



**MASINDE MULIRO UNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)**

**MAIN CAMPUS**

**UNIVERSITY EXAMINATIONS  
2023/2024 ACADEMIC YEAR**

**FIRST YEAR FIRST SEMESTER EXAMINATIONS  
FOR THE DEGREE  
OF  
MASTER OF ARTS IN GEOGRAPHY**

**COURSE CODE: GEO 814**

**COURSE TITLE: ADVANCED DIGITAL IMAGE PROCESSING**

**DATE: Wednesday 6<sup>th</sup> December, 2023**

**TIME: 2:00-5:00pm**

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**INSTRUCTIONS TO CANDIDATES**

Answer **ONE** and any other **THREE** Questions

TIME: 3 Hours

MMUST observes **ZERO** tolerance to examination cheating

This Paper Consists of 2 Printed Pages. Please Turn Over.

### Question ONE

In digital images errors occurs at both spatial and spectral levels. With relevant examples describe error types, causes and possible remedies applied for each. (15mks)

### Question TWO

You are in a project team tasked to prepare landuse/landcover map of Kakamega forest.

The available datasets are:

- i) Landsat5 MSS sensor data acquired during the month of April, 1986, bands are B4, B5, and B6 which measures 185km by 185km in gray scale.
- ii) Rivers and Roads shapefiles covering the whole country from Kenya data shapefile.

Explain the step-by-step image preprocessing procedures you will undertake to realize the required map. (15mks)

### Question THREE

Using the table below that shows a four band hypothetical image data answer the following questions:

- i. The image data contains errors identify the bands with the errors (2mks)
- ii. Explain how that error will be corrected (2mks)
- iii. Explain how the image data will be stored in three formats;
  - a) Band sequential format (BSQ) (3mks)
  - b) Band interleaved by line format (BIL) (4mks)
  - c) Band interleaved by pixel format (BIP) (4mks)

Table 1: Hypothetical image data

<i>Band 1</i>				<i>Band 2</i>				<i>Band 3</i>				<i>Band 4</i>			
1	4	5	6	2	5	8	9	105	79	103	114	20	25	31	26
3	4	4	5	10	3	2	1	114	100	124	134	29	19	29	50
2	3	9	10	9	8	7	6	130	125	109	150	25	30	33	50

### Question FOUR

Account for image pre-processing techniques that would be performed on a Land sat ETM+ image acquired on 23/4/2006 covering western Kenya to be used together with the following shape files; roads, county boundaries and rivers to produce a land use/cover map of the region.

(15mks)

### Question FIVE

Using tables 1 and 2 below that show image data structure for Landsat ETM+ Sensor data and filter kernel, answer the following questions;

8	8	6	6	6
2	8	6	6	6
2	2	8	6	6
2	2	2	8	6
2	2	2	2	8

Table2: Image data structure

-1	-1	-1
-1	16	-1
-1	-1	-1

Table 3: Filter Kernel

- i) Identify the error type in the image structure and filter kernel type. (2mks)
- ii) The filter kernel was applied on the image data structure to enhance land cover boundary edges. Explain the procedure and draw the resultant image structure. (10mks)
- iii) Explain the effect of applying the filter kernel on the image structure. (3mks)

### Question SIX

- (a) Describe the contrast manipulation techniques used in image enhancements. (7mks)
- (b) Explain any Four environmental applications of digital image processing. (8mks)

