St. Xavier's College (Autonomous), Ahmedabad-9
Proposed Syllabus: B.A. Statistics Semester I
Effective from June 2019

Elective Paper: Statistical Methods – 1
Course Code: ST1101
No. of Credits: 04
Learning Hours: 60 hrs (70 marks)

Course Outcomes:

CO-1 Identify the sources of data emission, record the data meaningfully, perform Exploratory Data Analysis and draw useful conclusions.

CO-2 Able to compute suitable measures of averages from sample data

CO-3 Able to compute suitable measures of dispersion from sample data

CO-4 Able to compute suitable measures of skewness, kurtosis from sample data

I. Course Overview & Course Objectives:

Unit 01: Statistics, Classification and Tabulation of Data, Graphs & Diagrams
Unit 02: Measures of Central Tendency
Unit 03: Measures of Dispersion
Unit 04: Skewness and Kurtosis

The main objective of this course is to introduce to the students the basic concepts of Classification and Tabulation of Data, Graphs & Diagrams, measures of central tendency, measures of dispersion, skewness and kurtosis.

II. Course Content:

Unit:1 Statistics, Classification and Tabulation of Data, Graphs & Diagrams   (15L)
- Definitions of Statistics.
- Concept of classification.
- Types and importance of classification.
- Concept of tabulation.
- Types of tabulation.
- Types of statistical variable.
- Formulation of discrete and continuous series for univariate& bivariate data.
- Representation of statistical data by
      a) Histogram b) Frequency Polygon c)Frequency Curve and Cumulative Frequency Curves of less than and more than type (Ogive curves)
- To obtain median, mode, quartiles, deciles, percentiles, from the above graphs and simple examples.

Unit:2 Measures of Central Tendency (15L)

- Meaning of central tendency.
- Various measures of central tendency: arithmetic mean, median, mode, their merits and demerits.
- Simple examples of Mean, Median and Mode.
- Positional Measures of central tendency: Quartiles, deciles, percentiles and their merits and demerits, Simple examples.

Unit:3 Measures of Dispersion (15L)

- Definition of dispersion.
- Range, quartile deviation, mean deviation, standard deviation
- Coefficient of dispersion, coefficient of variation.
- Simple examples to find various measures of dispersion by different methods (Range, Q.D., M.D., S.D) for grouped and ungrouped data.

Unit:4 Skewness and Kurtosis (15L)

- Meaning of Skewness.
- Tests of skewness, Measures of Skewness
- Karl Pearson's and Bowley's coefficients of skewness.
- Meaning of kurtosis, Measures of kurtosis.

III. Teaching methodology: Apart from the conventional blackboard teaching, other modes of teaching that will be adopted are power points, group discussions, quizzes, class test, problem solving and assignments.

References:

1. D.S. Sancheti &V. K. Kapoor: Statistics: Theory, Methods & Application",
   Sultan chand & Sons, New Delhi.
2. D. N. Elhance: Fundamentals of statistics"
3. Goon, Gupta, Das gupta: An outline of statistical Theory"Vol1 and 2, Word press, Calcutta.
4. Mathematics books of standard 11th and 12th science published by NCERT/State boards of Education
5. D.S. Sancheti &V.K. Kapoor: "Business Mathematics" Sultan chand & Sons, New Delhi.
6. ParimalMukhopadhyay: "Mathematical Statistics" Books & allied (p) Ltd.

Activities (following activities are part of evaluation system for 5 marks)

1. Project on Graphs and diagrams
2. Assignment on above units.
3. Class tests / quizzes.

Elective Paper: Mathematical Methods for Statistics– 1
Course Code: ST1102
No. of Credits: 04
Learning Hours: 60 hrs (70 marks)

Course Outcomes:
CO-1 Demonstrate the skill of associating function. To find Limit and identify different Graphs and their
     Curves.
CO-2 Demonstrate the skill of finding Differentiation and their applications in economics and phycology.

CO-3 Identify the need of Partial differentiation for Business and Economics situations. Demonstrate the

     Homogenous function.

