GUJARAT UNIVERSITY

B. COM. (HONS)
SEMESTER – V (MAJOR)
INFERENTIAL STATISTICS - I
COURSE CODE – DSC C STA 351
CREDIT MARK DISTRIBUTION – 04

AS PER NEP 2020 (To be effective from June 2025)

COURSE OBJECTIVES

Course objectives for "Inferential Statistics - I" typically aim to equip students with a solid understanding of the principles and techniques used to draw inferences about populations based on sample data. This course builds upon the foundational concepts of descriptive statistics and introduces students to the world of statistical inference, where the emphasis is on making predictions, testing hypotheses, and gaining insights from data that go beyond the immediate sample. "Inferential Statistics - I" sets the groundwork for more advanced statistical courses and provides students with valuable tools for making data-driven decisions and conducting research in various fields.

PRE – REQUISITE

A strong understanding of basic concepts in statistics is essential. Students should be familiar with descriptive statistics, including measures of central tendency (mean, median, mode), measures of dispersion (variance, standard deviation), and graphical representations of data (histograms, bar charts, etc.). A good grasp of probability theory is crucial, including an understanding of probability distributions (e.g., binomial, normal, Poisson) and basic rules of probability. College-level Mathematics: Proficiency in algebra and calculus is often required. This is because statistical inference involves mathematical calculations and derivations.

Familiarity with statistical software packages like R, Python, or SPSS is beneficial, as these tools are commonly used in practical data analysis during the course.

COURSE OUTCOMES

Students should be able to explain the fundamental principles and concepts of statistical inference, including the distinction between descriptive and inferential statistics. Students should demonstrate proficiency in applying probability concepts to solve problems related to random variables, probability distributions, and sampling distributions. Students should be able to formulate null and alternative hypotheses, perform hypothesis tests for means, proportions, and

other relevant statistical parameters, and interpret the results. Students should be able to calculate confidence intervals for population parameters and interpret them in the context of the data. Students should understand various sampling methods and their implications on the validity of statistical inferences. Students should be able to conduct simple linear regression analyses, interpret the results, and make predictions based on the regression model. Students should be able to conduct correlation analyses to measure the strength and direction of relationships between variables. Students should be able to apply inferential statistical techniques to real-life data sets and draw meaningful conclusions from the results. The course outcomes for "Inferential Statistics - I" are the specific learning objectives that students are expected to achieve by the end of the course. These outcomes demonstrate the knowledge, skills, and abilities that students will have gained upon successful completion of the course.

UNIT	CONTENT	WEIGHTAGE
1	**THEORY OF ESTIMATION** ➢ Introduction – Sampling distribution, Sampling and non-sampling errors, Standard Error and its uses, ➢ Statistical Inference ➢ Estimation Theory, Properties of good estimator (examples on unbiasedness only) ➢ Introduction to methods of Point Estimation (Theory only) and Interval Estimation. ➢ Simple examples on Confidence Interval for Population Mean and Population Proportion (for with and without replacement) ➢ Determination of Sample Size for Estimating Population Mean ➢ Determination of Sample Size for Estimating Population Proportion	**25%**
2	**INTRODUCTION OF TESTING OF HYPOTHESIS AND ITS PROCESS** ➢ Idea of Population and sample, Definition of Parameter and Statistic, difference between them. ➢ Meaning of Statistical Hypothesis and its Types – null, alternative, simple and composite hypothesis ➢ Meaning and definition of Type-I and Type-II Errors, Power of the Test, Simple examples on it. ➢ Definition of level of Significance and p-value. ➢ Critical Region for symmetric and non-symmetric distributions ➢ One Tailed Test and Two Tailed Test (Theoretical explanation only) ➢ Procedure for Testing of Hypothesis ➢ Concept of Small and Large Sample Tests and their comparison.	**25%**

