SYLLABUS FOR
M.SC. STATISTICS
( SEMESTER PATTERN )
( For Candidates admitted in the Colleges affiliated to Periyar University from 2017-2018 onwards )
REGULATIONS

1. OBJECTIVES OF THE COURSE

To transform graduates with sufficient strength in statistics so as to be employed in the Industry, Research and Development unit and Academic Institutions. The course is designed to impact professional knowledge and practical skills to the students.

2. CONDITION FOR ADMISSION

A candidate who have passed B.Sc Statistics / B.Sc Mathematics / B.Sc., Computer Science (with allied Mathematical Statistics) degree of Periyar University or any of the above degree of any other university accepted as per the norms set by the Government of Tamil nadu as equivalent thereto, subject to such condition as may be prescribed thereto are permitted to appear and qualify for the M.Sc Statistics degree examination of this university after a course of study of two academic years, under CBCS.

3. DURATION OF THE COURSE

The course for the degree of Master of Science in Statistics shall consist of two academic years divided into four semesters. Each semester consist of 90 working days.

4. COURSE OF STUDY

The course of study shall comprise instruction in the following subjects according to the syllabus and books prescribed from time to time.
# COURSE OF STUDY AND SCHEME OF EXAMINATION

## I SEMESTER

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Paper Code</th>
<th>Subject Title</th>
<th>Hours</th>
<th>University Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Credits</td>
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<td>Sampling Theory</td>
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<td>Practical I</td>
<td>Practical II</td>
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<tr>
<td></td>
<td>Core</td>
<td>Practical - II - Statistical Software</td>
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<td>Practical II</td>
<td>Practical - (Using R)</td>
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## II SEMESTER

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<td>Credits</td>
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<td>Core V</td>
<td>Probability Theory</td>
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<td>Core VI</td>
<td>Statistical Estimation Theory</td>
<td>5</td>
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<td>Core VII</td>
<td>Demography and Actuarial Statistics</td>
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<td>III SEMESTER</td>
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<td>Core VIII</td>
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<td>Testing Statistical Hypothesis</td>
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<td>Core IX</td>
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<td>Multivariate Analysis</td>
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<td>Elective - I</td>
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<td>Statistical Quality Control and Reliability</td>
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<td>Stochastic processes</td>
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<td>Core Practical III</td>
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<td>Practical –III (Calculator based)</td>
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<td>Practical - IV Statistical Software</td>
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<td>IV SEMESTER</td>
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<td>Core X</td>
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<td>Design and Analysis of Experiments</td>
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<td>Elective - III</td>
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<td>Elective - IV</td>
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<td>Applied Regression Analysis</td>
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<td>Practical – III (Calculator based)</td>
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<td>3</td>
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<td>Core Practical IV</td>
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<td>Practical - IV Statistical Software</td>
<td>4</td>
<td>3</td>
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<td>Core Project</td>
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<td>Project &amp; Viva-Voce</td>
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<td>TOTAL</td>
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</table>
List of Core/Elective Subjects to be offered

CORE THEORY SUBJECTS
1. Real Analysis and Linear Algebra
2. Measure Theory
3. Distribution Theory
4. Sampling Theory
5. Probability Theory
6. Statistical Estimation Theory
7. Demography and Actuarial statistics
8. Testing of Hypothesis
9. Multivariate Analysis
10. Design of Experiments
11. Project & VIVA-VOCE

CORE PRACTICALS
1. Practical – I (Calculator based)
2. Statistical Software Practical-I (Using R)
3. Practical – II (Calculator based)
4. Statistical Software Practical-II (Using SPSS)

ELECTIVE Subjects (Only four)
1. Statistical Quality control and Reliability
2. Stochastic processes
3. Advanced Operation Research
5. Statistical Computing (C++)

Extra Disciplinary Course:
1. Elements of Operations Research
2. Statistical Methods

Human rights. Common to all courses. Syllabus will be provided by the University.
Examination:
The examination shall be of three hours duration to each theory paper at the end of each semester. The candidate failing in any paper will be permitted to appear in the subsequent semester.

Practical examinations should be conducted at the end of even semester
At the end of fourth semester, viva-voce will be conducted on the basis of Project/Dissertation submitted by the student .The viva-voce should be conducted jointly by the guide and the external examiner.

