Vivekanand College, Kolhapur (AUTONOMOUS)
Department of Statistics

Curricular Relevance: Course outcomes with relevance to Local, Regional, National, Global needs U. G. (2018-19 to 2023-24)

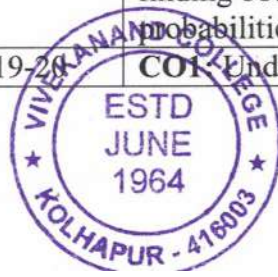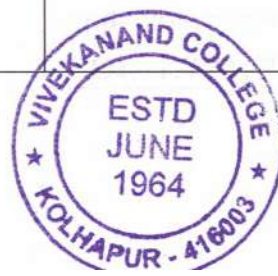| Sr. No.	Name of the Course	Year of Introduction	PSOs with relevance to local/ regional needs	PSOs with relevance to national needs	PSOs with relevance to global needs
1	B. Sc. Statistics	2018	**PSO1:** Apply mathematical tools to the theory of statistics.	**PSO3:** Organize sample surveys and estimate the parameters of a population by using Excel and R packages. **PSO4:** Specific jobs in UPSC / MPSC, appear for competitive examinations like NET & SET to pursue teaching / research in Statistics, etc.	**PSO2:** Evaluate probabilities and Fit probability Models for real-life situations.
2	B. Sc. Statistics	2021	**PSO1:** The students are expected to understand the principles, concepts and recent developments in the statistics.	**PSO3:** Organize sample surveys and estimate the parameters of a population by using Excel and R packages.	**PSO2:** Evaluate probabilities and Fit probability Models for real-life situations. **PSO4:**Apply statistical techniques to predict, optimize and monitor real life phenomena related to industry and business statistics etc.

Sr. No.	Name of the Course	Course Code	Year of Introduction	COs and PSOs with relevance to local/ regional needs	COs & PSOs with relevance to national needs	COs & PSOs with relevance to global needs
B. Sc. I Statistics (Newly Introduced between 2018-19 and 2020-21)						
1	Descriptive Statistics - I & Elementary Probability Theory	DSC-1004A	2018-19	**CO1:** To compute various measures of central tendencies, dispersion, Moments, skewness, kurtosis and to interpret them. **CO2:** Analyze data pertaining to attributes and interpret the results. **CO3:** Distinguish between Deterministic and Non-deterministic experiments. **CO4:** Understand the basic concepts of probabilities. **CO5:** Learn theorems on probabilities and compute probabilities.	**CO6:** Understand concepts of probabilities and independence of events.	**CO7:** Understand the concept of discrete random variable, probability distributions and mathematical expectations.

2	Descriptive Statistics II & Discrete Probability Distributions	DSC-1004B	2018-19	**CO1:** Understand concept of bivariate data and its analysis. **CO2:** Understand and interpret Multiple and Partial Correlation. **CO4:** Concept of bivariate random variable, probability distributions and mathematical expectations.	**CO3:** Know the concept and use of time series.	**CO5:** Apply some univariate standard discrete probability distributions to different situations.

B. Sc. II Statistics (Newly Introduced in 2019-20)

3	Probability Distributions I & Statistical Methods-I	DSC - 1004 C	2019-20	**CO1:** Compute descriptive statistics, moments, skewness, kurtosis, m.g.f. and c.g.f for continuous univariate distributions. **CO2:** Compute various statistical measures for continuous bivariate distributions. **CO3:** Understand transformation of continuous univariate and bivariate random variable. **CO8:** learn applications of Chebychev's inequality in finding bounds for probabilities.	**CO5:** Compute simple, weighted Index numbers and cost of living Index number. **CO6:** Understand vital statistics and computation of vital events.	**CO4:** Understand various continuous probability distributions and their applications in different fields **CO7:** Distinguish between process and product control, plotting control charts for variable and attributes.
4	Probability	DSC-1004D	2019-20	**CO1** Understanding	**CO4:** Learn	**CO3:** Learn basics