3	**LARGE SAMPLE TEST** ➢ Introduction to standard normal distribution; probability density function, and its properties, assumptions and its applications (Revision) ➢ Test of Significance for Mean ➢ Test for Difference between Two Means ➢ Test for Difference between Two Variances ➢ Test for Difference of Sample Proportion and Population Proportion ➢ Test for Difference between two Proportions ➢ Practical examples related to these Tests	**25%**
4	**SMALL SAMPLE TEST (Student t – test)** ➢ Introduction to t-distribution; Probability Density Function, and its properties, assumptions and its applications (Revision) ➢ Test of significance difference of population and sample mean. ➢ Test of significance difference of two populations means (Independent Samples) ➢ Paired t-test for Dependent Samples ➢ Test of significance difference of sample and population correlation coefficient ➢ Practical examples related to these Tests	**25%**

MODE OF EVALUATION

Evaluation will be divided in two parts.

- **External:** Semester end Examination will be conducted by the Gujarat University of 50 Marks
- **Internal:** Internal Evaluation of 50 marks will be decided by the colleges / Institutes/ University departments as per the instruction given by the University time to time

FBLD (Flip Blended Learning Design Template)

- Any One Unit from the above syllabus can be discussed by the faculty through online mode.
- Online mode can be SWAYAM MOOC Course or any other suggested by the UGC or Gujarat University.

REFERENCE BOOKS:

1. **Dr. P. Ganesan:** He has authored several books on statistics, including "Fundamentals of Mathematical Statistics" and "Inferential Statistics."
2. **Dr. S.C. Gupta:** Known for books like "Fundamentals of Statistics" and "Statistical Methods."
3. **S. C. Sharma:** Author of "Statistical Methods for Business and Economics," which covers both descriptive and inferential statistics.
4. **J.K. Thukral: Known for the book "Inferential Statistics," which may be suitable for beginners in statistics.**
5. **R. G. Gupta: Author of "Business Statistics," which may include a section on inferential statistics.**
6. **S. Chand Publishing: They have a wide range of academic books, including statistics and related subjects.**
7. **Himalaya Publishing House: Known for publishing textbooks and reference books on various academic topics, including statistics.**
8. **PHI Learning Pvt. Ltd.: This publisher offers academic and professional books in various fields, including statistics.**
9. **Vikas Publishing House: Known for its textbooks in management, economics, and statistical subjects.**
10. **Wiley India: The Indian subsidiary of John Wiley & Sons, Inc., they publish academic books in various disciplines, including statistics.**
11. **S.C. Srivastava: Anmol Publications Pvt. Ltd. "Fundamentals of Statistics"**

GUJARAT UNIVERSITY

B. COM. (HONS) NEP
SEMESTER –V (MAJOR)
Optimization Technique II

COURSE CODE – DSC C STA 352
CREDIT MARK DISTRIBUTION –04
AS PER NEP 2020 (To be effective from June 2025)

COURSE OBJECTIVES

- The course aims at building capabilities in the students for analyzing different situations in the industrial/ business scenario involving limited resources and finding the bestfeasible solution(Optimum Solution) within constraints.
- The objective of this course is to enable the student to understand and analyze managerial problems to equip him/ her to use the resources such as capitals, materials, productioncontrolling, directing, staffing, and machines more effectively.

- **PRE – REQUISITE**
- The world of Operations Research is dynamic and fast paced. It is also the blending of mathematics, optimization, statistics, and computer science, techniques to improve decision making, processes and systems. The learners should have knowledge of mathematics up to higher school level to learn basic contents of Operations Research.

COURSE OUTCOMES

- Understanding the basic concept and working of O.R. to solve the Industrial/ Organizational problem in optimum manner.
- Solve linear programming problems using appropriate technique and interpret the results obtained.
- Determine feasible strategy for Minimization of Cost of shipping of products from source to Destination using various methods, finding initial basic feasible solution of the Transportation problems.

- Optimize the allocation of resources to Demand points in the best possible way using various techniques and minimize the cost or timeof completion of number of jobs by number of persons as well as maximize the profit or sale.
- Allocation of work to appropriate persons to minimize the cost or time or to maximize the profit.
- To know the appropriate time to replace the machine for getting maximum benefit.

