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: January 2024	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

SECOND OPPORTUNITY \ SUPPLEMENTARY 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).

PERMISSIBLE MATERIAL

Calculator, ruler, pen

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

1. Discuss the meaning and implications of Earth Tides, in the context of Geodesy. [10 marks]

2. Discuss the meaning and major implications of the Vernal Equinox. Use a sketch if necessary. [6 marks]

3. Explain the difference between a sphere, spheroid, and ellipsoid. [4 marks]

4. Discuss the difference between a 'sidereal day' and a 'solar day'. [5 marks]

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

6. Discuss the height system and vertical datum commonly used in Namibia. Briefly mention the advantages and disadvantages of this system, compared to a more modern vertical datum. [10 marks]

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

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

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

10. Explain and discuss meridian convergence. Your discussion should include an explanation of true north, grid north, and geodetic azimuth, as well as a brief discussion of the use of and implications of meridian convergence in land surveying. [10 marks]

11. You have recorded the following observations from trig beacon *Daijobe,* to unknown Point A, using a gyro theodolite and EDM:
    - Geodetic azimuth: 190°15'23"
    - Horizontal distance: 7300.00m (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. [15 marks]

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+98 600*	*X+679 800*	*MSL Elevation: 210m*

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

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

$\ell = \lambda_0 - \lambda$ (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. = $S.Y^2/(2R^2)$

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