Master of Arts/Master of Science

OUTCOME BASED EDUCATION

Program outcome (POs)

Students will be able to:

PO1	**Disciplinary knowledge**: The students acquire knowledge and understanding in the field of social sciences, literature and humanities through facts, theories and fundamental concepts. It will enhance the global as well as regional knowledge.
PO2	**Critical Thinking and Problem Solving:** The students will develop critical and analytical skills to identify and analysis social issues and problems and suggest improvements for better result. It provides a multi-disciplinary and inter-disciplinary perspective to the students and enables them to analysis and critique the existing policies and explore innovative solutions.
PO3	**Investigations:** The students will analyse and evaluate data on the basis of empirical evidence and critically evaluate practices, policies and theories following scientific approach of Investigations.
PO4	**Team Learning:** The students will learning dependent individual learning and collaborative team learning through practical sessions that provide opportunities to interact with industry and gain hands-on experience
PO5	**Communication Skills**: The students will develop various communication and presentation skills which will help in expressing ideas and views clearly and effectively with the community and society at large.
PO6	**Professionalism:** The students will be confident and equipped with the skills that will promote self-management, employability, entrepreneurship, professional integrity and leadership needed in a global workplace.
PO7	**Ethics**: The students will learn values and ethics and an ability to apply these with a sense of responsibility within the workplace and community which will transform them as responsible citizens.
PO8	**Environment and Sustainable Development**: The students will be able to impart solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.
PO9	**Lifelong Learning:** The students will have the ability to develop confidence for self-education and ability for lifelong learning. The program will empower to appear for various competitive examinations and to work independently adapting to changing trades, technology and demands of work place through knowledge and skill development.

PO10	**Projects and Management:** The students will develop the ability to formulate problems and projects and to plan a process for solution taking advantage of diverse technical knowledge and skills. They can use the modern tools, techniques, skills and management principles to manage projects in multidisciplinary environments.
PO11	**Engineer and Society:** Apply reasoning and contextual knowledge to assess societal and cultural issues and the consequent responsibilities towards human, society and social institutions.
PO12	**Design/Development of solutions:** Able to come up with solutions for complex social problems and design social components or processes that meet the specified needs with appropriate considerations for the public health, safety, cultural, societal and environment considerations.

Program Specific Outcome (PSOs)

PSO 1	To develop strong foundation of statistics in students.
PSO2	To understand basic concepts of statistics, Probability theory, research methodology & project work, Designs of Experiment, survey sampling etc. in real life problems..
PSO3	To explain the applications of statistics concept in other disciplines such as mathematics, commerce, economics, etc.
PSO4	Provides a platform for pursuing higher studies leading to Post Graduate or Doctorate degrees
PSO5	Practical exercises done will enable students to analyse and interpret data and also to draw valid conclusions. This will enable students to face real time applications

Eligibility for admission:
Any candidate who has passed B.A/B.Sc. any state recognized University with not less than 40% /45%-marks in aggregate is eligible for admission, However, SC/ST, OBC and other eligible communities shall be given relaxation as per University rules.

Duration of the Programme: 2 Years

STUDY & EVALUATION SCHEME

Choice Based Credit System

Master of Arts/ Master of Science

First Semester

S. No.	Course Category	Course Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Core	MSTC101	Real Analysis & Complex Analysis	3	1	0	4	40	60	100
Theory										
2	Core	MSTC102	Matrices & Linear Algebra	3	1	0	4	40	60	100
Theory										
3	Core	MSTC103	Measure Theory & Probability	3	1	0	4	40	60	100
Theory										
4	Core	MSTC104	Distribution Theory	3	1	0	4	40	60	100
Practical										
	Statistics Lab	MSTL105	Lab Couse based on C102 and C103	0	0	2	2	40	60	100
Practical										
6	Statistics Lab	MSTL106	Lab Couse based on C104	0	0	2	2	40	60	100
			Total	12	4	4	20	240	360	600

L – Lecture, T – Tutorial, P – Practical, C – Credit

Second Semester

S. No.	Course Category	Course Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Core	MSTC201	Statistics Inference - I	3	1	0	4	40	60	100
Theory										

2	Core	MSTC202	Survey Sampling	3	1	0	4	40	60	100
Theory										
3	Core	MSTC203	Design & Analysis of Experiment	3	1	0	4	40	60	100
Theory										
4	Core	MSTC204	Linear Models and Regression Analysis	3	1	0	4	40	60	100
Practical										
5	Statistics Lab	MSTL205	Lab Couse based on C202	0	0	2	2	40	60	100
Practical										
6	Statistics Lab	MSTL206	Lab Couse based on C203	0	0	2	2	40	60	100
			Total	12	4	4	20	240	360	6

L – Lecture, T – Tutorial, P – Practical, C – Credit

Third Semester

S. No.	**Course Category**	**Course Code**	**Course Name**	**Periods**				**Evaluation scheme**		**Subject Total**
				L	**T**	**P**	**C**	**Sessional (Internal)**	**External (ESE)**	
Theory										
1	Core	MSTC301	Multivariate Analysis & Curve Fitting	3	1	0	4	40	60	100
Elective/ Optional Papers (Any three papers out of the paper No. MSTE302 to MSTE 309										
	Theory									
2	Elective	MSTE302	Advanced Operation Research -I	3	1	0	4	40	60	100
3	Elective	MSTC303	Statistical Inference I	3	1	0	4	40	60	100
4	Elective	MSTE304	Statistical Decision Theory	3	1	0	4	40	60	100
5	Elective	MSTE305	Time Series Analysis	3	1	0	4	40	60	100

6	Elective	MSTE306	Non Parametric and Semi parametric Methods	3	1	0	4	40	60	100
7	Elective	MSTE307	Research Methodology & Project Work-	3	1	0	4	40	60	100
8	Elective	MSTE308	Statistical Process and Quality Control	3	1	0	4	40	60	100
9	Elective	MSTE309	Reliability Theory	3	1	0	4	40	60	100
10	Statistics Lab	MSTL310	Lab course based on C301	0	0	2	2	40	60	100
11	Statistics Lab	MSTL311	Lab couse based on Elective papers E302, E306 and E308	0	0	2	2	40	60	100
			Total	12	4	4	20	240	360	600

L – Lecture, T – Tutorial, P – Practical, C – Credit

Fourth Semester

S. No.	**Course Category**	**Course Code**	**Course Name**	**Periods**				**Evaluation scheme**		**Subject Total**
				L	**T**	**P**	**C**	**Sessional (Internal)**	**External (ESE)**	
Theory										
1	Core	MSTC401	Economic Statistics and Demography	3	1	0	4	40	60	100
2	Elective	MSTE402	Advanced Operation Research -II	3	1	0	4	40	60	100
3	Elective	MSTE403	Official Statistics	3	1	0	4	40	60	100
4	Elective	MSTE404	Econometrics	3	1	0	4	40	60	100
5	Elective	MSTE405	Reliability Theory	3	1	0	4	40	60	100

6	Elective	MSTE-406	Environment Statistics	3	1	0	4	40	60	100
7	Elective	MSTE407	Stochastic Process	3	1	0	4	40	60	100
8	Elective	MSTE408	Bayesian Inference	3	1	0	4	40	60	100
9	Elective	MSTE409	Project Work	3	1	0	4	40	60	100
	Practical									
10	Statistics Lab	MSTL410	Lab Couse based on C401	0	0	2	2	40	60	100
	Practical									
11	Statistics Lab	MSTL411	Lab course based on Elective papers E402	0	0	2	2	40	60	100
			Total	12	4	4	20	240	360	600

L – Lecture, T – Tutorial, P – Practical, C – Credit

Examination Scheme:

Components	**Ist internal (Assignment)**	**IInd Internal (Written Exam)**	**External (ESE)**
Weightage(%)	**20**	**20**	**60**

Programme Name: M.A./M.Sc.

Course code : MSTC101				
Course Name : Real Analysis & Complex Analysis				
Semester /Year : Ist sem / Ist year				
	L	**T**	**P**	**C**
	3	1	0	4

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To summarize the data and to obtain its salient features from the mass of original data

2. To understand the basic fundamental processes and core Statistics concepts and their applications in everyday life.

3. To understand the concepts of Real Analysis and Complex Analysis and its applications

4. To understand the basic concept of differentiation and Integration

Course Contents

Unit 1:
Real Analysis: Continuity and discontinuity of functions, Differentiability, Roll's theorem, Mean Value theorem, Non differentiable functions,

Unit 2:
Riemann integration: Fundamental theorem of integral calculus, convergence of integrals and uniform convergence.

Unit 3:
Complex Analysis: Analytic functions, conformal representation, complex integration, Cauchy's Theorem, Morea's Theorem,

Unit 4:
Taylor's and Laurent's Series: Zero's and Poles of Functions, theory of Residues and its application to Contour integration.

Text Books:

1.Apostol,T.M.(1985) : Mathematical Analysis, Narosa Indian Edn.

2.ShantiNarain: A Course in Mathematical Analysis, S. Chandand Company (Pvt.) Ltd.

Reference Books:

1. Goel & Mittal : Numerical Mathematics.

2.Ruddin, Walter(1976):Principles of Mathematical Analysis, McGraw Hill.

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Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Identify the concept of a real analysis, continuity and discontinuity of functions.
CO2	Describe the Concept of differentiability and application of roll's theorem, mean value theorem.
CO3	Apply Measures of Riemann integration and fundamental theorem of integral calculus.
CO4	Analysis the Concept of analytic functions, conformal representation, complex integration and taylor's and laurent's series. .
CO5	Evaluate the different theoretical approaches of complex analysis.
CO6	Develop the critical thinking and skills for solving real analysis.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal (Assignment)	IInd Internal (Written Exam)	External (ESE)
Weightage(%)	20	20	60

Programme Name: M.A./M.Sc

Course code: MSTC102				
Course Name : Matrices & Linear Algebra				
Semester /Year : I sem / Ist Year				
	L	**T**	**P**	**C**
	3	1	0	4

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To study the concept of Matrices and Linear Algebra.
2. To study the different types of Matrices.
3. To enrich students' understanding Linear Algebra and its application

Unit 1:

Linear transformations: Algebra of matrices, row and column spaces of a matrix, elementary matrices, determinant, rank and inverse of a matrix, partitioned matrices.

Unit 2:

Vector Spaces: subspaces, linear dependence and independence, basis and dimension of vector space, finite dimensional vector spaces. Vector spaces with inner product, Gram-Schmidt orthogonalization process, ortho-normal projection of a vector.

Unit 3:

Canonical form :Hermite canonical form, diagonal form, triangular form, Jordan form, quadratic form, generalized inverse, Moore-Penrose generalized inverse,

Unit 4:

Idempotent matrix: Characteristics roots and vectors, algebraic multiplicity of a characteristic roots, Cale Hamilton theorem, spectral decomposition of a real symmetric matrix.

Text Books:

1.Seearl, S.R.(1982):Matrix Algebra for Statistical, John Wiley and Sons .

2.Rao,C.R. and Mitra, S.K.(1971):Generalized Inverse of Matrices and its Application, John Wiley and Sons Inc.

Reference Books:

1. .Biswas, S. (1984): Topics in Algebra of matrices, Academic publications.

