



**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**FACULTY OF ENVIRONMENTAL SCIENCE**

**DEPARTMENT OF GEOSPATIAL SCIENCE**

**DIGITAL IMAGE PROCESSING AND ANALYSIS (EGR 1201)**

**Main Examination Paper**

**September 2024**

This Examination Paper consists of 2 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: Calculator

Internal Examiner: Mr A. Chirima

External Examiner: Dr M. Shekede

**INSTRUCTIONS**

1. Answer **QUESTION ONE** and any **THREE** others
2. Each question carries 25 marks

**MARK ALLOCATION**

<b>QUESTION</b>	<b>MARKS</b>
1.	25
2.	25
3.	25
4.	25
5.	25
6.	25
<b>TOTAL</b>	<b>100</b>

1. Data in Table 1 show red and near infrared bands from Landsat 5 image for the year 2010 for a location in Nkayi District. Using 2 D scatter diagram illustrate pixels containing the following:
- a. Water **[5 marks]**
  - b. Green wet vegetation **[5 marks]**
  - c. Soil/bare ground **[5 marks]**
  - d. Built up areas **[5 marks]**
  - e. Cultivated land **[5 marks]**

**Table 1.** Red and near infrared band data extracted from a Landsat 5 satellite image.

17	18	26	60	48	50	55	Red Band
17	23	28	30	36	38	45	
25	26	15	30	29	35	44	
40	44	14	65	77	144	150	
95	97	78	66	155	145	155	
75	90	77	70	159	150	158	
77	78	76	75	158	160	170	
36	40	45	110	149	150	160	Near Infrared band
33	30	43	115	135	185	140	
21	20	28	98	99	100	130	
28	27	28	155	145	158	160	
94	97	150	140	170	155	170	
75	90	145	141	180	170	180	
75	76	144	143	190	190	200	

2. Using the data in Table 1:
- a. Calculate NDVI and EVI for all the pixels producing two images.
    - i. Image 1 for NDVI **[7 marks]**
    - ii. Image 2 for EVI. **[8 marks]**
  - b. From the NDVI image highlight the following
    - i. Water **[2 marks]**
    - ii. Green wet vegetation **[2 marks]**

- iii. Soil/bare ground [2 marks]
  - iv. Built up areas [2 marks]
  - v. Cultivated land [2 marks]
3. Explain 5 preprocessing operations that need to be carried out before carrying out image analysis.
4. Explain how the following terms are used to assess the accuracy of a land cover map produced through image analysis.
- a. Overall accuracy [4 marks]
  - b. Producer accuracy [7 marks]
  - c. User accuracy [7 marks]
  - d. Kappa statistic [7 marks]
5. Explain the following image properties
- a. Spatial resolution [5 marks]
  - b. Spectral resolution [5 marks]
  - c. Radiometric resolution [5 marks]
  - d. Temporal resolution [5 marks]
  - e. IFOV [5 marks]
6. Give a detailed account of the process carrying out a supervised land use land cover map for a named District in Zimbabwe using Landsat image, highlighting all the stages required to complete the task.