Theory Papers:
Total marks for each course (core/elective) is 100. 25 marks for Internal and 75 marks for University Examination. The components of Internal Assessment are:

1. Test = 10 Marks
2. Attendance = 5 Marks
3. Seminar = 5 Marks
4. Assignment = 5 Marks
Total = 25 Marks

Practical:
Total marks for each practical course is 100. 40 marks for internal and 60 marks for Written Examination. The components of Internal Assessment are:

1. Record work = 25 Marks
2. Test = 10 Marks
3. Attendance = 5 Marks
Total = 40 Marks

Project work:
The Marks for the Project work is 100 and the components are:

Internal Assessment: : 40 Marks
(For two reviews 20+20 = 40)

Evaluation:
Evaluation of Project report by External : 40 Marks
Examiner and Guide
Viva-Voce conducted by External
Examiner & Guide : 20 Marks
Total : 100 Marks
M.Sc. STATISTICS

QUESTION PAPER PATTERN:
(a) For Theory
- Total marks for each theory course (University examination) is 75.
- The Question paper is divided into two parts.
- PART-A consists of 5 questions, one from each unit with internal choice. Each question carries 5 marks. All questions should be answered. Total marks for PART-A is 25.
- PART-B consists of 5 questions, one from each unit with internal choice. Each question carries 10 marks. All questions should be answered. Total marks for PART-B is 50.

(b) For Practical
- Total marks for each practical (university examination) is 60.
- The candidate should attend 3 questions out of 5 questions each carrying 20 marks.

Classification of Results:
(i) Passing Minimum:
A candidate shall be declare to have passed the examination if the candidate secures not less than 50% of the marks in the Semester Examination and in IA in each course (or) practical. The candidate should get a minimum of 50% marks in semester examination (SE) as well as a minimum of 50% marks in Internal Assessment (IA), i.e., a minimum of 38 marks out of 75 in SE and minimum of 12 marks out of 25 in IA in the theory courses.

For practical courses, the distribution of marks will be 40 for IA & 60 for practical examination. The candidate should get a minimum of 20 marks out of 40 in IA and a minimum of 30 out of 60 in practical examination. The submission of record note book is a must in the practical examinations.

For the project work and viva-voce a candidate should secure 50% of the marks for pass. The candidate should compulsorily attend viva-voce examination to secure pass in the paper (Project).

Candidates who do not obtain the required minimum marks for a pass in a course or practical or project report shall be required to appear and pass the same at a subsequent appearance.

(ii) Minimum Credits to be earned : 90 credits
For Human Rights : 2 credits
Total : 92 Credit

(iii) Marks and Grades:
The following table gives the marks, grade points, letter grades and classification to indicate the performance of the candidate.
Conversion of Marks to Grade Points and Letter Grade (Performance in a paper / course)

<table>
<thead>
<tr>
<th>RANGE OF MARKS</th>
<th>GRADE POINTS</th>
<th>LETTER GRADE</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>90-100</td>
<td>9.0-10.0</td>
<td>O</td>
<td>Outstanding</td>
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<tr>
<td>80-89</td>
<td>8.0-8.9</td>
<td>D+</td>
<td>Excellent</td>
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<td>75-79</td>
<td>7.5-7.9</td>
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<td>Distinction</td>
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<tr>
<td>70-74</td>
<td>7.0-7.4</td>
<td>A+</td>
<td>Very Good</td>
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<tr>
<td>60-69</td>
<td>6.0-6.9</td>
<td>A</td>
<td>Good</td>
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<td>50-59</td>
<td>5.0-5.9</td>
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<td>00-49</td>
<td>0.0-4.9</td>
<td>U</td>
<td>Re-appear</td>
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<tr>
<td>ABSENT</td>
<td>0.0</td>
<td>AAA</td>
<td>ABSENT</td>
</tr>
</tbody>
</table>

Ci = Credits earned for course i in any semester.
Gi = Grade point obtained for course i in any semester
n = Refers to the semester in which such courses were credited.

a) Semester:
GRADE POINT AVERAGE (GPA) =

\[
\text{GPA} = \frac{\sum \text{Multiplication of grade points by the credits of the courses}}{\sum \text{Credits of the courses in a semester}}
\]

b) The Entire Programme:
CUMULATIVE GRADE POINT AVERAGE (CGPA) =

\[
\text{CGPA} = \frac{\sum \text{Multiplication of grade points by the credits of the entire programme}}{\sum \text{Credits of the courses of the entire programme}}
\]
# CGPA GRADE CLASSIFICATION OF FINAL RESULT

