(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2020/2021 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: STA312

COURSE TITLE: EXPERIMENTAL DESIGN I

DATE: 21/07/21   **TIME:** 2 PM -4 PM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

QUESTION ONE

i) Discuss the three principles of experimentation (9mks)

ii) (i) .The data in the table below gives the number of hours of pain relief provided by 4 different types of headache tablets administered to 24 people. The 24 experimental units were randomly divided into 4 groups and each group was treated with a different brand/type. Do the different drug types give significantly different hours of pain relief? (10 mks)

Brands

	1	2	3	4
	12.2	4.9	8.0	4.6
	9.5	10.6	12.1	6.1
	11.6	7.0	5.7	5.0
	13.0	8.3	8.6	3.8
	10.1	5.5	7.2	8.2
	9.6	11.7	12.4	7.7
y_{io}	66.0	48.0	54.0	36.0
$\bar{y}_{io}$	11.0	8.0	9.0	6.0

$y_{oo}=204$

(ii).Using Fisher's Least Significance Difference (With equal number of observations/treatments as seen in the table above) show the means that are not significant at $\alpha=0.05$ (5mks)

iii) Define the following words as used in designs of experiments:
   i) Experimental Error (2mks)
   ii) Treatment (2mks)
   iii) Standard Latin Square (2mks)

QUESTION TWO

a) Four groups of students were subjected to different teaching techniques and tested at the end of a specified period of time. The table below gives the performance in percentages. Are the teaching techniques significantly different judging from the performance of the students at $\alpha=0.05$? (10 mks)

Teaching techniques

	1	2	3	4
	65	75	59	94
	87	69	78	89
	73	83	67	80
	79	81	62	88
	81	72	83	
	69	79	76	
		90		
n_i	6	7	6	4
y_{io}	454	549	425	351
$\bar{y}_{io}$	75.67	78.43	70.83	87.75

$N = 23$ $\qquad$ $N = \sum_{i=1}^{a} ni$

$y_{oo} = 1779$

$\bar{y}_{oo} = \dfrac{1779}{23} = 77.34$

ii) Using Fisher's Least Significance Difference (With unequal number of observations/treatments as seen in the table above) show the means that are not significant at $\alpha=0.05$ $\qquad$ (10 mks)

QUESTION THREE

a) Advantages of Completely Randomized Design (CRD) $\qquad$ (5mks)
b) Discuss the steps of designing an experiment $\qquad$ (8mks)
c) Advantages of Randomized Block Design RBD $\qquad$ (4mks)
d) Differentiate between Type I error and Type II error. $\qquad$ (3mks)

QUESTION FOUR

a) List advantages of Replication (3mks)
b) The table below show the interaction of 3 bean varieties and 4 fertilizer types.

Yield of beans with 3 observations/cell

Fertilisers	Varieties of beans		
	V_1	V_2	V_3
t_1	64	72	74
	66	81	51
	70	64	65
t_2	55	57	47
	63	43	58
	68	52	67
t_3	59	66	58
	68	71	39
	65	59	42
t_4	58	57	53
	41	61	59
	46	53	38

$r = 4, c = 3, n = 3$

$N = rcn = 4 \times 3 \times 3 = 36$

Test the hypotheses that

i) The average yield of the beans is the same when different fertilizers are used.

ii) There is no difference in the average yield for the different varieties of the beans.

iii) There is no interaction between fertilizers and varieties. (17mks)

QUESTION FIVE

a) A study on the physical strength measured in kilograms on 7 subjects before and after a specified training period gave the following results:

Table 5: Pre test and post test study measures

Subject	Measures		d
	Pre test	Post test	
1	100	115	15
2	110	125	15
3	90	105	15
4	110	130	20
5	125	140	15
6	130	140	10
7	105	125	20
			110

Question: Was the training effective? Was there an improvement? (10mks)

b) If we considered the 5.a) above as an experiment at two (2) levels pre and post with 7 blocks which are our subjects, we make up an RBD.
Our data would appear as shown in table 6 below.

Table 6: RBD presentation for the data in |Table 5

Subjects	Measures		
	Pre test	Post test	y_{io}
1	100	115	215
2	110	125	235
3	90	105	195
4	110	130	240
5	125	140	265
6	130	140	270
7	105	125	230
y_{oj}	770	880	$y_{oo} = 1650$

Test whether the training has made a significant difference in the physical strength measurements at $\alpha=0.05$ (10mks)