2.ShantiNarain: A text book of matrices, S.Chand and Company (Pvt.) Ltd.

Course outcomes (COs):
Upon successful completion of the course a student will be able to:

CO1	Identify the concept of a matrices and types of matrices.
CO2	Describe determinant, rank and invers of a matrix.
CO3	Able to classify Measures of vector space, subspace, linear dependence and independence..
CO4	Analysis Concept of canonical form, hemite canonical form diagonal form, triangular form, Jordan form etc.
CO5	Evaluate the matrices concept and theories.
CO6	Develop critical analytical abilities .

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal (Assignment)	IInd Internal (Written Exam & Viva-voce)	External (ESE)
Weightage(%)	20	20	60

Programme Name: M.A./M.Sc.

Course code : MSTC103				
Course Name : Measure Theory & Probability				
Semester /Year : ISem/ Ist Year				
	L	**T**	**P**	**C**
	3	1	0	4

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To understand the basic measure theory and its application
2. To gain a reasonable knowledge and basic concepts of probability
3. To learn about the fundamental principles and processes of probability

Course Contents

Unit 1:

Measure and Integration: Measure and integration, Classes of sets, field, sigma fields, minimal sigma fields, Borel sigma fields, Limsupand limit of sets, Measure, Probability measure, properties of a measure, Lebesgue and Lebesgue-Steljes measures, measurable functions.

Unit 2

Probability : Baye's theorem, Random variable, Marginal and conditional distributions, Expectation, Tehebycheffsine quality and improvements on it, convergence in probability,

Unit :3

The weak law of large numbers: Bernoulli's theorem, convergence in distribution, continuity theorem, Khinchin's theorem. Strong law of large numbers, Kolmogorov's theorem, Borelzero- one law, Borel-Cantelli lemma.

Unit-4

Central limit theorem : Borelzero- one law,Borel-Cantelli lemma Lindberg Lev y's and

liapouneff forms.

Text Books:

1.Goon Gupta and Das Gupta: An outline of Statistical theory, World Press Calcutta, Vol.1.

2.Rohtagi,V.K. and Saleh A.K. (2005):Probability Theory, John Wiley.

Reference Books:

1. B.R. Bhat(1985):Modern Probability Theory.

2 Basu, A.K. (2001): Probability and Measure theory, Narosa Pub

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Identify the concept of a probability and its utility in real life problem
CO2	Describe the concept of measure and integration, classes of sets, sigma fields, measure probability and its properties of a measure
CO3	Apply Concept of baye's theorem and its application, random variable, marginal and conditional distribution and expectation with its properties
CO4	Analysis the Concept of weak law of large number, strong law of large number, Bernoulli theorem, convergence in distribution and Kolmogorov's theorem.
CO5	Evaluate the measure theories and probability
CO6	Develop an understanding of the probability in relation to the other

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal (Assignment)	IInd Internal (Written Exam)	External (ESE)
Weightage(%)	20	20	60

Programme Name: M.A./M.Sc.

Course code	:	MSTC104			
Course Name	:	Distribution Theory			
Semester /Year	:	Isem/ IstYear			
		L	**T**	**P**	**C**
		3	1	0	4

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To understand the basic probability, concepts, theories, and will be able to apply this knowledge to day to day life.
2. To gain a reasonable knowledge of the concepts like expectation, probability distribution.
3. To learn about the fundamental principles and processes of random variables, its types and properties.
4. To differentiate between discrete probability distributions with their properties and Continuous probability distributions with their properties.

Course Contents

Unit 1:

Univariate Distributions: Univariate Discrete distributions; properties and applications of Uniform Discrete, Binomial, Poisson, H yper-geometric, Geometric, Negative Binomial distribution and Multinomial distribution.

Unit 2

Univariate continuous Distribution: statement,derivation, properties and applications of Normal, Beta, Gamma, Cauchy, Exponential distribution

Unit 3:

Sampling Distributions: Sampling distribution from Binomial, Poisson, Exponential and Normal populations, Bi-variate distributions, Bi-variate normal, distribution of functions of

random variables. Large sample test. Derivation and properties of chi-square, T and F distribution and their inter relationship.

Unit 4:

Order Statistics: Test of significance based on chi-square, T and F distribution Order statistics-sample range, sample median, quartiles. Second order moments

Text Books:

Rao,C.R.(1973):Linear Statistical Inference and its Application, Wiley Eastern.

Kendall, M.G.,Stuart,A: The Advanced Theory of Statistics: Distribution Theory.Vol.1.

Reference Books:

1. Johnson and Kotz: Continuous Univariate Distribution,Vol.1 and Vol.2,Wiley.

.2.Dudwvicz, E.J.and Mishra, S.N.(1988):Modern Mathematics Statistics,Wiley.International students edition.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Identify discrete and continuous distributions and identify their characteristics. Students will be able to identify the type of statistical situation to which different distributions can be applied
CO2	Descibe sampling distribution theory and their applications in statistical inference. Chi- square, t and F distribution, Chebyshev's inequality
CO3	Apply various test used in sampling theory. Use the different test in solving statistical problems. .
CO4	Analysis the process of fitting of various distribution and their utility in practical life.
CO5	Evaluate the importance of fitting of distribution
CO6	Develop the ability and skill of effective analysis.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1

CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal (Assignment)	IInd Internal (Written Exam & Viva-voce)	External (ESE)
Weightage(%)	**20**	**20**	**60**

Programme Name: M.A./M.Sc.

Course code : MSTL105				
Course Name : Lab course based on C102 & C103				
Semester /Year : I Sem / I Year				
	L	**T**	**P**	**C**
	0	0	2	2

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To assess the Attitude of the individual towards women using Attitude towards women scale.

2. To measure the level of aggression of the individual using Aggression Inventory.

3. To assess the frustration level of the individual using Frustration scale.

4. To study the method for measuring social relationships using Sociometry.

Matrices and Algebra

1. Problems based on Determinant

2. Rank of Matrix

3. Inverse of Matrix

Measure Theory and Probability

1. Probability Measure

2. Problems based on Bayes' Theorem

3. Problems based on Random variable

4. Mathematical expectation

5. The weak law of large number

6.Stronglawof large number

7. Problems based on Bernoulli's Theorem

Text Books:

1.Seearl, S.R.(1982):Matrix Algebra for Statistical, John Wiley and Sons .

2.Rao,C.R. and Mitra, S.K.(1971):Generalized Inverse of Matrices and its Application, John Wiley and Sons Inc.

3.Rao,C.R.(1973):Linear Statistical Inference and its Application, Wiley Eastern.

4.Kendall, M.G.,Stuart,A: The Advanced Theory of Statistics: Distribution Theory.Vol.1.

Reference Books:

1 Biswas, S. (1984): Topics in Algebra of matrices, Academic publications.

2.ShantiNarain: A text book of matrices, S.Chand and Company (Pvt.) Ltd.
3.Johnson and Kotz: Continuous Univariate Distribution,Vol.1and Vol.2,Wiley.
4.Dudwvicz, E.J.andMishra,S.N.(1988):Modern Mathematics Statistics,Wiley.International students edition.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Remember the skill regarding analysis of data.
CO2	Apply the concepts of statistics through experiments.
CO3	Apply suitable technique for analysis data
CO4	Differentiate Quantitative and Qualitative data through practicals.
CO5	Evaluate the concepts of statistics through practical's
CO6	Develop basic tools and techniques for performing experiment

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	2	1	1	2	2	-	2	1	1	1	1	2	2	1
CO2	1	1	2	1	1	2	1	-	2	1	1	1	2	3	2	1
CO3	1	2	3	1	1	2	2	1	2	1	2	3	2	2	2	1
CO4	1	1	2	1	1	2	2	-	2	1	1	2	1	2	2	2
CO5	1	1	2	1	1	2	2	1	2	1	1	-	1	3	2	1
CO6	3	2	3	2	1	2	2	1	2	1	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination scheme:

Components	Ist internal (Assignment)	IInd Internal (Written Exam & Viva-voce)	External (ESE)
Weightage(%)	**20**	**20**	**60**

Programme Name: M.A. /M.Sc.

Course code : MSTL106				
Course Name : Lab course based on C104				
Semester /Year : I Sem / I Year				
	L	**T**	**P**	**C**
	0	0	2	2

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To gain knowledge of the concepts like expectation, probability distribution.
3. To learn about the fundamental principles and processes of random variables, its types and properties.
4. To Analysis various probability distributions and Continuous probability distributions.

Course Contents:

1 Fitting of binomial distributions for n and p=q=½.

2. Fitting of binomial distributions for given n and p.

3. Fitting of binomial distributions after computing mean and variance.

4. Fitting of Poisson distributions for given value of lambda.

5. Fitting of Poisson distributions after computing mean.

6. Fitting of negative binomial.

7. Fitting of suitable distribution.

8. Application problems based on binomial distribution.

9. Application problems based on Poisson distribution.

10. Application problems based on negative binomial distribution.

11. Fitting of normal distribution when parameters are given.

12. Fitting of normal distribution when parameters are not given.

13. Test of significance based on chi-square, T and F Distribution.

Text Books :

Rao,C.R.(1973):Linear Statistical Inference and its Application, Wiley Eastern.

Kendall, M.G.,Stuart,A: The Advanced Theory of Statistics: Distribution Theory.Vol.1.

Reference Books:

1. Johnson and Kotz: Continuous Univariate Distribution,Vol.1and Vol.2,Wiley.

.2.Dudwvicz, E.J.andMishra,S.N.(1988):Modern Mathematics Statistics,Wiley. International students edition.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Remember the skill regarding analysis of data.
CO2	Apply the concepts of statistics through experiments.
CO3	Apply suitable technique for analysis data
CO4	Differentiate Quantitative and Qualitative data through practical's.
CO5	Evaluate the concepts of statistics through practical's
CO6	Develop basic tools and techniques for performing experiment

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	2	1	1	2	2	-	2	1	1	1	1	2	2	1
CO2	1	1	2	1	1	2	1	-	2	1	1	1	2	3	2	1
CO3	1	2	3	1	1	2	2	1	2	1	2	3	2	2	2	1
CO4	1	1	2	1	1	2	2	-	2	1	1	2	1	2	2	2
CO5	1	1	2	1	1	2	2	1	2	1	1	-	1	3	2	1
CO6	3	2	3	2	1	2	2	1	2	1	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination scheme:

Components	Ist internal (Assignment)	IInd Internal (Written Exam & Viva-voce)	External (ESE)
Weightage (%)	**20**	**20**	**60**

Programme Name: M.A./M.Sc.

Course code : MSTC201				
Course Name : Statistical Inference -I				
Semester /Year : II sem/ I Year				
	L	**T**	**P**	**C**
	3	1	0	4

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To understand the basics concept of statistical inference
2. To drawing inference about the unknown population parameters based on random sample.
3. To gain understanding of estimation about the population using testing of hypothesis.
4. To understand the important tests which are using to draw valid conclusion.

Course Contents

Unit 1

Point Estimation:

Problem of point estimation: Unbiasedness, Consistency, Sufficiency, Efficiency, Complete Statistics, Complete Sufficient Statistics. Factorization theorem, Exponential family of distributions and its properties,

Unit 2

Minimum-variance unbiased estimators:

Rao Blackwell theorem. Lehmann Scheffe's theorm, Cramer- Rao Inequality. Method of estimation-Method of Maximum Likelihood and its properties.

