DEPARTMENT OF STATISTICS

B.Sc. Statistics

U.G. PROGRAMME

SYLLABUS

Effective from the Academic Year 2012-2013

Loyola College (Autonomous)

Chennai- 600 034

LOYOLA COLLEGE (AUTONOMOUS)
CHENNAI - 600 034.

Department Of Statistics (UG)

sem	Cate	Code	Title	Hrs	Crs
I	MC	ST 1502	STATISTICAL METHODS	6	6
I	MC	ST 1503	PROBABILITY AND RANDOM VARIABLES	3	3
II	AR	ST 2103	STATISTICAL METHODS FOR ECONOMICS	6	4
II	AR	ST 2104	BUSINESS STATISTICS	6	4
II	AR	ST 2105	FUNDAMENTALS OF STATISTICS	6	4
II	MC	ST 2503	CONTINUOUS DISTRIBUTIONS	6	6
II	MC	ST 2504	DISCRETE DISTRIBUTIONS	3	3
III	EG	ST 3301	BASIC STATISTICAL TECHNIQUES	3	1
III	AO	ST 3204	BIOSTATISTICS	6	4
III	AO	ST 3205	ADVANCED STATISTICAL METHODS	6	4
III	MC	ST 3505	SAMPLING THEORY	6	6
III	MC	ST 3506	MATRIX AND LINEAR ALGEBRA	3	3
IV	AO	ST 4208	STATISTICS FOR MANAGEMENT	6	4
IV	AO	ST 4209	MATHEMATICAL STATISTICS	6	4
IV	AO	ST4210	ECONOMETRICS	6	4
IV	EG	ST 4301	PROGRAMMING IN C	3	1
IV	MC	ST 4503	ESTIMATION THEORY	6	6
IV	MC	ST 4504	MS EXCEL	3	2
V	ES	ST 5407	SQL and PL SQL	3	2
V	ES	ST 5409	RELIABILITY THEORY	3	2
V	ES	ST 5406	ACTUARIAL STATISTICS	3	2
V	ES	ST5408	APPLIED STOCHASTIC PROCESSES	3	2
V	MC	ST 5508	APPLIED STATISTICS	6	6
V	MC	ST 5509	REGRESSION ANALYSIS	6	6
V	MC	ST 5510	TESTING OF HYPOTHESES	6	6
V	MC	ST 5511	STATISTICAL DATA ANALYSIS USING SPSS	6	6
VI	MS	ST 6606	DESIGN AND ANALYSIS OF EXPERIMENTS	5	7
VI	MS	ST 6607	OPERATIONS RESEARCH	5	6
VI	MS	ST 6608	STATISTICAL QUALITY CONTROL	5	7
VI	SK	ST 6652	R Language	9	9
VI	SK	ST 6652	SURVEY PRACTICE & REPORTING	6	6

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ST 1502 - STATISTICAL METHODS

Semester :I **Category : MC**
Hours/Week : 6 **Credits : 6**

Objectives: i) To introduce the basic concepts in Statistics
ii) To develop data reduction techniques

Unit - 1 Definition - Scope and limitations of Statistics - Collection of data - Census.Sampling surveys - Classification and tabulation - diagrammatic and graphical representation of data - Nominal, ordinal and interval scaling.

Unit - 2 Measures of central tendency - Measures of dispersion and Coefficient of variation - Problems based on raw data and grouped data - Moments - raw and central - Measures of skewness - Measures of Kurtosis and their applications.

Unit - 3 Curve fitting - Principle of least squares - linear, nonlinear, exponential and growth curves.

Unit - 4 Correlation - Rank Correlation - Regression analysis - Problems based on raw data and grouped data.

Unit - 5 Association of attributes - Notations - Classes and class frequencies - Consistency of data - Independence of attributes - Yule's coefficient of association - coefficient of colligation.

Books for Study:

1. Bansilal andArora (1989). New Mathematical Statistics, SatyaPrakashan, New Delhi.
2. Gupta. S.C. &Kapoor,V.K. (2002) . Fundamentals of Mathematical Statistics , Sultan Chand & Sons Pvt. Ltd. New Delhi.

Books for Reference:

1. Goon A.M. Gupta. A.K. & Das Gupta, B (1987) . Fundamentals of Statistics, Vol.2, World Press Pvt. Ltd., Calcutta.
2. Kapoor, J.N. &Saxena, H.C. (1976) . Mathematical Statistics , Sultan Chand and Sons Pvt. Ltd, New Delhi.

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ST 1503 - PROBABILITY AND RANDOM VARIABLES

Semester I **Category: MC**
Hours/Week : 3 **Credits : 3**

Objectives: (i) To introduce probability theory as a foundation for Statistics.
(ii) To help students understand the basic notions about random variables.

Unit 1 Introductory Notions of Probability- Random Experiments – Sample Space and Events. Axiomatic Approach to Probability – Addition Law – Problems in Axiomatic Approach.

Unit 2 Combinatorics and Classical Probabiltiy Elements of Combinatorics. Classical Definition of Probability. Problems in Classical approach.

Unit 3 Conditional Probability – Occupancy Problems. Stochastic Independence and related concepts - Independence of events – Pairwise and Mutual Independence.

Unit 4.Multiplication Law, Law of Total Probability, Baye's Theorem. Bernoulli Trials – Problems.

Unit 5 Introductory notions on Random Variables - Random Variables – Discrete and Continuous Random Variables – p.g.f, p.m.f. and p.d.f. – c.d.f. Mathematical Expectation and Variance of a random variables. Chebyshev's Inequality.

Books for Study :

1. Gupta, S.C. and Kapoor, V.K. (2002). Fundamentals of Mathematical Statistics. Sultanchand and Sons. New Delhi
2. Parzen, E.(1960). Modern Probability Theory. John Wiley & Sons, New York

Books for Reference:

1. Hogg, R.V. and Craig, A.T. (2002). Introduction to Mathematical Statistics. Pearson Education India

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ST 2103 - STATISTICAL METHODS FOR ECONOMICS

(for Economics Students)

Semester II **Category: AR**

Hours/Week : 6 **Credits : 4**

Objectives: (i) To introduce the basic concepts in Statistics and their applicability in Economics.
(ii) To develop problem solving skills using statistical tools and techniques.

Unit 1: Introduction to Statistics: Functions – Importance – Uses and Limitations of Statistics. Statistical data – Classification, Tabulation, Diagrammatic & Graphic representation of data.

Unit 2: Data Collection & Sampling Methods: Primary & Secondary data, Sources of data, Methods of collecting data. Sampling – Census & Sample methods – Methods of sampling, Probability Sampling and Non-Probability Sampling.

Unit 3: Averages and Dispersion: Measures of central tendency – Mean, Median, Mode, Geometric Mean, Harmonic Mean. Measures of Dispersion – Range, Quartile deviation, Mean deviation, Standard deviation, Coefficient of variation.Skewness& Kurtosis.

