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 2023	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER:	**Mr J.C. Lewis**
MODERATOR:	**Dr K. Owolabi**

INSTRUCTIONS

1. Answer all question.
2. Write clearly and neatly.
3. Number the answers clearly.
4. 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, ruler, pen

1. Define and discuss the meaning of Geodesy. Your discussion should include the following, amongst others: [10 marks]
   (a) Definition of Geodesy
   (b) Three 'pillars' of Geodesy
   (c) Main branches of Geodesy

2. Discuss the following movements of the Earth (use sketches if necessary):
   (a) Precession and Nutation
   (b) Polar Motion [10 marks]

3. Discuss the classification of coordinate systems used in Geodesy. [10 marks]

4. Briefly discuss the RA coordinate System. [10 marks]

5. Briefly discuss the terms 'Geodetic Latitude', 'Astronomic Latitude,' and 'Deflection of the Vertical'. Use a sketch if necessary. [10 marks]

6. Explain the meaning and differences between the following: [7 marks]
   (a) CTS
   (b) ITRS
   (c) ITRF

7. Discuss the difference between ITRF and WGS84. [8 marks]

8. Explain how a national geodetic coordinate system is typically defined. How was this done for the Namibian National Geodetic Datum? [10 marks]

9. Discuss Meridian Convergence. Your discussion should include the following, amongst others:
   (a) Definition
   (b) Applications and implications of meridian convergence in surveying and mapping.
   [10 marks]

10. You have recorded the following observations from trig beacon *Daijobe,* to unknown Point A, using a gyro theodolite and EDM:
    - Geodetic azimuth: 170°15'23"
    - Horizontal distance: 7325.23m (international metre)

    Discuss and calculate the necessary corrections that must be applied to these observations, in order to calculate the Lo2217 coordinates of Point A.
    Note: You must 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*

[15 marks]

FORMULAS:

$$t = T + (t - T)$$

Where:

$$(t - T) = \frac{\rho}{6r_1^2}(x_1 - x_2)(2y_1 + y_2) + \ldots$$

and where

ρ = 206265 (Correction factor from radians to the seconds)

r_1 = Mean radius of curvature at Point 1

$(t - T)_1 = \rho . \frac{x_1 - x_2}{2R^2} . y_m$ (With ρ=206265, (t–T) will be in seconds)

r_1 = 6 371 000m

$$\gamma \approx \ell . sin\phi + \frac{\ell^2}{3} . sin\phi . cos^2\phi . (1 + 3\eta^2) - \cdots$$

$\ell = \lambda_0 - \lambda$ (longitude difference, in radians);

$\eta^2 = e'^2 . cos^2\phi$;

$$\tau = tan\phi$$

λ = longitude; λ_0 = longitude of Central Meridian

ϕ = latitude

$e' = \sqrt{\frac{(a^2 - b^2)}{b^2}}$ ('Second Eccentricity' of the spheroid)

$e = \sqrt{\frac{(a^2 - b^2)}{a^2}}$ ('First Eccentricity' of the spheroid)

a= semi-major axis; b= semi-minor access of reference spheroid

MSL Correction = D(H/R)

$$S = K + \frac{K^3}{24 . R^2}$$

Corr. = $S.Y^2/(2R^2)$

$J = S + S.Y^2/(2R^2) = S[(1 + Y^2/(2R^2)]$