Reg. No..... (Pages : 4) **K 5185**

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
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

8. What are the assumptions of a completely randomised design ? State the model and carry out the analysis of variance.

9. Explain missing plot analysis. Describe how you will estimate a missing observation in a RBD. Obtain the estimate.

10. Describe a Latin square design and explain how the basic principles of experimentation are applied here. Also explain its advantages and RBD.

11. Obtain expressions for the efficiency of LSD over CRD and RBD.

12. 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

13. 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

nk	*kp*	*p*	*np*
291	391	312	373
1	*k*	*n*	*nkp*
101	265	106	450

Block II

kp	*p*	*k*	*nk*
407	324	272	306
n	*nkp*	*np*	1
89	449	338	106

Block III

p	1	*np*	*kp*
323	87	324	423
nk	*k*	*n*	*nkp*
334	279	128	471

Block IV

np	*nk*	*n*	*p*
361	272	103	324
k	1	*nkp*	*kp*
302	131	437	435

(1 × 8 = 8 marks)