



PAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF NATURAL RESOURCES AND SPATIAL SCIENCES

DEPARTMENT OF GEO-SPATIAL SCIENCES AND TECHNOLOGY

QUALIFICATION: BACHELOR OF GEOINFORMATION TECHNOLOGY DIPLOMA IN GEOMATICS BACHELOR OF GEOMATICS	
QUALIFICATION CODE: 07GITB 06DGEM 07BGEM	LEVEL: 5
COURSE CODE: RES511S	COURSE NAME: REMOTE SENSING 1
SESSION: JUNE 2019	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER(S)	Ms Celesté Espach
MODERATOR:	Dr Nicky Knox

INSTRUCTIONS
<ol style="list-style-type: none">1. Answer ALL the questions.2. Write clearly and neatly.3. Number the answers clearly.4. Submit page 8 with your examination script.

PERMISSIBLE MATERIALS

1. Calculator
2. Pen, pencil, ruler, eraser

THIS QUESTION PAPER CONSISTS OF 8 PAGES (Including this front page)

Question 1

Word search is a gridded word puzzle that contains letters of words as answers to given clues. In the grid these words (answers) may be horizontal, vertical or diagonal. There are two parts to this question, read each instruction carefully.

1.1 **INSTRUCTION:** Read the questions and/or clues given below, find and encircle the correct answer in the grid provided to you at the back of the question paper. *(example given below)*

PLATFORM

- a) Referring to a specific part of the electromagnetic spectrum? (1)
- b) The NIR and mid IR ranges are called Infrared? (1)
- c) The oldest earth observation programme. (1)
- d) Each type of surface material has a specific spectral to distinguish it from others. (1)
- e) What are the photosensitive detectors called that pushbroom scanners use instead of a scanning mirror? (1)

1.2 **INSTRUCTION:** Find a maximum of 10 other words related to remote sensing, and draw a line through them. Each correct word will count 0.5 marks. *(example given below)*

(5)

SENSOR

I	C	W	A	V	E	L	E	N	G	T	H	G	M
D	D	C	E	X	R	A	Y	P	T	R	T	E	R
E	P	E	D	N	R	E	I	R	R	A	C	L	E
R	C	A	V	R	A	D	A	R	G	S	R	A	F
U	C	T	S	I	O	C	E	E	C	T	A	N	L
T	C	I	R	T	C	E	L	E	R	E	L	D	E
A	G	L	C	O	A	E	G	A	I	R	U	S	C
N	R	R	M	D	C	S	O	N	A	R	C	A	T
G	H	I	S	T	O	G	R	A	M	O	E	T	E
I	I	M	A	G	I	N	G	I	R	A	P	A	D
S	A	L	O	N	G	T	R	A	C	K	S	L	A
R	L	E	A	H	S	F	P	H	O	T	O	N	S
C	I	D	I	F	F	U	S	E	I	R	D	N	V
C	W	I	S	F	R	A	S	C	E	E	A	A	S

[10]

Question 2

Negative marking will be applied to multiple choice questions. Please take the following into account when answering the multiple choice questions:

- If you select 1 correctly you get 2 marks
- If you select 1 incorrectly you get -2
- If you don't provide the calculation you get -1
- If you select the correct answer for the calculation question, but your calculation is wrong, you get 0
- If you select the correct answer for the calculation question, and your calculation is correct, you get 2

2.1 Which **one** of the following statements regarding the physics of remote sensing is correct? (2)

- a) Involves the interaction of electromagnetic radiation with the target
- b) Involves the emission of electromagnetic radiation from the target
- c) Both (a) and (b)
- d) Neither (a) nor (b)

2.2 Remote sensing techniques make use of the properties of _____ emitted or reflected by the sensed objects: (2)

- a) Electric waves
- b) Sound waves
- c) Electromagnetic waves
- d) Wind waves

2.3 Leaf reflectance depends primarily on: (2)

- a) Pigments
- b) Internal cell structure
- c) Water content
- d) All of these

2.4 What is the maximum value of the digital number which could be represented for an image with a radiometric resolution of 8 bits? Provide the calculation for 1 mark. (2)

