



TECHNICAL UNIVERSITY OF MOMBASA

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

SPECIAL/ SUPPLEMENTARY EXAMINATIONS

SERIES: SEPTEMBER

TIME: 3 HOURS

DATE: Pick Date Sep 2018

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.

Question ONE

- (a) Describe the application of the following separation processes in flow injection analysis (FIA)
- (i) Dialysis (9 marks)
 - (ii) Liquid-liquid extraction. (8 marks)
- (b) Briefly describe microfluidic systems (8 marks)

Question TWO

- (a) Briefly describe the design and function of a time-of-flight mass spectrometer. (13 marks)
- (b) Outline the design and function of a discrete-dynode electron multiplier. (12 marks)

Question THREE

- (a) Highlight the electrochemical processes associated with Electrospray Ionisation (ESI), indicating whether it is a hard or soft ionisation source. (11 marks)
- (b) Describe the differences between the spectra for electron impact (EI) and chemical ionization (CI) sources. (14 marks)

Question FOUR

- (a) Describe the principal of operation of SPME. Indicate advantages, and disadvantages of the technique. (14 marks)
- (b) Briefly describe interferences due to polyatomic ions in ICP/MS atomic mass spectra, and provide corrective measures for the problems. Give three example(s) of polyatomic ions interference. (7 marks)
- (c) State the advantages of the use of ICP/MS over ICP with optical detection for the analysis of rare earth metals and heavy metals (4 marks)

Question FIVE

- (a) (i) Explain how electroosmotic flow (EOF) is generated in a fused-silica capillary. (9 marks)
- (ii) Provide three methods for altering EOF. (3 marks)
- (b) Identify the causes of band-broadening in CE separations. (6 marks)
- (c) Describe the application of isoelectric focusing (IEF) in CE separations. (7 marks)

Question SIX

- (a) Highlight the application of capillary electrophoresis (CE) in separation and characterisation of microorganisms. (10 marks)
- (b) Describe the nature and function of the restrictor in a supercritical fluid extraction (SFE) instrument. (7 marks)
- (c) Describe the major reasons why it is more difficult to combine HPLC with mass spectrometry than it is to combine GC with mass spectrometry. (8 marks)