# B.Sc. STATISTICS
## Scheme of Examination (w.e.f. 2012- 2013)

| Semester | S.No. | Title of Paper | MARKS |
|---|---|---|---|
| **Semester I** | 1 | Tamil Paper I | 100 |
| | 2 | English Paper I | 100 |
| | 3 | Core Paper - I Descriptive Statistics | 100 |
| | 4 | Allied I - Paper I: Mathematics for Statistics I | 100 |
| | 5 | Environmental Studies | 100 |
| **Semester II** | 1 | Tamil Paper II | 100 |
| | 2 | English Paper II | 100 |
| | 3 | Core Paper - II Time Series,Index Numbers and Demand Analysis | 100 |
| | 4 | Allied II - Paper II: Mathematics for Statistics II | 100 |
| | 5 | Core Practical - I: Statistics Practical I | 100 |
| | 6 | Value Education | 100 |
| **Semester III** | 1 | Tamil Paper III | 100 |
| | 2 | English Paper III | 100 |
| | 3 | Core Paper - III Demographic Methods | 100 |
| | 4 | Allied I - Paper I : Computer Programming for Statistical Analysis(C) | 100 |
| | 5 | Skill based Elective - Statistical Quality Control-I | 100 |
| **Semester IV** | 1 | Tamil Paper IV | 100 |
| | 2 | English Paper IV | 100 |
| | 3 | Core Paper - IV Probability and Distributions | 100 |
| | 4 | Allied II - Paper II: Computer Programming for Statistical Analysis(C++) | 100 |
| | 5 | Skill based Elective - Statistical Quality Control-II | 100 |
| | 6 | Core Practical - II : Statistics Practical - II | 100 |
| | 7 | Extention Activities NSS/NCC/P.Ed/YRC | |
| **Semester V** | 1 | Core Paper V Statistical Inference - I | 100 |
| | 2 | Core Paper VI Basic Sampling Theory | 100 |
| | 3 | Core Paper VII Design of Experiments | 100 |
| | 4 | Core Paper VIII AOS Elements of Operations Research | 100 |
| | 5 | Skill based Elective - Statistical Quality Control-III | 100 |
| | 6 | Non Major Elective - I | 100 |
| **Semester VI** | 1 | Core Paper IX Elements of Econometrics | 100 |
| | 2 | Core Paper X Statistical Inference - II | 100 |
| | 3 | Core Paper XI AOS Numerical Analysis | 100 |
| | 4 | Core Practical III | 100 |
| | 5 | Core Practical IV | 100 |
| | 6 | Skill based Elective - Decision Theory and Applications | 100 |
| | 7 | Non Major Elective - II | 100 |
| | 8 | Project Work | 100 |
| | | **TOTAL MARKS** | **3600** |

## B.Sc. STATISTICS
## Scheme of Examination (w.e.f.2012-2013)

| Semester | S.No. | Title of Paper | No.of Credits |
|---|---|---|---|
| **Semester I** | 1 | Tamil Paper I | 3 |
| | 2 | English Paper I | 3 |
| | 3 | Core Paper - I Descriptive Statistics | 4 |
| | 4 | Allied I - Paper I: Mathematics for Statistics I | 5 |
| | 5 | Environmental Studies | 2 |
| **Semester II** | 1 | Tamil Paper II | 3 |
| | 2 | English Paper II | 3 |
| | 3 | Core Paper - II Time Series,Index Numbers and Demand Analysis | 4 |
| | 4 | Allied II - Paper II: Mathematics for Statistics II | 5 |
| | 5 | Core Practical - I: Statistics Practical - I | 4 |
| | 6 | Value Education | 2 |
| **Semester III** | 1 | Tamil Paper III | 3 |
| | 2 | English Paper III | 3 |
| | 3 | Core Paper - III Demographic Methods | 4 |
| | 4 | Allied I - Paper I: Computer Programming for Statistical Analysis(C) | 5 |
| | 5 | Skill based Elective - Statistical Quality Control-I | 3 |
| **Semester IV** | 1 | Tamil Paper IV | 3 |
| | 2 | English Paper IV | 3 |
| | 3 | Core Paper - IV Probability and Distributions | 4 |
| | 4 | Allied II - Paper II: Computer Programming for Statistical Analysis(C++) | 5 |
| | 5 | Skill based Elective - Statistical Quality Control-II | 3 |
| | 6 | Core Practical - II: Statistics Practical - II | 4 |
| | 7 | Extention Activities NSS/NCC/P.Ed/YRC | 1 |
| **Semester V** | 1 | Core Paper V Statistical Inference - I | 4 |
| | 2 | Core Paper VI Basic Sampling Theory | 4 |
| | 3 | Core Paper VII Design of Experiments | 4 |
| | 4 | Core Paper VIII AOS Elements of Operations Research | 4 |
| | 5 | Skill based Elective - Statistical Quality Control-III | 3 |
| | 6 | Non Major Elective - I | 2 |
| **Semester VI** | 1 | Core Paper IX Elements of Econometrics | 4 |
| | 2 | Core Paper X Statistical Inference - II | 4 |
| | 3 | Core Paper XI AOS Numerical Analysis | 4 |
| | 4 | Core Practical III: Statistics Practical - III | 4 |
| | 5 | Core Practical IV: Statistics Practical - IV | 4 |
| | 6 | Skill based Elective - Decision Theory and Applications | 3 |
| | 7 | Non Major Elective - II | 2 |
| | 8 | Project Work | 15 |
| | | **TOTAL MARKS** | **140** |

# GOVERNMENT ARTS COLLEGE (Autonomous)
## COIMBATORE – 18
## DEPARTMENT OF STATISTICS
### SCHEME OF EXAMINATION (2015 - 2016 Onwards)

