Re-Accredited 'B++' 2.86 CGPA by NAAC
VEER NARMAD SOUTH GUJARAT UNIVERSITY
University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭. ગુજરાત, ભારત.
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સંદર્ભ: યુનિવર્સિટી પરિપત્ર ક્રમાંકઃએસ./આંકડાશાસ્ત્ર/પરિપત્ર/૧૦૨૨૬/૨૦૨૪ તા.૧૪–૦૫–૨૦૨૪

–: પરિપત્ર :–

વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન આંકડાશાસ્ત્ર (Statistics) કોર્સ ચલાવતી તમામ કોલેજોનાં આચાર્યશ્રીઓને જણાવવાનું કે, NEP-2020 અંતર્ગત શૈક્ષણિક વર્ષ ૨૦૨૪–૨૫ થી અમલમાં આવનાર S.Y.B.Sc. Statistics Sem.-3 & 4 Major,Minor,MDC અને SECનો સુધારેલ અભ્યાસક્રમ આંકડાશાસ્ત્ર વિષયની અભ્યાસ સમિતિના કાર્યકારી ચેરમેનશ્રીએ અભ્યાસ સમિતિવતી મંજૂર કરી વિજ્ઞાન વિદ્યાશાખાને કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાના અધ્યક્ષશ્રીએ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિદ્યાશાખા વતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલની તા.૦૧/૦૩/૨૦૨૪ ની સભાના ઠરાવ ક્રમાંકઃ૧૦૪ અન્વયે માન.કુલપતિશ્રીને આપેલ સત્તા અંતર્ગત ઈ.ચા.માનનીય કુલપતિશ્રી દ્વારા મંજૂર કરેલ છે.જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

(બિડાણઃ ઉપર મુજબ)

ક્રમાંક : એસ./સાયન્સ/પરિપત્ર/૧૬૫૫૫/૨૦૨૪
તા.૩૧–૦૭–૨૦૨૪

કુલસચિવ

પ્રતિ,
૧) વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન આંકડાશાસ્ત્ર કોર્સ ચલાવતી તમામ કોલેજોનાં આચાર્યશ્રીઓ.
..... આપશ્રીની કોલેજના સંબંધિત શિક્ષકો તથા વિદ્યાર્થીઓને જાણ કરી અમલ કરવા સારૂ.
૨) અધ્યક્ષશ્રી, વિજ્ઞાન વિદ્યાશાખા.
૩) પરીક્ષા નિયામકશ્રી,પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.
.....તરફ જાણ તેમજ અમલ સારૂ.

Subject Code [2403000503011101]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

S.Y.B.Sc. (SEMESTER –III)

Statistics (Major)

PAPER – ST-MJ-301

Numerical Analysis (Major) (2 Credits)

As per NEP-2020

To be Implemented from the academic year 2024-25

	After the completion of the course, the student will be able to:	
	CO1: Understand basics of numerical analysis; **CO2:** Understand the difference operators and the use of interpolation; **CO3:** Understand numerical differentiation and integration; **CO4:** Develop problem solving skills through numerical methods.	
	OBJECTIVES The main objective of this course is to acquaint students with idea for finding future approximated value and for middle value of given value of variable x. Learn the great advantage of using numerical analysis is that it provides accurate solution to real life problems from the field. Useful for calculation of insurance risks and price of various policies of insurance. Useful for forecasting weather. Analyzing real life problem using numerical methods	
Unit-I	Finite Differences: • Concept of finite differences, Finite difference table, definition of operators $(\Delta, \nabla, E, \delta, \mu, D)$, relation among operators. • Fundamental theorem of finite differences. • Concept of divided Differences, Divided Difference Table.	30%
Unit-II	Interpolation: • concept of interpolation, assumptions, uses. Interpolation for equal intervals: • Newton forward difference interpolation formula. • Newton's backward difference interpolation formula. Interpolation for unequal intervals: • Newton's divided difference formula. • Lagrange's interpolation formula.	30%

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Unit-III	Numerical Integration and Differentiation: • Concept of numerical integration. • General Quadrature formula for equidistant ordinates. • Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule. • Concept of numerical Differentiation. • Differentiation based on Newton forward and Newton backward formula.	40%
	Books Recommended: 1. S. S. Shastry: Numerical Analysis; Prentice hall of India. 2. Gupta and Kapoor: Fundamentals of mathematical statistics. 3. H. Freeman: Finite Difference for actuarial sciences. 4. C.E. Froberg: Introduction to numerical analysis. 5. Richard Hamming: Numerical Methods for Scientists and Engineers by Dover Publications 6. S. Arumugam: Numerical Methods by Scitech Publications (India) Pvt Ltd. 7. Jorge Nocedal, Stephen Wright: Numerical Optimization (Springer Series in Operations Research and Financial Engineering) by Springer 8. Eugene Isaacson, Herbert Bishop Keller: Analysis of Numerical Methods by Dover Publications.	