Unit 4: Correlation & Regression: Simple Correlation – Scatter diagram, Rank Correlation, Karl Pearson's Correlation Coefficient. Simple Regression, OLS Technique, Standard Error.

Unit 5: Time Series & Index numbers: Index numbers – Price & Quantity index numbers of Fisher, Laspeyre, Paasche, Kelly& Marshal-Edgeworth. Cost of living Index. Uses & Limitations of index numbers. Analysis of Time series – (Linear Relationship only)

Books for study:

1. Agarwal, B.L. (2006):- **Basic Statistics**. Wiley Eastern Ltd., New Delhi
2. Gupta, S. P. (2011):- **Statistical Methods**. Sultanchand& Sons, New Delhi
3. Sivathanupillai, M &Rajagopal, K. R. (1979):- **Statistics for Economics Students**.

Books for Reference:

1. Arora, P.N., SumeetArora, S. Arora (2007):- **Comprehensive Statistical Methods**. Sultan Chand, New Delhi
2. Fox, James Allen (1991):- **Elementary Statistics in Social Research** – Ed 5.
3. Goon, A.M., Gupta, M.K., and Dasgupta, B. (1998):- **An Introduction to Statistical Theory**.
4. McClave, James, T and George Benson (1990):- **Statistics and Economics**. Collier Macmillan Publishers, London
5. Mood, A. M. and Graybill, F.A. (1974):- **Introduction to the Theory of Statistics**

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ST 2104 - BUSINESS STATISTICS
(for Commerce Students)

Semester II **Category: AR**
Hours/Week : 6 **Credits : 4**

Objectives: i) To introduce basic concepts of Statistics
ii)To provide statistical techniques for business data analysis.

Unit 1 Measures of Central tendency: Simple averages – mean, median and mode –Geometric mean and Harmonic mean – weighted arithmetic mean.
Measures of Dispersion: Range – Quartile deviation – mean deviation – Standard deviation – coefficient of variation – Combined mean and standard deviation.
Skewness: Karl Pearson and Bowley's Coefficient of skewness – Moments – Kurtosis.

Unit 2 Curve fitting: Fitting a straight line and second degree parabola.
Correlation: Scatter diagram – Limits of correlation coefficient – Spearman's Rank correlation coefficient – Simple problems. Regression: Properties of regression coefficients and regression lines.

Unit 3 Time Series: Components of time series-Additive and multiplicative models – Measurement of trend – Graphical method-Semi-average method-moving average method-least squares method. Measurement of Seasonal Variation –Method of Simple averages – ratio-to trend method – ratio to moving average method-method of link relatives.

Unit 4 Elements of Operation Research: Linear Programming – Solving L.P.P. by Graphical method – Transportation problems – North-West corner rule – Least cost method - Vogel's Approximation Method.

Unit 5 Game Theory : Introduction – Two-Person Zero-Sum Games – Pure Strategies – Mixed Strategies.

Books for study:

1. Vittal, P.R.(2010) Business Statistics. Margham Publications, Madras
2. Gupta, S.P. (2011), Statistical Methods-Sultan Chand and Sons Publishers. New Delhi.
3. Yule and Kendall (1993).Introduction totheory of Statistics. Universal Book Stall, New Delhi.

Books for reference:

1. Croxton and Cowden (1956).Applied General Statistics.Sir Isaac Pitman and Sons. Ltd., London.
2. Gupta,S.C. and Kapoor,V.K. (2002). Fundamentals of Mathematical Statistics.Sultanchand and Sons. New Delhi
3. Taha,H.A. (1997). Operations Research. Macmillan Publishing Housing Co., New Delhi.
4. KantiSwarup, Gupta, P.K. and Man Mohan (1996), Sultan Chand and Sons (P) Ltd., New Delhi.

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ST 2105 – FUNDAMENTALS OF STATISTICS

Semester III **Category: AR (for B.B.A / B.Com (CS))**
Hours/Week : 6 **Credits : 6**

Objective:
(i) To introduce basic concepts of Statistics
(ii) To provide statistical techniques for business data analysis

Unit 1 : Introduction: Origin and development of statistics – Definition of statistics – Importance and scope of statistics – Limitations of statistics – Misuse of statistics – Collection of data: Census method – Sampling method – Simple, Stratified, Systematic random sampling – Judgement, Convenient, Quota sampling – sampling error.

Unit 2: Presentation of Data: Diagrammatic representation of data – Bar diagram – pie diagram – Histogram – Frequency polygon and frequency curve – Pictogram- and cartogram – Measures of central tendency: Simple average, Mean, Median and Mode – Geo-metric mean and Harmonic Mean – Weighted arithmetic mean

Unit 3: Measures of Dispersion: Range – Quartile deviation – Mean deviation – Standard deviation – Coefficient of variation - combined mean and standard deviation - Skewness : Karl Pearson and Bowley's coefficient of Skewness

Unit 4: Correlation and Regression : Scatter diagram – Karl Pearson Coefficient of Correlation – rank correlation – Regression: Importance of regression analysis – regression equations.

Unit 5: Time Series: component of time series – Measurements of trend – graphical method , semi-average method, moving-average method and method of least squares – measurements of seasonal variation – method of simple averages, ratio-to-trend method, ratio-to-moving average method and Link relative method

Books for study:

1. Gupta, S.P. (2011), Statistical Methods-Sultan Chand and Sons Publishers. New Delhi.

Books for reference:

1. Gupta,S.C. and Kapoor, V.K.(2002), Fundamentals of Applied Statistics, Sultan Chand and sons publishers, New Delhi**.**
2. Vittal, P.R.(2010) Business Statistics. Margham Publications, Madras

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ST 2503 - CONTINUOUS DISTRIBUTIONS

Semester II **Category: MC**
Hours/Week : 6 **Credits : 6**

Objective: **(i)**To impart essential knolwedge in continuous distributions

(ii) To expose the real-life applications of continuous distribution

Unit 1: Joint - Marginal and Conditional distributions – Conditional Expectation – Conditional Variance – Stochastic Independence, Uniform Distribution – Mean – Variance – M.G.F - Distribution Function

Unit 2: Normal Distribution – Properties – M.G.F – Linear Combinations of Normal Variate – Reproductive Property, Bivariate Normal – Mean – Variance

Unit 3: Beta, Gamma, Cauchy, Exponential – Properties – M.G.F – Distribution Function – Properties

Unit 4: Functions of Random Variable – Transformation of Variables – Chi-square, t and F distribution – Properties

Unit 5: Order Statistics and their distributions. Limiting Distribution – Stochastic Convergence – Lindberg – Levy Central Limit Theorem

Books for Study

1. Hogg, R.V. & Craig, A.T. (2002):- Introduction to Mathematical Statistics. Pearson Education India
2. Rohatgi, V.K. and Saleh, A. K. Md. E (2002) :- An Introduction to Probability and Statistics. John Wiley & Sons, New York.

