



# TECHNICAL UNIVERSITY OF MOMBASA

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FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

**UNIVERSITY EXAMINATION FOR:**

**MASTER OF SCIENCE IN CHEMISTRY**

**ACH 5112: MODERN TRENDS IN ANALYTICAL METHODS**

**END OF SEMESTER EXAMINATION**

**SERIES: DECEMBER 2016**

**TIME: 3 HOURS**

**DATE:** Pick Date Jan 2017

## Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **SIX** Question(s). Answer any **FOUR** questions.

**Do not write on the question paper.**

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## Question ONE

- (a) Explain the capillary column configuration achievements over the packed column setup in gas chromatography. (15 points)
- (b) Briefly explain the effect of the following on the plate height of a chromatographic column.
- (i) Increasing the mass of the stationary phase relative to the packing weight. (2 marks)
  - (ii) Decreasing the rate of sample injection. (2 marks)
  - (iii) Increasing the injection port temperature. (2 marks)
  - (iv) Increasing the flow rate. (2 marks)
  - (v) Reducing the particle size of the packing. (2 marks)

## Question TWO

- (a) Briefly describe Electrokinetic Injection in Capillary Electrophoresis, and indicate its limitations. (7 marks)

- (b) Explain the principals and applications of the following electrophoretic techniques
- (i) Capillary Gel Electrophoresis (CGE) (8 marks)
  - (ii) Capillary Isoelectric Focusing (CIEF) (10 marks)

### Question THREE

- (a) Briefly describe the principles and function of the following mass analyzers;
- (i) Electric and magnetic sector mass analyzer (10 marks)
  - (ii) Linear time of flight (TOF) mass analyzer. (10 marks)
- (b) Calculate the ratio of the  $(M + 2)^+$  to  $M^+$  and the  $(M + 4)^+$  to  $M^+$  peak heights for
- (i)  $C_{10}H_6Br_2$  (ii)  $C_3H_7ClBr$  (5 marks)

### Question FOUR

- (a) Describe the basic function of an Inductively Coupled Plasma – Mass Spectrometer (ICP-MS). Indicate the essential components of ICP-MS. (13 marks)
- (b) Describe the principles and functioning of a Thermal Conductivity Detector used in Gas Chromatography. (12 marks)

### Question FIVE

- (a) (i) Describe the essential components and roles in a Supercritical Fluid Extraction (SFE) instrument. (8 marks)
- (ii) Provide any FOUR advantages and FOUR disadvantages of the use of supercritical  $CO_2$  in extraction (8 marks)
- (b) Outline the Matrix Assisted Laser Desorption Ionization (MALDI) technique (9 marks)

### Question SIX

- (a) The principle of the Sanger method for DNA sequencing is the use of dideoxynucleotide triphosphates (ddNTPs) as DNA chain terminators, and results in DNA fragments of varying lengths. Highlight the application of Capillary Gel Electrophoresis (CGE) in separation and identification of the DNA fragments. (15 marks)
- (b) Describe sample stacking as an enrichment technique in trace analysis by Capillary Electrophoresis (10 marks).