UNIT	CONTENT	WEIGHTAGE
1	**TRANSPORTATION PROBLEM (TP)** ➢ Meaning of balanced and unbalanced Transportation Problem(TP) ➢ General Transportation table and its mathematical form ➢ Initial basic feasible solution (IBFS) and its cost By using • North-West Corner Method (NWCM), • Least Cost (Matrix Minima) Method (LCM) • Vogel's Approximation Method (VAM) ➢ Methods for obtaining optimum solution by using MODI method. ➢ Various type of problems like unbalanced, restricted, maximization, etc. ➢ Examples based on these methods	**25%**
2	**ASSIGNMENT PROBLEM (AP) AND REPLACEMENT PROBLEM (RP)** ➢ Meaning of balanced Assignment Problem (AP) ➢ Mathematical form of AP ➢ Hungarian method for solving AP in the cases of Minimization and Maximization problem ➢ Crew Assignment Problem ➢ Meaning of Replacement Problem (RP) ➢ Simple examples of replacement problem when the units are deteriorate depending on time and money value remains same. In both the cases variety of problem is to be considered.	**25%**
3	**PERT AND CPM** ➢ Meaning and Characteristics of Program Evaluation and Review Technique (PERT) ➢ Meaning of Critical Path Method (CPM) ➢ Uses and Limitations of PERT and CPM	**25%**

	➢ Difference between PERT and CPM ➢ Explanation of basic terms such as • Activity • Event • Dummy Activity • Optimistic Time • Pessimistic Time • Most Likely Time • Expected Time • Fulkerson's Rules for numbering the event • Earliest Starting Time (EST) • Earliest Finish Time (EFT) • Latest Starting Time (LST) • Latest Finish Time (LFT) • Total Float Time, Free Float and Independent Float ➢ Simple Examples on the basis of all above	
4	**Simulation techniques** ➢ Introduction to the Simulation techniques ➢ Process of Simulation' ➢ Monte-Carlo Simulation ➢ Simulation of an inventory system ➢ Simulation of queuing system ➢ Advantages and disadvantages of Simulation	**25%**

MODE OF EVALUATION

Evaluation will be divided in two parts.

- **External:** Semester end Examination will be conducted by the Gujarat University of 50 Marks
- **Internal:** Internal Evaluation of 50 marks will be decided by the colleges / Institutes/ University departments as per the instruction given by the University time to time.

FBLD (Flip Blended Learning Design Template)

- Any One Unit from the above syllabus can be discussed by the faculty through online mode.
- Online mode can be SWAYAM MOOC Course or any other suggested by the UGC or Gujarat University.

REFERENCE BOOKS:

1. Operation Research - Kanti Swaroop
2. Operation Research : P. K. Gupta and Man Mohan
3. Operation Research : Dr R. V. S. Prasad
4. Operation Research : Dr. D. Giri
5. Operation Reach – S. D. Sharma and J. K. Sharma
6. Operations research - Models and methods by Chandrasekar Salimath, Bhupendar Parashar.
7. Operations Research – Taha
8. Operations Research – N. D. Vora

GUJARAT UNIVERSITY

B. COM. (HONS)

SEMESTER – V (MAJOR)

Econometrics I

COURSE CODE – DSC C STA 353

CREDIT MARK DISTRIBUTION – 04

AS PER NEP 2020 (To be effective from June 2025)

COURSE OBJECTIVES

This course offers students the knowledge about basics of methods of econometrics. This knowledge is necessary for the students who are opting statistics as core subject and for the professional and higher studies this course will be very useful.

PRE – REQUISITE

1. To be aware with the basic applications of statistical techniques to acquire fundamental knowledge of econometrics.
2. To give basic knowledge of constrained optimizing techniques.
3. To make them aware of importance of economic models.
4. To make students familiar with relation between various economic variables and its analytical interpretations

➢ CO – REQUISITE

The learner should have basic understanding of economic concepts for business.