Books for Reference

1. Goon, A.M., Gupta, M.K., &DasGupta, B. (1988):- An Introduction to Statistical Theory.
2. Gupta, S.C. &Kapoor, V.K. (2002): Fundamentals of Mathematical Statistics, Sultanchand& Sons, New Delhi
3. Sanjay Arora&Bansilal (1989):- New Mathematical Statistics.

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ST 2504 - DISCRETE DISTRIBUTIONS

Semester II **Category: MC**
Hours/Week : 3 **Credits : 3**

Objective: **(i)**To impart essential knolwedge in Discrete distributions

(ii) To expose the real-life applications of Discrete distribution

Unit 1: Joint - Marginal and Conditional distributions – Conditional Expectation – Conditional Variance – Stochastic Independence – Correlation Coefficient ,Generating functions.

Unit 2: Uniform Distribution –Properties– M.G.F – P.G.F , Bernoullie distribution – Properties – M.G.F – P.G.F - Binomial distributions – Properties – Recurrence Formula – Additive Property – Limiting Property

Unit 3: Poisson Distribution – Properties – Mode – M.G.F – P.G.F – Characteristic Function – Recurrence formula – Additive Property – Poisson Approximation to Binomial.

Unit 4: Geometric Distribution – Properties – Recurrence Formula – Memory less property- M.G.F – P.G.F, Negative Binomial Distribution – Properties – M.G.F – Recurrence Formula – P.G.F – Reproductive Property

Unit 5: Hyper geometric distribution – Properties – M.G.F – Characteristic function, Multinomial Distribution – Mean – Variance – Marginal and Conditional distribution – Additive Property

Books for Study :

1. Hogg, R.V. & Craig, A.T. (2002):- Introduction to Mathematical Statistics. Pearson Education India
2. Rohatgi, V.K. (1975):- An Introduction to the Theory of Probability and Mathematical Statistics.

Books for Reference:

1. Goon, A.M., Gupta, M.K., &DasGupta, B. (1988):- An Introduction to Statistical Theory.
2. Gupta, S.C. &Kapoor, V.K. (2002): Fundamentals of Mathematical Statistics, Sultanchand& Sons, New Delhi
3. Sanjay Arora&Bansilal (1989):- New Mathematical Statistics.

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ST 3204 - BIOSTATISTICS

(for Adv. Zoology and Plant Biology & Biotechnology Students)

Semester III **Category: AO**
Hours/Week : 6 **Credits : 4**

Objectives : 1) To imbibe statistical techniques applicable in biological sciences.

2) To demonstrate the applications of statistical methods in real-life situations.

Unit 1 Organizing and summarizing Biological Data – Measures of Central tendency – Measures of Dispersion – Correlation and Regression.

Unit 2 Probability – Addition, Multiplication and Baye's theorems, Distributions – Binomial, Poisson and Normal distributions – Sampling distributions χ^2, t and F

Unit 3 Tests of Significance-Single population mean and the difference between two population means – Paired comparisons-Single proportion and the difference between two population proportions – Confidence Interval – mean, difference of means, proportion, difference of proportions.

Unit 4 Chi-square distribution and the analysis of frequencies – Test of Goodness of fit – Test of Independence of attributes – Analysis of Variance-Completely Randomized Design-Randomized Block Design – Factorial experiments – 2^2, 2^3 experiments.

Unit 5 Non parametric tests – Sign test, Median test, Mann-Whitney test.

Books for study:

1. Daniel, W.W. (2008): Biostatistics – A Foundation for analysis in the Health Sciences, John Wiley & Sons, New York.
2. Altman, D.G.(1991): Practical Statistics for Medical Research, Chapman – Hall, London.
3. Bailey, N.T.J.(1994): Statistical Methods in Biology, Cambridge University Press, London.

Books for reference:

1. Gurumani, N. (2004): Introduction to Biostatistics, MJP Publishers, Chennai.
2. Bland, M. (1995): An Introduction to Medical Statistics, Oxford University Press, London.
3. Jasra, P.K. and Raj, G. (2000): Biostatistics, Krishna PrakeshamMandir, India.
4. Lewis, A.E.(1971): Biostatistics, Thomson-Wordsworth.
5. Negi, K.S. (2002): Biostatistics, AITBS Publishers.
6. Sokal, R.R. and Rohlf, F.J. (1973): Intrroduction to Biostatistics, Thomson-Wordsworth.

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ST 3205 - ADVANCED STATISTICAL METHODS

Semester III **Category: AO**
Hours/Week : 6 **Credits : 4**

Objective: (i)To impart knowlegde and methodology behind the various statistical techniques

(ii)To equip students with statistical techniques useful in business and economic analysis

Unit 1 Association of attributes: Consistency of data - Methods of studying association: Proportion method, Yule's coefficient of association, Coefficient of colligation, Coefficient of contingency. Partial association.

Unit 2 Probability and Random variables: Probability - Theorem of probability: Addition theorem - Multiplication theorem. Conditional probability: Baye's theorem. Mathematical expectation.Random variable.Probability distributions and concept of Normal distribution.

Unit 3 Tests of significance: Procedure of testing a hypothesis - Standard error and sampling distributions. Tests for assigned mean, assigned proportion, equality of means and equality of proportions(small and large sample tests) - Chi-square test for independence.

Unit 4 Analysis of variance: Assumptions in Analysis of variance - Techniques of Analysis of variance - One-way and Two-way classification models.

Unit 5 Statistical Quality Control: Control charts - Control limits - Types of control charts - X bar chart, R chart, p chart and c chart, Advantages and disadvantages of SQC.

Books for study :

1. Gupta, S.P.(2011), Statistical methods, Sultan Chand and sons publishers, New Delhi.
2. Gupta,S.C. and Kapoor, V.K.(2002), Fundamentals of Applied Statistics, Sultan Chand and sons publishers, New Delhi.
3. Gupta, S.C. and Kapoor, V.K.(2002), Fundamentals of Mathematical Statistics, Sultan Chand and sons publishers, New Delhi.

Books for reference:

1. Grant, E.L(1988), Statistical quality control, Mc-Grawhill publishers, USA.
2. Mood AM, Graybill FA, and Boes, D.C. (1985), Introduction to the theory of statistics, Mc-Grawhill Book Company, New Delhi.

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ST 3301: BASIC STATISTICAL TECHNIQUES

Semester: II **Category: EG**

Hours/Week : 3 **Credits : 1**

Objective: **(i)**To introduce the basic concepts of statistical methods
(ii) To demonstrate the applications via MS-Excel

Unit 1 Definition and scope of statistics - Construction of frequency table - Diagrammatic representation - Illustrations.

