University of Rajasthan
Jaipur

SYLLABUS

M.Sc.
(STATISTICS)
2015-2016 (I & II SEMESTER)
2016-2017 (III & IV SEMESTER)
DEPARTMENT OF STATISTICS
(FACULTY OF SCIENCES)

UNIVERSITY OF RAJASTHAN
JAIPUR

SYLLABUS
For
M.A. / M.Sc. in STATISTICS

2015-2016(I & II Semester)
2016-2017(III & IV Semester)
Theme of Examination:

Part-I

- Each theory paper EoSE shall carry 100 marks.
- The EoSE will be of **3 (Three) hrs** duration for each theory paper and 4hrs duration for each practical paper.
- Part A of theory paper shall contain 10 (ten) Short Answer Questions, covering entire syllabus and each question will carry 2 (two) marks i.e. part A will be of total 20 marks.
- Part B of the Question Paper will consist of Four (04) questions with internal choice and weightage of 20 marks each. i.e. total of 80 marks.
- Each laboratory EoSE will be of **four hours** duration and involve laboratory experiments/exercises, and viva- voce examination with weightage in the ratio of 75:25 (i.e. 15% for record and 10% for viva.)

Part-II

- The student will require to earn 120 credits for PG course out of total 144 credits.
- In theory 15 hrs of theory is equal to one credit.
- In practical 45 hrs of laboratory work is equal to 2 credits.
- Each semester of PG courses shall have 36 credits.
- Each semester will have continuous assessment (CA). The continuous assessment (CA) of two components, namely (i) Internal Assessment and (ii) Sessional Test(s) in the ratio 30:70. The Internal Assessment component comprises of assessment of student’s performance on the basis of factors like Attendance, Class Room Participation, Quiz, Home Assignment etc.

Course Structure:
The details of the courses with code, title and the credits assign are as given below:
Abbreviations Used

**Course Category**

CCC: Compulsory Core Course
EEC: Elective Core Course
OEC: Open Elective Course
SC: Supportive Course
SSC: Self Study Core Course
SEM: Seminar
PRJ: Project Work
RP: Research Publication

**Contact Hours**

L: Lecture
T: Tutorial
P: Practical or Other
S: Self Study

**Relative Weights**

IA: Internal Assessment (Attendance/Classroom Participation/Quiz/Home Assignment etc.)
ST: Sessional Test
EoSE: End of Semester Examination
### Semester Wise Course Plan

<table>
<thead>
<tr>
<th>Semester</th>
<th>Paper Number</th>
<th>Nomenclature</th>
<th>Max. Marks</th>
<th>Duration of Exam</th>
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<tbody>
<tr>
<td>I</td>
<td>MST 101</td>
<td>Statistical Mathematics</td>
<td>100</td>
<td>3 Hours</td>
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<tr>
<td></td>
<td>MST 102</td>
<td>Probability Theory</td>
<td>100</td>
<td>3 Hours</td>
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<td>MST 103</td>
<td>Measure Theory</td>
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<td>Probability Distributions</td>
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<tr>
<td></td>
<td>MST 112</td>
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<tr>
<td>II</td>
<td>MST 201</td>
<td>Sampling Distributions and Bivariate Distributions</td>
<td>100</td>
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<td>MST 202</td>
<td>Statistical Inference-I</td>
<td>100</td>
<td>3 Hours</td>
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<td>MST 203</td>
<td>Design of Experiment-I</td>
<td>100</td>
<td>3 Hours</td>
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<tr>
<td></td>
<td>MST 204</td>
<td>Sample Surveys-I</td>
<td>100</td>
<td>3 Hours</td>
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<tr>
<td></td>
<td>MST 211</td>
<td>Practical based on MST 201 and MST 202 with Applications of SPSS</td>
<td>100</td>
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<tr>
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<tr>
<td></td>
<td>MST 311</td>
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<td>Multivariate Analysis</td>
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<td>**** Elective Paper-II</td>
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<td>MST 412</td>
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*: Any one from MST A01, MST A02 and MST A03  
**: Any one from MST B01, MST B02 and MST B03  
***: Any one from MST C01, MST C02 and MST C03  
****: Any one from MST D01, MST D02 and MST D03
**Elective Papers**

Student will opt Elective papers from the following list of papers with the permission of the Head of the Department.