Unit 3:

Interval Estimation:

Interval estimation: Confidence Interval, Confidence Regions, best confidence Shortest confidence intervals, General method of finding Confidence interval. Obtaining confidence intervals based on small and large samples. Relationship with the testing of hypothesis.

Unit 4:

Testing of hypothesis: Basic concept, Simple and composite hypothesis, Two types of error, power of the test, Neyman-Pearson lemma and its generalization, critical regions, construction of Most Powerful test, Uniformly Most Powerful test, Uniformly Most Powerful Unbiasedness test using NP Lemma, Likelihood ratio test and its properties.

Text Books:

1.Lehmann,E.L.(1986):Theory of Point Estimation, Student Edition.

2. Goon, A.M.,M.K.Gupta,&B.DasGupta: Outline of Statistics,Vol-I

Reference Books:

1. Zacks,S.(1971):Theor y of Statistical Inference, Wiley,NewYork.

2.Rao,C.R.(1973):Linear Statistical Inference and its applications,2nd edition, John wile y and sons.

3. Kale,B.K.(1999):A First course on Parametric Inference , Narosa Publishing House

Course outcomes (COs):
Uponsuccessfulcompletionofthecourseastudentwillbeableto:

CO1	Evaluate different quantitative and qualitative statistical methods used in inference.
CO2	Develop critical thinking in order to construct the statistical test and use the appropriate statistical analysis in statistical inference.
CO3	Evaluate different quantitative and qualitative statistical methods used in inference.
CO4	Develop critical thinking in order to construct the statistical test and use the appropriate statistical analysis in statistical inference.
CO5	Evaluate different quantitative and qualitative statistical methods used in inference.
CO6	Develop critical thinking in order to construct the statistical test and use the appropriate statistical analysis in statistical inference.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal (Assignment)	IInd Internal (Written Exam)	External (ESE)
Weightage (%)	**20**	**20**	**60**

Programme Name: M.A./M.Sc.

Course code : MSTC202				
Course Name : Survey Sampling				
Semester /Year : II sem / I Year				
	L	**T**	**P**	**C**
	3	1	0	4

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To provide tools and technique for selecting a sample of elements from a target population
2. To understand the basics of sampling methods.
3. To develop critical thinking in order to use the appropriate sampling technique.
4. To analysis and interpret data..

Course Contents

Unit 1:
Basic Principles: Census and sample surveys, advantages and disadvantages of sample surveys. Basic principles in sampling ,survey enquiries ,choice of sampling units, problems of sample size, Bias in selection and estimation, simple random sampling, sampling from finite populations with and without replacement, sampling of attributes, unbiased estimates of population total, mean and estimation of their variances.

Unit 2:
Types of Sample: Stratified Sampling: Reason for stratification, choice of strata ,choice of sampling unit, stratified random sampling, estimation of population mean and its variance, choice of sample sizes in different strata, variances of estimates with different allocation, effects of deviation from optimum allocation, estimation of the gain in precision due to stratification, cost function, construction of strata.

Unit 3:

Systematic Sampling: Systematic Sampling: Estimation of sample mean and its variance, comparison of systematic sampling with simple random and stratified sampling. Double Sampling: Multi Stage sampling with special reference to two stage design, Non- sampling errors, problems of non response, errors of measurements, Interpenetrating sub sampling randomized Response techniques. Pilot survey.

Unit 4:

Ratio and Regression Estimation:

Ratio and Regression Estimation: Ratio and regression methods of estimation, variances of the estimates, optimum property of ratio estimates, comparison among ratio and regression and simple and biased estimates. PPS Sampling schemes, sampling techniques with varying probabilities for simple random sampling. Herwit's Thompson Estimators, Mid ZunoSen Sampling Scheme

Text Books:

1. Cochran W.G.: Sampling Techniques,Wiley Eastern Ltd.,New Delhi.

2. Des RajandChandhok (1998):Sampling Theory, Narosa Publishing House.

Reference Books:

1. MukhopadhayayParimal:Theor y and Methods of Surve y Sampling-Prentice Hall of India Ltd.

2.Kish L: Survey Sampling.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Identify basic concepts of survey sampling, basic principles in sampling, Simple random sampling, systematic sampling, stratified sampling
CO2	Explain different sampling technique in real life problem related to sample survey.
CO3	Apply Simple random sampling with and without replacement
CO4	Analysis ratio and regression estimation, methods of estimation with their utility in real life problem. . .
CO5	Evaluate different sampling techniques used in research

CO6	Develop critical thinking in order to construct ration and regression.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal (Assignment)	IInd Internal (Written Exam)	External (ESE)
Weightage(%)	**20**	**20**	**60**

Programme Name: M.A./M.Sc.

Course code	**:** MSTC203			
Course Name	**:** Design & Analysis of Experiment			
Semester /Year	**:** II sem / IYear			
	L	**T**	**P**	**C**
	3	1	0	4

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

To provide basic knowledge of Analysis of Variance
2. To understand the basics of design of experiment
3. To develop critical thinking in order to use the appropriate design and conduct experiment
4. To analysis and interpret data..

Course Contents

Unit 1

Basic Designs: Analysis of Variance for one-way, two-wa y with one observation per cell for fixed, mixed and random effect models. General theory of analysis of experimental designs;

Unit 2

Completely randomized design Randomized block design and Latin square design, Missing plot techniques in RBD and LSD.

Unit 3

Advance Design : Analysis of co-variance for CRD and RBD. Split plot and strip lot designs. Complete and Partial confounding. General factorial experiments: Definition, Estimation of factor's effect. Analysis of the factorial experiments using CRD and RBD.

Unit 4

BIBD: Balanced Incomplete block designs; Balanced Incomplete Block Design with and without recovery of inter information.

Books Recommended:

1. Goon A.M., Gupta, M.K. and Das Gupta, B.:Outline of StatisticsVol.-2.

2. Das and Giri: Design and analysis of experiment.

3. Cochran,W.G.and Cox,G.M.(1959):Experimental Designs, Asia Publishing House, Singapore.

4. Mann H.B.: Analysis and Design of Experiments, Dover Publications Inc. NewYork

Reference Books:

1. DasandGiri: Design and analysis of experiment.

2. Cochran,W.G.andCox,G.M.(1959):Experimental Designs, Asia Publishing House, Singapore.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Identify the concepts of analysis of variance and appropriately interpret the results of analysis of variance test.
CO2	Explain design of experiments and analyse the data . .
CO3	Apply the concepts of advance design, analysis of co- variance for CRD and RBD. split plot design, complete and partial confounding.
CO4	Analysis balanced Incomplete block design, balanced Incomplete Block Design with and without recovery of inter information.
CO5	Evaluate the importance of design of experiment.
CO6	Develop the ways to improve the different design of experiment.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal (Assignment)	IInd Internal (Written Exam)	External (ESE)
Weightage(%)	20	20	60

Programme Name: M.A./M.S.c

Course code	**:** MSTC204			
Course Name	**:** Linear Modals & Regression Analysis			
Semester /Year	**:** II sem / IYear			
	L	**T**	**P**	**C**
	3	1	0	4

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To understand the basics of regression .
2. To understand the concept of linear modals.
3. To gain understanding of Analysis of regression lines
4. To understand the important of regression lines and different linear modals

Course Contents

Unit 1:

Standard Gauss-Markov models: Estimability of parameters, Bestlinear unbiased estimator (BLUE), method of least square and Gauss-Markov theorem, Variance and Co-variance of BLUE.

Unit 2:

Introducing of one way random: effect linear models and estimationof Variance components.

Unit 3:

Maximum likelihood: MINQUE and restricted maximum likelihood estimators of variance components, best linear unbiased predicators (BLUP).

Unit 4:

Bi-variate and multiple linear regression: polynomial regression, use of orthogonal polynomial. Linear and non- linear regression models.

Text Books:

1. Rao, C.R. and Kleffe, J. (1988). Estimation of variance component and applications, North Holland.

2. Chatterjee, S. and Prince, B. (1991):Regression Analysis b y example, John Wiley, NewYork.

Reference Books:

1. Draper, N.R. and Smith H.(1998):Applied Regression Analysis, 3 Ed. Wiley.

2.Cook, R.D. and Weisberg, S.(1982): Residuals and Inference in Regression, Chapmanand Hall

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Identify basic concepts of linear models. Theory and estimation of linear models. Gauss Markov Theorem and linear model.
CO2	Explain simple and multiple linear regression models. Violation of usual assumptions concerning normality, homoscedasticity and collinearity
CO3	Able to describe one way random effect linear models and estimation of Variance components
CO4	Analysis the concepts of maximum likelihood and best linear unbiased predicators. (BLUP) expectation and their application. Know the properties of expectation.
CO5	Evaluate the importance of linear modals.
CO6	Develop the ways to improve the analysis of regression..

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal (Assignment)	IInd Internal (Written Exam)	External (ESE)
Weightage(%)	20	20	60

Programme Name: M.A./M.Sc.

Course code : MSTL205				
Course Name : Lab Course based on C202				
Semester /Year : II sem / IYear				
	L	**T**	**P**	**C**
	3	1	0	4

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To provide tools and technique for selecting a sample of elements from a target population
2. To understand the basics of sampling methods and different sampling techniques
3.To Analysis the data by using suitable sampling technique

Course Contents

1. Select a SRS with and without replacement.

2. For a population of size 5, estimate population mean, population mean square and population variance. Enumerate all possible samples of size 2 by WR and WOR and establish all Properties relative to SRS.

3.For SRS WOR, estimate mean, standard error & the sample size.

4. Stratified Sampling: allocation of sample to strata by proportional and Ne yman's methods

5.Compare the efficiencies of above two methods relative to SRS

6.Estimation of gain in precision in stratified sampling. Comparison of systematic sampling with stratified sampling and SRS in the presence of a linear trend. Ratio and Regression estimation: Calculate the population mean or total of the population.

7. Calculate mean squares. Compare the efficiencies of ratio and regression estimators relative to SRS.

Text Books:

1. Rao, C.R. and Kleffe, J. (1988). Estimation of variance component and applications, North Holland.

2. Chatterjee, S. and Prince, B. (1991):Regression Analysis b y example, John Wiley, NewYork.

Reference Books:

1. Draper, N.R. and Smith H.(1998):Applied Regression Analysis, 3 Ed. Wiley.

2. Cook, R.D. and Weisherg, S.(1982): Residuals and Inference in Regression, Chapmanand Hall.
.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Remember the skill regarding analysis of data.
CO2	Apply the concepts of statistics through experiments.
CO3	Apply suitable technique for analysis data
CO4	Differentiate Quantitative and Qualitative data through practical's.
CO5	Evaluate the concepts of statistics through practical's
CO6	Develop basic tools and techniques for performing experiment

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	1	1	2	1	1	2	2	-	2	1	1	1	1	2	2	1
CO2	1	1	2	1	1	2	1	-	2	1	1	1	2	3	2	1
CO3	1	2	3	1	1	2	2	1	2	1	2	3	2	2	2	1
CO4	1	1	2	1	1	2	2	-	2	1	1	2	1	2	2	2
CO5	1	1	2	1	1	2	2	1	2	1	1	-	1	3	2	1
CO6	3	2	3	2	1	2	2	1	2	1	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal (Assignment)	IInd Internal (Written Exam)	External (ESE)
Weightage(%)	20	20	60

Programme Name: M.A./M.Sc.

