



# TECHNICAL UNIVERSITY OF MOMBASA

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FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

**UNIVERSITY EXAMINATION FOR:**

**DIPLOMA IN ANALYTICAL CHEMISTRY**

**ACH 2303 : Instrumental Methods of Analysis II (paper1)**

**END OF SEMESTER EXAMINATION**

**SERIES: DECEMBER 2016**

**TIME: 2 HOURS**

**DATE:** Pick Date Dec 2016

## Instructions to Candidates

You should have the following for this examination

*-Answer Booklet, examination pass and student ID*

This paper consists of Choose No questions. Attempt Choose instruction.

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

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## Question ONE

- a) Define the following terms as employed in Instrumental methods of analysis;
- I. Ground state (2 marks)
  - II. Excited state (2 marks)
  - III. Singlet state (2 marks)
  - IV. Triplet state (2 marks)
- b) State the three components of a molecular energy state (3 marks)
- c) The Absorption spectra of a molecule is a band and not line. Using molecular energy-level diagram explain this occurrence (8 marks)
- d) Differentiate between emission and absorption spectra (4 marks)
- e) State the four quantum numbers which define the electronic energy levels and atomic orbitals of an atom (4 marks)
- f) List any three processes by which atoms, ions, and molecules can be excited to one or more higher energy levels (3 marks)

## Question TWO

- a) Describe the principle of a atomic absorption spectrophotometer (3 marks)
- b) Draw a well labeled schematic diagram of a double-beam atomic absorption spectrophotometer (12 marks)

## Question THREE

- a) Describe the three types of interference which may occur in flame atomic absorption measurements (6 marks)
- b) Draw a well labeled block diagram of a flame photometer. (9 marks)

## Question FOUR

- b) Differentiate between fundamentals and overtones as used in IR spectroscopy (3 marks)
- a) State the two modes of molecular vibrations (2marks)
- c) Calculate the wavenumbers and wavelength of the fundamental absorption peak due to the stretching of the carbonyl group (C=O) (10 marks)

**Force constant =  $5.0 \times 10^6$  dynes/cm**

**Avogadro constant =  $6.023 \times 10^{23}$**

**C = 12, O = 16**

## Question FIVE

- a) Discuss the limitations of IR spectroscopy (6 marks)
- b) Explain why the monochromator in U.V spectrophotometer is always placed after radiation source while it is placed immediately after the sample in IR spectrophotometer, (9 marks)