<table>
<thead>
<tr>
<th>CGPA</th>
<th>GRADE</th>
<th>CLASSIFICATION OF FINAL RESULT</th>
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<tbody>
<tr>
<td>9.5 – 10.0</td>
<td>O+</td>
<td>First Class – Exemplary</td>
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<tr>
<td>9.0 and above but below 9.5</td>
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</tr>
<tr>
<td>8.5 and above but below 9.0</td>
<td>D++</td>
<td>First Class with Distinction</td>
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<tr>
<td>8.0 and above but below 8.5</td>
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</tr>
<tr>
<td>7.5 and above but below 8.0</td>
<td>D</td>
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</tr>
<tr>
<td>7.0 and above but below 7.5</td>
<td>A++</td>
<td>First Class</td>
</tr>
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<td>6.5 and above but below 7.0</td>
<td>A+</td>
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<td>5.5 and above but below 6.0</td>
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<td>Second Class</td>
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<td>0.0 and above but below 5.0</td>
<td>U</td>
<td>Re-appear</td>
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* The candidates who have passed in the first appearance and within the prescribed semester of the PG Programme (Core, Elective, Non-major Electives and Extra-Disciplinary courses alone) are eligible.

**Dissertation:**

The topic of the dissertation shall be assigned to the candidate before the end of second semester. The student should prepare the plan of work for the dissertation at the end of second semester. In case the student wants to avail the facility from other organisations / university / laboratory, they will undertake the work with the permission of the guide and acknowledge the alien facilities utilized by them. The students should prepare three copies of dissertation and submit the same for the evaluation by Examiners.

**Format to be followed:**

The format / certificate for dissertation to be submitted by the students are given below.

**Format of the preparation of project work**

(a) Title page
(b) Bonafide Certificate
(c) Acknowledgement
(d) Table of Contents
<table>
<thead>
<tr>
<th>Chapter No.</th>
<th>Title</th>
<th>Page No.</th>
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<tbody>
<tr>
<td>1.</td>
<td>Introduction</td>
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<td>2.</td>
<td>Review of Literature</td>
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<td>5.</td>
<td>Summary of Conclusions</td>
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<td>Tables</td>
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</table>
A. Format of the title page

**TITLE OF THE DISSERTATION**

Dissertation submitted to the Periyar University
in partial fulfillment of the requirement for the Degree of
Master of Science
in
STATISTICS

By

NAME OF THE STUDENT

REG. NO.

(College Logo)

COLLEGE NAME

(AFFILIATED TO PERIYAR UNIVERSITY)

PLACE with Pin Code

MONTH – YEAR
M.SC. STATISTICS
SEMESTER - I

CORE I - REAL ANALYSIS AND LINEAR ALGEBRA

UNIT I

UNIT II
Real valued function of two variable – Limit – Continuity - Partial derivatives – Differentiability.

UNIT III

UNIT IV
Real quadratic forms, reduction and classification of quadraticforms-extrema of quadratic forms-index and signature. Reduction of positive definite matrix.

UNIT V

BOOKS FOR STUDY AND REFERENCE:

QP Pattern: Unit wise internal choice with maximum 75 marks
Part A: 5 x 5 = 25 & Part B: 5 x 10 = 50
M.SC. STATISTICS
SEMESTER - I
CORE II - MEASURE THEORY

UNIT I
Algebra of sets-Countable sets – field –monotonic field-monotonic class-field generated by a class of subsets-Borel sets- Borel field.

UNIT II

UNIT III

UNIT IV

UNIT V
Product measure – product measure functions-properties – Product measure theorem – Fubini’s theorem (concept) and its applications in probability. Radon- Nikodym theorem (concept) and its applications.

BOOKS FOR STUDY AND REFERENCE:

QP Pattern: Unit wise internal choice with maximum 75 marks
Part A: 5 x 5 = 25 & Part B: 5 x 10 = 50
M.SC. STATISTICS
SEMESTER - I
CORE III - DISTRIBUTION THEORY

UNIT I
Quick review of the following distributions – Discrete Distribution: Binomial, Poisson, Geometric, Hypergeometric, Multinomial, Negative binomial, Gamma and Beta distributions. Continuous Distribution: Normal, Bernoulli, Exponential, Lognormal and Cauchy (Application and Properties).

UNIT II
Bivariate and multivariate distributions; Concepts of joint, marginal and conditional distributions. Detailed study of Bivariate Binomial and Bivariate normal distribution. Functions of random variables and their distribution: sum and difference, products and quotients of random variables. Concept of truncated distribution and compound distribution (Binomial, Poisson).

UNIT III
Multivariate normal distribution and its properties: Marginal and conditional distribution; characteristic function and its uses. Distribution of linear functions of normal variables.

UNIT IV
Sampling distribution of statistics from normal samples leading to Normal, t, chi-square, and F (non-central) - properties of these distribution.

