

Annual Teaching Plan

Academic year 2023-2024

B.Sc. Part-I

Semester I

Department -Statistics

Subject - Statistics

Course -DSC03STA11/MIN03STA11

**DSC-I/MIN-I- Descriptive Statistics I**

Name of teacher – Makandar. A. M.

Month-July			Module/Unit	Sub-units planned
Lectures 09	Practicals —	Total 09	Unit-1 Introduction to Statistics & Measures of Central Tendency	<ol style="list-style-type: none"> <li>1. Meaning of primary and secondary data,</li> <li>2. Basis concept of population and sampling methods.</li> <li>3. Concept of central tendency.</li> </ol>
Month-August				
Lectures 08	Practicals —	Total 08	Unit -1 Measures of Central Tendency	<ol style="list-style-type: none"> <li>4. A.M., G.M., H.M., and its properties</li> <li>5. Partition values: Quartile, deciles and percentiles.</li> <li>6. Comparison between averages</li> </ol>
			Unit-2 Measures of Dispersion	<ol style="list-style-type: none"> <li>1. Concept of dispersion,</li> <li>2. Absolute and relative measure of dispersion.</li> </ol>
Month-September				
Lectures 8	Practicals —	Total 08	Unit-2 Measures of Dispersion	<ol style="list-style-type: none"> <li>3. Definition of variance and standard deviation with its properties</li> <li>4. Coefficient of variation</li> </ol>
			Unit-3 Moments, Skewness & Kurtosis	<ol style="list-style-type: none"> <li>1. Moments: Raw and central moments.</li> <li>2. Relation between raw and central moments.</li> <li>3. Skewness and kurtosis (concept and types).</li> </ol>
Month- October – November				
Lectures 10	Practicals —	Total 10	Unit-4 Theory of Attributes	<ol style="list-style-type: none"> <li>1. Concept of attributes and some definitions</li> <li>2. Concept of Consistency</li> <li>3. Concept of Independence and Association of two attributes.</li> <li>4. Definition and interpretation of Yule's coefficient of association (Q) and Coefficient of colligation (Y).</li> <li>5. Relation between Q and Y. Examples</li> </ol>

*Ashiyang*

Name & Signature of Teacher

Makandar A.M



*V. Pawar*

Ms. V. V. Pawar

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**DEPARTMENT OF STATISTICS  
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Annual Teaching Plan

Academic year 2023-2024

B.Sc. Part-I Semester I

Department -Statistics

Subject - Statistics

Course - DSC03STA12/MIN03STA12

**DSC-II/MIN-II - Elementary Probability Theory**

Name of teacher - Pawar V. V.

Month-July			Module/Unit	Sub-units planned
Lectures 08	Practicals 16	Total 24	Unit-1 Sample space and Events	1. Deterministic and non-deterministic experiments 2. Definitions: Sample space, Event, Types of events 3. Algebra of events
Month-August				
Lectures 09	Practicals 16	Total 25	Unit -1 Sample space and Events	4. Definition of Power set. 5. Symbolic representation of given events and Illustrative examples.
			Unit-2 Probability	1. Apriori definition of probability, Probability model 2. Axiomatic definition of probability 3. Illustrative examples
Month-September				
Lectures 08	Practicals 20	Total 28	Unit-2 Probability	4. Some theorems on probability 5. Definition of probability in terms of odd ratio.
			Unit-3 Conditional Probability & Independence of events	1. Definition of conditional probability, Multiplication theorem of probability 2. Baye's theorem, examples on conditional probability and Baye's theorem. 3. Independence of two events, Pairwise and Mutual Independence for three events. Elementary examples.
Month- October November				
Lectures 12	Practicals 16	Total 28	Unit-4 Univariate Probability Distributions (finite sample space):	1. Discrete random variable, p.m.f. and c.d.f. 2. Properties of c.d.f. 3. Probability distribution of function of random variable. 4. Median and Mode

Name & Signature of Teacher

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Academic year 2023-2024

B.Sc. Part-I

Semester I

Department -Statistics

Subject - Statistics

Course -OEC03STA11

**OEC-I - Data Visualization and Sample Survey**

Name of teacher – Patil R.M.

Month-July			Module/Unit	Sub-units planned
Lectures 08	Practicals 08	Total 16	Unit-1 Data Visualization & Presentation of Data	<ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Types of characteristics</li> <li>3. Basic Terms: Class interval, class frequency, class mark, class width, etc.</li> </ol>
Month-August				
Lectures 09	Practicals 08	Total 17	Unit-1 Data Visualization & Presentation of Data	<ol style="list-style-type: none"> <li>4. Diagrammatic Representation of Statistical Data –Bar diagram, subdivided bar diagram, Multiple bar diagram, Box plot, Pie chart, Scatter diagram.</li> <li>5. Graphical Representation of Statistical Data-Histogram, Ogive curves, Frequency polygon and frequency curves.</li> </ol>
Month-September				
Lectures 08	Practicals 08	Total 16	Unit-2 Sampling Survey	<ol style="list-style-type: none"> <li>1. Population, Sample, Sampling unit, Sampling frame, Sampling method, Census method. Coefficient of variation</li> <li>2. Principles of sampling survey, Principal steps in sample survey, Designing a questionnaire</li> <li>3. Sampling and non-sampling errors</li> </ol>
Month- October – November				
Lectures 11	Practicals 12	Total 23	Unit-2 Sampling Survey	<p>Methods of sampling:</p> <ol style="list-style-type: none"> <li>4. Probability Sampling: SRS, stratified random sampling, Systematic sampling, Cluster Sampling</li> <li>5. Non-Probability Sampling: Judgment sampling, Sequential sampling, Quota sampling, snowball sampling, Purposive sampling.</li> </ol>

Name & Signature of Teacher

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B.Sc. Part-I

Semester I

Department -Statistics

Subject - Statistics

Course -OEC03STA12

**OEC-II - EXPLORATORY DATA ANALYSIS**

Name of teacher – Patil R.M.

Month-July			Module/Unit			Sub-units planned
Lectures 08	Practicals 08	Total 16	Unit-1 Central Dispersion	Measures Tendency &	of	<ol style="list-style-type: none"> <li>1. Introduction to statistics</li> <li>2. Types of Data</li> <li>3. Arithmetic Mean, Median and Mode</li> </ol>
Month-August						
Lectures 09	Practicals 08	Total 17	Unit-1 Central Dispersion	Measures Tendency &	of	<ol style="list-style-type: none"> <li>4. Measures of Dispersion</li> <li>5. Range- Definition, Coefficient of Range</li> <li>6. Quartile Deviation (Q.D.) Definition, Coefficient of Q.D.</li> <li>7. Mean Deviation (M.D.): Definition of M.D. about Mean, Coefficient of M.D. about mean</li> <li>8. Standard Deviation (S.D.) and Variance: Definitions, Coefficient of S.D., Combined S.D. for two groups.</li> <li>9. Coefficient of Variation (C.V.): Definition and its uses.</li> <li>10. Numerical Examples.</li> </ol>
Month-September						
Lectures 08	Practicals 08	Total 16	Unit-2 Bivariate Data	Analysis of		<ol style="list-style-type: none"> <li>1. Correlation</li> <li>2. Methods of studying correlation, scatter diagram, Karl Pearson's correlation coefficient</li> <li>3. Spearman's rank correlation coefficient(R), computation of R</li> </ol>
Month- October – November						
Lectures 11	Practicals 12	Total 23	Unit-2 Bivariate Data	Analysis of		<ol style="list-style-type: none"> <li>4. Regression</li> <li>5. Lines of regression, regression coefficients. Properties of regression coefficients</li> <li>6. Numerical examples on correlation and regression.</li> </ol>

Name & Signature of Teacher

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Academic year 2023 -2024

B.Sc. Part-I

Semester II

Department -Statistics

Subject - Statistics

Course - DSC03STA21/MIN03STA21

**DSC-III/MIN-III - DESCRIPTIVE STATISTICS II**

Name of teacher – Makandar A. M.

Month- November- December			Module/Unit	Sub-units planned
Lectures 09	Practicals —	Total 09	Unit-1 Correlation	1. Bivariate Random variable 2. Correlation, Types of correlation. 3. Scatter diagram, its utility. 4. Karl Pearson's coefficient of correlation 5. Spearman's rank correlation coefficient
Month-January				
Lectures 9	Practicals —	Total 09	Unit -2 Regression	1. Concept of regression 2. Equations of regression lines 3. Regression coefficients and its properties.
			Unit-3 Multiple Linear Regression & Multiple and Partial Correlation	1. Concept of multiple linear regressions. 2. Fitting of regression plane
Month-February				
Lectures 08	Practicals —	Total 08	Unit-3 Multiple and Partial Correlation	3. Multiple and partial correlation coefficients and its properties 4. Examples
Month- March				
Lectures 07	Practicals —	Total 07	Unit-4 Time Series	1. Meaning, need and utility 2. components of time series
Month – April-May				
Lectures 10	Practicals —	Total 10	Unit-4 Time Series	3. Methods of measurement of trend 4. Measurement of seasonal indices

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Makandar A.M



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B.Sc. Part-I

Semester II

Department -Statistics

Subject - Statistics

Course - DSC03STA22/MIN03STA22

**DSC-IV/MIN- IV - Discrete Probability Distributions**

Name of teacher - Pawar V. V.

Month- November -December			Module/Unit	Sub-units planned
Lectures 10	Practicals 20	Total 30	Unit-1 Some Standard Discrete Probability Distributions- I	1. One point and two points distributions 2. Bernoulli Distribution 3. Discrete Uniform Distribution
Month-January				
Lectures 09	Practicals 12	Total 21	Unit -2 Some Standard Discrete Probability Distributions- II	1. Binomial Distribution 2. Hyper geometric Distribution. 3. Binomial approximation to Hypergeometric distribution
			Unit-3 Discrete Distributions: Poisson, Geometric and Negative Binomial Distribution	1. Poisson Distribution 2. Poisson distribution as a limiting case of Binomial distribution, 3. Examples.
Month-February				
Lectures 07	Practicals 16	Total 23	Unit-3 Discrete Distributions: Poisson, Geometric and Negative Binomial Distribution	4. Geometric Distribution: 5. Negative Binomial Distribution
Month- March				
Lectures 08	Practicals 12	Total 20	Unit-4 Bivariate Discrete Probability Distributions	1. Definition of bivariate discrete random variable, p.m.f, and c.d.f., 2. Properties of c.d.f.
Month – April-May				
Lectures 08	Practicals 16	Total 24	Unit-4 Bivariate Discrete Probability Distributions	3. Mathematical Expectation: Definition and it. 4. Conditional mean and variance, covariance and correlation coefficient.

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Academic year 2023 -2024

B.Sc. Part-I

Semester II

Department -Statistics

Subject - Statistics

Course -OEC03STA21

**OEC-III Business Statistics**

Name of teacher – Patil R.M.

