

**CHRIST UNIVERSITY**  
**HOSUR ROAD, BANGALORE - 560 029**



**DEPARTMENT OF STATISTICS**

**SYLLABUS FOR**  
**BSc STATISTICS**

# **Course Objectives**

**The main objectives of this course are**

- To acquaint students with various statistical methods and their applications in different fields**
- To cultivate statistical thinking among students**
- To develop skills in handling complex problems in data analysis and research design**
- To prepare students for future courses having quantitative components.**

## **Modular Objectives**

### **Semester I**

#### **STA 131 BASIC STATISTICS AND PROBABILITY**

This paper deals with some of the basic techniques used in describing and summarizing important characteristics of a set of univariate data. Also the concept of probability and univariate random variables are introduced in this paper.

### **Semester II**

#### **STA 231 LINEAR REGRESSION AND PROBABILITY DISTRIBUTIONS**

The concept Linear Regression deals with studying the linear relationship between two or more variables, which is needed to analyse the real life problems. The standard theoretical distributions, their chief characteristics and applications are also dealt with.

### **Semester III**

#### **STA 331 SAMPLING DISTRIBUTIONS AND INFERENCE I**

This paper deals with standard sampling distributions like Chi Square, t and F and their characteristics and applications. Also, the different techniques of point estimation for estimating the parameter values and test of significance are included in this paper.

### **Semester IV**

#### **STA 431 INFERENCE II**

In this paper, various topics of Inferential Statistics such as Interval estimation, Testing of Hypothesis, non-parametric tests and SPRT are dealt with. These techniques play an important role in many fields like pharmaceutical, agricultural, medical etc.

## **Semester V**

### **STA 531 SAMPLING TECHNIQUES, TIME SERIES AND INDEX NUMBERS**

Sampling techniques deals with the ways and methods that should be used to draw samples in such a manner that the resulting sample is a representative of the entire population with respect to a particular characteristic of interest. Time series and index numbers deals with application of statistics in forecasting Economics and business.

### **STA 532 STATISTICAL METHODS FOR QUALITY MANAGEMENT**

This paper deals with issues that are vital to all manufacturing firms. The control chart as a tool for studying the variability of a system is useful for managers to determine how to improve a process.

## **Semester VI**

### **STA 631 EXPERIMENTAL DESIGNS AND DEMOGRAPHY**

This paper introduces the theory and applications of experimental design, which is vital for designing statistical experiments. Demography deals with the collection and analysis of vital events that occur in human population, which helps the government to formulate appropriate policies.

### **STA 632 OPERATIONS RESEARCH**

This paper deals with theory and applications of operations research. The techniques used have wide range of applications including agriculture, industry, transportation, economics, health system etc.

## Course Structure for BSc Statistics

### I Semester

Paper Code	Title of Paper	Hrs / Week	Marks	Credit
STA 131	Basic Statistics and Probability	4	100	3
STA 151	Statistics Practical-1	2	50	1

### II Semester

Paper Code	Title of Paper	Hrs / Week	Marks	Credit
STA 231	Linear Regression and Probability Distributions	4	100	3
STA 251	Statistics Practical-2	2	50	1

### III Semester

Paper Code	Title of Paper	Hrs / Week	Marks	Credit
STA 331	Sampling Distributions and Inference I	4	100	3
STA 351	Statistics Practical-3	2	50	1

### IV Semester

Paper Code	Title of Paper	Hrs / Week	Marks	Credit
STA 431	Inference II	4	100	3
STA 451	Statistics Practical-4	2	50	1

## V Semester

<b>Paper Code</b>	<b>Title of Paper</b>	<b>Hrs / Week</b>	<b>Marks</b>	<b>Credit</b>
STA 531	Sampling Theory, Time Series and Index Numbers	3	100	2
STA 532	Statistical Methods for Quality Management	3	100	2
STA 551	Statistics Practical-5	2	50	1
STA 552	Statistics Practical-6	2	50	1

## VI Semester

<b>Paper Code</b>	<b>Title of Paper</b>	<b>Hrs / Week</b>	<b>Marks</b>	<b>Credit</b>
STA 631	Experimental Designs and Demography	3	100	2
STA 632	Operations Research	3	100	2
STA 651	Statistics Practical-7	2	50	1
STA 652	Statistics Practical-8	2	50	1