| Sem | Part | Subject | I MM (Hrs) | Exam (Hrs) | SE | CA | Total | SE-Min. | TPM | No. of Credits |
|-----|------|---------|-----------|-----------|-----|-----|-------|---------|-----|--------|
| I | I | **Part - I**<br>Language - I: Tamil - I | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | II | **Part - II**<br>English - I | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | III | **Part - III**<br>Core - I: Descriptive Statistics | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Allied - I:  Mathematics for Statistics - I | 8 | 3 | 75 | 25 | 100 | 30 | 40 | 5 |
| | | Core Practical - I: Statistics Practical - I | 2 | | | | | | | |
| | IV | **Part - IV**<br>Environmental Studies | 2 | 3 | 75 | 25 | 100 | 30 | 40 | 2 |
| II | I | **Part - I**<br>Language - II: Tamil - II | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | II | **Part - II**<br>English - II | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | III | **Part - III**<br>Core - II: Time Series and Index Numbers | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Allied - II:  Mathematics for Statistics - II | 8 | 3 | 75 | 25 | 100 | 30 | 40 | 5 |
| | | Core Practical - I: Statistics Practical - I | 2 | 3 | 60 | 40 | 100 | 24 | 40 | 4 |
| | IV | **Part - IV**<br>Value Education  - Gandhian Thoughts | 2 | 3 | 75 | 25 | 100 | 30 | 40 | 2 |
| III | I | **Part -I**<br>Language - III : Tamil - III | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | II | **Part- II**<br>English - III | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | III | **Part - III**<br>Core - III:  Probability and Distributions | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Allied III: C Programming for<br>            Statistical Analysis | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 5 |
| | | Core Practical - II:  Statistics Practical - II | 2 | | | | | | | |
| | IV | **Part - IV**<br>Skill based Elective - I: Demographic Methods | 4 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| IV | I | **Part - I**<br>Language - IV : Tamil - IV | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | II | **Part - II**<br>English - IV | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | III | **Part - III**<br>Core - IV:Numerical Analysis | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Allied - IV: Mathematical Economics | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 5 |
| | | Core Practical - II:  Statistics Practical - II | 2 | 3 | 60 | 40 | 100 | 24 | 40 | 4 |
| | IV | **Part - IV**<br>Skill Based Elective - II:  Psychological Statistics | 4 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | V | **Part - V**<br>Extention Activities:  NSS/NCC/P.Ed/YRC | | | | | | | | 1 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **V** | III | **Part - III**<br>Core - V: Statistical Inference - I | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Core - VI: Basic Sampling Theory | 5 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Core - VII: Design of Experiments | 5 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Core -VIII - AOS: Elements of Operations Research | 5 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Core Practical - III: Statistics Practical - III | 3 | | | | | | | |
| | IV | **Part - IV**<br>Skill Based Elective - III: Elements of Actuarial Statistics | 3 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | | Non - Major Elective - I | 3 | 3 | 75 | 25 | 100 | 30 | 40 | 2 |
| **VI** | III | **Part - III**<br>Core - IX: Elements of Econometrics | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Core - X: Statistical Inference - II | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Core - XI - AOS: Statistical Quality Control | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Core Practical - III: Statistics Practical - III | 1 | 3 | 60 | 40 | 100 | 24 | 40 | 4 |
| | | Core Practical - IV: Statistics Practical - IV | 2 | 3 | 60 | 40 | 100 | 24 | 40 | 4 |
| | | **Project & Viva Voce** | 2 | 80<br>(Report) | | 20<br>(Viva) | 100 | 32 | 40 | 15 |
| | IV | **Part - IV**<br>Skill based Elective - IV: Optimization Techniques | 4 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | | Non - Major Elective - II | 3 | 3 | 75 | 25 | 100 | 30 | 40 | 2 |
| | | **Total** | 180 | | | | 3600 | | | 140 |

Statitiscs - Non - Major Elective:

1. Basic Statitics - I
2. Basic Statitics - II

## GOVERNMENT ARTS COLLEGE (Autonomous)
## COIMBATORE – 18
## DEPARTMENT OF STATISTICS
### SCHEME OF EXAMINATION (2012 - 2013 Onwards)

| Sem | Part | Subject | I MM (Hrs) | Exam (Hrs) | Marks | | | | | No. of Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SE | CA | Total | SE-Min. | TPM | |
| I | I | **Part - I** Language - I: Tamil - I | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | II | **Part - II** English - I | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | III | **Part - III** Core - I: Descriptive Statistics | 8 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Allied - I:  Mathematics for Statistics - I | 8 | 3 | 75 | 25 | 100 | 30 | 40 | 5 |
| | IV | **Part - IV** Environmental Studies | 2 | 3 | 75 | 25 | 100 | 30 | 40 | 2 |
| II | I | **Part - I** Language - II: Tamil - II | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | II | **Part - II** English - II | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | III | **Part - III** Core - II: Time Series and Index Numbers | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Allied - II:  Mathematics for Statistics - II | 8 | 3 | 75 | 25 | 100 | 30 | 40 | 5 |
| | | Core Practical - I: Statistics Practical - I | 2 | 3 | 60 | 40 | 100 | 24 | 40 | 4 |
| | IV | **Part - IV** Value Education  - Gandhian Thoughts | 2 | 3 | 75 | 25 | 100 | 30 | 40 | 2 |
| III | I | **Part -I** Language - III : Tamil - III | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | II | **Part- II** English - III | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | III | **Part - III** Core - III: Numerical Analysis | 8 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Allied III: Computer Programming for             Statistical Analysis (C) | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 5 |
| | IV | **Part - IV** Skill based Elective - I: Demographic Methods - I | 4 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| IV | I | **Part - I** Language - IV : Tamil - IV | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | II | **Part - II** English - IV | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | III | **Part - III** Core - IV: Probability and Distributions | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Allied - IV: Mathematical Economics | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 5 |
| | | Core Practical - II:  Statistics Practical - II | 2 | 3 | 60 | 40 | 100 | 24 | 40 | 4 |
| | IV | **Part - IV** Skill Based Elective - II:  Demographic Methods-II | 4 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | V | **Part - V** Extention Activities:  NSS/NCC/P.Ed/YRC | | | | | | | | 1 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **V** | III | **Part - III**<br>Core - V:  Statistical Inference - I | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Core - VI:  Basic Sampling Theory | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Core - VII:  Design of Experiments | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Core -VIII - AOS:  Elements of Operations Research | 5 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | IV | **Part - IV**<br>Skill Based Elective - III: Elements of Actuarial Statistics | 4 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | | Non - Major Elective - I | 3 | 3 | 75 | 25 | 100 | 30 | 40 | 2 |
| **VI** | III | **Part - III**<br>Core - IX:  Elements of Econometrics | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Core - X:  Statistical Inference - II | 6 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Core - XI - AOS: Statistical Quality Control | 5 | 3 | 75 | 25 | 100 | 30 | 40 | 4 |
| | | Core Practical - III:  Statistics Practical - III | 2 | 3 | 60 | 40 | 100 | 24 | 40 | 4 |
| | | Core Practical - IV:  Statistics Practical - IV | 2 | 3 | 60 | 40 | 100 | 24 | 40 | 4 |
| | | **Project & Viva Voce** | 2 | 80 (Report) | 20 (Viva) | | 100 | 32 | 40 | 15 |
| | IV | **Part - IV**<br>Skill based Elective - IV: Optimization Techniques | 4 | 3 | 75 | 25 | 100 | 30 | 40 | 3 |
| | | Non - Major Elective - II | 3 | 3 | 75 | 25 | 100 | 30 | 40 | 2 |
| | | **Total** | 180 | | | | 3600 | | | 140 |

Statitiscs - Non - Major Elective:

1. Basic Statitics - I
2. Basic Statitics - II

## Semester I
## Core I: DESCRIPTIVE STATISTICS

### UNIT-I
Statistics – Definition – Collection of data – Primary and Secondary data – Classification and Tabulation of Data - Formulation of Frequency Distribution - Diagrammatic Presentation and Graphical Representation.
Measures of Central Tendency: Arithmetic Mean, Median, Mode, Geometric Mean and Harmonic Mean – Simple problems.

