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VEER NARMAD SOUTH GUJARAT UNIVERSITY
University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
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From,
Dr. R.D. Patel,
Prof. & Head,
Department of Statistics,
Veer Narmad South Gujarat University,
SURAT - 395007,
GUJARAT.

No./Stat/3110/2019
Date: 15.2019

માન્ય કાર્યાલય નં. ૭-૬-૨૦૨૮
ખાતા.....૬૧.....વિભાગ.....૩૨૨૭

To,
The I/C Registrar,
V.N.S.G. University,
Surat.

Sub.: Proposed Syllabus of M.Sc. (Statistics) and M.Sc.(Applied Statistics) to
be effective from 2019-20.

Dear Sir,

On behalf of Chairman BOS in Statistics, I am submitting herewith syllabus of M.Sc. (Statistics) and M.Sc.(Applied Statistics) formed by Sub-committee to be implemented from academic year 2019-2020.

Kindly do the needful in the matter.

Thanking you,

Yours sincerely,

(R.D. Patel)

Encl.: Syllabus

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

M.Sc.: APPLIED STATISTICS

Effective From: 2019 – 2020

**1. Fee structure :- Higher Payment Course
Rs. 12000/- per semester + university fees**

2. Eligibility for Admission:

- A student having statistics / mathematics / quantitative techniques / econometrics / research methodology at under graduate or post graduate level as principal / subsidiary subjects and has secured 40% marks will be eligible for admission to this course
- Any graduate with three subjects with one of them should be statistics / mathematics and has secured at least II class will be eligible for admission to this course.

3. Passing standard in this course; as per prevailing rules sanctioned by the University.

Nalel
Rajyognit.
B. Maiti
Ans

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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M.Sc.: APPLIED STATISTICS

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University Campus, Udhana-Magdalla Road,
Surat - 395 007.

M.Sc.: APPLIED STATISTICS

Effective from: 2019 – 2020
SEMESTER – I

Paper No.	Title of the Paper	Marks			Work Load (hrs /week)	Credit Point
		Int.	Ext.	Total		
MAS-101	Basic Mathematics and Elements of Probability Theory	30	70	100	4	4
MAS-102	Probability Distributions	30	70	100	4	4
MAS-103	Sample Survey	30	70	100	4	4
MAS-104	Industrial Statistics	30	70	100	4	4
MAS-105	Introduction to Ms-Office and Internet	30	70	100	4	4
MAS-106	Practical paper-I (Practical +viva-voce) based on Paper - 101, 102,103	20+ 10 =30	50+ 20 =70	100	4	2
MAS-107	Practical paper-II (Practical +viva-voce)based on Paper - 104, 105	20+ 10 =30	50+ 20 =70	100	4	2
Total		210	490	700	28	24
Total workload per week		28				

SEMESTER – II

Paper No.	Title of the Paper	Marks			Work Load (hrs /week)	Credit Point
		Int.	Ext.	Total		
MAS-201	Statistical Inference -I	30	70	100	4	4
MAS-202	Statistical Inference -II	30	70	100	4	4
MAS-203	Multivariate Analysis	30	70	100	4	4
MAS-204	Actuarial Statistics	30	70	100	4	4
MAS-205	Computer Programming Language - "C"	30	70	100	4	4
MAS-206	Practical paper-III (Practical +viva-voce) based on Paper - 201, 202, 203	20+ 10 =30	50+ 20 =70	100	4	2
MAS-207	Practical paper IV (Practical +viva-voce) based on Paper - 204, 205	20+ 10 =30	50+ 20 =70	100	4	2
Total		210	490	700	28	24
Total workload per week		28				

M.Sc.: APPLIED STATISTICS
Effective from: 2020 – 2021
SEMESTER - III

Paper No.	Title of the Paper	Marks			Work Load (hrs /week)	Credit Point
		Int.	Ext.	Total		
MAS-301	Statistics for Economics	30	70	100	4	4
MAS-302	Operations Research - I	30	70	100	4	4
MAS-303	Econometrics	30	70	100	4	4
MAS-304	Introduction to Statistical Softwares	30	70	100	4	4
MAS-3051 MAS-3052 MAS-3053	Elective* (Any one) Database Management Systems Official Statistics Population Studies	30	70	100	4	4
MAS-306	Practical paper V (Practical +viva-voce) based on Paper - 301,302,303	20+ 10 =30	50+ 20 =70	100	4	2
MAS-307	Practical paper VI (Practical +viva-voce) based on Paper - 304, 305	20+ 10 =30	50+ 20 =70	100	4	2
Total		210	490	700	28	24
Total workload per week		28				

* Elective Paper is to be selected from the above list of papers from papers 3051 to 3053.

SEMESTER – IV

Paper No.	Title of the Paper	Marks			Work Load (hrs /week)	Credit Point
		Int.	Ext.	Total		
MAS-401	Design of Experiments	30	70	100	4	4
MAS-402	Operations Research - II	30	70	100	4	4
MAS-4031 MAS-4032 MAS-4033	Elective* (Any one) Data Mining Bio-statistics & Clinical Research Statistical Simulation	30	70	100	4	4
MAS-404	Practical paper VII (Practical +viva-voce) based on Paper - 401, 402,403	20+ 10 =30	50+ 20 =70	100	4	4
**	Project and Seminar	60	140	200	4 hour per week per group	8
Project Viva		30	70	100		4
Total		420	280	700	16 + project workload	
Total workload per week		16 +project workload				

* Elective Paper is to be selected from the above list of papers from paper 4031 to 4033.

** To be done at some industry / firm / organization.

Grand Total: 2800 Marks

SEMESTER- I

PAPER: MAS-101

BASIC MATHEMATICS AND ELEMENTS OF PROBABILITY THEORY

UNIT I:

- Concepts of Function, Algebra of functions, Algebra of functions Polynomial and Exponential functions &Logarithmic functions.
- Concept of Derivative of a function. Derivatives of x^n , e^x , $\log x$. Algebra of differentiation. Interpretation of derivative as rate of change & Applications.
- Integration as an inverse operation of differentiation. Definite Integral. Integral as the area under a curve. Properties of Integral. Integrals of some standard functions & its Applications.

UNIT II:

- Sums of some standard series of positive terms.
- **Numerical Methods:** Solution of algebraic and transcendental equations, Numerical integration, Concept of interpolation, Simpson 1/3 rule & 3/8 rule & its Applications.

UNIT III:

- Determinants, Matrices, Algebra of matrices: Determinants & its properties. Scalar multiplication, addition and multiplication of matrices. Inverse of a square matrix. Concept of rank of a matrix. Rank determination. Linear equations, Systems of linear equations as matrix equations. Characteristic roots and vectors.

UNIT IV:

- Permutations and Combinations.
- **Probability:** Sample space of a chance experiment, Elementary outcomes, Events, Representation of events as sets, Combination of events (Complements, Intersections, Unions). Probability functions over a sample space (Discrete case). Case of Equally likely, elementary outcomes: Laplace definition of probability of an event, Axioms of probability. Combinatorial problems of Probability calculation. Conditional Probability. Bayes Theorem. Independent events.

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12. Sastry S. S.(2006): “Introductory Methods of Numerical Analysis” ; Prentice Hall India. 4th Ed., ISBN:10: 8120327616, ISBN:13: 9788120327610
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PAPER: MAS - 102
PROBABILITY DISTRIBUTIONS

UNIT I:

• **Random Variables & their Distributions :**

Definition of random variable, Discrete and continuous random variable. Probability distribution of a random variable. Concept of Probability mass function and Probability density function, Distribution Function (d.f.) of a random variable.

• **Expectations & Moments of a Distribution :**

Expectation of a random variable & a function of a random variable (Discrete and Continuous case). Moments, Different types of moment generating functions, Mean, Variance, Standard deviation, Skewness and Kurtosis of a random variable (distribution). Independence of variables. Linear transformation of variable, Moments under linear transformation, Problems on calculation of mean, variance, S.D. and other moments of a distribution.

UNIT II:

• **Frequency Distributions :**

Frequency distribution of a discrete and continuous random variable (Grouping of data in terms of class intervals). Mean, variance and Moments of a frequency distribution. Bivariate frequency distribution, Conditional distributions and their properties.

UNIT III:

• **Some Common Discrete Distributions: (proofs for p.m.f., mean & variance only):** Bernoulli distribution, Binomial distribution, Poisson distribution, Hyper-geometric distribution, Negative Binomial distribution, Geometric distribution. General concept of m.g.f. & other important properties of distributions (without proof).

UNIT IV:

• **Some Common Continuous Distributions: (proofs for p.d.f., mean & variance only):**

Uniform distribution, Normal distribution, Exponential distribution, Beta and Gamma distribution. General concept of m.g.f. & other important properties of distributions (without proof)

• **Sampling Distributions:** χ^2 - distribution, t – distribution, F – distribution, Distribution of \bar{x} and S^2 for Normal distribution.