**The students of 6<sup>th</sup> Semester BSc will be given training in data analysis using SPSS.**

## **End Semester Exam –Pattern of the Question Paper**

### **Theory:**

**Max. Marks: 100**

**Duration: 3 Hours**

**Section A consists of 12 questions out of which 10 are to be answered. Each question carries 2 marks.**

**Section B consists of 6 questions out of which 4 are to be answered. Each question carries 6 marks.**

**Section C consists of 6 questions out of which 4 are to be answered. Each question carries 14 marks.**

### **Practical:**

**Max. Marks: 50**

**Duration: 3 Hours**

**Students would be given three questions out of which they have to answer any two. Each question carries 25 marks.**

## Semester I

### STA 131 BASIC STATISTICS AND PROBABILITY

#### Theory Paper

**Total 60 hours**

**1. Introduction:** Importance of statistics, concepts of statistical population and a sample - quantitative and qualitative data - collection of primary and secondary data. Designing a questionnaire and a schedule. Classification and tabulation of data. Measurement scales- nominal, ordinal, interval and ratio. Diagrammatic and graphical representation of data. Construction of univariate and bivariate frequency distributions. Stem and leaf plot.

**12 hours**

**2. Univariate data:** Concepts of central tendency, Partition values and dispersion, Box plot. Measures of inequality- Gini's coefficient and Lorenz curve. Skewness and kurtosis. Their measures based on quartiles and moments.

**18 hours.**

**3. Probability:** Random experiments, trial, sample space, events. Approaches to probability - classical, empirical, subjective and axiomatic. Theorems on probabilities of events. Addition rules of probability. Conditional probability, independence of events and multiplication rule of probability. Bayes theorem and its applications.

**15 hours**

**4. Random variables and Expectations:** Definition, Discrete and continuous random variables, Distribution function probability mass and density functions expectation of a random variable and rules of expectation. Measures of location dispersion skewness and kurtosis for a probability distribution. Moment generating function of a random variable their properties and uses. Transformation of one dimensional random variable.

**15 Hours**

## Semester I

### STA 151 Statistics Practical-1

#### List of Practicals

30 hours

1. Pictorial representation of categorical data
2. Construction of univariate and bivariate frequency distributions
3. Graphical representation of numerical data
4. Measures of central tendency I
5. Measures of central tendency II
6. Partition values
7. Measures of dispersion I
8. Measures of dispersion II
9. Moments, Skewness and Kurtosis
10. Probability I
11. Probability II
12. Random variables and Expectations

#### Text Books:

- 1 Gupta. S.C and Kapoor V.K. Fundamentals of Mathematical Statistics, Sultan Chand and sons, (2001)
- 2 Freund J.E., Mathematical Statistics, Prentice hall, (2001)

#### References:

1. Berenson and Levine, Basic Business Statistics, Prentice- Hall India (1996, 6<sup>th</sup> edition)
2. Daniel and Terrell Business Statistics for Management and Economics, Prentice-Hall India, (1992, 6<sup>th</sup> edition)
3. Ross Sheldon, A First Course in Probability , Macmillan , (6<sup>th</sup> edition)

## Semester 2

### STA 231 LINEAR REGRESSION AND PROBABILITY DISTRIBUTIONS

#### Theory Paper

**Total 60 hours**

**1. Bivariate data:** Scatter diagram. Principle of least squares. Fitting of linear, quadratic, geometric and exponential curves. Product moment correlation coefficient and its properties. Coefficient of determination. Spearman's rank correlation coefficient. Concept of regression. Properties of regression coefficients.

**12 hours**

**2. Trivariate data:** Multiple regressions, multiple correlation and partial correlation coefficients and their related results.

**8 hours**

**3. Bivariate distributions:** Joint, marginal and conditional distribution for discrete and continuous variables. Moments, covariance and correlation coefficient. Independence of random variables. Mean and variance of linear combination of random variables. Conditional expectation and conditional variance. Transformation of two dimensional random variables.

**10 Hours**

**4. Discrete distributions:** Bernoulli, binomial, Poisson, uniform, hypergeometric, geometric and negative binomial distributions- mean, variance, moments through moment generating functions. Recursive relations for moments for binomial and Poisson variates. Binomial approximation to hypergeometric probabilities and Poisson approximations to binomial probabilities.

