KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR

FOURTH YEAR SECOND SEMESTER
MAIN EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF CHEMISTRY

COURSE CODE: SCH 420

COURSE TITLE: SCIENTIFIC INSTRUMENTATION

DURATION: 2 HOURS

DATE: 4/10/2021 **TIME:** 2:00-4:00 PM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of **5** printed pages. Please Turn Over

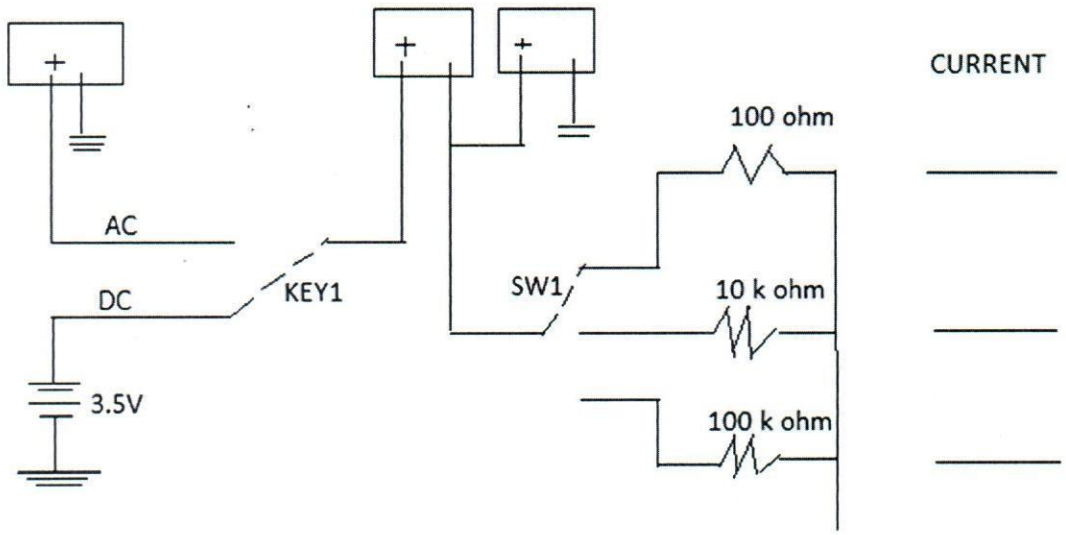
KIBU observes ZERO tolerance to examination cheating

Question 1 (30 marks)

a) i) Describe the following components on a circuit, resistors, capacitors, inductors and transistors **(4marks)**

ii) Sketch a circuit with all the components described **(4marks)**

b) Calculate the current in amperes on the circuit below **(3marks)**



c) i) State the critical difference between analogue and digital multitesters **(2marks)**

ii) Explain some of the advantages of digital instruments over analogue ones **(3marks)**

d) State the differences between the LED and LCD screens **(3marks)**

e) Sketch the waveforms for **(4marks)**

i) Sine wave
ii) Full rectified sine wave indicating rms in each case
iii) Sketch a pulse wave form

f) Explain some of the applications of MTDR **(3marks)**

g i) describe capillary electrophoresis **(2marks)**

iii) Describe the path length of the detection cell in electrophoresis **(2marks)**

Question 2 (20marks)

a) Identify the electronic transitions on the molecule CH_2CHCHO in UV light **(4marks)**

b) Explain the processing and detection of data on the UV spectrophotometer **(4marks)**

c) Sketch the flowchart for the double beam UV spectrometer and explain its advantage over the single beam one **(5marks)**

d) A grating containing 2000 grooves mm^{-1} was radiated with a polychromatic beam at an incidence angle of 48^0 to the grating normal. Calculate λ for the radiation that would appear at an angle of reflection $+20^0$ degree when the order is one. **(3marks)**

e) Sketch a hollow cathode lamp and describe how it works **(4marks)**

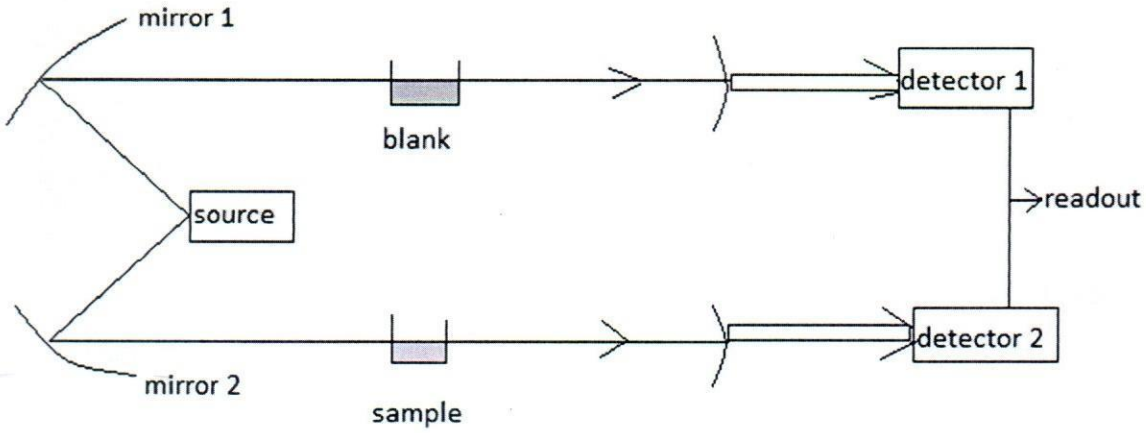
Question 3 (20marks)

a) i) Why are some molecules opaque to IR **(2marks)**

ii) Describe how such molecules may be tested on an industrial production line **(2marks)**

b) Explain the working of the Golay detector **(2marks)**

c) The flowchart below represents an FTIR machine



Briefly explain the advantage of this attenuated Total Reflectance-ATR technique to the normal single beam **(4marks)**