Month- November -December			Module/Unit	Sub-units planned
Lectures 11	Practicals 10	Total 21	Unit-1 Time Series & Index Number	<ol style="list-style-type: none"> <li>1. Definition, uses and components of time series</li> <li>2. Methods of determination of trend</li> <li>3. Numerical examples</li> </ol>
Month-January				
Lectures 08	Practicals 08	Total 16	Unit-1 Time Series & Index Number	<ol style="list-style-type: none"> <li>4. Meaning and construction of index numbers</li> <li>5. Types of index numbers</li> <li>6. Simple and weighted index number.</li> <li>7. Laspeyre's, Paasche's and Fisher's index numbers.</li> <li>8. Numerical examples</li> </ol>
Month-February				
Lectures 08	Practicals 08	Total 16	Unit-2 Probability Distributions & Statistical Quality Control	<ol style="list-style-type: none"> <li>1. Basic concepts in probability</li> <li>2. Binomial distribution: Properties and examples</li> <li>3. Poisson distribution: Properties and examples</li> </ol>
Month- March				
Lectures 08	Practicals 08	Total 16	Unit-2 Probability Distributions & Statistical Quality Control	<ol style="list-style-type: none"> <li>4. Normal distribution: Properties and examples</li> <li>5. Definition, uses and components of time series</li> <li>6. Methods of determination of trend</li> <li>7. Numerical examples</li> </ol>
Month- April-May				
Lectures 07	Practicals 10	Total 17	Unit-2 Probability Distributions & Statistical Quality Control	<ol style="list-style-type: none"> <li>8. Introduction to SQC, Process control, Product control</li> <li>9. Control charts for variables</li> <li>10. Control charts for Attributes</li> <li>11. Examples</li> </ol>

Name & Signature of Teacher

Patil R.M



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B.Sc. Part-I

Semester II

Department -Statistics

Subject - Statistics

Course - OEC03STA22

**OEC-IV Testing of Hypothesis**

Name of teacher – Patil R.M.

Month- November -December			Module/Unit	Sub-units planned
Lectures 11	Practicals 10	Total 21	Unit-1 Parametric Tests	<ol style="list-style-type: none"> <li>1. Notion of Population, Sample, Parameter, Statistic, Sampling distribution of Statistic, hypothesis, Simple and composite hypothesis</li> <li>2. Large Sample Tests: General procedure of testing Of hypothesis, Test for means</li> </ol>
Month-January				
Lectures 08	Practicals 08	Total 16	Unit-1 Parametric Tests	<p>Small Sample Tests:</p> <ol style="list-style-type: none"> <li>3. Definition of student's t variate, t test</li> <li>4. Chi square tests</li> <li>5. Yate's correction for continuity</li> <li>6. McNemar's test</li> <li>7. F test for testing equality of two population variances</li> </ol>
Month-February				
Lectures 08	Practicals 08	Total 16	Unit-2 Non- parametric Tests	<ol style="list-style-type: none"> <li>1. Notion of non-parametric statistical inference (test) and its comparison with parametric statistical inference</li> <li>2. Concept of distribution free statistic.</li> </ol>
Month- March				
Lectures 08	Practicals 08	Total 16	Unit-2 Non- parametric Tests	<ol style="list-style-type: none"> <li>3. Run test for one sample and run test for two independent sample problems.</li> <li>4. Sign test for one sample and two sample</li> <li>5. Wilcoxon's signed rank test for one sample and two sample</li> </ol>
Month- April-May				
Lectures 07	Practicals 10	Total 17	Unit-2 Non- parametric Tests	<ol style="list-style-type: none"> <li>6. Mann-Whitney U - test</li> <li>7. Median test</li> <li>8. Kolmogorov Smirnov test for one and for two independent samples.</li> </ol>

Name & Signature of Teacher

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Annual Teaching Plan

Academic year 2023 -2024

B.Sc. Part-II

Semester III Department -Statistics

Subject - Statistics

Course -DSC-1004 C1

**Paper V- Probability Distributions I**

Name of teacher – Pawar A.A.

Month-July			Module/Unit	Sub-units planned
Lectures 13	Practicals 32	Total 45	Unit-1 Continuous Univariate Distributions	<ol style="list-style-type: none"> <li>1. Definition of the continuous sample space,</li> <li>2. Continuous random variable (r.v.), p.d.f., c.d.f. and its properties</li> <li>3. Expectation of r.v., expectation of function of r.v., mean, median, mode, quartiles, variance, harmonic mean, raw and central moments, skewness and kurtosis.</li> </ol>
Month-August				
Lectures 13	Practicals 76	Total 89	Unit -1 Continuous Univariate Distributions	<ol style="list-style-type: none"> <li>4. Transformations of continuous univariate random variables</li> <li>5. Methods of transformation</li> </ol>
			Unit-2 Continuous Bivariate Distributions	<ol style="list-style-type: none"> <li>1. Definition of bivariate continuous random variable, p.d.f, c.d.f.,</li> <li>2. Expectation, conditional expectation.</li> </ol>
Month-September				
Lectures 11	Practicals 56	Total 67	Unit-2 Continuous Bivariate Distributions	<ol style="list-style-type: none"> <li>3. Transformation of continuous bivariate random variables</li> <li>4. Jacobin of transformation.</li> <li>5. Examples and problems.</li> </ol>
			Unit-3 Uniform and Exponential Distribution	<ol style="list-style-type: none"> <li>1. Uniform distribution</li> <li>2. Exponential distribution</li> </ol>
Month- October-November				
Lectures 12	Practicals 64	Total 76	Unit-4 Normal Distribution	<ol style="list-style-type: none"> <li>1. Normal distribution with parameters <math>\mu</math> &amp; <math>\sigma^2</math>, Standard normal distribution</li> <li>2. Properties of Normal distribution</li> <li>3. Numerical examples</li> </ol>

*Pawar A.A.*

Name & Signature of Teacher

Pawar Ajit A.



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Academic year 2023-2024

B.Sc. Part-II

Semester III

Department -Statistics

Subject - Statistics

Course -DSC-1004 C2

**Paper VI - Statistical Methods I**

Name of teacher – Bhosale A. B.

Month-July			Module/Unit	Sub-units planned
Lectures 12	Practicals 16	Total 28	Unit-1 Multiple linear Regression, Multiple and Partial Correlation (for trivariate data only)	1. Concept of multiple linear regressions. 2. Fitting of regression plane
Month-August				
Lectures 13	Practicals 20	Total 33	Unit-1 Multiple linear Regression, Multiple and Partial Correlation (for trivariate data only)	3. Properties of multiple correlation coefficient 4. Examples.
Month-September				
Lectures 13	Practicals 12	Total 25	Unit-2 Index Number & Official Statistics	1. Meaning and utility of index numbers. 2. Types of index numbers. 3. Laspeyre's, Paasche's and Fisher's index numbers 4. Tests of index numbers. 5. Cost of living index number
Month- October -November				
Lectures 12	Practicals 20	Total 32	Unit-2 Index Number & Official Statistics	6. National and International official statistical system 7. National Statistical Organization

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Name & Signature of Teacher

(Bhosale A.B.)



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Annual Teaching Plan

Academic year 2023 -2024

B.Sc. Part-II

Semester IV

Department -Statistics

Subject - Statistics

Course -DSC-1004 D1

**Paper VII- Probability Distributions II**

Name of teacher – Pawar A.A.

Month-November- December			Module/Unit	Sub-units planned
Lectures 14	Practicals 70	Total 84	Unit-1 Gamma, Beta and Exact Sampling Distributions	1. Gamma distribution 2. Beta distribution of 1 <sup>st</sup> kind
Month-January				
Lectures 14	Practicals 72	Total 86	Unit- 1 Gamma, Beta and Exact Sampling Distributions	3. Beta distribution of 1 <sup>st</sup> kind 4. Chi-Square distribution 5. Student's t- distribution
Month-February				
Lectures 12	Practicals 56	Total 68	Unit-1 Gamma, Beta and Exact Sampling Distributions	6. Snedecor's F distribution. 7. Inter relation between t, F and $\chi^2$
			Unit-2 Introduction to R	1. Creating, listing and deleting the objects 2. Arithmetic and simple functions
Month- March				
Lectures 11	Practicals 64	Total 75	Unit-2 Introduction to R	3. Import and export data. 4. Exploratory data analysis
Month- April-May				
Lectures 12	Practicals 60	Total 72	Unit-2 Introduction to R	5. Import and export data. 6. Exploratory data analysis

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Name & Signature of Teacher

Pawar Ajit A.



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B.Sc. Part-II

Semester IV

Department -Statistics

Subject - Statistics

Course -DSC-1004 D2

**Paper VIII - Introduction to Reliability Theory & Testing of Hypothesis**

Name of teacher – Bhosale A. B.

Month November -December			Module/Unit	Sub-units planned
Lectures 15	Practicals 20	Total 35	Unit-1 Reliability Theory I	1. Binary Systems 2. Reliability of binary System
Month-January				
Lectures 11	Practicals 20	Total 31	Unit-2 Reliability Theory II	1. Ageing Properties 2. Relationship between survival function and hazard function, density function and hazard rate 3. Hazard rate of a series system
Month-February				
Lectures 11	Practicals 12	Total 23	Unit-3 Testing of Hypothesis I	1. Definitions: Population, sample, hypothesis and types of hypotheses, One and two tailed tests 2. Type I and type II errors, level of significance, p-value, Critical region, power of test. 3. Large Sample Tests.
Month- March				
Lectures 12	Practicals 20	Total 32	Unit-4 Testing of Hypothesis II	1. Exact/Small sample tests (based on t, chi-square and F distribution)
Month- April- May				
Lectures 12	Practicals 20	Total 32		2. Numerical Examples

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Annual Teaching Plan

Academic year 2023 -2024

B.Sc. Part-III

Semester V

Department -Statistics

Subject - Statistics

Course -DSE-1004E1

**Paper No. IX: Probability Distributions**

Name of teacher – Bhosale A. B.

Month-July			Module/Unit	Sub-units planned
Lectures 12	Practicals 45	Total 57	Unit-1 Univariate Continuous Probability Distributions	1. Laplace (Double Exponential) Distribution 2. Lognormal Distribution 3. Cauchy Distribution
Month-August				
Lectures 14	Practicals 40	Total 54	Unit -1 Univariate Continuous Probability Distributions	4. Weibull Distribution 5. Relation of Weibull distribution with gamma and exponential distribution, 6. Examples and problems.
			Unit-2 Univariate and Multivariate Probability Distributions	1. Logistic distribution 2. Pareto distribution 3. Power series distribution
Month-September				
Lectures 12	Practicals 30	Total 42	Unit-2 Univariate and Multivariate Probability Distributions	4. Multinomial distribution 5. Trinomial distribution as particular case of multinomial distribution.
			Unit-3 Truncated Distributions	1. Truncated distribution as conditional distribution., 2. Truncated binomial distribution 3. Truncated Poisson distribution 4. Truncated normal distribution
Month- October-November				
Lectures 14	Practicals 40	Total 54	Unit-4 Bivariate Normal Distribution	1. P. d. f. of a bivariate normal distribution, 2. Marginal and conditional distributions 3. Conditional expectation and conditional variance

*A. B. Bhosale*

Name & Signature of Teacher  
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Annual Teaching Plan

Academic year 2023 -2024

B.Sc. Part-III

Semester V

Department -Statistics

Subject - Statistics

Course -DSE-1004E2

**Paper No. X: Statistical Inference - I**

Name of teacher – Makandar A. M.