	PAPER – ST-MJ-301 Numerical Analysis (Major) Practical (2 credit)	
	• Using Newton's forward method to estimate the value of variable. • Using Newton's backward f method to estimate the value of variable. • Using Newton's divided difference method to estimate the value of variable. • Using Lagrange's method to estimate the value of variable. • First and second order derivation using Newton's forward interpolation formula, Newton's backward interpolation formula and Lagrange's interpolation formula. • Calculate the value of finite integral Using Trepazodial rule. • Calculate the value of finite integral Using Simpson's 1/3 rule. • Calculate the value of finite integral Using Simpson's 3/8 rule.	

Subject Code [2403000503021101]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

S.Y.B.Sc. (SEMESTER –III)

Statistics(Major)

PAPER – ST-MJ-302

Continuous Probability distributions (Major)(2 Credits)

As per NEP-2020

To be Implemented from the academic year 2024-25

	After the completion of the course, the student will be able to:	
	CO1: Understand various continuous probability distributions theoretically **CO2:** Know the applications of normal distribution in different fields **CO3:** Relate gamma and beta distribution; **CO4:** Obtain properties of exponential distribution.	
	OBJECTIVES Statistics is used in different ways in different contexts. For a medical researcher investigating the effects of a new invention of medical vaccines. medicines with use of Normal distribution. In engineering field, with use of Gamma and Beta typeI and Beta type-II the construction of Bimb can be calculated. The continuous probability distributions are used in almost all fields like agriculture, business, management, economics, finance, insurance, education, biotechnology and medical science, etc. For the last two decades, large amount of data has been handled with the help of computers and more sophisticated statistical techniques can be used in an effective manner to draw valid conclusions. Knowledge of different aspects of Statistics has become crucial in the present scenario. There is a continuous demand for statisticians in fields of education, industry, software and research.	
Unit-I	Gamma Distribution: • Definition, Mean, Variance, M.G.F. about origin, C.G.F., Mode. • Examples of above topics. Beta Distribution of first kind: • Definition, mean, variance, r^{th}moment and hence first four raw moments, Mode, Harmonic Mean. • Examples of above topics.	40%

	Beta Distribution of second kind: • Definition, mean, variance, r^{th}moment and hence first four raw moments, Mode, Harmonic Mean. • Examples of above topics. • X and Y are independent Gamma variates then the Distribution of (i) X+Y (ii) $\frac{X}{X+Y}$ (iii)$\frac{X}{Y}$	
Unit-II	Normal Distribution: • Definition, Applications and importance, Mean, Variance, M.G.F. about origin and mean, Additive properties, Median, Mode, Quartile deviation, Mean Deviation, Relationship among Q.D, M.D. and S.D. , odd even order moments about mean, C.G.F., β_1,β_2,γ_1 *and* γ_2, Area property of normal curve, Recurrence relation for central moments. • Examples of above topics.	30%
Unit-III	Rectangular Distribution: • Definition, mean, variance, r^{th} moment about origin, M.G.F., C.G.F., odd and even order moments about mean and mean Deviation. • Examples of above topics. Exponential Distribution: • Definition, Mean, Variance, M.G.F. about origin, C.G.F. • Examples of above topics.	30%
	Books Recommended: 1. Mood, Graybill and Boes : Introduction to theory of Statistics. 2. Hogg and Craig: Introduction to mathematical statistics. 3. Gupta and Kapoor: Fundamentals of Mathematical Statistics. 4. Bhatt. B.R. Modern Probability theory; New Age International. 5. Johnson N.L. and KotzS.(1970): "Distributions in Statistics"; John Wiley. ISBN-13-9780471715812 6. Rohatgi V.K. (1976): "An Introduction to Probability Theory and Mathematical Statistics"; John Wiley. ISBN- ISBN-13-978-0471272144	

7. Johnson, N. L., S. And Balakrishnan, N. (2000): Continuous Univariate Distributions, John Wiley ISBN-13-978-0471584946

8. પ્રો. એચ. ડી. શાહ: "ગાણિતિકઆંકડાશાસ્ત્ર"યુનિવર્સીટીગ્રંથનિર્માણબોર્ડ, ગુજરાતરાજ્યઅમદાવાદ-૬.