CO-4 Identify the need of matrix and determination for Business and Economics data. Reflect the
     Application

I. Course Overview & Course Objectives:
Unit 01: Function, Limit and Graphs of different curves
Unit 02: Differentiation and its application
Unit 03: Partial Differentiation and its application
Unit 04: Matrix and Determinants

The main objective of this course is to introduce to the students the basic concepts of Functions,
limit and different graphs. Also introduce to the students the concepts of Differentiation, Partial
Differentiation and its application, Matrix and Determinants with applications

II. Course Content:

Unit 1: Function, Limit and Graphs of different curves (15L)
- Concept of function of a single variable
  (Linear, Quadratic and exponential function only)
- Domain, Co-domain and Range of a Function.
- Types of a function. Simple example of a function.
- Concept of Limit, Rules of limit (Without proof)
- Simple examples of limit.
- Drawing of graphs using different functions.

Unit 2: Differentiation and its application (15L)
- Concept of derivative of a real function,
- Rules of derivative without proof.
- Derivative of the function of types:

$$ax + b, ax^2 + bx + c, (ax + b)(cx + d), (ax + b)/(cx + d)x^n, e^x, logx$$

- To find rate of change, To determine whether function is increasing or decreasing
- To find Maximum and minimum values of the function.

Unit 3: Partial Differentiation and its application (15L)
- Definition of partial derivative involving two variables only up to first and second order.
- Homogenous function
- Euler's theorem (Statement only).
- Simple examples.

Unit 4: Matrix and Determinants (15L)
- Concept of determinant and its Properties (without proof)
- Simple examples of determinant and Cramer's rule
- Concept of matrix
- Types of matrices
- Addition and Multiplication of two matrices
- Transpose, minor and adjoint of matrices
- Inverse of a matrix
- Use of matrices to solve simultaneous equations (for two and three variables only).

III. Teaching methodology: Apart from the conventional blackboard teaching, other modes of teaching that will be adopted are power points, group discussions, quizzes, class test, problem solving and assignments.

References:
- D. S. Sancheti & V. K. Kapoor: Statistics: Theory, Methods & Application", Sultanchand & Sons, New Delhi.
- D. N. Elhance: Fundamentals of statistics"
- Goon, Gupta, Dasgupta: An outline of statistical Theory"Vol1 and 2, Word press, Calcutta.
- . Mathematics books of standard 11th and 12th science published by NCERT/State boards of Education
- D. S. Sancheti & V. K. Kapoor: "Business Mathematics" Sultan chand& Sons, New Delhi.
- ParimalMukhopadhyay: "Mathematical Statistics" Books & allied (p) Ltd.

Activities (following activities are part of evaluation system for 5 marks)
1. Project on Graphs and diagrams
2. Assignment on above units.
3. Class tests / quizzes

St. Xavier's College (Autonomous), Ahmedabad-9
Proposed Syllabus: B.A. Statistics Semester II
Effective from December-19

Elective Paper: Applied Statistics – 1
Course Code: ST2101
No. of Credits: 04
Learning Hours: 60 hrs (70 marks)

Course Outcomes:

CO-1 Demonstrate the skill of associating differentiations between complete enumeration and sample survey. Demonstrate the availability of Official Statistics, ability to design a sample survey. Familiarize with the functioning of CSO, NSSO, ICMR and ISI.

CO-2 Demonstrate the skill of finding rates of vital events (birth, death) and measures of population growth.

CO-3 Identify the need of Time series analysis for Business and Economics data. Demonstrate the scale of estimating components of Time series data.

CO-4 Identify the need of Index number analysis for Business and Economics data. Reflect the application of maximizing utility in Economics.

I. Course Overview & Course Objectives:
Unit 01: Time Series
Unit 02: Index Numbers
Unit 03: Official Statistics and Sample Survey
Unit 04: Demography Methods

The main objective of this course is to introduce to the students the basic concepts of population census, demographic methods, methods of collecting demographic methods, time series, components, methods of time series, index numbers, methods and test of index numbers.

II. Course Content:

Unit 1 Time Series: (15L)

- Meaning of Time series, various components of time series: Trend, Seasonal, Cyclic and Random components. Methods of measuring Trend by (a) Graphical method (b) Moving average method, (c) Least squares method.
- Concept of principle of least squares, linear and quadratic functions by the principle of least squares and to estimate trend for simple numerical data. Seasonal indices and simple examples to obtain seasonal indices.

Unit 2: Index Numbers (15L)

- Definition, Limitations and uses of Index numbers.
- Construction of wholesale price index number and cost of living index number
- Construction of index number by aggregate expenditure method and family budget method using Laspeyre's , Paasche's and Fisher's Formula.