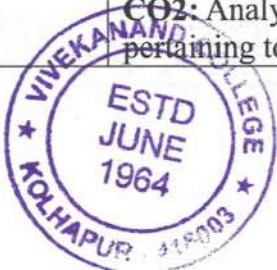|				various continuous probability distributions and their applications in different fields. **CO2:** Know the relation between various probability distributions. **CO6:** Understand the basic concepts of testing of hypothesis. **CO7:** Distinguish between large and small sample tests.	numerical methods. **CO5:** Understand the basic concepts of reliability and ageing properties.	and data analysis using R- software. **CO8:** Apply small and large sample tests for real life examples.
	Distributions & Statistical Methods-II					
B. Com. II (Newly Introduced in 2019-20)						
5	Business Statistics I	CC - 1051 C	2019-20	**CO1:** Know Applications Statistics in various fields. **CO2:** Classify data and representing it graphically. **CO4:** Acquaint with statistical methods viz. Measures of Central Tendency and Dispersion. **CO5:** Understand the concept of bivariate data	**CO3:** Understand concept of population, sample and different methods of sampling.	**CO6:** Analyze data by using correlation and regression.
6	Business Statistics II	CC - 1051 D	2019-20	**CO1:** Understand the concept of probability and probability distributions. **CO2:** Know applications of probability distributions in real life	**CO3:** Measure trend and seasonal indices in Time series. **CO4:** Compute simple and weighted Index numbers.	**CO5:** Distinguish between process and product control, plotting control charts for variable and attributes.

B. Sc. III Statistics (Newly Introduced in 2020-21)						
7	Probability Distributions	DSE 1004E1	2020-21	**CO1:** Understand the concept of standard continuous distributions. **CO2:** Apply standard continuous probability distributions to different real life data/situations. **CO5:** Learn concept of order statistics, convergence, weak law of large numbers and central limit theorem problem	**CO3:** Learn the concept of truncated distribution and its applications **CO4:** Learn Multinomial distribution and Bivariate Normal Distribution.	**CO6:** Learn concept of Markov chain and Queuing theory.
8	Sampling Theory & Operation Research	DSE 1004E2	2020-21	**CO1:** Design and execute sample surveys. **CO2:** Learn various sampling methods **CO4:** Compare various sampling techniques **CO5:** Learn different methods of estimation using auxiliary variables **CO7:** Solve Linear Programming Problems.	**CO3:** Conduct sample surveys and select appropriate sampling techniques.	**CO6:** Convert practical situations to the format of linear programming problem. **CO8:** Understand special cases of LPP viz. transportation problem, assignment problem. **CO9:** Learn different decision making environments. **CO10:** Simulate random numbers from different distributions.

9	Statistical Inference	DSE 1004F1	2020-21	**CO1:** Get acquainted with notion of parameter and estimator. **CO2:** Understand concept of point estimation **CO3:** Learn important properties of estimator, **CO4:** Understand concept of CR inequality. **CO5:** know different methods of estimation	**CO6:** Understand concept of interval estimation.	**CO7:** Learn concept of testing of hypothesis and different test procedures. **CO8:** Learn nonparametric statistical inference.
10	Design of Experiments, Quality Management & Data Mining	DSE 1004F2	2020-21	**CO1:** Understand the basic terms in design of experiments. **CO2:** Carry out one-way and two-way analysis of variance. **CO3:** Apply appropriate experimental design in real life. **CO4:** Understand concept of efficiency of design and ANOCOVA.	**CO5:** Understand factorial experiments and confounding.	**CO6:** Learn concepts of quality and tools used in quality management. **CO7:** Learn various control charts for monitoring process control **CO8:** Understand different sampling plans for product control. **CO9:** Know basics of data mining.
B. Sc. I Statistics(Newly Introduced in 2021-22)					
11	Descriptive Statistics - I	DSC - 1004 A	2021-22	**CO1:** Compute descriptive statistics, moments, skewness, kurtosis and to interpret it. **CO2:** Analyze data pertaining to attributes and		

				interpret the results.		
12	Elementary Probability Theory	DSC - 1004 A	2021-22	**CO1:** Distinguish between Deterministic and Non-deterministic experiments. **CO2:** Understand the basic concepts of probabilities. **CO3:** Learn theorems on probabilities and compute probabilities.	**CO4:** Understand concepts of probabilities and independence of events. **CO5:** Understand the concept of discrete random variable, probability distributions and mathematical expectations.	
13	Descriptive Statistics - II	DSC - 1004 B	2021-22	**CO1:** Understand concept of bivariate data and its analysis	**CO2:** Understand the need of vital statistics and concepts of mortality and fertility.	**CO3:** Know the concept and use of time series.
14	Discrete Probability Distributions	DSC - 1004 B	2021-22	**CO1:** Know the concept of bivariate random variable, probability distributions and mathematical expectations.		**CO2:** Apply some univariate standard discrete probability distributions to different situations.
B. Sc. II Statistics (Newly Introduced in 2022-23)						
15	Probability Distributions I	DSC - 1004 C1	2022-23	**CO1:** Compute descriptive statistics, moments, skewness, kurtosis, m.g.f. and c.g.f for continuous univariate distributions.	**CO3:** Understand transformation of continuous univariate and bivariate random	**CO4:** Understand various continuous probability distributions and their applications in

