Academic Council Meeting No. and Date : 8 / September 04, 2023
Agenda Number : 2 Resolution Number : 34, 35 / 2.5, 2.26

Vidya Prasarak Mandal's
B. N. Bandodkar College of Science (Autonomous), Thane

Syllabus for

Programme: Bachelor of Science

Specific Programme: STATISTICS

[F.Y.B.Sc. Statistics]

Level 4.5

CHOICE BASED GRADING SYSTEM

Revised under NEP

From academic year 2023 - 2024

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Eligibility:
Passed 12th standard (HSC) of Maharashtra State Board / CBSE / ICSE board.

Discipline/Subject: Statistics

Degree Programme: B.Sc.

Duration: 1 year (Including semester I & II)

Level: 4.5

Qualification Title: UG certificate

Credits Requirement: Minimum 40 or Maximum 44 Credits

Mode of Conduct:
Statistics Practical's / Practical's related to R software/Offline lectures / online lectures.

Specific Programme:
F.Y.B.Sc. (Statistics) (Major/Minor) Credits: 06
F.Y.B.Sc (Statistics) (Generic) Credits: 02
F.Y.B.Sc (Statistics) (Skill Enhancement) Credits: 02

Program Specific Outcome
By the end of the program, learners should be able to interpret, use and present information in written, graphical, diagrammatic and tabular terms. Enable efficient use of electronic devices to solve statistical problems. Develop the ability to use statistical knowledge and skills in other disciplines.

Preamble (Major/Minor)

VPM's B.N. Bandodkar College (Autonomous), Department of Statistics has proposed F.Y.B.Sc Statistics syllabus under Autonomy & as per the guidelines of NEP-2020. The B.Sc Statistics programme is aimed to develop the theoretical and analytical skills of the students so that they may be absorbed in the corporate world or able to pursue higher studies at the Master's level in Statistics. The main objectives of the course are:

- To get introduced to some statistical concepts that are relevant in the interpretation of measurements made on individuals and in the interpretation of statistical study materials.
- To apply their knowledge and skills to be employed and excel in Statistics professional careers and/or to continue their education in Statistics and/or related postgraduate programmes.
- To get Knowledge and understanding of basic statistical methods such as sampling and collecting data, probability, distributions, and Regression Analysis.
- To gain Knowledge and understanding to confidently read statistics and apply statistical methods within their working environment.
- To be capable of managing Statistics projects with consideration of human, financial and environmental factors.
- To work effectively as a part of a team to achieve a common stated goal.
- To communicate effectively with a range of audiences both technical and non-technical.
- To develop an aptitude to engage in continuing professional development.

The syllabus is aimed to achieve the objectives. The students will be ready for the jobs available in different fields like:

- Statistician
- Analyst
- Biostatistician
- Actuaries
- Banking sector
- Machine Learning and Artificial Intelligence
- Data Analytics
- Academics
- Government organizations like NSSO, NSO, ISS, SSC etc

And many others.
The students will also be trained in communication skills and knowledge related to R software.

VPM's B.N.Bandodkar College of Science (Autonomous), Thane
F.Y.B.Sc. (Statistics)
Structure of Programme

Semester 1: Major			
Course Code	**Course Title**	**No. of lectures In hrs**	**Credits**
23BUST1T1	Descriptive Statistics – 1	**30**	**2**
23BUST1T2	Statistical Methods – 1	**30**	**2**
23BUST1P1	Descriptive Statistics -1 & Statistical Methods-1	**60**	**2**
23BU1VEC7	Advanced Spreadsheets Tools	**45**	**2**
OR			
23BU1VEC8	Basic IT Tools	**45**	**2**
	Total	**165**	**8**
Semester 1: Minor			
Course Code	**Course Title**	**No. of lectures In hrs**	**Credits**
23BUST1T3	Descriptive Statistics – 1	**30**	**2**
23BUST1T4	Statistical Methods - 1	**30**	**2**
23BUST1P2	Descriptive Statistics -1 & Statistical Methods-1	**60**	**2**
	Total	**120**	**6**
Semester 1: Generic			
23BUST1T5	Basics of Statistics -I (Generic-1)	**30**	**2**
	Total	**30**	**2**
Optional Electives Semester 1 -Interdisciplinary Sciences			
23BUID1T6	**Soft skills and personality development-I**	**30**	**2**
	Total	**30**	**2**
Course Title Semester 1 - (AEC)			
23BUEN1T8	**Basic English Learning course**	**30**	**2**
	Total	**30**	**2**
Semester 1 - Indian Knowledge System			
23BUIK1T9	The Ancient Indian Social Structure. -I	**30**	**2**
	Total	**30**	**2**
Semester 2: Major			
Course Code	**Course Title**	**No. of lectures**	**Credits**