### UNIT-II
Measures of Dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation and Co-efficient of Variation - Lorenz Curve.
Measures of Skewness - Karl-Pearson's Co-efficient of Skewness - Bowley's Co-efficient of Skewness – Kurtosis, Moments - Simple problems.

### UNIT-III
Correlation: Types of Correlation, Uses and Properties - Scatter Diagram – Karl Pearson Co-efficient of Correlation - Spearman's Rank Correlation - Concurrent Deviation - Concept of Partial and Multiple Correlation.
Regression analysis: Regression Equations – Properties of Regression co-efficients – Uses of regression - Simple problems.

### UNIT-IV
Probability: Sample Space, Events - Definition of Probability - Independent Events, Conditional Probability - Addition and Multiplication Theorems - Baye's Theorem - Simple problems.

### UNIT-V
Random Variables – Distribution function – properties (without proof) - Discrete and Continuous Random Variables - Probability Mass Function, Probability Density Function – Mean, Median, Mode, Dispersion and Moments for continuous random variables - Simple Problems.

### Text Books:
1. S.P.Gupta - Statistical Methods, Sultan Chand & Sons, New Delhi, 42$^{nd}$ revised Edition, 2012.
2. S.C.Gupta and V.K.Kapoor - Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 11$^{th}$ revised Edition, June 2012.

### Reference Books:
1. PA. Navaneetham - Business Mathematics and Statistics, Jai Publishers, Trichy, July 2008.

2. B.L.Agarwal - Programmed Statistics, New Age International, Chennai.

# SEMESTER I
## ALLIED- I: MATHEMATICS FOR STATISTICS – I

### UNIT I

**Set Theory:** Definition – Examples – Venn diagram – Set operations – Laws and properties of sets – Number of elements – Problems (Chapter 3: Sections: 1 – 8).

### UNIT II

**Matrices:** Definition – Different types of matrices with examples – Matrix operations – Solving system of linear equations – Problems (Chapter 4: Sections: 1 – 7),

### UNIT III

**Determinants:** Determinants and its properties – Cramers rule - Inverse of a matrix – Rank of matrix - Problems (Chapter 4: Sections 8 – 10).

### UNIT IV

**Differential Calculus:** Derivatives of standard functions from first principle – Rules of differentiations – Product rule – Quotient rule - Problems (Chapters 6: Sections 1- 4).

### UNIT V

Chains rule – Differentiation of Implicit functions – Successive differentiation - Problems

 (Chapter 6: Sections: 4 – 8)

### TEXT BOOK:

**BUSINESS MATHEMATICS AND STATISTICS**, P. A. Navaneetham, Jai Publishers, Trichy, 2008.

### REFERENCE BOOK:

**ANCILLARY MATHEMATICS**, P. R. Vital, Margam Publishers, Chennai, 1998.

## Semester II
## Core II: TIME SERIES AND INDEX NUMBERS

**UNIT-I**

Time Series: Definition- Components of Time Series - Uses – Additive and Multiplicative Models - Measurement of Trend: Graphical Method, Semi-Average Method, Method of Moving Averages -   merits and demerits  - Method of Least Squares – Straight lines, Parabolic, Exponential of type $Y=ab^x$ - Exponential Smoothing - Simple Problems.

**UNIT-II**

Seasonal Variation – Measurement of Seasonal Variations - Method of Simple Averages, Ratio-to-Trend Method, Ratio-to-Moving Average Method and Link Relative Method – Cyclical Variations and Random Variations (Concepts only) - Simple Problems.

**UNIT-III**

Index numbers: Meaning, Definition, Uses and Types - Problems in the Construction of Index Numbers – Un-weighted Index Numbers – Simple aggregative method – Simple average of Price relative method – Limitations of Index Numbers- Simple Problems.

**UNIT-IV**

Weighted Index Numbers – Price Index, Quantity Index, Value Index – Selection of Weights - Average of Price Relatives Method – Laspeyre's Price Index – Paasche's Price Index – Bowley Price Index – Marshall Edgeworth Price Index – Fisher's Index Number- Simple Problems.

**UNIT-V**

Criteria of a Good Index Number -: Unit Test, Time Reversal Test, Factor Reversal Test and Circular Test – Construction of Chain Base Index Numbers -Cost of Living Index Numbers – Its uses – Construction - Aggregate Expenditure and Family Budget Methods - Simple Problems.

**Text Books:**
1. S.C. Gupta and V.K.Kapoor - Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi 4[th]Edition.

2. S.P.Gupta - Statistical Methods, Sultan Chand & Sons, New Delhi, 42nd revised Edition, 2012.

**Reference Books:**
1. Croxton and Cowden - Applied General Statistics, Prentice - Hall of India (Private) Ltd, New Delhi.
2. B.L.Agarwal - Programmed Statistics, New Age International, Chennai.

## SEMESTER II

## ALLIED II: MATHEMATICS FOR STATISTICS – II

## UNIT I

**Integral Calculus:** Infinite integrals – standard forms – Determination of c – Definite integrals – Problems (Chapter 8: Sections 1 – 4)

## UNIT II

**Methods of Integration:** Method of Partial fraction – Method of Integration by parts – Problems (Chapters 8: Sections 5 – 8)

## UNIT III

**Sets and Functions:** Sets and elements – Operation on sets – Functions – Real valued functions – Equivalence, Countability – Problems (Chapter 1: Sections: 1.1 – 1.5).

## UNIT IV

**Sequences of Real numbers:**  Real numbers – Least upper bounds – Sequence – Subsequence – Convergent sequence – Divergent sequence – Bounded sequence – Monotone sequence – Problems (Chapter 1: Sections: 1.6 – 1.7; Chapter 2: Sections: 2.1 – 2.6).