<table>
<thead>
<tr>
<th>Paper Number</th>
<th>Nomenclature</th>
<th>Max. Marks</th>
<th>Duration of Exam</th>
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<td>Stochastic Process and Demography</td>
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<td>MST A03</td>
<td>Bio-Statistics</td>
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<tr>
<td>MST B01</td>
<td>Statistical Quality Control and Operations Research</td>
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<td>Statistical Data Mining</td>
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<td>Statistics for Clinical Trials</td>
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<td>MST C01</td>
<td>Economic Statistics and Econometrics</td>
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<td>Operation Research-II</td>
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<td>Non-Parametric and Semi-Parametric Methods</td>
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<tr>
<td>MST D03</td>
<td>Survival Analysis</td>
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# M.A. / M.Sc. STATISTICS

## First Semester

<table>
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<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Course Title</th>
<th>Course Category</th>
<th>Credit</th>
<th>Contact Hours Per Week</th>
<th>EoSE Duration (Hrs)</th>
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**Total Credit**: 36

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Total Credit: 36

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<td>CC</td>
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****: Any one from MST D01, MST D02 and MST D03

-6-
Semester I
MST 101: Statistical Mathematics

1. Linear Algebra: Inverse and rank of a matrix, solution of linear equations, orthogonal matrix, orthogonal reduction of a real symmetric matrix to a diagonal form, generalized inverse and its simple properties, idempotent and nilpotent matrices, solutions of matrix equations.

2. Bilinear and quadratic forms, reduction to canonical forms, definite and indefinite forms, index and signature, triangular reduction of a positive definite matrix, Hermitian canonical form, characteristic equation, its roots and vectors, Cayley-Hamilton theorem, beta and gamma integrals.


References:
MST 102: Probability Theory


Concept of random variables, cumulative distribution function and probability functions, joint, marginal and conditional distributions. Functions of random variables and their distributions using Jacobian of transformation for one and two variables.


Convergence in probability, Convergence in distribution. Weak law of large numbers. Central limit theorem for a sequence of independent random variables under Lindeberg’s condition, central limit theorem for independent and identically distributed random variables with finite variance. Sequence of events and random variables: Borel 0-1 law, Kolmogorov’s 0-1 law,. Law of large numbers and central limit theorems for independent variables. Kintchin’s weak law of large numbers, Tchebycheff’s and Kolmogorov’s inequalities and strong law of large numbers. Martingales.

Reference:
MST 103: Measure Theory

Classes of sets: semi ring, ring, field, sigma field, monotone classes. Sequence of sets, limit supremum and limit infimum of a sequence of sets. Additive set functions, measure, outer measure and their properties.

Cartheodry extension theorem (statement only) definition of complete measure. Lebesgue and Lebsegue Stieltjes measure (one dimension only) Probability measure, distribution function and its correspondence with Lebesgue Stieltjes.

Measurable sets and measurable space. Simple, elementary and measurable functions. Sequence of measurable functions. Integrability of measurable function, properties of integrals.

Lebesgue monotone convergence theorems, Fatous lemma, dominance convergence theorem, Absolute continuity, Random Nikodym theorem (statement only) and applications, product measure (idea only), Fubinies theorem.

Reference:
MST 104: Probability Distributions

Measures of location, dispersion, Skewness and Kutosis, Moments, Sheppard’s correction, moment and cumulant generating functions, probability generating function.

Bernoulli, Binomial (compound and truncated also), poisson (compound and truncated also), negative binomial, geometric, hyper-geometric and multinomial distributions.

Rectangular, Normal (truncated also), Exponential, Lognormal and Triangular distributions.

 Gamma, Beta, Cauchy (truncated also), Laplace distributions, Pearson’s distributions (Type I, IV and VI).