		In hrs	
23BUST2T1	Descriptive Statistics - 2	**30**	**2**
23BUST2T2	Statistical Methods - 2	**30**	**2**
23BUST2P1	Descriptive Statistics - 2 & Statistical Methods -2	**60**	**2**
23BU2VEC7	Power BI	**45**	**2**
OR			
23BU2VEC8	Tableau	**45**	**2**
	Total	**165**	**8**
Semester 2: Minor			
Course Code	**Course Title**	**No. of lectures In hrs**	**Credits**
23BUST2T3	Descriptive Statistics - 2	**30**	**2**
23BUST2T4	Statistical Methods - 2	**30**	**2**
23BUST2P1	Descriptive Statistics - 2 & Statistical Methods -2	**60**	**2**
	Total	**120**	**6**
Semester 2: Generic			
23BUST2T5	Basics of Statistics -I (Generic-2)	**30**	**2**
	Total	**30**	**2**
Optional electives Semester 2-Interdisciplinary sciences			
23BUID2T6	**Soft skills and personality development- II**	**30**	**2**
	Total	**30**	**2**
Course Title Semester 2 (AEC)			
23BUEN2T8	**Scientific *English writing***	**30**	**2**
	Total	**30**	**2**
Semester 2- Indian Knowledge System			
I 23BUIK2T9	The Ancient Indian Social Structure. -II	**30**	**2**
	Total		**2**

Note: AEC IKS open elective syllabus view separately.

Semester I
(Statistics-Major)

Course Code 23BUST1T1	Course Title **Descriptive Statistics – 1**	Credits 2	No. of in hours

Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to

- Understand technique of data collection and its presentation.
- Emphasize the need of numerical summary measures for data analysis.
- Apply Statistical concepts using R software.

Unit I :	**Types of Data and Data Condensation:** **Types of data**: Qualitative and Quantitative data, Geographical, Time series data, Cross-section data, Discrete and Continuous data. **Types of Characteristics**, **Different types of scales**: nominal, ordinal, interval and ratio. **Collection of Data**: Concept of population and sample. Finite and Infinite population, Notion of SRS, SRSWOR and SRSWR **Primary data**: Concepts of Questionnaire and a schedule, distinction between them, problems collecting data through the Questionnaire. Secondary data. Their Merits and Demerits. **Elementary Categorical Data Analysis:** Preparation of tables with two or three factors (variable/attributes) of classification, Verification for consistency. Requisites of a good table. Independence and Association for 2 attributes in a 2×2 table using Yule's coefficient of colligation and coefficient of association. Relationship between two coefficients.	**15**
Unit II :	**Classification of Data and Measure of Central Tendency:** **Classification and Data Presentation:** Frequency distribution of discrete and continuous variables. Cumulative frequency distribution. Graphical representation of frequency distribution by Histogram, Frequency polygon, Cumulative Frequency Curve and Ogives. Diagrammatic representation using Bar diagrams and Pie Chart. Stem and leaf diagram, Dot plot. **Measures of Central Tendency:** Concept of central tendency of data. Requirements of good measure. Location averages: Median, Mode, and Partition Values: Quartiles, Deciles, and Percentiles. Mathematical averages: Arithmetic mean (Simple mean, Weighted mean, and Combined mean), Geometric mean, and Harmonic mean. Relation Between Arithmetic mean, Geometric mean, and Harmonic mean. Empirical relation between mean, median and mode. Merits and demerits of using different measures &their applicability.	**15**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Descriptive Statistics	Welling, Khandeparkar, Pawar, Naralkar	Manan Prakashan		
2.	Descriptive Statistics	Shah R.J	Sheth Publications	$_{8}$th	
3.	Descriptive Statistics	Milan Gholba,Sudha Phatak, Madhavi Jardosh	Vipul Prakashan	$_{1}$st	
4.	Fundamentals of Mathematical Statistics	S.C. Gupta V.K. Kapoor	Sultan Chand and Sons		

Course Code 23BUST1T2	Course Title **Statistical Methods - 1**	Credits 2	No. of in hours

Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to

- Solve probabilities using various definitions and rules of the probabilities.
- Understand the difference between discrete and continuous random variables.
- Understand mean, variance and other properties of some standard discrete distributions.
- Apply Statistical concepts using R software.

