



DEPARTMENT OF MATHEMATICS AND PHYSICS

UNIVERSITY EXAMINATION FOR:

AMA 4422: DESIGN AND ANALYSIS OF EXPERIMENT

SPECIAL/ SUPPLEMENTARY EXAMINATIONS**SERIES: September 2018****TIME: 2 HOURS****DATE: September 2018****Instructions to Candidates**

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of five questions. Attempt Question and any other two Questions.

Do not write on the question paper.

QUESTION ONE (30 marks)

- a. Show that the total sum of squares in a Completely randomized design is given as

$$SST = \sum_{i=1}^k \sum_{j=1}^{n_j} x_{ij}^2 - \frac{T^2}{N} \quad (5\text{marks})$$

- b. State the assumptions of the Completely Randomized Design (4marks)
c. State the assumptions of a two way ANOVA model with replication (4marks)
d. Explain the principle of randomization (4marks)
e. The following table shows the weight of one species of cabbage Gloria when subjected to three different types of fertilizers

Fertilizer 1	Fertilizer2	Fertilizer3
20	26	23
15	24	26
23	25	30
12	27	29

Obtain the sum of squares due to treatment (5marks)

- f. State the components of an experiment (3 marks)
- g. i. What is the principle of randomization (2 marks)
- ii. what is the significance of the principle of randomization in design and analysis of experiments? (3marks)

QUESTION TWO (20 marks)

A study was done to quantify the effect of cigarette smoking on standard measures of lung function in patients with idiopathic pulmonary fibrosis. Among the measurements taken were percent predicted residual volumes. The results by smoking history were as follows

Never	Former	Current
35	62	95
120	73	107
90	60	63
109	77	134
82	52	140
40	115	103
68	82	158

- a. Using the above data can we conclude that there is a difference among population means at 5% level of significance? (10 marks)
- b. Use Tukey’s HSD procedure to test for significant differences among individual pairs of means (10 marks)

QUESTION THREE (20 marks)

A study was done to evaluate the effects of chewing gum on tic frequency in patients whose tourette’s disorder was inadequately controlled by haloperidol. The following are the tic frequencies under four conditions

Number of Tics During 30-minute period after end of chewing				
Patient	Baseline	Gum chewing	0-30 mins after end of chewing	30-60 mins after end of chewing
1	249	108	93	59
2	1095	593	600	861
3	83	27	32	61
4	569	363	342	312
5	368	141	167	180
6	326	134	144	158

- a. Obtain;
- i. The total sum of squares (4marks)
- ii. The sum of squares due to block (4 marks)
- iii. The sum of squares due to treatment (4 marks)

- iv. The error sum of squares (2 marks)
- b. Prepare the ANOVA table (6 marks)

QUESTION FOUR (20 marks)

A remotivation team in a psychiatric hospital conducted an experiment to compare methods for remotivating patients. Patients were grouped according to level of initial motivation. Patients in each group were randomly assigned to the five methods. Patients were grouped according to level of initial motivation. Patients in each group were randomly assigned to the five methods. The patients were assigned a composite score as a measure of his or her level of motivation. The results are as follows

Level of initial motivation	Remotivation Method				
	A	B	C	D	E
NIL	58	68	60	68	64
VERY LOW	62	70	65	80	69
LOW	67	78	68	81	70
AVERAGE	70	81	70	89	74

- a. Identify the model you will use to design and analysis the above data and justify your choice of the model (2marks)
- b. State the assumptions of that model (3marks)
- c. Do these data provide sufficient evidence to indicate a difference in mean scores among methods at 5% level of significance? (15marks)

QUESTION FIVE (20 marks)

The following table shows the emotional maturity scores of 27 young adult males cross classified by age and the extent to which they use marijuana

Age (factor A)	Marijuana usage (factor B)		
	Never	Occasionally	Daily
15-19	25	18	17
	28	23	24
	22	19	19
20-24	28	16	18
	32	24	22
	30	20	20
25-29	25	14	10
	35	16	8
	30	15	12

At 5% level of significance;

- a. Does the mean emotional maturity score differ among different extent of marijuana usage? (8 marks)
- b. Does the age group affect the emotional maturity score? (6 marks)
- c. Is there interaction between extent of marijuana usage and age? (6 marks)