

Course Title	Statistics Practical-I		
Course Code: 23SBCS21VSB		No. of Credits:2	
Course Type: VSC		Total Teaching Sessions:10	

Sr. No	Syllabus	No. of Practical
1	Introduction to MS-Excel	1
	1. Creating Worksheet and Workbook 2. Insert, delete Columns and Rows 3. Formatting, Sorting 4. Save and Protect File	
2	Perform Operations with Basic Functions	1
3	Diagrams and Graphs Using MS-EXCEL	1
	1. Simple Bar Diagram 2. Multiple Bar Diagram 3. Histogram, Frequency Curve, Frequency Polygon 4. Less than and More than Cumulative frequency Curve	
4	Measures of Central Tendency, Dispersion and Skewness Using MS-Excel	2
5	Linear Correlation Using MS-Excel	1
6	Problems Based on Unit I : 23SBCS21MNB	1
7	Problems Based on Unit II : 23SBCS21MNB	1
8	Problems Based on Unit III :23SBCS21MNB	1
9	Problems Based on Unit IV : 23SBCS21MNB	1



M. C. E. Society's

Abeda Inamdar Senior College

Of Arts, Science and Commerce, Camp, Pune-1

(Autonomous) Affiliated to SavitribaiPhule Pune University

NAAC accredited 'A' Grade

B.Sc. [Three Year] Statistics [Minor]

(NEP 2020, CBCS – Autonomy 23 Pattern)

STRUCTURE OF STATISTICS SYLLABUS

Structure of the course for three years and the pattern of examination and question papers are as specified below

Semester	Paper code [23 patt]	Paper	Paper title	Credits	Marks		
					CIA	ESE	Total
3	23SBST31MN	I	Descriptive Statistics-II	2	20	30	50
	23SBST32MN	II	Statistics Practical-I	2	20	30	50
	23SBST31VSC	III (VSC)	Data Handling using MS Excel	2	20	30	50
4	23SBST41MN	I	Discrete Probability Distributions-II	2	20	30	50
	23SBST42MN	II	Statistics Practical-II	2	20	30	50

CONTINUOUS INTERNAL EVALUATION (CIE) FOR B.Sc

For Continuous Internal Evaluation (CIE), Evaluation will be done continuously. Internal assessment will be of **20** marks for a paper of 50 Marks. These 20 marks are divided as follows:

- There will be compulsory Test on Demand MCQ Examination of **20** marks of each subject which would be converted into **05 Marks**.

- b) Two Class Tests 10 Marks Each. Converted to 05 Marks.
- c) Mid Sem Exam of 20 Marks converted to 05 Marks
- d) Participation in two activities at department/ college level 05 Marks
- e) In case of students failing to score under category (d), the attendance can be considered to give marks.
- f) There will be a compulsory Mock Practical Examination, Viva Voce of subjects mentioned in for **20 Marks**.
- g) The subject teacher needs to adopt anyone out of the following methods for internal assessment:

Table 7: Methods of Internal Assessment

Written exam	Quiz
Presentations	Projects
Assignments	Tutorials
Oral examination	Open Book Test and Others

- 1) DURATION OF SEMESTER END EXAMINATION (FINAL):** Question papers will be set for Thirty Marks (One and Half Hour Duration) for Theory and Thirty Marks (Three and Half Hour) for Practical Examination.

Table 8: Criteria for Paper Setting of Internal Assessment and Semester End Examination

Knowledge	Understanding	Applications, Analysis, Problem Solving	Total Marks
50%	25%	25%	100%

2) STANDARD OF PASSING:

- A student must obtain a minimum of 40% marks in Continuous Internal Evaluation (CIE), and minimum 40% marks in Practical Examination and Semester End Examination (External Examination).
- Passing separately in Internal Assessment, Practical Examination and Semester End Examination is compulsory.
- The student has to secure at least 40 marks (40%) in the total assessment (50 Marks) for each subject.
- Students who are failed in Continuous Internal Evaluation (CIE) of any semester can reappear for the same in the next semester.