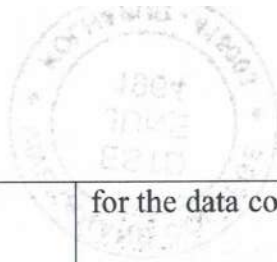|				CO2: Compute various statistical measures for continuous bivariate distributions.	variable.	different fields.
16	Statistical Methods	DSC - 1004C2	2022-23	CO1: Understand the concept of Multiple Linear Regression, residual. CO2: Understand the concept of multiple correlation and partial correlation.	CO3: Compute simple, weighted index numbers and cost of living index number. CO4: Understand the basics of official Statistics.	
17	Probability Distributions II	DSC - 1004D1	2022-23	CO1: Understand various continuous probability distributions and their applications in different fields. CO2: Know the relation between various probability distributions.		CO3: Learn basics of R- software CO4: Learn data analysis using R-software.
18	Introduction to Reliability Theory & Testing of Hypothesis	DSC - 1004D2	2022-23	CO1: Understand the basic concepts of reliability and ageing properties. CO2: Recognize the basic concepts of testing of hypothesis. CO3: Distinguish between large and small sample tests.		CO4: Apply small and large sample tests in real life examples.
B. Com. II (Newly Introduced in 2022-23)						
19	Business Statistics I	CC - 1051C	2022-23	CO1: Apply Statistics in		CO4: Understand

				various fields and classify data and representing it graphically. **CO2:** Understand concept of population, sample and different methods of sampling. **CO3:** Make familiar with statistical measures viz. Measures of Central Tendency and Dispersion.		the concept of bivariate data and analyze data by using correlation and regression.
20	Business Statistics II	CC - 1051 D	2022-23	**CO1:** Understand the concept of probability and probability distributions and apply probability distributions in real life. **CO2:** Measure trend and seasonal indices in Time series.	**CO3:** Compute simple and weighted Index numbers.	**CO4:** Distinguish between process and product control, plotting control charts for variable and attributes.
	B. Sc. I Statistics (NEP 2020 Newly Introduced in 2023-24)					
21	Descriptive Statistics I	DSC03STA11	2023-24	**CO1:** Know scope of Statistics and sampling methods **CO2:** Compute descriptive statistics. **CO3:** Compute moments, skewness, kurtosis and its interpretation **CO4:** Use an appropriate measure in given situations/data.		
22	Elementary	DSC03STA12	2023-24	**CO1:** Distinguish between		**CO4:** Understand

	Probability Theory				Deterministic and Non-deterministic experiments. **CO2:** Understand the basic concepts of probability, conditional probability and independence of events. **CO3:** Learn theorems on probabilities and compute probabilities.		the concept of discrete random variable, probability distributions and mathematical expectation.
23	Descriptive Statistics I	MIN03STA11	2023-24	**CO1:** Know scope of Statistics and sampling methods **CO2:** Compute descriptive statistics. **CO3:** Compute moments, skewness, kurtosis and its interpretation **CO4:** Use an appropriate measure in given situations/data.		
24	Elementary Probability Theory	MIN03STA12	2023-24	**CO1:** Distinguish between Deterministic and Non-deterministic experiments. **CO2:** Understand the basic concepts of probability, conditional probability and independence of events. **CO3:** Learn theorems on probabilities and compute probabilities.		**CO4:** Understand the concept of discrete random variable, probability distributions and mathematical expectation.
25	Data Visualization &	OEC03STA11	2023-24	**CO1:** Prepare instruments	**CO2:** Learn basic	**CO3:** Visualize data

