

2901/305
REMOTE SENSING
Oct. / Nov. 2021
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN PETROLEUM GEOSCIENCE

MODULE III

REMOTE SENSING

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
a non programmable scientific calculator (fx-82);
an answer booklet.

*This paper consists of **EIGHT** questions.*

Each question has a total of 20 marks.

*Answer any **FIVE** questions in the answer booklet provided.*

Maximum marks for each part of a question are as indicated.

Candidates should answer the questions in English.

This paper consists of 5 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

1. (a) (i) With the aid of a labelled graph, plot a spectral reflectance curve of soil, clear water and turbid water. (6 marks)
- (ii) Name the part of the visible light most reflected by clear water and state its wavelength range in micrometres. (2 marks)
- (iii) Explain the difference in reflectance between clear water and turbid water. (6 marks)
- (b) State the part of electromagnetic spectrum used in the optical remote sensing and its wavelength range in micrometres. (3 marks)
- (c) State **three** atmospheric constituents responsible for absorption of electromagnetic radiation. (3 marks)
2. (a) **Figure 1** shows an illustration of RADAR remote sensing. Study and use it to answer the questions that follow.

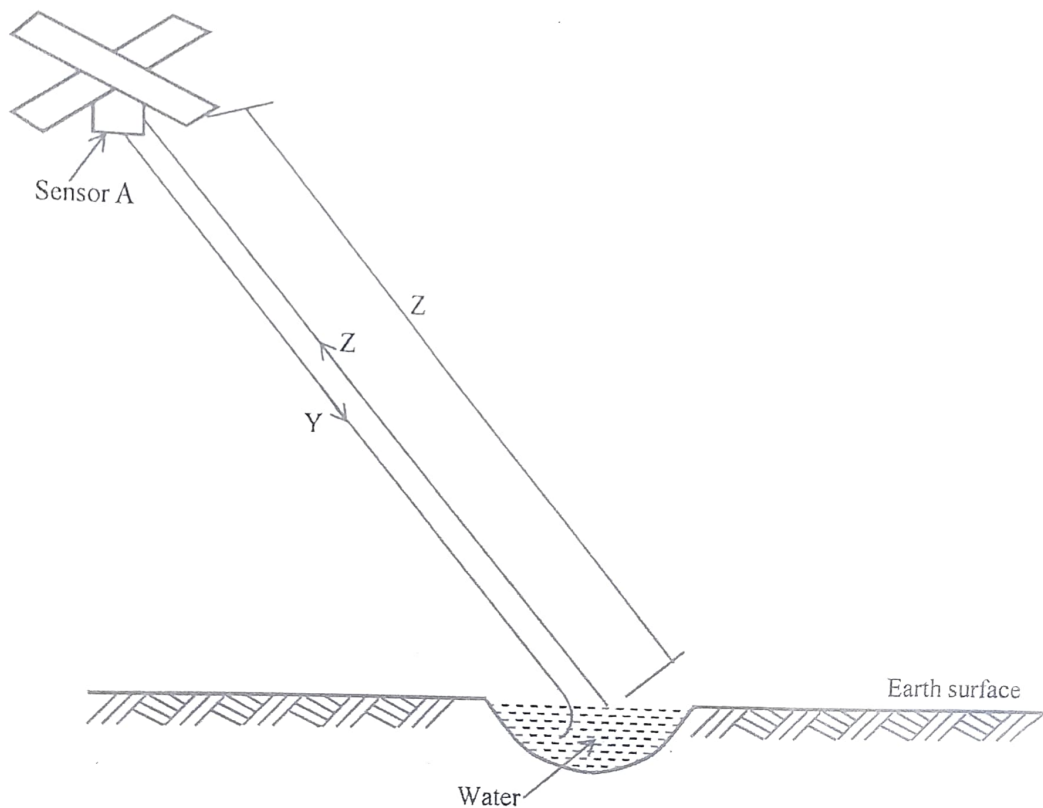


Fig. 1

- (i) Name the pulses represented by letters Y and Z. (2 marks)
- (ii) Name the type of sensor labelled A. (1 mark)
- (iii) State the portion of the electromagnetic spectrum use and the wavelength range. (3 marks)
- (iv) State the part represented by letter X. (1 mark)
- (v) Explain the interaction of pulse Y with water. (3 marks)