Unit 3 Official Statistics and Sample Survey (15L)

- Concept of complete enumeration and sample survey.
- Difference between census and survey.
- Importance of sample survey.
- Principal steps in sample survey.
- Sampling and non-sampling errors.
- Origin and functions of -National Sample Survey Organization (NSSO).
- Central Statistical Organization (CSO), Indian Statistical Institute (ISI).

Unit 4 Demography Methods: (15L)

- Method of collecting demographic statistics: Death rates, Crude death rate (C.D.R.) and standardized Death Rate (S.D.R.) Examples to find C.D.R., S.D.R., and to compare the healthiness of cities.
- Meaning of Infant Mortality Rate (I.M.R.), Crude birth rate (C.B.R.), Meaning of fertility rate, General Fertility Rate (G.F.R.), Specific Fertility Rate (S.F.R.) an d total fertility rate (T.F.R.), Simple examples.

III. Teaching methodology: Apart from the conventional blackboard teaching, other modes of teaching that will be adopted are power points, group discussions, quizzes, class test, problem solving and assignments.

References:
1. S. C. Gupta & V. K. kapoor: Fundamental of applied statistics Sultan chand & sons New Delhi.
2. D. S. Sancheti & V. K. Kapoor: Statistics: Theory, Method &Application" Sultan chand & Sons, New Delhi.
3. Goon, Gupta, Das gupta : An outline of statistical Theory" Vol 1&2 World press, Calcutta.

Activities (following activities are part of evaluation system for 5 marks)
1. Project on Graphs and diagrams
2. Assignment on above units.
3. Class tests / quizzes.

Elective Paper: Statistical Methods –II
Course Code: ST2102
No. of Credits: 04
Learning Hours: 60 hrs (70 marks)

Course Outcomes:

CO-1 Demonstrate the skills of finding permutations and combinations in real life situations. Apply this ideas in probability theory.

CO-2 Apply ideas of probability theory, conditional probability, Bayes' theorem in real life situations. Apply probability ideas in various fields.

CO-3 Apply the idea of random variables and their expected values to study the behavior of random phenomenon occurring in business, industry and daily life activities.

CO-4 Identify the real-life situations to apply Binomial and Poisson Probability Distribution and compute related probabilities & expected values.

I. Course Overview & Course Objectives:

Unit 01: Permutations and Combinations
Unit 02: Probability
Unit 03: Random Variable, Mathematical Expectation and Moments
Unit 04: Probability Distributions-I

The main objective of this course is to introduce to the students the basic concepts of permutation and combinations and probability theory .To expose the applicability of various distributions in different disciplines. By the end of this course students are expected to be able to obtain a probability distribution of random variable (univariate case) in the given situation and to apply standard discrete probability distribution to different situations.

Unit 1: Permutations and Combinations **(15L)**
- Basic idea of permutations with simple illustrations.
- Basic idea of combinations with simple illustrations.
- Formulae for nPr and nCr (Without proof)
- Examples based applications of   permutations and combinations.

Unit 2: Probability **(15L)**
- Definition of Random Experiment, Sample Space, Events, Mutually exclusive events, Exhaustive events, Favorable cases, Mathematical and Statistical definition of probability
- Theorems of addition and multiplication laws of probability (Without proof).
- Dependent events and Independent events, conditional probability with Simple examples
- Bay's theorem (without proof) and its simple examples.

Unit 3: Random Variable, Mathematical Expectation and Moments **(15L)**
- Concept of a discrete random variable, probability mass function of a discrete random variable and its properties.
- Definition of mathematical expectation of a discrete random variable.
- Mathematical expectations of sum and product of two independent and dependent random variable (without Proof) and its properties.
- Simple examples, Definition of raw and central moments of a discrete random variable up to order four.
- The relationship of raw moments with central moment (Without Proof).Numerical examples.

Unit 4: Probability Distributions-I **(15L)**
- Concept of probability mass function and probability density function
- Binomial distribution and Poisson distribution.
- Properties of these distributions (Without proof) and Simple examples based on these distributions.

III. Teaching methodology: Apart from the conventional blackboard teaching, other modes of teaching that will be adopted are power points, group discussions, quizzes, class test, problem solving and assignments.

References:
1. S. C .Gupta &V. K. kapoor :Fundamental of applied statistics Sultan chand & sons New Delhi(2007)
2. Sancheti & Kapoor: Business Mathematics" Sultanchand & Sons ,New Delhi.
3. Kapoor V.K.: Business Mathematics" Sultan chand & Sons, New Delhi.
4. Parimal Mukhopadhyay: Mathematical Statistics" Books & allied(p) Ltd. (2000).

