

Reg. No.....

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Name.....

SIXTH SEMESTER B.C.A. DEGREE EXAMINATION, FEBRUARY/MARCH 2005

(Vocational Course)

Optional Subject : Statistics

Paper XII—DESIGN OF EXPERIMENTS

Time : Three Hours

Maximum : 90 Marks

A maximum of 30 marks can be scored from each of the three units.

Unit I

1. Explain the basic principles of experimentation.
2. State and prove a necessary and sufficient condition for estimability of a parametric function  $b'\theta$ , w.r. to the standard Gauss-Markov set up.
3. If  $y_1, y_2, y_3$  and  $y_4$  are independent normal variables with  $E(y_1) = \mu + \theta_1, E(y_2) = \mu + \theta_1, E(y_3) = \mu + \theta_2$  and  $E(y_4) = \mu + \theta_2$ . Obtain the BLUE of  $\theta_2 - \theta_1$ .
4. What is meant by analysis of variance ? What are the important assumptions ? Carry out the analysis of variance of a one-way classification model.
5. A test run of three brands of scooters were made 5 times and the following mileages per litre of petrol were observed :—

Brand I : 68 km., 72 km., 69 km., 75 km., 79 km.

Brand II : 62 km., 75 km., 63 km., 68 km., 65 km.

Brand III : 70 km., 72 km., 68 km., 70 km., 71 km.

Carry out the analysis of variance and draw your conclusions.

6. Three varieties of coal were analysed by four chemists and the ash content in the varieties were as follows :

Variety	Chemists			
	1	2	3	4
A ...	8	5	5	7
B ...	7	6	4	4
C ...	3	6	5	4

Do the varieties differ significantly in their ash content ?

(6 × 7 = 42 marks)

Turn over

7. What is the general form of a two-way classified model? An agricultural experiment was conducted in an RBD with 6 varieties in 5 blocks, and the following results were obtained :—

		Blocks					Varieties						
		1	2	3	4	5	6	7	8	9	10	11	
Blocks	1	...	30	23	34	25	20	13					
	2	...	39	22	28	25	28	32					
	3	...	56	43	43	31	49	17					
	4	...	38	45	36	35	32	20					
	5	...	44	51	23	58	40	30					

Analyse the design and give a brief report on your findings.

(1 × 8 = 8 marks)

### Unit II

- What are the assumptions of a completely randomised design? State the model and carry out the analysis of variance.
- Explain missing plot analysis. Describe how you will estimate a missing observation in a RBD. Obtain the estimate.
- Describe a Latin square design and explain how the basic principles of experimentation are applied here. Also explain its advantages and RBD.
- Obtain expressions for the efficiency of LSD over CRD and RBD.
- Four types of food stuffs were applied on 20 chicks and the following gain in weight were observed. Carry out the analysis of variance :

A	55	49	42	21	52
B	61	112	30	89	63
C	42	97	81	95	92
D	169	137	169	85	154

- The following is an RBD with one missing observation. Carry out the analysis of variance and estimate the missing observation.

		Treatment					
		1	2	3	4	5	6
Blocks	1	18.5	15.7	16.2	14.1	13.0	13.6
	2	11.7	—	12.9	14.4	16.9	12.5
	3	15.4	16.6	15.5	20.3	18.4	21.5
	4	16.5	18.6	12.7	15.7	16.5	18.0

(6 × 7 = 42 marks)

14. Carry out the ANOVA for the following LSD and give a brief report :—

A	C	B	D
12	19	10	8
C	B	D	A
18	12	6	7
B	D	A	C
22	10	5	21
D	A	C	B
12	7	27	17

(1 × 8 = 8 marks)

### Unit III

15. Explain the important features of a factorial experiment. How does it differ from standard designs ?
16. Obtain expressions for the main effects and interaction effects of a  $2^3$  experiment.
17. What is meant by "confounding"? Explain how you will confound the interaction effect ABC in a  $2^3$  experiment. Describe the layout.
18. The following is a  $2^2$  factorial experiment arranged in the form of an RBD with 4 replications for each factor combination :—

Block				
I	(1)	k	p	kp
	23	25	22	38
II	p	(1)	k	kp
	40	26	36	38
III	(1)	k	pk	p
	29	20	30	20
IV	kp	k	p	(1)
	34	31	24	28

Analyse the data and give your comments.

19. Describe a  $3^2$  experiment. Explain how confounding is done in a  $3^2$  experiment using modulo relations.
20. Distinguish between Complete and Partial confounding. Illustrate using a  $2^3$  experiment.

(6 × 7 = 42 marks)

21. The following table gives the layout of a  $2^3$  factorial experiment in 4 replicates. Examine whether the blocks are homogeneous and the treatment effects differ significantly.

Block I				Block II			
<i>nk</i>	<i>kp</i>	<i>p</i>	<i>np</i>	<i>kp</i>	<i>p</i>	<i>k</i>	<i>nk</i>
291	391	312	373	407	324	272	306
1	<i>k</i>	<i>n</i>	<i>nkp</i>	<i>n</i>	<i>nkp</i>	<i>np</i>	1
101	265	106	450	89	449	338	106
Block III				Block IV			
<i>p</i>	1	<i>np</i>	<i>kp</i>	<i>np</i>	<i>nk</i>	<i>n</i>	<i>p</i>
323	87	324	423	361	272	103	324
<i>nk</i>	<i>k</i>	<i>n</i>	<i>nkp</i>	<i>k</i>	1	<i>nkp</i>	<i>kp</i>
334	279	128	471	302	131	437	435

(1 × 8 = 8 marks)