

[LD 1013]

OCTOBER 2013

Sub. Code: 2863

M.Sc NON-MEDICAL DEGREE EXAMINATION

FIRST YEAR

BRANCH II - BIOSTATISTICS

PAPER III – STATISTICAL INFERENCE, SAMPLING METHODS AND  
SAMPLE SIZE

*Q.P. Code : 282863*

**Time : 3 hours**

**Maximum : 100 marks**

**I. Elaborate on :**

**(2X20=40)**

1. a) Explain the Neyman – Pearson theory of testing of hypothesis.  
b) Prove that every most powerful test is unbiased.
2. a) Describe the procedure of stratified sampling and highlight its importance.  
b) In the usual notations prove that  
$$V_{st} \leq V_{sys} \leq V_{srs}$$

**II. Write notes on:**

**(10X6=60)**

1. The application of normal test for confidence interval
2. Point estimation and Interval estimation.
3. Prove that  $T^2$  is a consistent estimator of  $Q^2$  if  $T$  is a consistent estimator of  $Q$ .
4. Define most powerful test. Does it exist always? Justify your claim.
5. PPS sampling with replacement
6. Des Raj's ordered estimator
7. Observational errors in sample surveys.
8. The test for goodness of fit.
9. Double Sampling for Ratio estimator
10. Non-response errors and How are they controlled?

\*\*\*\*\*

[LE 0414]

APRIL 2014

Sub. Code: 2863

**M.Sc NON-MEDICAL DEGREE EXAMINATION  
FIRST YEAR  
BRANCH II - BIostatISTICS  
PAPER III – STATISTICAL INFERENCE, SAMPLING METHODS AND  
SAMPLE SIZE**

*Q.P. Code : 282863*

**Time : 3 hours**

**Maximum : 100 marks**

**Answer All Questions**

**I. Elaborate on :** **(2X20=40)**

1. Obtain an unbiased estimate of the population total with stratified random sample and obtain an expression for the standard error.
2. Describe method of estimating a 95 percent of confidence Interval for the variance  $\sigma^2$  if a sample of size n is taken when the mean is 1) known and 2) unknown.

**II. Write notes on:** **(10X6=60)**

1. What is a best linear unbiased estimator.
2. Explain the estimation of population proportion in stratified random sampling with SRSWS and its sampling variance.
3. Explain the chi square test for testing the goodness of fit.
4. Explain t test for testing the significance of correlation and regression coefficients.
5. Show that most powerful test obtained by Neyman Pearson lemma is unbiased.
6. Explain Sequential Probability Ratio test.
7. Describe sampling for ratio estimate.
8. Explain the types of errors in testing the hypothesis.
9. Explain PPS sampling with replacement.
10. Discuss the scope and limitations of convenient and judgment sampling in Biostatistical analysis.

\*\*\*\*\*

[LF 1014]

OCTOBER 2014

Sub. Code: 2863

**M.Sc., NON-MEDICAL DEGREE EXAMINATION  
FIRST YEAR  
(New Regulation)  
BRANCH II - BIostatISTICS  
PAPER III – STATISTICAL INFERENCE, SAMPLING METHODS AND  
SAMPLE SIZE**

*Q.P. Code : 282863*

**Time : Three hours**

**Maximum : 100 marks**

**I. Elaborate on :**

**(2 x 20 = 40)**

1. a) Derive Kolmogorov Smirnov Test.  
b) Apply Manwhitney U Test for the following data represent the lifetimes(hours) of batteries for two different Medical equipments:  
Equipment A : 40, 30, 40, 45, 55, 30  
Equipment B : 50, 50, 45, 55, 60, 40  
Are these equipments different with respect to average life and also whether they have come from the same population.
2. Methods of Sampling Techniques.

