

U.G. 4th Semester Examination - 2021**STATISTICS****[HONOURS]****Course Code : STAT-H-CC-T-8****[Survey Sampling and Indian Official Statistics]**

Full Marks : 20

Time : 1 Hour

*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.**Notations and symbols have their usual meaning.*

1. Answer any **five** questions: 1×5=5
- Define sample frame with an example.
 - Suggest a test for checking randomness of a number series.
 - Briefly discuss cluster sampling with an example.
 - Differentiate between target and sampled population with an example.
 - Write down two advantages of stratified random sampling.
 - Briefly discuss two divisions of NSSO.

- g) What are the two main activities of statistical wings under Ministry of Finance?

2. Answer any **one** question: 5×1=5
- Explain the advantages of using a random number table.
 - Show that in the presence of linear trend, systematic sampling performs better than the simple random sampling.
 - Briefly discuss optimum allocation in the context of stratified random sampling with mathematical justification.
3. Answer any **one** question: 10×1=10
- What are the advantages of sample survey over complete enumeration? Discuss with examples.
 - Explain the two basic principles of sample survey. 6+4=10
 - Derive the first and second order inclusion probabilities in SRSWOR sampling.
 - Show that for SRSWOR, the variance of the sample mean $\bar{y}$ is $\left(\frac{1}{n} - \frac{1}{N}\right) S_y^2$.

[Turn over]

Hence find the variance of an unbiased estimator of the population total.

$$4+(5+1)=10$$

- c) i) Show that, in simple random sampling, an unbiased estimator of $R = \frac{\bar{Y}}{\bar{X}}$ is given

$$\text{by } \hat{R} = \bar{r} + \frac{(N-1)n}{N(n-1)} \times \frac{\bar{y} - \bar{r}\bar{x}}{\bar{X}}.$$

- ii) With two strata, a sampler would like to have $n_1 = n_2$ for administrative convenience, instead of using the Neyman's optimum allocation principle. If V, V_{opt} denote the variances given by $n_1 = n_2$ and Neyman's allocation, respectively, show that fractional increase

in variance is $\frac{V - V_{\text{opt}}}{V_{\text{opt}}} = \left(\frac{r-1}{r+1}\right)^2$ where

$$r = \frac{n_1}{n_2} \text{ as given by Neyman's allocation.}$$

$$5+5=10$$

(Internal Assessment : 5)
