



PAMPIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF ENGINEERING AND SPATIAL SCIENCES

DEPARTMENT OF ARCHITECTURE & SPATIAL SCIENCES

QUALIFICATION(S): Bachelor of Geoinformation Technology; Diploma in Geomatics; Bachelor of Geomatics	
QUALIFICATION CODE (S): 07BGEI; 06DGEM; 06DGEO; 07BGEO	LEVEL: 5
COURSE CODE: RES511S	COURSE NAME: REMOTE SENSING 1
SESSION: JULY 2022	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100

SECOND OPPORTUNITY/SUPPLEMENTARY EXAMINATION QUESTION PAPER	
EXAMINER:	Dr Nichola Knox
MODERATOR:	Ms Celeste Espach

INSTRUCTIONS
<ol style="list-style-type: none">6. Answer ALL the questions.7. Write clearly and neatly.8. Number the answers clearly.9. All calculations, unless otherwise specified, must be rounded off to the 3rd decimal.10. For all calculations ensure that the formula's used are also provided in your answer.

PERMISSIBLE MATERIALS

3. All course material and written notes (Open-book examination)
4. Calculator, basic stationery

THIS QUESTION PAPER CONSISTS OF _5_ PAGES (Including this front page)

Question 1 – Short answer questions

1.1 Answer the following questions about satellite orbits:

- a. What are the names and heights above the earth's surface of the three orbital height regions that satellites can orbit in? (3)
- b. What are the primary satellite types that orbit at these different orbital heights? Provide an example of one satellite platform that is currently operating in each of these different orbital heights. (6)
- c. In which level/s of the atmosphere do each of these orbital heights occur? (3)

1.2 Match the correct type of scattering to the description of how scattering occurs: (3)

Scattering description	Types of scattering
1. Particles are smaller than the incoming radiation wavelength	A. Non-selective
2. Particles are about the same size as the incoming radiation wavelength	B. Mie
3. Particles are larger than the incoming radiation wavelength	C. Specular D. Diffuse E. Raleigh

1.3 Select which option shows **in the correct order** correct examples associated with these three application types of remote sensing: Terrestrial, Marine, and Atmospheric (1)

- a. Vegetation type detection, Weather forecasting, Sea Surface Temperature
- b. Oil spill monitoring, cloud movement analysis, Chlorophyll a
- c. Mineral mapping, current studies, rainfall monitoring
- d. SST, LST, hurricane path modelling

[16]

Question 2 – Understanding & Interpretation

2.1 For this question, you will be required to use the two images (at the end of this script) and

the information provided below to answer your questions. The colour composite images provided were generated from a spectral and spatial subset of a Sentinel 2 image. The image subset had 4 bands, and width of 490 columns and a height of 629 rows. The original file name from this image was: "S2A_MSIL2A_20200415T081601_N0214_R121_T34KFE"

- a. Using Sentinel 2 as an example, explain in your own words what you understand about the term a remote sensing platform and a remote sensing sensor? (3)
- b. Specifically which platform were these images acquired from? How did you determine this? (2)
- c. What was the time and date when this image was acquired? How did you determine this? (2)
- d. All four bands in the spectral subset are the same spatial resolution and different combinations of bands were used to generate the different colour composite images. Based on the 2 colour composite images provided below, which Sentinel 2 bands do you believe are included in the image subset? Explain your answer. (4)
- e. Based on your above answer (2.1d), indicate what you believe the spatial resolution in meters would be (no resampling is done on the original spectral bands) of these bands? Explain how you arrived at this answer. (2)
- f. Based on the answer you provided in the above answer (2.1e), calculate the image footprint size (i.e. the length, width and area on the ground) that this image spatial subset covered. Show how you calculated this, and express your answer in km/km². (5)
- g. Using the colour composites provided, at the end of the script, explain what is an image colour composite. Identify what type of colour composites are provided, and explain (in the order of the RGB channels for creating displays) the order (i.e. which band is applied to the red channel, etc) in which the spectral bands were applied to generate these different colour composites. (6)
- h. In the Composite 2 image, provided at the end of this script, there are 5 terrestrial features that have been pointed out (A-E). Identify what these features are, and explain (10)

what specific image components you use to assist you in visually interpreting each of them.