Unit V
BOOKS FOR STUDY AND REFERENCE:


QP Pattern: Unit wise internal choice with maximum 75 marks
Part A: 5 x 5 = 25 & Part B: 5 x 10 = 50
UNIT I

Principal steps in a sample survey – Drafting a questionnaire. Errors in Surveys - Non Response, types of Non-Response, Call -Backs, a mathematical model of the effects of Call-Backs. Interpenetrating sub sample. Randomized response Technique: Warner’s model-related and unrelated questionnaire method.

UNIT II

Finite population sampling techniques: SRSWR/WOR, stratified and systematic and related results on estimation of population mean and total - Allocation problems in stratified random sampling.

UNIT III


UNIT IV


UNIT V

M.Sc. STATISTICS

BOOKS FOR STUDY AND REFERENCE:

7. Dr. Sampath Sampling Techniques

QP Pattern: Unit wise internal choice with maximum 75 marks
Part A: 5 x 5 = 25 & Part B: 5 x 10 = 50
M.SC. STATISTICS
SEMESTER - II
CORE V - PROBABILITY THEORY

UNIT I

Probability measure – properties – Discrete probability space and general probability space, conditional probability space. Functions and inverse functions – Random variables – Induced probability space by random variables.

UNIT II


UNIT III


UNIT IV

Characteristic Function of random variables – properties – Inversion theorem – Simple examples – Uniqueness theorem, Levy continuity theorem (statement only). Law of Large numbers – WLLN for independent and i.i.d case – SLLN for independent and i.i.d case.

UNIT V

M.Sc. STATISTICS

BOOKS FOR STUDY AND REFERENCE:


QP Pattern: Unit wise internal choice with maximum 75 marks

Part A: 5 x 5 = 25 & Part B: 5 x 10 = 50
M.SC. STATISTICS  
SEMESTER - II  
CORE VI - STATISTICAL ESTIMATION THEORY

UNIT I  

UNIT II  

UNIT III  

UNIT IV  

UNIT V  
Bayesian Inference – Bayes theorem – concepts of prior distribution and its classification – Posterior distribution. Bayes estimation – Bayes estimates for Binomial, Poisson and Normal distribution using conjugate priors (Sec 3.4, 4.3, 6.8 of Bansal A.K-6).
M.Sc. STATISTICS

BOOKS FOR STUDY AND REFERENCE:


QP Pattern: Unit wise internal choice with maximum 75 marks
Part A: 5 x 5 = 25 & Part B: 5 x 10 = 50
UNIT I

Demographic data – Sources, Coverage and Content errors in demographic data- Balancing equations and Chandrasekaran Deming formula - Vital Registration system – Adjustment of age data - Whipple, Myer and UN Indices

UNIT II

Measures of fertility: CBR, GFR, TFR, GRR and NRR - Stochastic models for reproduction, Distribution of time to first birth, inter-live birth intervals and number of birth for homogenous group of women.

UNIT III

Measures of mortality – Life tables and its relation with survival function-Life table function at non-integer age (fractional ages) - Analytical laws of mortality – Gompertz’s law and Makeham’s law – Select, Ultimate and Aggregate mortality tables

UNIT IV

Abridged life table - Construction of abridged life table - methods by Reed and Merrell, Greville’s, Kings and JIA method - Utility theory – Insurance and utility theory

UNIT V

Models for individual claims and their sums - Multiple life function – joint life status and lost survivor status
M.Sc. STATISTICS

BOOKS FOR STUDY AND REFERENCE:


QP Pattern: Unit wise internal choice with maximum 75 marks

Part A: 5 x 5 = 25 & Part B: 5 x 10 = 50
M.SC. STATISTICS
SEMESTER - II
PRACTICAL –I (CALCULATOR BASED)
(Based on Core courses: Sampling theory, Statistical Estimation Theory & Demography)

The Maximum mark is 100 with 40 marks for Internal and 60 Marks for the University examination. The candidate should attend 3 questions out of 5 questions each carrying 20 marks. The Core Practical-I examination should be conducted at the end of II Semester.

UNIT I
(a) Estimation of population mean, total and SE in stratified Random Sampling
(b) Estimation of population mean, total and SE in Systematic sampling.
(c) Ratio estimation and Regression estimation for population mean, total and its variance (SRS).
(d) Estimation of mean, total and variance in Cluster sampling and two stage cluster sampling with equal size clusters.

UNIT II
(a) PPS sampling with replacement.
(b) Double sampling for stratification.
(c) Double sampling for Ratio estimation & Regression estimation.

UNIT III
(a) UMVUE in one parameter exponential family of distribution.
(b) Maximum likelihood estimation & Methods of Moments.
(c) Interval estimation based on i) Normal ii) t iii) \( \chi^2 \) iv) F distributions

UNIT IV
Fitting of Population Growth Models
(a) Gompertz’s Law.
(b) Makeham’s Law.
(c) Logistic Law - Method of partial sums & Method of three selected points.