Unit I :	**Elementary Probability Theory :** Probability: Trial, Random experiment, Sample point and Sample Space. Definition of an event. Operation of events, Mutually exclusive and exhaustive events. Classical (Mathematical) and Empirical and Axiomatic definitions of Probability and their properties. Theorems on Addition and Multiplication of probabilities. Independence of n events (n =2,3), pairwise and mutual independence for three event Conditional probability, Bayes theorem(with proof) and its applications.	15
Unit II :	**Concepts of Discrete random variable :** Univariate: Random variable, Definition and properties of Probability Mass Function and Cumulative Distribution Function of discrete random variable and their graphical representation. Expectation of a random variable. Theorems on Expectation & Variance. Raw and Central moments (definition only) and their relationship (up to order four). Concepts of Skewness and Kurtosis. Definition of Bivariate random variable, Joint probability mass function of two Discrete Random Variables. Marginal and Conditional Probability Distributions, Independence of two random variables, Theorems on Expectation &Variance, Covariance and Coefficient of Correlation. **Standard Discrete Probability Distributions:** Discrete Distributions: Degenerate distributions, Discrete Uniform distribution, Bernoulli distribution, Binomial distribution, Poisson distribution. Derivation of their mean and variance.	15

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Statistical Methods	Welling, Khandeparkar, Pawar, Naralkar	Manan Prakashan		
2.	Statistical Methods	Shah R.J	Sheth Publications		
3.	Statistical Methods	Milan Gholba, Sudha Phatak	Vipul Prakashan		
4.	Introduction to Mathematical Statistics	Hoel P.G.	Asia Publishing House		
5.	Probability	Pitan Jim	Narosa Publishing House		

Course Code 23BUST1P1	Course Title **Descriptive Statistics - 1 and Statistical Methods -1 Practical**	Credits 2
Practical No.	**Descriptive Statistics - 1 Practical's**	
1.1.1	Tabular Representation.	
1.1.2	Theory of Attributes.	
1.1.3	Classification of Data.	
1.1.4	Diagrammatic and Graphical Representation.	
1.1.5	Measure of Central Tendency	
1.1.6	Practical using R software: Classification of Data and Diagrammatic representation.	
1.1.7	Practical using R software: Measures of Central Tendency	
Practical No.	**Statistical Methods- 1 Practical's**	
1.2.1	Probability - I.	
1.2.2	Probability - II.	
1.2.3	Univariate Discrete Random variables.	
1.2.4	Expectation.	
1.2.5	Bivariate Discrete Random variables.	
1.2.6	Standard Discrete Probability Distributions - 1	
1.2.7	Standard Discrete Probability Distributions - 2	
1.2.8	Practical's Using R software: Discrete uniform, Binomial, Poisson and Hypergeometric distribution.	

Semester II
(Statistics-Major)

Course Code	Course Title	Credits	No. of in hours
23BUST2T1	**Descriptive Statistics – 2**	2	

Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to

- To analyses the data using Regression methods.
- Understand the shift of frequency curve.
- Understand concept of least square method.