**18 Hours**

**5. Continuous Distributions:** Uniform, Exponential, Normal, Gamma, Beta, Cauchy and Weibul- Properties with proofs.

**12 Hours**

## Semester II

### STA 251 Statistics Practical -2

#### List of Practicals

30 hours

1. Curve fitting
2. Correlation I
3. Correlation II
4. Regression
5. Multiple and partial correlation
6. Multiple regression and Residual Variance
7. Bivariate discrete distributions
8. Binomial Distribution – Computation of probabilities and fitting
9. Poisson Distribution - Computation of probabilities and fitting
10. Computation of probabilities based on Geometric and Hypergeometric distribution
11. Negative binomial Distributions – Computation of probabilities and fitting
12. Normal distribution – Computation of probabilities
13. Fitting of normal distributions

#### Text Books:

1. Gupta. S.C and Kapoor. V.K. Fundamentals of Mathematical Statistics, Sultan Chand and sons, (2001)
2. Freund J.E. Mathematical Statistics, Prentice hall, (2001)

#### References:

1. Mukhopadhyay P, Mathematical Statistics, New Central Book Agency, (1996)
2. Hogg and Craig, , Introduction to Mathematical Statistics, Pearson Education, (1995)

## Semester III

### STA331 SAMPLING DISTRIBUTIONS AND INFERENCE I

#### Theory Paper

**Total 60 hours**

**1. Limit Theorems:** Chebychev's inequality, Weak Law of Large Numbers, Central Limit Theorems. De Moivre-Laplace and Levy-Lindberg theorems.- Proofs and applications.

**6 Hours**

**2. Sampling Distributions:** Concepts of statistic, parameter, pivotal quantity, sampling distribution and standard error. Chi square, t and F distributions, their properties and interrelationships. Independence of sample mean and variance in random sampling from Normal distribution. Sampling distribution of standard statistics-sample mean, sample variance, student's t and F statistics,

**20 hours**

**3. Point Estimation:** Concepts of parameter, random sample and its likelihood. Properties of estimators- Unbiasedness, Efficiency, Consistency and sufficient condition for consistency. Sufficiency, Factorisation theorem, Minimum variance unbiased estimator, Rao-Cramer lower bound of variance and related results. Methods of estimation-maximum likelihood and method of moments

**14 Hours**

**4. Test of significance:** Statistical hypotheses-Simple and composite, Statistical tests, Critical region, Errors of Type I and Type II, size and power of a test. Test for the mean, equality of two means, variance and equality of two variances (large and small samples), large sample tests for proportions, test for correlation coefficients-simple, multiple and partial. Test for regression coefficients. Fisher's Z transformation and its applications.

**16 Hours**

## Semester III

### STA 351 Statistics Practical -3

#### List of Practicals

30 hours

1. Construction of sampling distribution of sample mean and variance and verification of the results.
2. Estimation of parameters by method of maximum likelihood
3. Estimation of parameters by method of moments.
4. Test for single mean for small and large samples
5. Test for difference between two means for small and large samples
6. Paired t test
7. Tests for single proportion and difference between two proportions
8. Test for single variance and ratio of two variances
9. Test for correlation coefficients
10. Test for multiple and partial correlation coefficients
11. Test for regression coefficients

#### Text Books:

1. Gupta. S.C and Kapoor. V. K. Fundamentals of Mathematical Statistics, Sultan Chand and sons, (2001)
2. Freund J.E., Mathematical statistics, Prentice hall, (2001)

#### References:

1. Mukhopadhyay P, Mathematical Statistics, New Central Book Agency, (1996)
2. Hogg and Craig, Introduction to Mathematical Statistics, Pearson Education, (1995)

## Semester IV

### STA 431 INFERENCE II

#### Theory Paper

**Total 60 hours**

**1. Interval estimation:** Concepts of confidence interval and confidence coefficient, confidence interval for mean, difference between means, variance and ratio of variances under normality. Large sample confidence interval for proportions and correlation coefficients

**10 Hours**

**2. Testing of Hypothesis:** Definition of Most Powerful (MP), Uniformly Most Powerful (UMP), Neyman Pearson Lemma, Monotone Likelihood Ratio Property, Statement of the theorem which gives UMP tests for testing one sided hypothesis for distribution with MLR property, Likelihood Ratio test, LRT for single mean for normal case (large and small samples), for equality of two means for unknown but equal variances. LRT for single variance and equality of two variances

**24 hours**

**3. Non Parametric Tests:** Need for non parametric tests, Sign test for one sample and two samples, Wilcoxon signed rank test, Median test, Wald Wolfowitz run test, Mann Whitney U test, Run test for randomness, test for independence based on Spearman's rank correlation coefficient (small and large samples), Chi square test, goodness of fit, independence of attributes in contingency table, and equality of many proportions. Kruskal Wallis Test for equality of several means.