PAPER-WISE DETAILED SYLLABUS

Offered as	Minor
Course/ Paper Title	Descriptive Statistics – II
Course Code	23SBST31MN
Semester	III
No. of Credits	2 (2 Units equivalent to 1 Credit)

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To acquaint students with the concept of bivariate data
2.	To present to the students the methods of analysis of bivariate data and the related developments in Statistics.
3.	To acquaint students with computation of correlation coefficient for bivariate data and interpret it
4.	To familiarize students with fitting of linear, quadratic and exponential curves to the bivariate data.
5.	To introduce the students with the concept of index numbers, a concept from Econometrics.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be acquainted with the data analysis of bivariate data
2.	Students will become aware about the correlation and regression analysis.
3.	Students will be acquainted with the computations of correlation and regression analysis techniques and interpretation of the results

Syllabus

Unit No	Title with Contents	No. of Lectures
Unit I	Correlation Analysis	10
	1. Bivariate data, Scatter diagram and interpretation. Concept of correlation between two variables, positive correlation, negative correlation, no correlation. Covariance between two variables: Definition, computation, effect of change of origin and scale.	3
	2. Karl Pearson's coefficient of correlation (r): Definition, computation for ungrouped data and interpretation. Properties: (i) $-1 \leq r \leq 1$ (with proof), (ii) Effect of change of origin and scale (with proof).	4
	3. Spearman's rank correlation coefficient: Definition, derivation of formula, computation and interpretation (without ties). In case of ties, compute Karl Pearson's correlation coefficient between ranks. (Spearman's rank correlation coefficient formula with correction for ties not expected.)	3
Unit II	Fitting of Linear Regression Equation	10

	1. Concept of dependent and independent variables. 2. Identification of response and predictor variables and relation between them. 3. Meaning of regression, difference between correlation and regression, Connection between correlation and regression. Fitting of line $Y = a + bX$. a and b are estimated using least square method. Regression coefficient. Explained and unexplained variation, coefficient of determination, standard error of an estimate of line of regression	2 2 6
Unit III	Fitting of Curves	08
	1. Necessity and importance of drawing second degree curve. 2. Fitting of second degree curve $Y = a + bX + cX^2$, 3. Fitting of exponential curves of the type $Y = ax^b$. In all these curves constants a, b, c are found out by the method of least squares.	2 3 3
Unit IV	Index Numbers	08
	1. Definition and Meaning, Introduction and scope of Index Numbers. Various types of Index Numbers like Human Development Index, Happiness Index, BSE sensitivity Index. 2. Problems/considerations in the construction of index numbers. 3. Laspeyre's, Paasche's and Fisher's Index numbers. 4. Consumer price index number: Considerations in its construction. Methods of construction of consumer price index number - (i) family budget method (ii) aggregate expenditure method. 5. Shifting of base, splicing, deflating, purchasing power (Only introduction).	2 1 2 2 1

References:

1. Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, New Delhi.
2. Goon,A.M., Gupta,M.K. and Dasgupta, B.(1983).Fundamentals of Statistics, Vol.1, Sixth Revised Edition, The World Press Pvt. Ltd., Calcutta.
3. Gupta,S.C.and Kapoor,V.K.(1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
4. Gupta, S.C.and Kapoor,V.K.(1997). Fundamentals of Applied Statistics, Third Edition, Sultan Chand and Sons Publishers, New Delhi.
5. Montgomery D.C, Peck E.A., Vining G.G.(2006).Introduction to Linear Regression Analysis, John Wiley and Sons
6. Purohit S.G., Gore S.D., Deshmukh S.R. (2008).Statistics Using R, Narosa Publishing House, New Delhi.
7. Sarma, K.V.S. (2001).Statistics Made it Simple: Do it yourself on PC. Prentice Hall of India, New Delhi.
8. Snedecor G.W. and Cochran W.G. (1989).Statistical Methods, Eighth Ed. East-West Press, Pvt Ltd. New Delhi.

Offered as	Minor
Course/ Paper Title	Statistics Practical – I
Course Code	23SBST32MN
Semester	III
No. of Credits	2.0

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To use various graphical and diagrammatic techniques and interpretation
2.	To analyse data pertaining to discrete and continuous variables and to interpret the results
3.	To compute various measures of central tendency, dispersion, skewness and kurtosis
4.	To interpret summary statistics of computer output
5.	To summarize and analyze the data using computers

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be able to use various graphical and diagrammatic techniques and interpretation
2.	Students will be able to compute various measures of central tendency, dispersion, skewness and kurtosis
3.	Students will be acquainted with the usage of computers for data analysis