UNIT V
(a) Computation of Mobility measures.
(b) Probability of living and dying rate of mortality.
(c) Estimation and other measures from mortality table.
(d) Construction of Abridged life tables
i) Reed and Merrell ii) JIA Method iii) Greville's methods
M.Sc. STATISTICS

SEMESTER - II

PRACTICAL II - STATISTICAL SOFTWARE PRACTICAL
(Using R)

The Maximum mark is 100 with 40 marks for Internal and 60 Marks for the University examination. The candidate should attend 3 questions out of 5 questions each carrying 20 marks. The Core Practical-II examination should be conducted at the end of II Semester.

Problems Relating to:

1. Using R command – Operations on vectors, logical vector, index vector and matrices
2. Graphical procedures – Bar charts, Box plots, Histograms using single & multiple groups.
3. Creating and Manipulation of data frames, using various user defined functions.
4. Calculations of probability functions and generation of random samples for various discrete and continuous distributions.
5. Writing R Functions for Descriptive statistics, Correlations and Regression coefficient
6. Statistical Inference : Confidence interval for Proportion, Mean, Median
7. Analysis of variance - One way and Two way ANOVA
UNIT I


UNIT II

UMP test, MLR property, UMP tests for one sided test in one parameter exponential and MLR family of distributions .Non existence of UMP test for simple hypotheses against two sided alternatives in one parameter exponential family.

UNIT III


UNIT III

Sequential Probability Ratio Test- Optimum properties of the SPRT- The Fundamental Identity of Sequential analysis, OC and ASN function of sequential plans. Simple examples

UNIT V

Non-parametric test; Empirical distribution, Kolmogorov – Smirnov goodness of fit for one sample and two sample problems, Sign test, Run test, Wilcoxon Signed- Rank test, Median test, Mann- Whitney U test.
M.Sc. STATISTICS

BOOKS FOR STUDY AND REFERENCE:


QP Pattern: Unit wise internal choice with maximum 75 marks

Part A: 5 x 5 = 25 & Part B: 5 x 10 = 50
**UNIT I**


**UNIT II**

Inference problems concerning the mean vector when the covariance matrix is known (one and two sample problems); likelihood ratio criterion and its application; Mahalanobis D-square and its application. Inference concerning the mean vector (s) when the covariance matrix is unknown (one and two sample problem); Generalized T-square statistics, its distribution and its application; The relationship between T-square and D-square.

**UNIT III**

Wishart distribution (WD) (no derivation) and its properties; characteristic function of WD and its uses; test for covariance matrix. Sphericity test; test for the equality of covariance matrices; testing the independence of sets of variates. Multivariate analysis of variance (one way and two way classification concepts only).

**UNIT IV**

Canonical correlation and variates; Estimation and interpretation. Classification problems, standard of good classifications; procedure of classification with two or more populations with known and unknown distributions. Classification procedures when the parent distribution are normal; Estimation of misclassification probabilities; Fisher’s discriminant function and its uses.

**UNIT V**

M.Sc. STATISTICS

BOOKS FOR STUDY AND REFERENCE:


QP Pattern: Unit wise internal choice with maximum 75 marks

Part A: 5 x 5 = 25 & Part B: 5 x 10 = 50
M.SC. STATISTICS
SEMESTER - III
ELECTIVE I - STATISTICAL QUALITY CONTROL AND RELIABILITY

UNIT I
Statistical process control: Moving average control chart – EWMA control chart. CUSUM control chart: two sided and one sided procedures, V-mask technique, Tabular cusum and decision interval. Economic design of $\bar{X}$-chart – single assignable cost model only.

UNIT II
Multivariate Quality Control Chart: Control of Means and process variability. Modified Control Chart (chart only) and Acceptance control charts. Statistical process control with auto correlated data: Sources and effects of auto correlation in process data – Model-Based approaches and Model-free approaches.

UNIT III
Acceptance sampling plan for variables: Advantages and disadvantages – Single sample plans – one sided and two sided specifications – known and unknown sigma. Continuous sampling plans: CSP-1, CSP-2 and CSP-3 - properties – (statement only).

UNIT IV
Reliability: Definition, applications, Reliability function, Cumulative distribution function – Failure rate function – Hazard rate function – Reliability in terms of hazard rate and failure rate density – Bath tub Curve – Conditional Reliability.
Reliability measures: Mean time to failure, Variance of failure distribution, median time to failure and mode time to failure – Simple problems.