**II. Write notes on:**

**(10 x 6 = 60)**

1. Estimate, Consistent Estimate and Unbiased Estimate
2. Give example for Cramer Rao inequality, when the underlying regularity conditions are violated?
3. Invariance property of MLE
4. Test for independence of contingency tables
5. Quantile tests
6. MVUE and BLUE
7. Differentiate Multiphase and Multistage Sampling
8. Systematic sampling and explain when we should not use systematic sampling
9. Compare census and sample survey
10. Non-probability sampling techniques

\*\*\*\*\*

[LH 0415]

OCTOBER 2015

Sub. Code: 2863

**M.Sc., NON – MEDICAL DEGREE COURSES  
BRANCH II - BIOSTATISTICS  
FIRST YEAR  
PAPER III – STATISTICAL INFERENCE, SAMPLING METHODS AND  
SAMPLE SIZE**

*Q.P. Code: 282863*

**Time: Three hours**

**Maximum: 100 marks**

**I. Elaborate on:**

**(2 x 20 = 40)**

1. a) Minimum variance unbiased estimator and BLUE.  
b) Confidence interval for difference between two proportions.
2. a) Estimation of variance of SRSWOR.  
b) Multistage sampling.

**II. Write notes on:**

**(10 x 6 = 60)**

1. Properties of Point Estimators.
2. Confidence interval for mean of sample samples.
3. Rao – Blackwell inequality.
4. UMP and UMP unbiased test.
5. Wilcoxon Mann – Whitney test.
6. Stratified Sampling.
7. Various of SRS under Proportional allocation
8. Estimation of mean in Cluster Sampling.
9. Ratio estimate.
10. Double sampling.

\*\*\*\*\*

[LJ 1016]

OCTOBER 2016

Sub. Code: 2863

**M.Sc. BIOSTATISTICS EXAMS**  
**FIRST YEAR**  
**PAPER III – STATISTICAL INFERENCE, SAMPLING METHODS**  
**AND SAMPLE SIZE**

*Q.P. Code: 282863*

**Time: Three hours**

**Maximum: 100 Marks**

**I. Elaborate on:**

**(2 x 20 = 40)**

1. a) Write about stratified, systematic, quota and snowball sampling.  
b) Write about cluster sampling and compare it with simple random sampling.
2. a) Suppose that  $y_1, y_2, \dots, y_n$  denote a random sample from Poisson distribution with mean  $\lambda$ .
  - i) Find MLE  $\hat{\lambda}$  for  $\lambda$ .
  - ii) Find the expected value and variance for  $\hat{\lambda}$ .
  - iii) What is the MLE for  $P(Y=0) = \exp(-\lambda)$ ?
- b) Write about parametric and non-parametric tests based on t and F distributions.

**II. Write notes on:**

**(10 x 6 = 60)**

1. Correlation and regression.
2. Sample size on difference between two means.
3. Regression estimator.
4. Intra class correlation coefficient (ICC).
5. Properties of an estimator.
6. Rank sum test.
7. State Rao-Blackwell and Cramer-Rao inequality.
8. Multiphase sampling.
9. Confidence interval for a single mean.
10. MVUE and BLUE.

\*\*\*\*\*

[LL 1017]

OCTOBER 2017

Sub. Code: 2863

**M.Sc. BIOSTATISTICS EXAMS  
FIRST YEAR  
PAPER III – STATISTICAL INFERENCE, SAMPLING METHODS AND  
SAMPLE SIZE**

*Q.P. Code: 282863*

**Time: Three hours**

**Maximum: 100 Marks**

**I. Elaborate on:**

**(2 x 20 = 40)**

1. a) Show that the sample mean  $\bar{x}_{\text{mean}}$  in random sampling from  
$$f(x, \theta) = \begin{cases} (1/\theta)\exp(-(x/\theta)), & 0 < x < \infty, \\ 0 & \text{otherwise,} \end{cases}$$
when  $0 < \theta < \infty$ , is an MLE estimator of  $\theta$  and has variance  $\theta^2/n$   
b) Cramer Rao inequality, Bhattacharya inequality and Rao-blackwell inequality.
2. a) Methods of drawing SRS.  
b) Multiphase and multistage sampling.

