(15)

(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OF MASTER OF SCIENCE IN STATISTICS

COURSE CODE: **STA 809**

COURSE TITLE: **DESIGN AND ANALYSIS OF EXPERIMENTAL I**

DATE: 27/05/2021 **TIME:** 2:00 PM - 4:00 PM

INSTRUCTIONS TO CANDIDATES

Answer Question One any other Two Questions

TIME: 2 Hours

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

QUESTION ONE (30 MARKS)

(a) Write short notes on
   i) Principles of experimentation (4 mks)
   ii) Estamability (4mks)

(b) For the model

$$Y = x\beta + \mu,$$

Where $E(\mu) = 0$

$$E(\mu'\mu) = \sigma^2 I$$

   i) Find the value of β (3 mks)
   ii) Find its mean and variance (5mks)
   iii) Hence or otherwise develop an ANOVA for this model (4 mks)

c) For (9, 3, 1)-BIBDs
   i) represent the design diagrammatically (5 mks)
   ii) construct the incidence matrix of this design (5 mks)

QUESTION TWO (20 MARKS)

(a) For the model $y_{ij} = u + ti + bj + eij$

$$i = 1, \quad 2 \ldots v$$
$$j = 1, 2 \ldots b$$

Where ti is the ith treatment effect (random) bj is the jth block effect (random) eij in $o.i.d$ $N(0, \gamma_e^2)$ .Show that under the null hypothesis mean sum of squares due to blocking is unbiased estimator of variation due to error (δ_e^2).

(b) Below is an ANOVA table extracted by MINITAB to test whether driving experience and road type have effect on steering corrections:

Analysis of variance (balanced design)

Factor	Type	Level	Value		
Experience	Fixed	2	1	2	
Road	Fixed	3	1	2	3

Analysis of variance for corrects

Source	D.f	S.S	M.SS	F	P
Experience	-	228.77	288.17 -	0.008	
Road	-	308.33	-	5.78	0.010
Error	20	533033	26.67		

Total 23

(i) Complete the ANOVA (1 mark)

(ii) Determine the linear additive model (1 mark)

(iii) Sketch how the raw data was arranged before analysis. (1 mark)

(iv) Make statistical conclusion from the ANOVA. (2 marks)

QUESTION THREE (20 MARKS)

Discuss the uses of the response surfaces methodology in design of experiments with special emphasis on models, properties and methods.

QUESTION FOUR (20 MARKS)

(a) Describe type of confounding in factorial and fractional designs

(b) Construct a 2^5 factorial in 2^3 blocks confounding interactions ABD,ACE,BCDE (15 marks)

QUESTION FIVE (20 MARKS)

1. Let the following be the results for a 2^3 factorial experiment run in randomized complete block design.

Treatments	Block 1	Block 2	Total	
1	42.6	42.9	85.5	
A	40.5.	43.4	83.9	
B	41.6	48.5	90.1	
C	41	41.5	82.5	
Ab	38.1	41.7	79.8	
Ac	39.5	39.4	78.9	
Bc	43.3	44.9	88.2	
Abc	42.5	44.1	86.6	

B1=329.1
B2=346.41
G=675.5

a. Find simple and main effects of A.
b. Interaction between B and A
c. Estimates of the effects
d. Calculate sum of squares due to blocks and sum of squares due to treatments