9. ડૉ. આર. ટી. રતાણી: "પ્રાયોજીતઆંકડાશાસ્ત્ર" યુનિવર્સીટીગ્રંથનિર્માણબોર્ડ, ગુજરાતરાજ્યઅમદાવાદ-૬.

Subject Code **[2403000503021102]**

	PAPER – ST-MJ-302 Discrete and Continuous Probability distributions (Major) Practical (2 credit)	
	• Test of goodness of fit for the binomial distribution. • Test goodness of fit for the Poisson distribution. • Test goodness of fit for the Negative binomia distribution. • Test goodness of fit for the Geometric distribution. • Test goodness of fit for the continuous Uniform distribution. • Test goodness of fit for Expon ution. • Test goodness of fit for the Normal distribution. • Finding probability with the use of Normal distribution. • Obtain parameters (mean and variance) for the Normal distribution.	

Subject Code [2403000503031101]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

S.Y.B.Sc. (SEMESTER –III)

Statistics (Major)

PAPER – ST-MJ-303

Discrete Probability Distributions(Major) (4 Credits)

As per NEP-2020

To be Implemented from the academic year2024-25

	After the completion of the course, the student will be able to:	
	CO1: Define discrete variables and study their distributions; **CO2:** Know the applications of discrete probability distribution in different situations; **CO3:** Understand some standard discrete probability distributions such as Binomial, Poisson, Geometric, Hyper geometric, Negative binomial, Uniform with real life situations.	
	OBJECTIVES Statistics is used in different ways in different contexts. For a medical researcher investigating the effects of a new drug, with use of binomial and Poisson distribution. The discrete probability distributions are used in almost all fields like agriculture, business, management, economics, finance, insurance, education, biotechnology and medical science, etc. For the last two decades, large amount of data has been handled with the help of computers and more sophisticated statistical techniques can be used in an effective manner to draw valid conclusions. Knowledge of different aspects of Statistics has become crucial in the present scenario. There is a continuous demand for statisticians in fields of education, industry, software and research.	
Unit-I	Discrete Uniform Distribution: • Definition, Mean, Variance. • Examples Bernoulli Distribution: • Definition, mean, Variance, Additive property. • Examples.	10%
Unit-II	Binomial Distribution: • Definition, Uses, Mean , Variance, M.G.F. about origin and mean, Factorial moments, C.G.F., $\beta_1, \beta_2, \gamma_1$ and γ_2, Additive property, limiting form, Recurrence relation for (i) raw moments (ii) central moments. • Examples of above topics.	30%

Unit-III	Poisson Distribution: • Definition, Uses, Mean , Variance, M.G.F. about origin and mean, Factorial moments, C.G.F., $\beta_1, \beta_2, \gamma_1$ and γ_2, Additive property, limiting form, Recurrence relation for (i) raw moments (ii) central moments. • Examples of above topics.	30%
Unit-IV	Hypergeometric Distribution: • Definition, Mean, Variance, Limiting form. Geometric Distribution: • Definition, Mean, Variance, M.G.F. about origin, Factorial moments. Negative Binomial Distribution: • Definition, Mean, Variance, M.G.F. about origin, limiting form. • Examples of above topics.	30%
	Books Recommended: 1. Mood, Graybill and Boes : Introduction to theory of Statistics. 2. Hogg and Craig: Introduction to mathematical statistics. 3. Gupta and Kapoor: Fundamentals of Mathematical Statistics. 4. Bhatt. B.R. Modern Probability theory; New Age International. 5. Johnson N.L. and Kotz S. (1970): "Distributions in Statistics"; John Wiley. ISBN-13-9780471715812 6. Rohatgi V.K. (1976): "An Introduction to Probability Theory and Mathematical Statistics"; John Wiley. ISBN-ISBN-13-978-0471272144 7. Johnson, N. L., S. And Balakrishnan, N. (2000): Discrete Univariate Distributions, John Wiley ISBN-13-978-0471584953 8. પ્રો. એચ. ડી. શાહ: "ગાણિતિક આંકડાશાસ્ત્ર" યુનિવર્સીટી ગ્રંથ નિર્માણ બોર્ડ, ગુજરાત રાજ્ય અમદાવાદ-૬. 9. ડૉ. આર. ટી. રતાણી: "પ્રાયોજીત આંકડાશાસ્ત્ર" યુનિવર્સીટી ગ્રંથ નિર્માણ બોર્ડ, ગુજરાત રાજ્ય અમદાવાદ-૬.	