UNIT IV
### BOOKS FOR STUDY AND REFERENCE:


2. Charles E. Ebling (2000) *An introduction to Reliability and Maintainability.* (For Unit – IV)


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QP Pattern: Unit wise internal choice with maximum 75 marks

Part A: 5 x 5 = 25 & Part B: 5 x 10 = 50
UNIT I


UNIT II


UNIT III

Markov process – continuous time and continuous state space – time homogenous Markov process – Kolmogorov’s equation. Wiener process as a limit of random walk, first passage time Diffusion process with Wiener process.

UNIT IV

Stationary process and time series – wide sense and strict sense stationary process – moving average and auto regressive process. Covariance function – Bochner’s function (statement), Khintchine’s representation of wide sense stationary process.

UNIT V

Renewal theory – renewal function and its properties – Elementary and key renewal theorems.
M.Sc. STATISTICS

BOOKS FOR STUDY AND REFERENCE:


QP Pattern: Unit wise internal choice with maximum 75 marks

Part A: 5 x 5 = 25 & Part B: 5 x 10 = 50
M.SC. STATISTICS
SEMESTER - IV
CORE X - DESIGN AND ANALYSIS OF EXPERIMENTS

UNIT I
Linear models- Estimability of linear parametric functions-Generalized Gauss-Markov theorem on linear estimation (BLUE) – Fixed, mixed and random effect models- ANOVA for one-way and two-way classified data – ANOCOVA for one-way and two-way classification with one concomitant variable.

UNIT II
Introduction to design of experiments – Efficiency of CRD,RBD & LSD– Missing plot techniques for RBD and LSD with one (or) two missing observations – Need and scope of Split-plot design – SPD as main effect confounded design.

UNIT III
General factorial experiments-analysis of symmetrical $2^n$ ($n \leq 4$), $3^n$ ($n \leq 2$), and asymmetrical ($p \times q$) factorial – construction and analysis of confounded (complete and partial) design.

UNIT IV
General block designs- concepts of connectedness, balancedness and orthogonality. – BIBD and its parametric relations – Information (C) matrix and criteria for connectedness of block designs - Intra and Inter block analysis of BIBD – Youden square design and its intra block analysis.

UNIT V
PBIBD with ‘m’ associate classes – classifications and parametric relations of PBIBD (2) – Intra block analysis of PBIBD(2) – Need and scope of response surface experiments- applications of experimental designs to quality management technique.
M.Sc. STATISTICS

BOOKS FOR STUDY AND REFERENCE:


QP Pattern: Unit wise internal choice with maximum 75 marks
Part A: 5 x 5 = 25 & Part B: 5 x 10 = 50
M.SC. STATISTICS
SEMESTER - IV
ELECTIVE III - ADVANCED OPERATION RESEARCH

UNIT I
Linear Programming Problems – Graphical method, Simplex method – Big – M method – Two Phase method – Dual Simplex method

UNIT II
Integer programming problem – All integer programming – Mixed integer programming – Gomory’s cutting plane method – Branch and Bound method.

UNIT III

UNIT IV

UNIT V
Queuing models – Specification and effectiveness measures. Steady – state solutions of M/M/1 and M/M/c models with associated distributions of queue – length and waiting time (Infinite Capacity only). Steady – state solution of M/Ek/1 and G/M/1 queues- M/G/1 queue and Pollaczek Khinchine result.
M.Sc. STATISTICS

BOOKS FOR STUDY AND REFERENCE:


QP Pattern: Unit wise internal choice with maximum 75 marks

Part A: 5 x 5 = 25 & Part B: 5 x 10 = 50
UNIT I


UNIT II


UNIT III


UNIT IV


Non-linear regression—nonlinear least square—transformation to linear model—parameter estimation.

UNIT V

BOOKS FOR STUDY AND REFERENCE:

1. Montgomery. D.C. Linear Regression Analysis,  
   (2003) (chapters 1,2,3,8,9,11).


QP Pattern: Unit wise internal choice with maximum 75 marks

Part A: 5 x 5 = 25 & Part B: 5 x 10 = 50
M.SC. STATISTICS
SEMESTER - IV
CORE PRACTICAL – III (Calculator Based)
(For the candidates admitted from 2017 - 2018 onwards)
(Based on papers: Multivariate Analysis, Testing of Hypothesis,
Design of Experiments and Statistical Quality Control & Operation Research)
The Maximum mark is 100 with 40 marks for Internal and 60 Marks for the University examination. The candidate should attend 3 questions out of 5 questions each carrying 20 marks. The Core Practical-III examination should be conducted at the end of IV Semester.

