UGANDAMARTYRS UNIVERSITY
NKOZI

UNIVERSITY EXAMINATIONS
January 2022

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS & STATISTICS

EXPERIMENTAL DESIGN & INDUSTRIAL MODELING

STA3102

DATE: 20/01/2022

TIME: 2:00PM- 5:00 Pm

DURATION: 3 HRS

Instructions:

1. *Carefully read through ALL the questions before attempting*
2. ***ANSWER Four (4) Questions**. (Each question carries equal marks)*
3. *No **names** should be written anywhere on the examination book.*
4. *Ensure that your **ID number** is indicated on all pages of the examination answer booklet.*
5. *Ensure your work is **clear** and **readable**. Untidy work shall be penalized*
6. *Any type of examination Malpractice will lead to automatic disqualification*
7. *Do not write anything on the questions paper.*

QUESTION 1

(a) What is experimental design? **(1 mark)**

(b) List the steps one should take when designing an experimental design **(5 marks)**

© Define the following terms

(i) Experimental unit

(ii) Replication

(iii) Treatment

(iv) Random effects/Models

(v) Experimental error **(1 marks @)) 5 marks**

(d) Consider the problem of determining whether or not the different brands of tires exhibit different amounts of tread wear/loss.

	CAR			
Brands	**I**	**II**	**III**	**IV**
	12	14	10	13
	17	13	11	9
	13	14	14	8
	11	12	13	9

Show whether or not the different brands of tires exhibit different amounts of tread wear/loss at 5% level of significance. **(9 marks)**

QUESTION 2

(a) What is a completely randomized experimental design and when do we use it? **(5 marks)**

(b) Draw an **ANOVA** table that can be used in the analysis of a completely randomized design.

(5 marks)

© A group of 24 people were randomly divided into 4 (four) groups and each group was treated with a different brand of medicine

	GROUP			
Brands	**I**	**II**	**III**	**IV**
	12.2	4.9	8.0	4.6
	9.5	10.6	12.1	6.7
	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

Show whether or not, that there was a significant difference in the hours of the pain relief, provided by four brands of medicine at 1% level of significance. **(10 marks)**

QUESTION 3

(a) List the advantages and disadvantages of completely randomized experimental design (CRD) **(10 marks)**

(b) Four groups of students are subjected to different teaching techniques and are tested at the end of a specified period of time

	Groups of Students			
Marks after different methods of teaching	**I**	**II**	**III**	**IV**
	65	75	59	94
	87	69	78	89
	73	83	67	80
	79	81	62	88
	81	72	83	
	69	79	76	
		90		

Test at 5% level of significance, whether or not there was a statistical significant difference in performance when different teaching techniques were applied. **(10 marks)**

QUESTION 4

a) What is a randomized block design and when do we use it? **(5 marks)**

(b) Draw an **ANOVA** table that can be used in the analysis of a randomized block design.

(5 marks)

© A group of 10 students was pre-tested before teaching (instruction) and then tested after six weeks period with the following achievement scores.

Student	Before	After
1	14	17
2	12	16
3	20	21
4	8	10
5	11	10
6	15	14
7	17	20
8	18	22
9	9	14
10	7	12

Test at 5 % level of significance, if there is evidence of an improvement in achievement over this 6 week period. **(10 marks)**

QUESTION 5

(a) List the advantages and disadvantages of using randomized block design (CRD) **(5 marks)**

(b) The table below gives treatment of different varieties of fertilizers of plots of land.

Fertilizers	Varieties		
	I	II	III
T1	64	72	74
T2	55	57	47
T3	59	66	58
T4	58	57	53

(i) Test the hypothesis at 5% level of significance, that there is no difference when different kinds of fertilizers were used. **(8 marks)**

(ii) Test the hypothesis at 1% level of significance, that there is no difference in the average yield of different varieties of beans. **(7 marks)**

QUESTION 6

(a) What is a Latin square design and when do we use it? **(5 marks)**

(b) List the advantages and disadvantages of using Latin square design **(5 marks)**

© State the model that can be used when using a Latin square design **(5 marks)**

(d) Draw an **ANOVA** table that can be used in the analysis of a Latin square design. **(5 marks)**

END