S.No.	Title of the experiment	No. of Practicals
1	Diagrammatic representation of statistical data: simple and subdivided bar diagrams, multiple bar diagram, percentage bar diagram, pie diagram.	1
2	Diagrammatic representation of statistical data: simple and subdivided bar diagrams, multiple bar diagram, percentage bar diagram, pie diagram. using Ms-Excel/Any statistical software	1
3	Graphical representation of statistical data: Histogram, frequency curve and ogive curves. Determination of mode and median graphically.	1
4	Graphical representation of statistical data: Histogram, frequency curve and ogive curves. Determination of mode and median graphically. Using Ms-Excel/Any statistical software	1
5	Tabulation	1
6	Data Interpretation from various graphs and diagrams.	1
7	Use of random number tables to draw SRSWOR, SRSWR, stratified sample and systematic sample.	1
8	Use of random number tables to draw SRSWOR, SRSWR, stratified sample and systematic sample. Using MS-Excel/Any statistical software	1
9	Computation of measures of central tendency and dispersion (ungrouped data). Use of an	1

	appropriate measure and interpretation of results and computation of partition values.	
10	Computation of Measures of skewness and kurtosis.	1
11	Computation of Measures of skewness and kurtosis, Boxplot.	1
12	Computation of summary statistics using Ms-Excel	1
13	Computation of summary statistics using PSPP Open source software	1

Offered as	VSC (Minor)
Course/ Paper Title	Data handling using MS Excel
Course Code	23SBST3VSC
Semester	III
No. of Credits	2 (3 Units equivalent to 1 Credit)

Aims & Objectives of the Course

Sr. No.	Objectives
1.	This course is designed to introduce MS-Excel to the students..
2.	It will enable students to understand basic concept of MS-Excel.
3.	It will help students to represent the data in pictorial forms.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will have learned to open the Excel spread sheet and are able to enter the data in worksheet.
2.	They will be able to represent data into charts, diagrams, graphs, etc.
3.	They can perform various mathematical calculations and can learn the use of excel as calculator.
4.	They can perform various statistical calculations.

Syllabus

Unit No	Title with Contents	No. of Lectures
Unit I	Introduction to MS-Excel	2
	Ribbon tabs, Ribbon bar, Understanding the worksheet (Rows and Columns, Sheets, Work- books), Active Cell, Columns, Rows, Fill Handle, Address Bar, Formula Bar, Title Bar, File Menu, Quick Access Toolbar, Ribbon Tab, Worksheet Tab, Status Bar. Data Entry in MS Excel.	Approx 1 lecture per section
Unit II	Microsoft Excel Basic Functions	2
	SUM, COUNT, AVERAGE, MIN, MAX, TIME, DATE, LEFT, RIGHT, IF, RAND etc.	
Unit III	Visualization of Data	4
	Diagrammatic representation of statistical data: simple and subdivided bar diagrams, multiple bar diagram, percentage bar diagram, pie diagram.	
Unit IV	Presentation of Data	6
	Graphical representation of statistical data: Histogram, frequency curve and ogive curves. Determination of mode and median graphically.	
Unit V	Statistical Computations	6
	Computation of summary statistics, mean , mode, median , partition values, variance, standard deviation, absolute deviation, Range, etc. Scatter diagram, correlation coefficient, fitting of a line of regression, fitting of second degree curve	
Unit VI	Problem solving with MS-Excel	10
	Computations using basic mathematical and Statistical functions. Diagrammatic representation of data. Graphical representation of frequency data. Computations of correlation coefficients and curve fitting.	

References:

1. Michael Alexander and John Walkenbach (2013), Microsoft Excel Dashboards and Reports, 2nd Edition, Wiley.
2. Greg Harvey (2019). Microsoft Excel 2019 All-in-one for Dummies, Wiley
3. John Walkenbach (2018), Excel 2016 Bible ,Wiley
4. Schmuller, Joseph (2020), Statistical Analysis with Excel, 4th Edition, Wiley

Offered as	Minor
Course/ Paper Title	Discrete Probability Distributions-II
Course Code	23SBST41MN
Semester	IV
No. of Credits	2 (2.5 Units equivalent to 1 Credit)

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To introduce the students with the concept of bivariate discrete probability distributions.
2.	To acquaint students with the application of standard discrete probability distributions defined on countable infinite sample space to different real life situations.
3.	To acquaint students to with the inter-relationship between different discrete probability distributions.
4.	To familiarize students with the concept of mathematical expectation of bivariate discrete random variable.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be acquainted with the understanding of the bivariate probability distributions.
2.	Students will become aware about the computation of bivariate probabilities.
3.	Students will be acquainted with computation of mathematical expectation in case of bivariate discrete random variables.

