CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN CHEMISTRY

CHEM 361: RESEARCH METHODS

STREAMS: BSC (CHEM) Y3S2 **TIME: 2 HOURS**

DAY/DATE: WEDNESDAY 15/04/2020 **8.30 A.M. – 10.30 A.M.**

INSTRUCTIONS:

- **Answer ALL questions in section I and TWO in section II**
- **Use of calculators and statistical tables is allowed**
- **Do not write on the question paper**

SECTION I (30 MARKS) – ANSWER ALL THE QUESTIONS

1. (a) Explain the following terms as used in experimental designs:
   - (i) Treatment. [2 marks]
   - (ii) Factor. [2 marks]

   (b) Discuss the fundamental components that characterize every experimental design. [6 marks]

   (c) Explain the term sampling error, giving its possible sources. [3 marks]

   (d) With an aid of a suitable diagram, describe the process of identifying a research gap. [8 marks]

   (e) Outline the types of data measurement scales. [4 marks]

   (f) Describe quasi experimental design. [5 marks]

/SECTION II (40 MARKS) – ANSWER ANY TWO QUESTIONS

2. (a) A technologist claims that it is faster to test soil samples using protocol A than protocols B. to test the claim, eight technicians of proven ability were assigned each to the two protocols and the time taken to carry out the analysis was recorded as follows:

Technician	1	2	3	4	5	6	7	8
Protocol A	26	38	40	22	32	38	36	46
Protocol B	34	44	34	28	28	42	34	48

At a 5% level of significance, determine if the technologist' claim is valid

[8 marks]

(b) Using the following data:

(i) Fit a regression model. [8 marks]

(ii) Obtain a correlation coefficient. [4 marks]

x	1	2	3	4	5	6	7
y	4	8	9	14	19	22	27

3. (a) The following measurements was taken from a soil sample on determination on potassium ion in ppm: 63, 45, 67, 52, 39, 68, 48, 78, 66, 56, 35, 89, 46, 34, 61, 75 and 63. Construct a 95% and 99% confidence interval for the population mean.

[12 marks]

(b) The following data are measurements of the heparin cofactor II (HCII) to plasma protein ratios in a group of patients at baseline and five months after haemodialysis.

Patient	1	2	3	4	5	6	7	8
Before	2.11	1.85	1.82	1.75	1.54	1.52	1.49	1.44
After	2.15	2.11	1.93	1.83	1.9	1.56	1.44	1.43

Using an appropriate non-parametric procedure, at 5% significance level determine if the two measurements are not significantly different. [8 marks]

4. Four different laboratories (A, B, C and D) determine the concentration of cadmium occurring naturally in soils in mg/kg and obtained the following results:

Laboratories	Block 1	Block 2	Block 3
A	32	32	28
B	39	28	31
C	27	28	29
D	26	29	28

Perform analysis of variance and test if the five laboratories yields different results. Take $\alpha = 0.05$. [20 marks]
