOK(s).

THIS QUESTION PAPER CONSISTS OF 3 PAGES (Including this front page)

PERMISSIBLE MATERIAL

Calculator

QUESTION 1 **[20 MARKS]**

1.1 In chronological order, trace the historical evolution of Geodesy [5 marks]

1.2 Discuss on the application of Geodesy to:
(a) Drought surveillance [8 marks]
(b) Earthquake monitoring and plate tectonics assessment [7 marks]

QUESTION 2 **[20 MARKS]**

2.1 If the longitude of A is $36^{\circ}\ 03'\ 37''$ and the LST is $11^{hr}\ 31^{m}\ 17^{s}$, find the LST at B whose longitude is $3^{\circ}\ 27'\ 13''$. [6 marks]

2.2 A ship sails eastwards from New York ($\lambda = 74°W$) on 2nd January at 8am LMT and arrives in Melborne ($\lambda = 145°E$) at 6pm on 12th February. Find the total time taken by the voyage. [7 marks]

2.3 At a certain location ($\varphi = 45°\ 52'\ 15''$) stellar observation is intended to be carried out at 8:45pm on 16th August, 2024. If the declination and hour angle of a star (Serius) at the proposed time of observation is $16°\ 41'\ 11''$ and $49°\ 51'\ 12''$ respectively, calculate the expected altitude and azimuth of the star at the time of observation. [7 marks]

Hints:

$$\sin h = \cos w \,.\cos P + \sin w.\sin P.\cos t \quad \text{(i)}$$

$$\cot Z = \frac{\cot P \,.\sin w - \cos w \cos t}{\sin t} \quad \text{(ii)}$$

QUESTION 3 **[20 MARKS]**

3.1 Given the following geodetic coordinates, find their corresponding cartesian form using the Bessel (1841) and Clarke (1866) ellipsoidal parameters. [16 marks]

3.2 Calculate the linear separation between the two points and discuss its implication to local surveys. [4 marks]

$\varphi = 40°\ 07'\ 04.595\ 51''$

$\lambda = 277°\ 01'\ 10.221\ 76''$

$h = 231.562\ \text{m}$

Hints:

$$X = (N + h)\cos\phi\cos\lambda$$

$$Y = (N + h)\cos\phi\sin\lambda$$

$$Z = [(1 - f^2)N + h]\sin\phi$$

$e^2 = 2f - f^2$

Let $N = \frac{a}{\sqrt{1 - e^2 \sin^2\phi}}$

Ellipsoid Name (year computed)	Semi-Major Axis, a, [m]	Inverse Flattening, $1/f$
Airy (1830)	6377563.396	299.324964
Everest (1830)	6377276.345	300.8017
Bessel (1841)	6377397.155	299.152813
Clarke (1866)	6378206.4	294.978698

QUESTION 4 [20 MARKS]

In your own words, discuss extensively on the Namibian Terrestrial Reference Frame. In your discussion, identify the choice of ellipsoid and reasons for it, and the reference frame itself (configuration, realization, observational methods, and recent adaptations).

QUESTION 5 [20 MARKS]

You have recorded the following observations from trig beacon Daijobe, to unknown point A using a theodolite and EDM:

Geodetic Azimuth = 170° 15′ 23″
Horizontal distance = 7325.23m (International metre)

Calculate the necessary corrections that must be applied to these observations in order to calculate the Lo2217 coordinates of Point A. You are required to calculate the final distance and direction that will be used for the polar calculation, but you do not have to calculate the coordinates of Point A.

Coordinates: *(System: Lo2217)*
Trig No. 29 (Daijobe): Y+ 97 337.90 X+672 615.20 MSL Elevation: 252.8m
Approximate coordinates of Point A: Y+96 098.00 X+679 834.00 MSL Elevation: 210m