- i. You download an image over this same area, once a month for 12 months in order to determine at what times of the year cropping is taking place. Provide a basic outline on what important processing steps will need to be done to these 12 images, and briefly elaborate why you think these steps are necessary. (10)

[44]

Question 3 – Calculations

- 3.1 Which has higher energy 420nm or 640THz? Show all your calculations (including formulas and units) and explain your final answer. (8)

3.2 You work at a company that flies and produces aerial photos. You have been requested to fly a campaign to produce analogue aerial photos (standard size) at a scale of 1:15 000. You will make use of a standard camera lens which has a focal length of 152 mm. Considering this request answer the following questions and show all your calculations:

- a. What is the height that you will have to fly at in order to produce this aerial photo? Provide your answer in ft. (4)
- b. What area will be covered by a single photo? Provide your answer in km². (3)
- c. How many photos will be required to fly an area that is 30 km long, and 6 km wide? In your calculations, presume that you are not flying with any photo overlap, and thus one photo can be immediately be placed directly alongside the next. (5)

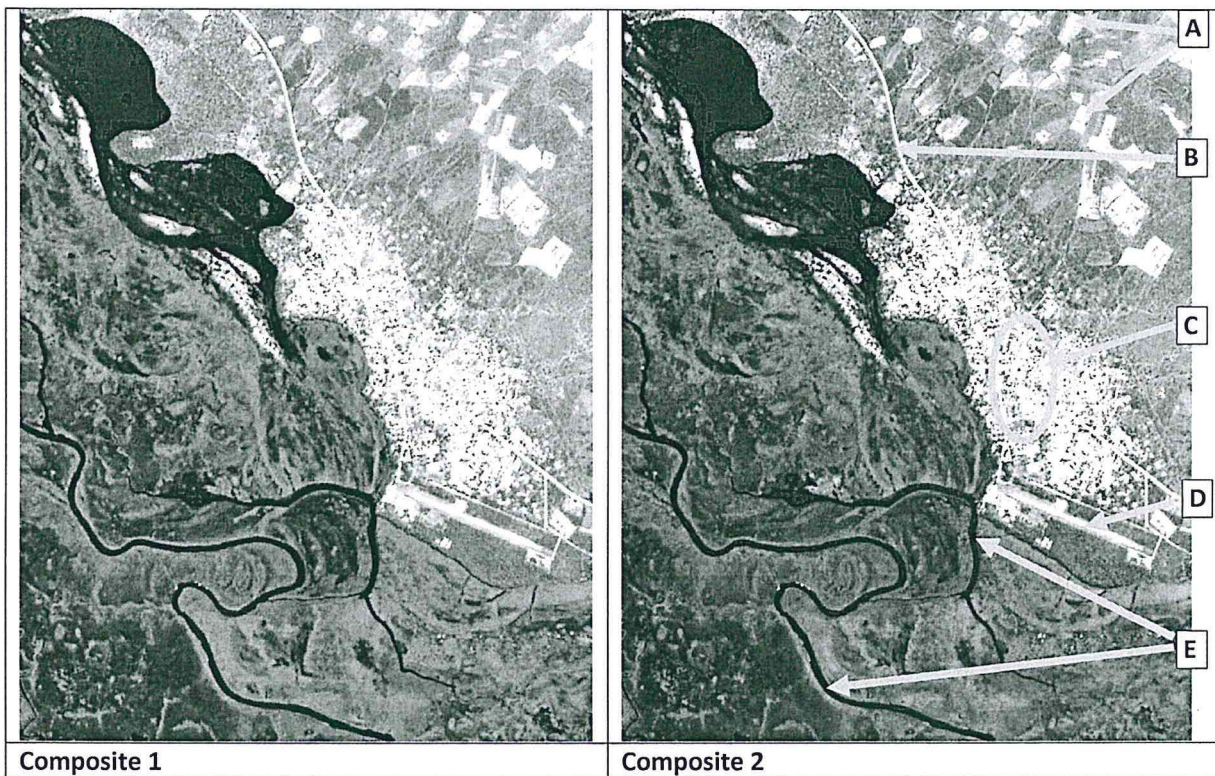
3.3 You wish to digitally compare an analogue aerial photo taken of Luderitz (**Latitude:** -26° 38' 53.02"S; **Longitude:** 15° 09' 33.98" E) in 1996 (1:35 000), and compare it with the digital aerial photo taken in 2018, to determine how much growth has occurred in the town. Considering this objective, answer the following questions and show all your calculations used to derive your answers:

- a. What is the aerial photo “address” you will need to obtain these photos when you go to the MLR? Provide a degree square diagram to explain how you arrived at your final address. (5)

- b. What is the scanning resolution (in μm and dpi) that will be required to scan in the 1996 image to have the same spatial resolution as the 2018 image which has a ground resolution of 40 cm? Show all your calculations (10)

- c. The scanner can only scan in at a 12-bit resolution. Calculate what the file size of the scanned image will be, and present the results in kb and Mb. (5)

[40]



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[40]

