

3/EH-28 (iii) (Syllabus-2015)

2 0 1 8

(October)

STATISTICS

(Elective/Honours)

**(Categorical Data, Survey Sampling and Design
of Experiments)**

[STEH-3 (TH)]

Marks : 56

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

Answer five questions, taking one from each Unit

UNIT—I

1. (a) What do you understand by consistency of data? State the conditions for consistency of data. 4
- (b) What do you mean by independence of attributes? Give criteria of independence for two attributes. 3
- (c) What do you mean by coefficient of contingency? Describe how to use the same for a 2×2 contingency table. 5

(2)

2. (a) Define association of attributes. When are two attributes said to be positively associated and negatively associated? Also define complete association and dissociation of two attributes.
- (b) Show that if A occurs in a larger proportion of the cases where B is than where B is not, then B will occur in a larger proportion of cases where A is than where A is not.

(c) Show that if

$$\frac{(A)}{N} = x, \frac{(B)}{N} = 2x, \frac{(C)}{N} = 3x \text{ and}$$
$$\frac{(AB)}{N} = \frac{(BC)}{N} = \frac{(CA)}{N} = y$$

then the value of neither x nor y can exceed $\frac{1}{4}$.

(Notations have their usual meanings).

UNIT—II

3. (a) Distinguish between complete enumeration and sample survey.
- (b) Define simple random sampling with replacement and without replacement from a finite population.

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(Continued)

(3)

- (c) Show that, in SRSWOR, the sample mean square is an unbiased estimate of the population mean square, i.e.

$$E(s^2) = s^2$$

4. (a) Define systematic sampling. Discuss its advantages and disadvantages.
- (b) Obtain the sampling variance of the mean based on systematic sample and compare the variance with that based on simple random sampling.
- (c) In simple random sampling with replacement, show that $v(\bar{x}) = \frac{\sigma^2}{n}$.

UNIT—III

5. (a) What is stratified random sampling? When will you use stratified random sampling? Describe the advantages of stratified random sampling.
- (b) In stratified random sampling, show that $\text{Var}(\bar{y}_{st})$ is minimum for fixed total size of the sample n if $n_i \propto N_i S_i$, where, N_i is the number of sampling units in the i th stratum ($i = 1, 2, \dots, k$), n_i is the number of sampling units selected with SRSWOR from the i th stratum and S_i^2 is the population mean square of the i th stratum.

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(Turn Over)

(4)

6. Obtain the variance of the estimates of the population mean under stratified random sampling with proportional and optimum allocation respectively and show that under certain conditions to be stated

$$\text{Var(opt)} \leq \text{Var(prop)} \quad 11$$

UNIT—IV

7. (a) Explain the meaning of 'analysis of variances' and give its uses. State the basic assumptions in the analysis of variance. $2+1+1=4$

- (b) State the mathematical model used in analysis of variance in a two-way classification. Discuss the analysis of variance of a two-way classified data with one observation per cell. Explain the hypotheses to be used. Also, discuss the advantages of this method over one-way classification, if any. $1+4+1+1=7$

8. (a) Describe the following three fundamental principles with suitable illustrations : 8

(i) Randomization

(ii) Replication

(iii) Local control

- (b) Define experimental error. What are its main sources? 3

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(Continued)

(5)

UNIT—V

9. (a) Give the layout of a completely randomized block design and explain the situations when it is used. 6

- (b) Give an outline of the analysis of a variance of a $p \times p$ Latin square design involving a single missing observation. 5

10. (a) Describe the factorial method of experimentation. Explain the situation where it could be used. 5

- (b) Show that in a 2^2 -factorial experiment the main effects are mutually orthogonal contrast. How would you obtain the sum of squares due to a main effect or an interaction effect in a 2^2 -experiment? $3+3=6$

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