



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR DEGREE OF:

**BACHELOR OF SCIENCE IN ENVIRONMENTAL PHYSICS & RENEWABLE
ENERGY**

APS 4208: SPECTROSCOPIC METHODS

END OF SEMESTER EXAMINATION

SERIES: APRIL 2015

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Mathematical tables*
- *Scientific Calculator*

This paper consist of **FIVE** questions

Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

Question One (Compulsory)

- a) Define the following terms:
- (i) Population (1 mark)
 - (ii) Sample (1 mark)
- b) (i) What does the term sampling mean? (1 mark)
(ii) Briefly describe the advantages of sampling (4 marks)
- c) Clearly distinguish between the following. Give an example in each case:
- (i) Finite and infinite population (4 marks)
 - (ii) Homogeneous and heterogeneous population (4 marks)
- d) Define the terms:
- (i) Mean
 - (ii) Median

(iii) Mode (3 marks)

e) Suppose you randomly sampled eight acres of land in Kwale County for a non-indigenous weed and came up with the following counts of this weed in the region.

100 40 34 43 81 106 106 and 115

Find

(i) Mean (3 marks)

(ii) Median (2 marks)

(iii) Mode (1 mark)

f) Define the following terms:

(i) Electromagnetic wave (1 mark)

(ii) Frequency (1 mark)

(iii) Wavelength (1 mark)

g) Calculate the frequency of electromagnetic radiation that has a wavelength of $1.315\mu\text{m}$. The speed of light in vacuum is $3 \times 10^8\text{ms}^{-1}$ (3 marks)

Question Two

a) Define the term Statistics (1 mark)

b) Citing examples discuss at least FOUR probability sampling techniques (12 marks)

c) Discuss TWO non-probability sampling techniques. Give an example in each case (6 marks)

d) What is data analysis (1 mark)

Question Three

a) Why is graphical representation of data important? (2 marks)

b) Define frequency as used in Statistics (1 mark)

c) Suppose a sample of 38 university students was asked their weight and the following data obtained:

130 108 135 120 97 110
130 112 123 117 170 124
120 133 89 130 160 126
110 135 115 127 102 130
89 135 89 137 115 110
105 130 115 100 125 120
120 120

Suppose we want '9' class intervals

(i) Compute the class width (3 marks)

(ii) Construct a frequency distribution table (4 marks)

- (iii) Construct the corresponding histogram (4 marks)
- (iv) With reference to the histogram, discuss results (5 marks)
- d) What is meant by null hypothesis (1 mark)

Question Four

The scores of students in a Mathematics test are:

50	35	70	50	30	40
65	50	75	45	53	75
60	55	55	40	55	50

- a) Find:
- (i) The mean score (3 marks)
- (ii) The standard deviation (5 marks)
- b) Make a line plot of the scores (4 marks)
- c) Given that the pass mark is 50, discuss the students performance in the test (6 marks)
- d) How would you gauge the student's performance? Explain your answer (2 marks)

Question Five

- a) Define spectroscopy (2 marks)
- b) Differentiate between uv/vis and infra-red spectroscopy (4 marks)
- c) Discuss FIVE basic components of an optical instrument (10 marks)
- d) Briefly describe the working of an atomic absorption spectrophotometer (4 marks)