- a) 256

- b) 255
- c) 63
- d) 64

2.5 How many megabytes of computer disk space would be required to store an 8-bit Landsat Thematic Mapper image (7 bands, 7 200 x 6 700 pixels)? Provide the calculation for 1 mark. (2)

- a) 322 megabytes
- b) 230 megabytes
- c) 368 megabytes
- d) 46 megabytes

[10]

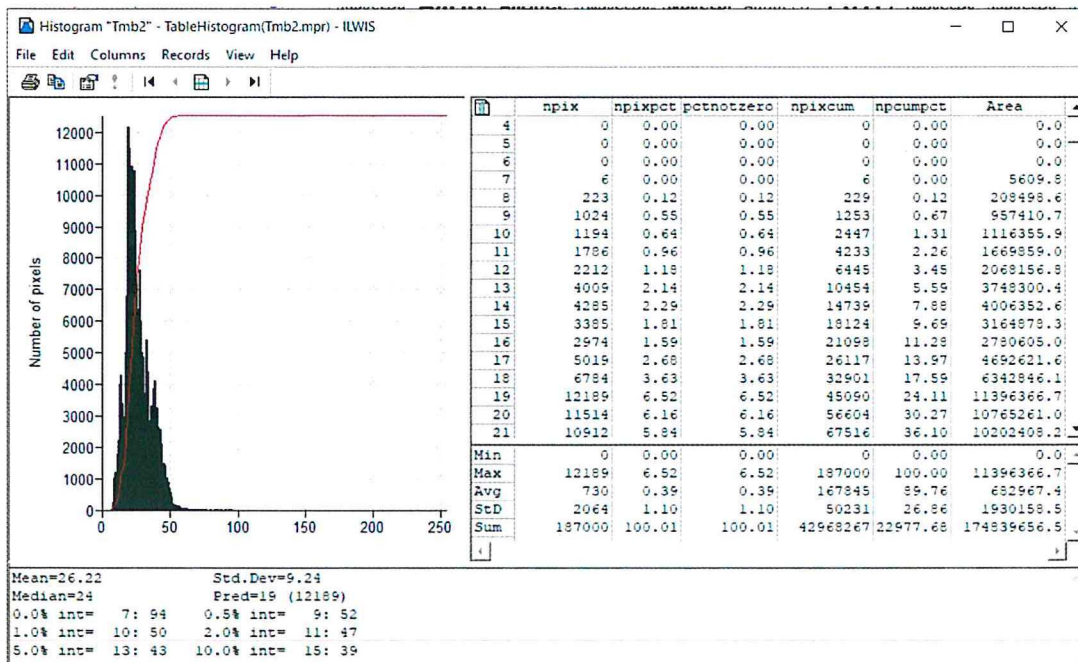
Question 3

3.1 In the catalog window of ILWIS, there are various objects related to a specific dataset. All these objects can be divided into two groups. Name and briefly explain each object group, providing an example of each. (4)

3.2 The key to understanding contrast enhancement is to understand the concept of an image histogram. Based on this statement, answer the questions below.

- a) Briefly define an image histogram. (2)
- b) By manipulating the range of digital values in an image through various enhancement methods, one can enhance the contrast and detail. Name and briefly explain the two most commonly applied methods that were covered in class. (8)

- c) Below is a screenshot of the histogram of Landsat TM band 2. Use the information in the histogram to complete the table where you need to find the corresponding DN value for specific cumulative percentages. Redraw the table in your answer book. (3)
- (Each correct DN value counts 0.5 marks)**



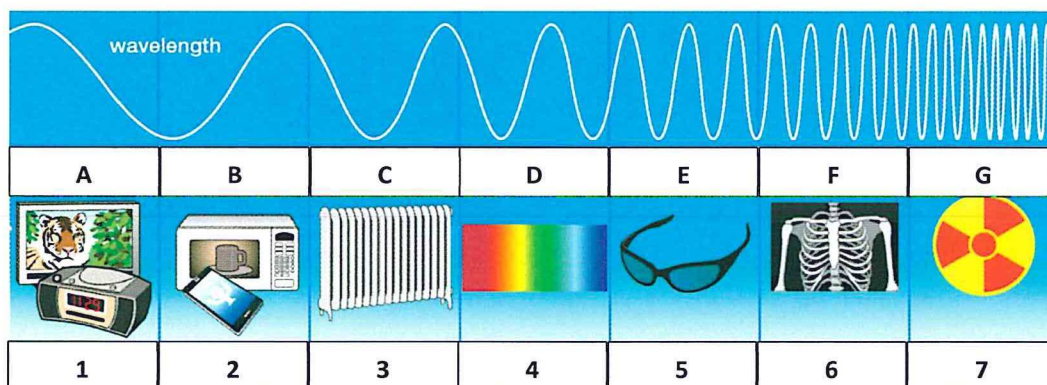
Cumulative Percentage	0	0.5	1	5	10	25
DN values						

