NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF THE BUILT ENVIRONMENT

BACHELOR OF QUANTITY SURVEYING (HONOURS) DEGREE

PART II SECOND SEMESTER EXAMINATIONS – MAY 2014

STATISTICS II - AQS 2209

Time: 3 Hours Total Marks: 100

INSTRUCTIONS TO CANDIDATES
Answer **ONLY FOUR** questions
Each question carries (25 marks)

A1. An experiment was conducted to study the effect of temperature and type of oven on the manufacturing of bricks which was being tested. Four types of ovens and 3 temperature levels were used in the experiment. Twenty four – observations were assigned randomly, 2 to each combination of treatments, and the following results recorded:

	QUANTITY OF BRICKS FROM DIFFERENT OVENS			
TEMPERATURE (degrees)	OVEN 1	OVEN 2	OVEN 3	OVEN 4
500	227 221	214 259	225 236	260 229
550	187 208	181 179	232 198	246 273
600	174 202	198 194	178 213	206 219

(a) Construct a two-way table of totals. [3 marks]

(b) Carry out a preliminary ANOVA to test for the significance of treatment combinations at the 5 % level of significance. [8 marks]

(c) Carry out a complete ANOVA to test for the significance of the main effects and interaction at the 5 % level of significance. [10 marks]

(d) Give an appropriate table of means and appropriate standard errors for the comparisons. [4 marks]

A2. In an investigation to determine the amount of rainfall (0.01 centimetres) and the quantity of corrosion of a building (micrograms per cubic meter), the following data were collected:

Daily Rainfall (x)	4.3	4.5	5.9	5.6	6.1	5.2	3.8	2.1	7.5
Quantity of Corrosion(y)	126	121	116	118	114	118	132	141	108

(a) Draw a scatter diagram of y against x on graph paper. Fit the least squares straight line to these data and draw your fitted line on your scatter diagram. [10 marks]

(b) Carry out an analysis of variance (ANOVA) to test at the 5 % level of significance whether the slope is significantly different from zero. From your ANOVA table, compute the coefficient of determination, r^2, and interpret it. [9 marks]

(c) Predict the amount of corrosion when the daily rainfall is x = 4.8.
Compute the standard error of the predicted value and hence construct the 95 % confidence interval of this prediction. [6 marks]

A3. A manufacturing firm wants to investigate the effects of 5 colour additives on the setting time of a concrete mix. Variations in the setting times can be expected from day - to - day changes in temperature and humidity and also from the different workers who prepare the test moulds. To eliminate these extraneous sources of variation, a 5 by 5 Latin square design was used in which the letters A, B, C, D, and E represent the 5 additives. The setting times, in hours, for the 25 moulds are shown in the following table:

	DAY				
WORKER	1	2	3	4	5
1	D=10.7	E=10.3	B=11.2	A=10.9	C=10.5
2	E=11.3	C=10.5	D=12.0	B=11.5	A=10.3
3	A=11.8	B=10.9	C=10.5	D=11.3	E=7.5
4	B=14.1	A=11.6	E=11.0	C=11.7	D=11.5
5	C=14.5	D=11.5	A=11.5	E=12.7	B=10.9

At the 0.05 level of significance, can we say that the colour additives have any effect on the setting time of the concrete mix? [25 marks]

A4. The following data shows the number of disputes received by a Quantity Surveying firm over the jobs they did in 2013 by different categories of its workers that is Trainees, Junior and Senior Quantity Surveyors.

Class of Quantity Surveyors	Work done perfectly	Disputed work
Trainee	15	10
Junior	23	8
Senior	54	40

(a) What are the assumptions when using a Chi-Square? [6 marks]

(b) Test at 0.05 level of significance if there is an association between the experience of a Quantity Surveyor and the number of disputed work. [9 marks]

(c) Test again at 0.10 level of significance if there is an association between the experience of a Quantity Surveyor and comment on the accuracy of the test. [10 marks]

A5. A construction firm wishes to analyse the effectiveness of advertising with 3 different style advertisements for their services and these are: block; classified and display. Each is tried in a sample of 4 publications of equal circulation and the resulting enquiries are shown in the following table:

	STYLE OF ADVERTISEMENT		
PUBLICATION	Block	Classified	Display
1	8	5	21
2	4	10	18
3	7	12	14
4	5	5	11

(a) A junior editor decides that there are no systematic differences among the four publications and she therefore ignores the effect of publication type in her analysis to determine whether significant differences exist among the three advertisement styles. Carry out this analysis at the 5% level of significance. [10 marks]

(b) A senior editor, however, concludes that there are systematic differences among the four publications and she, therefore, includes this source of variation in her analysis to determine whether there are any significant differences in the three advertisement styles. Carry out this analysis at the 5% level of significance.
[10 marks]

(c) Of the two approaches, (a) and (b), which one is more precise and why?
[5 marks]

A6. (a) Two educators hypothesised that there was a relationship between students' home conditions and their reading ability. Under 'home conditions' they included factors such as whether or not the home contained books and magazines, whether or not the parents were readers, and whether or not the children were provided with appropriate reading material. These factors were then rated as excellent, average, or poor. A sample of 200 Quantity Surveying students on attachment produced the following results where reading ability is rated as A(excellent), B(good), C(satisfactory), and D(poor).

	READING ABILITY				
HOME CONDITIONS	A	B	C	D	TOTAL
EXCELLENT	15	30	20	5	70
AVERAGE	20	15	19	13	67
POOR	10	13	18	22	63
TOTAL	45	58	57	40	200

Test at the 5% level of significance whether reading ability and home conditions are statistically independent. [15 marks]

(b) Two drugs were administered to two groups of randomly assigned patients from the construction industry to cure the same disease caused by inhaling dust. One group of 60 patients and another group of 40 patients were selected. The following table gives information about the number of patients who were cured and not cured by each of the two drugs.

	Cured	Not cured
Drug 1	44	16
Drug 11	18	22

Test at the 1% significance level whether or not the two drugs are similar in curing

and not curing the patients. [10 marks]