Subject Code [2403000503041101]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
S.Y.B.Sc. (Statistics)
SEMESTER –III
(Multidisiplinary)

Matrices Determinants and Functions (Credit-2)
As per NEP-2020
To be Implemented from the academic year 2024-25

CO1: Understand Matrices.
CO2: Understand Determinants.
Co3: Know to perform operations on matrices.
CO4: Know to find solution of simultaneous equations by using matrices and determinants.
CO5: Know to find slope and intercept of functions.
CO6: Will know to solve problems of business and economics by using functions.

Objectives

Matrix is widely used in super market and mole for arranging different commodities in systematic pattern

multiplication is used to plot graphs of data, render graphical images, analyze the product of model electrical circuits, guide robots and aircraft, develop scans used in health care, encrypt messages, facilitate the process of electronic communication, and perform statistics.

They are used to create graphs, statistics, calculate and conduct scientific studies and research in a variety of subjects. Matrices are also used to represent real-world statistics such as population, infant mortality rate, and so on.

Applications of functions include finding profit, populations, and distance traveled. Functions are used by plugging a number into the formula or finding that independent variable on the table or graph and then calculating the resulting dependent variable.

Unit-I	Matrices: Definition, • Transpose, • Symmetric, • Skew symmetric, • Null matrix, • Identity matrix, • Orthogonal matrix. Operation on matrices • Addition • Subtraction • scalar multiplication • multiplication of matrices. • Determinants • Singular and non singular matrix. • Inverse of matrix (0f order 2 and 3), • Rank of a matrix, Elementary transformation • Reduction of normal form • solution of simultaneous equation by matrix inverse method and by using Cramer's Rule • Examples.	50%
Unit-II	Functions : Definition • types of function • Single Value Function • Multivalue Function • Implicit Function • Composite Function • Inverse Function Graph of Linear Function • Slope and intercept of linear function. • Equation of linear function passing through two points • Functions useful in Business and Economics.	50%
	Books Recommended: 1. Shantinarayan :" Text Book of Matrices". 2. D.C. Sancheti and V.K. Kapoor: 'Statistics(Theory, methods and application)" Sultan Chand Publication. 3B.J Venkatachella Functional Equations 4. Karmel P.H Applied Statistics for Economics. 5. Sancheti and V.K.Kapoor Mathematical Statistics.	

Subject Code [2403000503041102]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

S.Y.B.Sc. (Statistics)

SEMESTER –III

(Multidisciplinary Practical)

Matrices Determinants and Functions

(Credit-2)

As per NEP-2020

To be Implemented from the academic year 2024-25

Practical:

1. Examples of Operations on matrices.
2. Matrix inverse.
3. Solution of equations by matrix inverse method.
4. solution of equations by using Determinants (Cramer's Rule)
5. Graph of function, slope and intercept of linear function.
6. Examples of functions useful in business and Economics.

Subject Code *[2403000503061101]*

	VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT **S.Y.B.Sc. (Statistics)** **SEMESTER –III** **(Skill Enhancement Course)** **Statistical Techniques for Research Methods** **(Credit-1)** **As per NEP-2020** **To be Implemented from the academic year 2024-25**	
	CO1: Will come to know methods of data collection. CO2: Will be able to collect statistical data for research efficiently. CO3: Will be able to prepare Questionnaire for research problem. CO4: Will be able to interpret results and draw inferences.	
	Objectives **After the completion of the course, the student will be able to** Statistical Techniques provide scientific approaches to develop the domain of human knowledge largely through empirical studies. The course aims at enabling students understand basic concepts and aspects related to research, data collection, analyses and interpretation.	
	UNIT I ➢ Introduction: Meaning, objection and motivation in research, types of research, research approach, significance of research. ➢ Research problems: definition, selection and necessity of research problems. ➢ Survey Methodology and Data Collection, inference and error in surveys, the target populations, sampling frames and coverage error, methods of data collection, non-response, questions and answers in surveys.	**50%**
	UNIT II ➢ Develop a questionnaire, collect survey data pertaining to a research problem. ➢ Interpret the results and draw inferences.	**50%**

References:

1. Kothari, C.R. (2009): Research Methodology: Methods and Techniques, 2nd Revised
Edition reprint, New Age International Publishers.