COURSE OUTCOMES

1. This course helps to get feel of real life business problem and its conversion into mathematical forms.
2. This course gives idea of optimizing business objective with constraints.
3. Learning the problems related to economics and also to learn its practical applications.
4. Attaining knowledge of regarding resource allocation to service providers.

UNIT	CONTENT	WEIGHTAGE
1	Demand Analysis and Monopoly & Duopoly Problems	25%

	➢ Introduction to demand function and demand law ➢ Supply function and supply law ➢ Market equilibrium, effect of taxation and subsidy on market equilibrium and simple examples related to it ➢ Cost function, average cost, marginal cost, Revenue function, average revenue, marginal revenue, Profit function and marginal profit. Simple examples related to it. ➢ Discussion of monopoly problem and Cournot and Bertrand models. ➢ Classical Duopoly problems and its simple examples. ➢ Difference between Monopoly and Duopoly	
2	Partial differentiation and its Application ➢ Definition of partial derivative involving two independent variables up to second order ➢ Definition of Homogeneous functions ➢ Statement of Euler's theorem (without proof) and its application. ➢ Application of partial derivative to the problems related to constrained optimization problems, (Cost function and Utility function). ➢ Simple examples on it	**25%**
3	Economic Models & Distribution of Income ➢ Classical models- structural equations and structural parameters of model ➢ Linear homogeneous equation system, study of (i) price determination model and (ii) income determination model. ➢ Simple examples on it ➢ Concept of Income Distribution models ➢ Study of Pareto's income distribution- analysis and interpretations. ➢ Lorentz curve of concentration ➢ Fitting of Pareto and Lorentz curves- numerical examples only.	**25%**
4	Index Numbers ➢ Definition, limitations, characteristics, and uses of index numbers ➢ Construction of whole sale price index number and cost of living index number ➢ Construction of index number by using aggregate expenditure method (Laspeyre's, Paasche's, Fisher's, Marshall Edgeworth's and Dorbish Bowley's) and family budget methods. ➢ Weighted mean formulae, Deflating, Splicing of index numbers ➢ Time Reversal Test (TRT) and Factor Reversal Test (FRT) for various index numbers ➢ Numeric examples.	**25%**

MODE OF EVALUATION

Evaluation will be divided in two parts.

- **External:** Semester end Examination will be conducted by the Gujarat University of 50 Marks
- **Internal:** Internal Evaluation of 50 marks will be decided by the colleges / Institutes/ University departments as per the instruction given by the University time to time

FBLD (Flip Blended Learning Design Template)

- Any One Unit from the above syllabus can be discussed by the faculty through online mode.
- Online mode can be SWAYAM MOOC Course or any other suggested by the UGC or Gujarat University.

REFERENCE BOOKS:

1. J. K. Sharma, Mathematics for Business and Economics, Asian Books Private Ltd.
2. S. C. Gupta, V. K. Kapoor, Fundamentals of Applied Statistics, Sultan Chand & sons, New Delhi.
3. David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Statistics For Business and Economics, South-Western Cengage Learning India Pvt. Ltd. New Delhi.
4. S.C. Gupta: "Fundamentals of Mathematica Statistics" S. Chand, New Delhi.
5. R. G. D. Allen, Mathematical Analysis for Ecomomists, Macmillan, New,York

B. COM. (HONS) NEP
SEMESTER – V (MINOR)
OPERATIONS RESEARCH - II
COURSE CODE – DSC-M-STA-354
CREDIT MARK DISTRIBUTION – 04

COURSE OBJECTIVES

The course aims at building capabilities in the students for analyzing different situations in the industrial/ business scenario involving limited resources and finding the feasible solution within constraints. The objective of this course is to enable the student to understand and analyze managerial problems to equip him/ her to use the resources such as capitals, materials, production controlling, directing, staffing, and machines more effectively.

PRE – REQUISITE

The world of Operations Research is dynamic and fast paced. It is also the blending of mathematics, optimization, statistics, and computer science, techniques to improve decision making, processes and systems. The learners should have knowledge of mathematics up to higher school level to learn basic contents of Operations Research.

