3/EH–28 (iii) (Syllabus–2015)

2 0 1 6

(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 given data? How do you check it?   1+3=4

   (b) What do you mean by independence of attributes? Give a criterion of independence for attributes A and B.   1+3=4

   (c) When are two attributes said to be *(i)* positively associated, and *(ii)* negatively associated? Also define complete association and dissociation of two attributes.   1×4=4

(Turn Over)

2. (a) Define Yule's coefficient of association and coefficient of colligation. Establish the following relation between coefficient of association Q and coefficient of colligation Y :

$$Q = \frac{2Y}{1+Y^2}$$ 1+1+4=6

(b) Show that if A occurs in a larger proportion of the cases when 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. 3

(c) Show that if

$$\frac{(A)}{N} = x, \ \frac{(B)}{N} = 2x, \ \frac{(C)}{N} = 3x$$

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.) 3

UNIT—II

3. (a) Explain the advantages and disadvantages of sample survey vis-à-vis census. 5

(Continued)

(b) Distinguish between sampling with replacement and sampling without replacement. Show that, in SRS, the probability of selecting a specified unit of the population at any given draw is equal to the probability of its being selected at the first draw. 2+4=6

4. (a) Explain a method of determining appropriate sample size under simple random sample. 4

(b) Explain how a systematic sample is to be drawn. 2

(c) Write the expression for variance of mean of systematic sample. Also write the advantages of systematic sampling over simple random sampling. 1+4=5

UNIT—III

5. (a) Find an unbiased estimator of the population mean under stratified random sampling and hence, find the variance of the estimator. 5

(b) 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 ith stratum and S_i^2 is the population mean square of the ith stratum. Explain. 6

(Turn Over)

6. *(a)* Explain briefly how the allocation of the sample sizes for different strata is done in stratified random sampling.   5

(b) Show that

$$\text{var}(\overline{y})_{\text{opt}} \leq \text{var}(\overline{y})_{\text{prop}} \leq \text{var}(\overline{y})_{\text{SRSWOR}}$$ 6

UNIT—IV

7. *(a)* Explain the meaning of analysis of variances. State the basic assumptions in the analysis of variance.   2+2=4

(b) State some applications of the analysis of variance.   2

(c) Distinguish between fixed effects model and random effects model in the analysis of variance.   2½+2½=5

8. *(a)* For the one-way classified fixed effects model

$$y_{ij} = \mu + \alpha_i + e_{ij}$$

$$(i = 1, 2, \cdots, k;\ j = 1, 2, \cdots, n_i)$$

where the symbols have their usual meanings. Obtain the estimates of the parameters μ and α_i's. Also give the ANOVA table.   5

(b) Give the fixed effects mathematical model for two-way classification with one observation per cell, stating clearly the assumptions involved. Obtain the estimates of the parameters in the model. Also give the ANOVA table.   6

UNIT—V

9. *(a)* Give the layout of a completely randomised block design and explain the situations when it is used. Discuss its merits and demerits.   3+1+2=6

(b) What is the use of 'missing plot technique'? Show that in a randomised block design with r blocks and t plots; the analysis can be carried out by substituting the value

$$y = \frac{rB + rT - G}{(r-1)(t-1)}$$

for the missing yield, B = the actual total of the block with the missing unit, T = the total of yields of the treatment with the missing unit and G = the grand total.   5

10. *(a)* Describe the factorial method of experimentation. Explain the situation where it could be used.   2+2=4

(b) Explain what are meant by main effects and interactions in factorial experiment. Give the expressions for the total effect, the main effect, S.S. due to an effect and the standard error of an effect for 2^3-experiment.   3+4=7

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