REFERENCES

1. Mood A. M., Graybill F. A. and Boes D. C. (2001): “An Introduction to Theory of Statistics”; McGraw Hill and Tata McGraw Hill. ISBN: 100070445206, ISBN-13: 9780070445208
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Statistics, 2nd Ed **ISBN: 10-** 8126519266, **ISBN-13:** 9788126519262

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PAPER: MAS – 103

SAMPLE SURVEY

UNIT I:

- **Planning and Execution of Surveys :**

Concept of population, sample, Advantages of sample survey, Principal steps in a sample survey and Determination of sample size, Pilot surveys, selection of enumerators, training of enumerators, supervision of enumerators, control of quality of field work, observation, reinterviews, field edit, follow-up of nonresponse, interpenetrating sub samples, time coding, tabulation, control of data processing, use of computers, report writing, general report, technical report.

- **Data Collection in Selected Fields :**

Surveys of agricultural area, surveys of agricultural production, demographic surveys, employment and unemployment surveys, consumer expenditure surveys, surveys of health, industrial surveys, surveys of distributive trade, sampling as an census surveys of road traffic, public opinion surveys, marketing research, payroll surveys, postal traffic surveys, sociological research.

UNIT II:

- **Simple random sampling:**

Selection of sample, Estimation of population total and means, standard error and coefficient of variation of estimator.

- **Stratified random sampling:**

Estimation of mean, variance of the estimator, Estimation of the variance, Estimation of gain due to stratification from a stratified sample: finding sample sizes under proportional and optimum allocations and their comparisons for a given sample.

UNIT III:

- **Systematic Sampling :**

Estimation of mean, variance of the estimator, Estimation of variance based on interpenetrating sub samples, Comparison of systematic and simple random sampling for a given population.

- **Two stage sampling :**

Estimation of the population mean, variance of the estimator and Estimation of the variance for first stage units of equal sizes, finding optimum values of first and second stage sample sizes for a given simple cost function.

UNIT-IV:

- **Cluster sampling :**

Meaning and need, Estimation of population mean per unit, variance of estimator. Estimation of this variance. Variance in terms of intra class correlation coefficient as its comparison with unistage mean per unit estimator, when clusters are of equal selection, nationwide surveys, Design of nationwide sample surveys.

- **Ratio, Product and Regression methods of Estimation :**

Finding the estimates and their standard errors from given data, comparison of their performance.

REFERENCES

1. Cochran W. G.(1977): “Sampling Techniques”; Ed.-III, John Wiley & Sons, Inc., New York, ISBN: 047116240X
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15. Foreman E. K. (01991): Survey sampling principles, Marcel Dekker, ISBN: 0824784073, 9780824784072

PAPER : MAS – 104
INDUSTRIAL STATISTICS

UNIT-I:

- The meaning of Quality & Quality improvement
- Introduction of statistical quality control
- Statistical process control
 - Introduction
 - Measure of location and variability
 - Process of control charts for variables & attribute
 - Process of control limits
 - Out of control criteria
- Process and measurement system capability analysis

UNIT-II:

- Cumulative sum chart
- Statistical product control
 - Introduction
 - Standard plans for attributes
 - Plan for acceptance sampling by measurement

UNIT-III:

- Total Quality Management
 - Meaning and important concepts
 - Importance of quality management
 - Total quality management models
 - Six sigma and Quality management
 - Kaizen process
 - Strategic quality planning and total quality management
 - The cost of quality
 - Productivity
 - ISO 9001

UNIT-IV:

- Reliability
 - Basic concepts and distributions for product life, failure rate.
 - Hazard function, Reliability function for Exponential, Normal, Lognormal, Weibull and Gamma Distributions.
 - Analysis of Complete Data.
 - Linear analysis and maximum likelihood analysis of censored data for exponential distribution only.
 - System reliability.

REFERENCES

1. Hopper A.G. : “Basic Statistical Quality Control”; McGraw Hill, London.
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9. Douglas C. Montgomery: Introduction to statistical quality control

PAPER: MAS - 105
INTRODUCTION TO MS-OFFICE AND INTERNET

UNIT-I:

- WINWORD
 - Typing, Editing, Proofing & Reviewing
 - Formatting Text & Paragraphs
 - Automatic Formatting and Styles
 - Working with Tables
 - Graphics and Frames
 - Mail Merge
 - Automating Your Work & Printing Documents

UNIT-II:

- EXCEL
 - Working & Editing in Worksheets
 - Creating Formats & Links
 - Formatting a Worksheet & Creating Graphic Objects
 - Creating Charts (Graphs), formatting and analyzing data
 - Organizing Data in a List (Data Management)
 - Sharing & Importing Data
 - Printing

UNIT-III:

- POWER POINT PRESENTATION
 - Preparation of Slides,
 - Inserting Elements into Slides,
 - Inserting Animation
 - Preparing Slideshows.

UNIT-IV:

- Introduction to Internet
 - Internet Protocols: http, ftp, TCP/IP, etc.
 - Internet Utilities: e-mail, chat, searching, etc.
- Web Browsers
- Web Server
- HTML
 - HTML Tags
- Dreamweaver

REFERENCES

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4. Townsend :Mastering Excel - 4 For Windows, - Townsend – BPB, SBN:8170292301, ISBN-13: 9788170292302

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SEMESTER - II

PAPER: MAS – 201
STATISTICAL INFERENCE – I

UNIT I:

- **Estimation & Properties of Point estimator:**

Theoretical finite and infinite population, parameter, parametric space, statistic, estimation of a parameter, Problem of Criterion of selecting a good estimator, Properties of closeness, Unbiasedness, Consistency, Efficiency and Sufficiency. Jointly sufficient statistics, Statement and application of factorization theorem. Minimal sufficient statistics, Complete sufficient statistics, BAN estimator.

UNIT II:

- Minimum variance unbiased estimator, Lower bound of variance of an estimator, Statements & application of Cramer- Rao inequality, condition of existence of uniformly minimum variance bound unbiased estimator, difference between MVUE and MVBUE. Uniformly minimum variance unbiased estimator, statement and applications of Rao-Blackwell theorem and Lehman-scheffe theorem, Location and scale invariance estimator and parameter. Pitman's estimator for location and scale parameter.

UNIT III:

- **Methods of estimation:**

(i) Method of maximum likelihood, Properties of maximum likelihood estimator, (ii) Method of moments, (iii) Method of scoring, (iv) Method of minimum chi-square, (v) Method of modified minimum chi-square, (vi) Method of least squares.

- **Interval Estimation:**

Introduction to confidence interval, Definition of confidence interval, Pivotal quantity, Pivotal quantity method.

- Confidence interval for mean and variance when sampling is done from normal population.
- Confidence interval for large samples.

UNIT IV:

- **Elementary Decision Theory:**

Decision problem, basic components and spaces associated with the decision problem, Decision rules, Risk function, Minimax-decision rule, prior and posterior distribution, Bayes risk, Bayes Rule, Value of information.

REFERENCES

1. Mood A.M., Graybill F.A. and Boes D.C. (2001) : “An Introduction to Theory of Statistics”; McGraw Hill and Tata McGraw Hill, ISBN: 0070445206, ISBN-13: 9780070445208, 978-0070445208
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PAPER: MAS - 202
STATISTICAL INFERENCE - II

UNIT I:

• **Testing of Hypotheses:**

Concepts of hypothesis, statistical hypothesis, simple and composite hypothesis, Null and Alternative hypothesis. One sided and two sided hypothesis. Test of hypothesis, critical region or region of rejection, acceptance region. Types of errors. Sizes of the errors, Level of significance, Size of the test, power function of the test, Two-tail and one tail tests, most powerful test, Likelihood Ratio Test & Test of significance as its particular case.

UNIT II:

• **Parametric tests:**

- i) Large sample test for mean, variance, proportion and correlation
- ii) Small sample tests: χ^2 , t, F & Z-transformation
- iii) ANOVA

UNIT III:

• **Nonparametric tests:**

Sign, Median, Run, Mann Whitney, Wilcoxon, K-S tests, K-W.Test,

UNIT IV:

• **SPRT:**

Wald's sequential probability ratio test, its properties and applications.

REFERENCES

1. Mood A.M., Graybill F.A. and Boes D.C. (2001) : “An Introduction to Theory of Statistics”; McGraw Hill and Tata McGraw Hill, ISBN: 0070445206, ISBN-13: 9780070445208, 978-0070445208
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PAPER: MAS - 203
MULTIVARIATE ANALYSIS

UNIT I:

- Concept and need of multivariate analysis, Concept of multinomial distribution and multivariate Normal distribution – its properties (without proof).

UNIT II:

- Concept of Hotelling T² distribution (without derivation) & its applications.
- Comparisons of several multivariate means: multivariable analysis of variances.

UNIT III:

- Partial correlation and multiple correlations.
- Multiple linear regression model, least square estimation, inference.

UNIT IV:

- Concept and application of (i) Factor analysis (ii) Principal Component analysis and (iii) Canonical Correlation analysis.
- Discrimination and classification: Separation and classification of populations, classification of multivariate populations. Fisher's discriminant function, Classification of several populations. Fisher's method of discriminating among several populations.

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PAPER: MAS – 204
ACTUARIAL STATISTICS

UNIT I:

- Basics of Probability & Interest: Theory of Interest, Variable interest rates, continuous time payment streams.
- Interest & Mortality: Annuities, Loan Amortization and Mortgage Refinancing, Mortality and Analytical models.

UNIT II:

- Life Tables: Concepts of Life Tables, Assumptions related to life tables, columns of life tables, Complete and Abridged life tables, Construction of life tables, Estimation from life table data.

