UNAM
UNIVERSITY OF NAMIBIA

FACULTY	**AGRICULTURE, ENGINEERING, AND NATURAL SCIENCES**		
DEPARTMENT	**ENVIRONMENTAL SCIENCE**		
SUBJECT	**REMOTE SENSING II**		
SUBJECT CODE	**GRS3652**		
DATE	**October/November 2022**		
DURATION	**3 HOURS**	**MARKS**	**100**

SPECIAL/SUPLIMMENTARY EXAMINATION

Examiners: Eliakim Hamunyela, PhD & Martin Hipondoka, PhD

Internal Moderator: Mr Andreas Amukwaya

External Moderator: Prof T. Dube, University of Western Cape

INSTRUCTIONS

1. Work in an orderly manner and present your work as neatly as possible.
2. While most of the marks will be awarded for content, candidates must bear in mind the importance of presentation, i.e. insight and critical thinking.
3. Number your questions correctly and clearly.
4. This paper consists of two (2) pages (excluding this front page).
5. Answer all questions in Section A and B.
6. Usage of calculator is allowed.

SECTION A: **Total marks: 46**

1. Differentiate between:
   (a) Training and testing dataset **[4]**

   (b) Omission error and commission error **[4]**

   (c) Spectral index and spectral band **[4]**

2. What purpose does accuracy assessment serves in Remote Sensing? **[4]**

3. A colleague of yours approached you in her quest to understand the difference between long wave radiation and surface temperature as estimated from satellite images. What purpose does it serve to measure long wave radiation using remote sensing? **[4]**

4. Ms Likando, Director, Disaster Risk Management in the Office of the Prime Minister is interested in getting areas threatened by heat wave in the country. She then approach you for advice whether Remote Sensing can be useful in detecting surface temperature across the country. Advise her. **[4]**

5. Discuss one advantage and one disadvantage of 'first return' in the context of LiDAR. **[4]**

6. Optical remote sensing is often used for mapping distribution of plant species at landscape level. Explain what makes this often possible. **[4]**

7. Table 1 below shows the surface reflectance values per spectral bands of Landsat 8 for three pixels in Windhoek, Namibia.
   (a) Calculate the Normalized Difference Water Index (NDWI) for each pixel. Show all your work. **[6]**
   (b) Justify why we refer to this index as "**Normalized Difference Water Index**". **[4]**
   (c) Judging from the NDWI values you computed, which pixel is likely to be for water? Motivate your answer. **[4]**

Table 1: Surface reflectance values for each spectral band of Landsat 8 at three pixels in Windhoek, Namibia.

Band name	Pixel A	Pixel B	Pixel C
Blue	0.0364	0.3489	0.0240
Green	0.0558	0.4165	0.0417
Red	0.0523	0.4387	0.0263
NIR	0.2066	0.4214	0.0246
SWIR-1	0.1640	0.3255	0.0083
SWIR-2	0.1070	0.2986	0.0058

SECTION B: **Total marks: 54**

1. Suppose, while you are processing your satellite images from Sentinel-2 sensor, a crop farmer came by and wondered if remote sensing could be useful to her as a farmer.

(a) **Justify** to this crop farmer why remote sensing could be useful. **[4]**

(b) Discuss the application of remote sensing in the following fields:

i. Hydrosphere **[4]**

ii. Soil Science **[4]**

2. Remote sensing experts spend a lot of time and money classifying satellite images to create land cover maps. **Justify** why land cover maps are important to humanity. **[6]**

3. Discuss the main differences between optical and passive remote sensing **[6]**

4. Suppose Simon created a land cover map of Windhoek, Namibia, by classifying one multispectral Landsat 8 image acquired in 14 April 2021 using supervised classification. He then constructed a confusion matrix (shown in Table 2) to perform accuracy assessment of his map. He used reference data acquired through visiting each sampling point in the field. Sampling points were generated post-classification from the classified map through stratified probability sampling.

(a) What was the total number of his reference sampling points? **[2]**

(b) Which map class was allocated the highest number of sampling points? **[4]**

(c) **Calculate** producer's and the user's accuracy of each map class. **[12]**

(d) What is the overall accuracy of Simon's land cover map? **[6]**

(e) Which two map classes had the highest commission error? **[6]**

Table 2: Confusion matrix of Windhoek land cover map

Classified Map	Reference data			
	Bare soil	Vegetation	Water	Built-up area
Bare soil	80	5	0	21
Vegetation	8	95	4	3
Water	0	5	78	0
Built-up area	17	2	0	54

---END---