

EASTERN UNIVERSITY, SRI LANKA
SECOND EXAMINATION IN SCIENCE 2001 / 2002
(APRIL' 2002)
FIRST SEMESTER

ST 203 - DESIGN OF EXPERIMENT

Answer All Questions

Time : Three Hours

- Q1. (a) Explain what do you understand by "Analysis of Variance". State the basic assumptions in an analysis of variance.
- (b) A photographic company is testing four types of lithium batteries, labeled A, B, C, and D, which are used in cameras. A decision has to be made soon, on the basis of mean length of life, as to which type or types to recommend for final experimentation. Some preliminary results on the length of life of batteries in an experiment are given below:

	Type A	Type B	Type C	Type D
	134	151	131	143
	119	126	146	134
	115	144	122	145
	134	131	134	131
	130	127	126	129
	128	126	115	157
	130	150	153	144
	109	132	130	141
	143	132	127	133
	133	147	132	151
Total	1275	1366	1316	1408
Sum of Squares	163501	187536	174280	198988

Carry out an appropriate analysis of these data and explain your findings.

- Q2. (a) Distinguish between completely randomized design and a randomized complete block design.
- (b) In a soft drinks factory, 4 similar machines produce orange drink. The following data from 5 days₂ operations of the machines at 65°C are available.

Production rate (litre / day)

Machine	Day					Total
	1	2	3	4	5	
1	16.4	18.7	18.2	20.3	18.9	92.5
2	16.3	20.4	19.0	23.3	20.8	99.8
3	18.9	22.4	18.0	20.0	20.1	99.4
4	18.1	22.6	19.6	21.4	22.1	103.8
Total	69.7	84.1	74.8	85.0	81.9	

Analyse the data.

- Q3. Four experimenters determine the moisture content of samples of a powder; each man taking a sample from each of six consignments. The assessments are,

Observer	Consignment					
	1	2	3	4	5	6
1	9	10	9	10	11	11
2	12	11	9	11	10	10
3	11	10	10	12	11	10
4	2	11	11	14	12	10

Carry out the ANOVA and state your conclusions.

- Q4. An experiment was conducted to examine the productivity of a new variety of vegetable seed (NEW) in comparison with the traditional variety (TRAD). The sowing rate was also investigated through factorial design, arranged as a randomized block experiment. The data on yield are given in the table below.

Variety Sowing rate		1	2	3
TRAD	1	9	9	17
	2	12	19	21
	3	12	19	21
	4	18	22	27
NEW	1	8	12	16
	2	16	15	21
	3	20	20	28
	4	17	25	27

- (a) Assuming that the variety is to be ignored as a treatment factor analyse the effect of the sowing rate.
- (b) By constructions of suitable table of means and graphical displays, examine whether the data suggest that there is evidence of a real difference between varieties and interaction.

- (a) Explain what is meant by main effects and interactions in factorial experiment.
- (b) Find out the main effects and interactions in the following 2^2 factorial experiment and write down the analysis of variance table.

	(1)	a	b	ab
	00	10	01	11
I	64	25	30	6
II	75	14	50	33
III	76	12	41	17
IV	75	33	25	10

- (c) In an N, P, K trial with two levels of each fertilizer and 3 replicates, the treatment totals were

(1)	n	p	k	np	nk	pk	npk
94	108	97	98	114	123	111	124

The error mean square is known to be 8.90 calculate the sum of squares for N and NP and test their significance.

6. An experiment was carried out to determine the effect of claying the ground on the field of barley grains. Amount of clay used, were as follows:

- A: No clay
 B: Clay at 100 per acre
 C: Clay at 200 per acre
 D: Clay at 300 per acre

The yields were in plots of 8 meters by 8 meters and layout was given below:

Col ^m \ Row	I	II	III	IV	Row Total (R_i)
I	D 29.1	B 18.9	C 29.4	A 5.7	83.1
II	C 16.4	A 10.2	D 21.2	B 19.1	66.9
III	A 5.4	D 38.8	B 24.0	C 37.0	105.2
IV	B 24.9	C 41.7	A 9.5	D 28.9	105.0
Column Total (C_i)	75.8	109.6	84.1	90.7	360.2

- (a) Analyse the above data,
- (b) Construct the ANOVA table and test the treatment effect,
- (c) By further analyzing find which of the treatment mean effects differ significantly,
- (d) Calculate the efficiency of the above Latin square design over
 - (i) Randomized completely block design,
 - (ii) Complete randomized design.