- (b) (i) Explain **two** reasons why ultraviolet radiation cannot be detected by a passive sensor. (4 marks)
- (ii) State **three** negative effects of ultraviolet radiation on human beings. (3 marks)
- (c) Highlight **three** advantages of carrying out optical remote sensing at noon on a cloud free sunny day. (3 marks)
3. (a) (i) Give the equation showing the relationship between velocity, frequency and wavelength of the electromagnetic radiation and define the terms. (4 marks)
- (ii) I. An electromagnetic was measured to have $0.98 \mu\text{m}$ wavelength. Calculate its frequency. (3 marks)
- II. Name the possible electromagnetic radiation in 3(ii) (I). (1 mark)
- (b) State **four** applications of thermal remote sensing. (4 marks)
- (c) Explain the digital image processing pre-processing stages applied to remotely sensed data. (8 marks)
4. (a) Explain **five** elements of image interpretation. (10 marks)
- (b) (i) Explain the **two** types of radar systems:
- I. imaging radar system; (3 marks)
- II. non-imaging radar system. (3 marks)
- (ii) Give **two** examples of each of the radar systems in b (i). (4 marks)
5. (a) (i) With the aid of labelled diagrams, explain the type of reflection that occurs when the electromagnetic radiation interacts with each of the following targets:
- I. oil spill on water body; (5 marks)
- II. offshore petroleum field. (5 marks)
- (ii) State **two** factors affecting electromagnetic interaction with targets. (2 marks)

- (b) **Table I** shows radar bands, their wavelengths and frequencies. Study and use it to answer the questions that follow.

Table I

Radar band	Wavelength range (cm)	Frequency (GHz)
x-band	M	Y
A	15 - 30	Z
S-band	N	2 - 4
B	11 - 1.67	18 - 26.5
C	P	0.3 - 1

- (i) Identify the radar bands represented by letters A, B and C. (3 marks)
- (ii) Name the wavelength range represented by letters M, N and P. (3 marks)
- (iii) State the frequency range represented by letters Y and Z. (2 marks)
6. (a) (i) Define the term 'polarization' as used in microwave remote sensing. (2 marks)
- (ii) I. Distinguish between like-polarized and cross-polarized. (2 marks)
- II. Give **two** examples of each of the polarizations in I. (4 marks)
- (b) Describe the procedure used by Radar remote sensing to acquire data about the target. (12 marks)
7. (a) **Figure 2** shows portions of the electromagnetic spectrum. Study and use it to answer the questions that follow.



X ray

Fig. 2

- (i) Identify the portions represented by letters A, B, C, D and E. (5 marks)
- (ii) Name **five** sub-divisions of portion C in decreasing wavelength. (5 marks)
- (iii) State the wavelength range of portion E. (2 marks)
- (iv) Name the **three** sub-divisions of portion D. (3 marks)

- (b) (i) Explain the term 'Remote Sensing.' (2 marks)
- (ii) State **three** advantages of remote sensing. (3 marks)
8. (a) (i) Explain the term 'instantaneous field of view (IFOV) as used in remote sensing. (2 marks)
- (ii) I. Define the term 'cell resolution' as used in remote sensing. (1 mark)
- II. Give the mathematical formula for determining cell resolution. (2 marks)
- (b) (i) Outline **five** differences between supervised and unsupervised image classification. (10 marks)
- (ii) Outline **three** advantages of performing unsupervised image classification. (3 marks)
- (iii) State **two** disadvantages of performing supervised image classification. (2 marks)

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