



**RX-003-1016051** Seat No. \_\_\_\_\_

**B. Sc. (Sem. VI) (CBCS) Examination**

**March - 2019**

**Statistics : 601**

*(Design of Experiment and Sampling Techniques)*

*(New Course)*

**Faculty Code : 003**

**Subject Code : 1016051**

Time :  $2\frac{1}{2}$  Hours]

[Total Marks : 70

**Instructions :**

- (1) All question are compulsory.
- (2) Each question carries equal marks.
- (3) Students can use their own scientific calculator.
- (4) Statistical tables and graph paper will be provided on request.

1 (A) Give the answer of following question : 4

- (1) The plan of an experiment which controls all factors as far as possible expect the treatment in known as \_\_\_\_\_.
- (2) A subject receiving a treatment in an experiment is called \_\_\_\_\_.
- (3) The average performance of a treatment is better reflected through \_\_\_\_\_.
- (4) Greater homogeneity within the block in an experiment is better maintained through \_\_\_\_\_.

(B) Write any **one** : 2

- (1) Define ANOVA.
- (2) Define Design of Experiment.

(C) Write any **one** : 3

- (1) The three samples below have been obtained from the normal population with equal variance. Test the hypothesis at 5% level that population means are equal.

$x_1$	8	10	7	14	11
$x_2$	7	5	10	9	9
$x_3$	12	9	13	12	14

- (2) Analysis the following information by two way classification.

<i>Machine</i>	<i>Workers</i>		
	$W_1$	$W_2$	$W_3$
$M_1$	8	28	6
$M_2$	32	36	38
$M_3$	20	38	14

- (D) Write any **one** : 5
- (1) State basic principle of design of experiment and explain any two.
  - (2) Analysis of two way classification.
- 2 (A) Give the answer of following question : 4
- (1) A completely randomized design is used when all experimental units are \_\_\_\_\_.
  - (2) Each treatment occurs \_\_\_\_\_ in a block of randomized complete block design.
  - (3) If there are t treatments and m blocks in a randomized block design, the error degrees of freedom in ANOVA table be \_\_\_\_\_.
  - (4) A Latin square design is a \_\_\_\_\_ two way classification scheme.
- (B) Write any **one** : 2
- (1) Define RBD.
  - (2) Explain CRD lay out with example.
- (C) Write any **one** : 3
- (1) Explain estimation of one missing plot in RBD.
  - (2) Explain analysis of CRD.
- (D) Write any **one** : 5
- (1) Define LSD and analysis it.
  - (2) Analysis two missing treatments in RBD with same block or different block.
- 3 (A) Give the answer of following question : 4
- (1) An experiment involving two or more factors at various levels is called a \_\_\_\_\_ experiment.
  - (2) The linear combination  $-3T_1 - T_2 + T_3 + 3T_4$  of four treatments is a \_\_\_\_\_.
  - (3) An experiment involving 5 levels of nitrogen, 4 levels of phosphorous and 3 level of potash \_\_\_\_\_ factorial experiment.
  - (4) If A and B are two factors each at 2 levels, the simple effect of A at the first level of B is \_\_\_\_\_.

- (B) Write any one : 2
- (1) Define complete confounding.
  - (2) Define main effect in factorial experiment.
- (C) Write any one : 3
- (1) Write the set of orthogonal contrasts for main effects and interaction effect in  $2^2$  factorial experiment.
  - (2) Write Yate's method for  $2^3$  factorial experiment.
- (D) Write any one : 5
- (1) Define efficiency and comparison efficiency of LSD over CRD.
  - (2) Why confounding ? Explain it.
- 4 (A) Give the answer of following question : 4
- (1) A population consisting of an unlimited number of units is called an \_\_\_\_\_ population.
  - (2) The errors other than sampling errors are termed as \_\_\_\_\_.
  - (3) Formula for standard error of sample mean  $\bar{x}$  based on a sample of size n and with stand deviation is s is \_\_\_\_\_.
  - (4) The probability of selection of any one sample out of  $\binom{N}{n}$  sample is \_\_\_\_\_.
- (B) Write any one : 2
- (1) Define sample unit.
  - (2) A random sample of 400 units is taken without replacement from a population of 4000 units. The population variance 120 Find the variance of sample mean ?
- (C) Write any one : 3
- (1) Explain meaning of Non-sampling error.
  - (2) For simple random sample without replacement prove
- $$\text{that } V(\bar{y}) = \left( \frac{N-n}{N} \right) \frac{S^2}{n} .$$
- (D) Write any one : 5
- (1) Explain in brief Non-probability sampling method. Also show that Cluster sampling is a area sampling.
  - (2) The observation of population are 5, 9, 11, 19. Taking all possible samples of size 2 without replacement
- verify the result (i)  $E(\bar{y}) = \bar{Y}$  (ii)  $V(\bar{y}) = \left( \frac{N-n}{N} \right) \frac{S^2}{n}$
- (iii)  $E(s^2) = S^2$ .

- 5 (A) Give the answer of following question : 4
- (1) Stratified sampling is not preferred when the population is \_\_\_\_\_.
  - (2) When the population consists of units arranged in a sequence and deck, one would prefer \_\_\_\_\_.
  - (3) In stratified random sampling, the variance of  $\bar{x}_{st}$  for fixed total size of sample is minimum if  $n_j$  is proportional to \_\_\_\_\_.
  - (4) With varying cost  $C_j$  per unit in stratified random sampling, the variance of  $\bar{x}_{st}$  attains the smallest value if  $n_j$  is proportional to \_\_\_\_\_.

- (B) Write any one : 2
- (1) 100 units of a population are divided into two strata. The numbers of units in the first stratum are 60 and in the second stratum are 40. The variances of the strata are respectively 12 and 8. If is desired to take a sample of 10 units by proportional allocation, find how many units should be taken from each stratum. Also find the variance of stratified mean.
  - (2) From the following data find  $V(\bar{y}_{st})$  under optimum allocation 10% stratified sample is to be taken

<i>Stratum</i>	$N_h$	$S_h$
<i>I</i>	400	10
<i>II</i>	200	8
<i>III</i>	400	6

- (C) Write any one : 3
- (1) Prove that  $V(\bar{y}_{st})$  is minimum for fixed total size of the sample  $n$  and  $n_i \propto N_i S_i$ .
  - (2) Prove that  $V(\bar{y}_{sys}) = \frac{(N-1) S^2}{N} \frac{1}{n} \{1 + (n-1)\rho\}$ .
- (D) Write any one : 5
- (1) If the population consists of a linear trend then prove that  $V(\bar{y}_{st}) \leq V(\bar{y}_{sys}) \leq V(\bar{y}_n)_{ran}$ .
  - (2) Prove that  $V(\bar{y})_{ran} \geq V(\bar{y}_{st})_{prop} \geq V(\bar{y}_{st})_{opt}$ .