2. Kumar, R (2011): Research Methodology: A Step - by - Step Guide for Beginners,
SAGE publications.

Subject Code *[2403000503061102]*

	VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT **S.Y.B.Sc. (Statistics)** **SEMESTER –III** **(Skill Enhancement Course-Practical)** **Statistical Techniques for Research Methods** **(Credit-1)** **As per NEP-2020** **To be Implemented from the academic year 2024-25**	
	Practical: 1. select a research problem and describe the type of research and method of collection of data for problem. 2. Prepare Questionnaire for a research problem. Interpret the results and draw inferences.	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

S.Y.B.Sc. (SEMESTER –IV)

Statistics(Major)

PAPER – ST-MJ-401

Statistical Quality Control (Major) (2 Credits)

As per NEP-2020

To be Implemented from the academic year 2024-25

	After the completion of the course, the student will be able to:
	CO1: Manufacturing companies today are facing ever increasing competition. Raw material costs labor cost, transportation cost maintenance costs are continuing to be increase. for the most part, cannot control. **CO2:** Therefore, companies must concentrate on what they can control: their processes. Companies must strive for continuous improvement in quality, efficiency and cost reduction. **CO3:** These are factors that companies, for SQC is statistical technique which is used to access the cause of variation in the quality of the manufacturer. **CO4:** SQC method is used to monitoring and maintaining of the quality of products and services. **CO5:** Statistical quality control can be used to identify patterns and trends in quality data, as well as to detect anomalies that may indicate and remove it
	The main **objective** of this course is to acquaint students • The meaning of Statistical Quality Control • Causes of variations impact on the quality of product. • Difference between assignable causes and chance causes • Finding ability of control limits of various types of charts • Ability to apply various types of charts for various types of production process. • Interpretation of the production process. • Meaning of acceptance sampling plan (Single sampling plan, double sampling plan. Use of OC curve, AOQ curve, ASN curve and ATI curve (Single sampling plan, double sampling plan.

Unit-I	**Statistical Techniques in quality control – I** ➢ Introduction of Statistical Quality Control (SQC), Importance of Statistical methods in industrial research, Objectives and Advantages of SQC, Causes of Variations, Types of Quality control, Control charts, Advantages of use of a control chart, 3σ limits, Theory of runs. ➢ Control chart for variables: (i) R Chart (ii) σ Chart and (iii) $\bar{x}$ Chart. ➢ Behavior of $\bar{x}$ chart in relation to R chart, R chart versus σ chart,	40%
Unit-II	**Statistical Techniques in quality control- II** ➢ Control chart for attributes: (1) p Chart (11) np Chart and (iii) c Chart and its uses, (iv) u chart ➢ Difference between variable charts and attribute charts.	20%
Unit-III	**Acceptance sampling plan for attributes:** ➢ Introduction, ➢ Principle of accepting sampling. ➢ Sampling risks and indices. ➢ Role of Acceptance sampling. ➢ Producer's risk and Consumer's risk, ➢ Acceptable Quality Level (AQL) and AOQL ➢ Lot Tolerance Proportion Defective (LTPD), ➢ Construction of Operating Characteristic Curve, Ideal Operating Characteristics Curve, ➢ Effect of lot size, sample size on Operating Characteristic Curve ➢ Single and Double Sampling Plan: • Explain • Operating Characteristics Curve (OC Curve) • Average Sample Number (ASN) • Rectifying inspection procedure • Average Outgoing Quality (AOQ) • Average Total Inspection (ATI) • Numerical examples	40%

Books Recommended:

1. Montgomery D.C: introduction to statistical Quality Control, Wiley.
2. Grant E.L.: statistical Quality Control; Tata McGraw Hill.
3. Ott E.R.: Process quality control, ; Tata McGraw Hill.
4. Wetherill G.B: Sampling inspection and quality control: Halsted Press.
5. Wetherill G.B and Brown D.W: Statistical Process Control, theory and practice; Chapmann and Hall.
6. Hopper A.G.: Basic Statistical Quality Control, Tata McGraw Hill.
7. Gupta R.C.: Statistical Quality Control, Khanna Publishers, New Delhi.
8. Ryan T.P.: Statistical Methods for Quality Improvement, John Wiley & Sons.
9. Omachonu V.K. and Ross J.E.: Principles of Total Quality, S. Chand & Co. New Delhi.
10. Dr R.T.Ratani. આંકડા શાસ્ત્રિય ગુણવત્તા નિયંત્રણ યુનિવર્સીટી ગ્રંથ નિર્માણ બોર્ડ, ગુજરાત રાજ્ય અમદાવાદ-૬.