Unit 2 Measures of central tendency - Mean, Median, Mode and Quartiles. Illustrations.

Unit 3 Measures of Dispersion - Mean deviation, Standard deviation, Quartile deviation and Co-efficient of variation. Illustrations.

Unit 4 Correlation and regression - Karl Pearson's correlation co-efficient - Spearman's rank correlation - Regression lines. Applications.

Unit 5 Simple ideas in probability theory - Sample space - Events - Probability of an event. Simple problems.

Books for study:

1. Gupta, S.P.(2011), Statistical methods, Sultan Chand and sons.
2. Kapoor, J.N. and Saxena,H.C(2002), Mathematical Statistics, Sultan Chand and Sons. Pillai.

Books for Reference :

1. R.S.N and Bagavathi,(1984), Practical statistics, Sultan Chand and sons.

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ST 3505 - SAMPLING THEORY

Semester III **Category: MC**
Hours/Week : 6 **Credits : 6**

Objectives: i.)To equip students with Sampling Techniques used in conducting samplesurveys.
ii.) To compare the efficiency of various estimation strategies resulting from different sampling techniques.

Unit 1 Preliminaries: Sampling Vs Census - Basic concepts of sampling - Population - Parameter - Statistic - Unbiasedness - Mean square error - simple problems.

Unit 2 Simple Random Sampling: Simple random sampling with and without replacement - Estimation of population mean - Variance of estimators - Simple problems.

Unit 3 Stratified Sampling: Estimation of total ,mean - Its variance - Allocation problems - Simple problems.

Unit 4 Systematic Sampling: Linear, Circular. Comparisons for populations with one-dimensional linear trend.

Unit 5 Use of Auxiliary Information.Ratio Estimation.Regression Estimation.

Book for study:

1. Cochran, W.G.(2009), Sampling Techniques, Wiley Eastern Company Ltd.

Books for Reference:

1. Murthy,M.N.(1983), Sampling theory and methods, Statistical publishing society,Calcutta.
2. Sampath,S.(2000), Sampling theory and methods, Narosa publishing house.

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ST 3506 - MATRIX AND LINEAR ALGEBRA

Semester III **Category: MC**
Hours/Week : 3 **Credits : 3**

Objective:

(i)To expose students acquaintance with some fundamental notions and techniques of matrices and vectors

(ii)To impart mathematical techniques which are required for pursuing core areas of statistics.

Unit 1 (Matrix Algebra): Matrices – Operations on matrices. Various types of matrices. Trace of a square matrix. Determinants, Cofactors, Minors.Properties of Determinants (without proof).Evaluation of Determinants.

Unit 2 (Inversion & Rank): Singular & Non-Singular matrices. Inverse of a matrix – Properties. Rank of a matrix – Properties. Methods of matrix inversion.

Unit 3 (Vectors): Vector space. Linear dependence & Independence.Basis & Dimension.Linear equations – Cramer's rule.

Unit 4 (Linear Transformations) : Linear Transformations & Properties. Matrix of a LT. Orthogonal Transformations.

Unit 5 (Eigen values & Vectors): Characteristic equation, eigen roots & vectors – Properties. Cayley-Hamilton Theorem.Matrix inversion by CH Theorem.

Book for Study:

1. Datta, K. B. (2004): Matrix and Linear Algebra. Prentice Hall of India.
   [Chapters & Sections to be covered]
   For Unit 1: Chapter 1 (Sections 1.1 to 1.4 – Relevant Portions)
   Chapter 2 (Sections 2.2 to 2.4 – Relevant Portions)
   For Unit 2: Chapter 3 (Sections 3.1 to 3.3 – Relevant Portions) ;
   Chapter 4 (Sections 4.1, 4.2, 4.4, 4.5, 4.7 – Relevant Portions)
   For Unit 3: Chapter 5 (Sections 5.1, 5.2, 5.6 – Relevant Portions)
   yFor Unit 4: Chapter 6 (Sections 6.1 – 6.3, 6.5 – Relevant Portions)
   For Unit 5: Chapter 7 (Sections 7.1, 7.2, 7.4 – Relevant Portions)

Books for Reference:

1. Hohn, F.E. (1964): Elementary Matrix Algebra. Amerind Publishing Co. Pvt. Ltd.
2. Shantinarayan (1964): A Textbook of Matrices. Sultanchand& Co, New Delhi

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ST 4208 - STATISTICS FOR MANAGEMENT

Semester: IV **Category:AO**
Hrs./Week: 6 **Credits: 4**

Objectives: (i) To expose students to concepts in Business Statistics
(ii) To teach the applications of Statistics in Management

UNIT - 1: Probability: Definition - Theorems of probability: Addition and multiplication theorem - Conditional probability - Baye's theorem - Probability distributions: Binomial, Poisson and Normal distributions - fitting of Binomial and Poisson distributions.

UNIT - 2: Tests of Significance: Procedure for testing hypothesis - standard error - tests for assigned mean, assigned proportion, equality of means and equality of proportions - small and large sample tests - Chi-square test for independence - Analysis of Variance - one and two way ANOVA only.

UNIT - 3: Index Numbers: Construction of Index numbers - unweighted index numbers - weighted index numbers - Laspeyre's method, Paasche's method, Dorbish&Bowley method, Marshal Edgeworth method, Fisher's method, Kelly's method - quantity index numbers - chain index numbers - base shifting - Splicing and deflating the index numbers - consumer price index numbers - aggregate expenditure method and family budget method.

UNIT - 4: Statistical Quality Control: Control charts - control limits - types of control charts - $\overline{X}$ Chart, R chart, p Chart and c chart - merits and demerits of SQC.

UNIT - 5: Operations Research: Elements of Operations Research - Linear Programming - formulation - solving L.P.P. by graphical method only - transportation problem (North West Corner Rule, Least Cost Method, Vogel's Approximation Method only) - assignment problem - game theory.

Books for study:

1. S. P. Gupta (2011): Statistical Methods, Sultan Chand & Sons Publishers, New Delhi.
2. KantiSwarup, Gupta P. K. and Man Mohan (1996), Operations Research for Management Sultan Chand & Sons (P) Ltd., New Delhi.

Books for reference:

1. Vittal, P. R. (2008): Business Statistics, Margham Publishers, Madras.
2. Grant E .L. (1988): Statistical Quality Control, McGraw Hill Publlilshers, USA.
3. Taha, Hamdy A. (2008): Operations Research, Macmillan Publishing Housing Co., New York.

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ST 4209 - MATHEMATICAL STATISTICS

Semester IV **Category: AO**
Hours/Week : 6 **Credits : 4**

Objective: (i)To impart statistical concepts and results with rigorous mathematical treatment.

(ii) To enable the real-life applications of Statistics

Unit 1 Probability: Definition of probability, finite sample space, conditional probability and independence of events. Basic problems.