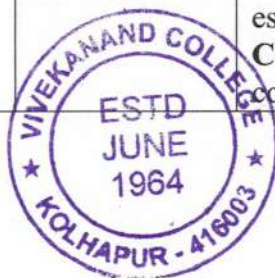|						
	Sample Survey			for the data collection.	concepts of sample survey & different methods of sampling.	diagrammatically. **CO4:** Visualize data graphically.
26	Exploratory Data Analysis	OEC03STA12	2023-24	**CO1:** Learn basic concepts in statistics. **CO2:** Compute descriptive statistics. **CO3:** Understand the concept of bivariate data.		**CO4:** Analyze data by using correlation and regression.
27	Descriptive Statistics II	DSC03STA21	2023-24	**CO3:** Analyze data pertaining to attributes and interpret the results.	**CO4:** Understand the need of vital statistics and concepts of mortality and fertility.	**CO1:** To compute correlation coefficient and its interpretation. **CO2:** To compute regression coefficients and regression lines.
28	Discrete Probability Distributions	DSC03STA22	2023-24	**CO2:** Obtain mathematical expectation of different distributions. **CO3:** To learn relation between different discrete distributions. **CO4:** Concept of bivariate random variable, probability distributions		**CO1:** Apply some univariate standard discrete probability distributions to different situations.
29	Descriptive Statistics II	MIN03STA21	2023-24	**CO3:** Analyze data pertaining to attributes and interpret the results.	**CO4:** Understand the need of vital statistics and concepts of mortality and	**CO1:** To compute correlation coefficient and its interpretation. **CO2:** To compute

					fertility.	regression coefficients and regression lines.
30	Discrete Probability Distributions	MIN03STA22	2023-24	**CO2:** Obtain mathematical expectation of different distributions. **CO3:** To learn relation between different discrete distributions. **CO4:** Concept of bivariate random variable, probability distributions		**CO1:** Apply some univariate standard discrete probability distributions to different situations.
31	Business Statistics	OEC03STA21	2023-24	**CO1:** Measure trend and seasonal indices in Time series. **CO3:** Understand the concept of probability and probability distributions and apply probability distributions in real life.	**CO2:** Compute simple and weighted Index numbers.	**CO4:** Distinguish between process and product control, plotting control charts for variable and Attributes.
32	Testing of Hypothesis	OEC03STA22	2023-24	**CO1:** Understand concept of testing of hypothesis. **CO2:** Develop test procedures for testing hypothesis.		**CO3:** Apply small and large sample tests in real life examples **CO4:** Implement appropriate nonparametric tests for real life testing of hypothesis problems.
33	Sample survey and official statistics	SEC03STA21	2023-24	**CO1:** Understand the basic concepts of sample survey. **CO2:**	**CO3:** Understand Indian Statistical system.	

				Learn different methods of sampling.	CO4: Know the functioning of MoSPI.	

<table>
<tr><td colspan="7" align="center">B. Com. I Statistics (NEP 2020 Newly Introduced in 2023-24)</td></tr>
<tr><td>34</td><td>Business Statistics I</td><td>SEC02STA11</td><td></td><td>CO1. Understand basic terms in sampling and different sampling methods.
CO2.Visualize data and compute descriptive statistics.</td><td></td><td></td></tr>
<tr><td>35</td><td>Business Statistics II</td><td>SEC02STA21</td><td></td><td>CO1. Understand the concept of probability, probability distributions and its applications in real life</td><td></td><td>CO2. Distinguish between process and product control, plot various control charts</td></tr>
<tr><td colspan="7" align="center">B. Sc. III CBCS Syllabus with effect from July, 2023-24</td></tr>
<tr><td>36</td><td>Probability Distributions</td><td>DSE1004E1</td><td>2023-24</td><td>CO1: Understand the knowledge of important univariate distributions such as Laplace, Cauchy, Lognormal, Weibull, Logistic, Pareto, Power series distributions.
CO2: Understand the knowledge of multinomial distribution and bivariate normal distributions.</td><td>CO3: Understand the knowledge of truncated distributions</td><td>CO4: Apply standard continuous probability distributions to different real-life situations.</td></tr>
<tr><td>37</td><td>Statistical Inference I</td><td>DSE1004E2</td><td>2023-24</td><td>CO1: Understand the notion of parameter and estimator.
CO2: Understand the concept of point estimation</td><td></td><td>CO4: Apply various methods of estimation.</td></tr>
</table>