UNIT III:

- Expected present values of payments, Continuous contracts & residual life, Premium calculations, m-payment net single premiums
- Population functions and indicator notations, Stationary population concepts

UNIT IV:

- Risk models: Proportional Hazard models, excess risk models, Multiple decrement models, death rate estimators, causes specific life insurance premiums.

REFERENCES

1. Barcley G.W. (1970). Techniques of Population Analysis. John Wiley, New York.
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PAPER: MAS - 205

COMPUTER PROGRAMMING LANGUAGE – ‘C’

UNIT I:

- Introduction
 - Algorithms and Flowchart
 - Types of Language
 - Introduction to C Language
- C Fundamentals
 - Identifiers
 - Data Types
 - Constants and Variables
 - Arrays
- Operators and Expressions
 - Arithmetic Operators
 - Unary Operators
 - Relations Operators
 - Logical Operators
 - Assignment Operators
 - Conditional Operators
 - Library Functions
 - Expressions
 - Evaluation of Expression

UNIT II:

- Data Input and Output
 - Single Character input and output
 - The scanf function
 - The printf function
 - Gets and Puts functions
- Control Statements
 - The While Statement
 - do-while statement
 - for statement
 - if - else statement
 - switch statement
 - break statement
 - continue statement
 - goto statement

UNIT III:

- Functions
 - Introduction to functions
 - Function definition
 - Accessing function
 - Passing arguments to function
 - Recursive function
- Data Files

UNIT IV:

- Arrays
 - Defining an array
 - Processing an array
 - Multi dimensional arrays
 - Passing array to a function
 - Arrays and Strings
- Structures and Unions
 - Defining a structure
 - Processing a structure
 - Unions

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7. Kanetkar Yashwant (2006) : “Let us C” ; 9th Edition , BPB, **ISBN: 8183331637, ISBN-13: 9788183331630,**
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10. Robert Lafore (1995) : “Object Oriented Programming in C++”; Galgotia Publications.

SEMESTER – III

PAPER: MAS - 301
STATISTICS FOR ECONOMICS

UNIT I:

- **Analysis of Time Series :**
 - Definition and importance of time series analysis, Components of a Time series, Different methods for determination of trend, their merits and demerits, Methods for elimination of seasonal components, Determination of cyclic components, Variate difference method.
 - Stationary Time series, Box-Jenkins Models, Introduction to Autoregressive (AR) Models, Moving Average (MA) Models, Mixed Autoregressive Moving Average (ARMA) Models, Autoregressive Integrated Moving Average (ARIMA) Models, Properties of these models, Forecasting Techniques.

UNIT II:

- **Index Numbers :**

Importance of Index Numbers, Various Formulae: Ratio of Simple Aggregate, Ratio of Weighted Aggregate, Unweighted average of price relatives, Choice of base period, Different tests of a good index number, Cost of Living Index Number and Various Official Index Numbers, HDI (Human Development Index).

UNIT III:

- **Demand Analysis :**

Concept related to demand and supply, price elasticities of demand and supply, Methods of determining demand and supply curves for cross section data and time series data, Leontief's method, Pigou's Method, Engels Curves, Pareto's Law of Income Distribution.

UNIT IV:

- **Input-Output Analysis :**

Leontief's Static Model for Inter-industry relations.
- **Growth Models**

Concepts of multiplier and accelerator, Hicks-Smauelson's Model, Harrod-Domar and Solow's Growth Models.

REFERENCES

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PAPER: MAS – 302
OPERATIONS RESEARCH – I

UNIT I:

- **Linear Programming:**
 - Definition of linear programming problem (LPP)
 - Formulation of LPP .
 - Solution of LPP by Graphical and Simplex Method (including Big-M and Two-phase method)

UNIT II:

- **Transportation and Assignment Problems:**
 - Definition of Transportation Problem (TP)
 - Special structure of TP
 - Methods for getting basic feasible solution to TP
 - Methods for getting optimum solution to TP
 - Unbalanced TP
 - Definition of Assignment Problem (AP)
 - Algorithm for solving an AP
 - Unbalanced AP
 - Routing Problem

UNIT III:

- **Duality:**
 - Definition of Dual Problem.
 - Rules for converting any Primal into its Dual
 - Properties of Duality
 - Dual-Simplex Method
- **Simulation**
 - Introduction & definitions
 - Types of simulation
 - Uses & limitation
 - Phases of simulation Model
 - Event type simulation
 - Monte-Carlo Simulation & its applications
 - Advantages and Disadvantages
- **Dynamic Programming**
 - Introduction
 - The recursive Equation Approach
 - Characteristics of Dynamic Programming
 - Dynamic Programming Algorithm
 - Solution of Discrete D.P.P.
 - Some APPLICATION
 - Solution of L.P.P. By Dynamic Programming

UNIT IV:

- **Inventory Management Systems:**
 - Definition
 - Costs involved in Inventory Problems
 - Classical EOQ Models without and with shortages
 - Multi-item Deterministic Models
 - Probabilistic Inventory Models
 - Inventory Models with Price Breaks
- **Sequencing:**
 - Definition, Notations and Assumptions
 - Solution of sequencing problem.
 - Problems with n-jobs and 2-machines
 - Problems with n-jobs and 3-machines
 - Problems with 2-jobs and m-machines

REFERENCES

1. K. Swarup, Gupta P.K. and Man Mohan(2008): “Operations Research”; S.Chand & Co., New Delhi, **ISBN:** 8180545350, **ISBN-13:** 9788180545351
2. G. Hadley (2002): “Linear Programming”; Narosa Book Distributors Pvt Ltd, **ISBN:** 8185015910, **ISBN-13:** 9788185015910
3. Murthy K.G.(1988): Linear complementarity, linear and nonlinear programming, Heldermann Verlag, ISBN: 3885384035, 9783885384038
4. Kasana H.S. and Kumar K.D.(2005) : “Introductory Operations Research: Theory & Applications”; Springer Verlag , ISBN: 8181282827, 9798181282827.
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PAPER: MAS - 303

ECONOMETRICS

UNIT I:

- Introduction to Econometrics and Methodology of an Econometrics study.
- Multivariate Linear regression model : Three variable case :
Introduction to OLS estimation, Coefficient of multiple correlations, Interpretation of regression coefficients, Partial correlation coefficients.
- Multivariate Linear regression model: The general Model.
The General form of model, Gauss-Markoff Theorem, OLS estimators and their properties, Coefficient of determination, Normality assumptions about error term, Statistical inference under normality assumption.

UNIT II:

- **Multicollinearity :**
Introduction, Three variable cases, General case, Perfect and imperfect (near) multicollinearity, Tests for detecting the presence of multicollinearity, Methods for handling multicollinearity.
- **General Linear Model:**
General form of the model with assumptions and their implication.
Estimation of Parameters (Aitken estimator), Scalar Predictor (Goldberger Predictor)
Particular Cases: (a) Heteroschedasticity (b) Autocorrelation.

UNIT III:

- **Heteroscedasticity:**
The problem of heteroscedasticity, Consequence of heteroscedasticity, Tests for detecting the presence and nature of heteroscedasticity, Methods for handling heteroscedasticity.
- **Autocorrelation:**
The problem of autocorrelation, Consequences of applying OLS method when there is autocorrelation, Tests for detecting presence of autocorrelation, Estimation of parameters when autocorrelation exists.

UNIT IV:

- **Simultaneous equations models:**
Introduction and need for simultaneous equations models, General form and reduced form equations, Problem of identification, Conditions for identification, Methods of estimation, Indirect Least Square method and Two-stage Least Square (2-SLS) method.

REFERENCES

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2. Apte P. G.(1990): " Text book of Econometrics"; Tata McGraw Hill, ISBN: 0074515217, 9780074515211
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PAPER: MAS - 304
INTRODUCTION TO STATISTICAL SOFTWARES

UNIT I:

- **SPSS:**
 - SPSS Introduction
 - Starting SPSS
 - Types of Data
 - Levels of Measurement
 - Missing Values
 - Important Files // database files
- **Data Management**
 - Selecting Cases
 - Standardizing Data
 - Transformation of Data
 - Split File
 - Variable and Value Labels
 - Recode Variables/Visual Binning
 - Random Sample of the Data
 - Creating a Population Variable
 - Multi Response
 - Time Saving Features / SPSS MACRO

UNIT II:

- **Basic Data Analysis**
 - Descriptive Statistics
 - Frequency Tables/Cross Tabs
 - Independent T test
 - Paired T Test
 - One-Way ANOVA
 - Correlation / Regression
- **Interpret the Results**
Presentation with live data

UNIT III:

R:

- **Introduction to R**
 - Background and resources
 - Installing R.
 - R console.
 - R commander
 - Command and syntax
 - Packages and libraries
 - Help in R
 - Workspace in R

- **Data Structures**
 - Introduction to data structure
 - Vectors
 - Matrices
 - Arrays
 - Lists
 - Factors
 - Data frames
 - Importing and Exporting data
 - Data types
- **Frequencies & Descriptive Statistics**
 - Frequency
 - Measure of central tendency
 - Measure of Dispersion
 - Measure of skewness
 - Box and Whisker part
- **Data management**
 - Split
 - Find and replacement
 - Manipulations with alphabets
 - Evaluation of strings
 - Data frames.