Course code	**:** MSTC206
Course Name	**:** Lab Couse based on C204
Semester /Year	**:** II sem / IYear

L	**T**	**P**	**C**
3	1	0	4

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To understand the basics of analysis of variance.
2. To understand he appropriate design and conduct experiment for Analysis.
3. To Analysis the data by using suitable design of experiment

.

Course Contents

1.Analysis of variance for one way and two way with one/m observation per cell

2.Analysis of a CRD

3.Analysis of a RBD

4.Analysis of a LSD

5.Analysis of RBD with missing observation

6.Analysis of LSD with missing observation Analysis of co-variance for CRD and RBD Split plot and strip plot designs complete and partial confounding

7. Analysis of the factorial experiments using CRD and RBD

8 .Balanced Incomplete Block Design

9. Balanced Incomplete Block Design with and without recovery of inter information

Text Books:

1.Rao, C.R. and Kleffe, J. (1988). Estimation of variance component and applications, North Holland.

2.Chatterjee, S. and Prince, B. (1991):Regression Analysis b y example, John Wiley, NewYork.

Reference Books:

1. Feldman, R.S. (1985). Social psychology: Theories, Research and Application. New York: McGraw Hill.

2. Tripathi, L.B. (1992). Adhunik Samajik Manovigyan. Agra: National Psychological Corporation.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Remember the skill regarding analysis of data.
CO2	Apply the concepts of statistics through experiments.
CO3	Apply suitable technique for analysis data
CO4	Differentiate Quantitative and Qualitative data through practical's.
CO5	Evaluate the concepts of statistics through practical's
CO6	Develop basic tools and techniques for performing experiment

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	1	1	2	1	1	2	2	-	2	1	1	1	1	2	2	1
CO2	1	1	2	1	1	2	1	-	2	1	1	1	2	3	2	1
CO3	1	2	3	1	1	2	2	1	2	1	2	3	2	2	2	1
CO4	1	1	2	1	1	2	2	-	2	1	1	2	1	2	2	2
CO5	1	1	2	1	1	2	2	1	2	1	1	-	1	3	2	1
CO6	3	2	3	2	1	2	2	1	2	1	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal (Assignment)	IInd Internal (Written Exam)	External (ESE)
Weightage(%)	20	20	60

Programme Name: M.A./M.S.c

Course code	**:** MSTC301			
Course Name	**:** Multivariate Analysis & Curve Fitting			
Semester /Year	**:** IIIrd SEM / IInd Year			
	L	**T**	**P**	**C**
	3	1	0	0

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To understand the basic concept of multivariate analysis.

2. To learn the basic of various and it's fitting.

3. To Analysis and interpret data by using the concept of multivariate analysis..

Course Contents

Unit 1:

Multi variate normal distribution: Multivariate normal distribution and its properties. Random sampling from normal distribution. Maximum likelihood estimators of parameters, distribution of sample mean vector.

Unit 2:

WishartDistribution: Wishart matrix-its distribution and properties, distribution of sample generalized variance, null and non- null distribution of multiple correlation coefficient.

Unit 3:

Hotelling Distribution: Hotelling's T^2 and its sampling distribution, application in test on mean vector for one and more multivariate normal population.

Unit 4:

MahalonobishDistribution: Mahalonobish D^2 Statistics and its application, Principal component. Orthogonal polynomials, Hermite polynomials, Pearsonian system of curves.

Text Books:

1. Anderson,T.W.(1983):An Introduction to Multivariate Statistical Analysis,2Nd Ed.,Wiley.

2. N.S. Giri: Multivariate Statistical Analysis.

Reference Books:

1. Johnson, R. and Wychern (1992): Applied Multivariate Statistical Analysis, Prentice Hall, 3 Edition.

2. Sharma, S.(1996): Applied Multivariate Techniques, Wiley.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Identify sample mean vector, sample covariance matrix, partial and multiple correlation. .
CO2	Describe multivariate normal distribution and its properties, characteristic function, moments, marginal and conditional distribution, etc.
CO3	Apply characteristic function, moments, marginal and conditional distribution, etc. .
CO4	Analysis Wishart distribution and its properties.
CO5	Evaluate the different theoretical approaches of multivariate analysis.
CO6	Develop the critical thinking and skills of curve fitting.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination scheme:

Components	Ist internal (Assignment)	IInd Internal (Written Exam & Viva-voce)	External (ESE)
Weightage(%)	20	20	60

Programme Name: M.A./M.S.c

Course code : MSTE302				
Course Name : Advanced Operation Research- I				
Semester /Year : IIIsem / IInd Year				
	L	**T**	**P**	**C**
	3	1	0	4

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To understand the fundamental concepts of operation research.
2. To Acquire the fundamental concepts of linear programming
3. To learn and analysis the transportation problem and assignment problem and to solve it

Course Contents

Unit 1:

Basics of O.R :Definition and scope of Operational research, phases in Operations Research, models and their solutions. Review of linear programming problems (LPP);

Unit 2:

Games Theory: Two-person game's, pure and mixed strategies, existence of solution and uniqueness of value in zero sum games, finding solution in 2x2,2x m and mxn games, reduction of game problem to a linear programming problem. Allocation Problems, transportation problem (TP),degeneracy in TP, unbalanced TP, Assignment Problem.

Unit 3:

Queuing Theory: Queuing Models, Stead y-state solutions of (M/M/1) and (M/M/C) models with associated distribution of queue length and waiting time, M/G/1 queue.

Unit 4:

NLP: Non-Linear Programming, Kuhn-Tucker conditions, Wolfe's and Beale's algorithms for solving quadratic programming problems. Inventory Control-Economic lot size, Formulae of

Harris for known demand and its extension allowing shortage, Random demand; discrete and continuous cases.

Books Recommended:

1. Sharma, S.D.: Operation Research, Pragati Prakashan, Meerut.

2. Taha,H.A.(1982):Operations Research: An Introduction; Mac Millan Publishing Company, NewYork.

Reference Books:

1. Kanti Swaroop, Gupta,P.K. and Singh, M.M.(1985): Operations Research; Sultan Chand and Sons.

2.Hadle y, G and Whitin, T.M.(1963):Analysis of Inventory System; Prentice Hall

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Identify the concepts of operation research
CO2	Describe the concept of linear programming and their procedure for obtaining the best results..
CO3	Apply the concept of basic feasible solution and their different to find initial feasible solution
CO4	Analysis between transportation and assignment problems as LPP.
CO5	Evaluate the different theoretical approaches of operation research.
CO6	Develop the thinking and skills of analysis .

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal (Assignment)	IInd Internal (Written Exam)	External (ESE)
Weightage(%)	20	20	60

Programme Name: M.A.M.S.C

Course code : MSTE303				
Course Name : Statistical Inference –I				
Semester /Year : IIIsem / IInd Year				
	L	**T**	**P**	**C**
	3	1	0	4

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To understand the basics concept of statistical inference
2. To drawing inference about the unknown population parameters based on random sample.
3. To gain understanding of estimation about the population using testing of hypothesis.
4. To understand the important tests which are using to draw valid conclusion.

Course Contents

Unit1

Consistency and asymptotic relative efficiency of estimators. Consistent asymptotic normal (CAN) estimator. Method of maximum likelihood, CAN estimator for one parameter Cramer family, Cramer- Huzur bazar theorem. Solutions of likelihood equations, method of scoring. Fisher lower bound to asymptotic variance. MLE in Pitman family and double exponential distribution, MLE in censored and truncated distributions.

Unit 2

Similar tests, Neyman structure, UMPU tests for composite hypotheses, Invariance tests and UMP in variant tests, Likelihood ratio test, Asymptotic distribution of LRT statistic, Consistency of large sample test, Asymptotic power of large sample test.

Unit 3

Sequential tests-SPRT and its properties, Wald's fundamental identity, OC and ASN functions. Sequential estimation.

Unit 4

Non-parametric methods-estimation and confidence interval, U-statistics and their asymptotic properties, UMVU estimator, non parametric tests-single sample location, location cum-symmetry, randomness and goodness of fit problems; Rank order statistics, Linear rank statistics, Asymptotic relative efficiency.

Text books:

1. Ferguson, T.S. (1967). Mathematical Statistics, Academic Press.
2. Gibbons, J.D. and Chakraborti, S. (1992). Non parametric Statistical Inference, Marcel Dekker.
3. Kale, B.K. (1999).A First Courseon Parametric Inference, Narosa Publishing House.
4. Lehmann, E.L. (1986).Theory of Point Estimation, John Wiley & Sons.
5. Lehmann, E.L. (1986).Testing Statistical Hypotheses, John Wiley & Sons.

Reference Books:

1. Randles, R.H. and Wolfe, D.S. (1979).Introduction to the Theory of Non- parametric Statistics, John Wiley & Sons.
2. Rao, C.R. (1973).Linear Statistical Inference and Its Applications, Second Ed., Wiley Eastern Ltd.,
3.Rohatgi, V.K.and Saleh, A.K. Md.E. (2005).An Introduction to Probability and Statistics, Second Edition, John Wiley.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Identify fundamental concepts of Point estimation. Properties of estimators and mean square error, Minimum variance unbiased estimators, Rao
CO2	Describe Large sample test, Use of central limit theorem to obtain large sample tests for binomial proportions and means of populations, etc., Related confidence intervals.
CO3	Apply the different methods of estimations.
CO4	Analysis practical utility of various test of significance based on t, F and chi square test.
CO5	Evaluate the different theoretical approaches of statistical inference..
CO6	Develop the critical thinking and skills of statistical tests.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal (Assignment)	IInd Internal (Written Exam)	External (ESE)
Weightage(%)	20	120	60

Programme Name: M.A./M.Sc.

Course code : MSTE-304				
Course Name : Statistical Decision Theory				
Semester /Year : IIIsem / IInd Year				
	L	**T**	**P**	**C**
	3	1	0	4

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To study the basic concepts of decision theory.

2. To apply the concepts of decision problem and solve it.

3. To Analysis the different decision problem through practical's.

Course Contents

Unit 1:

Decision theory :Decision problem and 2-person game, utility theory, loss functions, expected loss, decision rules (non- randomized and randomized), decision principles (conditional Bayes, frequentist), inference problems as decision problems, optimal decision rules, concepts of admissibility and completeness, Bayes rules, admissibility of Bayes' rules, Supporting and separating hyper plane theorems.

Unit 2:

Mini-max theorem: finite parameter space, mini-max estimators of Normal and Poisson means, admissibility of minimax rules, Invariant decision rules-location parameter problems, invariance and minimaxity, admissibility of invariant rules.

Unit 3:

Complete class theorem: complete and essentially complete classes in simple estimation and testing situations, estimation of a distribution function, Multivariate normal distribution, Exponential family of distributions.