Activities (following activities are part of evaluation system for 5 marks)
1. Project on Graphs and diagrams
2. Assignment on above units.
3. Class tests / quizzes.

Elective Paper: Mathematical Methods for Statistics-II
Course Code: ST3101
No. of Credits: 04
Learning Hours: 60 hrs (70 marks)

Course Outcomes:

CO-1 Identify the real-life situations to apply integration and compute related real life applications.

CO-2 Identify the real-life situations to apply Interpolation and Extrapolation and compute related applications.

CO-3 Demonstrate the need of identifying the real-life situation to apply Arithmetic Progression and Geometric Progression.

CO-4 Apply the knowledge of Co-ordinate geometry also apply the knowledge of Necessary and sufficient conditions for parallel and perpendicular lines.

I. Course Overview & Course Objectives:

Unit 01: Integration and its applications

Unit 02: Interpolation and Extrapolation

Unit 03: Arithmetic Progression and Geometric Progression

Unit 04: Co-ordinate geometry

The main objective of this course is to introduce to the students the basic concepts of integration and its real life applications, interpolation and extrapolation. The end of the course students apply their knowledge to identify the real life situation in Arithmetic Progression and Geometric Progression and Co-ordinate geometry

II. Course Content:

Unit 1: Integration and its applications (15L)
- Definition of integration.
- Rules of integration (without proof).
- Standard forms of integrals ($x^n, e^{(ax+b)}, a^x, \frac{1}{x}, (ax+b)^n, \frac{1}{(ax+b)}$).
- Simple examples.
- Definite Integration and its simple applications.

Unit 2: Interpolation and Extrapolation (15L)
- Meaning and importance of interpolation and extrapolation.

- Explanations of operators Δ and E.
- Newton's method.
- Binomial expansion method.
- Lagrange's method.
- Examples

Unit 3: Arithmetic Progression and Geometric Progression (15L)
- Introduction of arithmetic progression and geometric progression.
- Sum of n terms in arithmetic progression.
- Arithmetic mean.
- Geometric mean.
- Sum of n terms in geometric progression.
- Real life applications of arithmetic progression and geometric progression.

Unit 4: Co-ordinate geometry (15L)
- Definition of slop a line.
- Intercepts.
- Necessary and sufficient conditions for parallel and perpendicular lines.
- Equations of a line in the following forms:

$$(1)\; y = mx + c \;\; (2)\; y - y_1 = m(x - x_1) \;\; (3) \frac{x}{a} + \frac{y}{b} = 1 \;\; (4) \frac{y - y_1}{y_1 - y_2} = \frac{x - x_1}{x_1 - x_2}$$

- Simple examples

III. Teaching methodology: Apart from the conventional blackboard teaching, other modes of teaching that will be adopted are power points, group discussions, quizzes, class test, problem solving and assignments.

References:

1. S. C. Gupta &V. K. kapoor: Fundamental of applied statistics Sultan chand& sons New Delhi.
2. D. S. Sancheti &V. K. Kapoor: Statistics: Theory, Method & Application" Sultan chand& Sons, New Delhi.
3. Goon, Gupta, Dasgupta: An outline of statistical Theory" Vol. 1&2 World press, Calcutta.

Activities (following activities are part of evaluation system for 5 marks)

1. Quizzing.
2. Assignment on above four units.
3. Group Discussion on above four units.

Elective Paper: Statistical Methods III
Course Code: ST3102
No. of Credits: 04
Learning Hours: 60 hrs (70 marks)

Course Outcomes:
CO-1 Identify the real-life situations to apply Negative Binomial, Hyper Geometric and Geometric Probability Distribution and compute related probabilities & expected values.

CO-2 Identify the real-life situations to apply Normal Probability Distribution and compute related probabilities & expected values.

CO-3 Demonstrate the need of identifying the real-life situation to apply correlation, Regression and Association of Attribution.
CO-4 Apply the skill of drawing Simple Random Sample from the population and compute various estimates with their standard errors and confidence intervals.

I. Course Overview & Course Objectives:
Unit 01: Hyper Geometric, Negative Binomial and Geometric distribution
Unit 02: Normal distribution
Unit 03: Correlation, Regression and Association of Attributes
Unit 04: Sampling Methods

The main objective of this course is to introduce to the students the basic concepts of different probability distributions and their applications. Also, students will be introduced concept of correlation and regression for bivariate distribution .By the end of this course students are expected to be able to find probabilities of a given probability distribution. Students are also expected to interpret coefficient of correlation and fitting of regression line.

