



**KENYATTA UNIVERSITY**

**UNIVERSITY EXAMINATIONS 2016/2017**

**SECOND SEMESTER EXAMINATION FOR THE DEGREE OF MASTER OF SCIENCE  
(APPLIED ANALYTICAL CHEMISTRY)**

**SCH 857: SPECIAL ANALYTICAL TECHNIQUES**

**DATE: Wednesday, 17<sup>th</sup> May, 2017**

**TIME: 9.00 a.m. - 12.00 p.m.**

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**INSTRUCTIONS:** Answer ALL questions.

- Q1. a) Using diagrams explain the theoretical basis and application of the following techniques:
- (i) Auger electron spectroscopy (AES)
  - (ii) X-ray fluorescence (XRF) [8 marks]
- b) Using an example where each technique is applied, Explain the difference between differential thermal analysis (DTA) and differential scanning calorimetry (DSC). [6 marks]
- c) Discuss the following polarimetric techniques in terms of their theory and instrumentation.
- i) Optical rotatory dispersion (ORD)
  - ii) Circular dichroism (CD) [6 marks]
- d) Using diagrams describe the process of Raman scattering and interpretation of results. [4 marks]

- Q2. a) (i) Describe the principles of ISS and SIMS techniques used in surface analysis.  
(ii) Mention one technique used to enhance Raman scattering technique and explain how enhancement is achieved. [8 marks]

b) (i) Explain how thermogravimetry (TG) is used to determine barium ions in a soil sample

(ii) A 1.00g sample of soil was analyzed for calcium ions by thermogravimetry and a residue that weighed 0.78g in the range of 200 – 350° and 0.65g in the range of 480 – 600° was obtained. Draw the resultant thermogram and calculate the percentage calcium ions in the sample. [Ca = 40, C = 12, O = 16, H = 1]

[8 marks]

c) Discuss X-ray photoelectron spectroscopy (XPS) and its use in determining the structure of an organic compound. [6 marks]

- Q3. a) (i) Write short notes on nephelometry and turbidimetry techniques  
(ii) Using a diagram explain how a gas ionization detector works. [9 marks]

b) (i) Describe the decay processes in an atom with low neutron to proton ratio in its nucleus.

(ii) Discuss activation analysis; explaining how it is used to determine heavy metals in a food material.

(iii) Explain the working of a retarding analyzer of an electron spectrometer

[10 marks]

c) Briefly describe the procedure used in scanning electron microscopy.

[5 marks]