References:
MST-111 (Practical Paper Based on MST 101 & MST 104)

List of Practical (MST 101)

1. Determinants - by row and column operations, by partitioning.
2. Inverses of a matrix - by row and column operations, by partitioning
3. Rank of a matrix
4. Solutions of matrix equations
5. Characteristic roots and vectors of a matrix
6. Interpolation using Lagrange's formula, Newton-Gregory formula
7. Interpolation using Newton's divided difference formula
8. Numerical differentiation using Newton's formula
9. Numerical differentiation using Lagrange's formula
10. Numerical integration using trapezoidal formula
11. Numerical integration using Simpson's one-third formula

(MST 104)

1. Coefficient of variation.
2. Calculation of central moments, coefficient of variation, $\beta_1$, $\beta_2$ and $\gamma_1$, $\gamma_2$ coefficients, Sheppard's correction to moments.
3. Plot binomial curve for different values of $n$ and $p$
4. Fitting of binomial distributions when $p$ is known and when $p$ is unknown.
5. Fitting of Poisson distribution when $\lambda$ is known and when $\lambda$ is unknown.
6. Fitting of negative binomial distribution.
7. Fitting of Normal distribution
8. Calculation of areas under normal curve.
MST 112: Practical Paper based on Computer Applications and Data Processing


Data Processing:

Digital number system, Number conversions, Binary representation of integers, Binary representation of real numbers, Logical data element like character, fields, records, files, fundamentals of data transmission and processing including error control and error processing.

Data base management: Data Resources management. Data base and file organization and processing. (a) Direct, (b) Sequential, (c) Indexed Sequential file. Concepts of client server architecture, data base administrator. An overview of DBMS Software.

MS-Excel:
Creating, Saving & Entering Data into a Worksheet, Performing Mathematical & Statistical Computations on Data entered in a worksheet, preparing frequency Distribution Table, Creating Charts (2 & 3 Dimensional Charts)

SPSS:
Basics of SPSS with its application in Statistical Analysis.
Semester II
MST 201: Sampling Distributions and Bivariate Distributions

Sampling Distributions: Basic concepts, standard error, Chi-Square, t and F distributions (central and non-central) and their applications. Fisher’s Z-distribution and its applications.

Standard errors of functions of moments. Order statistics: their distributions and properties; joint and marginal distributions of order statistics, sampling distributions of range and median of univariate population.

Bivariate Normal Distribution: Joint, marginal and conditional distributions and their properties.

Correlation, linear regression, intra-class correlation and correlation ratio. Null and non-null distribution of sample correlation coefficient. Power series distribution.

References:
MST 202: Statistical Inference-I


Methods of Estimation: Maximum likelihood method, moments, minimum Chi-square and modified minimum Chi-square methods. Properties of maximum likelihood estimator (without proof). Confidence intervals: Determination of confidence intervals based on large samples, confidence intervals based on small samples.

Statistical Hypothesis: Simple and composite, critical region, types of errors, level of significance , power of a test, most powerful test and Neyman-Pearson lemma.


Non-Parametric Tests: Sign tests, signed rank test, Kolmogorov-Smirnov one sample test. General two sample problems: Wolfowitz runs test, Kolmogorov Smirnov two sample test (for sample of equal size), Median test, Wilcoxon-Mann-Whitney test. Test of randomness using run test based on the total number of runs and the length of a run. Concept of asymptotic relative efficiency.

Reference:
MST 203: Design of Experiment-I


Principles of design of experiments, uniformity trails, randomized experiments, completely randomized design, randomized block design, Latin square design.

Factorial Experiment $2^n$ and $3^2$, total and partial confounding. Construction of confounded factorial experiments belonging to $2^n$ series.

Analysis of non orthogonal data, analysis of missing plot and mixed plot data. Split plot and strip plot designs. Balanced incomplete block design (intra-block analysis).

References:

MST 204: Sample Surveys-1

Planning, execution and analyses of sample surveys with illustrative examples. Errors in survey, sources of non-sampling errors. Determination of sample size. Role of NSSO, CSO.

Basic finite population sampling techniques: Simple random sampling with and without replacement. Stratified sampling. Sample allocation problems in stratified sampling and related results on estimator of mean/total.

Systematic sampling, cluster sampling, two-stage sampling with equal and unequal number of second stage units, Multistage sampling.