Syllabus

Unit No	Title with Contents	No. of Lectures
Unit I	Some Standard Discrete Probability Distributions	16
	1. Poisson distribution: p.m.f., m.g.f. and c.g.f. Moments, mean, variance, skewness and kurtosis. Situations where this distribution is applicable. Additive property for Poisson distribution.	8
	2. Geometric distribution: p.m.f., Mean, variance, m.g.f. and c.g.f. Situations where this distribution is applicable. Lack of memory property.	8
Unit II	Bivariate Discrete Probability Distribution	06
	1. Definition of two-dimensional discrete random variable, its joint p.m.f. and its distribution function and their properties.	1
	2. Computation of probabilities of events in bivariate probability distribution.	2
	3. Concepts of marginal and conditional probability distributions.	2
	4. Independence of two discrete random variables based on joint and marginal p.m.f.s	1
Unit III	Mathematical Expectation (Bivariate Random Variable)	14
	1. Definition of raw and central moments, m.g.f, c.g.f.	2
	2. Theorems on expectations of sum and product of two jointly distributed random variables.	4
	3. Conditional expectation.	2
	4. Definitions of conditional mean and conditional variance.	2
	5. Definition of covariance, coefficient of correlation, independence and un-correlatedness of two variables.	2
	6. Variance of linear combination of variables $\text{Var}(aX+bY)$.	2

References:

1. Agarwal B. L. (2003). Programmed Statistics, second edition, New Age International Publishers, New Delhi.
2. Gupta, S.C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
3. Hoel P. G. (1971). Introduction to Mathematical Statistics, John Wiley and Sons, NewYork.
4. Hogg,R.V. and Craig R.G.(1989).Introduction to Mathematical Statistics, Ed. Mac Millan Publishing Co., NewYork.
5. Mayer, P. (1972). Introductory Probability and Statistical Applications, Addison Wesley Publishing Co., London.
6. Mood A.M. and Graybill F.A.and Boes D.C.(1974).Introduction to the Theory of Statistics, Ed. 3, McGraw Hill Book Company.
7. Ross S. (2002). A First Course in Probability, Sixth Edition, Pearson Education, Inc.and Dorling Kindersley Publishing, Inc.

Reference Websites for Paper I and Paper II:

1. www.stats.unipune.ac.in [100Datasets for Statistics Education by Dr. Anil P. Gore, Dr. Mrs. S. A. Paranjpe and Madhav B. Kulkarni available in ISPS folder].
1. www.freestatistics.tk(NationalStatisticalAgencies)
2. www.psychstat.smsu.edu/sbk00.htm(Onlinebook)
3. www.bmj.bmjournals.com/collections/statsbk/index.shtml
4. www.statweb.calpoly.edu/bchance/stat-stuff.html
5. www.amstat.org/publications/jse/jse-data-archive.html(International journal on teaching and learning of statistics)
6. www.amstat.org/publications/chance(Chancemagazine)
7. www.statsci.org/datasets.html(Datasets)

8. www.math.uah.edu/stat(Virtual laboratories in Statistics)
9. www.amstat.org/publications/stats(STATS: the magazine for students of Statistics)
10. www.stat.ucla.edu/cases(Case studies in Statistics).
11. www.statsoft.com
12. www.statistics.com
13. www.indiastat.com
14. www.unstat.un.org
15. www.stat.stanford.edu
16. www.statpages.net
17. www.wto.org
18. www.censusindia.gov.in
19. www.mospi.nic.in
20. www.statisticsofindia.in
21. www.nationmaster.com (Population studies)

Offered as	Minor
Course/ Paper Title	Statistics Practical – II
Course Code	23SBST42MN
Semester	IV
No. of Credits	2.0

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To compute correlation coefficient, regression coefficients
2.	To compute probabilities of bivariate distributions
3.	To fit binomial and Poisson distributions to the given data
4.	To compute probabilities of bivariate distributions
5.	To use computer software to fit the curves to the given numerical data

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be able to correlation coefficient along with graphical representation of correlation with interpretation
2.	Students will be able to fit line of regression to the given data
3.	Students will be acquainted with the fitting of curves as a part of data analysis

S.No.	Title of the experiment	No. of Practicals
1	Scatter diagram, correlation coefficient (ungrouped data).	1
2	Fitting of line of regression of Y on X	1