Unit 4:

Sufficient Statistics: essentially complete classes of rules based on sufficient Statistics, Complete Sufficient Statistics, sequential decision rules, Baye's and minimax sequential decision rules, invariant sequential decision problems, sequential tests of a simple hypothesis against a simple alterative, SPRT and stopping rule principle.

Text Book:

1. Berger, J.O. (1985): Statistical Decision Theory andBayesian Analysis, 2 Edition Springer Verlag.

2. Rohatgi,V.K,(1988):An Introduction to Probability y and Mathematical Statistics, Wile y Eastern, NewDelhi.

Reference Book:

1. Rao,C.R.(1973):Linear Statistical Inference and its Applications, Wiley Eastern.

2. Ferguson,T.S.(1967):Mathematical Statistics-A Decision Theoretic Approach, Academic Pres.

Course outcomes (COs):
Upon successful completion of the course a student will be able to:

CO1	Identify the basic concept of decision theory and problems
CO2	Explain the knowledge about minimax theorem
CO3	Apply the qualitative data and interpret the result of the test.
CO4	Analysis statistics and its related theorem.
CO5	Evaluate the importance of statistical decision theory.
CO6	Develop the ability and skill of effective decision.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination scheme:

Components	Ist internal (Assignment)	IInd Internal (Written Exam & Viva-voce)	External (ESE)
Weightage(%)	20	20	60

Programme Name: M.A./ M.Sc

Course code	**:**	MSTE305			
Course Name	**:**	Time Series Analysis			
Semester /Year	**:**	III rd sem / IInd Year			
		L	**T**	**P**	**C**
		3	1	0	4

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1.Enabled to design and conduct the components of time series.
2. To understanding of the process generating a time series
3. To learn forecasting future values of the observed series.
4. To Analysis the time series data by using different components..

Course Contents

Unit 1:

Introduction: Time-Series as discrete parameter, stochastic process. Auto covariance Autocorrelation function and their properties. Exploratory time series analysis, Holt and Winters smoothing. Forecasting based on smoothing, adaptive smoothing.

Unit 2:

Detailed study : stationary processes;(1) moving average(MA), (2)autoregressive(AR),

(3)ARMAand(4)AReintegratedMA(ARIMA) models. Box-Jenkinmodels.

Unit 3:

Discussion:(without proof) of estimation of mean, auto covariance and autocorrelation function under large sample theory. Choice of AR and MA periods. Estimation of AR IMA model parameters, Forecasting.

Unit 4:

Spectral analysis of weakly stationary process. Periodogram and correlogram analysis Computations based on Fourier transform. Spectral decomposition of weakly AR process and representation as a one- sided MA process, necessary and sufficient condition. Implication in prediction problems.

Text Books:

1. Anderson, T.W. (1971):The Statistical Analysis of Time Series, John Wiley, New York.

2. Box, G.E.P. and Jenkins, G.M. (1976): Time Series Analysis- Forecasting and Control, Holden-day, San Francisco.

Reference Books:

1. Kendall,SirMauriceandOrd,J.K.(1990):TimeSeries,EdwardArnold, London. **4.** Findle y, D.F.(Ed.)(1981):AppliedTimeSeriesII,AcademicPres

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Identify the concepts of time series, the different models, measurement of trend and seasonal variations.
CO2	Describe the fitting a various mathematical curve and growth curve.
CO3	Apply method of moving average and estimation of seasonal component by method of simple averages..
CO4	Analysis the process of moving average and autoregressive process of order one and two..
CO5	Evaluate the approaches and various techniques used in time series analysis.
CO6	Develop the different components of times series.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4

CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	**Ist internal (Assignment)**	**IInd Internal (Written Exam)**	**External (ESE)**
Weightage (%)	**20**	**20**	**60**

Programme Name: M.A./M.S.c

Course code	**:** MSTE306			
Course Name	**:** Non Parametric and Semi Parametric Methods			
Semester /Year	**:** IIIsem / IInd Year			
	L	**T**	**P**	**C**
	3	1	0	4

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To introduce the concepts of non parametric methods.
2. To understand various tests which are using in non-parametric methods.
3. To learn various ways of analysis the data by using different test.
4. To apply non parametric methods of testing of hypothesis.

Course Contents

Unit 1:

Empirical distribution:function, Glivenko Cantelli Theorem, Kolmogorov Goodness off it test.

Unit 2:

One sample U-statistics: Kernel and symmetric kernel, Two sample U-statistics, Asymptotic distribution of U- statistics. UMVUE property of U-statistics, Asymptotic distribution of linear function of order statistics.

Unit 3:

Rank tests: Locally most powerful rank tests, Linear rank statistics and their distributional properties under null hypothesis, Pitman's asymptotic relative efficiency.

Unit 4:

One sample location problem: sign test and signed rank test, two sample Kolmogorov S mirnov tests. Two sample location and scale problems.Wilcoxon-Mann-Whitney test, normal scoretest, ARE of various tests based on linerankstatistics.Kruskal–Wallis K sample test. Cox's Proportional Hazard Model, rank test (partial likelihood) for regression coefficients. Concepts of Jackknifing method of Quenouille for reducing bias, Bootstrap methods, Confidence intervals

Text Books:

1.Davison,A.C.andHinkley, D.V. (1997):Boot strap methods and their application, Cambridge University Press.

2.Gibbons,J.D. (1995): Non-parametric statistical inference,2nd ed., Marcel Dekker, Inc.

Reference Books:

1..Randles, R.H. and Wolfe, D.A. (1979):Introduction to the theory of non-parametric statistics, John Wiley & Sons, Inc.

2.Puri,M.L. and Sen,P.K.(1971):Non para metric method sin multivariate analysis, John Wile y & Sons, Inc

Course outcomes (COs):
Upon successful completion of the course a student will be able to:

CO1	Identify the basic concept and importance of non-parametric methods
CO2	Explain the concept of empirical distribution function and Kolmogorov goodness of fit test
CO3	Apply parametric and non- parametric test.
CO4	Analysis testing of hypothesis using non- parametric test.
CO5	Evaluate the various methods in non-parametric.
CO6	Write a difference between parametric & non parametric methods.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	I[st] internal (Assignment)	II[nd] Internal (Written Exam)	External (ESE)
Weightage(%)	**20**	**20**	**70**

Programme Name: M.A./M.Sc.

Course code	**:** MSTE307			
Course Name	**:** Research Methodology & Project Work			
Semester /Year	**:** IIIthsem / IInd Year			
	L	**T**	**P**	**C**
	3	1	0	4

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To understand how the principles of research methodology can be applied to the area of research
2. To understand the concepts and theories of research problem, research design..
3. To understand the comparative study of different methods of data collection
4. To teach students how to construct of questionnaires for project work.

Course Contents

Unit 1:

Meaning of Research: Objective of Research–Approach to research–significance of research – type of research–research in Social Sciences–facts, theories and concepts in Social Science research–research design– features of a good research design.

Unit 2:

Research problem: Identifying the research problem–formulation of research problem-concept of hypothesis– role and formulation of hypothesis–scientific method of research–nature of scientific research–stages of scientific method.

Unit 3:

Logic and scientific method : Deductive and inductive methods – the Case stud y method-merits and demerits of Case study methods–survey methods– merits and demerits of survey methods– Types of survey–selecting the survey method–sample surveys–different types–merits and demerits.

Unit 4

Schedule and questionnaire: Principle underlying the construction of questionnaire-measurement and scaling techniques–processing and analysis of data. Interpretation and report writing–Steps–bibliography, quality of a good research report.

Text Books:

1. Kothari, C.R.(1985):Research Methodology: Methods and Techniques, Wiley Eastern**.**

2. Dominowski, R.L.(1980):Research Methods ,Prentice Hall Inc. New Jersey.

Reference Books:

1.Mishra, R.P.(1980): Research Methodology, Handbook Concept Publishing Company, NewDelhi.

2.IIPS(1996):Research Methodology, IIPS, Mumbai

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Identify the basic concepts meaning of research and types of research
CO2	Explain research problems selection and necessity of research problems.
CO3	Apply the concepts of survey methodology and how to collect data collection, processing data analysis and interpretations..
CO4	Analysis to develop a questionnaire collect survey data and their analysis by using suitable statistical tools.
CO5	Evaluate the research methods for analysis data.
CO6	Develop the ability to use the research concepts.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal (Assignment)	IInd Internal (Written Exam)	External (ESE)
Weightage (%)	15	15	70

Programme Name: M.A./M.Sc.

Course code : MSTE308				
Course Name : Statistical Process and Quality Control				
Semester /Year : IIIrd sem / IInd Year				
	L	**T**	**P**	**C**
	3	1	0	4

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. . To introduce the basic concepts of statistical quality control
2. To Learn techniques and approach of SQC being used in various filed especially industry
3. Describe the concepts of various methods to control quality
4. Describe the concept of sigma and index numbers.

Course Contents

Unit 1:

I**ntroduction**: Basic concept of process monitoring and control, process capability and process optimization. General theory and review of control charts for attribute and variable data; O.C. and A.R.L. of control charts; control by gauging; Moving average and exponentially weighted moving average charts; Cu-sum charts using V-masks and decision intervals; Economic design of X-bar chart.

Unit 2:

Acceptance sampling plans: attribute inspection; single, double and sequential sampling plans and their properties; Plans for inspection by variables for one-sided and two-sided specifications; Mil Std and IS plans; continuous sampling plans of Doge type abd Wald Wolfowitz type and their properties. Bayesian sampling plans.

Unit 3:

Capability indices Cp, Cpk and Cpm; estimation, confidence intervals and tests of hypotheses relating to capability indices for Normally distributed characteristics. Use of Design of Experiments in SPC; factorial experiments, fractional factorial designs, construction of such designs and analysis of data.

Unit 4:

Multivariate quality control; use of control ellipsoid and of utility function.

Books Recommended:

1. Montgomery, D.C. (1985): Introduction to Statistical Quality Control; Wiley.
2. Wetherill, G.B. and Brown, D.W.: Statistical Process Control: Theory and Practice; Chapman and Hall.

Reference Books:

1. Phadke, M.S.(1989): Quality Engineering Through Robust Design, Prentice Hall.
2. Ott, E.R. (1975): Process Quality Control; McGraw Hill

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Identify the basic concepts of statistical process control tools
CO2	Explain the various tools which are using to control quality
CO3	Apply the statistical product control tools and sampling inspection plan
CO4	Analyse and check whether the process in control or out of control by applying various control charts.
CO5	Evaluate the work attitudes and their impact on quality control.
CO6	Develop the ability & skill to perform statistical quality control. .

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal (Assignment)	IInd Internal (Written Exam)	External (ESE)
Weightage (%)	20	20	60

Programme Name: M.A./M.S.c

Course code : MSTE309				
Course Name : Reliability Theory				
Semester /Year : IIIrd sem / IInd Year				
	L	**T**	**P**	**C**
	0	0	2	2

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To understand the concepts of Reliability and its use
2. To gain the knowledge of various measures of Reliability
3. To grasp the concept of Basic ideas of accelerated life testing.

Course Contents

Unit 1

Reliability concepts and measures: components and systems; coherent systems; Reliability of coherent system; cuts and paths; modular decomposition; bounds on system reliability; structural and reliability importance of components.