**II. Write notes on:**

**(10 x 6 = 60)**

1. Confidence interval for difference of two sample proportions.
2. Method of modified minimum chi-square.
3. Neymen Pearson test of hypothesis.
4. Test based on F-distribution.
5. Mann-Whitney test.
6. Parameter, statistic and sampling distribution.
7. Estimation of mean and variance of SRSWOR.
8. Quota sampling for proportions.
9. Non-sampling errors.
10. Interpenetrating sub sampling.

\*\*\*\*\*

[LM 0518]

MAY 2018

Sub. Code: 2863

**M.Sc. BIOSTATISTICS EXAMS  
FIRST YEAR  
PAPER III – STATISTICAL INFERENCE, SAMPLING METHODS AND  
SAMPLE SIZE**

*Q.P. Code: 282863*

**Time: Three hours**

**Maximum: 100 Marks**

**I. Elaborate on:**

**(2 x 20 = 40)**

1. a) Confidence interval for mean and variance of normal distribution.  
b) Let  $x_i$ 's,  $i=1,2,\dots,n$  is a random sample from the distribution.  
 $f(x,\theta)=\exp(-(x-\theta))$ ,  $0 < x < \infty$ ;  $-\infty < \theta < \infty$ . Obtain sufficient statistic for  $\theta$ .
2. Types of probability and non-probability sampling.

**II. Write notes on:**

**(10 x 6 = 60)**

1. BLUE.
2. Method of moments.
3. Likelihood ratio.
4. Test of independence of attributes.
5. SPRT.
6. Advantageous of sampling.
7. Variance of sample mean of stratified sampling.
8. Cluster sampling.
9. Ratio and regression estimate.
10. Double sampling.

\*\*\*\*\*

[LN 1018]

OCTOBER 2018

Sub. Code: 2863

**M.Sc. BIOSTATISTICS EXAMS**  
**FIRST YEAR**  
**PAPER III – STATISTICAL INFERENCE, SAMPLING METHODS AND**  
**SAMPLE SIZE**

*Q.P. Code: 282863*

**Time: Three hours**

**Maximum: 100 Marks**

**I. Elaborate on:**

**(2 x 20 = 40)**

1. a) Minimum variance unbiased estimator and Best linear unbiased estimator.  
b) Cramer-Rao inequality.
2. a) Methods of drawing Simple Random Sampling.  
b) Multiphase and multistage sampling.

**II. Write notes on:**

**(10 x 6 = 60)**

1. Confidence interval for difference of two sample proportions.
2. Explain simple hypothesis and composite hypothesis with example.
3. Test of independence of attributes.
4. Neymen Pearson test of hypothesis.
5. Mann-Whitney test.
6. State Rao-Blackwell.
7. Estimation of sample size for clinical experiments.
8. Systematic sampling and explain when we should not use systematic sampling
9. Stratified Sampling.
10. Discuss the scope and limitations of convenient and judgment sampling in biostatistical analysis.

\*\*\*\*\*

[LP 1019]

OCTOBER 2019

Sub. Code: 2863

**M.Sc. BIOSTATISTICS EXAMS  
FIRST YEAR  
PAPER III – STATISTICAL INFERENCE, SAMPLING METHODS AND  
SAMPLE SIZE**

*Q.P. Code: 282863*

**Time: Three hours**

**Maximum: 100 Marks**

**I. Elaborate on:**

**(2 x 20 = 40)**

1. Types of probability and non-probability sampling.
2. a) Cramer-Rao inequality.  
b) Rao-Blackwell inequality.

**II. Write notes on:**

**(10 x 6 = 60)**

1. Critical region and level of significance.
2. Method of Moments.
3. BLUE.
4. The convenience and Judgment sample.
5. Any two non-parametric tests.
6. Sampling and its advantages.
7. Some important points of Estimation of sample size.
8. Properties of point estimators.
9. UMP unbiased test.
10. Systematic sampling and its advantages.