Unit 2 Random variables: Definition of random variable, distribution function, and expectation. Discrete, continuous and concept of mixture of distributions. Expectation and moments: Moment generating function, Chebyshev's inequality.

Unit 3 Special univariate distributions: Discrete distributions - uniform, binomial and Poisson distributions. Their properties. Continuous distributions - uniform, normal, exponential, beta and gamma distributions.

Unit 4 Joint, marginal and conditional distributions: Trinomial and bivariate normal distribution. Their properties. Correlation and regression. Transformation of random variables. Chi-square, t, and F distributions.

Unit 5 Statistical inference: Random sample - Parametric point estimation unbiasedness and consistence - method of moments and method of maximum likelihood. Tests of hypotheses - Null and Alternative hypotheses. Types of errors. Neyman-Pearson lemma - MP and UMP tests. Illustrations.

Books for study:

1. Hogg ,R.V. and Craig, A.T.(2006), An introduction to mathematical statistics, Amerind publications.
2. Hogg, R.V and Tanis, E.(1989), Probability and statistical inference, Macmillan publishing house, New york.
3. Kapur, J.N. and Saxena,H.C.(1970), Mathematical statistics, Sultan Chand & company, New Delhi.

Books for reference:

1. Mood AM, Graybill FA, and Boes, D.C.(1985), Introduction to the theory of statistics, Mc-Grawhill Book Company, New Delhi.
2. Rao, C.R.(1989), Linear statistical inference and its applications, Wiley eastern company, New Delhi.
3. Rohatgi, V.K.(1976), An introduction to probability theory and mathematical statistics, John Wiley and sons, New York.

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ST4210 - ECONOMETRICS

Semester IV **Category: AO**
Hours/Week : 6 **Credits : 4**

Objective: (i) To equip the students with concepts and techniques of analysing economic phenomenausing statistical tools.
(ii) To expose the students to econometrical modelling.

Unit 1 Statistical inference (basic concepts only), random variables, probability distribution, expectation and variance, random sample, sampling distributions, point and interval estimation, hypothesis testing, illustrations.
Unit 2 Role of econometrics, General linear model - matrix representation,
Least - squares estimation, properties of OLSE , two and three variable regression models, illustrations.
Unit 3 Linear hypothesis - hypothesis testing, coefficient of determination. Tests of structural change. Dummy variables. Prediction. Illustrations.
Unit 4 Problems in regression analysis - Multicollinearity, heteroscedasticity,
Auto - correlation, specification error. Tests for heteroscedasticity and auto - correlation. Illustrations.
Unit 5 Generalized least squares, GLS estimator and its properties, Auto - regressive models, lagged variables.

Books for study

1. Gujarati,D.(2007).Basic Econometrics.Mc-Graw Hill, New Delhi.
2. Johnson,A.C,Johnson,M.B and Buse,R.C(1993)., Econometrics- Basic and Applied. Macmillan Publishing Company.
3. Johnston,J(2007).Econometric Methods.Mc-Graw Hill. New Delhi.

Book for reference:

1. Kelejian,H.H and Oates,W.E(1989).Introduction to Econometrics - Principles and applications.Harper and Rower Publishers . Singapore.

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ST 4301: PROGRAMMING IN "C"

Semester III **Category: EG**
Hours/week: 3 **Credit: 1**

Objective: (i) To equip the students with basic principles of "C" language.
(ii) To expose the students to their real-life applications.

Unit 1 "C" –Character set, constants, variables and arithmetic expressions. Basic structure of a C program. Operators: Arithmetic operators, assignment operator, relational operators, conditional operators, logical operators and special operators.

Unit 2 Pre-processor directives: #define and #include directives. Library functions: mathematical library functions, string-handling functions. Input and output functions: scanf, printf, gets, puts, getchar and putchar functions.

Unit 3 Control statements: decision making statements – if, if … elseif, goto, switch case, break and continue statements.

Unit 4 Loop statement: while, do and for statements.

Unit 5 Arrays: one-dimensional and two – dimensional arrays. User defined functions – examples.

Books for study :

1.Balagurusamy, E. (2011), ANSI "C" programming, Tata-McGrawhill publishers ltd.

Books for Reference:

1. Byron Gottfried, (2006). Programming with ""C". Tata- McGrawhill. New York

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ST 4503 - ESTIMATION THEORY

Semester IV **Category: MC**
Hours/Week : 6 **Credits : 6**

Objective: (i) To equip the students with the theory essential for estimation of unknown parameters.
(ii) To expose the students to its real-life applications.

Unit 1 Unbiasedness, Consistency - Efficiency - Cramer - Rao inequality - Chapman - Robbin's inequality. Example.

Unit 2 Sufficiency - Factorization theorem - UMVUE - Properties- Completeness.Rao-Blackwell theorem, Lehmann - Scheffe theorem - Examples.

Unit 3 Methods of estimation: Method of moments - Method of maximum likelihood - Method of minimum chi-square, Method of modified minimum chi-square, Properties of MLE(without proof) - Method of least squares - Examples.

Unit 4 Elements of Baye's estimation - Prior and Posterior distributions - Examples.

Unit 5 Confidence intervals for mean when S.D is known and S.D is unknown when the sample is drawn from Normal Population , Confidence interval for Proportion, Confidence interval for difference in means, difference in proportions, Confidence interval of variance and ratio of variances.

Books for study:

1. Hogg, R.V. and Craig, A.T.(2002), Introduction to Mathematical Statistics, Pearson Education(P.Ltd, Singapore).
2. Mood, A.M. Graybill, F.A. and Boes, D.C.(1988), Introduction to the Theory of Statistics, New York; McGraw Hill.
3. Rohatgi.V.K.andSaleh, A.K.Md.E. (2002), An Introduction to Probability and Statistics, John Wiley and Sons, New York.

Books for Reference:

1. Casella, G and Berger,R.L. (1990), Statistical Inference, Wadworth, Inc., Belmont, California.
2. Goon,A.M., Gupta, M.K. amdGupta,B.D.(1987) An outline of Statistical Thoery, Vol.II, The World Press Pvt. Ltd., Calcutta.
3. Kale, B.K.1999, A First Course on Parametric Inference, Narosa Publishing House.
4. Silvey, S.D.(1970), Statistical Inference, Chapmans Hall, London.

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ST 4504 – MS EXCEL

Semester IV **Category: MC**
Hours/Week : 3 **Credits : 2**

Objective: (i) To impart knowledge in Excel Functions and Data Handling

(ii)To train students in Applied Statistics through MS Excel

Unit 1: Overview of MS Excel – Numeric, String and Date Formats – Entering formula in cell, Inbuilt mathematical and Statistical functions and its use

Unit 2: Construction of Bar, Pie, Histogram, Line Chart, Scatter Plot, Usage of Secondary axis in charts, Chi-square test of independence

Unit 3: Sorting - Filtering – Removing duplicates – Conditional formatting – Relative and Absolute Cell reference – Vlookup – Hlookup – Pivot tables – Integration with Data base MS access and Oracle.