Use of Auxiliary Information: Ratio, product and regression methods of estimation, their comparisons among them, and with sample mean under SRSWOR. Concept of double sampling and its uses in ratio, product and regression methods of estimation.

References:
MST-211 (Practical Paper Based on MST 201 & MST 202)

MST 201
1. Correlation and regression coefficients for Bivariate frequency distributions.

2. Large sample tests (i) For population mean (ii) equality of two population means (iii) For population variance (iv) equality of two population variances.
3. Small sample tests viz. t, F, $x^2$ and Z tests.

MST 202

1. Test of significance of sample correlation coefficient.
2. Sign, median and run tests for small and large samples.
3. Sequential probability ratio test and calculation of constants and graphical representation for testing simple null against simple alternative for (i) Binomial (ii) Poission (iii) Normal (iv) Exponential distributions.
MST-212 (Practical Paper Based on MST 203 & MST 204)

MST-203
1. One-way classified data
2. Two way classification with single and equal observations
3. Two way classification with unequal observations
4. Analysis of CRD.
5. Analysis of RBD.
6. Analysis of LSD.
7. Analysis of BIBD.
8. Analysis of RBD, LSD with missing observations.
9. Yates method for analysis $2^n$ factorial experiments - $n=3$
10. $2^n$ factorial experiments – $n = 4$
11. Total confounding in $2^n$, $n = 3, 4$
12. Partial confounding in $2^n$, $n = 3, 4$
13. $3^2$ factorial experiments
15. Analysis of covariance in one way classified data
16. Analysis of covariance in two way classified data

MST-204
1. Drawing of random samples from finite populations.
2. Drawing of random samples from Binomial and Normal populations.
3. Estimation of population mean and estimation of variance in SRS with and without replacement.
4. Estimation of mean and variance in stratified sampling under proportional and optimum allocations.
5. Gain in precision due to stratification.
6. Estimation of mean and variance in systematic sampling and comparison with S.R.S.
7. Estimation of mean and variance in cluster sampling and comparison with S.R.S.
8. Estimation of mean and variance by (i) ratio and (ii) regression methods of estimation.
Semester III
MST 301: Design of Experiment-II

Linear estimation, Gauss-Markoff's theorem. Testing of hypothesis: involving several linear functions, test of sub-hypothesis and test involving equality of the parameters.


Constructions of orthogonal Latin squares - (i) for prime power numbers and (ii) by Mann-Mechneish theorem. Simple methods of construction of BIB, PBID designs. Constructions of symmetrical fractional factorial experiments.

References:
MST 302: Statistical Inference-II

Location Invariance, scale invariance. Pitmann’s estimators for location and scale parameters. Proof of the properties of M.L.E, Huzur Bazaar theorem, consistent asymptotic normal (CAN) estimator, invariance property. Resampling, Bookstrap and Jacknife.


Reference:
MST-311 (Practical Based on Paper MST 301 and Elective Paper *):

(i) Testing of Hypotheses regarding equality of some treatment effects in one and two way classifications.
(ii) Analysis of Incomplete block designs without specific form of C matrix.
(iii) Group divisible designs.
(iv) Linked Block designs.
(v) Simple lattice designs with 2 or more replications.
Youden square Designs.

MST-312 (Practical Paper Based on MST 302 & Elective Paper **)

1. Power curve for testing one sided Null Hypothesis hypothesis against one sided alternative for
(i) Binomial distribution
(ii) Poisson distribution
(iii) Normal distribution
(iv) Exponential distribution

2. Power curve for testing a null hypnosis against two sided alternative for
(i) Binomial distribution
(ii) Poisson distribution
(iii) Normal distribution
(iv) Exponential distribution

3. Construction of Randomized test of a desired size for testing simple null against simple alternative hypothesis for
(i) Bernoulli’s trial
(ii) Poisson distribution.

4. Test of hypothesis using generalized likelihood ratio test for testing equality of (i) two means (ii) two variances in normal distribution(s).

*: Any one from MST A01, MST A02 and MST A03
**: Any one from MST B01, MST B02 and MST B03
MST 401: Multivariate Analysis


Maximum likelihood estimator of the mean vector and covariance, their independence and related distributions. Partial and multiple correlation coefficients.

