(13)

(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2017/2018 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER

SPECIAL/ SUPPLEMENTARY EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

MATHEMATICS

COURSE CODE: **STA 345**

COURSE TITLE: **EXPERIMENTAL DESIGN I**

DATE: 15/10/18 **TIME:** 11.30 AM -1.30 PM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

This Paper Consists of 3 Printed Pages. Please Turn Over.

QUESTION ONE (30 MARKS)

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

b) A certain company had four salesmen A, B, Cand D, each of whom was sent for a month to three types of area-country side K, outskirt of city O and shopping centre of the city S. The sales in thousands of shillings per month are shown below

	Salesmen			
Districts	A	B	C	D
K	30	70	30	30
O	80	50	40	70
S	100	60	80	80

Calculate the relevant F ratio by carrying out analysis of variance (10 mks)

(c) 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 (14mks)

QUESTION TWO (20 MARKS)

(a) Analyse the following randomized block design after estimating the missing value at 5% significance level. (10mks)

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

(b) 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 is given below.

Blocks	Varieties				
	V_1	V_2	V_3	V_4	V_5
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

Analyse the design and comment on your findings (10mks)

QUESTION THREE (20 MARKS)

Set up an analysis of variance for the following results in a Latin square design, taking $\alpha = 1\%$. (20mks)

A 5	C 10	B 5	D 4
C 7	B 6	D 4	A 3
B 15	D 10	A 5	C 10
D 10	A 4	C 20	B 8

QUESTION FOUR (20 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. (20mks)

QUESTION FIVE (20 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 and S^2_t is sum of squares due to treatment, and hence show that the mean sum of squares due to random error is an unbiased estimator of the error variance, δ^2_e (20 mks)