TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR:

BTAC

ACH 4302 : ANALYTICAL INSTRUMENTATION II PAPER 1

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 **FIVE** questions. Answer question ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

Question ONE

a. Define the following terms

   i. Spectroscopy (1mark)

   ii. Mass to charge ratio (1 mark)

b. Differentiate between

   i. Stationary phase and mobile phase (2 marks)

   ii. single beam and double beam instrument. (2 marks)

   iii. Isocratic and gradient elution (2 marks)

c. State 4 limitations of beers law. (4 marks)

d. Use a diagram to represent a double beam instrument (5 marks)

e. state an advantage and disadvantage of flame atomizers used in AAS (2 marks)

f. A solution containing Bi(III) has a molar absorptivity of $9.32x10^{3}$l/mol/cm at 470nm.

   i. Calculate the absorbance at a concentration of $4.5x10^{-4}$M and 1cm path length (2 marks)

   ii. calculate %T of this solution (2 marks)

g. Describe using a diagram the working of a thermal conductivity detector (4 marks)

h. State 3 advantages of the FTIR spectrophotometer over dispersive instruments (3 marks)

Question TWO

a. Using a diagram describe paper chromatography (5 marks)
b. In a chromatographic analysis of lemon oil a peak for limonene has a retention time of 8.36 min with a baseline width of 0.96 min. g-Terpinene elutes at 9.54 min, with a baseline width of 0.64 min. What is the resolution between the two peaks? (3 marks)
c. State what controls temperature in a GC (1 mark)
d. Draw the schematic diagram of a gas chromatography and explain the different parts (8 marks)
e. State 3 factors to consider when selecting a stationary phase (3 marks)

Question THREE

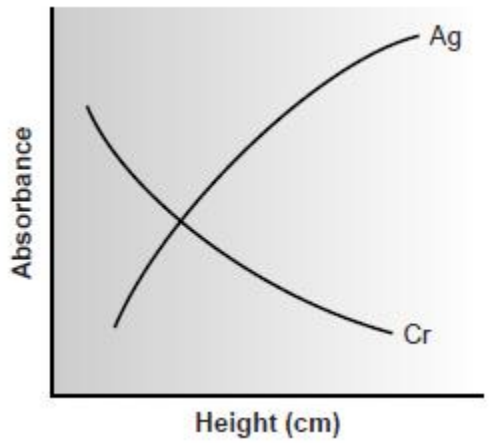
a. Differentiate between standard and blank samples. (2 marks)
b. The determination of Fe in an industrial waste stream was carried out by the o-phenanthroline method.Using the data shown in the following table, determine the concentration of Fe in the waste stream. (6 marks)

ppm Fe	Absorbance
0.00	0.000
1	0.183
2	0.364
3	0.546
4	0.727
unknown	0.269

c. What is Mass Spectrometry? (1 marks)
d. State 3 advantages of Mass spectrometry. (3 marks)
e. State 2 differences between mass spectrometers and optical instruments (4 marks)
f. Name any 4 ion sources used in mass spectrometry (4 marks)

Question FOUR

a. The absorbance profile for Ag and Cr shown below was obtained using flame atomic absorption spectrometer. Explain the observations (4 marks)



b. In a hydrogen flame the atomic absorption signal for iron was found to decrease in the presence of large concentrations of sulphate ions
    i. Suggest an explanation for this observation (2 marks)
    ii. Suggest 3 possible methods that can be used for overcoming the potential interference of sulphate in a quantitative determination of iron. (3 marks)
    iii. Define releasing agent (2 mark)
c. Describe the following methods of sample preparation in IR spectrometry
    i. Mull Technique (3 marks)
    ii. Potassium Bromide Disc Technique (3 marks)
d. Name 3 detectors used in IR (3 marks)

Question FIVE

a) Define the following terms
    i) Chemical shift (1 mark)
    ii) Spin spin splitting (1 mark)
    iii) Coupling constant (1 mark)
b) For the following compound determine the multiplicity for each band and relative area (6 marks)
$CH_3CH_2OCH_3$
c) Draw the NMR spectra for $CH_3CH_2OCH_3$ (3 marks)
d) Name the basic components of NMR Spectrometry? (5 marks)
e) State the limitations of NMR Spectrometer. (3 marks)