II. Course Content:

Unit 1: Hyper Geometric, Negative Binomial and Geometric distribution   (15L)
* Definitions, basic properties of hyper geometric, negative binomial and geometric distributions (without proof) – Mean and Variance.
* Examples of hyper geometric, negative binomial and geometric distributions.

Unit 2: Normal distribution   (15L)
* Definition, basic properties of Normal distribution (without proof)
* Idea of area under the normal curve
* Importance of normal distribution
* Examples of Normal distribution.

Unit3: Correlation, Regression and Association of Attributes (15L)
- Concept of bivariate data, Correlation Coefficient and its types, Scatter diagram.
- Karl Pearson's coefficient of correlation, Independence of variables.
- Spearman's Rank correlation coefficient.
- Coefficient of Determination and Probable Error.
- Meaning of Regression
- Linear Regression model
- Equations of lines of Regression
- Calculation of Regression coefficient
- Simple examples based on Correlation and Regression
- Concept of Association of attributes
- Consistency of data
- Types of Association and methods of studying Association
- Simple examples based on Association

Unit 4: Sampling Methods (15L)
- Concept of population survey and sample survey.
- Characteristics of good sample.
- Meaning of sampling (with replacement and without replacement).
- Simple random sampling and its examples.
- Stratified random sampling and its examples (up to 3 strata).

III. Teaching methodology: Apart from the conventional blackboard teaching, other modes of teaching that will be adopted are power points, group discussions, quizzes, class test, problem solving and assignments.

References:
1. S. C. Gupta &V. K. kapoor :Fundamental of applied statistics Sultan chand & sons New Delhi(2007)
2. Sancheti & Kapoor: Business Mathematics" Sultan chand &Sons, New Delhi.
3. Kapoor V.K.: Business Mathematics Sultan chand &Sons, New Delhi.
4. Parimal Mukhopadhyay: Mathematical Statistics"Books & allied(p)Ltd.(2000).

Activities (following activities are part of evaluation system for 5 marks)
1. Project on Graphs and diagrams
2. Assignment on above units.
3. Class tests / quizzes

Elective Paper: Applied Statistics II
Course Code: ST4101
No. of Credits: 04
Learning Hours: 60 hrs (70 marks)

Course Outcomes:

CO-1 Identify the real-life situations to apply large sample tests with hypothesis and different errors.
CO-2 Identify the real-life situations to Statistical Quality Control with using Chance and assignable causes of Variation in quality. Also find tolerance limits.
CO-3 Demonstrate the need of identifying the real-life situation to Demand law, demand function (curve), Supply law, demand function (curve) and Monopoly, Maximization of profit under monopoly.
CO-4 Identify the real-life situations to apply small sample tests.

I. Course Overview & Course Objectives:

Unit 01: Large Sample tests
Unit 02: Statistical Quality Control
Unit 03: Economic Statistics
Unit 04: Small Sample Tests

The main objective of this course is to introduce to the students the basic concepts of discuss idea of statistical quality control and its applications. To introduce the basic concepts of hypothesis testing for large sample and small sample tests. The end of the course they will get ideas about Economics statistics.

Unit 1: Large Sample tests (15L)
- Meaning of parameters and statistics
- Idea of hypothesis testing, Statistical hypothesis-null and alternative hypothesis
- Types of error, Standard error, level of significance.
- Standard errors of mean and proportion.
- Procedure of hypothesis testing.
- Test for variables- test of significance of one sample mean and difference between two sample means.
- Test of Proportions – test of significance of one sample proportion and difference between two sample proportion.

Unit 2: Statistical Quality Control (15L)
- Introduction and importance of SQC
- Chance and assignable causes of Variation in quality
- Determination of tolerance limits.
- Theory of runs and criteria for detecting lack of control in the process.
- Control charts for Variables

- Construction of $\bar{X}$ and R charts with their interpretations.
- Control charts for attributes.
- Construction of p, np, c charts and their interpretations.