				CO3: Recall various properties of good estimators.		
38	Sampling Theory	DSE1004E3	2023-24	CO1: Understand basic concepts sampling theory. CO3: Estimate population parameters using sampling distributions of estimator. CO4: Compare different sampling methods	CO2: Recall different sampling methods.	
39	Operations Research	DSE1004E4	2023-24	CO1: Understand different optimization techniques.	CO2: Transform real life situations/problems to its mathematical form.	CO3: Apply appropriate optimization technique to solve real life problems. CO4: Generate real life scenario.
40	Probability Theory	DSE1004F1	2023-24	CO1: Understand necessity of order statistics and its distributions. CO2: Implement various laws of probability to get solution for different problems in Statistics.		CO3: Understand basic concepts of stochastic processes and their applications. CO4: Apply Queuing theory and its real-life situations.
41	Statistical Inference II	DSE1004F2	2023-24	CO1: Understand concept of testing of hypothesis. CO2: Develop test procedures for testing hypothesis.	CO3: Construct confidence intervals for population parameters.	CO4: Implement appropriate nonparametric tests for real life testing of hypothesis problems.
42	Design of	DSE1004F3	2023-24	CO2: Estimate parameters	CO1: Understand	CO3: Analyse

				of different statistical designs. CO4: Compare efficiency of different designs.	the basic terminology in design of experiments.	different real life situations using appropriate designs.
43	Quality Management	DSE1004F4	2023-24	CO1: Understand concept of quality and dimensions of quality.	CO2: Construct various types of control charts for various quality control problems.	CO3: Apply acceptance sampling plan for monitoring quality of products. CO4: Understand basic terminology of data mining.
44	Database Management Systems	SEC3	2023-24	CO1: to enhance database handling, data manipulation and data processing skills through SQL		CO2: develop data centric computer applications.

Dr. R. R. Kumbhar
CHAIRMAN
BoS STATISTICS
VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)

Dr. R. R. Kumbhar
PRINCIPAL
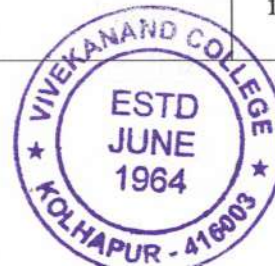**VIVEKANAND COLLEGE, KOLHAPUR**
(EMPOWERED AUTONOMOUS)

"Dissemination of Education for Knowledge, Science and Culture"
-Shikshanmaharshi Dr. Bapuji Salunkhe
Shri Swami Vivekanand Shikshan Sanstha's

Vivekanand College, Kolhapur (AUTONOMOUS)
Department of Statistics

Curricular Relevance: Course outcomes with relevance to Local, Regional, National, Global needs P. G. (M. Sc. Statistics)

(2022-23 to 2023-24)

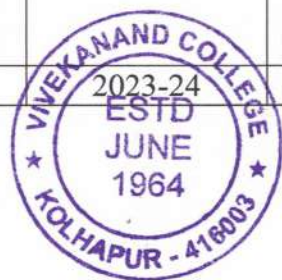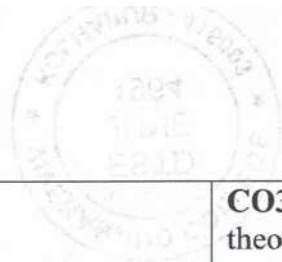| Sr. No.	Name of the Course	Year of Introduction	PSOs with relevance to local/ regional needs	PSOs with relevance to national needs	PSOs with relevance to global needs
1	M. Sc. Statistics	2022	**PSO1:** Enhance sense of enthusiasm for Statistics and to involve them in an intellectually stimulating experience of learning in a supportive environment.	**PSO4:** Describe complex statistical ideas to non-statisticians and to present the results of their analyses in written, oral forms and can make practical suggestions for improvement.	**PSO2:** Handle and analyse small as well as large databases with computer skills. **PSO3:** Understand, implement and develop statistical models. **PSO5:** Apply statistical techniques to optimize and monitor real life phenomena related to industry and business analytics etc.
2	M. Sc. Applied Statistics	2023	**PSO1:** Enhance sense of enthusiasm for Statistics and to involve them in an intellectually stimulating experience of learning in a supportive environment.	**PSO4:** Describe complex statistical ideas to non-statisticians and to present the results of their analyses in written, oral forms and can make practical suggestions for improvement.	**PSO2:** Handle and analyse small as well as large databases with statistical software and computing environment including C, R, Python, MS-EXCEL **PSO3:** Understand, implement and develop statistical models. **PSO5:** Apply statistical