**18 hours**

**4. Sequential Probability Ratio Test:** Need for sequential test, Wald's SPRT, Sequential test for the mean of Normal population when variance is known and for the proportion. Derivation of expressions for OC and ASN functions in Bernoulli and Normal distributions

**8 Hours**

## STA 451 Statistics Practical - 4

### List of Practicals

30 hours

1. Confidence interval for single mean and difference between two means for small and large samples
2. Confidence interval for single proportion and difference between two proportions
3. Confidence interval for single variance and ratio of two variances
4. Confidence interval for correlation coefficients
5. OC and Power curve for testing the mean of a normal distribution
6. Construction of the MP test for binomial, Poisson and Normal distributions
7. Sign test for one and paired samples.
8. Wilcoxon signed rank test for one and paired samples.
9. Mann Whitney U test and Wilcoxon's rank sum test
10. Median test and Wald Wolfowitz run test.
11. Run test for randomness.
12. Test for independence using Spearman's rank correlation coefficient
13. Chi square test for independence of attributes
14. Chi square test for goodness of fit.
15. Chi square test for equality of several proportions
16. Kruskal Wallis test for equality of several means
17. SPRT for proportions
18. SPRT for mean of normal distribution

### Text Books:

1. Gupta. S.C and Kapoor. V. K Fundamentals of Mathematical Statistics, Sultan Chand and Sons.(2001)
2. Freund J.E, Mathematical Statistics, Prentice hall, (2001)

### References

1. Mukhopadhyay P, Mathematical Statistics, New Central Book Agency, (1996)
2. Hogg and Craig, Introduction to Mathematical Statistics, Pearson Education, (1995)

## Semester V

### STA 531 SAMPLING THEORY, TIME SERIES AND INDEX NUMBERS

#### Theory Paper

Total 45 hours

**1. Basics:** Concepts of population and sample. Need for sampling – complete enumeration Vs sample surveys. Principal steps in a sample survey. Planning, execution, analysis and reporting stages. Requisites of a good questionnaire. Drafting of questionnaires and schedules and their pre-test. Pilot surveys. Non-sampling errors and simple methods of controlling them. Non-probability and probability sampling-meaning, need and illustrations. Methods of drawing random samples-Lottery system. Use of random numbers. Bias accuracy and precision of the estimates.

10 Hours

**2. Simple random sampling:** Sampling with and without replacement. Unbiased estimators of population mean and total. Derivation of sampling variances. Standard errors of the estimators. Confidence limits. Sampling for proportions. Derivation of the variances of the estimators and their estimation. Determination of sample size. Obtaining the sample size while estimating population proportions and population means.

10 Hours

**3. Stratified random sampling:** Need for stratification. Unbiased estimator of mean and total in stratified random sampling. Derivation of the standard errors and their estimation. Allocation of sample size under proportional, optimum and Neyman allocations. Comparison of  $V(\text{ran})$ ,  $V(\text{prop})$  and  $V(\text{opt})$  ignoring fpc. Estimation of gain in precision due to stratification.

10 Hours

**4. Linear systematic sampling:** Advantages and limitations. Estimation of mean and standard error of the estimate. Comparison with simple random and stratified random sampling. Circular Systematic sampling.

5 Hours

#### **5. Time Series and Index numbers:**

**Time Series:** Components of Time series. Additive and multiplicative models. Measurement of trend by moving averages and by least square methods. Construction of seasonal indices by sample averages and ratio to moving averages.

**Index Numbers:** Meaning and Applications. Price and quantity relatives, link and chain relatives. Construction of Index numbers: their computation and interpretation. Simple, aggregative and weighted average methods. Laspeyres, Paasche's, Marshall-Edgeworth's, and Fisher's index numbers. Time and factor reversal tests, Consumer price index. Splicing and deflating of index numbers.

