7. (a) Show that in srswor, the sample mean square is an unbiased estimate of the population mean square.

(b) In usual notations, prove that the systematic sample mean is more precise than the mean of simple random sample taken without replacement if $S_{wsy}^2 > S^2$.   6,6

Section C (Official Statistics)

8. Write short notes on any *two* of the following :

(i) Trade Statistics in India

(ii) Functions of NSSO

(iii) Difference between the de-jure and de-facto methods of conducting a census of population.   6,6

23/5/17 (Evening)

This question paper contains **4** printed pages]

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt *six* questions in all.

Question No. **1** is compulsory.

Attempt any *two* questions from Section A and

Section B each and attempt any *one* question from Section C.

1. (a) Write three basic principles of Design of Experiments.

(b) Fill in the missing entries :

Source of Variation	d.f.	Sum of Squares	Mean Sum of Squares	F ratio
Treatments	5	SST	MST=SST/?	F=MST/MSE
Error	?	SSE	MSE=SSE/?	~F(?,?)
Total	20	TSS		

(c)   Fill in the blanks :

(i) $V(\bar{y}_n)_{srswor}$ .... $V(\bar{y}_n)_{srswr}$

(ii) Stratified sampling provides estimates with great precision if strata are ....

(d)   Consider a population of 4 units with values 1, 2, 3 and 4. Write down all possible samples of size 2 (without replacement) from this population and verify that sample mean is an unbiased estimate of population mean.

(e)   Name any *two* publications of CSO.   2,4,2,5,2

Section A (Design of Experiments)

2.   Give analysis of variance for Completely Randomized Design, stating clearly the mathematical model and the underlying assumptions.   12

3.   Describe Yates method of computing factorial effect total for a 2^3 factorial experiment. Write down ANOVA table assuming that experiment is run in Randomized Block Design with b blocks.   12

4.   (a) Define LSD. Estimate a missing value in LSD.

(b) In a two-way classification with one observation per cell, show that the mean square error provides an unbiased estimate of error variance.   6,6

Section B (Sample Survey)

5.   (a) A simple random sample of size 3 is drawn from a population of size N with replacement. Show that the probabilities that the sample contains 1, 2 and 3 (e.g. aaa, aba, abc) different units respectively are :

$$P_1 = \frac{1}{N^2}, \ P_2 = \frac{3(N-1)}{N^2}, \ P_3 = \frac{(N-1)(N-2)}{N^2}.$$

(b) What is the need of a sample survey ? Compare it with census explaining its advantages and disadvantages. Also, discuss the principal steps in a sample survey.   6,6

6.   (a) Estimate the gain in efficiency due to stratification for arbitrary allocation over simple random sampling.

(b) Explain the following :

(i)   Probability and non-probability sampling

(ii) Sampling error and non-sampling error.   6,6