UNIT IV:

- **Graphical Analysis**
 - Creating a simple graph
 - Modifying the points and line of graph
 - Modifying title and subtitle of a graph
 - Modifying axes of the graph
 - Adding additional elements to graph
 - Adding legend on a graph
 - Special graph
 - Multiple plots
- **Comparing Populations**
 - Cross tabulation
 - One sample t test
 - Independent sample t test
 - Paired sample t test
 - One way ANOVA
- **Bivariate Data Analysis**
 - Correlation
 - Simple linear regression
 - Multiple linear regression

- **Conditional executions and loops**
 - If loop
 - While loop
 - For loop

REFERENCES

1. Miller R. L., Ciaran Acton and Fullerton D. A., John Malthy (2009), "SPSS for Social Scientists"; 2nd Edition, Palgrave Macmillan. ISBN: 9780230209930.
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8. Dr. Mark Gardener (2015), "Beginning R: The statistical programming language", Wiley, ISBN-978-81-265-4120-1
9. Jared P. Lander (2014), "R for everyone advance analytics and graphics", Addison Wesley data & analytics series, Dorling Kindersley (India) Pvt. Ltd., ISBN-978-93-325-3924-2
10. Yanchang Zhao and Yonghua Cen (2014), "Data mining application with R", Elsevier, ISBN- 978-93-5107-218-8
11. Nina Zumel and John Mount (2015), "Practical data science with R", Dreamtech Press, ISBN-978-93-5119-437-8
12. Paul D. Lewis (2010), "R for medicine and biology", Jones and Bartlett Publishers, ISBN- 978-0-7637-5808-0.

ELECTIVE PAPERS

PAPER: MAS - 3051
DATABASE MANAGEMENT SYSTEMS

UNIT I:

- Overview of Database Management System
 - Introduction to Database Languages
 - Advantages of DBMS over file processing systems.
- Relational Database Management System
 - Entity relationship model
 - Mapping constraints
 - Primary Keys
 - Foreign Keys
 - Structural Constraints
 - ER notations & ER model
 - Enhanced Entity Relationship Model

UNIT II:

- Database System
 - Database Structure
 - Levels of abstraction in DBMS
 - View of data
 - Role of Database users and administrators
 - Database Structure: DDL, DML, DCL,TCL

UNIT III:

- Types of Data Models
 - Hierarchical databases
 - Network databases
 - Relational databases
 - Object oriented databases

UNIT IV:

- PL/SQL
 - Stored Procedure
 - Concepts Procedure, Functions, Cursors ,Triggers

REFERENCE

1. An Introduction to Database System- C. J. Date-Narosa
2. Database System Concepts-Henry F. Korth & Abraham Silberschatz-McGraw-Hill
3. Principles of Database System-J. Ullman-Galgotia Pub.
4. Introduction to database system - Bipin C. Desai - Galgotia pub.
5. Fundamentals of Database System-Elmasri Navathe, Addison Wesley
6. Introduction to Database Management- Navin Prakash - TMH
7. Oracle PL/SQL Programming-Feuerstein & Pribyl, O'Reilly, Shroff Publishers & Distributors Pvt. Ltd.
8. Manual of RDBMS

PAPER: MAS - 3052
OFFICIAL STATISTICS

UNIT I:

- Statistical System in India: Central and State Government Organizations, Functions of Central Statistical Organization (CSO), National Sample Survey Organization (NSSO).

UNIT II:

- Official statistics: Meaning, methods of collection, limitations and reliability. Principal publications containing data on the topics such as population, agriculture, industry, trade, prices, labour and employment, transport and communications - Banking and finance.

UNIT III:

- National Income – Measures of national income - Income, expenditure and production approaches - Applications in various sectors in India.

UNIT IV:

- Measurement of income inequality: Lorenz curves, Application of Pareto and Lognormal as income distribution.
- Organization of large scale sample surveys. General and special data dissemination systems.

REFERENCES

1. Bhaduri, A. (1990). Macroeconomics: The Dynamics of Commodity Production, Macmillan India Limited, New Delhi.
2. Branson, W. H. (1992). Macroeconomic Theory and Policy, Third Edition, Harper Collins Publishers India (P) Ltd., New Delhi.
3. C. S. O. (1990). Basic Statistics Relating to the Indian Economy.
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PAPER: MAS - 3053
POPULATION STUDIES

UNIT I:

- **Introduction:**
The nature of demography, demographic view of population, techniques of population studies.
Basic demographic measures, sex-ratio, child-women ratio, crude rates, specific rates.
- **Life Tables :**
Concepts of Life Tables, Assumptions related to life tables, The columns of life tables, Complete and Abridged life tables, Construction of life tables.

UNIT II:

- **Mortality :**
Infant Mortality, Neonatal mortality, Perinatal mortality, Maternal mortality, death rates, standardized death rates.
- **Fertility and Reproduction :**
Crude Birth Rate (CBR), General fertility rate (GFR), Age specific fertility rate, Total fertility rate (TFR), Gross reproduction rate (GRR), Net reproduction rate (NRR).
Marriage rates, divorce rates, age pattern of marriage, types of migration, migration rates, migrant components, migrant streams, internal migration, international migration.

UNIT III:

- **Growth of Population and Models of Population :**
Introduction, Simple Birth and Death Process, Stationary population models, Stable population models, intrinsic rate of growth, intrinsic age distribution, Quasi stability.
- **Population Estimates and Projections :**
Inter - censal and Post - censal estimates, population projections, mathematical methods, component methods, mortality basis for projections, fertility basis for projections, migration basis for projections.

UNIT IV:

- **Census and Sample Surveys :**
Definition of Census and its features, Organizing the Census, methods of enumeration, Census in India, Indian Census in 1991 and 2001.
Defining the objectives and scope of sample surveys. Questionnaire design, sample design, organization of field work, collecting and processing the data, reporting.

REFERENCES

1. Barkley G.W. (1958): "Techniques of Population Analysis"; John Wiley & Sons Inc; First Edition, ISBN-10: 0471048186 ,ISBN-13: 978-0471048183
2. Pathak K. B. and F. Ram (1998) : "Techniques of Demographic Analysis"; 2nd Edition, Himalaya Publishing House, ISBN : 81-7493-472-3
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4. H. Raj (1986): "Fundamentals of Demography"; Surjeet Publication. **ISBN:** 8122903363, **ISBN-13:** 9788122903362
5. Cox. P.R. (1970): "Demography"; Cambridge University Press.
6. Keyfitz N. and Caswell H. (2005): "Applied Mathematical Demography"; 3rd Edition, Springer.
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SEMESTER - IV

PAPER: MAS – 401
DESIGN OF EXPERIMENTS

UNIT I:

- Concept and history of Design of experiments.
- The need for Designed experiments.
- Elementary ideas of blocking and randomized block design.
- Elementary idea of treatment structure and Basic principles of Design of experiments
- Concept of complete and incomplete block designs. Completely Randomized Design(CRD), Randomized Block Design(RBD), Latin square design(LSD), their analysis with applications. Missing plot technique for RBD, LSD with their applications.

UNIT II:

- Concept of BIBD and its properties. Intra block analysis of BIBD, construction of BIBD, Missing plot technique for BIBD

UNIT III:

- Analysis of Covariance: Analysis of covariance for CRD, RBD and LSD, Youden square design, Cross over design, split-plot designs.

UNIT VI:

- Factorial Experiments : Characterization of experiments, factorial experiments, factorial experiments with factors at two levels, grouping for interaction contrasts, confounding, confounding in more than two blocks, experiments with factors at three levels each, analysis of factorial experiments.

REFERENCES

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PAPER: MAS – 402
OPERATIONS RESERACH – II

UNIT I:

- Sensitivity Analysis:
 - Basic concepts
 - Changes in the coefficient of objective function
 - Changes in the components of vector b and of Matrix A
 - Addition / Deletion of variable in the problem
 - Addition / Deletion of constraint in the problem

UNIT II:

- Integer Programming:
 - Introduction
 - All and mixed integer programming (IPP) problems
 - Gomory's all-IPP algorithm
 - The branch and bound technique
 - Zero - one programming

UNIT III:

- PERT / CPM:
 - Basic concepts .
 - Construction and Time Calculation of the Network
 - Determination of Float and of the Critical Path
 - Crashing a Project
 - Scheduling a Project
 - Resource Analysis and Allocation
 - Application of PERT/ CPM

UNIT IV:

- Replacement Theory:
 - Types of Replacement Problem
 - Replacement of Items that Deteriorate
 - Replacement of Items that fails completely and that of Staff
- Goal Programming:
 - Definitions and Concepts
 - Formulation of Goal Programming Problem (GPP)
 - Solution of GPP by Graphical and Extended Simplex Methods

REFERENCES

1. K. Swarup, Gupta P.K. and Man Mohan(2008): “Operations Research”; S.Chand & Co., New Delhi, **ISBN:** 8180545350, **ISBN-13:** 9788180545351
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11. Hira,D.S., Gupta,P.K.(2007): OPERATIONS RESEARCH, S.Chand & Co., New Delh, **ISBN:** 81-219-0281-9

ELECTIVE PAPERS

PAPER: MAS - 4031

DATA MINING

UNIT I:

- Introduction to Data Mining
 - Process of data mining
 - Types of data used for data mining
 - Application of data mining

UNIT II:

- Supervised Learning
 - Exploratory Data Analysis (EDA)
 - Multiple Regression/Stepwise Regression
 - Logistic Regression/Multi-Nomial regression
 - K-nearest neighbors (KNN)
 - Linear Discriminant Analysis (LDA)
 - Quadratic Discriminant Analysis (QDA)
 - Bayes classifier
 - Nearest neighbor classifier
 - Tree based methods like boosting or random forest

UNIT III:

- Unsupervised Learning
 - Clustering procedures- k-means hierarchical
 - Self-organizing map
 - EM algorithm
 - Feature selection: principal component analysis
 - Association rules

UNIT IV:

- Optimization
 - Neural Network
 - Genetic Algorithm
- Graphical evaluation of classification, Association rules
- Imputation of missing data

REFERENCES

1. Jiawei Han, Micheline Kamber(2006) : "Data Mining"; II-Ed., Morgan Kaufmann Publishers, ISBN: 1558609016, 9781558609013
2. Hillol Kargupta, Jiawei Han, Philip S. Yu(2008): Next Generation of Data Mining, CRC Press, ISBN: 1420085867, 9781420085860
3. Margaret H. Dunham: "Data Mining - Introductory and Advance Topics"; Pearson Edu., ISBN: 8177587854, 9788177587852

PAPER: MAS - 4032
BIO-STATISTICS AND CLINICAL RESEARCH

UNIT I:

- Introduction to Bio-statistics, Sources of medical uncertainties, Managing medical uncertainties. Applications and uses of Bio-statistics as a science.
- Clinical trials: the need and ethics of clinical trials, bias and random error in clinical studies, conduct of clinical trials, overview of Phase I-IV trials, multi-center trials. Data management: data definitions, data collection systems for good clinical practice, protocol definition.

UNIT II:

- Design of clinical trials : parallel vs. cross-over designs, cross-sectional vs. longitude designs, review of factorial designs, objectives and endpoints of clinical trials, design of Phase I trials, design of single-stage and multi-stage Phase II trials, design and monitoring of Phase III trials with sequential stopping, design of bioequivalence trials.

UNIT III:

- Reporting and analysis: analysis of categorical outcomes from Phase I - III trials, analysis of survival data from clinical trials. Interim analysis method, motivating intent- to-treat analysis.

UNIT IV:

- Determining sample size. Surrogate endpoints: selection and design of trials with surrogate endpoints, analysis of surrogate endpoint data.

REFERENCES

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14. B. K. Mahajan: Method in Biostatistics for medical students and research work, Sixth edition, Jaypee Brothers medical publisher LTD. ISBN 81-7179-520-X.

PAPER: MAS – 4033
STATISTICAL SIMULATION

UNIT I:

- Statistic simulations: generating random variables, simulating normal, gamma and beta random variables. Comparison of algorithms to generate random variables. Generating random variables from failure rates.

UNIT II:

- Simulating multivariate distributions, MCMC methods and Gibbs sampler, simulating random fields, simulating stochastic process. Variance reduction technique: importance sampling for integration, control variates and antithetic variables.

UNIT III:

- Simulating a non-homogeneous Poisson process, Optimization using Monte Carlo methods, simulated annealing for optimization. Solving differential equations by Monte Carlo methods.

UNIT IV:

- Jackknife and Bootstrap: Bootstrap methods, re-sampling paradigms, bias and standard errors, Bootstrapping for estimation of sampling distribution. Confidence intervals, variance stabilizing transformation, bootstrapping in regression and sampling from finite populations.

REFERENCES

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યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલા રોડ, સુરત - ૩૯૫ ૦૦૭
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ક્રમાંક : એક્ઝ. / એપ્લા. સ્ટેટ. / ૩૪૮૬/૧૦
તા. ૦૮-૦૪-૧૦

પ્રતિ,
વડાશ્રી,
ડિપાર્ટમેન્ટ ઓફ સ્ટેટેસ્ટિક્સ,
વીર નર્મદ દક્ષિણ ગુજરાત યુનિ.,
સુરત.

વિષય :- M.Sc. (Applied Statistics) નો અભ્યાસક્રમ અંગે.

સુશશ્રી,
સર્વિન્ય જગ્યાવવાનું કે, એમ.એસ.સી. એપ્લાઈડ સ્ટેટેસ્ટિક્સના શૈક્ષણિક વર્ષ ૨૦૧૦-૧૧ થી
અમલમાં આવનાર અભ્યાસક્રમ અંગે આંકડાશાસ્ત્ર વિષયની અભ્યાસસમિતિની તા. ૦૮-૦૮-૦૮ ની સભાના
ઠરાવ ક્રમાંક : ૪ અન્વયે કરેલી નીચેની ભલામણ વિજ્ઞાન વિદ્યાશાખાએ તેની તા. ૨૮-૦૧-૧૦ ની સભાના
ઠરાવ ક્રમાંક : ૧૮ થી સ્વીકારી છે. જે એક્ઝેમ્પ્ટિક કાઉન્સિલે તેની તા. ૦૮-૦૩-૧૦ ની સભાના ઠરાવ ક્રમાંક :
૨૮ અન્વયે મંજૂર કરેલ હોય તેની જાણ સંબંધકર્તા શિક્ષકો અને વિદ્યાર્થીઓને કરવી, તદુપરાંત તેનો અમલ
કરવા વિનંતી.

આંકડાશાસ્ત્ર વિષયની અભ્યાસસમિતિની તા. ૦૮-૦૮-૦૮ ની સભાની ભલામણ
ક્રમાંક : ૪

એમ.એસ.સી. (એપ્લાઈડ સ્ટેટેસ્ટિક્સ) નો અભ્યાસક્રમ શૈક્ષણિક વર્ષ ૨૦૧૦-૧૧ થી અમલમાં આવે
તે રીતે સ્વીકારવા વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

ભિડાણ : ઉપર મુજબ

દુલસચિવૃક્તિ

પ્રતિ,

- 1) અધ્યક્ષશ્રી, વિજ્ઞાન વિદ્યાશાખા
- 2) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.
- 3) લાયબ્લેરી વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.

...તરફ જાણ તેમજ ઘટતી કાર્યવાહી સારુ.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc.: APPLIED STATISTICS

Effective From: 2011 – 201~~1~~

1. Fee structure :- Higher Payment Course
Rs. 10000/- per semester + university fees

2. Eligibility for Admission:

- A student having statistics / mathematics / quantitative techniques / econometrics / research methodology at under graduate or post graduate level as principal / subsidiary subjects and has secured 40% marks will be eligible for admission to this course
 - Any graduate with three subjects with one of them should be statistics / mathematics and has secured at least II class will be eligible for admission to this course.
- 3. Passing standard** in this course; as per prevailing rules sanctioned by the University.

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M.Sc.: APPLIED STATISTICS

**Effective From: 2011 – 2012
SEMESTER – I**

Paper No.	Title of the Paper	Marks			Work Load (hrs /week)	Credit Point
		Int.	Ext.	Total		
MAS-101	Basic Mathematics and Elements of Probability Theory	30	70	100	4	4
MAS-102	Probability Distributions	30	70	100	4	4
MAS-103	Sampling Techniques	30	70	100	4	4
MAS-104	Industrial Statistics	30	70	100	4	4
MAS-105	Introduction to Ms-Office and Internet	30	70	100	4	4
MAS-106	Practical paper-I (Practical +viva-voce) based on Paper - 101, 102, 103	20+ 10 =30	50+ 20 =70	100	4	2
MAS-107	Practical paper-II (Practical +viva-voce)based on Paper - 104, 105	20+ 10 =30	50+ 20 =70	100	4	2
Total		210	490	700	28	24
Total workload per week						

SEMESTER – II

Paper No.	Title of the Paper	Marks			Work Load (hrs /week)	Credit Point
		Int.	Ext.	Total		
MAS-201	Statistical Inference -I	30	70	100	4	4
MAS-202	Statistical Inference -II	30	70	100	4	4
MAS-203	Multivariate Analysis	30	70	100	4	4
MAS-204	Population Studies	30	70	100	4	4
MAS-205	Computer Programming Language - "C"	30	70	100	4	4
MAS-206	Practical paper-III (Practical +viva-voce) based on Paper - 201, 202, 203	20+ 10 =30	50+ 20 =70	100	4	2
MAS-207	Practical paper IV (Practical +viva-voce) based on Paper - 204, 205	20+ 10 =30	50+ 20 =70	100	4	2
Total		210	490	700	28	24
Total workload per week						

M.Sc.: APPLIED STATISTICS

Effective From: 2010 – 2011

SEMESTER - III

Paper No.	Title of the Paper	Marks			Work Load (hrs /week)	Credit Point
		Int.	Ext.	Total		
MAS-301	Statistics for Economics	30	70	100	4	4
MAS-302	Operations Research - I	30	70	100	4	4
MAS-303	Database Management System	30	70	100	4	4
MAS-304	Design of Experiments	30	70	100	4	4
MAS-305	Introduction to Statistical Softwares	30	70	100	4	4
MAS-306	Practical paper V (Practical +viva-voce) based on Paper - 301,302,303	20+ 10 =30	50+ 20 =70	100	4	2
MAS-307	Practical paper VI (Practical +viva-voce) based on Paper - 304, 305	20+ 10 =30	50+ 20 =70	100	4	2
Total		210	490	700	28	24
Total workload per week						28

SEMESTER – IV

Paper No.	Title of the Paper	Marks			Work Load (hrs /week)	Credit Point
		Int.	Ext.	Total		
MAS-401	Econometrics	30	70	100	4	4
MAS-402	Operations Research - II	30	70	100	4	4
MAS-403	Data Mining	30	70	100	4	4
MAS-404	Practical paper VII (Practical +viva-voce) based on Paper - 401, 402,403	20+ 10 =30	50+ 20 =70	100	4	4
*	Project and Seminar	200	-	200	1 hour per 5 students per week	8
Project Viva		100		100		4
Total		420	280	700	19 + project workload	
Total workload per week		19 +project workload				

* To be done at some industry / firm / organization.