UNIT I
(a) Finding partial, multiple correlation & Regression coefficients from Σ matrix.
(b) Testing for partial, multiple correlation and regression coefficients.
(c) Testing Ho : μ = μ₀ When Σ is known & When Σ is unknown.
(d) Testing Ho : μ₁ = μ₂ When Σ is known & When Σ is unknown.
(e) MLE’s for μ and Σ in a p – variate normal distribution.
(f) Test for dispersion matrix of p- variate Normal distribution (All Asymptotic tests)
   i) Ho : Σ = Σ₀
   ii) Ho : Σ₁ = Σ₂
   iii) Ho : μ = μ₀ and Σ = Σ₀
(g) First principal component and its variance – Extraction method

UNIT II
(a) Most powerful test – Binomial, Normal, Exponential.
(b) UMP Test : One – sided - Normal, Exponential and two – sided Bernoulli
(c) UMPU Test : Binomial, Normal, Exponential
(d) Sequential Probability Ratio Test (SPRT)
i) Bernoulli ii) Normal iii) Exponential
(e) Non – Parametric Tests : Wilcoxon signed Rank Test, Mann – Whitney U Test,
   Kolmogorov – Smrinov ( One sample and Two Sample) Test.

UNIT III
(a) Statistical Analysis of RBD with two observations missing.
(b) Statistical Analysis of LSD with two observations missing.
(c) Statistical analysis of 23 and 32 factorial experiments
(d) Statistical analysis of BIBD (intra block analysis only)
M.Sc. STATISTICS

UNIT IV
(a) Construction of moving average control chart.
(b) Construction of EWMA control chart.
(c) Acceptance sampling plan for variables – construction of one sided - procedure schemes, known and unknown sigma plans – O.C.curves.

Unit V
(a) Integer Programming Problem :
    i) Gomory’s Cutting Plan Method for Pure IPP.
    ii) Gomory’s Cutting Plan Method for Mixed IPP.
(b) Quadratic Programming problem
    I Wolfe’s modified Simplex Method
    ii) Beale’s Method
M.SC. STATISTICS
SEMESTER - IV
PRACTICAL IV - STATISTICAL SOFTWARE PRACTICAL
(Using SPSS)

The Maximum mark is 100 with 40 marks for Internal and 60 Marks for the University examination. The candidate should attend 3 questions out of 5 questions each carrying 20 marks. The Core Practical-I examination should be conducted at the end of II Semester.

Problems relating to:

1. Functions of Statistics (Classification, Diagrams and Graphical representation of Data)
2. Descriptive Statistics
3. Calculation of Probabilities under various distributions
4. Correlation & Regression – Partial and Multiple Correlations, Multiple Regression
5. Curve Fitting, Time series and Forecasting
6. Confidence Intervals for mean, variance, proportions
7. Inferential Statistics for Single through multiple samples. (Chi – Square, t, f and z test)
8. Non-Parametric tests.
9. Experimental Design: One way ANOVA, Two way ANOVA – Factorial designs – Multiple comparison tests
10. Multivariate: Principal component and discriminant analysis – Factor Analysis
M.SC. STATISTICS

SEMESTER - IV

PROJECT WORK

Project/Dissertation work shall be carried out under the supervisor of a Faculty
member on the recommendation of the Head of the Department. Three copies of the
Project report should be submitted the beginning of the fourth semester. The Marks
for the Project work is 100 and the components are:

Internal Assessment : 40 Marks

(For two reviews 20+20 = 40)

Evaluation of Project report by External
Examiner and Supervisor : 40 Marks

Viva-Voce by External Examiner : 20 Marks

and Supervisor

The Evaluation of the Project will be based on Project Report and a VIVA-VOCE
examination to be conducted by the Supervisor and an External Examiner.
M.SC. STATISTICS
SEMESTER - IV
ELECTIVE PAPER V - STATISTICAL COMPUTING (C++)

OBJECTIVE:
To impart the knowledge of programming skills in C++

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V
M.Sc. STATISTICS

TEXT BOOK:


REFERENCE BOOK:


QP Pattern: Unit wise internal choice with maximum 75 marks

Part A: 5 x 5 = 25 & Part B: 5 x 10 = 50
M.SC. STATISTICS
SEMESTER - IV
ELECTIVE PAPER VI - ECONOMETRICS

OBJECTIVE:
To impart the knowledge of programming skills in C++

UNIT I
Nature and scope of Econometrics: Production and cost analysis - price and income
Elasticity of demand. Price Elasticity and supply – Torquvisits model of demand
Inferior goods - Models building – Bias in construction of models.