Classification and discrimination procedure for discrimination between two multivariate normal populations, sample discriminate function, test associated with discriminate functions probabilities of misclassification and their estimation.


References:
MST 402: Sample Survey-II

Rational behind the use of unequal probability sampling: Probability proportional to size with and without replacement method (including cumulative total method and Lahri’s method), related estimators of finite population mean (Hansen-Hurwitz, Desraj’s estimators for general sample size & Murthy’s estimator for a sample of size of 2). Horvitz Thompson estimator (HTE) of a finite population total/mean and expression for variance of HTE and its unbiased estimator due to Horvitz-Thompson and Yates & Grundy.

P.P.S. Schemes of sampling due to Midzuno-Sen, Brewer, Durbin and JNK Rao (sample size of 2 only), Rao-Hartley and Cochran sampling scheme and their estimation procedure. Theory of multi-stage sampling with varying probabilities (with or without replacement) due to Durbin, Narain and Sukhatme sampling schemes.

Quenouille’s technique of bias reduction and its application to ratio type estimator, Hartley and Ross unbiased ratio type estimator. Ratio method of estimator under Midzuno scheme of sampling when X is known. Multivariate extension of ratio and regression method of estimator (when population mean of auxiliary variable is known). Inter penitrating sub sampling.

Non Sampling Errors: Hansen-Hurwitz approach of estimations from incomplete sample, Politz and Simmon’s techniques of estimation, randomized response model due to Warner. Simmons unrelated question randomized response model.

References:
MST-411 (Practical Paper Based on MST 401 & Elective Paper

1. Linear combination of correlated normal variates and evaluation of Probabilities.
2. Estimation of mean vector and covariance matrix.
3. Estimation and testing of partial and multiple correlation coefficients.
4. Discriminate function.

MST-412 (Practical Paper Based on MST 402 & Elective paper ****):

1. PPSWR Sampling: Cumulative total method, Lahri's method of sample selection/section, estimation of total and its variance.
2. Horvitz and Thompson's procedure of estimating mean (total) and variance of the population.
3. Yates and Grundy estimator of variance.
4. Midzuno's sampling schemes.
6. Two-stage sampling method where f.s.u. being selected with pps with replacement and s.s.u. with equal prob. without replacement. Estimation of optimum number of s.u. and s.s.u.

NOTE:
Those students who will opt Elective paper **** (Project work) will appear in Practical Examination based on MST 402 along with Viva-voce on their Project Work.

***: Any one from MST C01, MST C02 and MST C03
****: Any one from MST D01, MST D02 and MST D03
List

Papers

Elective
MST A01: Stochastic Processes and Demography


Census and vital statistical data, vital rates and ratio, standardization of rates trends and differentials in mortality and fertility. (Greville’s formula for construction ,Reed and Merrell’s formula, King’s method) T.F.R.,G.R.R.,N.R.R. Projection methods including fitting of logistic curve. Internal and international migration, net migration, international and postcensal estimates.


References:

-30-
MST A02: Reliability Analysis

Reliability: Concepts and measures, components and systems, coherent systems, reliability of coherent systems; cuts and paths, modular decomposition, bounds on system reliability, structural and reliability importance of components. Life distributions, reliability function; hazard rate; common life distributions-exponential, Weibull, Gamma etc. Estimation of parameters and tests in these models.

Notions of ageing, IFR, IFRA, NBU, DMRL and NBUE classes and their duals, loss of memory property of the exponential distribution; closures or these classes under formation of coherent systems, convolutions and mixtures. Univariate shock models and life distributions arising out of them; bivariate shock models; common bivariate exponential distributions and their properties.

Reliability estimation based on failure times in variously censored life tests and in tests with replacement of failed items stress-strength reliability and its estimation. Maintenance and replacement policies, availability of repairable systems, modeling of a repairable system by a non-homogeneous Poisson process.

Reliability growth models, probability plotting techniques, Hollander-Proshan and Deshpande tests for exponentiality; tests for HPP vs. NHPP with repairable systems. Basic ideas of accelerated life testing.