Grand Total: 2800 Marks

SEMESTER- I

PAPER: MAS-101

BASIC MATHEMATICS AND ELEMENTS OF PROBABILITY THEORY

1. Concepts of Function, Algebra of functions, Algebra of functions Polynomial and Exponential functions &Logarithmic functions.
2. **Permutations and Combinations**
3. **Determinants, Matrices, Algebra of matrices:** Determinants & its properties. Scalar multiplication, addition and multiplication of matrices. Inverse of a square matrix. Concept of rank of a matrix. Rank determination. Linear equations, Systems of linear equations as matrix equations. Characteristic roots and vectors.
4. Sums of some standard series of positive terms.
5. Concept of Derivative of a function. Derivatives of x^n , e^x , $\log x$. Algebra of differentiation. Interpretation of derivative as rate of change & Applications.
6. Integration as an inverse operation of differentiation. Definite Integral. Integral as the area under a curve. Properties of Integral. Integrals of some standard functions & its Applications.
7. **Numerical Methods:** Solution of algebraic and transcendental equations, Numerical integration, Concept of interpolation, Simpson 1/3 rule & 3/8 rule & its Applications.
8. **Probability:** Sample space of a chance experiment, Elementary outcomes, Events, Representation of events as sets, Combination of events (Complements, Intersections, Unions). Probability functions over a sample space (Discrete case). Case of Equally likely, elementary outcomes: Laplace definition of probability of an event, Axioms of probability. Combinatorial problems of Probability calculation. Conditional Probability. Bayes Theorem. Independent events.

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 16. Goon A. M., Gupta M. K. and Dasgupta B. : "An Outline of Statistical Theory"; Vol. 1 & 2, World press. ISBN:10- 8187567260, ISBN-13: 9788187567264, 978-8187567264
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MAS - 102

Probability Distribution

1. Random Variables & their Distributions :

Definition of random variable, Discrete and continuous random variable. Probability distribution of a random variable. Concept of Probability mass function and Probability density function, Distribution Function (d.f.) of a random variable, Bivariate Distribution, Conditional distributions, Multivariate distributions

2. Frequency Distributions :

Frequency distribution of a discrete and continuous random variable (Grouping of data in terms of class intervals). Mean, variance and Moments of a frequency distribution. Bivariate frequency distribution.

3. Expectations & Moments of a Distribution :

Expectation of a random variable & a function of a random variable (Discrete and Continuous case). Moments, Mean, Variance, Standard deviation, Skewness and Kurtosis of a random variable (distribution). Independence of variables. Linear transformation of variable, Moments under linear transformation, Problems on calculation of mean, variance, S.D. and other moments of a distribution.

4. Some Common Discrete Distributions: (proofs for p.d.f., mean & variance only):

Bernoulli distribution, Binomial distribution, Poisson distribution, Hyper-geometric distribution, Negative Binomial distribution, Geometric distribution.

General concept of m.g.f. & other important properties of distributions (without proof)

5. **Some Common Continuous Distributions:** (proofs for p.d.f., mean & variance only): Uniform distribution, Normal distribution, Exponential distribution, Beta and Gamma distribution. General concept of m.g.f. & other important properties of distributions (without proof)
6. **Sampling Distributions:** χ^2 - distribution, t – distribution, F – distribution, Distribution of \bar{x} and S^2 for Normal distribution.

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8. Julian James Faraway(2006): Extending the linear model with R: generalized linear, mixed effects and nonparametric regression models, CRC Press, ISBN: 158488424X, **ISBN-13:9781584884248**

PAPER - 103 SAMPLING TECHNIQUES

1. **Planning and Execution of Surveys :**
Concept of population, sample, Advantages of sample survey, Principal steps in a sample survey and Determination of sample size, Pilot surveys, selection of enumerators, training of enumerators, supervision of enumerators, control of quality of field work, observation, reinterviews, field edit, follow-up of nonresponse, interpenetrating sub samples, time coding, tabulation, control of data processing, use of computers, report writing, general report, technical report.
2. **Simple random sampling:**
Selection of sample, Estimation of population total and means, standard error and coefficient of variation of estimator.

3. Stratified random sampling:

Estimation of mean, variance of the estimator, Estimation of the variance, Estimation of gain due to stratification from a stratified sample: finding sample sizes under proportional and optimum allocations and their comparisons for a given sample.

4. Systematic Sampling :

Estimation of mean, variance of the estimator, Estimation of variance based on interpenetrating sub samples, Comparison of systematic and simple random sampling for a given population.

5. Two stage sampling :

Estimation of the population mean, variance of the estimator and Estimation of the variance for first stage units of equal sizes, finding optimum values of first and second stage sample sizes for a given simple cost function.

6. Cluster sampling :

Meaning and need, Estimation of population mean per unit, variance of estimator. Estimation of this variance. Variance in terms of intra class correlation coefficient as its comparison with unistage mean per unit estimator, when clusters are of equal selection, nationwide surveys, Design of nationwide sample surveys.

7. Ratio, Product and Regression methods of Estimation :

Finding the estimates and their standard errors from given data, comparison of their performance.

8. Data Collection in Selected Fields :

Surveys of agricultural area, surveys of agricultural production, demographic surveys, employment and unemployment surveys, consumer expenditure surveys, surveys of health, industrial surveys, surveys of distributive trade, sampling as an census surveys of road traffic, public opinion surveys, marketing research, payroll surveys, postal traffic surveys, sociological research.

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PAPER – 104

INDUSTRIAL STATISTICS

Quality Control :

Review of :

Quality and Statistical Quality control concept.

Control Charts for Measurements.

Control Charts for Attributes.

Acceptance sampling Plans for Attributes.

Cusum Charts.

Standard Plans for Attributes.

Plan for Acceptance Sampling by Measurement.

Concept of Total Quality Management (TQM).

Accelerating use of TQM.

Service Quality vs Product Quality.

Strategic Quality Planning.

Strategy and Strategic Planning Process

Strategic Quality Management

Organizing for TQM

Productivity and Quality

The Leverage of Productivity

Quality management Systems vs Technology

Basic Measures of Productivity

The Cost of Quality.

Cost of Quality Defined.

Different views of Quality Costs.

Quality Costs and its Measurement.

Criteria for Quality Programs.

ISO 9000 and onwards.

Concept of six sigma limits.

Reliability :

Basic concepts and distributions for product life, failure rate. Hazard function, Reliability function for Exponential, Normal, Log-normal, Weibull and Gamma Distributions. Analysis of Complete Data. Linear analysis and maximum likelihood analysis of censored data for exponential distribution only. Introduction of Bayes Methods in Reliability. Accelerated life testing. System reliability.

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PAPER - 105

INTRODUCTION TO MS-OFFICE AND INTERNET

1. WINWORD
 - 1.1 Typing, Editing, Proofing & Reviewing
 - 1.2 Formatting Text & Paragraphs
 - 1.3 Automatic Formatting and Styles
 - 1.4 Working with Tables
 - 1.5 Graphics and Frames
 - 1.6 Mail Merge
 - 1.7 Automating Your Work & Printing Documents

2. EXCEL
 - 2.1 Working & Editing in Workbooks
 - 2.2 Creating Formats & Links
 - 2.3 Formatting a Worksheet & Creating Graphic Objects
 - 2.4 Creating Charts (Graphs), formatting and analyzing data
 - 2.5 Organizing Data in a List (Data Management)
 - 2.6 Sharing & Importing Data
 - 2.7 Printing
3. POWER POINT PRESENTATION
 - 3.1 Preparation of Slides,
 - 3.2 Inserting Elements into Slides,
 - 3.3 Inserting Animation
 - 3.4 Preparing Slideshows.
4. Introduction to Internet
 - 5.1 Internet Protocols
http, ftp, TCP/IP, etc.
 - 5.2 Internet Utilities
e-mail, chat, searching, etc.
6. Web Browsers
7. Web Server
8. HTML
 - 8.1 HTML Tags
9. Dreamweaver

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SEMESTER - II

PAPER – 201

STATISTICAL INFERENCE - I

Estimation :

Theoretical finite and infinite population, parameter, statistic, estimation of a parameter, Problem of Criterion of selecting a good estimator, Unbiasedness, Consistency, Efficiency and Sufficiency. Introduction of order statistics (without proof) and parameter exponential family of distribution.