[17]

Question 4

- 4.1 What is the relationship between pixel size and spatial resolution, and why is it important for a researcher to know the pixel size and resolution before data gathering and analysis can start? (3)
- 4.2 Differentiate between active and passive remote sensing sensors. (3)
- 4.3 Why is it that the best atmospheric conditions for remote sensing in the visible part of the electromagnetic spectrum are around noon, on a sunny, dry day with no clouds and no pollution? (4)

- 4.4 Spatial resolution gives an indication of the level of detail on an image. All remote sensing sensors can basically be grouped into three groups based on their spatial resolution. Indicate the three groups, with two sensors for each group and the respective spatial resolutions of the sensors which you select as examples. (9)
- 4.5 Explain the effects of surface roughness on the reflectance scattering of electromagnetic energy. (7)
- 4.6 Briefly explain the three forms of interaction that can take place when energy strikes the earth's surface. (3)
- 4.7 Below is a schematic of the types of electromagnetic radiation, as well as what it can be used for. Answer the following questions based on this schematic.



- a) Indicate which part of the electromagnetic spectrum is represented by the letters A through to G. **(Each correct answer will count 0.5 marks)** (3.5)
- b) Indicate what each electromagnetic radiation type can be used for as represented by the numbers 1 to 7. **(Each correct answer will count 0.5 marks)** (3.5)

[36]

Question 5

5.1 You are requested by the Ministry of Agriculture, Water and Forestry to assist in determining the best site for irrigation farming for local crop production in the vicinity of Rundu. Part of your terms of reference is to do a time-series analysis between 2000 and 2018 to determine the town expansion along the Okavango river. You have two (2) panchromatic analogue and

three (3) colour digital aerial photographs of that area.

a) Through scanning, you need to convert the analogue aerial photographs to digital format as to facilitate the analysis process. These photographs were taken at a scale of 1:5 000, which resulted in having a standard photo size of 23 cm. You need to scan the photographs in such a way that the final ground resolution is 15 cm. What will the scanning resolution be in μm (2nd decimal) and dpi (rounded number)? (9)

b) Determine the total size of your scanned, as well as digital aerial photographs in megabytes, as to give these to the Ministry to include in their report. Your digital aerial photographs has a row and column size of 2 516 and 3 500 respectively. Show all your calculation, and round off your answers at each level of calculation to a rounded number. (12)

5.2 Determine the number of rows and columns of a band from Landsat 7 ETM with only the following information available: its spatial resolution is 30 m, the swath width is 183 km, and the rows are 15 % less than the number of columns. Show all your calculations.

(6)

[27]

APPENDIX TO QUESTION 1**Student Number:****Remove from Question Paper and hand in with your examination script**

I	C	W	A	V	E	L	E	N	G	T	H	G	M
D	D	C	E	X	R	A	Y	P	T	R	T	E	R
E	P	E	D	N	R	E	I	R	R	A	C	L	E
R	C	A	V	R	A	D	A	R	G	S	R	A	F
U	C	T	S	I	O	C	E	E	C	T	A	N	L
T	C	I	R	T	C	E	L	E	R	E	L	D	E
A	G	L	C	O	A	E	G	A	I	R	U	S	C
N	R	R	M	D	C	S	O	N	A	R	C	A	T
G	H	I	S	T	O	G	R	A	M	O	E	T	E
I	I	M	A	G	I	N	G	I	R	A	P	A	D
S	A	L	O	N	G	T	R	A	C	K	S	L	A
R	L	E	A	H	S	F	P	H	O	T	O	N	S
C	I	D	I	F	F	U	S	E	I	R	D	N	V
C	W	I	S	F	R	A	S	C	E	E	A	A	S