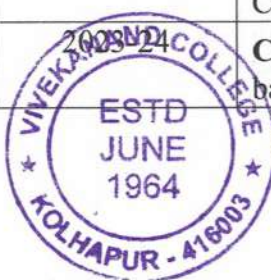|				formulas, including the use of built-in functions and analysis tool pack. **CO2:** Develop the fundamentals of statistical analysis in R environment.		
4	Research Methodology	RMD18STA11	2023-24	**CO1:** Understand the concept of research, research process, and research ethics.	**CO2:** Understand and apply various sampling methods for data collection and estimate the parameters.	**CO3:** Understand the concept of simulation and able to simulate real life processes **CO4:** Apply numerical methods to solve systems of linear equations and definite integrals
5	Mathematical Statistics	DSE17STA11	2023-24	**CO1:** Define and recognize the basic properties of the field of real numbers. CO3: Demonstrate understanding of the concepts of vector space and subspace, linear independence, span, and basis.	**CO2:** Define and recognize the series of real numbers and convergence.	**CO4:** Apply principles of matrix algebra to linear transformations and solve systems of linear equations using multiple methods.
6	Real Analysis	DSE17STA12	2023-24	**CO1:** Define and recognize the basic properties of the field of real numbers.	**CO2:** Define and recognize the series of real numbers and	**CO4:** Define and recognize the real functions and its limits and

Sr. No.	Name of the Course	Course Code	Year of Introduction	COs and PSOs with relevance to local/ regional needs	COs & PSOs with relevance to national needs	COs & PSOs with relevance to global needs
M. Sc. I (Newly introduced in 2023-24)						
1	Distribution Theory	DSC18STA11	2023-24	**CO1:** Recognize and learn concept of mixture of distribution and their decomposition. **CO3:** Describe the concept of central and non-central distributions. **CO4:** Learn the concept of order statistics.	**CO2:** Execute transformation of univariate random variables and different moment inequalities.	
2	Estimation Theory	DSC18STA12	2023-24	**CO1:** Describe the notion of parametric models, point estimation of the parameters of those models. **CO2:** Construct the sufficient statistic, minimal sufficient statistic, m.l.e., moment estimator of the parameter. **CO3:** Discuss the concept of MVUE, MVBUE, UMVUE.		**CO4:** Describe the concept of Bayesian inference and their real life applications.
3	Statistical Computing	DSC18STA13	2023-24	**CO1:** Construct		

				CO3: Apply the theorem in a correct mathematical way.	convergence.	differentiability of real functions and its related theorems.
7	Linear Algebra	DSE17STA13	2023-24	CO1: Solve matrix operations, including inverses and determinants. CO2: Demonstrate understanding of the concepts of vector space and subspace, linear independence, span, and basis.		CO3: Describe eigenvalues and eigenvectors and solve eigenvalue problems. CO4: Apply principles of matrix algebra to linear transformations and solve systems of linear equations using multiple methods.
8	C Programming	DSE18STA11	2023-24	CO1: Explain the Basic Terminology Used in Computer Programming CO2: Implement different Operations on arrays, functions, pointers, structures, unions and files. CO3: Write Compile and Debug Programs in C Language.		CO4: Analyze and Solve Complex and Real Life Problems by Developing Application Programs using C Programming Language.
9	Statistical Analysis Using SPSS	DSE18STA12	2023-24	CO1: Memorize the basic concepts of SPSS.	CO2: Learn descriptive and	

				CO4: Recognize the study of Parametric and Nonparametric Test.	basic inferential statistics. CO3: Understand variables and prepare data for analysis.	
10	Linear model and Regression Analysis	DSC18STA21	2023-24	CO1: Understand General linear model, Gauss Markov theorem, variances and covariance's of BLUEs. CO3: Understand concept of multicollinearity and non-linear regression.	CO2: Understand and apply multiple regression models in real life situations.	CO4: Understand concept of Robust regression, Logistic regression and Poisson regression.
11	Theory of Testing of Hypothesis	DSC18STA22	2023-24	CO1: Formulate null and alternative hypotheses, compute probabilities of types error, MP tests and MLR property. CO2: Understand UMP and UMPU test with their applications.	CO3: Construct asymptotic confidence interval of a parameter and its relation with testing of hypothesis problem.	CO4: Execute small, large sample size tests and non-parametric tests in real life problems.
12	Multivariate Analysis	DSC18STA23	2023-24	CO1: Understand Wishart distribution, Hotelling T2 and Mahalanobis D2 statistic.		CO2: Implement dimension reduction techniques, discriminant and clustering analysis techniques using