Month-July			Module/Unit	Sub-units planned
Lectures 13	Practicals 80	Total 93	Unit-1 Point Estimation	<ol style="list-style-type: none"> <li>1. Concept and definition of Point estimation</li> <li>2. Definition of an estimator (statistic) &amp; its S.E.,</li> <li>3. Properties of estimator</li> <li>4. Unbiased estimators and results regarding unbiased estimators</li> </ol>
Month-August				
Lectures 12	Practicals 80	Total 92	Unit-1 Point Estimation	<ol style="list-style-type: none"> <li>5. Relative efficiency</li> <li>6. Minimum Variance Unbiased Estimator and Uniformly Minimum Variance Unbiased Estimator</li> <li>7. Consistency</li> </ol>
			Unit-2 Likelihood and Sufficiency	<ol style="list-style-type: none"> <li>1. Definition of likelihood function</li> <li>2. Sufficiency</li> <li>3. Pitman Koopman form and sufficient statistic</li> </ol>
Month-September				
Lectures 12	Practicals 80	Total 92	Unit-2 Likelihood and Sufficiency	<ol style="list-style-type: none"> <li>4. Fisher information function</li> <li>5. Concept of minimal sufficient statistic</li> <li>6. Illustrative examples.</li> </ol>
			Unit-3 Cramer's Rao Inequality	<ol style="list-style-type: none"> <li>1. Cramer Rao inequality.</li> <li>2. Minimum Variance Bound Unbiased Estimator (MVBUE) of <math>\phi(\theta)</math>.</li> <li>3. Some results related to MVBUE</li> </ol>
Month- October- November				
Lectures 13	Practicals 100	Total 113	Unit-4 Method of Estimation	<ol style="list-style-type: none"> <li>1. Method of maximum likelihood</li> <li>2. Invariance property of MLE, relation between MLE and sufficient statistic.</li> <li>3. Method of moments</li> <li>4. Method of minimum chi-square</li> </ol>

Name & Signature of Teacher

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Academic year 2023 -2024

B.Sc. Part-III

Semester V

Department -Statistics

Subject - Statistics

Course -DSE-1004E3

**Paper No. XI: Sampling Theory**

Name of teacher – Pawar V.V.

Month-July			Module/Unit	Sub-units planned
Lectures 13	Practicals 80	Total 93	Unit-1 Basic Terminology and Simple Random Sampling	1. Basic Terminology 2. Simple random sampling, SRSWR, SRSWOR 3. SRS for attributes 4. Determination of the sample size
Month-August				
Lectures 12	Practicals 80	Total 92	Unit-2 Stratified Sampling	1. Stratified random sampling 2. Determination of the sample size under proportional and Neyman allocation 3. Comparison amongst SRSWOR, stratification with proportional optimum allocation.
Month-September				
Lectures 12	Practicals 80	Total 92	Unit-3 Other Sampling Methods	1. Systematic Sampling: Real life situations, technique of drawing a sample 2. Comparison of SRS, stratified and systematic sampling when population is in linear trend 3. Circular Systematic Sampling. 4. Cluster Sampling, Two Stage and Multi Stage Sampling, 5. Systematic sampling as a particular case of cluster sampling.
Month- October-November				
Lectures 13	Practicals 100	Total 113	Unit-4 Sampling Methods using Auxiliary variables	1. Ratio Method: Concept of auxiliary variable and its use in estimation 2. Situations where Ratio method is appropriate. 3. Relative efficiency of ratio estimators with that of SRSWOR 4. Regression Method Relative efficiency of regression estimators over SRSWOR

Name & Signature of Teacher

*V.V. Pawar*  
Ms. V.V. Pawar



*V.V. Pawar*  
Ms. V. V. Pawar

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Annual Teaching Plan

Academic year 2023-2024

B.Sc. Part-III

Semester V

Department -Statistics

Subject - Statistics

Course -DSE-1004E4

**Paper No. XII: Operations Research**

Name of teacher – Tangawade. A. S.

Month-July			Module/Unit	Sub-units planned
Lectures 12	Practicals 20	Total 32	Unit-1 Linear programming, Transportation, Assignment and Sequencing Problem	1. Concept and formulation of problem as LPP 2. Some definitions
Month-August				
Lectures 14	Practicals 20	Total 34	Unit-1 Linear programming, Transportation, Assignment and Sequencing Problem	3. Solution of L.P.P.: 1. Graphical Method 2. Simplex Method 3. Big-M method 4. Duality Theory Examples and problems
Month-September				
Lectures 10	Practicals 15	Total 25	Unit-1 Linear programming, Transportation, Assignment and Sequencing Problem	4. Transportation problem (T.P.) IBFS by NWCR, LCM and VAM, MODI method of obtaining optimum solution 5. Assignment Problem (A.P.): Optimum solution by using Hungarian method. 6. Sequencing Problem:
Month- October November				
Lectures 14	Practicals 20	Total 34	Unit-2 Decision Theory and Simulation Techniques	1. Basic concept and some definitions 2. Type of decision-making environments. 3. Decision making under uncertainty 4. Decision making under risk Meaning of simulation 5. Methods of generating random number 6. Techniques of generating and continuous distributions

Name & Signature of Teacher

(Tangawade Atish S.)

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B.Sc. Part-III

Semester V

Department -Statistics

Subject - Statistics

**Practical Paper IV: Probability Distributions and R-Software**

Name of teacher – Dr. Kumbhar R.R.

Month-July			Practicals planned
Lectures -	Practicals 25	Total 25	1. Model sampling from Laplace and Cauchy distributions 2. Model sampling from Lognormal & Weibull distribution
Month-August			
Lectures -	Practicals 20	Total 20	3. Model sampling from pareto & Logistic distribution 4. Model sampling from truncated binomial and poison distributions
Month-September			
Lectures -	Practicals 15	Total 15	5. Model sampling from truncated normal and exponential distributions. 6. Model sampling from bivariate normal distribution
Month- October-November			
Lectures -	Practicals 20	Total 20	7. Fitting of Lognormal & Weibull distribution. 8. Fitting of Logistic distribution. 9. Fitting of truncated Binomial & truncated Poisson distribution

*R.R. Kumbhar*  
Name & Signature of Teacher  
(Dr. R. R. Kumbhar)



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B.Sc. Part-III

Semester VI

Department -Statistics


Subject - Statistics

Course -DSE1004F1


**Paper No. XIII: Probability Theory**

Name of teacher – Bhosale A. B.

Month- November -December			Module/Unit	Sub-units planned
Lectures 13	Practicals 30	Total 43	Unit-1 Order Statistics	1. Order statistics: definition, derivation of distribution function and density function of the $i$ th order statistic. 2. Derivation of joint p. d. f. of $i$ -th and $j$ -th order statistics
Month- January				
Lectures 14	Practicals 45	Total 59	Unit-1 Order Statistics	3. Distribution of the sample range and sample median when $n$ is odd. 4. Examples and Problems.
			Unit-2 Convergence and Limit Theorem	1. Convergence: Definition and modes of convergence 2. WLLN i. i. d. random variables
Month- February				
Lectures 13	Practicals 40	Total 53	Unit-2 Convergence and Limit Theorem	3. Central Limit Theorem: Statement and proof 4. Simple examples based on Bernoulli, binomial, Poisson and chi-square distribution.
			Unit-3 Finite Markov Chains	1. Definition, examples and classification of stochastic process 2. Markov chain: Definition and examples of Markov chain, 3. Classification of states, simple problems.
Month- March				
Lectures 11	Practicals 35	Total 46	Unit-3 Finite Markov Chains	4. Stationary probability distribution, applications. 5. Continuous Markov chain: Pure birth process, Poisson process, birth and death process.
Month- April-May				
Lectures 11	Practicals 70	Total 81	Unit-4 Queuing Theory	1. Basic concepts in queuing theory 2. Distribution of arrival, inter arrival time, departure and service time. 3. Types of queuing models.

  
Name & Signature of Teacher  
(Bhosale A.B.)



  
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B.Sc. Part-III

Semester VI

Department -Statistics

Subject - Statistics

Course -DSE1004F2

**Paper No. XIV: Statistical Inference II**

Name of teacher – Makandar A. M.

Month- November-December			Module/Unit	Sub-units planned
Lectures 13	Practicals 100	Total 113	Unit-1 Interval Estimation	<ol style="list-style-type: none"> <li>1. Notion of interval estimation and some definitions</li> <li>2. Pivotal quantity and its use in obtaining confidence intervals and bounds.</li> <li>3. Interval estimation for the different cases of normal distribution</li> </ol>
Month-January				
Lectures 13	Practicals 70	Total 83	Unit-2 Parametric Test	<ol style="list-style-type: none"> <li>1. Statistical hypothesis, problems of testing of hypothesis.</li> <li>2. Most Powerful (MP) test.</li> <li>3. Neyman - Pearson (NP) lemma</li> <li>4. Likelihood Ratio Test</li> </ol>
Month-February				
Lectures 12	Practicals 80	Total 92	Unit-3 Sequential Test	<ol style="list-style-type: none"> <li>1. General theory of sequential analysis and its comparison with fixed sample procedure.</li> <li>2. Wald's SPRT of strength <math>(\alpha, \beta)</math></li> <li>3. Illustrations for standard distributions</li> <li>4. Graphical and tabular procedure for carrying SPRT</li> </ol>
Month- March				
Lectures 12	Practicals 80	Total 92	Unit-4 Non – Parametric Test	<ol style="list-style-type: none"> <li>1. Notion of non-parametric statistical inference (test) and its comparison with parametric statistical inference.</li> <li>2. Concept of distribution free statistic.</li> </ol>
Month- April-May				
Lectures 13	Practicals 80	Total 93	Unit-4 Non – Parametric Test	<ol style="list-style-type: none"> <li>3. Some non-parametric tests: Run test, Sign test, Wilcoxon's signed rank test, Mann-Whitney U –test, Median test, and Kolmogorov Smirnov test</li> </ol>

Name & Signature of Teacher

Makandar A.M



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B.Sc. Part-III

Semester VI

Department -Statistics

Subject - Statistics

Course -DSE1004F3

**Paper No. XV: Design of Experiment**

Name of teacher – Pawar V. V.

Month- November -December			Module/Unit	Sub-units planned
Lectures 13	Practicals 100	Total 113	Unit-1 Simple Design of Experiment I	<ol style="list-style-type: none"> <li>1. Basic terms in design of experiments,</li> <li>2. Principles of design of experiments</li> <li>3. Completely Randomized Design (CRD)</li> </ol>
Month- January				
Lectures 12	Practicals 70	Total 82	Unit-2 Simple Design of Experiment II	<ol style="list-style-type: none"> <li>1. Randomized Block Design (RBD)</li> <li>2. Latin Square Design (LSD)</li> <li>3. Missing plot technique for RBD and LSD</li> <li>4. Identification of real life situations where CRD, RBD and LSD are used.</li> </ol>
Month- February				
Lectures 12	Practicals 80	Total 92	Unit-3 Efficiency of design and ANOCOVA	<ol style="list-style-type: none"> <li>1. Efficiency of design</li> <li>2. Analysis of Covariance (ANOCOVA) with one concomitant variable: Purpose of ANOCOVA</li> <li>3. Practical situations</li> <li>4. Estimation of parameters</li> </ol>
Month- March				
Lectures 10	Practicals 80	Total 90	Unit-4 Factorial Experiment	<ol style="list-style-type: none"> <li>1. Concept of factorial experiments</li> <li>2. Definitions of main effects and interaction effects</li> </ol>
Month- April-May				
Lectures 14	Practicals 80	Total 94	Unit-4 Factorial Experiment	<ol style="list-style-type: none"> <li>3. ANOVA for <math>2^2</math> and <math>2^3</math> factorial experiments arranged in RBD.</li> <li>4. Total confounding and Partial Confounding</li> </ol>

Name & Signature of Teacher

*Ms. V.V. Pawar*



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Ms. V. V. Pawar

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Annual Teaching Plan

Academic year 2023 -2024

B.Sc. Part-III

Semester VI

Department -Statistics

Subject - Statistics

Course -DSE1004F4

**Paper No. XVI: Quality Management**

Name of teacher – Tangawade. A. S.

