ALUPE UNIVERSITY COLLEGE
...Bastion of Knowledge...
P. O.Box 845-50400 Busia(K)
principal@auc.ac.ke
Tel: +254 741 217 185
+254 736 044 469
off Busia-Malaba road

A CONSTITUENT COLLEGE OF MOI UNIVERSITY

UNIVERSITY EXAMINATIONS

2019/2020 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE APPLIED STATISTICS AND COMPUTING

COURSE CODE: STA320

COURSE TITLE: DESIGN AND ANALYSIS OF EXPERIMENT I

DATE: 30TH OCTOBER, 2020 **TIME: 1400 – 1700 HRS**

INSTRUCTIONS TO CANDIDATES

(i) **Answer question ONE and TWO (Compulsory)**
(ii) **Answer any other THREE questions**
(iii) **Answers should be comprehensive, informative and neat**

TIME: 3 Hours

QUESTION ONE (16 MARKS)

a) Discuss three principles of experimentation. (6 mks)

b) A newspaper vendor wanted to test whether or not selling on different days had any impact on the mean amount of newspapers sold. The number of lots sold on a day varied from 1 to 4. The data for one week was as shown below

Monday	3,100	3,300		
Tuesday	4,000			
Wednesday	2,600	2,800	2,900	3,000
Thursday	1,800	2,400		
Friday	1,500			

Taking the level of significance as 5% and assuming normality of the random elements, test the null hypothesis of no difference between the days (10 mks)

QUESTION TWO (15 MARKS)

i. Define conjugate in latin square (3mks)

ii. Define orthogonal latin square (3mks)

iii. Define Graeco-Latin square (3mks)

iv. Obtain a Graeco-latin square from the following orthogonal latin squares. (6mks)

L_1

A	B	C
B	C	A
C	A	B

L_2

α	β	¥
¥	α	β
β	¥	α

QUESTION THREE (13 MARKS)

Analyse the following randomized block design after estimating the missing value at 5% significance level.

	Blocks			
Treatments	1	2	3	4
T_1	9	-	13	16
T_2	16	18	17	23
T_3	10	19	12	16

(13 mks)

QUESTION FOUR (13 MARKS)

Starting with a linear additive model of the form $Y_{ij} = \mu + t_i + e_{ij}$, where μ is the grand mean yield t_i is the i^{th} treatment effect e_{ij} is the random error effect show that $S^2_T = S^2_e + S^2_t$, where S^2_T is total sum of squares S^2_e is sum of squares due to random error S^2_t is sum of squares due to treatment and hence show that the mean sum of squares due to random error $(\frac{S_e^2}{N-k})$ is an unbiased estimator of the error variance, δ^2_e

(13 mks)

QUESTION FIVE (13 MARKS)

A manufacturer of steel is interested in improving the tensile strength of the product. Product engineers think that tensile strength is a function of the iron concentration in the alloy and that the range of iron concentrations of practical interest is between 5% and 20%. A team of engineers responsible for the study decide to investigate four levels of iron concentration: 5%, 10%, 15%, and 20%. They decide to make up six test specimens at each concentration level, using a pilot plant. All 24 specimens are tested on a laboratory tensile tester in a random order. The data from this experiment are shown in the table below

Hard wood concentration (%)	Observations					
	1	2	3	4	5	6
5	7	8	15	11	9	10
10	12	17	13	18	19	15
15	14	18	19	17	16	18
20	19	25	22	23	18	20

Test at 5% significance level whether or not the hard wood concentration causes a significant difference in the tensile strength. (13 mks)

QUESTION SIX (13 MARKS)

Analyze the following Latin square design after estimating the missing value at 1% level of significance.

A 8	B 9	C 6	D 12
B 14	C 10	D 7	A 10
C 13	D 9	A 7	B 12
D 10	A 11	B 8	C 9

QUESTION SEVEN (13 MARKS)

In an agricultural station an experiment was performed to determine whether there was any difference in the yield of five varieties of maize. The design adopted was five randomized blocks of five plots each. The yield in kgs per plot obtained in the experiment are given below.

Blocks	Varieties					
	V_1	V_2	V_3	V_4	V_5	**Total**
1	20	13	24	15	10	
2	29	12	18	15	18	
3	46	33	33	21	39	
4	28	35	26	25	22	
5	34	41	13	48	30	
Total						

Analyse the design and comment on your findings at 5% significance level (13 mks)

END