## UNIT V

**Operations on Sequence:** Operation on convergent sequence- operation on divergent sequence – Limit Superior – Limit inferior (definitions only) Cauchy's sequence– Problems.

(Chapter 2: Sections: 2.7 – 2.10)

## TEXT BOOK:

1. **BUSINESS MATHEMATICS AND STATISTICS**, Navanitham, P. A, Jai Publisher, Trichy, 2008.(For Units I and II)
2. **METHODS OF REAL ANALYSIS**, Richard R. Goldberg,  Oxford and IBH Publishing Company Private Limited, New Delhi, 1970. (For Units III, IV and V)

## Semester II

## Core Practical – I: STATISTICS PRACTICAL - I

## (Using MS - EXCEL)

1. Formation of Frequency Distribution - Formation of Charts and Diagrams: Bar Diagrams, Pie Diagram, Frequency Polygon, Frequency Curve, Ogive Curves

2. Calculation of Measures of Central Tendency: Mean, Median, Mode, Geometric Mean, and Harmonic Mean - Calculation of Percentiles.

3. Calculation of Measures of Dispersion: Range, Quartiles, Mean Deviation, Variance, Standard Deviation.

4. Calculation of Skewness and Kurtosis.

5. Scatter Diagram - Calculation of Correlation and Regression Coefficients and Formation of Regression Lines.

6. Problems Related to Curve Fitting - Fitting a Straight Line, Non-Linear Trend Lines and Calculation of Trend Values using Moving Averages.

7. Calculation of Index Numbers – Un-weighted Index numbers, simple aggregative method, simple average of price relative method, Weighted Index numbers – Price and Quantity Index – Laspeyre's, Pasche's, Bowleys, Fisher Ideal price Index numbers. Time Reversal and Factor Reversal test. Chain Base Index and Fixed Base Index numbers.

## Semester III

## Core III: PROBABILITY AND DISTRIBUTIONS

**UNIT I**

Mathematical expectation – definition, properties, Variance and Covariance - Addition and Multiplication theorems (for two variables only) – Moment Generating function - Characteristic function and their properties (without proof) –Tchebyshev's inequality – Weak Law of Large Numbers  - Central Limit Theorem (Concept only)

**UNIT II**

Bivariate Distribution: Concepts of Bivariate, Marginal and Conditional Distributions – Independence of Random Variables. Marginal and Conditional Expectations, Conditional Variance.

**UNIT III**

Discrete Distributions – Bernoulli, Binomial, Poisson and Geometric Distributions – Definition – moments - MGF- Recurrence relations – additive property – limiting cases (statement only).

**UNIT IV**

Continuous distributions – rectangular, Normal, Exponential, Beta (first and second kind) and Gamma distributions – Definition – moments – MGF- additive property -  limiting cases (statement only)

**UNIT V**

Definition – Application and Derivation of t , F and Chi-square distributions – MGF- additive property – Mean and variance- relationship between t , F and Chi-Square distributions (no other constants).

**Text Books:**

1.  S.C.Gupta and V.K.Kapoor - Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 11th revised Edition, June 2012.
2.   R.V.Hogg and A.G Craig - Introduction to Mathematical Statistics, Amerind.

**Reference Book:**

1.  J.N. Kapoor and   H.C. Sexana - Mathematical Statistics, Sultan Chand & Sons, New Delhi.

## Semester III
## Allied III:  C - PROGRAMMING FOR STATISTICAL ANALYSIS

### UNIT I
Overview of C: Introduction to C – Importance of C – Structure of C Program – Programming Style – Executing a C Program – Constants, Variables and Data Types: Character Set –  C Tokens – Keywords and Identifiers – Constants – Variables – Data Types – Declaration of Variables – Assigning Values to Variables – Symbolic Constants.

### UNIT II
Operators and Expression: Arithmetic Operator – Relational Operators – Logical Operators – Assignment Operators – Conditional Operators – Increment and Decrement Operators – Library Function. Managing Input and Output Statements: Single Character Input- getchar() function – putchar() function- scanf() function – output functions:  printf() function – gets() and puts() function.

### UNIT III
Decision Making and Branching: Decision making with if statement – simple if statement – if – else statement – Nesting if-else statement – switch statement – break – continue statement – Looping and Branching using while statement – do-while statement – for loop statement – its syntax and simple examples.

### UNIT IV
Arrays: One Dimensional Arrays – Declaration - Initialization –two Dimensional arrays – syntax – initialization – Simple Programs to find Mean – Median – Standard Deviation – Correlations. – Character arrays and Strings – Declaration Syntax – Initialization – Reading Strings from the Keyboard – Output of the Strings using Printf() – String functions – strcat() – strcmp() – strlen().

### UNIT V
User Defined Functions – Need – Multi-function program – Elements of User Defined Functions – Definition of Functions – Function Calls – Return Types – Declaration – Category of Functions- Function program to sort an array of integers.

**Text Book:**

1.  E. Balagurusamy- Programming in ANSI , Tata McGraw-Hill, New Delhi.

**Reference Book:**

1.  Herbert Scheldt - The Complete Reference

## Semester III

## Skilled Based Elective-I: DEMOGRAPHIC METHODS

### UNIT-I

Demography: Definition – Sources of Demographic data - Vital Registration - Population Census -Population Register - Demographic Surveys - Population data as an aid to Social, Economic and Health Planning - Simple Problems.

### UNIT-II

Fertility measurements: Rates and Ratios –Fertility – Factors affecting fertility – Fertility Measures - Crude Birth Rate (CBR), General, Specific and Total Fertility Rates – Growth Rates-Gross and Net Reproduction Rates (GRR, NRR) - Simple Problems.

### UNIT III

Mortality Measurements: Mortality – Mortality Measures - Crude Death Rate (CDR), Age, Sex and Cause Specific Death Rates - Standardized Death Rate - Infant Mortality Rate - - Simple Problems

### UNIT IV

 Life Table: Assumptions, Description of various columns of a Life table and their relationships - Construction of a Life table - Uses of a Life table - Simple Problems

### UNIT V

 Migration: Definition - Factors affecting Migration - Gross and Net Migration Rates - Projection : Population estimates and Projection – Arithmetic, Geometric and Exponential Growth Rates - Basic ideas of Stationary and Stable population - Simple Problems

**Text Books:**
1. Goon. A.M, Guptha.M.K and Das Guptha - Fundamentals of Statistics Vol.II (world press) Gupta.S.C and Kapoor.V.K - Fundamentals of Applied Statistics, S.Chand &Co, 4th thoroughly revised edition, New Delhi, Reprint 2009.
2. S.C. Gupta and V.K.Kapoor - Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.