Month- November -December			Module/Unit	Sub-units planned
Lectures 13	Practicals 15	Total 28	Unit-1 Quality Tools	1. Meaning and dimensions of quality 2. Seven magnificent tools of quality 3. Deming's PDCA cycle and its applications.
Month-January				
Lectures 14	Practicals 25	Total 39	Unit-1 Process Control	4. CUSUM chart, tabular form, 5. Moving average and exponentially weighted moving average charts. 6. Six-sigma methodology, 7. DMAIC cycle and case studies
Month-February				
Lectures 11	Practicals 20	Total 31	Unit-2 Product Control	1. Sampling Inspection plans for attribute inspection: Concept of AQL, LTPD, Consumer's risk, and producer's risk, AOQ, AOQL, OC, ASN and ATI.
Month- March				
Lectures 12	Practicals 20	Total 32	Unit-2 Product Control	2. Single and double sampling plans
Month- April-May				
Lectures 11	Practicals 30	Total 41	Unit-2 Product Control	3. Sequential Sampling 4. Continuous sampling plans

*Atish*

Name & Signature of Teacher

*(Tangawade Atish S.)*



*V. V. Pawar*

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Academic year 2023 -2024

B.Sc. Part-III

Semester VI

Department -Statistics

Subject - Statistics

**Practical Paper IV: Probability Distributions and R-Software**

Name of teacher –Dr. Kumbhar R.R.

Month- November -December			Practicals planned
Lectures -	Practicals 15	Total 15	10. Application of multinomial distribution. 11. Application of bivariate normal distribution.
Month- January			
Lectures -	Practicals 20	Total 20	12. Computation of probabilities of type I and type II errors and power of a test using R- Software. 13. Model sampling from log-normal and Weibull distributions using R- Software
Month- February			
Lectures -	Practicals 20	Total 20	14. Model sampling from logistic distribution using R-Software. 15. Fitting of Binomial and Poisson distribution using R-Software
Month- March			
Lectures -	Practicals 15	Total 15	16. Fitting of Normal distribution using R-Software.
Month- April-May			
Lectures -	Practicals 35	Total 35	17. Fitting of log-normal distribution using R-Software 18. Analysis of Completely Randomized Design (CRD) & Randomized Block Design (RBD using R-Software.

*R.R.*  
Name & Signature of Teacher  
(Dr. R. R. Kumbhar)



*V.P.*  
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Annual Teaching Plan

Academic year 2023 -2024

B. Com. Part – I

Semester I

Department -Statistics

Subject - Statistics

Course- SEC02STA11

**Paper I- Business Statistics I**

Name of teacher – Patil R.M.

Month-July			Module/Unit	Sub-units planned
Lectures 17	Practicals BSc-I 16	Total 33	Unit-1 Introduction to Statistics & Sampling Techniques	1. Meaning and scope of Statistics. 2. Basic terms 3. Diagrammatic Representation of Data 4. Graphical Representation of Data 5. Illustrative Examples
Month-August				
Lectures 17	Practicals 20	Total 37	Unit-1 Introduction to Statistics & Sampling Techniques	6. Definitions 7. Sample Survey 8. Methods of Sampling
Month-September				
Lectures 18	Practicals 12	Total 40	Unit-2 Measures of Central Tendency & Dispersion	1. 1.Concept of central tendency, Mean, median and mode, 2. Partition values 3. Empirical relation 4. Examples 5. Merits and Demerits of Mean, Median and Mode.
			Unit-2 Measures of Central Tendency & Dispersion	6. Concept of Dispersion 7. Absolute and Relative measures of dispersion. 8. Range, Coefficient of Range, 9. Quartile Deviation (Q.D.), Coefficient of Q.D., M.D. about Mean, Coefficient of M.D. about mean 10. Numerical Examples.
Month- October-November				
Lectures 16	Practicals 16	Total 32	Unit-2 Measures of Central Tendency & Dispersion	11. Standard Deviation (S.D.) 12. Variance, Coefficient of Variation, (C.V.), 13. Combined S.D. for two groups. 14. Merits and Demerits of Range, Q.D., M.D. and S.D. 15. Numerical Examples.

Name & Signature of Teacher

Patil R.M.



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Annual Teaching Plan

Academic year 2023 -2024

B. Com. Part – I Semester I

Department -Statistics

Subject - Statistics

Course SEC02STA11

**Paper I- Business Statistics I**

Name of teacher – Pawar A. A.

Month-July			Module/Unit	Sub-units planned
Lectures 17	Practicals —	Total 17	Unit-1 Introduction to Statistics & Sampling Techniques	1. Meaning and scope of Statistics. 1. Basic terms 2. Diagrammatic Representation of Data 3. Graphical Representation of Data 4. Illustrative Examples
Month-August				
Lectures 18	Practicals —	Total 18	Unit-1 Introduction to Statistics & Sampling Techniques	5. Definitions 6. Sample Survey 7. Methods of Sampling
Month-September				
Lectures 17	Practicals —	Total 17	Unit-2 Measures of Central Tendency & Dispersion	1. 1. Concept of central tendency, Mean, median and mode, 2. Partition values 3. Empirical relation 4. Examples 5. Merits and Demerits of Mean, Median and Mode.
			Unit-2 Measures of Central Tendency & Dispersion	6. Concept of Dispersion 7. Absolute and Relative measures of dispersion. 8. Range, Coefficient of Range, 9. Quartile Deviation (Q.D.), Coefficient of Q.D., M.D. about Mean, Coefficient of M.D. about mean 10. Numerical Examples.
Month- October-November				
Lectures 16	Practicals —	Total 16	Unit-2 Measures of Central Tendency & Dispersion	11. Standard Deviation (S.D.) 12. Variance, Coefficient of Variation, (C.V.), 13. Combined S.D. for two groups. 14. Merits and Demerits of Range, Q.D., M.D. and S.D. 15. Numerical Examples.

Name & Signature of Teacher

Pawar Ajit A.



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Annual Teaching Plan

Academic year 2023 -2024

B. Com. Part – I Semester II

Department -Statistics

Subject - Statistics

Course- SEC02STA11

**Paper II- Business Statistics – II**

Name of teacher – Patil R.M.

Month-December			Module/Unit	Sub-units planned
Lectures 17	Practicals BSc-I 16	Total 33	Unit-1 Probability and Discrete Probability Distributions	<ol style="list-style-type: none"> <li>1. Basic concepts in probability</li> <li>2. Conditional probability.</li> <li>3. Random variable, Probability mass function, cumulative distribution function</li> <li>4. Expectation of r.v</li> </ol>
Month-January				
Lectures 16	Practicals 16	Total 32	Unit-1 Probability and Discrete Probability Distributions	<ol style="list-style-type: none"> <li>5. Binomial distribution: Properties and examples</li> <li>6. Poisson distribution: Properties and examples</li> <li>7. Numerical examples.</li> </ol>
Month-February				
Lectures 16	Practicals 12	Total 28	Unit-2 Statistical Quality Control (S.Q.C.):	<ol style="list-style-type: none"> <li>1. Concept and need of S.Q.C.</li> <li>2. Advantages of S.Q.C.</li> </ol>
Month- March				
Lectures 15	Practicals 16	Total 31	Unit-2 Statistical Quality Control (S.Q.C.):	<ol style="list-style-type: none"> <li>3. Chance and assignable causes, process control and product control.</li> <li>4. Control chart and its construction.</li> </ol>
Month- April-May				
Lectures 16	Practicals 16	Total 32	Unit-2 Statistical Quality Control (S.Q.C.):	<ol style="list-style-type: none"> <li>5. Control charts for variable: Mean and range chart.</li> <li>6. Control charts for attribute</li> <li>7. Numerical examples.</li> </ol>

Name & Signature of Teacher

Patil R. M.



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Annual Teaching Plan

Academic year 2023 -2024

B. Com. Part – I Semester II

Department -Statistics

Subject - Statistics

Course- SEC02STA11

**Paper II- Business Statistics – II**

Name of teacher – Pawar A. A.

Month-December			Module/Unit	Sub-units planned
Lectures 16	Practicals —	Total 16	Unit-1 Probability and Discrete Probability Distributions	<ol style="list-style-type: none"> <li>1. Basic concepts in probability</li> <li>2. Conditional probability.</li> <li>3. Random variable, Probability mass function, cumulative distribution function</li> <li>4. Expectation of r.v</li> </ol>
Month-January				
Lectures 18	Practicals —	Total 18	Unit-1 Probability and Discrete Probability Distributions	<ol style="list-style-type: none"> <li>5. Binomial distribution: Properties and examples</li> <li>6. Poisson distribution: Properties and examples</li> <li>8. Numerical examples.</li> </ol>
Month-February				
Lectures 16	Practicals —	Total 16	Unit-2 Statistical Quality Control (S.Q.C.):	<ol style="list-style-type: none"> <li>1. Concept and need of S.Q.C.</li> <li>2. Advantages of S.Q.C.</li> <li>3. Chance and assignable causes, process control and product control.</li> </ol>
Month- March				
Lectures 16	Practicals —	Total 16	Unit-2 Statistical Quality Control (S.Q.C.):	<ol style="list-style-type: none"> <li>4. Control chart and its construction.</li> <li>5. Control charts for variable: Mean and range chart.</li> <li>6. Control charts for attribute</li> <li>7. Numerical examples.</li> </ol>
Month- April-May				
Lectures 15	Practicals —	Total 15	Unit-2 Statistical Quality Control (S.Q.C.):	<ol style="list-style-type: none"> <li>8. Control charts for attribute</li> <li>9. Numerical examples.</li> </ol>

Name & Signature of Teacher

Pawar Ajit A.



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Annual Teaching Plan

Academic year 2023 -2024

B.Com. Part-II

Semester III

Department -Statistics

Subject - Statistics

Course - CC - 1051 C

**Paper I- Business Statistics I**

Name of teacher – Makandar A. M.

Month-July			Module/Unit	Sub-units planned
Lectures 17	Practicals -	Total 17	Unit-1 Introduction to Statistics & Sampling Techniques	<ol style="list-style-type: none"> <li>1. Meaning and scope of statistics</li> <li>2. Graphical representation, types of data.</li> <li>3. Sampling Techniques</li> </ol>
Month-August				
Lectures 17	Practicals -	Total 17	Unit-2 Measures of Central Tendency	<ol style="list-style-type: none"> <li>1. Concept of central tendency, Mean median and mode,</li> <li>2. Partition values</li> <li>3. Empirical relation</li> <li>4. Examples</li> </ol>
Month-September				
Lectures 16	Practicals -	Total 16	Unit-3 Measures of Dispersion	<ol style="list-style-type: none"> <li>1. Concept of dispersion and its types</li> <li>2. Coefficient of variation</li> <li>3. Examples.</li> </ol>
			Unit-4 Analysis of Bivariate Data	<ol style="list-style-type: none"> <li>1. Correlation: Definition, Types of correlation</li> <li>2. Methods of studying correlation</li> <li>3. Illustrative examples.</li> </ol>
Month- October-November				
Lectures 18	Practicals -	Total 18	Unit-4 Analysis of Bivariate Data	<ol style="list-style-type: none"> <li>4. Concept of regression</li> <li>5. Lines of regression</li> <li>6. Regression coefficients and its Properties</li> <li>7. Illustrative Examples.</li> </ol>

*Ashwani*

Name & Signature of Teacher

Makandar A.M.



