



**NAMIBIA UNIVERSITY  
OF SCIENCE AND TECHNOLOGY**

**FACULTY OF NATURAL RESOURCES AND SPATIAL SCIENCES**

**DEPARTMENT OF GEO-SPATIAL SCIENCES AND TECHNOLOGY**

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

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| <b>SUPPLEMENTARY/SECOND OPPORTUNITY EXAMINATION QUESTION PAPER</b> |                   |
| <b>EXAMINER(S)</b>   | Ms Celesté Espach |
| <b>MODERATOR:</b>  | Dr Nicky Knox     |

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| <b>INSTRUCTIONS</b>  |
| <ol style="list-style-type: none"><li>1. Answer ALL the questions.</li><li>2. Write clearly and neatly.</li><li>3. Number the answers clearly.</li></ol> |

**PERMISSIBLE MATERIALS**

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

**THIS QUESTION PAPER CONSISTS OF 4 PAGES** (Including this front page)

**Question 1**

Provide a term for the following descriptions and / or definitions:

- 1.1 Collection of data on features and phenomena on land with remote sensing (1)
- 1.2 A form of energy transfer that does not require an intervening material medium. (1)
- 1.3 Photons that are generated from nuclear decay or other nuclear processes. (1)
- 1.4 A system that allows identifying the range, altitude, direction, or speed of both moving and fixed objects. (1)
- 1.5 The nature of the reflected component of a specific material over a range of wavelengths. (1)
- 1.6 Possibility of a sensor to be directed to different directions and therefore different areas on Earth (1)
- 1.7 Sensor that measures radiation information about a target in one dimension or direction. (1)
- 1.8 Type of imaging sensors that are able to measure radiation in broad sections / bands of the electromagnetic spectrum, where the data is simultaneously collected for different regions within the EM spectrum. (1)
- 1.9 A type of camera lens that has a short focal length and captures more of the landscape. (1)
- 1.10 A process that aims to remove geometric distortions in an image and link it to real world coordinates. (1)

**[10]**

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**Question 2**

- 2.1 By definition, Remote Sensing is *“any process whereby information is gathered about an object, area or phenomena from a distance without being in contact with it.”* Make use of a drawing to graphically explain the remote sensing process, and label each step of this process. **(0.5 marks for each graphical step, and 0.5 marks for labelling each** (8)

**step correctly)**

- 2.2 Before radiation reaches the earth's surface, it has to travel some distance through the atmosphere where it comes into contact with particles and gases. Briefly name, and discuss, the main interactions that can occur in the atmosphere between the incoming radiation and particles and / or gases. (10)
- 2.3 There are passive sensors that make use of the sun as an energy source, and then there are passive sensors that make use of alternative energy sources. Which passive sensors make use of alternative energy sources; name them and briefly discuss what each records. (10)
- 2.4 Differentiate between Active and Passive sensors; and give two examples of each type of sensor. (5)

**[33]**

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**Question 3**

- 3.1 Aerial photographs can be divided into several groups depending on their a) type, b) colour, and c) format characteristics. Discuss each of the characteristics briefly. (24)
- 3.2 In your own words, how would you explain to someone what the correct meaning of the electromagnetic spectrum is? (4)

**[28]**

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**Question 4**

- 4.1 A digital raster image is characterized by its spatial resolution, digital size, radiometric resolution and colour. Answer the following questions based on this.
- a) You have received a colour composite satellite image from an unknown source. You need to determine the spatial resolution of this image, but the only information you have available is that it has a swath width of 190 km and the number of columns are 6 350. (3)

- b) Determine the size of the above 8-bit raster image, if you know that the number of rows are 20 % less the number of columns. Show all your calculations, with your final answer at kb and Mb being rounded to a full number. (7)
- c) The radiometric resolution of an image determines the grey tone values that are displayed in the histogram of a specific image. Comparing your Landsat 5 image (8 bit) to an SPOT 7 image (12 bit), what will be the grey tone value range displayed in the respective histograms. Show all your calculations. (4)
- 4.2 A tender has gone out to remove all illegal shacks around Windhoek, and your services as remote sensing technician is required to identify all these shacks. You need to produce various 1:5 000 maps of specific areas on the outskirts of Windhoek. You have at your disposal an aerial photograph that was taken in 2018 by a camera with a focal length of 210 mm at a scale of 1:15 000. Determine at what height the plane flew, in both meter and feet. Show all your calculations, making sure that the final answers are rounded to a full number. (6)
- 4.3 You've determined that the scanning resolution of aerial photos from 2005 should be 360 dpi, but have discovered that the scanner only scans in  $\mu\text{m}$ . Convert the 360 dpi to  $\mu\text{m}$ . Show all the necessary conversions and calculations. Your final answer should be rounded to a full number. (4)

[24]

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### Question 5

A strong fire destroyed most of the natural vegetation and crops along a road in the Zambezi region. The affected area is about 200 km long and 2 km wide. The local authority wants to determine the degree of destruction in order to provide assistance to the community. The best data to use would be aerial photographs. Which three parameters should they take into consideration to design a proper flight plan before flying the area? Name these parameters (0.5 marks each), with a brief explanation what each entails (**0.5 marks for each fact**). (5)

[5]