**Reference Book:**
1. Mishra D.E - An introduction to the study of population (South India publishers, Madras)
2. Jhingan M.L, Bhatt B.K and Desai J.N. - Demography, Vrinda Publications (P) Ltd, Delhi, 2003 2nd Revised Edition

**Semester IV**
**Core IV:  NUMERICAL ANALYSIS**

## UNIT I

Finite Differences - Operators – Forward  and Backward  Difference Operators – Operator E and their basic Properties (without proof) - Interpolation with Equal Intervals - Newton's Forward and Backward Differences Formulae – Simple Problems – Equidistant Terms with One or More Missing Values .

## UNIT II

Central Difference Interpolation Formula – Gauss Forward Interpolation Formula – Gauss Backward Interpolation Formula – Stirling's Formula – Bessel's formula – Simple problems.

## UNIT III

Interpolation with unequal intervals – Divided Difference and their properties (without proof) – Newton Divided Difference Formula – Lagrange's Formula –simple problems – Inverse Interpolation using Lagrange's formula.

## UNIT IV

 Numerical Differentiation - Newton's Forward  and  Newton's Backward  Difference  Formula to Compute  the  Derivative – Derivative  using  Stirlings  Formula (Upto Second Order Only).

## UNIT V

Numerical Integration: Trapezoidal  Rule, Simpson's  $1/3^{rd}$ and $3/8^{th}$ Rules - Numerical Method of Solution of Ordinary Differential Equations - Taylor's Series Method - Euler Method and Runga - Kutta Method upto Second Order - Simple Problems Only.

75% Problems and 25% Theory

**Text Books:**

1. P.Kandasamy, K.Thilagavathy, K.Gunavathi - Numerical Methods , S.Chand
   Company Ltd, New Delhi.
2. S.S. Sastry - Numerical Analysis, PHI Learning Pvt. Ltd, New Delhi.

**Reference Book:**

1. G.Shanker Rao - Numerical Analysis, New Age International (P) Ltd, Publishers,
   New Delhi

## Semester IV

## Allied IV:  MATHEMATICAL ECONOMICS

### UNIT –I

Introduction to Economics and Economic Laws – Scope of Mathematical Methods in Economics – Theory of Demand – Demand Function – Demand Curve – Elasticity of Demand – Revenue Function – Average and Marginal Revenue – Normal Conditions of Demand.

### UNIT – II

Consumer's Equilibrium – Utility Approach to Consumer's Equilibrium – Limitation – Scale of Preference – Indifference Curve Approach – Income and Substitution Effects.

### UNIT – III

Cost Function and Cost Curves – Average and Marginal Cost Curves – Cost Elasticity and Normal Cost Conditions – Short Term and Long Term Cost Curves.

### UNIT – IV

Concept of Market Equilibrium – Input and Output Models – Fixation under Perfect Competition – Monopoly – Discriminating Monopoly.

### UNIT – V

Production Function – Constant Product Curves – Laws of Returns and Returns to Scale. Marginal Rates of Substitution – Expansion Path – Elasticity of Substitution.


**Text Books:**

1.  Agarwal    -  Mathematics Approach to Economics
2.  R.G.D Allen - Mathematical Analysis for Economists, Macmillan.

**Reference Books:**

1.  Mehtha and Madhamani - Mathematics for Economics
2.  Goel and Saxena - Mathematics for Economics

**Semester IV**

**Core Practical – II: STATISTICS PRACTICAL - II (Using C)**

1. C program to find Factorial of N Numbers.

2. C program to Arrange Data in Ascending Order Using Bubble Sort.

3. C program to find the Value of Mean and Standard Deviation.

4. C program to Calculate Correlation Coefficient.

5. C program to Calculate Individual and Cumulative Probabilities of Binomial Distribution.

6. C program to Calculate Individual and Cumulative Probabilities of Poisson Distribution.

7. C program to interpolate by using Newton Forward Interpolation formula.

8. C program to Calculate Laspeyre's, Paasche's and Fisher's Index Numbers.

9. C program to Calculate Seasonal Index by the Method of Simple Averages.

10. C program to fit a Linear Model by the Method of Least Squares.

**Semester IV**

**Skill Based Elective-II: PSYCHOLOGICAL STATISTICS**

### UNIT I

Introduction-scaling procedures- Z or σ scores-standard scores-Normalized scores- T-scores-Percentile score-Scaling of rankings in terms of Normal Probability curve-scaling of ratings in terms of Normal Probability curve

### UNIT II

Reliability of test scores- definition of reliability- index of reliability- Parallel tests- Methods for determining test reliability- the test-retest method- Alternate or parallel forms method- split half method- effect of test length on the reliability of the test- effect of different ranges on the reliability of the test – Cronbach's alpha.

### UNIT III

Estimation of validity- types of validity- validity and test length- comparison between reliability and validity- Intelligence tests- Mental age- Intelligence quotient

### UNIT IV

Biserial correlation- correlation from fourfold tables- the contingency coefficient- curvilinear relationship

### UNIT V

Correlation ration- intra-class correlation- partial and multiple correlation- definition- formula for three variables- limitations- simple problems

**Text Books:**

1. S.C.Gupta and V.K.Kapoor - Fundamentals of Applied Statistics, Sultan Chand and Sons, 4th thoroughly revised edition, New Delhi, Reprint 2009.
2. H.E.Garrett - Statistics in Psychology and Education , International Book Bureau.

**Reference Book:**

1. S.C.Gupta& V.K.Kapoor - Fundamentals of Mathematical Statistics, Sultan Chand and Sons, 11th Revised Edition, June 2012.

**Semester V**

## Core V: STATISTICAL INFERENCE - I

### UNIT I

Basic Concepts - Population, Sample, Statistic, Parameter - Point estimation: Meaning – Characteristics of  Estimators – Unbiasedness – Simple Problems.

### UNIT II

Minimum Variance Unbiased Estimators – Cramer Rao Inequality- MVB estimator  - Consistency – Sufficient Conditions for Consistency– Simple Problems.

### UNIT III

Efficiency – Most Efficient Estimator.  Sufficiency - Neymann's Factorization Theorem - Rao Blackwell Theorem – Simple Problems.

### UNIT IV

Methods of Estimation: Method of Maximum Likelihood - Properties of MLE (Without Proof) - Methods of Moments  – Simple Problems.

### UNIT V

Interval estimation: Sampling Distribution and Standard Error - Confidence Intervals - Derivation of Confidence Intervals for Proportion, Mean and Variance Based on Normal, t , $\chi^2$ and F Distributions – Simple Problems.