Methods of obtaining estimators:

(i) Method of maximum likelihood (ii) Method of least squares (iii) Method of moments, Method of minimum chi-square, (v) Minimum distance method, Properties of M.L.E. & moment estimators.

Properties of Point estimator:

(i) Closeness (ii) Unbiasedness Estimators (iii) consistency (BAN or CAN Estimators)
Sufficiency: Sufficient statistic and jointly sufficient statistic, Factorization theorem, Minimal sufficient statistic, complete sufficient statistic.

Minimum variance unbiased estimation :

UMVUE Lower bound of variance of an estimator. Statements & application of C. R. inequality, Rao-Blackwell theorem, Lehman-scheffe theorem.

Invariance :

Location and scale invariance. Pitman's estimators for location and scale parameter.

Interval Estimation :

Introduction to confidence interval, Definition of confidence interval, Pivotal quantity, Pivotal quantity method.

- (i) Confidence interval for mean and variance when sampling is done from normal population.
- (ii) Confidence interval for large samples.

Elementary Decision Theory:

Decision problem, basic components and spaces associated with the decision problem, Decision rules, Risk function, Minimax-decision rule, prior and posterior distribution, Bayes risk, Bayes Rule, Value of information.

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PAPER-202

STATISTICAL INFERENCE - II

Testing of Hypothesis :

Concepts of hypothesis, statistical hypothesis, simple and composite hypothesis, Null and Alternative hypothesis. One sided and two sided hypothesis. Test of hypothesis, critical region or region of rejection, acceptance region. Types of errors. Sizes of the errors, Level of significance, Size of the test, power function of the test, Two-tail and one tail tests, most powerful test, Likelihood Ratio Test & Test of significance as its particular case.

Parametric tests:

- i) Large sample test for mean, variance, proportion and correlation
- ii) Small sample tests: χ^2 , t, F & Z-transformation
- iii) ANOVA

Nonparametric tests:

Sign, Median, Run, Mann Whitney, Wilcoxon, K-S tests, K-W.Test,Tests of independence in 2x2, 2xn and nxc contingency tables, Yates correction, conversion of contingency coefficient as function of χ^2 - statistic. Wald's sequential probability ration test, its properties and applications.

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PAPER - 203

MULTIVARIATE ANALYSIS

1. Concept and need of multivariate analysis, Normal distribution - Some important properties, Concept of Hoteling T² distribution (without derivation) & its applications.
2. Comparisons of several multivariate means, multivariable analysis of variances.
3. Classical linear regression model, least square estimation, inference from estimated linear regression model. Multivariate multiple regression. Comparison of two formulation of the regression models. Multiple Regression model with time dependent errors.
4. Concept and application of (i) Factor analysis (ii) Principal Component analysis and (iii) Canonical Correlation analysis.

5. Discrimination and classification : Separation and classification of populations, classification of multivariate populations. Fisher's discrement function, Classification of several populations. Fisher's method of discriminating among several populations.
6. Concept of correspondence analysis and its application.

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PAPER – 204

POPULATION STUDIES

Introduction :

The nature of demography, demographic view of population, techniques of population studies.

Basic demographic measures, sex-ratio, child-women ratio, crude rates, specific rates.

Life Tables :

Concepts of Life Tables, Assumptions related to life tables, The columns of life tables, Complete and Abridged life tables, Construction of life tables.

Mortality :

Infant Mortality, Neonatal mortality, Perinatal mortality, Maternal mortality, death rates, standardized death rates.

Fertility and Reproduction :

Crude Birth Rate (CBR), General fertility rate (GFR), Age specific fertility rate, Total fertility rate (TFR), Gross reproduction rate (GRR), Net reproduction rate (NRR).

Marriage rates, divorce rates, age pattern of marriage, types of migration, migration rates, migrant components, migrant streams, internal migration, international migration.

Growth of Population and Models of Population :

Introduction, Simple Birth and Death Process, Stationary population models, Stable population models, intrinsic rate of growth, intrinsic age distribution, Quasi stability.

Population Estimates and Projections :

Inter - censal and Post - censal estimates, population projections, mathematical methods, component methods, mortality basis for projections, fertility basis for projections, migration basis for projections.

Census and Sample Surveys :

Definition of Census and its features, Organizing the Census, methods of enumeration, Census in India, Indian Census in 1991 and 2001.

Defining the objectives and scope of sample surveys. Questionnaire design, sample design, organization of field work, collecting and processing the data, reporting.

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PAPER - 205
COMPUTER PROGRAMMING LANGUAGE – ‘C’

1. Introduction
 - 1.1 Algorithms and Flowchart
 - 1.2 Types of Language
 - 1.3 Introduction to C Language
2. C Fundamentals
 - 2.1 Identifiers
 - 2.2 Data Types
 - 2.3 Constants and Variables
 - 2.4 Arrays
3. Operators and Expressions
 - 3.1 Arithmetic Operators
 - 3.2 Unary Operators
 - 3.3 Relations Operators
 - 3.4 Logical Operators
 - 3.5 Assignment Operators
 - 3.6 Conditional Operators
 - 3.7 Library Functions
 - 3.8 Expressions
 - 3.9 Evaluation of Expression
4. Data Input and Output
 - 4.1 Single Character input and output
 - 4.2 The scanf function
 - 4.3 The printf function
 - 4.4 Gets and Puts functions
5. Control Statements
 - 5.1 The While Statement
 - 5.2 do-while statement
 - 5.3 for statement
 - 5.4 if - else statement
 - 5.5 switch statement
 - 5.6 break statement
 - 5.7 continue statement
 - 5.8 goto statement
6. Functions
 - 6.1 Introduction to functions
 - 6.2 Function definition
 - 6.3 Accessing function
 - 6.4 Passing arguments to function

6.5 Recursive function

- 7. Data Files
- 8. Arrays
 - 8.1 Defining an array
 - 8.2 Processing an array
 - 8.3 Multi dimensional arrays
 - 8.4 Passing array to a function
 - 8.5 Arrays and Strings
- 9. Structures and Unions
 - 9.1 Defining a structure
 - 9.2 Processing a structure
 - 9.3 Unions

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SEMESTER - III
PAPER - 301

STATISTICS FOR ECONOMICS

Analysis of Time Series :

Definition and importance of time series analysis. Stationary Time series. Components of a Time series. Different methods for determination of trend, their merits and demerits. Methods for elimination of seasonal components. Determination of cyclic components. Variate difference method.

Box-Jenkins Models, Introduction to Autoregressive (AR) Models, Moving Average (MA) Models, Mixed Autoregressive Moving Average (ARMA) Models, Autoregressive Integrated Moving Average (ARIMA) Models. Properties of these models. Forecasting Techniques.

Index Numbers :

Importance of Index Numbers.

Various Formulae : Ratio of Simple Aggregate, Ratio of Weighted Aggregate, Unweighted average of price relatives.

Choice of base period, Different tests of a good index number, Cost of Living Index Number and Various Official Index Numbers, HDI (Human Development Index)

Demand Analysis :

Concept related to demand and supply, price elasticities of demand and supply, Methods of determining demand and supply curves for cross section data and time series data, Leontief's method, Pigou's Method, Engels Curves, Pareto's Law of Income Distribution.

Input-Output Analysis :

Leontief's Static Model for Inter-industry relations.

Growth Models

Classical and Keyensian simple income determination models, Concepts of multiplier and accelerator, Hicks-Smauelson's Model, Harrod-Domar and Solow's Growth Models.

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PAPER – 302

OPERATIONS RESEARCH – I

1 Linear Programming:

- 1.1 Definition of linear programming problem (LPP)
- 1.2 Formulation of LPP
- 1.3 Solution of LPP by Graphical and Simplex Method (including Big-M and Two-phase method)

2 Duality:

- 2.1 Definition of Dual Problem.
- 2.2 Rules for converting any Primal into its Dual
- 2.3 Properties of Duality
- 2.4 Dual-Simplex Method

3 Transportation and Assignment Problems:

- 3.1 Definition of Transportation Problem (TP)
- 3.2 Special structure of TP
- 3.3 Methods for getting basic feasible solution to TP
- 3.4 Methods for getting optimum solution to TP
- 3.5 Unbalanced TP
- 3.6 Definition of Assignment Problem (AP)
- 3.7 Algorithm for solving an AP
- 3.8 Unbalanced AP
- 3.9 Routing Problem

4 Inventory Management Systems:

- 4.1 Definition
- 4.2 Costs involved in Inventory Problems
- 4.3 Classical EOQ Models without and with shortages
- 4.4 Multi-item Deterministic Models
- 4.5 Probabilistic Inventory Models
- 4.6 Inventory Models with Price Breaks

5. Dynamic Programming

- 5.1 Introduction
- 5.2 The recursive Equation Approach
- 5.3 Characteristics of Dynamic Programming
- 5.4 Dynamic Programming Algorithm
- 5.5 Solution of Discrete D.P.P.
- 5.6 Some APPLICATION
- 5.7 Solution of L.P.P. By Dynamic Programming

6 Simulation

- 6.1 Introduction & definitions
- 6.2 Types of simulation
- 6.3 Uses & limitation

- 6.4 Phases of simulation Model
- 6.5 Even type simulation
- 6.6 Monte-Carlo Simulation & its applications
- 6.7 Advantages and Disadvantages