Unit 2

Life distribution: reliability function, hazard rate; common life distribution- exponential, Weibull, gamma, normal, etc.; Estimation of parameters and tests in these models.

Unit 3

Notion of aging ;IFR; IFRA; NBU; DMRL and NBUE classes and their duals; Io of memory property of the exponential distribution; closures of these classes under formation of coherent system; convolution and mixture. Basic ideas of accelerated life testing.

Unit 4

Univariate shock models: life distribution 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.

Text Book:

1. Zacks, S.: Reliability Theory, Springer.
2. Barlow, R.E. and Proschan, F. (1985): Statistical Theory of Reliability and Life Testing; Holt, Rinehart and Winston.

Reference Book :

1. Nelson, W. (1982): Applied life Data Analysis; John Wiley.

2. Lawless, J.F. (1982): Statistical Models and Methods of Life Time Data; John Wiley.

Course outcomes (COs):
Upon successful completion of the course a student will be able to:

CO1	Identify the concepts of Reliability
CO2	Explain the various measures based on Reliability
CO3	Able notion of aging and its practical use
CO4	Analysis the concept related to univariate shock models
CO5	Evaluate the work attitudes and their impact on Reliability.
CO6	Develop the ability & skill to perform Reliability. .

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	**Ist internal Assignment**	**IInd Internal Written Exam**	**External (ESE)**
Weightage(%)	**20**	**20**	**60**

Course code : MSTL310				
Course Name : Lab course based on Elective				
Semester /Year : IIIsem / IInd Year				
	L	**T**	**P**	**C**
	0	0	2	2

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To understand how the principles of psychology can be applied to the area of education.
2. To understand the concepts and theories of creativity and aptitude in Educational Psychology.
3. To comprehend the effective teaching and classroom management strategies.
4. To understand the role and responsibilities of teachers towards the learners with special needs.

Course Contents

1.Multivariate normal distribution and Random sampling from multivariate normal distribution.

2. Maximum likelihood estimators of parameters, distribution of sample mean vector.

3.Wishart matrix-its distribution and properties, distribution of sample generalized variance Non-null distribution of multiple correlation coefficient.

4.Hotelling' sT^2 and its sampling distribution, application on mean vector for one and more multivariate normal population.

5.MahalonobishD^2 Statistics and its application.

6. Principal component. Orthogonal polynomials, Hermite polynomials, Pearsonian system of curves.

Text Books:

1. Anderson T.W.(1983):An Introduction to Multivariate Statistical Analysis,2_{Nd}Ed.,Wiley.

2.N.S. Giri: Multivariate Statistical Analysis.

Reference Books:

1. Johnson, R. and Wychern (1992): Applied Multivariate Statistical Analysis, Prentice Hall, 3 Edition.

2. Sharma, S.(1996): Applied Multivariate Techniques, Wiley.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Remember the skill regarding analysis of data.
CO2	Apply the concepts of statistics through experiments.
CO3	Apply suitable technique for analysis data
CO4	Differentiate Quantitative and Qualitative data through practical's.
CO5	Evaluate the concepts of statistics through practical's
CO6	Develop basic tools and techniques for performing experiment

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	1	1	2	1	1	2	2	-	2	1	1	1	1	2	2	1
CO2	1	1	2	1	1	2	1	-	2	1	1	1	2	3	2	1
CO3	1	2	3	1	1	2	2	1	2	1	2	3	2	2	2	1
CO4	1	1	2	1	1	2	2	-	2	1	1	2	1	2	2	2
CO5	1	1	2	1	1	2	2	1	2	1	1	-	1	3	2	1
CO6	3	2	3	2	1	2	2	1	2	1	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal (Assignment)	IInd Internal (Written Exam)	External (ESE)
Weightage(%)	**20**	**20**	**60**

Programme Name: M.A./M.S.c

Course code : MSTL311				
Course Name : Lab Course based on Elective				
Semester /Year : IIIrd sem / IInd Year				
	L	**T**	**P**	**C**
	0	0	2	2

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1.To understand the application of psychological concepts for growth and wellbeing.

2. To comprehend the relevance of psychology with other disciplines.

3. To comprehend and utilize a strengths-based coping strategy for dealing with mental health concerns.

Course Contents

1. Allocation problem using Transportation model

2. Allocation problem using Assignment model

3. Problems based on North west corner method.

4. Problems on two persons games Problems on two persons games by dominance rule problems on inventory control

5. Problems on quadratic programming

Text Books:

1. Sharma, S.D.: Operation Research, Pragati Prakashan, Meerut.

2. Taha,H.A.(1982):Operations Research: An Introduction; Mac Millan Publishing Company, NewYork.

Reference Books:

1. Kanti Swaroop, Gupta,P.K. and Singh, M.M.(1985): Operations Research; Sultan Chand and Sons.

2.Hadle y, G and Whitin, T.M.(1963):Analysis of Inventory System; Prentice Hall

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Remember the skill regarding analysis of data.
CO2	Apply the concepts of statistics through experiments.
CO3	Apply suitable technique for analysis data
CO4	Differentiate Quantitative and Qualitative data through practicals.
CO5	Evaluate the concepts of statistics through practical's
CO6	Develop basic tools and techniques for performing experiment

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	1	1	2	1	1	2	2	-	2	1	1	1	1	2	2	1
CO2	1	1	2	1	1	2	1	-	2	1	1	1	2	3	2	1
CO3	1	2	3	1	1	2	2	1	2	1	2	3	2	2	2	1
CO4	1	1	2	1	1	2	2	-	2	1	1	2	1	2	2	2
CO5	1	1	2	1	1	2	2	1	2	1	1	-	1	3	2	1
CO6	3	2	3	2	1	2	2	1	2	1	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal Assignment	IInd Internal Written Exam	External (ESE)
Weightage(%)	**20**	**20**	**60**

Programme Name: M.A./M.S.c

Course code	**:** MSTL311			
Course Name	**:** Lab Couse based on E306			
Semester /Year	**:** III rd sem / IInd Year			
	L	**T**	**P**	**C**
	4	1	0	4

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To introduce the concepts of non-parametric methods.
2. To understand various tests which are using in non-parametric methods.
3. To learn various ways of analysis the data by using different test.
4. To apply non parametric methods of testing of hypothesis.

Course Contents

1. One sample and two sample sign test

2. Wald-Wolfo witz run test,

3. Run test for randomness,

4. Median test and Wilcoxon-Mann-Whitney test). Rank tests,

5. Locally most powerful rank tests, Linear rank statistics.

6. One sample location problem, Sign test and signed rank test, Two sample Kolmogorov smirnov tests

7. Two sample location and scale problems. Kolmogorov goodness of fit

Text Books:

1.Davison,A.C.and Hinkley, D.V. (1997):Boot strap methods and their application, Cambridge University Press.

2.Gibbons,J.D. (1995): Non-parametric statistical inference,2nd ed., Marcel Dekker, Inc.

Reference Books:

1..Randles, R.H. and Wolfe, D.A. (1979):Introduction to the theory of non-parametric statistics, John Wiley & Sons, Inc.

2.Puri,M.L. and Sen,P.K.(1971):Non para metric method sin multivariate analysis, John Wile y & Sons, Inc

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Remember the skill regarding analysis of data.
CO2	Apply the concepts of statistics through experiments.
CO3	Apply suitable technique for analysis data
CO4	Differentiate Quantitative and Qualitative data through practicals.
CO5	Evaluate the concepts of statistics through practical's
CO6	Develop basic tools and techniques for performing experiment

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	1	1	2	1	1	2	2	-	2	1	1	1	1	2	2	1
CO2	1	1	2	1	1	2	1	-	2	1	1	1	2	3	2	1
CO3	1	2	3	1	1	2	2	1	2	1	2	3	2	2	2	1
CO4	1	1	2	1	1	2	2	-	2	1	1	2	1	2	2	2
CO5	1	1	2	1	1	2	2	1	2	1	1	-	1	3	2	1
CO6	3	2	3	2	1	2	2	1	2	1	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal Assignment	IInd Internal Written Exam	External (ESE)
Weightage(%)	**20**	**20**	**60**

Programme Name: M.A./M.S.c

Course code	**:** MSTL311			
Course Name	**:** Lab Course based on E308			
Semester /Year	**:** IIIrdsem / IInd Year			
	L	**T**	**P**	**C**
	0	0	2	2

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To analysis various controls charts for controlling quality
2. To understand the statistical product control tools and sampling inspection plan.
3 To Analyse and check whether the process in control or out of control by Appling various control charts.

Course Contents

1.Construction and interpretation of statistical control charts for

a) R-chart
b) s-chart
c) np-chart
d) p-chart
e) c-chart
f) u-chart

2. Single sample inspection plan: Construction and interpretation of OC, AQL, LTPD, ASN, ATI, AOQ, AOQL curves.
3. Calculation of process capability and comparison of 3-sigma control limits with specification limits.
4. Calculate price and quantity index numbers using simple and weighted average of price relatives.
5. To Calculate the Chain Base Index numbers.
6. To Calculate the Consumer Price Index numbers.
7. Practical based on shifting of base, splicing and deflating of index numbers

Text Book:

1. Suddhendu Biswas, Statistics of Quality Control, New Central Book Agency Kolkata

2. Arun Kumar and Alka Chaudhary, Applied Statistics, Krishna House, 11, Shivaji Road Meerut..

Reference Books:

1.David, H. (1995). ISO Quality Systems Handbook, 2nd Ed., Butterworth Heinemann Publication.

2. Montgomery, D. C. (2009). Introduction to Statistical Quality Control, 6th Ed., Wiley India Pvt. Ltd.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Remember the skill regarding analysis of data.
CO2	Apply the concepts of statistics through experiments.
CO3	Apply suitable technique for analysis data
CO4	Differentiate Quantitative and Qualitative data through practical's.
CO5	Evaluate the concepts of statistics through practical's
CO6	Develop basic tools and techniques for performing experiment

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	1	1	2	1	1	2	2	-	2	1	1	1	1	2	2	1
CO2	1	1	2	1	1	2	1	-	2	1	1	1	2	3	2	1
CO3	1	2	3	1	1	2	2	1	2	1	2	3	2	2	2	1
CO4	1	1	2	1	1	2	2	-	2	1	1	2	1	2	2	2
CO5	1	1	2	1	1	2	2	1	2	1	1	-	1	3	2	1
CO6	3	2	3	2	1	2	2	1	2	1	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal Assignment	IInd Internal Written Exam	External (ESE)
Weightage (%)	**20**	**20**	**60**

Programme Name: M.A. /M.S.c

Course code : MSTC401				
Course Name : Economic Statistics & Demography				
Semester /Year : IVthsem / IInd Year				
	L	**T**	**P**	**C**
	0	0	2	2

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. **The objectives of this course are:**
1. To introduce the concepts of demography and its types
2. To help students in defining and to collect valid demography data using different methods
3. To gain specific knowledge about basic measures of Mortality, Fertility and life table.
4. To understand how to construct life Tables and various measures of Index numbers.

Course Contents

Unit 1

Time Series Analysis: Time Series Analysis, Objects, Decomposition, Tests of Randomness, Trend component, polynomial, logistic, Gompertz, Log-normal trend functions, Moving average, Spencer's formulae and effects, Slutsk y- yule effect, Variate difference method, Measurement of seasonal and cyclic functions, Periodogramand Harmonic analysis, Auto correlation and Correlogram analysis.