	PAPER – ST-MJ-401 **Statistical Quality Control (Major)** **Practical (2 Credits)**	
	• Construction and interpretation of $\bar{x}$ and R chart • Construction and interpretation of revised $\bar{x}$ and R chart • Construction and interpretation of p chart. • Construction and interpretation of revised p chart. • Construction and interpretation of np chart. • Construction and interpretation of revised np chart. • Construction and interpretation of c chart. • Construction and interpretation of revised c chart. • Construction and interpretation of U chart. • Construction and interpretation of revised U chart. • Single sampling plan (OC, AOQ, ASN and ATI curves), consumer and producer risk from OC curve • Double sampling plan (OC, AOQ, ASN and ATI curves)	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

S.Y.B.Sc. (SEMESTER –IV)

Statistics(Major)

PAPER – ST-MJ-402

Testing of Hypothesis (Major) (2 Credits)

As per NEP-2020

To be Implemented from the academic year 2024-25

	After the completion of the course, the student will be able to: **CO1:** Understand the concept of hypothesis and its testing and applications in various fields; **CO2:** Identify the components of a classical hypothesis test, including the parameter of interest, the null and alternative hypotheses, type I error and type II error, Critical region, the test statistic etc; **CO3:** Understand the difference between large and small sample and tests based on it; **CO4:** Use the p-value decision rule to make a statistical decision; **CO5:** Carry out appropriate statistical test of significance; **CO6:** Obtain different large and small sample tests; **CO7:** Relate t, F and chi-square variates.	
	OBJECTIVES The main objective of this course is to acquaint students with idea **of** the application and problems based on Normal distribution; Compute probabilities of normal distribution; Learn testing of hypothesis based on large sample tests. Learn testing of hypothesis based on small sample tests; Fit various probability distributions;	
Unit-I	Basic concepts of testing of hypothesis: Definition of hypothesis, statistical hypothesis, simple and composite hypothesis, null and alternative hypothesis, test of statistical hypothesis, Type-I error and Type-II errors, Power of a test, Level of Significance, Rejection Region, Critical value, Test statistic, Two tailed and One tailed test, degrees of freedom, concept of p-value.	20%

Unit-II	Large sample tests: • Test of attributes: i. Test for significance of single proportion. ii. test for significance of Difference of proportions. • Test of Variables: i. test for significance of single mean. ii. test for significance of difference between means. iii. test for significance of difference between standard deviations. • Examples of above topics.	30%
Unit-III	Small Sample tests: • Chi-Square test: Chi-Square variate, Assumptions of Chi-Square test. Applications: • test the goodness of fit. • to test independence of attributes, Yates correction • to test specified value of the variance of the population. • t-test: t- statistic, Assumptions of t test. • Test for significance of single mean. • Test for significance of difference of means for dependent and independent Samples. • Test for significance of observed sample correlation coefficient. • F-test: F-statistic, Assumptions of F-Test. • test for equality of two population variances	50%
	Books Recommended: 1. Mood, Graybill and Boes : Introduction to theory of Statistics. 2. Hogg and Craig: Introduction to mathematical statistics. 3. Gupta and Kapoor: Fundamentals of Mathematical Statistics. 4. Bhatt. B.R. Modern Probability theory; New Age International. 5. Jhonston and Korz: Distributions in Statistics. 6. Stuart. G. and Ord. J.K. ; Advanced theory of Statistics Vol.2.	