\*\*\*\*\*

**THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY**

[AHS 0321]

**MARCH 2021**

**Sub. Code: 2863**

**(OCTOBER 2020 EXAM SESSION)**

**M.Sc. BIOSTATISTICS**

**FIRST YEAR (From 2011-2012 onwards)**

**PAPER III – STATISTICAL INFERENCE, SAMPLING METHODS AND  
SAMPLE SIZE**

***Q.P. Code : 282863***

**Time: Three hours**

**Answer ALL Questions**

**Maximum: 100 Marks**

**I. Elaborate notes on:**

**(2 x 20 = 40)**

1. a) Cramer Rao Inequality  
b) Rao Blackwell Inequality
2. a) What are the goals of a well-designed sampling plan?  
b) Under what conditions would it make sense to use a stratified.  
(i) cluster sample? and (ii) systematic random sample

**II. Write Short Notes on:**

**(10x6 = 60)**

1. Maximum likelihood estimators
2. Properties of point estimators
3. UMP unbiased test and Likelihood ratio test
4. Critical region and level of significance
5. Test for goodness of fit
6. Why is it important to have a sample that is representative of the target population?
7. Target population and sampling frame
8. Quota sampling
9. Sample size estimation for comparing two proportions
10. Sources of errors in surveys

\*\*\*\*\*

**THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY**

[AHS 0222]

**FEBRUARY 2022  
(OCTOBER 2021 EXAM SESSION)**

**Sub. Code: 2863**

**M.Sc. BIOSTATISTICS  
FIRST YEAR (From 2011-2012 onwards)  
PAPER III – STATISTICAL INFERENCE, SAMPLING METHODS AND  
SAMPLE SIZE  
Q.P. Code : 282863**

**Time: Three hours**

**Answer ALL Questions**

**Maximum: 100 Marks**

**I. Elaborate notes on:**

**(2 x 20 = 40)**

1. a) Best linear unbiased estimator and Bhattacharya inequality  
b) Derive Kolmogorov Smirnov test
2. a) Methods of drawing simple random sampling with examples  
b) In the usual notations prove that  
$$V_{st} \leq V_{sys} \leq V_{srs}$$

**II. Write Short Notes on:**

**(10x6 = 60)**

1. Maximum likelihood estimators
2. Properties of point estimators
3. UMP unbiased test and Likelihood ratio test
4. Critical region and level of significance
5. Test for goodness of fit
6. Snowball sampling
7. Systematic sampling
8. Quota sampling for proportions
9. Principles of sample size and their importance
10. Sources of errors in surveys

\*\*\*\*\*

**THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY**

[AHS 1022]

**OCTOBER 2022**

**Sub. Code: 2863**

**M.Sc. BIOSTATISTICS  
FIRST YEAR (From 2011-2012 onwards)  
PAPER III – STATISTICAL INFERENCE, SAMPLING METHODS AND  
SAMPLE SIZE**

*Q.P. Code : 282863*

**Time: Three hours**

**Answer ALL Questions**

**Maximum: 100 Marks**

**I. Elaborate notes on:**

**(2 x 20 = 40)**

1. a. Minimum variance unbiased estimator and Best linear unbiased estimator.  
b. Cramer-Rao inequality.
2. Types of probability and non probability sampling.

**II. Write Short Notes on:**

**(10x6 = 60)**

1. Confidence interval for difference of two sample proportions.
2. Explain simple hypothesis and Composite hypothesis with example.
3. Test of independence of attributes.
4. Neymen Pearson test of hypothesis.
5. Mann-Whitney test.
6. State Rao-Blackwell inequality.
7. Properties of point estimators.
8. Prove that  $V_{st} \leq V_{sys} \leq V_{srs}$ .
9. Stratified Sampling.
10. Discuss the scope and limitations of convenient and judgment sampling in biostatistical analysis.