10 Hours

## Semester V

### STA 551 Statistics Practical 5

#### List of Practicals

30 hours

1. Drawing random samples using random number tables (grouped and ungrouped cases)
2. Listing of all possible SRSWR and SRSWOR from a given population and verifying that the estimators of the mean, total and the sampling variance of the estimator are unbiased.
3. Drawing of random sample under SRSWR and SRSWOR design from a given population and estimation of the mean and total and the standard error of the estimators.'
4. Estimation of the proportion and the standard error of the estimator under SRSWR and SRSWOR designs.
5. Stratified random sampling
6. Systematic random sampling
7. Determination of secular trend by moving averages and least squares methods.
8. Measurement of seasonal variation by simple averages and ratio to moving averages.
9. Index Number I
10. Index Number II

#### Text Books:

1. Cochran, W. G: Sampling Techniques, Wiley Eastern, 3<sup>rd</sup> edition
2. Gupta, S.C., and V.K.Kapur: Fundamentals of Applied Statistics, Sultan Chand and Co., 3<sup>rd</sup> edition.

#### Reference Books:

1. Singh, D and Chaudhary, F.S(1986); Theory and Analysis of Sample Survey Design, Wiley Eastern
2. Goon, A. M., et al., Fundamentals of Statistics Volume II, World Press, 6<sup>th</sup> edition

## Semester V

### STA 532 STATISTICAL METHODS FOR QUALITY MANAGEMENT

#### Theory Paper

**45 Hours**

**Basics:** Quality assurance and management. Quality costs. Aims and objectives of statistical process control. Chance and assignable causes of variation. Statistical quality control. Process control, Rational subgroups. product control. Importance of statistical quality control in Industry.

**5 hours**

**Charts for variables:** Theoretical basis and practical background of control charts for variables. 3 sigma limits, warning limits and probability limits. Criteria for detecting lack of control. Derivation of limits and construction  $\bar{X}$ , R and  $\sigma$  charts and interpretation. Group control charts and sloping control charts. Natural tolerance limits and specification limits. Process capability studies. O.C and ARL curve for variable charts.

**12 hours**

**Control charts for attributes:** np chart, p chart, c chart and u chart. Basis, construction and interpretation. OC and ARL curve for attribute charts.

**6 hours**

**Product Control:** Sampling inspection and 100 percent inspection. AQL, LTPD, Producer's risk and consumer's risk. Acceptance sampling. Sampling plans-single and double sampling plans by attributes. Derivation of OC, AOQ, ASN and ATI for single and double sampling plans. Expressions for consumers' risk and producers' risk for single and double sampling plans

**12 hours**

**Reliability:** Reliability concepts. Reliability of components and systems. Life distributions, reliability functions, hazard rate, common life distributions-Exponential, Gamma and Weibull. System reliability, Series, parallel, standby systems, r/n systems. Complex systems

**10 hours**

## Semester V

### STA 552 Statistics Practical-6

#### List of Practicals

30 Hours

1.  $\bar{X}$  and R charts (Standard values known and unknown)
2.  $\bar{X}$  and  $\sigma$  charts (Standard values known and unknown)
3. Group control chart
4. Sloping control chart
5. np and p charts (Standard values known and unknown)
6. c and u charts (standard values known and unknown)
7. OC and ARL curves for variable and attribute charts
8. Drawing OC, ASN, ATI and AOQ curves for single sampling plan for attributes
9. Drawing OC, ASN, ATI and AOQ curves for double sampling plans for attributes
10. Construction of single sampling plan by attributes
11. System reliability evaluation
12. Sketching reliability and hazard function

#### Text Books

1. Montgomery D. C., Introduction to Statistical Quality Control. Wiley International edition, (1985)
2. K. S. Krishnamurthy, Reliability Methods for Engineers, ASQ Press, (1992)

#### Reference Books

1. Grant E. L. and Leavenworth R. S., Statistical Quality control, , McGrawHill, 6<sup>th</sup> edition (1988)
2. Gupta R. C., Statistical Quality Control, Khanna Pub. Co.

## Semester VI

### STA 631 EXPERIMENTAL DESIGNS AND DEMOGRAPHY

#### Theory Paper

**45 Hours**

**1. Analysis of Variance:** Meaning and assumptions. Gauss Markov model and Gauss Markov Theorem (statement only). Analysis of variance (fixed effects model)-Analysis of one-way, two-way and three-way classified data-expected mean squares, ANOVA tables. Least significant difference. Case of multiple but equal number of observations per cell in two-way classification (with interaction)

**12 hours**

**2. Design of Experiments:** Principles of randomization, replication and local control. Completely randomized, randomized block and Latin square designs-layout, models, least squares estimates of parameters, hypotheses, test procedures and ANOVA tables. Efficiency of a design. Missing plot technique for RBD and LSD- Estimation of single missing observation.