3	Fitting of second degree curve	1
4	Fitting of exponential curve of the type $Y = ax^b$	1
5	Fitting of Binomial distribution and computation of expected frequencies.	1
6	Applications of Binomial and hypergeometric distributions.	1
7	Fitting of Poisson distribution and computation of expected frequencies.	1
8	Index numbers.	1
9	Scatter diagram, correlation coefficient using Ms-excel/ Any statistical software & interpretation.	1
10	Fitting of a line of regression using Ms-excel / Any statistical software & interpretation.	1
11	Fitting of second degree curve using Ms-excel / Any statistical software & interpretation.	1
12	Fitting of exponential curve using Ms-excel / Any statistical software & interpretation.	1

NEPCBCS 2023-24

Statistics



M. C. E. Society's

Abeda Inamdar Senior College

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(Autonomous) Affiliated to SavitribaiPhule Pune University

NAAC accredited 'A' Grade

Faculty of Science & Technology

Choice Based Credit System Syllabus

To be implemented from the academic year 2024-2025

S.Y.B.Sc.(Computer Science) Statistics
Semester III (CBCS – Autonomy 2023Pattern)

CourseTitle	Statistics for Data Science -II		
Course Code: 23SBCS31MNB		No. of Credits:2	
Course Type: Minor		Total Teaching Hours:30	

Course Objectives	
1.	A student should be able to recall basic concepts and terminology in Statistics and covers basic tools and methods required for data analysis from their studies.
2.	A student able to recall basic concepts in probability, conditional probability and independent events, random variable, mathematical expectation, and different types of distributions.
3.	A student able to design a statistical hypothesis about the real world problem and conduct appropriate test for drawing valid inference.
4.	A student able to recall basic arithmetic operations on vectors and matrices, including inverse, determinants, eigenvalues and eigenvectors of a matrix

Course Outcome	
1.	Calculate the simple linear regression equation for a set of data, principles of linear regression and correlation, including least square method, predicting a particular value of Y for a given value of X and significance of the correlation coefficient
2.	Use discrete and continuous probability distributions, mean and variance, and making decisions, define binomial outcomes and compute the probability of getting X successes in N trials, use Poisson, exponential distributions to solve statistical problems
3.	Calculate inverse of a square matrix, the determinant, transpose of a square matrix, and of eigenvalues and corresponding eigenvectors of a given matrix

Syllabus

Syllabus		
Unit I	Regression (for ungrouped data)	07
	1. Concept of linear and nonlinear regression.	01
	2. Principle of least square, fitting straight line by method of least square.	02
	3. Concept of regression coefficients and correlation coefficient.	01
	4. Concept of multiple regressions, Yule's Notations and Fitting of multiple regression planes.	02
	5. Concept of partial regression coefficients, interpretations.	01
Unit II	Theory of Probability	10
	1. Counting Principles, Permutation, and Combination.	02
	2. Deterministic and non-determination models.	01
	3. Random Experiment, Sample Spaces (Discrete and continuous).	01
	4. Concept of Event.	01
	5. Concept of Probability: classical definition, probability models, axioms of probability, probability of an event, theorems of probability (without proof).	02
	6. Independence of two events, Conditional probability, multiplication theorem $P(A \cap B) = P(A).P(B A)$	02
	7. Bayes' theorem (without proof). True positive, false positive and sensitivity	01
Unit III	Random Variable and Mathematical Expectation	07
	1. Random variable (r.v.), discrete random variable and Continuous random Variable	01
	2. Probability mass function (P.m.f.) of discrete r.v. and cumulative distribution function (c.d.f.) of discrete r.v.	02
	3. Mathematical expectation and variance of discrete r.v.	01
	4. Probability mass function (P.m.f.) of continuous r.v. and cumulative distribution function (c.d.f.) of continuous r.v.	02
	5. Mathematical expectation and variance of continuous r.v.	01
Unit IV	Standard Discrete Distribution	06
	1. Discrete Uniform Distribution.	01
	2. Binomial Distribution.	02
	3. Geometric Distribution.	01
	4. Poisson Distribution	02

Suggested Readings

1.	Introduction to Linear Regression Analysis: Douglas C. Montgomery, Elizabeth A. peck, G. Geoffrey Vining, Wiley
2.	Fundamentals of Statistics. Vol I, A.M.Goon, M.K. Gupta, B.Das Gupta, World press

Web Reference:

1. <https://open.umn.edu/opentextbooks/textbooks/459>
2. <https://openstax.org/books/introductory-business-statistics/pages/5-1-properties-of-continuous-probability-density-functions>

Course Title	Statistics Practical-II		
Course Code: 23SBCS32MNB			No. of Credits:2
Course Type: Minor			Total Teaching Session:10

