UNAM
UNIVERSITY OF NAMIBIA

FACULTY	**AGRICULTURE, ENGINEERING AND NATURAL SCIENCES**		
DEPARTMENT	**ENVIRONMENTAL SCIENCE**		
SUBJECT	**REMOTE SENSING I**		
SUBJECT CODE	**GRS3611**		
DATE	**June 2023**		
DURATION	**3 HOURS**	**MARKS**	**100**

FIRST OPPORTUNITY EXAMINATION

Examiner: **M Hipondoka, PhD**
External Moderator: **Prof Timothy Dube, University of the 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 three (3) pages (excluding this front page).
5. Answer all questions in Section A and answer one (1) question in Section B.
6. Usage of a calculator is allowed.

Section A

1. In the context of Remote Sensing, **define** the following terms: **/10/**

a) Platform (2)
b) Panchromatic band (2)
c) Image resampling (2)
d) Full width at half maximum (FWAHM) (2)
e) Atmospheric window (2)

2. **Using practical examples, demonstrate your understanding (not definitions)** of the difference (*not definitions*) between the following terms: **/12/**

a) Radiance and Irradiance (4)
b) Short and long wavelength (4)
c) Nadir and Principal point (4)

3. Assume that you met a student radiographer at the School of Allied Health Sciences. She then asked whether you regard radiography as a component of remote sensing. **Answer** her question and **motivate** your viewpoint. (4)

4. A hydrologist measured water quality using a handheld probe immersed in water in channels of the Zambezi River. **Argue** whether or not this mode of measurements is remote sensing. (4)

5. Using either Equation 1 or Equation 2 below, **determine** the wavelength where a healthy human body would radiate maximum energy (show all of your work). (5)

$$M = \sigma T^4 \quad \text{..... Equation 1}$$

$$\lambda_m = \frac{A}{T} \quad \text{..... Equation 2}$$

Note: In equation 1, the Stefan-Boltzmann constant (σ) is 5.6697 x 10-8 W m-2; while in equation 2, A = 2898 μm K

6. a) **What** is the purpose of taking aerial photographs with a 60% overlap? (3)
b) **What** is the purpose of the bubble level shown on aerial photographs? (2)

7. a) **Provide a practical example** of energy transfer through radiation. (3)
b) Under **which** medium can energy be transferred through radiation, but not through conduction or convection? (2)

8. **Give practical steps** on how to go about to georeference an aerial photograph. (6)

9. A colleague approached you for advice regarding the ideal pixel size for capturing outdoor swimming pools ranging between 20 m x 20 m and 100 m x 100 m located in a city. **What** is the possible coarsest spatial resolution for capturing the smallest swimming pools mentioned above? (***Show*** *all your work on how you derived the coarsest spatial resolution*). (5)

10. **Briefly explain** why the albedo of a thin cloud ought to be lower than that of a thick cloud. (3)

11. Sentinel data products are distributed as either top of atmosphere (ToA) or bottom of atmosphere (BoT). **/10/**

a) **What** is the difference between the two? (4)
b) **Which** of the two products would you use for change detection without a radiometric correction? (2)
c) **Motivate** your answer in 11b. (4)

12. A colleague carried out a visual image interpretation and submitted for his assignment a 'cartographically sound map' shown in Figure 1.

a) **What** is visual image interpretation? (2)

b) **Critique** the map in the context of cartographically sound principles. Your coverage should include a minimum of three (3) major issues. (6)

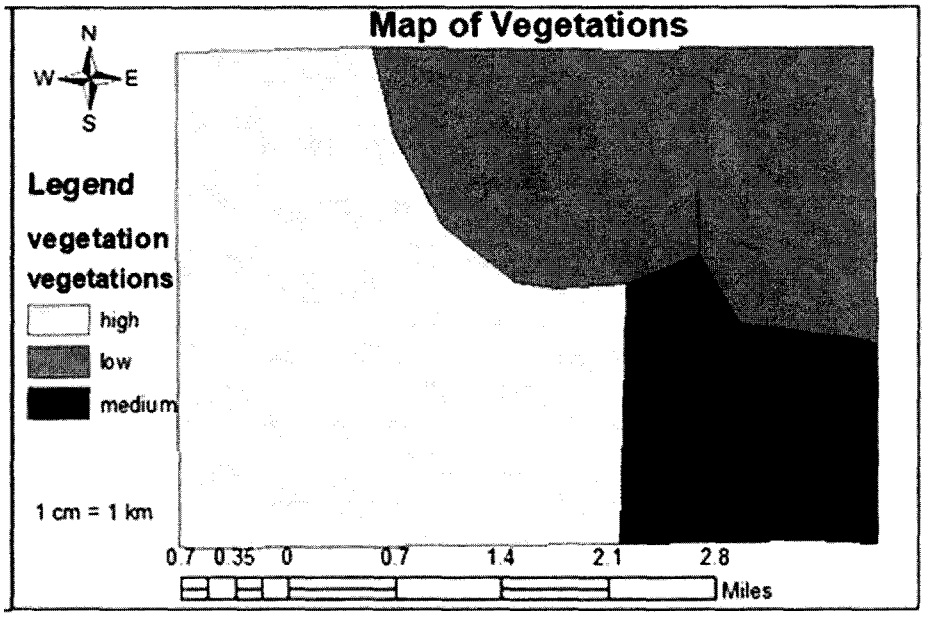

Figure 1: *Partial results of visual image interpretation from a colleague*

13. /8/

a) Using Table 1, **construct** the spectral signature for features A and B. (4)

b) On the basis of the spectral signature derived in 13a) **what** is the likely ground cover represented by the signatures of A and B? (2)

c) **Motivate** your answer for features A and B. (2)

Table 1: Reflected values for selected features captured in the Sentinel 2 image covering part of Windhoek. Image acquisition date, April 27, 2023.

FEATURE	Band Number (and Spectral Region)								
	(Blue)	(Green)	(Red)	(Red Edge)	(Red Edge)	(Red Edge)	(NIR)	(SWIR)	(SWIR)
A	221	423	254	1243	1319	940	1264	1695	1496
B	551	1240	880	1771	4555	5095	5742	2826	1617
C	1132	1854	2580	2956	3062	3174	3294	4575	4288

Section B

Answer only one question in this section. **/15/**

A. A farmer purchased from Surveyor General office a hardcopy of an aerial photograph covering her farm. She then approached you to assist her in producing terrain mapping units (TMU), and in the end present her with five maps, including vegetation density, drainage density, relief, and drainage lines. **Describe** how you will go about generating such maps in a GIS program. (15)

OR

B. With practical examples, **describe** the tradeoffs between temporal and spatial resolutions. (15)

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