COURSE OUTCOMES

Understanding the basic concept and working of O.R. to solve the Industrial/ Organizational problem in optimum manner. Solve Decision Theory using appropriate technique and interpret the results obtained. Determine feasible strategy for Minimization of Cost of shipping of products from source to Destination using various methods, finding initial basic feasible solution of the Transportation problems. Optimize the allocation of resources to Demand points in the best possible way using various techniques and minimize the cost or time of completion of number of jobs by number of persons as well as maximize the profit or sale.

UNIT	CONTENT	WEIGHTAGE
1	**DECISION THEORY** ➢ Meaning and Importance of Decision Theory ➢ Components of Decision Theory ➢ Different Methods of Taking Decision ✓ Maxi – Min Principle ✓ Maxi – Max Principle ✓ Laplace's Principle ✓ Hurwitz's Principle ✓ Expected Monetary Value (EMV) ✓ Expected Profit under Perfect Information (EPP) ✓ Expected Value for Perfect Information (EVPI) ➢ Practical Problems relating to the stated Methods	**25%**

2	**GAME THEORY** ➢ Meaning of Game ➢ Two Person Zero Sum Game ➢ Strategy and Pay – off matrix for two persons zero sum game ➢ Saddle point ➢ Pure strategy ➢ Value of the Game ➢ Mixed Strategy ➢ Dominance Principle for Solving the Game without Saddle Point ➢ Reduction of m x n pay off matrix into 2 x 2 matrix using dominance principle and solving the Game ➢ Simple Sums of Game Theory – with and without Saddle point using dominance principle only	**25%**
3	**PERT AND CPM TECHNIQUES** ➢ Meaning and Characteristics of Path Evaluation Review Technique (PERT) ➢ Explanation of basic terms such as ✓ Activity ✓ Event ✓ Dummy Activity ✓ Optimistic Time ✓ Pessimistic Time ✓ Most Likely Time ✓ Expected Time ✓ Fulkerson's rules for numbering the event ➢ Meaning of Critical Path Method (CPM) ➢ Difference between PERT and CPM ➢ Earliest Start Time (EST) ➢ Earliest Finish Time (EFT) ➢ Latest Start Time (LST) ➢ Latest Finish Time (LFT) ➢ Total Float Time of Activity ➢ Uses and Limitations of PERT and CPM ➢ Simple Examples on the basis of all above	**25%**
4	**SEQUENCING PROBLEMS** ➢ Introduction to Sequencing Problems: ➢ Overview of sequencing problems in operations research ➢ Notations, Terminology and Assumptions of Sequencing Problems ➢ Processing n jobs through two machines ➢ Processing n jobs through three machines ➢ Simple examples based on these models	**25%**

MODE OF EVALUATION

Evaluation will be divided in two parts.

- **External:** Semester end Examination will be conducted by the Gujarat University of 50 Marks
- **Internal:** Internal Evaluation of 50 marks will be decided by the colleges / Institutes/ University departments as per the instruction given by the University time to time.

FBLD (Flip Blended Learning Design Template)

- Any One Unit from the above syllabus can be discussed by the faculty through online mode.
- Online mode can be SWAYAM MOOC Course or any other suggested by the UGC or Gujarat University.

REFERENCE BOOKS:

1. Operation Research - Kanti Swaroop
2. Operation Research : P. K. Gupta and Man Mohan
3. Operation Research : Dr R. V. S. Prasad
4. Operation Research : Dr. D. Giri
5. Operation Reach – S. D. Sharma and J. K. Sharma
6. Operations research - Models and methods by Chandrasekar Salimath, Bhupendar Parashar.
7. Operations Research – Taha
8. Operations Research – N. D. Vora

B. COM. (HONS) NEP
SEMESTER – V (MINOR)
OPERATIONS RESEARCH - I
COURSE CODE – DSC-M-STA-355
CREDIT MARK DISTRIBUTION – 04

COURSE OBJECTIVES

The course aims at building capabilities in the students for analyzing different situations in the industrial/ business scenario involving limited resources and finding the feasible solution within constraints. The objective of this course is to enable the student to understand and analyze managerial problems to equip him/ her to use the resources such as capitals, materials, production controlling, directing, staffing, and machines more effectively.