Sr. No	Title of the Practical	No. of Practical
1	Introduction to Pivot Table and Pivot Charts	1
2	Lookup and Logical Functions	1
3	Regression Using MS-EXCEL	1
4	Probability using MS-EXCEL	1
5	Random Variables and Distributions Using MS-EXCEL	2
6	Problems Based on Unit I :23SBCS31MNB	1
7	Problems Based on Unit II : 23SBCS31MNB	1
8	Problems Based on Unit III : 23SBCS31MNB	1
9	Problems Based on Unit IV : 23SBCS31MNB	1

CBCS–Autonomy 2023Pattern

Course Title	Statistics for Data Science -III		
Course Code: 23SBCS41MNB		No. of Credits:2	
Course Type: Minor		Total Teaching Hours:30	

Syllabus

Syllabus		
Unit I	Matrix Algebra	08
	1. Vectors in $\mathbb{R}^n$	02
	2. Matrices and Operations on Matrices	02
	3. Determinant	02
	4. Inverse of a matrix	02
Unit II	Introduction to Testing of Hypothesis	02
	1. Concepts of population and sample.	01
	2. Definitions: random sample from a probability distribution, parameter, statistic, standard error of estimator.	
	3. Concept of the null hypothesis and alternative hypothesis (Research hypothesis), critical region.	01
	4. Concept level of significance, type I and type II error, one-sided and two-sided tests, a test of hypothesis, p-value.	
Unit III	Parametric Tests	10
	1. Large Sample Tests.	02
	2. $H_0: \mu = \mu_0$ Vs $H_1: \mu \neq \mu_0$ or $H_1: \mu < \mu_0$ or $H_1: \mu > \mu_0$ (One sided and two-sided tests).	02
	3. $H_0: \mu_1 = \mu_2$ Vs $H_1: \mu_1 \neq \mu_2$ or $H_1: \mu_1 < \mu_2$ or $H_1: \mu_1 > \mu_2$ (One-sided and two-sided tests).	02
	4. $H_0: P = P_0$ Vs $H_1: P \neq P_0$ or $H_1: P < P_0$ or $H_1: P > P_0$ (One sided and two-sided tests).	02
	5. $H_0: P_1 = P_2$ Vs $H_1: P_1 \neq P_2$ or $H_1: P_1 < P_2$ or $H_1: P_1 > P_2$ (One sided and two-sided tests).	02
Unit IV	Test Based on Chi-square, t distribution & F distribution	10
	1. Tests based on Chi-square distribution, Chi-square test for the goodness of fit, Test for the independence of attributes (mxn and 2x2)	03
	2. Tests based on t –distribution, $H_0: \mu_1 = \mu_2$ Vs $H_1: \mu_1 \neq \mu_2$ or $H_1: \mu_1 < \mu_2$ or $H_1: \mu_1 > \mu_2$ (One-sided and two-sided tests).	03
	3. Paired t-test.	02
	4. Test based on F- distribution, F-test for testing significance of equality of two population variances.	02

Suggested Readings	
1.	Fundamentals of Statistics, Sixth Revised and Enlarged Edition, S.C. Gupta, Himalaya Publishing House.
2.	Linear Algebra and its Applications, David C Lay, Steven R. Lay, Judi J. MacDonald Pearson Publication, 2016, Fifth Edition.

Web Reference:

1. <http://math.mit.edu/~gs/linearalgebra/>
2. <https://openstax.org/books/introductory-business-statistics/pages/5-1-properties-of-continuous-probability-density-functions>

Course Title	Statistics Practical-III		
Course Code: 23SBCS42MNB		No. of Credits:2	
Course Type: Minor		Total Teaching Session:10	

Sr. No	Title of the Practical	No. of Practical
1	Introduction to R-software	1
2	Charts and Plots using R-Software	1
3	Basics of Statistics Using R-software	1
4	Probability and Distributions Using R-software	1
5	Testing of Hypothesis Using R-software	1
6	Matrix and Matrix Operations Using R-software	1
7	Problems Based on Unit I :23SBCS42MNB	1
8	Problems Based on Unit III : 23SBCS42MNB	2
9	Problems Based on Unit IV :23SBCS42MNB	1

Suggested Readings	
1.	Introduction to Statistics and Data Analysis With Exercises, Solutions and Applications in R, Christian Heumann, Michael Schomaker Shalabh.
2.	Using R for Data Analysis and Graphics Introduction, Code and Commentary J H Maindonald Centre for Mathematics and Its Applications, Australian National University.