



UNIVERSITY OF SWAZILAND
FINAL EXAMINATION PAPER

PROGRAMME: BSc. AGRICULTURAL AND BIOSYSTEMS ENGINEERING YR 2

COURSE CODE: ABE210

TITLE OF PAPER: REMOTE SENSING AND GIS

TIME ALLOWED: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: NONE

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO OTHER
QUESTIONS

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QUESTION 1: COMPULSORY QUESTION

- a) An Error matrix was prepared for digital image classification as shown in the table below.

| Classification data (Map) | Training Set Data (Known Cover Type) | | | | | |
|------------------------------|--------------------------------------|-----------|-----------|-----------|-----------|------------|
| | Feature | Water | Sand | Forest | Urban | Total |
| | Water | 45 | 5 | 3 | 2 | 55 |
| | Sand | 4 | 35 | 1 | 0 | 40 |
| | Forest | 5 | 3 | 50 | 2 | 60 |
| | Urban | 3 | 1 | 1 | 40 | 45 |
| | Total | 57 | 44 | 55 | 44 | 200 |

Calculate the following:

- (i) Overall accuracy of the classification. (10 marks)
 - (ii) Producer's accuracy for water. (5 marks)
 - (iii) Producer's accuracy for urban. (5 marks)
 - (iv) User's accuracy for sand. (5 marks)
 - (v) User's accuracy for forest. (5 marks)
- b) Determine the total radiation ($W m^{-2}$) from a surface that has a temperature of 30 °C. The Stefan-Boltzmann constant is $5.6697 * 10^{-8} W m^{-2} K^{-4}$. (10 marks)

Total

40 marks

QUESTION TWO

- a) The table below shows reflectance values for three land features in the Red (ETM 3), Near Infra Red (ETM 4) and Middle Infra Red) bands.

| Object/ land feature | Reflectance | | |
|----------------------|-------------|---------------------|-----------------------|
| | Red Band | Near Infra Red Band | Middle Infra Red Band |
| A | 51 | 61 | 140 |
| B | 35 | 14 | 9 |
| C | 24 | 130 | 74 |

- i) Calculate NDVI values for each of the three land features (15 marks).

- ii) Specify the actual land cover type for each of the features based on the NDVI values if one of the features is water, one is bare dry soil and the other is dense vegetation cover. (5 marks)
- b) Discuss how “categories” can be used to show information in attribute tables of GIS, using examples to illustrate your answer (10 marks).

Total

30 marks

QUESTION THREE

- a) Calculate the size of a satellite image (in MB) if it has 200 rows and 300 columns. (10 marks)
- b) Determine the area on the ground covered by the image in (1) above, if it has a spatial resolution of 20 m. (5 marks)
- c) Describe the following terms as applied in remote sensing, using examples to illustrate your answers:
 - i) Spatial resolution (8 marks)
 - ii) Temporal resolution (7 marks)

Total

30 marks

QUESTION FOUR

- a) Calculate the spectral reflectance for land features if the reflectance for feature A was 80 units, while that for feature B was 40 units. The incident energy was 120 units. (10 marks)
- b) Which of the land features in (4) above should be considered to be green vegetation if the sensor used was operating at NIR waveband? (5 marks)
- c) Calculate wavelength of maximum spectral radiant exitance for an object with temperature of 60 °C. (10 marks)
- d) Discuss the difference between active remote sensing and passive remote sensing. (5 marks)

Total

30 marks