PRE – REQUISITE

The world of Operations Research is dynamic and fast paced. It is also the blending of mathematics, optimization, statistics, and computer science, techniques to improve decision making, processes and systems. The learners should have knowledge of mathematics up to higher school level to learn basic contents of Operations Research.

CO – REQUISITE

Linear Programming (Up to two variables and construction of general problem up to three variables), Transportation Problems (Balanced and Unbalanced Transportation Problems), Assignment Problems (Balanced assignment problems, Maximization and Minimization Problems Using Hungarian's method) & Replacement Problems (Problem when units are deteriorating with time and the value of money remains unchanged).

COURSE OUTCOMES

- Understanding the basic concept and working of O.R. to solve the Industrial/ Organizational problem in optimum manner.
- Solve linear programming problems using appropriate technique and interpret the results obtained.
- Determine feasible strategy for Minimization of Cost of shipping of products from source to Destination using various methods, finding initial basic feasible solution of the Transportation problems.
- Optimize the allocation of resources to Demand points in the best possible way using various techniques and minimize the cost or time of completion of number of jobs by number of persons as well as maximize the profit or sale.

UNIT	CONTENT	WEIGHTAGE
1	**INTRODUCTION TO OPERATIONS RESEARCH** ➢ Origin of OR ➢ Definitions of Operations Research (OR) ➢ Nature and Scope of OR ➢ Characteristics of OR ➢ Phases of OR ➢ Merits and Limitations of OR ➢ Different types of Models in OR ➢ Applications of OR in the fields of Marketing, Finance Planning ➢ Techniques of OR	**25%**
2	**LINEAR PROGRAMMING PROBLEM (LPP)** ➢ Meaning of Linear Programming Problems (LPP) ➢ Advantages / Uses, Assumptions and Limitations of LPP ➢ Understanding of Terms used in LPP ➢ Mathematical form of LPP ➢ Conversion of practical problem into mathematical form up to 3 variables only ➢ Solution of LP problem for two variables only by graphical method	**25%**
3	**TRANSPORTATION PROBLEM (TP)** ➢ Meaning of balanced and unbalanced Transportation Problem (TP) ➢ General Transportation table and its mathematical form ➢ Initial basic feasible solution (IBFS) and its cost By using ✓ North-West Corner Method (NWCM), ✓ Least Cost (Matrix Minima) Method (LCM) ✓ Vogel's Approximation Method (VAM) ➢ Examples based on these methods	**25%**
4	**ASSIGNMENT PROBLEM (AP) AND REPLACEMENT PROBLEM (RP)** ➢ Meaning of balanced Assignment Problem (AP) ➢ Mathematical form of AP ➢ Hungarian's method for solving AP in the cases of Minimization and Maximization problem ➢ Meaning of Replacement Problem (RP) ➢ Simple examples of Replacement Problem when the units are deteriorating with time and the value of money remains unchanged	**25%**

MODE OF EVALUATION

Evaluation will be divided in two parts.

- **External:** Semester end Examination will be conducted by the Gujarat University of 50 Marks
- **Internal:** Internal Evaluation of 50 marks will be decided by the colleges / Institutes/ University departments as per the instruction given by the University.

FBLD (Flip Blended Learning Design Template)

- Any One Unit from the above syllabus can be discussed by the faculty through online mode.
- Online mode can be SWAYAM MOOC Course or any other suggested by the UGC or Gujarat University.

REFERENCE BOOKS:

1. Operation Research - Kanti Swaroop
2. Operation Research : P. K. Gupta and Man Mohan
3. Operation Research : Dr R. V. S. Prasad
4. Operation Research : Dr. D. Giri
5. Operation Reach – S. D. Sharma and J. K. Sharma
6. Operations research - Models and methods by Chandrasekar Salimath, Bhupendar Parashar.
7. Operations Research – Taha
8. Operations Research – N. D. Vora