\*\*\*\*\*

**THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY**

[AHS 1023]

**OCTOBER 2023**

**Sub. Code: 2863**

**M.Sc. BIOSTATISTICS  
FIRST YEAR (From 2011-2012 onwards)  
PAPER III – STATISTICAL INFERENCE, SAMPLING METHODS AND  
SAMPLE SIZE**

*Q.P. Code: 282863*

**Time: Three hours**

**Answer ALL Questions**

**Maximum: 100 Marks**

**I. Elaborate notes on:**

**(2 x 20 = 40)**

1. a) Derive Kolmogorov Smirnov Test.  
b) Describe method of estimating a 95 % of confidence Interval for the variance  $\sigma^2$  if a sample of size n is taken when the mean is i) known and ii) unknown.
2. a) Estimation of variance of simple random sampling without replacement.  
b) In the usual notations prove that  $V_{st} \leq V_{sys} \leq V_{srs}$ .

**II. Write Short Notes on:**

**(10x6 = 60)**

1. Explain correlation and regression with example.
2. Show that most powerful test obtained by Neyman Pearson lemma is unbiased.
3. Properties of point estimators.
4. What is a best linear unbiased estimator?
5. Give example for Cramer Rao inequality, when the underlying regularity conditions are violated?
6. Explain Sequential Probability Ratio test.
7. Cluster sampling.
8. Quota sampling for proportions.
9. Double sampling for ratio estimator.
10. Multistage Sampling.

\*\*\*\*\*

**THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY**

[AHS 1024]

**OCTOBER 2024**

**Sub. Code: 2863**

**M.Sc. BIOSTATISTICS**  
**FIRST YEAR (From 2011-2012 onwards)**  
**PAPER III – STATISTICAL INFERENCE, SAMPLING METHODS AND**  
**SAMPLE SIZE**

*Q.P. Code: 282863*

**Time: Three hours**

**Answer ALL Questions**

**Maximum: 100 Marks**

**I. Elaborate notes on:**

**(2 x 20 = 40)**

1. a) Write about stratified, systematic, quota, and snowball sampling.  
b) Write about cluster sampling and compare it with simple random sampling.
2. a) Cramer Rao Inequality.  
b) Rao Blackwell Inequality.

**II. Write Short Notes on:**

**(10x6 = 60)**

1. UMP and UMP unbiased test.
2. Method of moments.
3. Critical region and level of significance.
4. The convenience and Judgment sample.
5. Advantageous of sampling.
6. Non-sampling errors.
7. Interpenetrating sub-sampling.
8. Double sampling for ratio estimator.
9. Properties of point estimators.
10. Sources of errors in surveys.

\*\*\*\*\*

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

[AHS 1025]

OCTOBER 2025

Sub. Code: 2863

M.Sc. BIOSTATISTICS  
FIRST YEAR (From 2011-2012)  
PAPER III – STATISTICAL INFERENCE, SAMPLING METHODS AND  
SAMPLE SIZE

*Q.P. Code: 282863*

**Time: Three hours**

**Answer ALL Questions**

**Maximum: 100 Marks**

**I. Elaborate notes on:**

**(2 x 20 = 40)**

1. a) What are the goals of a well-designed sampling plan?  
b) Under what conditions would it make sense to use a stratified, cluster sample and systematic random sampling?
2. a) Show that the sample mean  $\bar{x}$  in random sampling from  
$$f(x, \theta) = \begin{cases} (1/\theta) \exp(-x/\theta), & 0 < x < \theta \\ 0 & \text{otherwise,} \end{cases} \quad \text{when } 0 < \theta$$
  
b) Multiphase and multistage sampling.

**II. Write Short Notes on:**

**(10x6 = 60)**

1. Properties of Point Estimators.
2. How the non-response errors could be controlled?
3. Sampling for ratio estimate.
4. Kolmogorov Smirnov Test.
5. Stratified Random sampling.
6. Importance to have a sample that is representative of the target population.
7. Type of errors in testing of hypothesis.
8. Rao Blackwell Inequality.
9. Double sampling for ratio estimator.
10. Multistage Sampling.

\*\*\*\*\*