CHUKA   **UNIVERSITY**

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF DOCTOR OF PHILOSOPHY OF CHEMISTRY

CHEM 901: APPLIED CHEMOMETRICS

STREAMS: PhD   **TIME: 3 HOURS**

DAY/DATE: TUESDAY 13/8/2019   **8.30 A.M. – 11.30 A.M**

INSTRUCTIONS:
- **Answer any THREE questions**
- **Use of calculators and statistical tables is allowed**
- **Do not write anything on the question paper**

QUESTION ONE (20 MARKS)

An experiment with three replications was conducted to test the concentration of three heavy metals in plant tissues of one plant species collected from three dumpsites. The data on heavy metal concentration are given below:

Dumpsite	Block	Pb	Cd	Ni
Kang'oki	1	6.6	6.5	7.4
	2	6.5	6.5	7.4
	3	6.7	6.6	7.2
Kisumu	1	6.8	7.0	7.4
	2	6.9	7.0	7.5
	3	6.9	6.9	7.5
Nanyuki	1	7.0	7.3	7.8
	2	7.1	7.3	7.9
	3	7.1	7.4	8.0

(a)   Giving a statistical model   [3 marks]

(b)   Analyze the data to test an appropriate hypothesis using a factorial design. TSS = 4.68 and SSAB 0.13. Take   [14 marks]

QUESTION TWO (20 MARKS)

(a)   The data below gives the concentration of copper in tissues of a given plant:

Leaves	35	42	60	22	39	75	52	78	56	36	17	69	25	32	48	53	46
Roots	40	51	71	29	49	89	62	77	63	46	27	70	35	32	58		

Construct a 95% and 99% confidence interval for the difference between the two population mean. [10 marks]

(b)   The following computer output show two sets of the analysis of results from an instrumental analysis on signal (Y) and concentration (X). Interpret the two outputs.

[10 marks]

Model I – Response variable: Signal

Analysis of variance

Source	df	SS	MS	F-Value
Regression	1	249798.01	249798.01	15.628
Error	145	2269682.63	15983.68	
Total	143	2519480.64		

Estimates of regression coefficient

Variable	df	Estimate	StdError	t
Intercept	1	601.934	40.118	15.004
Concentration	1	-3.401	0.860	-3.953

Model II – Response variable: Signal

Analysis of variance

Source	df	Estimate	StdError	F-value
Regression	2	282587.347	141293.67361	8.906
Error	141	2236893.292	15864.49143	-3.953
Total	143	2519480.636		

Estimates of regression coefficient

Variable	df	Estimate	StdError	T
Intercept	1	868.68	189.80	4.577

Concentration	1	-16.205	8.95	-1.811
Concentration *Time	1	0.14	0.0996	1.438

QUESTION THREE (20 MARKS)

(a)   Discuss the type of data measurements   [8 marks]

(b)   The following data gives the X and Y concentration levels of a certain biochemical compound in   the cells of seven individuals

X	36	39	23	31	33	51	45
Y	80	72	101	90	98	70	50

(i)   Obtain a Spearman rank correction coefficient and test if there is significant negative relationship between the two variables at   [6 marks]

(ii)   The readings of X and Y levels of 35 individuals in the same population was taken and the rank correlation coefficient between them was found to be 0.64. Test if there is significant relationship between the two variables in the population at .   [6 marks]

QUESTION FOUR (20 MARKS)

An experiment with three metals concentration was carried out over two seasons (dry and wet). Carry out an analysis of variance of data combined over seasons.   and . Take

Season	Replication	Cu	As	Cr
Dry	1	4.9	6.0	6.7
	2	2.6	6.6	6.7
	3	4.5	5.7	6.8
Wet	1	5.0	6.4	6.1
	2	3.5	6.3	6.0
	3	5.4	6.6	5.9