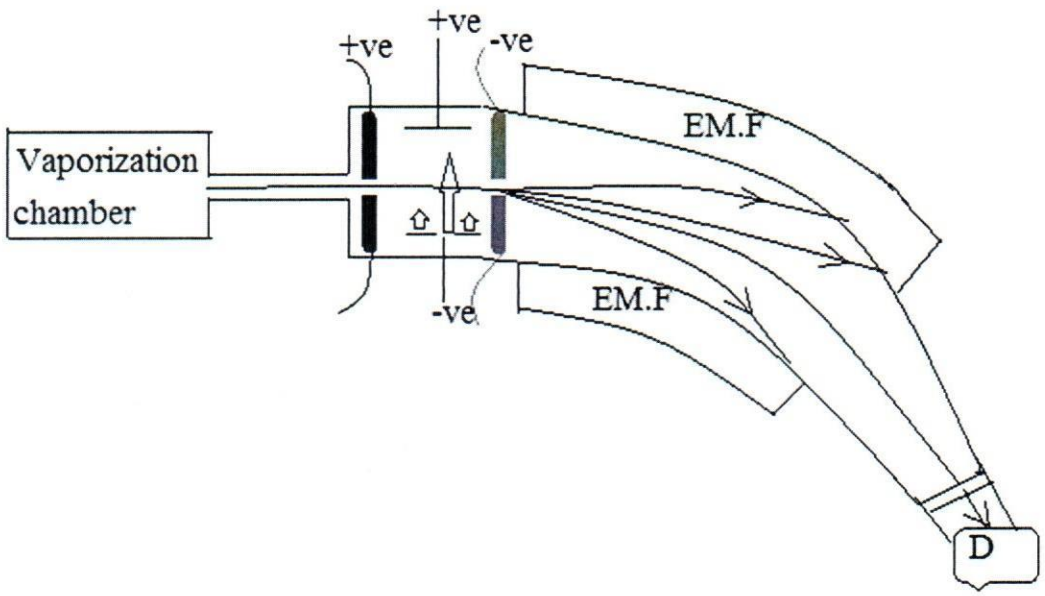
d) Calculate the V and λ of a fundamental absorption peak due to stretching vibration of a carbonyl group, C=O (C=12, O=16, F=1x 10^3)
(3marks)

g) i) Briefly explain the working of a CRT **(4marks)**

ii) Describe phosphorescence as a light output from a CRT **(3marks**

Question 4 (20marks)

a) Sketch the flowchart diagram for the mass spectrum below and explain its working **(10marks)**



b) Identify the fragments from CH3CH3 using a soft method and draw a spectrum for the same **(4marks)**

c) State the importance of constant magnetic field in NMR. **(2marks)**

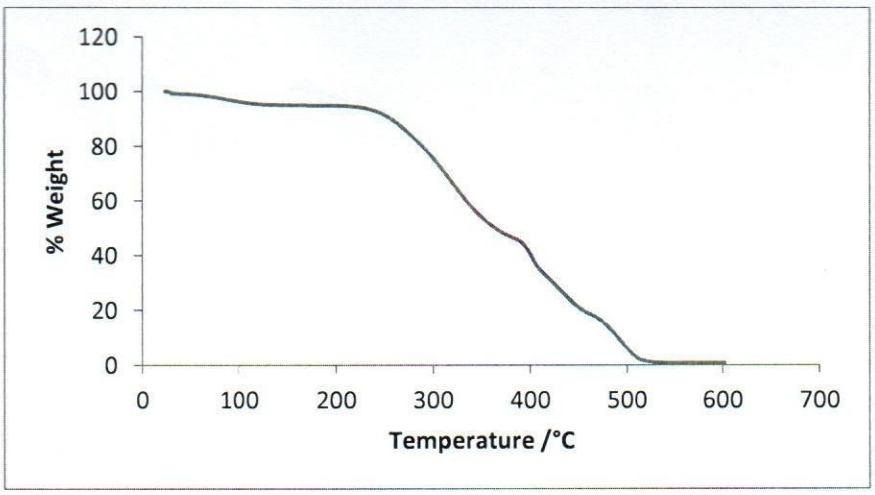
d) What is a spectrum and when does it use a fourier transform analyser **(4marks)**

Question 5 (20marks)

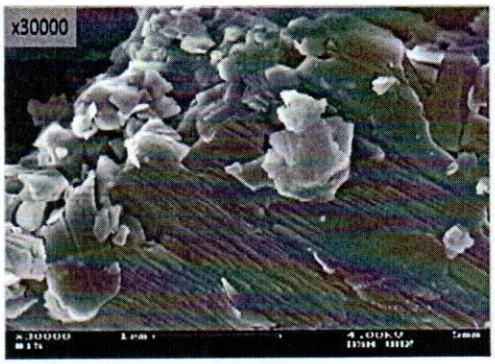
a) Describe the working of and XRD machine and explain why it does not produce a satisfactory result for powder corn starch **(4marks)**

b) Describe the difference in atomization and ionization between AAS and FES **(5marks)**

c) Describe the TGA of corn starch as shown by the graph below **(6marks)**



d) Describe how the SEM machine generates the picture below **(3marks)**



e) Explain the features of an IC **(2marks)**