REFERENCES

MSTA03: BIO-STATISTICS


Estimation of points on the Quantal Response Function. Dose allocation schemes, Estimation of points on the quantal response function, Robbins-Monro Process & Procedure, Parametric estimation, up and down rule, modified up & down method, sequential up & down methods.


REFERENCES:
MST B01: Statistical Quality Control and Operation Research

Control-Charts: Concept and construction of control charts for variables and attributes and their OC Curve. Modified control limits.


Inventory Control System: Inventory models, costs, advantages, EOQ models without shortages, reorder level and optimum buffer stock, EOQ models with shortages. ABC analysis.

Queuing System: Characteristics of queuing system, Poisson process, pure birth and pure death process. Steady state solution of (M/M/1) and (M/M/C) models. (M/G/1) model—Pollaczek Khintchine formula.

References:

2. Kanti Swaroop et. al Operation Research, Sultan chand & Sons.

-33-
MST B02: STATISTICAL DATA MINING


Data Cubes and data Generalization, OLAP Technology, Clustering methods from both statistical and data mining viewpoints; vector quantization. Categorisation of major Clustering Techniques, Mining Streams, Time Series data, Biological Data.

Unsupervised learning from univariate and multivariate data; Supervised learning from moderate to high dimensional input spaces; Artificial neural networks and Extensions of regression models, Regression trees.

Introduction to databases, including simple relational databases; data warehouses and introduction to online analytical data processing. Association rules and prediction: data attributes, applications to electronic commerce. Data Mining & Data warehousing Software.

REFERENCES:
MST B03: STATISTICS FOR CLINICAL TRIALS

Introduction to clinical trials: the need and ethics of clinical trials, bias and random error in clinical studies, conduct of clinical trials, overview of Phase I-IV trials, multi-center trials. Data management: data definitions, case report forms, database design, data collection systems for good clinical practice.

Design of clinical trials: parallel vs. cross-over designs, cross-sectional vs. longitudinal designs, review of factorial designs, objectives and endpoints of clinical trials.

Design of Phase I trials, design of single-stage and multi-stage Phase II trials, design and monitoring of Phase III trials with sequential stopping, design of bioequivalence trials.


REFERENCES:

MST C01: Economic Statistics and Econometrics


Income Distributions: Pareto's law of income distributions. Engles curve, curves of concentration. Concept of national income and methods of estimating national income. Inter-sectoral flows, inter industry table.


Serial correlation, multi co-linearity, errors invariable models. Simultaneous equation models- identification, rank and other conditions. Indirect least and two stage least square. Short term economic forecasting.

REFERENCES:
MSTC02: Operations Research-II

Duality Theorems, Revised Simplex Method, Dual Simplex Method. Nonlinear programming-Kuhn Tucker conditions, Wolfe’s and Beale’s algorithms for solving, Quadratic programming problems. Bellman’s principle of optimality, general formulation, computational methods and application of Dynamic Programming.

S-S policy for inventory and its derivation in case of exponential demand, Multi Item Models, Models with variable supply and models for perishable items, Estimation of EOQ in some simple case.


References:

Additional References:
MST C03: NON-PARAMETRIC AND SEMI-PARAMETRIC METHODS


Asymptotic distribution of linear function of order statistics. Rank tests, locally most powerful rank tests, linear rank statistics and their distributional properties under null hypothesis, Pitman’s asymptotic relative efficiency.

One sample location problem, sign test and signed rank test, two sample Kolmogorov Smirnov tests. Two sample location and scale problems. Wilcoxon-mann-Whitney test, normal score test, ARE of various tests based on linear rank statistics.


REFERENCES:
MST D01: Project Work

Guidelines for Project Report

Project Duration: 1st December to 15th May. (Students may start preliminary work related to their project after third semester.)

Project Guide: Teachers from the Department of Statistics. Each project group will be guided by concerned teacher (guide) for one hour per week throughout the semester.

Fieldwork: Students will be given 4 to 6 weeks during last semester for their industrial work/data collection/survey or any other fieldwork involved in the project.