7 Sequencing:

- 7.1 Definition, Notations and Assumptions
- 7.2 Solution of sequencing problem.
- 7.3 Problems with n-jobs and 2-machines
- 7.4 Problems with n-jobs and 3-machines
- 7.5 Problems with 2-jobs and m-machines

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PAPER – 303

DBMS (DATABASE MANAGEMENT SYSTEM)

1. Relational Database Design
 - 1.1 Structure of Relation Database
 - 1.2 Database Manager
 - 1.3 Database Administrator
 - 1.4 Pitfalls in Relational Database Design
 - 1.5 Functional Dependencies
 - 1.6 First, Second & third Normal Form, BCNF
2. R. D. B. M. S. package and its tools
 - 2.1 SQL Commands: SELECT, CREATE TABLE, INSERT, UPDATE, DELETE, ALTER TABLE, DROP TABLE, CREATE SEQUENCE, ALTER SEQUENCE, DROP SEQUENCE, CREATE INDEX, ALTER INDEX, DROP INDEX, ROLLBACK, COMMIT, SAVEPOINT, TRUNCATE, CREATE VIEW, DROP VIEW
 - 2.2 Built-in Functions & group functions
 - 2.3 PL/SQL: Data type in PL/SQL, user defined RECORD data type, Control statements (IF, LOOP, WHILE, FOR), cursor, passing parameter to cursor, Implicit Cursor, Exception Handling, Stored & Local Procedures & Functions, Packages,

Reference

1. An Introduction to Database System- C. J. Date-Narosa
2. Database System Concepts-Henry F. Korth & Abraham Silberschatz-McGraw-Hill
3. Principles of Database System-J. Ullman-Galgotia Pub.
4. Introduction to database system - Bipin C. Desai - Galgotia pub.
5. Fundamentals of Database System-Elmasri Navathe, Addison Wesley
6. Introduction to Databased Management- Navin Prakash - TMH
7. Oracle PL/SQL Programming-Feuerstein & Pribyl, O'Reilly, Shroff Publishers & Distributors Pvt. Ltd.
8. Manual of RDBMS

PAPER – 304

DESIGN OF EXPERIMENTS

Concept and history of Design of experiments.

The need for Designed experiments.

Elementary ideas of blocking and randomized block design.

Elementary idea of treatment structure and Basic principles of Design of experiments

Concept of complete and incomplete block designs. Completely Randomized Design(CRD), Randomized Block Design(RBD), Latin square design(LSD), their analysis with applications. Missing plot technique for RBD, LSD with their applications.

Analysis of Covariance : Analysis of covariance for CRD, RBD and LSD.

Concept of BIBD and its properties. Intra block analysis of BIBD, Youden square design, Cross over design, construction of BIBD, Missing plot technique for BIBD.

Factorial Experiments : Characterization of experiments, factorial experiments, factorial experiments with factors at two levels, grouping for interaction contrasts, confounding, confounding in more than two blocks, experiments with factors at three levels each, analysis of factorial experiments, split-plot designs.

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PAPER - 305
INTRODUCTION TO STATISTICAL SOFTWARES

Introduction and use of MATLAB, SYSTAT, SPSS and other such statistical packages for analysis of practical problems.

MATLAB

Introduction :

Introduction to Matlab, variable and array, subarrays, displaying output data, data files operation on array, hierarchy of operation on array, built in function in Matlab

Plotting :

Introduction to plotting, graph window, two dimensional plot, multiple plot, components of graph(legend, title,),graphical image, commet, 3D graph, additional plotting features
Subplots, polar plots,

Branching statement and program design :

The if construct, switch construct, The try-catch construct , relational operators, logic operators, logical functions

Loops :

The while loop, The for loop, The break and continue statements, Nesting loops.

User defined function :

Introduction to Matlab functions, variable passing in Matlab(pass by value), preserving data between calls to functions, sub functions, private function, nested function

SPSS

I.Using SPSS

- o Starting SPSS
 - o Types of Data
 - o Levels of Measurement
 - o Missing Values
- Important Files // database files

2. Data Manipulation

- Selecting Cases
- Standardizing Data
- Transformation of Data
- Split File
- Variable and Value Labels
- Recode Variables/Visual Binning
- Random Sample of the Data
- Creating a Population Variable
- Multi Response
- Time Saving Features / SPSS MACRO

3. Basic Data Analysis

- Descriptive Statistics
- Frequency Tables/Cross Tabs
- Independent T test
- Paired T Test
- One-Way ANOVA
- Correlation / Regression

4. Interpret the Results

- Presentation with live data

SYSTAT

Introduction

Preparing data for the package

Invoking, Using Date Editor, Reading ASCII Files, Transforming Data, Selecting Subset of Cases, Other Windows.

Procedure Statistics for Data Analysis :

Frequency, Comparing Means, Crosstabs, ANOVA, Correlation, Linear Regression

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SEMESTER - IV

**PAPER - 401
ECONOMETRICS**

1. Introduction to Econometrics and Methodology of an Econometrics study.
2. Multivariate Linear regression model : Three variable case :
Introduction to OLS estimation, Coefficient of multiple correlation, Interpretation of regression coefficients, Partial correlation coefficients.
3. Multivariate Linear regression model: The general Model.
The General form of model, Gauss-Markoff Theorem, OLS estimators and their properties, Coefficient of determination, Normality assumptions about error term, Statistical inference under normality assumption.
4. Multicollinearity :
Introduction, Three variable cases, General case, Perfect and imperfect (near) multicollinearity, Tests for detecting the presence of multicollinearity, Methods for handling multicollinearity.
5. General Linear Model:
General form of the model with assumptions and their implication.
Estimation of Parameters (Aitken estimator), Scalar Predictor (Goldberger Predictor)
Particular Cases: (a) Heteroscedasticity (b) Autocorrelation.
6. Heteroscedasticity:
The problem of heteroscedasticity, Consequence of heteroscedasticity, Tests for detecting the presence and nature of heteroscedasticity, Methods for handling heteroscedasticity.
7. Autocorrelation:
The problem of autocorrelation, Consequences of applying OLS method when there is autocorrelation, Tests for detecting presence of autocorrelation, Estimation of parameters when autocorrelation exists.
8. Simultaneous equations models:
Introduction and need for simultaneous equations models, General form and reduced form equations, Problem of identification, Conditions for identification, Methods of estimation, Indirect Least Square method and Two-stage Least Square (2-SLS) method.

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1. Samprit Chatterjee, Ali S. Hadi(2006): Regression analysis by example, IV-Ed., John Wiley and Sons,ISBN: 0471746967, 9780471746966
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PAPER – 402

OPERATIONS RESEARCH - II

1. Sensitivity Analysis:
 - 1.1 Basic concepts
 - 1.2 Changes in the coefficient of objective function
 - 1.3 Changes in the components of vector b and of Matrix A
 - 1.4 Addition / Deletion of variable in the problem
 - 1.5 Addition / Deletion of constraint in the problem
2. Integer Programming:
 - 2.1 Introduction
 - 2.2 All and mixed integer programming (IPP) problems
 - 2.3 Gomory's all-IPP algorithm
 - 2.4 The branch and bound technique
 - 2.5 Zero - one programming
3. Replacement Theory:
 - 3.1 Types of Replacement Problem
 - 3.2 Replacement of Items that Deteriorate
 - 3.3 Replacement of Items that fails completely and that of Staff
4. PERT / CPM:
 - 4.1 Basic concepts.
 - 4.2 Construction and Time Calculation of the Network
 - 4.3 Determination of Float and of the Critical Path
 - 4.4 Crashing a Project
 - 4.5 Scheduling a Project
 - 4.6 Resource Analysis and Allocation
 - 4.7 Application of PERT/ CPM
5. Goal Programming:
 - 5.1 Definitions and Concepts
 - 5.2 Formulation of Goal Programming Problem (GPP)
 - 5.3 Solution of GPP by Graphical and Extended Simplex Methods

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1. K. Swarup, Gupta P.K. and Man Mohan(2008): "Operations Research"; S.Chand & Co., New Delhi, ISBN: 8180545350, ISBN-13: 9788180545351
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PAPER - 403 DATA MINING

1. Introduction to Data Mining
 - 1.1 What is Data Mining
 - 1.2 Applications of Data Mining
 - 1.3 The process of Data Mining
2. Types of data for Data Mining
 - 2.1 Relational Data
 - 2.2 Data Warehouses
 - 2.3 Transactional Data
 - 2.4 Advance database system
3. Data description
 - 3.1 Clustering
 - 3.2 Link Analysis
4. Predictive Data Mining
 - 4.1 Classification
 - 4.2 Regression
 - 4.3 Time series
5. Models and Patterns
 - 5.1 Decision Trees
 - 5.2 Multivariate adaptive regression spline
 - 5.3 Rule Induction
 - 5.4 K-nearest neighbor and memory based reasoning
 - 5.5 Logistic Regression

6. Introduction to Genetic Algorithm

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1. Jiawei Han, Micheline Kamber(2006) : "Data Mining"; II-Ed., Morgan Kaufmann Publishers, ISBN: 1558609016, 9781558609013
2. Hillol Kargupta, Jiawei Han, Philip S. Yu(2008): Next Generation of Data Mining, CRC Press, ISBN: 1420085867, 9781420085860
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