Unit 2

Demand Analysis: Demand Analysis, Distribution of Income, Income and Demand elasticities. Methods for estimating elasticities using family budget data and time series data, Engel's Curve and Engel's law, Pareto's law.

Unit 3

Demography: Source of Demographic data, Limitations and uses of demographic data, vital rates and ratios, Definition, construction and uses, life tables, complete and abridged construction of life table from vital statistics, uses of life tables. Logistic and other population growth curves.

Unit 4:
Measure of fertility,Gross and Net reproduction rates, stationary and stable population theory. Uses of Lotka'sstable population theory in estimation of demographic parameters, methods of inter- censaland post-censal estimation.

Books Recommended:

1. Lodge,II. F & Roming:Sampling Inspection P lansand Tables, John Wile y

2. Goon Gupta and Das Gupta: Fundamental of Statist ics, Vol-II, The World Press, Pvt. Ltd.

3. Biswas, S: Stochastic processes in demograph y and applications

4. Johnsonton J: Economic Models, John Wile y and Sons, NewYork.

Reference Books:

1. Kaplan, R. M., &Saccuzzo, D. P. (2005). Psychological testing: Principles, applications and issues. New Delhi: Cengage.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Identify the basic concepts of vital statistics. Mortality rates, fertility rates and their measurements. Have a basic idea about migration and population projection.
CO2	Describe the various measures of mortality and fertility and their practical utility in different fields.
CO3	Apply the concepts of life table, their constructions, uses of time table and their utility for the society.
CO4	Analysisbetween gross reproduction and net reproduction rate.
CO5	Evaluate the work attitudes and their impact on economic statistics.
CO6	Develop the ability & skill to perform economic statistics

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2

CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination scheme:

Components	Ist internal (Assignment)	IInd Internal (Written Exam & Viva-voce)	External (ESE)
Weightage(%)	**20**	**20**	**60**

Programme Name: M.A./M.S.c

Course code	**:** MSTE-402			
Course Name	**:** Advanced Operation Research- II			
Semester /Year	**:** IVthsem / IInd Year			
	L	**T**	**P**	**C**
	3	1	0	4

L - Lecture T – Tutorial P – Practical C – Credit

CourseObjectives:

Theobjectivesofthiscourseare:

1.To understand the concept of integer programming.
2. To Learn the sequencing and scheduling problem
3. To learn various ways of analysis CPM and PERT

Course Contents

Unit 1:

Integer Programming : Integer Programming, Branch and bound algorithm and cutting plane algorithm. Multi- criterion and goal programming.

Unit 2:

Sequencing and Scheduling Problem: Sequencing and scheduling problems, 2 machines n –job and 3-machinesn-job problems with identical machine sequence for all jobs, 2-jobn-machine problem with different routing, branch and bound method for solving travelling-salesman problems. Sensitivity analysis. Parametric programming.

Unit 3:

Project Management: Project management, CPM and PERT, probability of project completion, PERT- crashing.

Unit 4:

Replacement Problem: Replacement problems: block and age replacement policies; dynamic programming approach for maintenance problems, replacement of items with long life.
Queuing Theory: Transient solution of M/M/1 queue; bulk queues (bulk arrival and bulk service), finite queues, GI/G/1 queue and its solutions, simulation of queues.

Text Book:

1. Taha, H.A. (1982) : Operations Research: An Introduction; Mac Millan Publishing Company, New York.

2. Shamblin, J.E. and Stevens,G.T.(1974) : Operations Research: A Fundamental Approach; McGraw
Hill.

3. KantiSwaroop, Gupta, P.K. and Singh, M.M. (1985): Operations Research Sultan Chand and Sons.

4. Kleinrock,L. (1975) : Queuing Systems, Vol.I; John Wiley.

5. Starr, M.K.and Miller, D.W. (1962): Inventory Control-Theor y and Practice; PrenticeHall.

Reference Books:

1. Weiten, W., Dunn, D. S., & Hammer, E. Y. (2012). Psychology applied to modern life: Adjustment in 21st century (10th Ed.). Belmond, CA: Wadsworth, Cengage Learning.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Identifythe basic concepts of Operation research, Formulation of a linear programming problem, Obtain graphical solutions to a linear programming problem.
CO2	Explain the concept of linear programming and their procedure for obtaining the best results..
CO3	Apply the concept of basic feasible solution and their different to find initial feasible solution
CO4	Analysis between transportation and assignment problems as LPP, solve transportation and assignment problems using different methods.
CO5	Evaluate the different theoretical approaches of operation research.
CO6	Develop the critical thinking and skills for solving probels based on operation research..

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1

CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal Assignment	IInd Internal Written Exam	External (ESE)
Weightage(%)	**20**	**20**	**60**

Programme Name: M.A./M.S.c

Course code : MSTE403				
Course Name : Official Statistics				
Semester /Year : IV sem / IInd Year				
	L	**T**	**P**	**C**
	5	1	0	6

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To understand the concepts of Indian Statistical System
2. To Differentiate between International & state statistical system
3. To understand the function of various Statistical offices.

Course Contents

Unit 1

Introduction to Indian and International Statistical systems. Present Official Statistical System in India, role, functions and activities of central and state organization. Organization of large scales ample survey methods of collection of official statistics, Role of National Sample Survey Organization.

Unit 2

General and special data dissemination systems, population growth in developed and developing countries. Evaluation of performance of family welfare programs projection of labor force and man power. Scope and content of population of census of India.

Unit 3

System of collection of agriculture Statistics, Crop forecasting and estimation. Support prices buffer stock, impact of irrigation projects.

Unit 4

Statistics related to industries, balance of payment, cost of living, educational and other Social Statistics.

Text Books:

1. Basic Statistics relating to Indian Economy (CSO) 1990.

2. Statistical system in India (CSO) 1975.

Reference Books:

1.Guide to Official Statistics (CSO) 1999.

2. Principles and accommodation of National Populations Census. UNESCO.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Identify the concepts of statistical system in India
CO2	Explain the function of various statistical office in India
CO3	Apply the concept of population census.
CO4	Analysis the work of various offices like CSO, NSSO etc.
CO5	Evaluate the different theoretical approaches of indian official statistics.
CO6	Develop the critical thinking of official statistics.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal Assignment	IInd Internal Written Exam	External (ESE)
Weightage(%)	**20**	**20**	**60**

Programme Name: M.A./M.S.c

Course code : MSTE404				
Course Name : Econometrics				
Semester /Year : IVthsem / IInd Year				
	L	**T**	**P**	**C**
	5	1	0	6

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To understand the concepts of econometric
2. To gain the knowledge of various econometric models
3. To Understand the concept of maximum likelihood and its application

Course Contents

Unit 1

Models and Identification, Meaning of Econometrics, formulation of economic phenomena with specification analysis, Meaning of street.

Unit 2

Problems involved in construction of Econometric models. Endogenous and exogenous variables. Concept of Multi collinearity. Identification everywhere in the parametric space, Ward's criteria of identification.

Unit 3

Estimation Methods of estimation–two stage three stage, least squares, k–class estimates with properties. Bias and Moments Matrix.

Unit 4

Maximum likelihood estimators, full information and limited information, Monte Carlo studies

Text Books:

1. Johnston,J.(1984):Econometrics methods,ThirdEdition,McGraw Hill.

2. Apte,P.G.(1990):Textbooks of Econometrics, Tata McGraw Hill.

Reference Books:

1. Damodar N. Gujrati(2004):Basic Econo metrics, Fourth edition, McGraw Hill.

2. Cramer,J.S.(1971):Empirical Econometrics, NorthHolland.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Identify the concepts of various econometric models
CO2	Explain the different between various models.
CO3	Apply the concept of multicollinearity
CO4	Analysis the concept related to estimation
CO5	Evaluate the different theoretical approaches of econometrics
CO6	Develop the critical thinking and skills for solving econometrics.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal Assignment	IInd Internal Written Exam	External (ESE)
Weightage(%)	**20**	**20**	**60**

Programme Name: M.A./M.S.c

Course code : MSTE405				
Course Name : Reliability Theory				
Semester /Year : IVthsem / IInd Year				
	L	**T**	**P**	**C**
	5	1	0	6

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To understand the concepts of Reliability and its use
2. To gain the knowledge of various measures of Reliability
3. To grasp the concept of Basic ideas of accelerated life testing.

Course Contents

Unit 1

Reliability concepts and measures: components and systems; coherent systems; Reliability of coherent system; cuts and paths; modular decomposition; bounds on system reliability; structural and reliability importance of components.

Unit 2

Life distribution : reliability function, hazard rate; common life distribution- exponential, Weibull, gamma, normal, etc.; Estimation of parameters and tests in these models.

Unit 3

Notion of aging ;IFR; IFRA; NBU; DMRL and NBUE classes and their duals; Io of memory property of the exponential distribution; closures of these classes under formation of coherent system; convolution and mixture. Basic ideas of accelerated life testing.

Unit 4

Univariate shock models :life distribution arising out of them; bivariate shock models; common bivariate exponential distributions and their properties. Reliability estsimation based on failure times in variously censored life tests and in tests with replacement of failed items; stress-strength reliability and its estimation.

Text Book:

1. Zacks, S.: Reliability Theory, Springer.
2. Barlow, R.E. and Proschan, F. (1985): Statistical Theory of Reliability and Life Testing; Holt, Rinehart and Winston.

Reference Book :

1. Nelson, W. (1982): Applied life Data Analysis; John Wiley.

2.Lawless, J.F. (1982): Statistical Models and Methods of Life Time Data; John Wiley.

Course outcomes (COs):
Upon successful completion of the course a student will be able to:

CO1	Identify the concepts of Reliability
CO2	Explain the various measures based on Reliability
CO3	Able notion of aging and its practical use
CO4	Analysis the concept related to univariate shock models
CO5	Evaluate the work attitudes and their impact on Reliability.
CO6	Develop the ability & skill to perform Reliability.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	**Ist internal Assignment**	**IInd Internal Written Exam**	**External (ESE)**
Weightage(%)	**20**	**20**	**60**

Programme Name: M.A.M.S.c

Course code	**:** MSTE406			
Course Name	**:** Environment Statistics			
Semester /Year	**:** IVthsem / IInd Year			
	L	**T**	**P**	**C**
	5	1	0	6

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To understand the concepts of environment Statistics
2. To gain the knowledge and practical utility of Environment Statistics

Course Contents

Unit 1:

Ecological diversity : species abundance curve, Indices of diversity (Simpson's Index, Shannon- Wiener index).Resources- Maximum sustainable yield, tragedy of the commons,
Unit 2:
Diversity as average rarity: Harvesting renewable biological

Unit 3:
Pollution: Air and water pollution, precaution to control pollution

Unit 4:
Methods to Control Pollution

Text Book:

1. Bodkin,DanielD.(1995):Environmental Science-Earth as a living planet,John Wile y&Sons, NewYork

2. Clack, C.W.(1976):Mathematical Bioeconomics: Optimal management of renewable resources, John Wiley and Sons, NewYork

Reference Book:

1.Pielow,E.C.(1997):An introduction to Mathematical ecolog y, John Wiley and Sons, NewYork

2.Gore,Anil and Paranhoe,S.A.(2000):Acourseon Mathematical and Statistical Ecology, Kluwer.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Identify the concepts of environment Statistics
CO2	Explain the ecological diversity species and abundance curve
CO3	Apply various harvesting renewable biological resources
CO4	Analyse major issues of environment.
CO5	Evaluate the importance of environment statistics.
CO6	Develop the ability and skill of control pollution.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal Assignment	IInd Internal Written Exam	External (ESE)
Weightage(%)	**20**	**20**	**60**

Programme Name: M.A./M.S.c

Course code	**:** MSTE407			
Course Name	**:** Stohastic Process			
Semester /Year	**:** IVsem / IIndYear			
	L	**T**	**P**	**C**
	5	1	0	6

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To understand the concepts of Stochastic Process
2. To gain the knowledge regarding Markov Chains.
3. To understand the poisson process and related distribution .