Project Topic: Students in consultation with the guide will decide Project Topic/Area. Topic may be decided after completion of third semester. Project work may be carried out in a group of students depending upon the depth of fieldwork/problem involved.

Project report: Project report should be submitted as per university norms.

Project Evaluation: Project valuation will be done according to university norms.

(i) Project Report (70 marks)
(ii) Presentation by student or group of students. (30 marks)

Project report will be evaluated from the panel of examiners submitted by B.O.S. convener.
MST D02: ACTUARIAL STATISTICS

Utility theory, insurance and utility theory, models for individual claims and their sums, survival function, curate future lifetime, force of mortality. Life table and its relation with survival function, examples, assumptions for fractional ages, some analytical laws of mortality, select and ultimate tables.

Multiple life functions, joint life and last survivor status, insurance and annuity benefits through multiple life functions evaluation for special mortality laws.

Multiple decrement models, deterministic and random survivorship groups, associated single decrement tables, central rates of multiple decrement, net single premiums and their numerical evaluations.

Distribution of aggregate claims, compound Poisson distribution and its applications. Distribution of aggregate claims, compound Poisson distribution and its applications.

REFERENCE:

MST D03: Survival Analysis


Parametric inference (Point estimation, Confidence intervals Scores, LR, MLE tests (Rao-Willks-Wald) for these distribution life tables failure rate, mean residual life and their elementary properties. Ageing classes-and their properties, Bathtub failure rate.

Estimation of survival function- Actuarial estimator, Kaplan-Meier estimator, estimation under the assumption of IFR/DFR. Tests of exponentially against non-parametric classes, total time on test, Deshpande test. Two sample problem-Gehan test, log rank test Mantel–Haenszel test, Tarone-Ware tests.

Cox’s proportional hazards model with one and several covariates. Rank test for the regression coefficients. Competing risks model, parametric and non-parametric inference for this model. Assumptions, extended Cox model, MLE of Cox PH model, hazard ratio, survival curves.

References:
List of Practical of Elective Papers For Semester –III & IV
MST A01: Stochastic Process & Demography

1. To find the Eigen values, Eigen vectors of a given stochastic matrix and test its primitiveness.
2. To find the steady state solution of an irreducible Markov Chain with a finite number of states.
3. Test for the order of Markov Chain.
4. To find the limiting probabilities of embedded Markov Chain.
5. On probability of extinction of a branching process.

MST B01: Statistical Quality Control & Operations Research

1. Problems based on Monte Carlo Simulation
2. Real Life problems based on L.P.P.
3. Duality problems
4. Transportation Problems
5. Assignment Problems
6. Replacement Problems
7. Simulation Problems based on Inventory Control
8. Simulation Problems based on Queuing Problems
9. Control charts for variables
   i. $\bar{x}$ & R charts with known parameters.
   ii. $\bar{x}$ & R charts with unknown parameters.
   iii. $\bar{x}$ & s charts with known parameters.
   iv. $\bar{x}$ & s charts with unknown parameters.
10. Control Charts for Attributes
    i. c - charts with known & unknown.
    ii. p - charts with known & unknown.
    iii. np - charts with known & unknown.
    iv. 100 np - charts with known & unknown.
11. Control charts for varying sample size.
12. Draw O.C. ASN curve of:
    (i) Single sampling Plan
    (ii) Double sample Plan
13. Find producer’s risk and consumer’s risk
MST C01: (Economic Statistics and Econometrics)

1. OLS estimation and prediction in GLM.
2. Use of dummy variables (dummy variable trap) and seasonal adjustment.
3. GLS estimation and prediction.
5. Tests for autocorrelation. BLUS procedure.
7. Instrumental variable estimation.
8. Estimation with lagged dependent variables.
9. Identification problems - checking rank and order conditions.
10. Estimation in recursive systems.
11. Two SLS estimation.
12. Simulation studies to compare OLS, 2 SLS, LISE and FIML methods.
13. Fitting of trend by all methods.
14. Determination of seasonal fluctuation by all methods.
15. Calculation of index numbers by all methods and tests for ideal index numbers.
16. Calculation of demand and income elasticity.

List of Practical will be provided on the basis of Elective Paper(s) opted by the students.