NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

DEPARTMENT OF LAND AND SPATIAL SCIENCES

QUALIFICATIONS: DIPLOMA IN GEOMATICS, BACHELOR OF GEOMATICS, BACHELOR OF GEOINFORMATION TECHNOLOGY	
QUALIFICATION CODES: 06DGEO, 07BGEO, 07BGEI	**LEVEL:** Level 6 - 06DGEO Level 7 - 07BGEO, 07BGEI
COURSE CODE: RES511S	**COURSE NAME:** REMOTE SENSING 1
SESSION: JULY 2025	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

SECOND OPPORTUNITY/SUPPLEMENTARY EXAMINATION QUESTION PAPER	
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INSTRUCTIONS
1. Write your student number and programme code (e.g.07BGEI) on the answer sheet. 2. Answer ALL the questions. 3. Read each question carefully before attempting to answer. 4. Write clearly and neatly.

PERMISSIBLE MATERIALS
1. Pen 2. Pencil 3. Eraser 4. Ruler 5. Non-programming calculator

This question paper consists of seven (7) pages, including this cover page.

Question 1

Answer the multiple-choice questions listed below. Please select the ONE most relevant to the following questions. Indicate the correct answer on the answer sheet.

1.1. The altitudinal distance of a geostationary satellite from the Earth is about: (1)

A. 26 000 km
B. 30 000 km
C. 36 000 km
D. 44 000 km

1.2. Which of the following might be considered the fourth dimension in Remote Sensing? (1)

A. Time
B. Scale
C. Space
D. Location

1.3. Vegetation has a remarkably_____reflection in the near-infrared channel and a_____reflection in the visible red channel. (1)

A. Low, low
B. Low, high
C. High, high
D. High, low

1.4. Which of the following is an example of a passive remote sensing technology? (1)

A. Landsat
B. LiDAR
C. SONAR
D. RADAR

1.5. Which of the following factors affects the temporal resolution of remote sensing imagery? (1)

A. The altitude of the platform carrying the sensor
B. The orbit of the platform carrying the sensor
C. The wavelength of the radiation used
D. The type of sensor used

1.6. What allows certain wavelengths of electromagnetic radiation from space to reach Earth's surface? (1)

A. Rayleigh scattering
B. Ionospheric reflection
C. Atmospheric windows
D. Atmospheric refraction

1.7. Which concept defines a unique spectral signature? (1)

A. Atmospheric haze impacting image clarity
B. Image detail defined by spatial resolution
C. Sensor location on a platform's altitude
D. Reflected energy across various wavelengths

1.8. How does temporal resolution differ between Landsat and MODIS satellite systems? (1)

A. Landsat revisits every hour; MODIS weekly
B. Landsat revisits daily; MODIS every 16 days
C. Landsat revisits every 16 days; MODIS daily
D. Both have the same temporal resolution

1.9. Vegetation with more chlorophyll will reflect more: (1)

A. Ultraviolet energy
B. Emitted energy
C. Near-infrared
D. Thermal infrared

1.10. A remote sensing analyst interprets a deforested area's satellite images. Which of the following spectral characteristics would most likely indicate recent deforestation? (1)

A. Decreased reflectance in the blue band
B. Increased reflectance in the thermal infrared (TIR) band
C. Decreased reflectance in the mid-infrared (MIR) band
D. Increased reflectance in the near-infrared (NIR) band

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Question 2

2.1. Remote Sensing is *"any process whereby information is gathered about an object, area or phenomenon from a distance without contact with it."* Use a drawing to explain the remote sensing process and label each step graphically. (0.5 marks for each graphical step and 0.5 marks for labelling each correctly. (8)

2.2. Three different types of electromagnetic waves are described below:

- Wave X has a wavelength of 750 nm
- Wave Y has a wavelength of 0.1 mm
- Wave Z has a wavelength of 0.01 nm

Answer the following questions:

2.2.1. Identify which region of the electromagnetic spectrum each wave (X, Y, and Z) belongs to. (3)

2.2.2. Which of these waves would penetrate Earth's atmosphere most effectively? Explain why. (3)

2.2.3. Give one safety concern when working with each of these electromagnetic waves. (3)

2.2.4. Describe one (1) practical application for each type of wave. (3)

2.2.5. Justify why remote sensing is more effective than traditional ground surveys in this scenario. (3)

2.3. How is remote sensing applied in agriculture? Describe two (2) specific applications and their two (2) benefits to farmers. (6)

2.4. You are working for the Namibian Ministry of Environment and Tourism to monitor wildlife populations in Etosha National Park, where poaching of endangered rhinos has increased in recent years. The ministry is considering implementing a new monitoring system and has asked you to evaluate the advantages and limitations of drone-based remote sensing compared to traditional satellite imagery for this specific application.

Explain the advantages and limitations of using drone-based remote sensing compared to traditional satellite imagery for environmental monitoring. Provide two (2) advantages and two (2) limitations of drone-based systems. (4)

2.5. Spectral signatures can be illustrated using values indicating the brightness in several spectral regions. The table below shows the reflectance values of different land cover types across five (5) spectral bands. Assume that atmospheric effects influence these spectral signatures.

	UV	Blue	Green	Red	NIR
Forest	38	39	46	38	67
Water	22	26	20	14	7
Grass	53	60	63	65	81
Soil	40	49	32	22	71

2.5.1. Can all categories be reliably separated based on these spectral values? Justify your answer by comparing reflectance values across bands. (5)

2.5.2. Which spectral bands are most useful for distinguishing between these classes? Explain your reasoning. (6)

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Question 3

3.1. How do atmospheric conditions affect the quality of optical satellite imagery? Provide two specific atmospheric factors and their impacts. (6)

3.2. You are a GIS consultant hired by the Ministry of Agriculture, Fisheries, Water and Land Reform to update land cover maps in the northern regions. Using satellite imagery, you need to identify settlements, farms, and natural vegetation visually. List and briefly explain two (2) key elements of visual image interpretation that would help distinguish these land cover types in northern Namibia. (6)

3.3. You are working on a project that involves mapping vegetation in a semi-arid region. You are provided with two (2) datasets:

- Image A: A high-resolution aerial photograph taken with a drone at 10 cm spatial resolution.
- Image B: A medium-resolution satellite image (Sentinel-2) with a spatial resolution of 10 metres and additional spectral bands.

How do the two (2) images differ in terms of resolution and their suitability for vegetation mapping under dry and sparse vegetation conditions? Explain your reasoning. (6)

3.4. Assume an aerial photo with a scale of 1:24000 needs to be scanned in such a way that the ground resolution of the pixel will be equal to 50 cm. What would the scanning resolution be in µm (2nd decimal) and dpi (rounded number)? (10)

3.5. An area 40 km long (north-south) and 32 km wide (east-west) will be photographed using a drone equipped with a 25 cm focal length camera lens. The size of each photograph is 18 cm × 18 cm. The desired scale is 1:15000, effective at an average elevation of 500 m above the datum. To ensure sufficient image overlap for mosaic generation:

- Forward overlap is to be 65%
- Sidelap is to be 35%

The drone will maintain a ground speed of 180 km/h. The flight lines will be aligned north-south, and the outermost flight lines should coincide with the east and west boundaries of the area. Calculate the following:

3.5.1. Flying Height (2)

3.5.2. Ground distance between exposures (4)

3.5.3. Exposure interval (4)

3.5.4. Flight Line Spacing (4)

3.5.5. Number of Flight Lines (4)

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