Course Contents

Unit 1:

Probability generating function : Binomial, Poisson, Geometric and Negative Binomial. Convolution. General Stochastic Process, Definition, classification and examples. Compound distribution.

Unit 2 :
Branching process: Properties of Generating function, Probability of extinction, Distribution of total progeny. Random walk, first passage time, Gambler's ruin problem, duration of game.

Unit 3 :
Markov chains: higher transition probabilities. Classifications of states and chain, determination of higher transition probabilities. Stability of Markov system, limiting behavior.

Unit 4
Poisson process : related distribution. Generalization of Poisson process. Birth process, Yule-Furry process, Generalized Birth death processes, Linear Birth death processes.

Text Book :

1. Medhi, J. (1982): Stochastic process, New age international, New Delhi.
2. Bhat, B.R.: Stochastic models, Analysis and applications

Referance Book

1.Ross, S.M.: Stochastic process, New age international, New Delhi.
2.Bailey, N.T.J.: Elements of Stochastic process.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Identify the concepts of Stochastic process and it use.
CO2	Explain the branching process and its properties
CO3	Apply various distribution related to Poisson process
CO4	Analysis the concept related to Markov chain and branching process
CO5	Evaluate the importance of stochastic process
CO6	Develop the ability and skill of stochastic process.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal Assignment	IInd Internal Written Exam	External (ESE)
Weightage(%)	**20**	**20**	**60**

Programme Name: M.A.M.S.c

Course code	**:** MSTE408			
Course Name	**:** Bayesian Inference			
Semester /Year	**:** IVthsem / IInd Year			
	L	**T**	**P**	**C**
	5	1	0	6

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To understand the concepts of Inference
2. To gain the knowledge of Bayesian Inference.
3. To Describe the practical utility of Bayesian Inferance

Course Contents

Unit 1 :

Subjective probability: existence and interpretation. Prior distribution, subjective determination of prior distribution. Improper priors, non-informative (default) priors, invariant priors. Conjugate prior families, construction of conjugate families using sufficient statistics of fixed dimension, mixtures of conjugate priors, hierarchical priors and partial exchangeability. Parametric Empirical Bayes.

Unit 2

Bayesian inference : Bayes sufficiency, summary through posterior, predictive inference.

Unit 3 :

Bayesian decision theory:Bayes solutions for practical decision problems. Point estimation, credible sets, testing of hypotheses. Comparison with classical procedures. Admissibility and minimaxity of Bayes and generalized Bayes procedures.

Unit 4 :

Ideas on Bayesian robustness: Asymptotic expansion for the posterior density. Bayesian calculation, Monte-Carlo Integration and Markov chain. Monte Carlo techniques (Without proof).

Text Book:

1. Berger, J.O.: Statistical Decision Theory and Bayesian analysis, Springer Verlag.

2. Robert, C.P. and Casella, G.: Monte Carlo Statistical Methods, Springer Verlag.

ReferenceBook:

1. Leonard, T. and Hsu, J.S.J.: Bayesian Methods, Cambridge University Press.

2. Box, G.P. and Tiao, G.C.: Bayesian Inference in Statistical Analysis, Addison- Wesley.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Identify the concepts of Bayesian Inference
CO2	Explain the basic subjective probability and its use
CO3	Apply various theory based on Bayesian Theory
CO4	Analysis the concept related to ideas on Bayesian robustness
CO5	Evaluate the importance of inference.
CO6	Develop the ability and skill of effective Bayesian inference.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal Assignment	IInd Internal Written Exam	External (ESE)
Weightage(%)	**20**	**20**	**60**

Programme Name: M.A./M.S.c

Course code	**:** MSTE409			
Course Name	**:** Project Work			
Semester /Year	**:** IVthsem / IInd Year			
	L	**T**	**P**	**C**
	5	1	0	6

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To understand the concept of project work
2. To gain the knowledge and benefits of project work
3. To understand their subject clearly for doing project work

Course Contents

The ProjectWork will spread over the whole semester. A project may be undertaken by a group of students. However, the project report shall be submitted by each member of the group separately. A project report shall clearly state the problem addressed, the methodology adopted, the assumption and the hypotheses formulated, any previous reference to the study undertaken, statistical analyses performed and the broad conclusion drawn. There shall be an external examiner and an internal examiner (preferably the supervisor of the student) for the evaluation of the project work.

Text Book:

1. Basic Statistics relating to Indian Economy (CSO) 1990.

2. Statistical system in India (CSO) 1975.

Reference Book

1. Guide to Official Statistics (CSO) 1999.

2. Principles and accommodation of National Populations Census. UNESCO.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Identify the concepts and use of project work.
CO2	Explain the advantage of project work.

CO3	Apply the utility and practical use of project work.
CO4	Analysis the practical utility of project work
CO5	Evaluate the importance of project work.
CO6	Develop the ability and skill of effective project work.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	3	1	1	-	-	2	2	-	2	1	1	1	3	2	1	1
CO2	3	2	1	-	-	2	1	-	2	1	1	1	3	2	1	1
CO3	2	2	1	1	1	2	2	-	2	2	2	3	3	1	2	1
CO4	2	2	1	-	-	2	2	-	2	1	2	2	3	2	2	2
CO5	3	2	2	-	-	2	2	-	2	1	-	-	2	2	1	1
CO6	2	2	1	1	1	2	2	-	2	2	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal Assignment	IInd Internal Written Exam	External (ESE)
Weightage(%)	**20**	**20**	**60**

Programme Name: M.A./M.S.c

Course code : MSTL410				
Course Name : Lab Course based on Elective				
Semester /Year : IVthsem / IInd Year				
	L	**T**	**P**	**C**
	5	1	0	6

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1. To introduce the concepts of demography and its types
2. To help students in defining and to collect valid demography data using different methods
3. To gain specific knowledge about basic measures of Mortality, Fertility and life table.
4. To understand how to construct life Tables and various measures of Index numbers

Course Contents

1. Construction of price and quantity index numbers by Laspeyre's formula, Paasche's formula, Marshall- Edge worth's formula, Fisher's Formula.

2. Comparison and interpretation. Construction of whole sale price index number, fixed base index number and consumer price index number with interpretation

3. Construction and interpretation of X bar & R-chart
4. Construction and interpretation p-chart (fixed sample size) and c-chart
5. Computation of measures of mortality, Completion of life table
6. Computation of measures of fertility and population growth
7. To calculate CDR and Age Specific death rate for a given set of data
8. To find Standardized death rate by :-(i)Direct method (ii)Indirect method
9. To construct a complete life table

Text Books:

1. Basic Statistics relating to Indian Economy (CSO) 1990.

2. Statistical system in India (CSO) 1975.

Reference Books

1. Guide to Official Statistics (CSO) 1999.

2. Principles and accommodation of National Populations Census. UNESCO.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Remember the skill regarding analysis of data.
CO2	Apply the concepts of statistics through experiments.
CO3	Apply suitable technique for analysis data
CO4	Differentiate Quantitative and Qualitative data through practicals.
CO5	Evaluate the concepts of statistics through practical's
CO6	Develop basic tools and techniques for performing experiment

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	1	1	2	1	1	2	2	-	2	1	1	1	1	2	2	1
CO2	1	1	2	1	1	2	1	-	2	1	1	1	2	3	2	1
CO3	1	2	3	1	1	2	2	1	2	1	2	3	2	2	2	1
CO4	1	1	2	1	1	2	2	-	2	1	1	2	1	2	2	2
CO5	1	1	2	1	1	2	2	1	2	1	1	-	1	3	2	1
CO6	3	2	3	2	1	2	2	1	2	1	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal Assignment	IInd Internal Written Exam	External (ESE)
Weightage(%)	20	20	60

Programme Name: M.A./M.S.c

Course code : MSTL411				
Course Name : Lab Course based on E402				
Semester /Year : IVthsem / IIrd Year				
	L	**T**	**P**	**C**
	0	0	2	2

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives:

The objectives of this course are:

1**The objectives of this course are:**

1.To understand the concept of integer programming.

2. To learn the sequencing and scheduling problem

3. To learn various ways of analysis CPM and PERT

Course Contents

1. Project management through PERT/CPM, Updating of PERT Charts.
2. Project Crashing, Sequencing Problems.
3. Processing n jobs through two/three machines.
4. General n/m job-shop problem.
5. Replacement problems.Block and age replacement policies;
6. Dynamic programming approach for maintenance problems;
7. Approach for maintenance problems; Replacement of items with long life.
8. Transient solution of M/M/ 1queue; Bulk queues (bulk arrival and bulk service); Finite tequeues; GI/ G/1queue and its solutions; simulation of queues.

Text Book:

1.Taha, H.A. (1982) : Operations Research: An Introduction; Mac Millan Publishing Company, New York.

2.Shamblin, J.E. and Stevens,G.T.(1974) : Operations Research: A Fundamental Approach; McGraw
Hill.

3.KantiSwaroop, Gupta, P.K. and Singh, M.M. (1985): Operations Research Sultan Chand and Sons.

Reference Books:

1. Weiten, W., Dunn, D. S., & Hammer, E. Y. (2012). Psychology applied to modern life: Adjustment in 21st century (10th Ed.). Belmond, CA: Wadsworth, Cengage Learning.

Course outcomes (COs):

Upon successful completion of the course a student will be able to:

CO1	Remember the skill regarding analysis of data.
CO2	Apply the concepts of statistics through experiments.
CO3	Apply suitable technique for analysis data
CO4	Differentiate Quantitative and Qualitative data through practical's.
CO5	Evaluate the concepts of statistics through practical's
CO6	Develop basic tools and techniques for performing experiment

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	1	1	2	1	1	2	2	-	2	1	1	1	1	2	2	1
CO2	1	1	2	1	1	2	1	-	2	1	1	1	2	3	2	1
CO3	1	2	3	1	1	2	2	1	2	1	2	3	2	2	2	1
CO4	1	1	2	1	1	2	2	-	2	1	1	2	1	2	2	2
CO5	1	1	2	1	1	2	2	1	2	1	1	-	1	3	2	1
CO6	3	2	3	2	1	2	2	1	2	1	2	3	2	3	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Examination Scheme:

Components	Ist internal Assignment	IInd Internal Written Exam	External (ESE)
Weightage (%)	**20**	**20**	**60**