	PAPER – ST-MJ-402 **Testing of Hypothesis (Major)** **Practical (2 Credits)**	
	• Large sample tests on attributes. ▪ Test of significance of Proportion. ▪ Test of significance difference between two Proportions. • Large sample tests on variables. ▪ Test of significance of a population mean, ▪ Test of significance of two means. ▪ Test of significance of two standard deviations. ▪ Test of significance of population correlation coefficients. • Small sample tests • Test of significance of a population mean. • Testing the significance difference of two population means. • Test of significance difference of population correlation coefficients. • Test of significance difference of population Regression coefficients.	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

S.Y.B.Sc. (SEMESTER –IV)

Statistics(Major)

PAPER – ST-MJ-403

Operation Research - I (Major) (4 Credits)

As per NEP-2020

To be Implemented from the academic year 2024-25

	CO1: The application of operations research involves using analytical methods to solve complex problems and make better decisions. CO2: LP is employed in business decision-making to maximize profit or minimize cost within resource limitations. It is also used in various real-life applications such as agriculture, management, industry, and engineering to optimize outcomes and achieve optimum results from limited resources. CO3: Understand the basics and formulation of linear programming problems, solve linear programming problem through graphical l method, simplex, two-phase and Big-M method. CO4: To learn the mathematical formulation of complex decision-making problems and arrive at optimal or near-to optimum solution using different mathematical techniques of operations research. CO5: various mathematical techniques to verifying maximum profit and minimum cost.	
	The main **objective** of this course is to acquaint students • The meaning of operation research. • Use of OR in Decision making, Risk management, Business, Marketing, Supply chain management. • Various techniques of OR in Finance, Logistics, Production, Scheduling, Inventory management, and health care management, Network analysis, Testing the model and solutions. Mathematical formulation of linear programming problem.	
Unit-I	➢ Introduction of OR • definition and scope and uses of OR. • linear programming problem. Uses of LPP. • meaning and definition of standard form of LPP, solution, Feasible Solution, Optimum Solution, Slack and Surplus Variables, Basic solution,	15%

	Degenerate Solution, Basic Feasible solution, concave and convex sets.	
Unit-II	➢ Graphical method. • formulation and solution of LPP by graphical method. ➢ Simplex Method: • Solution of LPP using simplex method. • Examples..	30%
Unit-III	➢ Big-M Method: • concept of artificial variables. • solution of LPP using Big-M method. • Examples ➢ Two-Phase Simplex method. • Solution of LPP using Two-Phase Simplex method. • Examples.	30%
Unit-IV	➢ Duality in LPP. • The non-symmetric & symmetric dual problems. • Relation between primal & dual problems. Examples.	25%
	Books Recommended: 1. K. Swarup, Gupta P.K, Man Mohan: Operations Research; S Chand & Co. New Delhi. 2. Sharma S.D.: Operations Research: Kedarnath & Ramnath & Co. Publisher, Meerut. 3. Hira D.S, Gupta P.K : Operations Research; S Chand & Co. New Delhi. 4. Kapoor V.K: Operations Research; Jain book depot. 5. G. Hadley: Linear Programming; Narosa Book distributors pvt Ltd. 6. Murthy K.G. : "Linear and Nonlinear Programming". 7. Kasana H.S. and Kumar K.D. : "Introductory Operations Research"; Springer.	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

S.Y.B.Sc. SEMESTER –IV

(Statistics)

(Minor) PAPER-ST(ME-III)

Probability, probability functions and measures(Credit-2)

As per NEP-2020

To be Implemented from the academic year 2024-25

After successfully completing this course, students will be able to:

CO1: be familiar with some basic concepts of probability;

CO2: distinguish between random and non-random experiments;

CO3: understand axioms of probability and various theorems on probability;

CO4: find the probabilities of various events.

CO5: understand the concepts of conditional probability and independence of events;

CO6: know about Bayes' theorem and its applications; know the basic concept of random variables;

CO7: understand events associated with random variables, probabilities of events and how they are related;

CO8: understand the difference between a discrete and a continuous random variable, recognize when an experiment should be modelled by a discrete or a continuous random variable;

CO9: know about p.m.f.,p.d.f. and c.d.f.;

CO10: obtain probability functions;

CO11: interpret the expectation, variance and standard deviation of a discrete and continuous random variable.

CO12: understand measure of central tendency and measure of dispersion

OBJECTIVES

- Use of probability to solve real life problem, social science problem, industrial problem and problem arise in science.
- How to use Bayes' theorem for solving problems?
- Understand basic concept of random variables
- Learn types of random variables and difference between them.
- Know about p.m.f., p.d.f. and c.d.f.
- Learn various types of measures.