**Text Books:**

1.  S.C. Gupta and V.K. Kapoor - Fundamentals of Mathematical Statistics , Sultan Chand & Sons, New Delhi, 11$^{\text{th}}$ Revised Edition, June 2012.
2. Goon ,A.M., Gupta,M.K & Das Gupta,B - An Outline of Statistical Theory V-II, The World Press Kolkatta, (1989).

 **Reference Books:**

1. G. W. Snedecor and W.G. Cochran - Statistical Methods.
2. P.G. Hoel - Introduction to Mathematical Statistics, Wiley International.

**Semester V**

## Core VI: BASIC SAMPLING THEORY

### UNIT I

Concept of Sampling and Population – Need for Sampling – Design, Organization and Execution of Sample Survey – Principal Steps in Sample Surveys – Preparation of Questionnaire and Schedules – Pilot Survey – Sampling and Non-Sampling Errors – Limitations of Sampling.

### UNIT II

Sampling from Finite Population – Simple Random Sampling With and Without Replacement – Unbiased Estimate of Mean and Variance – Finite Population Correction – Estimation of Standard Error from a Sample – Simple Random Sampling of Attributes – Estimation of Sample Size.

### UNIT III

Stratified Random Sampling: Concept of Stratifying Factor - Unbiased Estimate of the Mean and Variance of the Estimated Mean – Proportional and Optimum Allocation – Neyman's Allocation - Comparison of Stratified and Simple Random Sampling.

### UNIT IV

Systematic Sampling: Estimation of the Mean and Variance – Comparison of Simple, Stratified and Systematic Sampling – Population with Linear Trend - Circular Systematic Sampling.

### UNIT V

Cluster Sampling - Two Stage Sampling with respect to Simple Random Sampling – Unbiased Estimator of the Mean and Population Variance.

**Text Books:**

1. W.G. Cochran - Sampling Techniques, Wiley India (P)Limited, New Delhi, 2011
2. S.C. Gupta and V.K. Kapoor - Fundamental of Applied Statistics , Sultan Chand & Sons, New Delhi , 2007.

**Reference Books:**

1. P.V. Sukathme and B.V. Sukathme - Sampling theory of survey with applications, Asia Publishing House.
2. Daroga singh, F.S.Chauwdhary – Theory and Analysis of sample survey designs, New Age International (P) Ltd, publishers, New Delhi, 2002.

**Semester V**

**Core VII: DESIGN OF EXPERIMENTS**

**UNIT I**

Analysis of Variance (ANOVA): Definition – Assumptions – Importance – Linear Models – Fixed Effect Model – Random Effect Model – One-way ANOVA for Fixed Effect Model – Least Square Estimates of Parameters – Variance of the Estimates – Two-way ANOVA for Fixed Effect Model - Least Square Estimates of Parameters.

**UNIT II**

Fundamentals of Design of Experiments – Phases of Experimentation – Experimental Error – Uniformity Trials – Principles of Experimental Design – Size and Shape of the Plots – Concept of Completely Randomized Design (CRD) -  Layout - Statistical Analysis.

**UNIT III**

Concept of Randomized Block Design (RBD) – Layout – Statistical Analysis – Advantages and Disadvantages – Efficiency of RBD over CRD – Estimation of  one Missing Values.

**UNIT IV**

Concept of Latin Square Design (LSD) - Layout – Advantages and Disadvantages – Statistical Analysis –  Least Square Estimates  – Estimation of  one Missing Values.

**UNIT V**

Factorial Experiments – advantages – $2^2$ Factorial Design – Statistical Analysis of $2^2$ Design – Yates method of Computing Factorial Totals – $2^3$ Factorial Design  -     Statistical Analysis of $2^3$ Design – Confounding (Concept only).

**Text Books:**

1. Gupta S.C and Kapoor V.K - Fundamental of  Applied Statistics, Sultan Chand & Sons, New Delhi, 4$^{th}$ thoroughly revised edition, New Delhi, Reprint 2009.
2. W.G.Cochran  and G.M. Cox - Experimental Designs, John Wiley.

**Reference Book:**

1. Montgomery - Design and Analysis of Experiments, Wiley India Pvt. Ltd, 5$^{th}$   Edition, Reprint 2009.

**Semester V**
**Core VIII:  AOS - ELEMENTS OF OPERATIONS RESEARCH**

## UNIT I

Definition and Scope of Operations Research – Uses and Limitations of Operations Research – Models in Operations Research – Phases of Operations Research - Linear Programming Problem – Formulation of LPP – Solution by Graphical Method.

## UNIT II

Canonical and Standard Form of LPP – Maximization and Minimization Problems – Simplex Method – Big M Method - Duality in LPP – Formulation of Dual LPP (Concept Only – No Problems in Duality).

## UNIT III

Transportation Problem – Balanced and Unbalanced Transportation Problem – Initial Basic Feasible Solution – North West Corner Rule, Least Cost Method, Vogel's Approximation Method – Optimum Solution – MODI Method.

## UNIT IV

Assignment Problem – Balanced and Unbalanced Assignment Problem – Maximization and Minimization Problems – Hungarian Method – Travelling Salesman Problem.

## UNIT V

Inventory Control –Types – Reasons – Costs involved in Inventory – Lead Time – Reorder Level –EOQ – Purchasing and Manufacturing Models with No Shortages – ABC and VED analysis (concept only).

**Text Books:**

1. Kanti Swarup, P.K. Gupta and Manmohan - Operations Research (1980), Sultan Chand & Sons, New Delhi.
2. J.K. Sharma - Operations Research -Theory & Applications (2007), Macmillan India Ltd, Third Edition, 2007.

**Reference Books:**
1. V.K.Kapoor - Problems in Operations Research, Sultan Chand &  Sons, New Delhi.
2. Prof. V.Sundaresan, K.S. Ganapathy, Subramanian,  K.Ganesan - Resource Management Techniques (2000), A.R. Publications, Tamil Nadu, New Revised Edition, June 2000.

**Semester V**

**Skill Based Elective -III:  ELEMENTS OF ACTUARIAL STATISTICS**

**UNIT – I**

Principles of Life Assurance:  Nature of Insurance – Classification of Insurance – History of Life Insurance in India.

**UNIT – II**

Basic Concepts of Mathematics of Finance – Elements of Simple Interest – Elements of Compound Interest – Effective and Nominal Rates of Interest – Depreciation.

**UNIT – III**

Annuities – Present Value of Immediate Annuity- Present value of Immediate Annuity Certain – Accumulated value of Annuity- Present Value of Deferred Annuity Certain-Accumulated value of a Deferred Annuity Certain.