*V. V. Pawar*

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Annual Teaching Plan

Academic year 2023 -2024

B.Com. Part-II

Semester III

Department -Statistics

Subject - Statistics

Course - CC - 1051 C

**Paper I- Business Statistics I**

Name of teacher – Ransubhe. P.V.

Month-July			Module/Unit	Sub-units planned
Lectures 34	Practicals BSc-I 16	Total 50	Unit-1 Introduction to Statistics & Sampling Techniques	<ol style="list-style-type: none"> <li>1. Meaning and scope of statistics</li> <li>2. Graphical representation, types of data.</li> <li>3. Sampling Techniques</li> </ol>
Month-August				
Lectures 34	Practicals 20	Total 54	Unit-2 Measures of Central Tendency	<ol style="list-style-type: none"> <li>1. Concept of central tendency, Mean median and mode,</li> <li>2. Partition values</li> <li>3. Empirical relation</li> <li>4. Examples</li> </ol>
Month-September				
Lectures 32	Practicals 20	Total 52	Unit-3 Measures of Dispersion	<ol style="list-style-type: none"> <li>1. Concept of dispersion and its types</li> <li>2. Coefficient of variation</li> <li>3. Examples.</li> </ol>
			Unit-4 Analysis of Bivariate Data	<ol style="list-style-type: none"> <li>1. Correlation: Definition, Types of correlation</li> <li>2. Methods of studying correlation</li> <li>3. Illustrative examples.</li> </ol>
Month- October- November				
Lectures 36	Practicals 20	Total 56	Unit-4 Analysis of Bivariate Data	<ol style="list-style-type: none"> <li>4. Concept of regression</li> <li>5. Lines of regression</li> <li>6. Regression coefficients and its Properties</li> <li>7. Illustrative Examples.</li> </ol>

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P.V.R

Name & Signature of Teacher

Pallavi V. Ransubhe.



Ms. V. V. Pawar

Ms. V. V. Pawar

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Annual Teaching Plan

Academic year 2023 -2024

B.Com. Part-II Semester IV

Department -Statistics

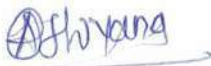
Subject - Statistics

Course - CC - 1051 D

**Paper II Business Statistics – II**

Name of teacher – Makandar A. M.

Month- November -December			Module/Unit	Sub-units planned
Lectures 18	Practicals -	Total 18	Unit-1 Probability and probability distributions	9. Basic concepts in probability 10. Binomial distribution: Properties and examples 11. Poisson distribution: Properties and examples
Month-January				
Lectures 18	Practicals -	Total 18	Unit-1 Probability and probability distributions  Unit-2 Time Series	12. Normal distribution: Properties and examples 13. Definition, uses and components of time series 14. Methods of determination of trend 15. Numerical examples
Month-February				
Lectures 16	Practicals -	Total 16	Unit-3 Index Number	1. Meaning and construction of index numbers 2. Types of index numbers 3. Simple and weighted index number. 4. Laspeyre's, Paasche's and Fisher's index numbers. 5. Numerical examples
Month- March				
Lectures 16	Practicals -	Total 16	Unit-4 Statistical Quality Control	1. Introduction to SQC, Process control, Product control 2. Control charts for variables
Month- April-May				
Lectures 16	Practicals -	Total 16	Unit-4 Statistical Quality Control	3. Control charts for Attributes 4. Examples



Name & Signature of Teacher

Makandar A.M





Ms. V. V. Pawar

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Annual Teaching Plan

Academic year 2023 -2024

B.Com. Part-II

Semester IV

Department -Statistics

Subject - Statistics

Course - CC - 1051 D

**Paper II Business Statistics – I**

Name of teacher – Ransubhe. P.V.

Month- November -December			Module/Unit	Sub-units planned
Lectures 36	Practicals 20	Total 56	Unit-1 Probability and probability distributions	<ol style="list-style-type: none"> <li>1. Basic concepts in probability</li> <li>2. Binomial distribution: Properties and examples</li> <li>3. Poisson distribution: Properties and examples</li> </ol>
Month-January				
Lectures 36	Practicals 20	Total 56	Unit-1 Probability and probability distributions  Unit-2 Time Series	<ol style="list-style-type: none"> <li>4. Normal distribution: Properties and examples</li> <li>5. Definition, uses and components of time series</li> <li>6. Methods of determination of trend</li> <li>7. Numerical examples</li> </ol>
Month-February				
Lectures 36	Practicals 16	Total 52	Unit-3 Index Number	<ol style="list-style-type: none"> <li>1. Meaning and construction of index numbers</li> <li>2. Types of index numbers</li> <li>3. Simple and weighted index number.</li> <li>4. Laspeyre's, Paasche's and Fisher's index numbers.</li> <li>5. Numerical examples</li> </ol>
Month- March				
Lectures 32	Practicals 16	Total 48	Unit-4 Statistical Quality Control	<ol style="list-style-type: none"> <li>1. Introduction to SQC, Process control, Product control</li> <li>2. Control charts for variables</li> </ol>
Month- April-May				
Lectures 32	Practicals 16	Total 48	Unit-4 Statistical Quality Control	<ol style="list-style-type: none"> <li>3. Control charts for Attributes</li> <li>4. Examples</li> </ol>

Name & Signature of Teacher

*P.V.R.*  
Pallavi V. Ransubhe



*V.Pawar*  
Ms. V. V. Pawar

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(EMPOWERED AUTONOMOUS)

Annual Teaching Plan

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M.Sc. Part-I

Semester I

Department -Statistics

Subject - Statistics

Course - DSC17STA11/ DSC18STA11

**DISTRIBUTION THEORY**

Name of teacher – Pandhare R.S.

Month-July			Module/Unit		Sub-units planned
Lectures 16	Practicals 16	Total 32	Unit-1 experiment	Random	1. Review of Random experiment 2. Discrete random variables, continuous random variables. 3. Cumulative distribution function (CDF), properties of CDF.
Month-August					
Lectures 18	Practicals 16	Total 34	Unit -1 experiment	Random	4. Computation of probabilities of events using CDF, quantiles 5. absolutely continuous and discrete distributions 6. Mixtures of probability distributions 7. Decomposition of mixture CDF into discrete and continuous CDFs 8. expectation and variance of mixture distributions.
			Unit-2 Transformation		1. Transformations of univariate random variables 2. probability integral transformation.
Month-September					
Lectures 17	Practicals 16	Total 33	Unit-2 Transformation		3. Concepts of location, scale and shape parameters of distributions with examples. 4. Symmetric distributions and their properties. 5. Moment inequalities
			Unit-3 Random vectors		1. Random vectors, joint distributions, Independence, variance-covariance matrix, joint MGF. Conditional expectation and variances, 2. Transformations of bivariate random variables, Poisson distribution. 3. Convolutions, compound distributions.
Month- October-November					
Lectures 17	Practicals 16	Total 33	Unit-4 Sampling distributions		1. Sampling distributions of statistics from univariate normal random samples. 2. Distributions of linear and quadratic forms involving normal random variables 3. Fisher Cochran and related theorems. 4. Distribution of an order statistics.

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Name & Signature of Teacher

Pandhare.R.S.



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Semester I

Department -Statistics

Subject - Statistics

Course - DSC17STA12/ DSC18STA12

**ESTIMATION THEORY**

Name of teacher – Bhosale A.B.

Month-July			Module/Unit	Sub-units planned
Lectures 17	Practicals 16	Total 33	Unit-1 Sufficiency, Completeness	<ol style="list-style-type: none"> <li>1. Sufficiency principle, minimal sufficient statistic for exponential family, Pitman family.</li> <li>2. Completeness, bounded completeness, ancillary statistics, Basu's theorem and applications.</li> </ol>
Month-August				
Lectures 17	Practicals 20	Total 37	Unit-2 Point estimation, Rao- Blackwell theorem and Lehmann-Scheffe theorem	<ol style="list-style-type: none"> <li>1. Problem of point estimation,</li> <li>2. Unbiased estimators, minimum variance unbiased estimator,</li> <li>3. Rao- Blackwell theorem and Lehmann-Scheffe theorem and their uses.</li> </ol>
Month-September				
Lectures 16	Practicals 12	Total 28	Unit-2 MVUE, Cramer- Rao inequality, Chapman- Robinson bounds, Bhattacharya bounds	<ol style="list-style-type: none"> <li>4. Necessary and sufficient condition for MVUE and their applications.</li> <li>5. Fisher information and information matrix, Cramer- Rao inequality, Chapman-Robinson bounds,</li> <li>6. Bhattacharya bounds, their applications.</li> </ol>
			Unit-3 MLE, Method of moments, minimum Chi square. U-Statistics	<ol style="list-style-type: none"> <li>1. Method of maximum likelihood (MLE) and small sample properties of MLE</li> <li>2. Method of scoring and application to estimation in multinomial distribution. MLE in non-regular families.</li> <li>3. Other methods of estimation: method of moments, minimum Chi square. U-Statistics</li> </ol>
Month- October-November				
Lectures 17	Practicals 16	Total 33	Unit-4 Asymptotic estimation	<ol style="list-style-type: none"> <li>1. Consistency of an estimator</li> <li>2. Consistent and Asymptotic Normal (CAN) Estimators</li> <li>3. Methods of constructing CAN estimators</li> <li>4. BAN estimators</li> </ol>

*A.B. Bhosale*

Name & Signature of Teacher

(Bhosale A.B.)



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Semester I

Department -Statistics

Subject - Statistics

Course - DSC17STA13/ DSC18STA13

**STATISTICAL COMPUTING**

Name of teacher – Makandar A. M.

Month-July			Module/Unit	Sub-units planned
Lectures 16	Practicals 16	Total 32	Unit-1 MSEXCEL	1. MSEXCEL: Introduction 2. Data manipulation using EXCEL
Month-August				
Lectures 16	Practicals 16	Total 32	Unit-1 MSEXCEL	3. Working with Multiple Worksheets and Workbooks 4. Lookup functions 5. Excel add-ins: analysis tool pack, Pivot tables and charts.
Month-September				
Lectures 20	Practicals 20	Total 40	Unit-2 R-software	1. R-software: Introduction to R, data types and objects, operators 2. Built in functions
Month- October-November				
Lectures 17	Practicals 20	Total 37	Unit-2 R-software	3. Saving work in R. Matrix algebra. 4. Built in functions: lm, t.test, prop.test, wilcox.test, ks.test, 5. Control statements. Programming, user defined functions, Rpackages. R-studio.

*Ashyana*

Name & Signature of Teacher

*Makandar A.M*



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Semester I

Department -Statistics

Subject - Statistics

Course - RMD17STA11/ RMD18STA11

**Research Methodology**

Name of teacher – Bhosale A. K.

