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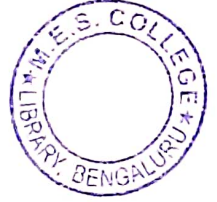
V Semester B.Sc. Degree Examination, March - 2021

STATISTICS

Sampling Theory and Statistical Quality Control

(CBCS Freshers 202-21 and Onwards)

Paper : V



Time : 3 Hours

Maximum Marks : 70

*Instructions to Candidates:*

- 1) Answer any **Five** questions from Section A and Five questions from Section B.
- 2) Scientific calculators are allowed.

**SECTION - A****I. Answer any Five questions from the following. (5×5=25)**

1. What is a sample survey ? Explain the advantages of a sample survey over complete enumeration.
2. What is simple random sampling? Distinguish between SRSWOR and SRSWR. With usual notations, under SRSWOR, prove that  $E(\bar{y}) = \bar{y}$ .
3. Obtain an unbiased estimator of the population mean in case of stratified random sampling and derive its variance.
4. Explain the procedure of drawing a systematic samples and mention its merits and demerits.
5. What are control charts? Explain the role of normal distribution in adopting  $3\sigma$  - control limits.
6. Explain the construction of S-chart.
7. Derive control limits for a np-chart.
8. Describe double sampling plan and mention its advantages.

**SECTION - B****II. Answer any Five questions from the following. (5×9=45)**

9. a) What are questionnaire and schedule? What precautions do you take while drafting a questionnaire? Explain.
- b) Distinguish between sampling and non sampling errors. Explain the factors causing non-sampling errors. (5+4)

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10. Derive the expression for the various of sample mean under SRSWOR and setup the confidence interval for the population mean and population total. (9)
11. a) With usual notations show that.  $V\left(\hat{A}\right) = N^2 \left(\frac{N-n}{N-1}\right) \frac{PQ}{n}$   
b) Obtain an expression for the sample size while estimating population proportion in case of SRSWOR. (4+5)
12. In stratified random sampling, show that the variance of the estimate of the population mean is minimum if  $n_h$  is proportional to  $N_h S_h$ ;  $h=1,2,\dots,L$  and hence obtain an expression for  $V(\bar{y}_{st})$ . (9)
13. a) Explain  
i) Proportional allocation  
ii) Optimum allocation  
b) Obtain an unbiased estimator of population mean under systematic sampling  
c) Under systematic sampling prove that
- $$V(\bar{y}_{sy}) = \frac{N-1}{N} S^2 - \left(\frac{N-K}{N}\right) S^2_{wsy} \quad (2+3+4)$$
14. a) Obtain control limits for mean and range chart when process standards are unknown.  
b) Distinguish between natural tolerance and specification limits.  
Interpret the following situation  
i)  $USL-LSL > 6\sigma$   
ii)  $USL-LSL = 6\sigma$   
iii)  $USL-LSL < 6\sigma$  (4+5)
15. a) Define the terms  
i) AOQ  
ii) ASN  
iii) LTPD  
iv) Producer's risk.  
b) Obtain an expression for oc function in a single sampling plan using poisson approximations.  
c) Obtain A.T.I of a single sampling plan. (4+3+2)
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