**15 hours**

**3. Factorial Experiments:**  $2^2$  and  $2^3$  factorials. Main effects and interactions, their best estimates and orthogonal contrasts. Yates method of computing factorial effects. Total and partial confounding in a  $2^3$  experiment with RBD layout.

**7 hours**

**4. Demography:** Sources of demographic data. Measurement of mortality; Crude, specific and standardized death rates, infant mortality rate. Maternal mortality rate. Fecundity and fertility, measurement of fertility: crude, age specific general and total fertility rates. Reproduction rates. Life table: Components of a life table, force of mortality and expectation of life, construction of a life table. Abridged life table. Uses of a life table.

**11 hours**

## Semester VI

### STA 651 Statistics Practical - 7

#### List of Practicals

30 hours

1. Analysis of one way classified data.
2. ANOVA for two way classified data: single observation per cell
3. ANOVA for two way classified data: multiple but equal number of observations per cell (assuming interaction)
4. Analysis of CRD
  - a. Analysis of RBD
6. Analysis of LSD
7. Missing plot technique for RBD with single observation missing
8. Missing plot technique for LSD with single observation missing
9. Analysis of  $2^2$  factorial experiments
10. Analysis of  $2^3$  factorial experiments (With and without confounding -total and partial)
11. Vital statistics – computation of mortality, fertility and reproduction rates
12. Vital statistics – construction of life table.

#### Text Books:

1. Gupta S.C. and Kapoor V.K: Fundamentals of Applied statistics, Sultan Chand and Co., 3<sup>rd</sup> edition
2. Montgomery D.C.: Design and Analysis of experiments, John Wiley

#### Reference Books:

1. Cochran W and G, M. Cox, Experimental Designs, John Wiley
2. Goon, A. M., et al., Fundamentals of Statistics Volume II, World Press, 6<sup>th</sup> edition
3. Cox P. R, Demography, Cambridge University Press.,(1970)

## Semester VI

### STA 632 OPERATIONS RESEARCH

#### Theory Paper

45 Hours

**1. Introduction:** Definition and scope of operations research (OR). Phases of OR. Modeling and solution.

2 hours

**2. Linear Programming:** Linear Programming problem (LPP). Formulation of LPP. Graphical solution. Simplex algorithm (without derivation). Examples.

7 hours

**3. Statistical Decision Theory and Game Theory:**

**Statistical decision problem:** Maximin-Minimax, Laplace, Hurwicz criterion. Regret function. Expected value of perfect information. Bayesian Analysis. Decision tree analysis.

**Game theory-** Introduction. Two person Zero-sum game. Pure and mixed strategies. Saddle point solution. Payoff function. Dominance principle. Solution of game by graphical method.

8 hours

**4. Inventory Theory and Replacement problem:** Description of an inventory system. Inventory costs. Demand and lead time. EOQ model with without shortages. Replacement of items that deteriorate. Individual and group replacement policies.

8 hours

**5. Queueing Models and Simulation:**

**Queueing models-**specifications and effectiveness measures. Steady-state solutions of M/M/1 and finite capacity.

**Simulation :** Monte Carlo method, Generation of random numbers (Uniform, Exponential, Gamma, Normal, Bernoulli, Binomial, Poisson)

8 hours

**6. CPM and PERT:** Project planning with CPM and PERT. Drawing of project network. Critical path calculation. Critical path, slack time and float. PERT three estimate approach. Calculation of probabilities of completing a project within a specified period.

5 hours

**7. Transportation :** Introduction, General Transportation problem, Transportation table, L.P formulation of a Transportation problem. Finding an initial Basis feasible solution. Test for optimality. Transportation algorithm. Introduction, Mathematical formulation of the problem. Unbalanced transportation problem, problem of degeneracy.

7 hours

## Semester VI

### STA 652 Statistics Practical -8

#### List of Practicals

30 Hours

1. Solution of LPP by graphical method.
2. Solution of LPP involving slack variables only-using simplex algorithm.
3. Decision theory problems.
4. Game theory problems.
5. Inventory problems.
6. Replacement problems
7. Queuing problems.
8. Simulation
9. CPM and PERT
10. Transportation problems.
11. Assignment problems.

#### Text Books:

Kantiswaroop, Manmohan and P.K.Gupta Operations research. Sultan Chand & Co., (2003)

#### Reference Books:

1. P.K .Gupta, Manmohan : Problems in Operations research. Sultan Chand & Co.
2. H. A. Taha, Operations Research,. Pearson Education,