Month-July			Module/Unit		Sub-units planned
Lectures 17	Practicals 32	Total 49	Unit-1 research	Meaning of	<ol style="list-style-type: none"> <li>1. Meaning of research, objectives of research</li> <li>2. Motivation in research, types of research, research approaches</li> </ol>
Month-August					
Lectures 18	Practicals 36	Total 54	Unit -1 research	Meaning of	<ol style="list-style-type: none"> <li>3. Significance of research, research methods vs. methodology, research and Scientific method, research process</li> <li>4. Criteria of good research, defining research problem, research design</li> <li>5. Research Ethics, publication of research, Plagiarism</li> </ol>
			Unit-2 techniques	Sampling	<ol style="list-style-type: none"> <li>1. Sampling techniques</li> <li>2. Two phase sampling, ratio and regression method of estimation</li> </ol>
Month-September					
Lectures 14	Practicals 32	Total 46	Unit-2 techniques	Sampling	<ol style="list-style-type: none"> <li>3. Probability proportional to size sampling</li> <li>4. Non-sampling errors, Hansen–Horwitz and Demings model for the effect of call-backs</li> <li>5. Warners model, MLE in Warners model</li> </ol>
			Unit-3 Simulation		<ol style="list-style-type: none"> <li>1. Concept and need of simulation, requisites of a good random number generator</li> <li>2. Algorithms for generating random numbers</li> <li>3. Acceptance-Rejection Technique</li> </ol>
Month- October-November					
Lectures 17	Practicals 36	Total 53	Unit-4 methods	Resampling	<ol style="list-style-type: none"> <li>1. Resampling methods: Bootstrap methods, Jackknife method</li> <li>2. Newton-Raphson method, bisection method, quadrature formula, trapezoidal rule and Simpson's rules for single integral.</li> </ol>

*Ashu*

Name & Signature of Teacher

Miss. Bhosale Aishwarya



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Semester I

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Subject - Statistics

Course - DSE17STA11

**Mathematical Statistics**

Name of teacher – Pawar A.A.

Month-July			Module/Unit	Sub-units planned
Lectures 17	Practicals 16	Total 33	Unit-1	<ol style="list-style-type: none"> <li>Sequences of real numbers, Convergence, divergence, monotone</li> <li>Limit points, Limit inferior and limit superior of the sequences and their properties.</li> </ol>
Month-August				
Lectures 17	Practicals 16	Total 33	Unit -1	<ol style="list-style-type: none"> <li>Subsequence and properties</li> <li>Series of numbers, tests for convergence test for absolute convergence</li> </ol>
			Unit-2	<ol style="list-style-type: none"> <li>Real valued functions, continuous functions, Uniform continuity of functions and sequences of functions.</li> <li>Riemann, Riemann-Stieltjes Integrals and their common properties.</li> </ol>
Month-September				
Lectures 15	Practicals 20	Total 35	Unit-2	<ol style="list-style-type: none"> <li>Maxima, minima of functions of several variables. Constrained maxima, minima, Lagrange's method, Taylor's theorem.</li> <li>Theorem on differentiation under integral sign and Leibnitz rule (statements only) with applications.</li> </ol>
			Unit-3	<ol style="list-style-type: none"> <li>Vectors, linear dependence and independence of vectors, example</li> <li>Gram-Schmidt orthogonalization process, Orthonormal basis, Linear transformations, types of matrices</li> <li>Cayley-Hamilton theorem and its applications.</li> </ol>
Month- October- November				
Lectures 17	Practicals 20	Total 37	Unit-4	<ol style="list-style-type: none"> <li>Generalized inverse, Vector and Matrix differentiation, Spectral decomposition of a real symmetric matrix.</li> <li>Cholesky decomposition, real quadratic forms, reduction and classification.</li> <li>Index and signature, extrema of a quadratic form, simultaneous reduction of two quadratic forms..</li> </ol>

*Pawar A.A.*  
Name & Signature of Teacher

*Pawar Ajit A.*



*Pawar*  
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Semester I

Department -Statistics

Subject - Statistics

Course - DSE18STA11

**FUNDAMENTALS OF COMPUTER PROGRAMMING**

Name of teacher – Dinde M.P.

Month- July			Module/Unit	Sub-units planned
Lectures 17	Practicals -	Total 17	Unit-1	1. Overview of Computer programming 2. Algorithms 3. Flow charts 4. Fundamentals of C programming
Month- August				
Lectures 17	Practicals -	Total 17	Unit -2	1. Control Structures 2. Structured programming 3. Examples
Month- September				
Lectures 15	Practicals -	Total 15	Unit-3	1. Arrays 2. Pointers 3. Examples 4. Dynamic Memory Allocations using MALLOC, CALLOC and REALLOC.
Month- October- November				
Lectures 17	Practicals -	Total 17	Unit-4	1. Structures and Union 2. Operations on file using C Library Functions

*Dinde M.P.*  
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Ms. M.P. Dinde



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CASH  
2023/24-25-26/27/28/29/30/31/32/33/34/35/36/37/38/39/40/41/42/43/44/45/46/47/48/49/50/51/52/53/54/55/56/57/58/59/60/61/62/63/64/65/66/67/68/69/70/71/72/73/74/75/76/77/78/79/80/81/82/83/84/85/86/87/88/89/90/91/92/93/94/95/96/97/98/99/100/101/102/103/104/105/106/107/108/109/110/111/112/113/114/115/116/117/118/119/120/121/122/123/124/125/126/127/128/129/130/131/132/133/134/135/136/137/138/139/140/141/142/143/144/145/146/147/148/149/150/151/152/153/154/155/156/157/158/159/160/161/162/163/164/165/166/167/168/169/170/171/172/173/174/175/176/177/178/179/180/181/182/183/184/185/186/187/188/189/190/191/192/193/194/195/196/197/198/199/200/201/202/203/204/205/206/207/208/209/210/211/212/213/214/215/216/217/218/219/220/221/222/223/224/225/226/227/228/229/230/231/232/233/234/235/236/237/238/239/240/241/242/243/244/245/246/247/248/249/250/251/252/253/254/255/256/257/258/259/260/261/262/263/264/265/266/267/268/269/270/271/272/273/274/275/276/277/278/279/280/281/282/283/284/285/286/287/288/289/290/291/292/293/294/295/296/297/298/299/300/301/302/303/304/305/306/307/308/309/310/311/312/313/314/315/316/317/318/319/320/321/322/323/324/325/326/327/328/329/330/331/332/333/334/335/336/337/338/339/340/341/342/343/344/345/346/347/348/349/350/351/352/353/354/355/356/357/358/359/360/361/362/363/364/365/366/367/368/369/370/371/372/373/374/375/376/377/378/379/380/381/382/383/384/385/386/387/388/389/390/391/392/393/394/395/396/397/398/399/400/401/402/403/404/405/406/407/408/409/410/411/412/413/414/415/416/417/418/419/420/421/422/423/424/425/426/427/428/429/430/431/432/433/434/435/436/437/438/439/440/441/442/443/444/445/446/447/448/449/450/451/452/453/454/455/456/457/458/459/460/461/462/463/464/465/466/467/468/469/470/471/472/473/474/475/476/477/478/479/480/481/482/483/484/485/486/487/488/489/490/491/492/493/494/495/496/497/498/499/500/501/502/503/504/505/506/507/508/509/510/511/512/513/514/515/516/517/518/519/520/521/522/523/524/525/526/527/528/529/530/531/532/533/534/535/536/537/538/539/540/541/542/543/544/545/546/547/548/549/550/551/552/553/554/555/556/557/558/559/560/561/562/563/564/565/566/567/568/569/570/571/572/573/574/575/576/577/578/579/580/581/582/583/584/585/586/587/588/589/590/591/592/593/594/595/596/597/598/599/600/601/602/603/604/605/606/607/608/609/610/611/612/613/614/615/616/617/618/619/620/621/622/623/624/625/626/627/628/629/630/631/632/633/634/635/636/637/638/639/640/641/642/643/644/645/646/647/648/649/650/651/652/653/654/655/656/657/658/659/660/661/662/663/664/665/666/667/668/669/670/671/672/673/674/675/676/677/678/679/680/681/682/683/684/685/686/687/688/689/690/691/692/693/694/695/696/697/698/699/700/701/702/703/704/705/706/707/708/709/710/711/712/713/714/715/716/717/718/719/720/721/722/723/724/725/726/727/728/729/730/731/732/733/734/735/736/737/738/739/740/741/742/743/744/745/746/747/748/749/750/751/752/753/754/755/756/757/758/759/760/761/762/763/764/765/766/767/768/769/770/771/772/773/774/775/776/777/778/779/780/781/782/783/784/785/786/787/788/789/790/791/792/793/794/795/796/797/798/799/800/801/802/803/804/805/806/807/808/809/810/811/812/813/814/815/816/817/818/819/820/821/822/823/824/825/826/827/828/829/830/831/832/833/834/835/836/837/838/839/840/841/842/843/844/845/846/847/848/849/850/851/852/853/854/855/856/857/858/859/860/861/862/863/864/865/866/867/868/869/870/871/872/873/874/875/876/877/878/879/880/881/882/883/884/885/886/887/888/889/890/891/892/893/894/895/896/897/898/899/900/901/902/903/904/905/906/907/908/909/910/911/912/913/914/915/916/917/918/919/920/921/922/923/924/925/926/927/928/929/930/931/932/933/934/935/936/937/938/939/940/941/942/943/944/945/946/947/948/949/950/951/952/953/954/955/956/957/958/959/960/961/962/963/964/965/966/967/968/969/970/971/972/973/974/975/976/977/978/979/980/981/982/983/984/985/986/987/988/989/990/991/992/993/994/995/996/997/998/999/1000



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M.Sc. Part-I

Semester II

Department -Statistics

Subject - Statistics

Course - DSC17STA21/ DSC18STA21

**Linear Models and Regression Analysis.**

Name of teacher – Bhosale A.K.

Month- November-December			Module/Unit	Sub-units planned
Lectures 16	Practicals 36	Total 52	Unit-1	<ol style="list-style-type: none"> <li>1. General linear model</li> <li>2. Guass Markov theorem, variances and Covariance of BLUEs,</li> <li>3. Distribution of quadratic forms for normal variables</li> </ol>
Month- January				
Lectures 18	Practicals 28	Total 46	Unit-2	<ol style="list-style-type: none"> <li>1. Multiple regression model, Least squares estimate, Properties of LSE,</li> <li>2. Hypothesis testing</li> <li>3. Model adequacy checking.</li> <li>4. Transformations to correct model inadequacies</li> </ol>
Month- February				
Lectures 15	Practicals 28	Total 43	Unit-3	<ol style="list-style-type: none"> <li>1. Multicollinearity.</li> <li>2. Autocorrelation</li> <li>3. Parameter estimation using Cochrane-Orcutt method.</li> <li>4. Variable Selection Procedures</li> </ol>
Month- March				
Lectures 15	Practicals 28	Total 43	Unit-4	<ol style="list-style-type: none"> <li>1. Robust Regression: breakdown and efficiency.</li> <li>2. Asymptotic distribution of M-estimator).</li> </ol>
Month- April-May				
Lectures 16	Practicals 32	Total 48	Unit-4	<ol style="list-style-type: none"> <li>3. Nonlinear Regression Models: nonlinear least squares</li> <li>4. Transformation to a linear model</li> </ol>

*Ashku*

Name & Signature of Teacher

Miss .Bhosale Aishwarya



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Semester II

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Subject - Statistics

Course- DSC17STA22/ DSC18STA22

**THEORY OF TESTING OF HYPOTHESIS**

Name of teacher – Bhosale A.B.

