UNIVERSITY of RWANDA

COLLEGE OF SCIENCE AND TECHNOLOGY
SCHOOL OF ENGINEERING
DEPARTMENT OF
CIVIL, ENVIRONMENTAL AND GEOMATIC ENGINEERING

END OF SEMESTER IEXAMINATION -ACADEMIC YEAR 2024-2025

YEAR: 2 **SEMESTER: II** **PROGRAMME(S): SGE**

MODULE: SGE2266 REMOTE SENSING II

DATE: 10/06/2025

TIME: 2hours

MAXIMUM MARKS = 50

INSTRUCTIONS

1. This paper contains **FOUR (4)** questions.
2. **Answer THREE (3) Questions only:**
   Question ONE (1) from Section "A" is Compulsory and Answer any TWO (2) from Section "B"
3. Any written materials and Programmable calculators are NOT allowed.
4. Do not forget to write your Registration Number.
5. Write all your answers in the booklet provided
6. Do not write any answers on this questions paper.
7. **Start each question in a NEW page**

SECTION: A

Question: 1 **[20]**

a) Which order of Polynomial equation is needed to have fifty-five ground control points in image transformation process? **[2]**

b) In the subtractive color model (CMY), What happen when all primary colors (cyan, magenta, and yellow) are combined at full intensity? **[2]**

c) When upsampling or downsampling an image, explain how does the choice of resampling technique influence the output, and what is a good practice? **[3]**

d) Tobler's first law of states that "everything is related to everything else, but near things are more related than distant." Look at the following portion of Landsat satellite image, and based on the Tobler's law and the distribution of Digital numbers' values, answer the following questions.

78	80	92	85	82	90	91	88	86	79
77	92	100	87	85	89	89	87	80	78
81	102	100	90	91	100	95	90	88	80
100	105	101	95	96	103	97	93	90	85
0	0	0	0	0	0	0	0	0	0
102	104	100	98	95	102	100	95	91	87
100	103	255	96	93	100	101	96	89	88
100	100	98	98	94	102	103	98	90	89

i. What are the two main errors are you finding in this image? **[2]**

ii. Are these errors systematic or random? **[2]**

iii. Explain briefly the cause of these errors. **[2]**

iv. Explain briefly effects of these errors. **[2]**

v. Explain the correction methods for these errors. **[2]**

vi. Apply these correction methods and print the corrected output image. **[3]**

SECTION: B

Question: 2 **[15]**

The following 5x5 input images of Landsat satellite represent the two neighboring area, but were taken under different solar illuminations (winter and summer) with the solar elevation angle of 60 degrees.

Input image A

100	103	98	88	76
97	98	100	101	82
99	100	105	107	89
102	98	100	104	95
97	98	99	100	98

Input image B

105	110	100	90	82
100	102	108	110	92
106	109	112	120	98
118	110	118	115	106
111	113	115	120	118

a) Which correction do you need before performing mosaicking of these images? **[2]**

b) If these images are 8 bits, which one of them has high radiometric resolution, and why? **[5]**

c) Apply the appropriate formula and print the corrected output images A' and B' from input A and B respectively. **[8]**

Question: 3 **[15]**

a) Explain the potential effects of inappropriate resampling on remote sensing analysis? **[4]**

b) Explain what is the Tristimulus model, and how is it related to remote sensing? **[4]**

c) Explain what is the Normalized Differential Vegetation Index (DVI), and which spectral bands does it use? **[4]**

d) Explain Which resampling technique is most appropriate for categorical data, such as land use/land cover maps, and why? **[3]**

Question one: **Encircle the correct answer from the bracket**

a) A linear contrast stretch (correctly, evenly, uniformly, equally) expands small range of DN to cover the full range of values from 0 to 255. **[2]**

b) Filter operations are (global, regional, local) image transformations **[2]**

c) Filter operations are usually carried out on (Single pixel, a single image, multispectral image, single band, neighboring pixels) **[2]**

d) Band combination for the standard false Color composite for landsat-8 is {(4, 3, 2); (7, 5, 3); (5, 4, 3); (3, 2, 1)} **[2]**

e) The band combination which provides a "natural color" for Landsat-8 is {(4, 5, 1); (5, 6, 2); (4,3,2); (4, 5, 3); (7, 6, 4)} **[2]**

Question two:

a) Explain the following terms as are used in image analysis:

i. Image space **[3]**

Image space : Is the spatial arrangements which defines of measurements which defines an Image. an digital Image is 2D array element and for each element energy reflected or emitted corresponds as a component on earth surface is store

ii. Feature space **[2]**

feature space Is the graph that present feature vector. feature vector is formed when there is one pixel which has values for two bands serves as a Composition of 2 dimensional vector.

b) What are the main image classification processes **[5]**

- Preparation and selection of Image data
- Definition of cluster in feature space.
- selection of classification of algorithm
- Running of actual classification
- Validation of the result.

$$\frac{\sum f(x-\bar{x})^2}{\sum f-1}$$

Question three:

a) What is the reason for not using all available bands during image classification? [2]

the reason for not using all available bands during Image classifica is because there can be a problem of band calle correlation, for u We use landsat TM which have 7 bands this can destroy the softw since it also has limited bands. Band correlation is caused by Similar spectral reflectance for two bands.

b) Explain the effects of spectral overlap of clusters during image classification [2]

Effects of spectral overlap of clusters during Image classification is that when there is overlap be of clusters the discrimination of pixels / classes of clusters during Image classification is impossibl Hence the solution to this problem is to add another spectral band or using Image acquired at another moment.

c) Explain the main difference between supervised classification and unsupervised classification [2]

During Supervised classification operator does the training process by defining the clusters and then select classifier algorithm depending on his/her objects then Run the supervised classification for Unsupervised Classification the operator provides only the number of maximum clu he/she wants, then computer use mean of centroid of clusters to assign classes to other Unknown pixels which are in least distance.

d) Explain the main advantages of The Maximum Likelihood (ML) classifier Algorithm over The box classifier, and the Minimum Distance to Mean (MDM) classifier [3]

Maximum likelihood classifier Algorithm takes the variability of classes into account where as Minimum Distance to Mean classifier doesn't tak the variability of classes into account.

Maximum likelihood classifier algorithm consider not only the distanc but also size, shape and orientation where box classifier about it' box shape some of them overlap and the computer assign values to the box it saw first.

Maximum likelihood classifier algorithm to determine the distance where t assign the unknown pixel by using statistical mean distance calculated by mean and covariance matrix whereas for MDm even computer can assign classes to unknown pixels even to those which are long distance and for box classifier lower and upper limit for each class are defined by using mean and standard deviation.