**UNIT – IV**

Premiums: General Principles – Natural Premiums – Level Premiums – Office Premiums with Profit and Without Profit Premiums – Adequacy of Premiums.

**UNIT – V**

Legal Environment – Motor Vehicles Act- Hit & Run Accidents Act- Public Liability Insurance Act- Marine Insurance ACT- Carriage of Goods by Sea Act- Merchant Shipping Act- Indian Railway Act- Indian Post Office Act-   Carriage by Air Act- Consumer Production Act- Indian Information Technology Act .

**Text Books:**
1. Insurance Institute of India - Mathematical Basis of Life Assurance.
2. Insurance Institute of India - Insurance Business Environment. IC-12

**Reference Books:**
1. PA. Navaneetham - Business Mathematics and Statistics, Jai Publishers, Trichy
2. CT-5 General Insurance, Life and Health Contingencies – Institute of Actuaries of India.

## Semester VI

## Core IX: ELEMENTS OF ECONOMETRICS

### UNIT I

Econometrics – Origin, Definition, Objectives, Characteristics and Scope of Econometrics – Limitations of Econometrics – Models in Econometrics.

### UNIT II

Simple linear regression model - Error Term in Econometric Models - Statistical Assumptions in Linear Model - Least Square Estimation- Properties of Least Square Estimation - Testing of Parameters of the Model - Estimation of Error Variance - Simple Problems.

### UNIT III

General Linear Model - Assumptions- Least Square Method of Estimation - Testing of the Parameters of the model - Gauss-Markov Theorem.

### UNIT IV

Multicollinearity - Meaning- Causes of Multicollinearity- Effects of Multicollinearity - Autocorrelation- Sources of Autocorrelation - Durbin-Watson Test - Dummy Variables (Concept Only) - Uses of Dummy Variables - Specification Errors.

### UNIT V

Econometric Models in Planning - Mahalanobis Four Sector Model – Introduction - calculation of net investment -  income and employment generated - summary of the model - Criticism of the Model.

**Text Books:**

1. K.Dhanasekaran - Econometrics (II$^{nd}$ Edition), Vrinda Publications (P) Ltd, Delhi-91(2011).
2. S.P.Singh, AnilK - Econometrics and Mathematical Economics, Parashar & H.P.Singh,S.Chand & Company Ltd, New delhi-110 055, seventh Edition, (1999)

**Reference Book:**

1. A. Koutsoyannis -  Theory of Econometrics, PALGRAVE, Replica Press Pvt. Ltd, India, second edition, Reprint 2004.

**Semester VI**

**Core X: STATISTICAL INFERENCE – II**

## UNIT I

Testing of Hypothesis - Statistical Hypothesis - Simple and Composite Hypothesis, Null and Alternative Hypothesis - Two Types of Errors-Critical Region-Power of a Test - Neyman-Pearson Lemma.

## UNIT II

Most Powerful Test - Uniformly Most Powerful Tests - Simple Problems - Tests Based on Student's - t, Chi-Square, F and Normal Distributions (Without Proof) - Likelihood Ratio Criterion - Definition and Test for Mean and Variance (One Sample Only).

## UNIT III

Tests of Significance - Large Sample Tests - Z-Test For Single Mean, Two Means and Single SD. Small Sample Tests - t-test for Single Mean, Two Means, Paired t-test - Correlation Co-Efficient and Partial correlation Co-Efficient.

## UNIT IV

F-test for Two Variances – Multiple correlation - Chi-Square Test – Contingency Tables – Test for Goodness of Fit and Independence of Attributes.

## UNIT V

Non-Parametric Tests: Run Test, Median Test and Mann-Whitney 'U' Test (One Sample and Two Sample Problems) - Kolmogorov's Smirnov One Sample Test (Without Proof)- Kruskal Wallis Test – simple problems.

**Text Books:**
1. S.C. Gupta, and V.K.Kapoor - Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 11th Revised Edition, June 2012.
2. M. Rajagopal and P. Dhanavanthan – Statistical Inference, PHI Learning Private limited, New Delhi, 2012 Eastern Economy Edition.

**Reference Books:**
1. Lehmann, E.L - Testing statistical Hypothesis (2nd Edition) , (1986), Springer New York.
2. C.W. Snedecor, and W.G.Cochran - Statistical Methods, Oxford and IBH

**Semester VI**

**Core XI: AOS - STATISTICAL QUALITY CONTROL**

**UNIT I**

Basic concepts of quality – Meaning of quality – Quality of design – Quality of conformance – Quality of performance - Statistical Quality Control – Meaning – Basic concepts of SQC – Uses – Causes of variation.

**UNIT II**

Process control -  Control Charts – 3 Sigma Limits – Uses of control charts -  Control Charts for Variables – $\bar{x}$ and R Charts – Control Charts for Attributes – p,  np and c Charts (for fixed and varying sample size) – Comparison of attribute and variable control charts - Simple Problems.

**UNIT III**

Product Control - Acceptance Sampling – Meaning – Applications in  Industry Producer's Risk and Consumer's Risk -  Definitions of AQL, LQL, IQL, AOQL, ASN and ATI - Measures of performance - Concept of OC Function -  Type A  and Type B OC curves – OC Functions Based on Hypergeometric, Binomial and Poisson distributions.

**UNIT IV**

Attribute Sampling Plans – Single and Double Sampling Plans - Conditions of Applications – Operating Procedures – OC, ASN, AOQ and ATI functions - Evaluation of Measures of Performance of SSP and DSP.

**UNIT V**

Multiple Sampling Plan for Attributes -   Concept - Operating Procedure – Comparison of Single, Double and Multiple Sampling Plans - Sequential Sampling Plan for Attributes – Wald's Sequential Probability Ratio Test – OC Curve – Five Points OC Curve –Five Points ASN  - Advantages.

**Text Books:**

1. Gupta S.C and Kapoor V.K - Fundamentals of Applied Statistics Sultan Chand & Sons, New Delhi, 4th thoroughly revised edition, New Delhi, Reprint 2009.
2. Duncan A.J - Quality Control and Industrial Statistics,  Irwin Homewood.

**Reference Books:**

1. Grant  E.L and  eaven Worth R.S - Statistical Quality Control,  McGraw Hill,New York.
2. Mahajan M., - Statistical Quality Control   Dhanpat Rai & Co (P) Ltd, Delhi, 2009.