Month- November-December			Module/Unit	Sub-units planned
Lectures 17	Practicals 16	Total 33	Unit-1	<ol style="list-style-type: none"> <li>1. Problem of testing of Hypothesis, Simple and composite hypotheses.</li> <li>2. Randomized and non- randomized tests, most powerful test, Neyman-Pearson Lemma and its applications.</li> <li>3. Determination of minimum sample size to achieve the desired strengths.</li> </ol>
Month- January				
Lectures 18	Practicals 16	Total 34	Unit -1	<ol style="list-style-type: none"> <li>4. Monotone likelihood ratio property, UMP test, power function of a test, existence of UMP.</li> <li>5. Tests for one-sided alternatives. Concept of p-value.</li> </ol>
			Unit-2	<ol style="list-style-type: none"> <li>1. UMP tests for two sided alternatives examples, their existence and non- existence.</li> <li>2. Generalized Neyman Pearson lemma, unbiased test.</li> </ol>
Month- February				
Lectures 16	Practicals 12	Total 28	Unit-2	<ol style="list-style-type: none"> <li>3. UMPU test and their existence in the case of exponential families (Statements of the theorems only).</li> <li>4. Similar tests, test with Neyman structure.</li> </ol>
			Unit-3	<ol style="list-style-type: none"> <li>1. Problem of confidence intervals</li> <li>2. UMA and UMAU confidence intervals.</li> </ol>
Month- March				
Lectures 16	Practicals 16	Total 32	Unit-4	<ol style="list-style-type: none"> <li>1. Likelihood ratio test and its application to standard distribution.</li> <li>2. Goodness of fit tests based on Chi-square distribution</li> <li>3. Spearman's Rank Correlation Test; Kendall's Rank Correlation Test; Kruskal-Wallis Test; Fridman's Two-way analysis of variance by ranks.</li> </ol>
Month- April-May				
Lectures 17	Practicals 16	Total 33	Unit-4	<ol style="list-style-type: none"> <li>4. Spearman's Rank Correlation Test; Kendall's Rank Correlation Test</li> <li>5. Kruskal-Wallis Test; Fridman's Two-way analysis of variance by ranks.</li> </ol>

*A. B. Bhosale*  
 Name & Signature of Teacher  
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Semester II

Department -Statistics

Subject - Statistics

Course - DSC17STA23/ DSC18STA23

**Multivariate Analysis**

Name of teacher – Pandhare R. S.

Month- November-December			Module/Unit	Sub-units planned
Lectures 17	Practicals 20	Total 37	Unit-1	1. Review of Multivariate Normal distribution 2. Hotelling's $T^2$ Statistic, and its null distribution. Applications of $T^2$ statistics 3. Mahalanobis' $D^2$ statistic
Month- January				
Lectures 16	Practicals 12	Total 28	Unit -1	4. Wishart matrix and its distribution 5. Properties of Wishart distribution, distribution of generalized variance.
Month- February				
Lectures 15	Practicals 20	Total 35	Unit-2	1. Discrimination and classification. Fisher's discriminant function and likelihood ratio procedure, minimum ECM rule 2. Rao's U statistics and its use in tests associated with discriminant function,
Month- March				
Lectures 14	Practicals 12	Total 26	Unit-2	3. Classification with three populations. 4. Cluster analysis
Month- April-May				
Lectures 17	Practicals 16	Total 33	Unit-2	5. Heirarchical methods: Single, Complete, average linkage method 6. Principal component analysis

*Pandhare R.S.*

Name & Signature of Teacher

Pandhare. R.S.



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Semester II

Department -Statistics

Subject - Statistics

Course - DSE 17STA21

**PROBABILITY THEORY**

Name of teacher – Pawar A.A.

Month- November- December			Module/Unit	Sub-units planned
Lectures 16	Practicals 20	Total 36	Unit-1	1. Classes of sets 2. Probability measure, Probability space.
Month- January				
Lectures 16	Practicals 16	Total 32	Unit -2	1. Measurable function, random variable, distribution function of a random variable, 2. simple randomvariable 3. Method of obtaining a random variable as a limit of sequence of simple random variables.
Month- February				
Lectures 15	Practicals 16	Total 31	Unit-2	4. Integration of a measurable function with respect to a measure, expectation of a random variable 5. independence. Characteristic function, simple properties. 6. Inversion theorem and uniqueness property (Statement only).
			Unit-3	1. Monotone convergence theorem 2. Fatous Lemma, Dominated Convergence theorem, Borel- Cantelli Lemma, and their applications. 3. Modes of convergence
Month- March				
Lectures 16	Practicals 20	Total 36	Unit-4	1. Borel- Cantelli Lemma, and their applications. 2. Modes of convergence
Month- April-May				
Lectures 15	Practicals 20	Total 25	Unit-4	3. Weak and Strong laws of large numbers 4. CLT

*Pawar A.A.*

Name & Signature of Teacher

Pawar Ajit A.



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M.Sc. Part-I

Semester II

Department -Statistics

Subject - Statistics

Course - DSE18STA21

**DBMS**

Name of teacher – Dinde M.P.

Month- November-December			Module/Unit	Sub-units planned
Lectures 17	Practicals —	Total 17	Unit-1	1. Introduction to Databases and Data Models 2. Basic building blocks, business rules, 3. Data abstraction 4. Database users and administrators
Month- January				
Lectures 16	Practicals —	Total 16	Unit -2	1. Introduction to Data Models and Normalization 2. Database design and ER Model 3. Relational Database design
Month- February				
Lectures 15	Practicals —	Total 15	Unit-3	1. Introduction to SQL 2. Constraints 3. Views
Month- March				
Lectures 14	Practicals —	Total 14	Unit-4	1. Operators in SQL 2. Functions 3. Clauses
Month- April-May				
Lectures 16	Practicals —	Total 16	Unit-4	4. Join Transaction management 5. NoSQL

*Dinde M.P.*

Name & Signature of Teacher

Ms. M. P. Dinde



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M.Sc. Part-II

Semester III

Department -Statistics

Subject - Statistics

Course - CC-2312A

**ASYMPTOTIC INFERENCE**

Name of teacher – Patil D. D.

Month-July			Module/Unit	Sub-units planned
Lectures 16	Practicals 32	Total 48	Unit-1	1. Consistency of an estimator 2. CAN Estimators 3. Methods of constructing CAN estimators
Month- August				
Lectures 16	Practicals 32	Total 48	Unit -2	1. CAN and BAN estimators in one parameter and multi-parameter exponential family of distributions 2. Super efficient estimators 3. Crammer regularity conditions, Cramer – Huzurbazar results
Month- September				
Lectures 16	Practicals 32	Total 48	Unit-3	1. Variance stabilizing transformations 2. Asymptotic Confidence Intervals based on CAN estimators based on VST 3. Asymptotic Confidence regions in multi-parameter families
Month- October-November				
Lectures 16	Practicals 32	Total 48	Unit-4	1. Likelihood ratio test and its asymptotic distribution 2. Comparison of tests

*Patil*

Name & Signature of Teacher

(Mr. Patil D. D.)



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M.Sc. Part-II Semester III

Department -Statistics

Subject - Statistics

Course - CC-2313A

**MULTIVARIATE ANALYSIS**

Name of teacher – Bhosale A.K.

Month- July			Module/Unit	Sub-units planned
Lectures 17	Practicals 32	Total 49	Unit-1	1. Exploratory multivariate data analysis 2. Partial and multiple correlation coefficients 3. Correlations of linear transforms 4. Multivariate normal distribution
Month- August				
Lectures 18	Practicals 20	Total 38	Unit -2	1. Maximum likelihood estimators 2. Hotelling's T <sup>2</sup> Statistic and its null distribution 3. Wishart matrix and its distribution 4. distribution of generalized variance
Month- September				
Lectures 14	Practicals 16	Total 30	Unit-3	1. Discrimination and classification 2. Fisher's discriminant function and likelihood ratio procedure 3. Minimum ECM rule 4. Rao's U statistics 5. Hierarchical methods: Single, Complete, average linkage method and non-hierarchical clustering method-kmeans clustering
Month- October-November				
Lectures 16	Practicals 16	Total 32	Unit-4	1. Canonical correlation analysis 2. Principal component analysis 3. Factor analysis and estimation

Name & Signature of Teacher

Miss. Bhosale Aishwarya



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M.Sc. Part-II Semester III

Department -Statistics

Subject - Statistics

Course - CC-2314A

**STOCHASTIC PROCESSES**

Name of teacher – Pandhare R.S.

Month- July			Module/Unit	Sub-units planned
Lectures 16	Practicals 36	Total 52	Unit-1	<ol style="list-style-type: none"> <li>1. Definition of stochastic process</li> <li>2. Examples of various stochastic processes</li> <li>3. Definition of Markov chain</li> <li>4. Examples of Markov chains, Formulation of Markov chain models, initial distribution</li> <li>5. Chapman-Kolmogorov equations</li> <li>6. Simulation of Markov Chain</li> </ol>
Month- August				
Lectures 18	Practicals 32	Total 50	Unit -2	<ol style="list-style-type: none"> <li>1. Classification of states</li> <li>2. Random walk and gambler's ruin problem</li> <li>3. Long-Run proportions and limiting probabilities</li> <li>4. Stationary distribution</li> </ol>
Month- September				
Lectures 17	Practicals 28	Total 45	Unit-3	<ol style="list-style-type: none"> <li>1. Discrete state space continuous time Markov chain</li> <li>2. Poisson process and related results</li> <li>3. Birth and death processes and associated cases</li> <li>4. Renewal and delayed renewal processes</li> <li>5. Simulation of Poisson process and discrete state space Markov processes</li> </ol>
Month- October-November				
Lectures 17	Practicals 32	Total 49	Unit-4	<ol style="list-style-type: none"> <li>1. Galton-Watson Binaymi Branching process</li> <li>2. Probability of ultimate extinction</li> <li>3. Queuing model</li> <li>4. M/M/1, M/M/1 with balking, M/M/c and M/G/1</li> </ol>

*Pandhare*

Name & Signature of Teacher

Pandhare R.S.



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M.Sc. Part-II Semester III

Department -Statistics

Subject - Statistics

Course - CC-2315A

**DATA MINING**

Name of teacher – Patil R. M.

Month- July			Module/Unit	Sub-units planned
Lectures 17	Practicals —	Total 17	Unit-1	1. Data understanding and data cleaning 2. Supervised and unsupervised learning 3. Problem of classification 4. Classification techniques: k-nearest neighbor, decision tree, Naïve Bayesian, classification based on logistic regression, Bayesian belief Network
Month- August				
Lectures 17	Practicals —	Total 17	Unit -2	1. Model evaluation and selection 2. Holdout Method and Random Subsampling 3. Bootstrap 4. Comparing Classifiers Based on Cost–Benefit and ROC Curves 5. Techniques to Improve Classification Accuracy
Month- September				
Lectures 16	Practicals —	Total 16	Unit-3	1. ANN and SVM 2. McCulloch-Pitts AN model 3. ANN & regression models 4. Support vector regression 5. Linear programming support vector machine for classification and regression
Month- October-November				
Lectures 16	Practicals —	Total 16	Unit-4	1. Unsupervised learning 2. CLARA, DENCLUE, DBSCAN 3. Market Basket Analysis: Association rules and prediction 4. Apriori Algorithm, data attributes, applications to electronic commerce

Name & Signature of Teacher

Patil R.M.