Unit 4: Simple Correlation, Simple Regression - Constructing Model - Predicting New Observation - Curve Fitting – Fitting of Binomial, Poisson, Normal

Unit 5: Matrix Operations – Inverse – Solutions of linear of equations – Eigen roots and Vectors

Book for Reference:

1. John Walkenbach. Excel for Windows 95 Bible.

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ST 5407 - SQL and PL SQL

Semester : V **Category: ES**
Hours/Week : 3 **Credits : 2**

Objectives: i) To create an awareness to database concepts
ii) To manage database effectively through SQL and PL/SQL

Unit - 1 Introduction to Database Systems – Basic concepts of relational database systems – Database administrator- Data models - Storage management - Entity Relationship model

Unit – 2 Delimiters- Identifiers-Reserved Words-Predefined Identifiers-Quoted Identifiers-Literals-Numeric Literals-Character Literals-String Literals-BOOLEAN Literals-Comments-Restrictions on Comments-Declarations-Constants - Restrictions on Declarations and properties.

Unit - 3 Data Definition Language (DDL) - Data Manipulation Language (DML) - Data Control Language (DCL).

Unit - 4 Programming Languages through SQL. PL / SQL - PL / SQL syntax and constructs - SQL within PL / SQL - DML in PL / SQL - Cursors – Procedures.

Unit- 5: Functions - Packages and Triggers – Merges – Inner joint - Outer joint.

Books for study :

1. Abraham Silberschatz , Henry F.Korth, and S.Sudharshan(2010). Database systems and concepts. Tata McGrawhill Companies Inc., New Delhi.

Book for Reference:

1. Scott Urman, (2002). Oracle PL/SQL programming (The authorized Oracle Press Edition): Osborne McGrawHill, New Delhi.

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ST 5409: RELIABILITY THEORY

Semester: V **Credits : 2**
Category: ES **Hours/week: 3**

Objective: (i) To Impart the Statistical concepts underlying Reliability theory
(ii) To discuss several performance measures of systems in industries and related inference problems.

Unit 1 Basic concepts in reliability theory – failure time distribution, reliability, MTBF, hazard rate function, examples, IFR and DFR distributions. Reliability importance of exponential distribution.

Unit 2 types of systems – series, parallel and standby systems of order2.(k, n) systems.Measures of system performance.

Unit 3 Systems with repair, parallel and standby systems of order 2 with a repair facility. Transient solution and measures of performance. Availability and Steady state availability.

Unit 4 Coherent systems – structure function, examples of coherent systems, properties – representation of coherent systems in terms of paths and cuts – reliability of systems of independent components.

Unit 5 Life testing – exponential distribution in life testing. Inference based on Type II censored sample.

Books for Study and reference:

Barlow, R.E and Proschan, F. (1981). Statistical Theory of reliability and life testing. Holt, Rienhart and Winston Inc. New York.
Rau, J.G. (1970). Optimization and probability in systerms engineering. Van Nostrand.
Ross, S.M. (1987). Introduction to probability and statistics for engineers and scientists .John Wiley and sons. New York.
Sinha, S.K (1986). Reliability and life testing. Wiley Eastern Ltd. New Delhi.
Zacks, S. (1993). Introduction to reliability anasysis. Springer-Verlag. Germany.

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ST 5406 - ACTUARIAL STATISTICS

Semester V **Category: ES**
Hours/Week : 3 **Credits : 2**

Objectives: (i) To impart basic concepts in actuarial studies
(ii) To prepare students to take up a career in Actuarial Practice

Unit –1 Effective Rate of Interest i - Nominal Rate of Interest $i^{(m)}$ - Force of Interest δ - Relationships between different rates of interest - Expression for δ by use of calculus - Present values - Effective rate of discount d - Nominal rate of discount $d^{(m)}$.

Unit - 2 Annuities - Immediate Annuity - Annuity-due - Perpetuity - Accumulation and Present values of Annuities - Increasing and Decreasing annuities - Annuities and interest rates with different frequencies - Continuous Annuities.

Unit - 3 Analysis of Annuity payments - Capital and Interest elements included in the Annuity payments - Loan outstanding after t payments - Purchase price of Annuities - Annuities involving income tax - Purchase price of an annuity net of tax.

Unit - 4 Stochastic Interest rates - Independent annual interest rates - The definition of S_n - Mean and variance of S_n - Definition of A_n - Mean and variance of A_n - Simple problems.

Unit - 5 Probabilities of living and dying - The force of mortality μ_x - Estimation of μ_x - Uniform Distribution of deaths - Select and Ultimate rates.

Books for study :

1. Dixit, S.P., Modi, C.S. & Joshi, R.V. (2002) Mathematical Basics of Life Assuarnce. Insurance Institute of India, Mumbai.
2. Donald, D.W.A.(1975). Compound Interest and Annuities certain .Heinemann, London.
3. Frank Ayres, J.R. (1983). Theory and problems of mathematics of finance. Schaum's outline series, McGrawHill, Singapore.

Books for reference:

1. McCutcheon J.J. and Scott.(1989). Mathematics of Finance. Heinemann, London. Neill, A (1977). Life Contingencies. Heinemann, London.

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ST 5408: APPLIED STOCHASTIC PROCESSES

Semester: V **Credits : 2**
Category: ES **Hours/week: 3**

Objective: (i) To imbibe Statistical knowledge in Stochastic Process
(ii)To equip students with elements of stochastic processes with applications in other disciplines.

Unit – 1 Elements of stochastic processes - definition and examples. Classification of general Stochastic processes.

Unit – 2 Markov Chains - definition and examples. Recurrent and transient states, periodicity. Examples. One-dimensional random walk.

Unit – 3 Basic limit theorem and its applications - Irreducible Markov Chain, Basic limit theorem - examples.

Unit – 4 Stationary distribution of a Markov Chain - existence of a stationary distribution. Illustrations.

Unit – 5 Continuous time Markov Chains - Poisson process - marginal distribution of a Poisson process - Pure Birth process - marginal distribution of a Pure Birth process.

Books for study:

1. Karlin, S. and Taylor, H. M. (1975): A First Course in Stochastic Processes, Academic Press, New York.
2. Feller, W. (1957): An Introduction to Probability Theory and its Applications, Vol. 1 2nd ed., John Wiley & Sons, New York.

Books for reference:

1. Medhi, J. (1994): Stochastic Processes, Wiley Eastern Ltd., New Delhi.
2. Ross, S. M. (1983): Stochastic Processes, John Wiley & Sons, New York.