	Unit-1 Probability:	50%
	➢ Concepts in probability, ➢ Some important terms: Random experiment, Sample space, Event, Mutually exclusive events, Exhaustive events, Equally likely events, Favorable cases, Independent events. ➢ Classical and statistical definition of probability, ➢ Axiomatic approach to probability, ➢ Theorem based on above topics. ➢ Conditional Probability and its related theorem, ➢ Bayes' theorem and its applications, ➢ Numerical Problems.	
	Unit-2 Random Variables, Probability functions and Moments:	50%
	➢ Random variables: Discrete and Continuous, ➢ Probability functions: Probability mass function (p.m.f), Probability density function (p.d.f) and Cumulative distribution function (c.d.f.) with properties, ➢ Mathematical expectation, ➢ Moments (of a random variable): Raw moments, Central moments, Factorial moments. ➢ Relations of above moments ➢ Variance and its properties. ➢ Measure of Central tendency: Mean, Mode, Median, Harmonic mean and Geometric mean. Quartiles. ➢ Measure of Dispersion: Range, Quartile deviation, Mean deviation, Standard deviation ➢ Problems of above topics.	
	Reference Books: 1. S. C. Gupta, V. K. Kapoor: Fundamentals of Mathematical Statistics – 12th Edition, Sultan Chand & Sons 2. Gupta S.P.: Statistical Methods - 34th Edition, S. Chand & Sons., New Delhi.	

3. Goon A.M., Gupta M. K. and Dasgupta B.: Fundamentals of Statistics, Vol. I & II, 8th Edition. The world press, Kolkata.
4. Neil Weiss: Introductory Statistics - 10th Edition, Pearson.
5. Roxy Peck, Chris Olsen, Jay L. Devore: Introduction to Statistics and Data Analysis – 5th Edition, Cengage Learning
6. Starnes and Tabor: The Practice of Statistics – 6th Edition, W.H. Freeman and Company.

	VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT **S.Y.B.Sc.** **SEMESTER –IV** **Statistics Practical (Minor)** **PAPER – ST-ME-III** **Probability, probability functions and measures (Practical) (Credit-2)** **As per NEP-2020** **To be Implemented from the academic year 2024-25**	
	1. Examples of probability. 2. examples based on Bayes' theorem. **3.** calculation of constant and probability for given p.m.f , c.m.f, and draw its curve. **4.** calculation of mean, variance, median, mode for given p.m.f. **5.** calculation of constant and probability for given p.d.f. **6.** Find raw moments, Central moments, Coefficient of skewness and Kurtosis for a given p.m.f. **7.** Find raw moments, Central moments, Coefficient of skewness and Kurtosis for a given p.d.f.	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
S.Y.B.Sc. SEMESTER –IV
(Statistics)
(Skill Enhancement Course)

Human Development Index (HDI)
(Credit-1)
As per NEP-2020
To be Implemented from the academic year 2024-25

CO1. Will know about Human Development Index (HDI) a composite statistic used to rank countries by their level of human development.
CO2. Will come to know components of HDI.
CO3 Will know calculation methodology of HDI.

Objectives

The HDI is used to capture the attention of policy-makers, the media and nongovernmental organizations, and to change the focus from the usual economic statistics to human outcomes.
This index is a tool used to follow changes in development levels over time and compare the development levels of **different** regions , states and countries.

Unit-1

Introduction to Human Development Index (HDI) — 70%

- Definition and purpose of HDI
- Historical background and evolution of HDI
- Significance of measuring human development beyond GDP

Components of HDI

- Life expectancy at birth: Understanding health indicators
- Mean years of schooling and expected years of schooling: Assessing educational attainment
- Gross National Income (GNI) per capita: Evaluating economic standard of living

Unit-II — 30%

Methodology of Calculating HDI

- Mathematical formula and computation process

Books for Reference:

1."Development as Freedom" by Amartya Sen
2."The Argumentative Indian: Writings on Indian History, Culture and Identity" by Amartya Sen
3."Human Development in India: Challenges and Prospects" edited by Santosh Mehrotra and Richard Jolly.
4."Human Development in India: A Regional Analysis" by N. S. Jodha

	VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT **S.Y.B.Sc. SEMESTER –IV** **(Statistics)** **(Skill Enhancement Course-Practical)** **Human Development Index (HDI)** **(Credit-1)** **As per NEP-2020** **To be Implemented from the academic Year 2024-25**	
	Practical: 1. Calculation of Life expectancy. 2. Calculation of Education Index. 3. Calculation of Income Index. 4. Calculation of HDI. 5. Comparing HDI Trends for two countries over the Decade.	