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M.Sc. Part-II Semester III

Department -Statistics

Subject - Statistics

Course - CC-2316A

**TIME SERIES ANALYSIS**

Name of teacher – Tangawade A. S.

Month- July			Module/Unit	Sub-units planned
Lectures 17	Practicals —	Total 17	Unit-1	1. Exploratory time series analysis 2. Holt – Winter smoothing and forecasting 3. Auto - Covariance, Auto-correlation functions 4. Partial auto covariance function 5. First and second order Stationary time series
Month- August				
Lectures 17	Practicals —	Total 17	Unit -2	1. Wold representation of linear stationary processes 2. linear time series models: Autoregressive, Moving Average, Autoregressive Moving Average models 3. Computation of ACVF, ACF and PACF for AR(1), AR(2), MA(1), MA(2), ARMA(1,1) process
Month- September				
Lectures 16	Practicals —	Total 16	Unit-3	1. Estimation of ARMA models: Yule-Walker estimation for AR Processes 2. Maximum likelihood and least squares estimation 3. Minimum mean squared error forecasting 4. Introduction to SARIMA models. 5. Spectral Representation of the ACVF, Spectral density of an ARMA process, its computation for simple models.
Month- October-November				
Lectures 16	Practicals —	Total 16	Unit-4	1. Introduction to ARCH and GARCH models 2. Vector time-series models: Covariance and Correlation Matrix functions, MA and AR representation of vector processes, Covariance matrix function of the vector AR(1) and MA(1) models.

Name & Signature of Teacher

*(Tangawade Atish S.)*



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M.Sc. Part-II Semester IV

Department -Statistics

Subject - Statistics

Course - CC-2318B

**GENERALIZED LINEAR MODELS**

Name of teacher – Makandar A.M.

Month- November -December			Module/Unit	Sub-units planned
Lectures 20	Practicals 36	Total 56	Unit-1	1. Generalized linear models 2. Quasi-likelihood estimation 3. Residual analysis, types of residuals: raw, Pearson, deviance, Anscombe, quantile; residual plots 4. Variable selection: AIC and BIC
Month- January				
Lectures 14	Practicals 28	Total 42	Unit -2	1. Logistic regression: logit, probit and cloglog model for dichotomous data 2. Linear time series models: Autoregressive, Moving Average, Autoregressive Moving Average models 3. ML estimation 4. Logistic regression for Nominal response: Baseline Category model and ordinal response: Proportional odds model
Month- February				
Lectures 16	Practicals 32	Total 48	Unit-3	1. Poisson regression 2. ML and Quasi-likelihood estimation of parameters 3. Power family of link functions 4. Over dispersion: Types, causes and remedies. Negative Binomial regression: NB-2 model.
Month- March				
Lectures 16	Practicals 32	Total 48	Unit-4	1. Generalized linear mixed models (GLMM) 2. Estimation by generalized estimating equations and conditional likelihood
Month- April-May			Unit-4	
Lectures 16	Practicals 32	Total 48		3. Tests of hypothesis: LRT, asymptotic variance, Wald and score test

*Ashiyana*

Name & Signature of Teacher

Makandare A.M



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M.Sc. Part-II Semester IV

Department -Statistics

Subject - Statistics

Course - CC-2319B

**SURVIVAL ANALYSIS**

Name of teacher – Tangawade A. S.

Month- November- December			Module/Unit	Sub-units planned
Lectures 16	Practicals —	Total 16	Unit-1	<ol style="list-style-type: none"> <li>1. Estimating the survivor function</li> <li>2. Various types of censoring: right, left, interval Censoring; random censoring</li> <li>3 Survivor, hazard and cumulative hazard functions</li> <li>4. Life-table estimate, Kaplan-Meier estimate, Nelson-Aalen estimate</li> <li>5. Estimating the median and percentiles of survival times; Confidence intervals for the median and percentiles</li> </ol>
Month- January				
Lectures 16	Practicals —	Total 16	Unit -2	<ol style="list-style-type: none"> <li>1. The Cox regression model</li> <li>2. Models corresponding to the linear component of the model</li> <li>3. Confidence intervals and hypothesis tests for coefficients and for hazard ratios using R</li> <li>4. Model checking using various types of residuals: Cox-Snell; Modified CoxSnell; Martingale; Deviance; Schoenfeld; Score residuals, plots based on these residuals and their interpretation.</li> </ol>
Month- February				
Lectures 15	Practicals —	Total 15	Unit-3	<ol style="list-style-type: none"> <li>1. Competing risks</li> <li>2. Kaplan-Meier estimate of survivor function</li> <li>3. Cause specific hazard function</li> <li>4. Parametric models for cumulative incidence functions</li> </ol>
Month- March				
Lectures 14	Practicals —	Total 14	Unit-4	<ol style="list-style-type: none"> <li>1. Comparison of two groups of survival data</li> <li>2. Introduction to frailty Models</li> </ol>
Month- April-May				
Lectures 16	Practicals —	Total 16		<ol style="list-style-type: none"> <li>3. Comparing shared frailty models</li> </ol>

Name & Signature of Teacher

(Tangawade Ash S.)



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M.Sc. Part-II

Semester IV

Department -Statistics

Subject - Statistics

Course - CC-2320B

**BIOSTATISTICS**

Name of teacher – Patil R.M.

Month- November- December			Module/Unit	Sub-units planned
Lectures 16	Practicals —	Total 16	Unit-1	<ol style="list-style-type: none"> <li>1. Introduction to clinical trials</li> <li>2. Data management</li> <li>3. Concept of blinding/masking in clinical trials</li> <li>4. Bioavailability, pharmacokinetics and pharmacodynamics, two compartment model.</li> </ol>
Month- January				
Lectures 18	Practicals —	Total 18	Unit -2	<ol style="list-style-type: none"> <li>1. Design of clinical trials</li> <li>2. Parallel vs. cross-over designs, cross-sectional vs. Longitudinal designs</li> <li>3. Design of single-stage and multi-stage Phase II trials</li> <li>4. Design and monitoring of Phase III trials with sequential stopping.</li> </ol>
Month- February				
Lectures 16	Practicals —	Total 16	Unit-3	<ol style="list-style-type: none"> <li>1. Design of bio-equivalence trials, Inference for 2x2 crossover design</li> <li>2. Classical methods of interval hypothesis testing for bioequivalence</li> </ol>
Month- March				
Lectures 16	Practicals —	Total 16	Unit-3	<ol style="list-style-type: none"> <li>3. Bayesian methods, nonparametric methods</li> <li>4. Reporting and analysis: analysis of categorical outcomes from Phase I - III trials, analysis of survival data from clinical trials.</li> </ol>
Month- April-May			Unit-4	
Lectures 16	Practicals —	Total 16		<ol style="list-style-type: none"> <li>1. Epidemiological studies: case-control and cohort designs.</li> <li>2. Measures of disease occurrence and association, variation and bias.</li> <li>3. Identifying non-causal association and confounding.</li> <li>4. Communicating results of epidemiological studies, ethical issues in epidemiology.</li> </ol>

Name & Signature of Teacher

Patil R.M.



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M.Sc. Part-II

Semester IV

Department -Statistics

Subject - Statistics

Course - CC-2321B

**OPTIMIZATION TECHNIQUES**

Name of teacher – Pandhare R.S.

Month- November -December			Module/Unit	Sub-units planned
Lectures 18	Practicals 28	Total 46	Unit-1	<ol style="list-style-type: none"> <li>1. Convex Sets and Functions</li> <li>2. Linear programming problem (LPP)</li> <li>3. Graphical method, Simplex method</li> <li>4. Examples</li> <li>5. Artificial variable technique: Two phase method, Big M method, degeneracy.</li> </ol>
Month- January				
Lectures 16	Practicals 36	Total 52	Unit -2	<ol style="list-style-type: none"> <li>1. Concept of Duality</li> <li>2. Sensitivity Analysis</li> </ol>
Month- February				
Lectures 15	Practicals 32	Total 47	Unit-3	<ol style="list-style-type: none"> <li>1. Integer Linear Programming Problem (ILPP)</li> <li>2. Branch and Bound method.</li> <li>3. Quadratic programming: KuhnTucker conditions, methods due to Beale, Wolfe.</li> </ol>
Month- March				
Lectures 16	Practicals 28	Total 44	Unit-4	<ol style="list-style-type: none"> <li>1. Theory of games</li> <li>2. Solution of 2 x 2 game by algebraic method, Graphical method, Reduction of the game problem as LPP</li> </ol>
Month- April-May			Unit-4	
Lectures 14	Practicals 36	Total 50		<ol style="list-style-type: none"> <li>3. Dynamic Programming: The Recursion Equation Approach, Computational Procedure, Characteristics of Dynamic Programming, Solution of L.P.P. by Dynamic Programming.</li> </ol>

*Pandhare R.S.*

Name & Signature of Teacher

Pandhare .R.S.



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M.Sc. Part-II

Semester IV

Department -Statistics

Subject - Statistics

Course - CC-2322B

**STATISTICAL QUALITY CONTROL**

Name of teacher – Bhosale A.K.

Month- November -December			Module/Unit	Sub-units planned
Lectures 15	Practicals 16	Total 31	Unit-1	<ol style="list-style-type: none"> <li>1. Quality Improvement Tools</li> <li>2. Shewhart Control charts</li> <li>3. Performance measures of a control chart, <math>\bar{X}</math>, R, S, S<sub>2</sub>, p, c and D charts, <math>\sigma</math>-control limits and probability control limits</li> <li>4. Economic design of a control chart</li> </ol>
Month- January				
Lectures 18	Practicals 20	Total 38	Unit -2	<ol style="list-style-type: none"> <li>1. CUSUM and EWMA charts</li> <li>2. SPRT chart, GLR Chart, charts for autocorrelated data, nonparametric control charts, Bayesian control charts. The change point model for process monitoring</li> </ol>
Month- February				
Lectures 15	Practicals 16	Total 31	Unit-3	<ol style="list-style-type: none"> <li>1. Process capability Analysis</li> <li>2. process capability, process capability indices (C<sub>p</sub>, C<sub>pk</sub>, C<sub>pm</sub>, C<sub>pmk</sub>), point and interval estimation of C<sub>p</sub> and C<sub>pk</sub></li> <li>3. DIMAC process</li> <li>4. Six Sigma Methodology</li> </ol>
Month- March				
Lectures 15	Practicals 16	Total 31	Unit-4	<ol style="list-style-type: none"> <li>1. Acceptance sampling plans for attributes</li> <li>2. Single sampling plan,</li> </ol>
Month- April-May				
Lectures 15	Practicals 12	Total 27	Unit-4	<ol style="list-style-type: none"> <li>3. Double and multiple sampling plans, sequential sampling</li> <li>4. Deming inspection criterion, Continuous sampling plans, skip-lot sampling plans.</li> </ol>

*Ashw*

Name & Signature of Teacher

Miss-Bhosale Aishwarya



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