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ST 5508 - APPLIED STATISTICS

Semester V **Category: MC**
Hours/Week : 6 **Credits : 6**

Objective: (i) To expose statistics students to wide genre of study
(ii) To bring out its significant role in various areas of study

Unit 1: Index Numbers :-Basic problems in construction of index numbers. Methods – Simple and WeghtedAggeregate methods, Average of Price Realtives, Chain Base method
Criteria of goodness – Unit test, Time Reversal, Factor Reversal & Circular tests.
Base shifting, Splicing & Deflating index numbers.Wholesale Price index & Consumer price index numbers. Index of industrial production.

Unit 2: Educational & Psychological Statistics
Scaling procedures – Scaling of individual test items, of scores, of rankings & of ratings.
Reliability of test scores – Index of reliability, Parallel tests, Methods for determining test reliability, Effect of test length & ranges on reliability.

Unit 3: Vital Statistics
Uses and Methods of obtaining vital statistics. Rates & Ratios. Measurement of Mortality – Crude, Specific & Standardised death rates.Life Table – Stationary & Stable population, Construction of life tables.Fertitlity – Crude, General, Specific & total fertility rates

Unit 4: Time Series – Trend Component :-
Components of Time Series, Mathematical models of time series. Measurement of Trend Component : Graphic, Semi-Averages, Moving Averages. Least-squares – Straight Line, Second Degree Parabola, Exponential Curve, Modified Exponential Curve, Gompertz Curve, Logistic Curve.

Unit 5: Time Series – Other Components:
Measurement of Seasonal Variations – Simple averages, Ratio-to-trend, Ratio-to Moving average, Link Relative. Deseasonalisation of data.Measurement of Cyclic variations.

Book for Study:

1. Gupta, S.C. &Kapoor, V.K (2007). Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.

Book for Reference:

1. Gupta, S.P. (2011), Statistical Methods. Sultan Chand and Sons Publishers. New Delhi.

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ST 5509 - REGRESSION ANALYSIS

Semester V **Category: MC**
Hours/Week : 6 **Credits : 6**

Objective: (i) To introduce the vital area of regression models applicable in a wide variety of situations.

(ii) To expose the students to the wide areas of its applications

Unit 1: Introduction to Regression – Mathematical and Statistical Equation – Meaning of Intercept and Slope – Error term – Measure for Model Fit –R^2 – MAE – MAPE – Testing Significance of Model Coefficients, Confidence interval for model coefficients.

Unit 2: Model diagnostics - Mean predicted value, Testing normality of error term, QQ-plot, PP-plot, Anderson Darling, Kolmogrov Smirnov

Unit 3: Introduction to Multiple Linear Regression Model, Partial Regression Coefficients, Testing Significance overall significance of Overall fit of the model, Testing for Individual Regression Coefficients, Estimating R^2, MAE and MAPE

Unit 4: Dummy Variable trap, Study of Interaction Effects, Varying Intercept and Slope using dummy variable, Detection and Removal of Outliers

Unit 5: Study of Normality of Error Term using graphical and testing procedures, Testing for Multicollinearity using VIF, Testing for assumption of Homoscedasticity

Books for Study:

1. Gujarati, D.(2004): Introduction to Econometrics. McGraw Hill, New Delhi.

Books for Reference:

1. Montgomery,D.C. ,Peck E.A, & Vining G.G.(2003). Introduction to Linear Regression Analysis. John Wiley and Sons,Inc.NY

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ST 5510 : TESTING OF HYPOTHESES

Semester V **Category: MC**
Hours/Week : 6 **Credits : 6**

Objective: (i)To introduce the concepts of hypothesis testing
(ii) To illustrate the concepts with various numerical examples.

Unit – 1 Statistical hypotheses- simple null hypothesis against simple alternative - Best Critical Region. Neyman -Pearson Lemma - Most powerful randomized tests - examples.

Unit - 2 One parameter exponential family - Families with monotone likelihood ratio property - UMP tests for one-sided hypotheses (without proof) - examples.

Unit - 3 Elements of SPRT - Likelihood ratio tests - examples.

Unit - 4 Tests of significance - tests based on normal, t, chi - square and F distributions

Unit - 5 Non-parametric methods - Run test for randomness - sign test for location - Median test - Mann-Whitney - Wilcoxon test - Kolmogorov-Smirnov test - one and two sample problems.

Books for Study:

1. Hogg, R.V. and Craig, A.T.(2002), Introduction to Mathematical Statistics, Pearson Education(P.Ltd, Singapore).
2. Beaumont, G. P. (1980). Intermediate Mathematical Statistics, Chapman and Hall, New York.
3. Gibbons, J. D. (1971). Non-parametric Statistical Inference, McGraw-Hill Kogakusha Ltd., New Delhi.

Books forReference:

1. Rohatgi.V.K.andSaleh, A.K.Md.E. (2002), An Introduction to Probability and Statistics, John Wiley and Sons, New York.
2. Hogg, R. V. and Tanis, E. A. (1983). Probability and Statistical Inference, Maxwell Macmillan international edition, New York.
3. Mood, A. M., Graybill, F. A. and Boes, D. C. (1983). Introduction to the Theory of Statistics, McGraw-Hill, New Delhi.

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ST 5511 - STATISTICAL DATA ANALYSIS USING SPSS

Semester V **Category: MC**
Hours/Week : 6 **Credits : 6**

Objective: (i) To train students in SPSS Software
(ii)To expose the students to the analysis of statistical data

Unit 1: Data handling: open SPSS data file – save – import from other data source – data entry – labeling for dummy numbers - recode in to same variable – recode in to different variable – transpose of data – insert variables and cases – merge variables and cases.

Unit 2: Data handling: Split – select cases – compute total scores – table looks – Changing column - font style and sizes

Unit 3: Diagrammatic representation: Simple Bar diagram – Multiple bar diagram – Sub-divided Bar diagram - Percentage diagram - Pie Diagram – Frequency Table – Histogram – Scatter diagram – Box plot.

Unit 4: Descriptive Statistics - Mean, Median, Mode, SD- Skewness- Kurtosis. Correlation – Karl Pearson's and Spearman's Rank Correlation
Regression analysis: Simple and Multiple Regression Analysis
[Enter and stepwise methods]

Unit 5: Testing of Hypothesis: Parametric – One sample – Two sample Independent t – test – Paired t – test. Non – parametric: One sample Mann-Whitney u – test – Wilcoxon Signed Rank test - Kruskal Wallis test – Chi- square test. Analysis of variance: One way and Two way ANOVA.

Books for Study:

1. Clifford E.Lunneborg (2000). Data analysis by resampling: concepts and applications. Dusbury Thomson learning. Australia.
2. Everitt, B.S and Dunn, G (2001). Applied multivariate data analysis. Arnold London.

Books for reference:

1. Jeremy J. Foster (2001). Data analysis using SPSS for windows. New edition. Versions 8-10. Sage publications. London.
2. Michael S. Louis – Beck (1995). Data analysis an introduction, Series: quantitative applications in the social sciences. Sage. Publications. London.