**Semester  VI**

**Skill Based Elective - IV: OPTIMIZATION TECHNIQUES**

**UNIT I**

Game Theory – Introduction – Two-Person Zero-Sum Games – Concept of Pure and Mixed Strategies – Games With and Without Saddle Points – Solving 2 x 2 Games – Dominance Property – Graphic Solution of  2 x n  and  m x 2 Games.

**UNIT II**

Network analysis – Basic Concepts – Construction of Network – Critical Path Method (CPM) – Floats – Program Evaluation and Review Technique (PERT) – Difference between CPM and PERT  – Resource allocation and scheduling (Concept only).

**UNIT III**

Replacement Problems – Introduction – Replacement of Items that Deteriorates Gradually (Value of Money Does Not Changes With Time and Changes With Time) – Replacement of Items that Fails Suddenly – Individual and Group Replacement.

**UNIT IV**

 Queuing Theory: Introduction – Characteristics of Queuing Models – Classification of Queues – Problems from Single Server: Infinite Population Model.             .

**UNIT V**

Sequencing Problem – Problems with  n- jobs Through Two Machines – Problems with  n- jobs on Three Machines – Idle Times and Total Elapsed Time Calculations.

**Text Books:**

1.  Kanti Swarup, P.K. Gupta and Manmohan - Operations Research, Sultan Chand & Sons, New Delhi, 14$^{th}$ edition, 2008 .
2.  V.Sundaresan, K.S. Ganapathy Subramanian, K.Ganesan - Resource Management Techniques, A.R. Publications, Tamil Nadu, New Revised Edition, June 2000.

 **Reference Book:**

1.  J.K. Sharma - Operations Research -Theory & Applications, Macmillan India Ltd, Third Edition, 2007.

## Semester VI

## Core Practical – III: STATISTICS PRACTICAL - III

1. **Statistical Inference**

   - Estimation of Parameters of Distribution by the Method of Moments and Maximum Likelihood with regard to Discrete and Continuous Distribution.
   - Test of Significance- Large Sample Tests-Single Mean – Difference of Means. Small sample tests – Paired t-test – F-test – Ratio of Two Variances.
   - Chi – Square Test - Independence Test and Goodness of Fit.
   - Non – Parametric Tests – Median Test, Run Test, Mann-Whitney Test, Kruskal Wallis Test, Kolmogorov Smirnov Test.

2. **Design of Experiments :**

   - Analysis of CRD, RBD and LSD Layouts.
   - Missing Plot Techniques in RBD and LSD.
   - Analysis of $2^2$ and $2^3$ Factorial Experiments.

3. **Basic Sampling Theory :**

   - Estimation of Mean and Variance of The Population - The Variance of the Estimator of the Mean Using Simple Random Sampling Procedure.
   - Stratified Random Sampling, Estimation of the Mean And Variance of the Population and of the Variance of the Estimation of the Mean Under Proportional and Optimum Allocation.
   - Systematic Sampling.

4. **Elements of Econometrics**

   - Simple and Multiple Regression –Estimation of Regression Coefficient and Error Variance-Linear Prediction.
   - Tests of Significance of Regression Coefficients.
   - Estimating Serial Correlation and Testing –Durbin-Watson Test.

5. **Statistical Quality Control**

   - Control Charts for Attributes and Variables: $\bar{x}$, R, p, np and c charts.
   - Single Sampling Attributes Plan : OC, ASN, ATI, AOQ Curves.

## SEMESTER - VI

## Core Practical – IV: STATISTICS PRACTICAL – IV

## (USING STATISTICAL SOFTWARE PACKAGE)

### UNIT I

Essential terminology for all SPSS users-getting to SPSS for windows - the components of window - SPSS for windows screens – crucial preliminaries-entering data into SPSS-editing data-saving data file-retrieving data file.

### Unit II

Merging data files –adding scores to existing cases –add variables – running Mean,Median,Range, Standard Deviation, Variance, Skewness, Kurtosis and obtaining the output.

### Unit-III

Checking the data –Box plots of score distributions –listing of the data using case summaries – graphs –bar, line, pie chart, scatter plots and histograms.

### Unit IV

Frequency distribution-measures of frequency distributions-cross tabulations – obtaining two sample chi-square tests-log linear analysis –parametric statistical tests –comparing means-Independent and paired t-tests

### Unit V

Correlation and multiple regession-analysis-non parametric analysis- Wilcoxon, mann-whitney, Kruskal Wallis tests –ANOVA: one way

## Semester V

## Non-Major Elective I:  BASIC STATISTICS – I

### UNIT – I

Statistics – Introduction – Definition, Origin, Scope and Limitations of Statistics – Collection of data – Primary and Secondary data – Classification and Tabulation of  Data- Formulation of Frequency Distribution - Diagrammatic and Graphical Representation.

### UNIT – II

Measures of Central Tendency: Requisites of a good average - Arithmetic Mean, Median, Mode, Geometric Mean and Harmonic Mean.

### UNIT – III

Measures of Dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation and Co-efficient of Variation.

### Unit – IV

Skewness : Measures of Skewness - Karl-Pearson's Co-efficient of Skewness - Bowley's Co-efficient of Skewness, Kurtosis (Concept only).

### Unit V

Probability – Definition - Mutually Exclusive and Independent Events – Addition Theorem – Multiplication Theorem - Simple Problems.

### Text Book:

1. P.A. Navanitham - Business Mathematics and Statistics, Jai Publishers, Trichy, July 2008.

### Reference Book:

1.S.P. Gupta - Statistical Methods,Sultan Chand & Sons, New Delhi, 42$^{nd}$ revised Edition,2012.

## Semester  VI

## Non-Major Elective II:  BASIC STATISTICS – II

### UNIT I

Correlation – Meaning – Scatter diagram – Karl Pearson's Correlation Coefficient – Merits and Demerits - Simple Problems.

### UNIT II

Rank Correlation – Spearman's Rank Correlation Coefficient – Merits and Demerits – Concurrent Deviation Method – Simple Problems.

### UNIT III

Regression – Uses - Regression Equations – Properties - Simple Problems.

### UNIT IV

Time series – Uses – Components of Time Series – Measurement of Trend –Graphical method-Semi Average Method - Moving Average Methods – Simple Problems.

### UNIT V

Index Numbers – Uses – Characteristics - Construction of Weighted Index Numbers – Laspeyre's, Paasches and Fisher's Index Numbers – Cost of Living Index - Simple Problems.

**Text Book:**

1. P.A. Navaneetham - Business Mathematics and Statistics, Jai Publishers, Trichy.

**Reference Book:**

1.  S.P. Gupta - Statistical Methods, Sultan Chand & Sons, New Delhi.