UNIT II
The General Linear Model (GLM) and its extension. Ordinary Least square (OLS)
estimation and prediction . Generalized Least square (GLS) estimation and prediction
and their properties – problem of heteroscedasticity and multicollinearity pure and
mixed estimation . Grouping of observations and equations.

UNIT III
Single equation linear model – dynamic case; Autocorrelation and its consequences
Testing for Autocorrelation; Theil’s BLUS procedure . Estimation and Prediction
Estimation of parameters of a linear model with auto correlated disturbances and
distributed lag models – Errors in variable models.

UNIT IV
Simultaneous linear equation model – Examples. Identification problem . Estimation
Using LIM, Instrumental Variables. 2 – SLS methods.

UNIT V
K class estimators; Full information Maximum Likelihood methods . 3-SLS
estimators - Simultaneous LSE and integrated LST methods . Monte Carlo studies and
simulation – Concepts of structural change – Tests of structural change
M.Sc. STATISTICS

BOOKS FOR STUDY AND REFERENCE:


QP Pattern: Unit wise internal choice with maximum 75 marks

Part A: 5 x 5 = 25 & Part B: 5 x 10 = 50
UNIT I

Linear programming problem. Formulation of LPP.

UNIT II
Graphical method of solving LPP. Simplex method –Big M method. Concept of duality in LPP. Formulation of dual problems only.

UNIT III

UNIT IV
Sequencing: problem of sequencing- basic terms used in sequencing- processing 'n' jobs through two machines- processing 'n' jobs through 'k' machines- processing two jobs through 'k' machines.

UNIT V
Game Theory: Definition-types of games- The Maximin - Minimax principle. Games without saddle points (mixed strategies)-graphical method of 2 x n and m x 2 games - Dominance property.
BOOKS FOR STUDY AND REFERENCE:


QP Pattern: Unit wise internal choice with maximum 75 marks

Part A: 5 x 5 = 25 & Part B: 5 x 10 = 50
UNIT I

UNIT II
Measures of central tendency: concept and uses. Mean, Median, Mode, Geometric Mean and Harmonic mean.

Measures of variation: concept and uses. Range, Quartile deviation, standard deviation and coefficient of variation. Measures of Skewness.

UNIT III

UNIT IV
Simple linear correlation: meaning and its uses. Scatter diagram-Karl pearson (product moment) correlation-rank correlation.


UNIT V
M.Sc. STATISTICS

BOOKS FOR STUDY AND REFERENCE:


QP Pattern: Unit wise internal choice with maximum 75 marks

Part A: 5 x 5 = 25 & Part B: 5 x 10 = 50
(For the candidates admitted from 2017 - 2018 onwards)

MODEL QUESTION PAPER
M.Sc, DEGREE EXAMINATION
BRANCH II - STATISTICS
First Semester
Core IV - SAMPLING THEORY

Time : Three hours
Maximum: 75 marks

PART A - ( 5 x 5 = 25 marks )
Answer ALL questions.
All questions carry equal marks.

1. (a) Mention the important steps involved in drafting a questionnaire. (Or)
    (b) What is meant by non-response? Write down its types.

2. (a) In SRSWOR, show that the sample mean square is an unbiased estimate of the population mean square (Or)
    (b) Explain circular systematic sampling.

3. (a) Explain separate and combined regression estimators. (Or)
    (b) Define multivariate ratio estimator.

4. (a) Explain Lahiri’s method of selecting sample under PPSWR scheme. (Or)
    (b) Derive Horwitz-Thompson estimator for population total.

5. (a) Describe the sub sampling procedure. (Or)
    (b) In double sampling for stratification, show that the sample mean is an unbiased estimate of the population mean.

PART B - (5 x 10 = 50 marks)
Answer ALL questions.
All questions carry equal marks.

6. (a) Explain the principal steps involved in sample survey? (Or)
    (b) Derive Warner’s model in randomized response technique.

7. (a) If f.p.c is ignored, then show that

\[ V_{opt} < V_{prop} < V_{rand} \] (Or)

(b) Compare systematic sampling with stratified and simple random sampling when the population consists of linear trend.

8. (a) Define ratio estimator. Derive the variance of the ratio estimator and also obtain its relative bias. (Or)
    (b) Obtain an unbiased estimate of population mean and its variance in cluster sampling.

9. (a) Define Desraj’s ordered estimator. Also derive the expression for the variance of the estimate of the population total. (Or)
    (b) In the case of pps sampling with replacement, obtain an unbiased estimator of the population total and variance of the estimator.

10. (a) Suggest an estimator for population mean in two stage sampling and obtain its variance. (Or)
    (b) Discuss double sampling for stratification and derive the standard error of estimate.