Unit 3: Economic Statistics (15L)
- Demand law, demand function (curve)
- Supply law, demand function (curve)
- Market Equilibrium, Revenue
- Concept of price elasticity of demand and supply, Interpretations of their values.
- Idea of Monopoly, Maximization of profit under monopoly
- Concept of total utility and marginal utility, Maximization of utility.
- Examples

Unit 4: Small Sample Tests (15L)
- Chi-square test of goodness of fit, independence of attributes and 2X2 contingency table.
- t-test for single mean, difference of two means, correlation coefficient, regression coefficient
- F-test for equality of two variances and Fisher's Z-transformation

III. Teaching methodology: Apart from the conventional blackboard teaching, other modes of teaching that will be adopted are power points, group discussions, quizzes, class test, problem solving and assignments.

References:
1. S. C. Gupta &V. K. kapoor: Fundamental of applied statistics Sultan chand & sons New Delhi (2007)
2. Sancheti & Kapoor: Business Mathematics Sultan chand &Sons, New Delhi.
3. Kapoor V.K.: Business Mathematics "Sultan chand &Sons, New Delhi.
4. Parimal Mukhopadhyay: Mathematical Statistics "Books &allied (p) Ltd. (2000).

Activities (following activities are part of evaluation system for 5 marks)
1. Project on Graphs and diagrams.
2. Assignment on above units.
3. Class tests / quizzes.

Elective Paper: Operations Research
Course Code: ST4102
No. of Credits: 04
Learning Hours: 60 hrs (70 marks)

Course Outcomes:
CO-1 Apply the skill of formulating and solving liner programming problems using graphical method.
CO-2 Apply the methods of solving transportation and assignment problems arising in business and industry
CO-3 Apply the skill of decision making process under certainty, uncertainty and risk using various methods.
Co-4 Demonstrate the need of identifying 'game theory' like situation, construct pay-off matrix   and find optimum strategies rusting in best inserts of players/competitors.

I. Course Overview & Course Objectives:
Unit 01: Linear programming problem
Unit 02: Transportation Problem, Assignment Problem & Replacement Problem
Unit 03: Decision Theory
Unit 04: Game Theory

To introduce quantitative techniques of linear programming problem, transportation problem, assignment problem, game theory. Along with the methods of solutions of these problems. By the end of this course students are expected to be able to obtain optimum solution of the problems arising in business, industry, social science by using the method of graphical, , Vogel's method, Hungarian method. They will also be able to solve simple problems using the concept of game theory

II. Course Content:

III. Teaching methodology: Apart from the conventional blackboard teaching, other modes of teaching that will be adopted are power points, group discussions, quizzes, class test, problem solving and assignments.

Unit 1: Linear programming problem   **(15L)**
  • Meaning of linear programming problem, uses, assumptions and limitations
  • Explanation of basic terminology.
  • Formulation of linear programming problem
  • Mathematical form of LPP.
  • Solution of LPP by using graphical method.

Unit2: Transportation Problem, Assignment Problem & Replacement Problem   **(15L)**
  • Introduction.
  • Mathematical model of Transportation Problem.
  • The Transportation Algorithm.

- Methods for finding initial Solution: North-West corner Rule, Least cost method, Vogel's Approximation method.
- Introduction and Mathematical model for Assignment Problem.
- Hungarian Method for solving an Assignment Problem.
- Replacement problem: Replacement of items whose efficiency deteriorates with time.

Unit 3: Decision Theory   **(15L)**
- Introduction.
- Steps of Decision-Making process.
- Types of Decision-Making environment.
- Decision-Making under Uncertainty: Mini-max Criterion, Maxi-min Criterion, Laplace Criterion, Hurwitz Criterion, Regret(Savage) Criterion.
- Decision-Making Under Risk: Expected monetary value (EMV), Expected Opportunity Loss (EOL), Expected value of perfect information (EVPI).

Unit 4: Game Theory   **(15L)**
- Introduction.
- Two -person zero -sum game.
- Pure Strategies (Mini-max and Maxi-min Principles): Games with saddle point.
- Mixed Strategies: Games without Saddle point.

III. Teaching methodology: Apart from the conventional blackboard teaching, other modes of teaching that will be adopted are power points, group discussions, quizzes, class test, problem solving and assignments.

References:
1. J. K. Sharma: O.R. Theory and application" Macmillan India Ltd.
2. H. A. Taha: O.R. Theory" Macmillan India Ltd.
3. D. C. Sancheti &V .K. Kapoor: Statistics Theory, Methods & Application Sultan chand & sons.
4. Kanti swaroop: O.R. Theory and application" Sultan chand & sons.

Activities (following activities are part of evaluation system for 5 marks)
1. Project on Graphs and diagrams.
2. Assignment on above units.
3. Class tests / quizzes.