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ST 6606 - DESIGN AND ANALYSIS OF EXPERIMENTS

Semester VI **Category: MS**
Hours/Week : 5 **Credits : 7**

Objective: (i) To provide basic principles of experimentation
(ii) To discuss the analysis of data relating to agriculture, biological sciences and industry.

Unit 1 Contrasts - linear constraints - orthogonal contrasts - linear models - fixed effect model - random effect model - mixed effect model.

Unit 2 Principles of experimentation - analysis of variance - one-way classification - two-way classification - two-way classification with more than one observation per cell efficiency of two way over one way.

Unit 3 Completely Randomised Design (CRD) - Randomised Block Design (RBD) - Latin Square Design (LSD) - missing plot techniques.

Unit 4 Factorial designs: 2^2, 2^3 and 3^2 factorial designs; confounding and partial confounding.

Unit 5 BIBD: Intra block analysis of BIBD. Construction of BIBD (Simple construction).

Books for study:

1. Gupta S.C and Kapoor V.K.(2008), Fundamentals of Applied Statistics
2. Montgomery, D.C. (2010), Design and Analysis of Experiments, John Wiley & sons.

Books forreference:

1. Das M.N. and Giri N. (1986), Design and Analysis of Experiments, Wiley Eastern.
2. Kempthorne, O. (1987), Design and Analysis of Experiments, Wiley Eastern.

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ST 6607 - OPERATIONS RESEARCH

Semester VI **Category: MS**
Hours/Week : 5 **Credits : 6**

Objective: (i) To train the students with Optimization techniques towards solving decision making problems based on deterministic and probabilistic models.
(ii)To impart an insight of the applications of Operations Research in Management

Unit 1 Introduction to OR - Linear programming problem - Formulation - Graphical method - Basic solution - Optimum solution - Simplex method - Various cases - Unbounded solution - Unrestricted variables, alternative optimum.

Unit 2 Need for artificial variables - Two phase method - Big M method - Primal, Dual relationship - Dual simplex method.

Unit 3 Transportation problem- North-west corner rule – least cost method- Vogel's Approximation Method – Modified Method, Assignment problem.

Unit 4 Networks - CPM and PERT - problems.

Unit 5 Decision under uncertainty - Laplace criterion - Minimax criterion - Savage criterion - Hurvitz theorem - Games - Two person zero sum games - Saddle point - Solving by graphical method - solving by LPP.

Books for study

1. Don T. Philips, Ravindran, A, James J. Solberg (2007), Operations Research: Principles and Practices, John Wiley & sons.
2. Hadley (2006), Linear Programming, Addison - Wesley publishers.
3. Hamdy A. Taha (2008) Operations Research - An Introduction (fourth edition), Macmillan publishers.

Books for reference:

1. Hillier, F.S. and Lieberman, G.J. (1974), Introduction to Operations Research, Holden Day Publishing, San Francisco.
2. KantiSwarup, Gupta, P.K., Manmohan (1993), Operations Research, Sultan Chand Publishers.
3. Mittal, K.V. (1976), Optimization Methods in Operations Research, Wiley Eastern.

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ST 6608 - STATISTICAL QUALITY CONTROL

Semester VI **Category: MS**
Hours/Week : 5 **Credits : 7**

Objective: (i) To provide an insight into quality assessment techniques.
(ii) To provide an insight into the real-life and varied application of the subject.

Unit 1 Quality improvement in the modern business environment: Philosophy and basic concepts of quality improvement - Statistical methods for quality improvement - Total Quality Management (TQM).

Unit 2 Modeling process quality: Describing variation - Histogram, Stem and Leaf plot, Box plot, Frequency distributions, Quantile plot (qq-plot) applications.

Unit 3 Statistical Process Control (SPC): Methods and philosophy of SPC - Control charts for attributes data - p chart, np chart, c and u charts and D chart - Control charts for variables - X and R charts, X and S charts - Applications.

Unit 4 Basic principles of CUSUM and slant control charts - process capability analysis - Applications.

Unit 5 Acceptance sampling: The acceptance sampling problem - Single sampling plan for attributes with applications - Basic concepts of double, multiple and sequential sampling plans - Concept of CSP.

Books for study:

1. Montgomery, D.C. (2007), Introduction to Statistical Quality Control (Third Edition), John Wiley and sons Inc.
2. Duncan, A.J. (2010), Quality Control and Industrial Statistics (Fourth Edition), Irwin, Homewood, Ill.
3. Forrest W. Breyfogle III(1999)- implementing six sigma: smarter solutions using statistical methods, john Wiley and Sons, Inc.

Books for reference:

1. Schilling, E.G. (1982), Acceptance Sampling in Quality Control, Marcel Dekker Inc., N.Y.
2. Grant, E.L. and Leavenworth, R.S. (1980), Statistical Quality Control (Fifth Edition), McGraw Hill, New York.

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SKILL BASED MODULE
Component 1
ST 6652 - R Language

Semester VI **Category: SK**
Hours/Week : 9 **Credits : 9**

Objective: **(i)** To Impart efficient Data Handling Techniques
(ii) To equip students to Statistical Programming Skills based on real life examples and datasets

Unit 1: Overview of R Environment – R editor – Workspace – Data type – Importing and Exporting Data – Basic Computational Ideas – Merges in R

Unit 2: Matrix Determinant – Inverse – Transpose – Trace – Eigen Values and Eigen Vectors – Construction of Bar, Pie, Histogram, Line Chart, Box Plot, Scatter Plot

Unit 3: Parametric and Non Parametric testing of Statistical Hypothesis – One Sample t test – two group t test – paired t test – one way ANOVA- two way ANOVA – Latin Square Design – Sign Test – Wilcoxon – Mann Witney – Kruskal Wallis

Unit 4: Simple Correlation - Linear Regression – Multiple Linear Regression – Testing for overall significance of Model Coefficients – Testing for Individual Regression Coefficients – Outliers Detection – Dealing with Multicollinearity

Unit 5: Control Charts – Variable Control Chart - $\bar{x}$, R, S. Attribute Control Chart- p, np, c, u. CUSUM Control Chart, EWMA Control Chart, Process Capability Analysis

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ST 6652 - SURVEY PRACTICE & REPORTING

COMPONENT 2

Semester VI **Category: SK**
Hours/Week : 6 **Credits : 6**

Objective: (i) To motivate the students to understand the fundamentals to Sampling Survey
(ii) To enable and motivate the students to perform Statistical Analysis in Sampling Survey

Groups of students are expected to collect Primary Data through Design of Sample Surveys and Secondary Data from various sources, carry out statistical analysis and present a report on their findings. The surveys shall address some of the contemporary issues.

The data analysis needs to be carried out using any statistical package of the students' choice.