



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

MAIN CAMPUS

**UNIVERSITY EXAMINATIONS
2023/2024 ACADEMIC YEAR**

THIRD YEAR FIRST SEMESTER EXAMINATIONS

MAIN EXAMINATION

**FOR THE DEGREE
OF
BACHELOR OF SCIENCE IN DISASTER PREPAREDNESS AND
ENVIRONMENTAL TECHNOLOGY**

COURSE CODE: DPG 306

COURSE TITLE: DIGITAL IMAGE ANALYSIS-I

DATE: 13/12/2023

TIME: 12-2PM

INSTRUCTIONS TO CANDIDATES

This paper contains **FOUR (4)** questions

Question **one (1)** is compulsory {total = 30 Marks}

Attempt **any other two (2)** {total = 40 Marks} from the remaining questions

Be brief and to the point

TIME: 2 Hours

MMUST observes **ZERO** tolerance to examination cheating

This Paper Consists of 3 Printed Pages. Please Turn Over →

SECTION I: COMPULSORY (30 MARKS)

Question One

- a) Explain **three** resampling methods used in digital image processing **(9 marks)**
- b) Perform histogram equalization on a 3-bits image of size 64x64 pixels. The intensity distribution of the image is given in **Table 1** below.

Table 1

Gray level	0	1	2	3	4	5	6	7
No. of Pixels (nk)	790	1023	250	656	329	245	122	81

(10 marks)

- c) From the information given in the confusion matrix **Table 2** below, calculate the following:
 - i. Producer's accuracy **(3 marks)**
 - ii. User's accuracy **(3 marks)**
 - iii. Overall accuracy **(3 marks)**
 - iv. Kappa coefficient **(2 marks)**

Table 2

		Ground Truth Classes				
		A	B	C	D	Total
Map Classes	A	325	32	8	87	452
	B	5	765	34	24	828
	C	0	98	87	45	230
	D	4	5	3	345	357
Total		334	900	132	501	1867

SECTION II: ATTEMPT ANY OTHER TWO (2) QUESTIONS (40 MARKS)

Question Two

The radiance emanating from a pixel in the absence of any noise is 196 units. Compute the theoretical (recorded) radiance for the pixel given that:

- The sky irradiance from the neighboring pixels and the atmosphere is 6 units and 10 units respectively.
- Sky and path radiance are 14 and 2 units respectively.
- Atmospheric transmittance is 0.89
- The sun is at a distance of 1 astronomical unit and declination of 16.7°
- (Assume Landsat image whose angle is 98.2°). Use illustrations where necessary.

(20 marks)

Question Three

- a) Using a flow diagram, explain the procedure of geometric correction process (10 marks)
- b) Describe how the change in platform velocity and roll introduces errors in satellite image (10 marks)

Question Four

- a) Explain the steps involved in the following image classification algorithms (10 marks)
- Supervised classification
 - Unsupervised classification
- b) The image below is the output of an image contrast enhancement, derive a possible original image. Assuming the maximum and minimum digital numbers of original image is 100 and 19 respectively.

50	0	160	222
82	32	80	35
61	255	82	122
60	35	82	122

(10 marks)