Unit I :	**Measures of Dispersion, Skewness & Kurtosis:** **Concept of Dispersion**: Concept of dispersion. Requirements of good measure. Absolute and Relative measures of dispersion: Range, Quartile Deviation, Mean absolute deviation, Standard deviation. Variance and Combined variance, Raw and central moments up to fourth order and relations between them (with proof). Their properties. **Concept of Skewness and Kurtosis:** Measures of Skewness, Karl Pearson's, and Bowley's Coefficient of Skewness based on moments. Measure of Kurtosis, Box- Whisker Plot.	**15**
Unit II :	**Correlation and Regression Analysis:** **Correlation:** Scatter Diagram, Product moment correlation coefficient and its properties. Spearman's Rank correlation (With and without ties). **Regression Analysis:** Concept of linear regression. Principle of least squares. Fitting a straight line by method of least squares. Relation between Regression coefficients and Correlation Coefficient. **Fitting of Curves**: Fitting of curves reducible to linear form by transformation. Concept and use of coefficient of determination (R^2). Fitting a quadratic curve by method of least squares.	**15**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Descriptive Statistics	Welling, Khandeparkar, Pawar, Naralkar	Manan Prakashan		
2.	Descriptive Statistics	Shah R.J	Sheth Publications	8th	
3.	Descriptive Statistics	Milan Gholba,Sudha Phatak, Madhavi Jardosh	Vipul Prakashan	1st	
4.	Introduction to Mathematical Statistics	Hoel P.G.	Asia Publishing House		
6.	Fundamentals of Mathematical Statistics	S.C. Gupta V.K. Kapoor	Sultan Chand and Sons		

Course Code 23BUST2T2	Course Title **Statistical Methods - 2**	Credits 2	No. of hours

Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to

- Study the concept of continuous Probability distributions.
- Understand the nature of frequency curve.
- Get the clear ideas about continuous random variables using various examples?

Unit I :	**Continuous random variable :** **Basic concepts of continuous random variable.** Concept of Continuous random variable and properties of its Probability Density Function and Cumulative Distribution Function and their graphical representation. Expectation and variance of a random variable and its properties. Measures of location, dispersion, skewness and kurtosis. Raw and Central moments (simple illustrations).	**15**
Unit II :	**Continuous Probability Distributions:** Uniform Distribution, Exponential Distribution, Memory less property of Exponential Distribution and Normal Distribution Derivations of mean, median and variance for Uniform and Exponential distributions. Properties of Normal distribution and Normal Curve (without proof). Normal approximation to Binomial and Poisson distribution (statement only). Use of normal tables.	**15**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Statistical Methods	Welling, Khandeparkar, Pawar, Naralkar	Manan Prakashan		
2.	Statistical Methods	Shah R.J	Sheth Publications		
3.	Statistical Methods	Milan Gholba, Sudha Phatak	Vipul Prakashan		
4.	Introduction to Mathematical Statistics	Hoel P.G.	Asia Publishing House		
5.	Basic Statistics	Agarwal B.L.	New Age International Ltd		
6.	Fundamentals of Mathematical Statistics	S.C. Gupta V.K. Kapoor	Sultan Chand and Sons		
7.	Statistical Methods	Medhi J.:	New Age International Ltd	2nd	

Course Code 23BUST2P1	Course Title **Descriptive Statistics - 2 and Statistical Methods -2 Practical**	Credits 2
Practical No.	**Descriptive Statistics - 2 Practicals**	
2.1.1	Measures of Dispersion.	
2.1.2	Measures of Skewness	
2.1.3	Measures of Kurtosis	
2.1.4	Correlation analysis.	
2.1.5	Regression analysis.	
2.1.6	Fitting of curve .	
2.1.7	Practical using R Correlation analysis and Regression analysis.	
2.1.8	Practical using R Fitting of curve & Measures of Dispersion.	
Practical No.	**Statistical Methods – 2 Practical's**	
2.2.1	Continuous Random Variables.	
2.2.2	Expectation and variance of a random variable and its properties.	
2.2.3	Uniform and Exponential Distributions.	
2.2.4	Normal Distributions.	
2.2.5	Applications of Central Limit Theorem and Normal Approximation.	
2.2.6	Practical's Using R Uniform and Exponential Distributions.	
2.2.7	Practical's Using R Normal Distributions.	

Evaluation Scheme

Internals Examination: (Continuation Internal Assessment for each course/paper)

Internal Test	Project (Attending Seminars/Conference/workshops/any other and writing reports on it)	Attendance & Leadership qualities	Total
10	**05**	**05**	**20**

- **Internal Examination:**

Duration: 1 Hour **Total Marks: 10**

	Answer the following	**10**
Q. 1	Objective	05
Q. 2	Subjective	05

- **Theory Examination:**

Suggested Format of Question paper

Duration: $1\frac{1}{2}$ Hour **Total Marks: 30 (each paper 30 marks)**

- **All questions are compulsory**

Q. 1	Answer ***any two*** of the following		**10**
	a	Based on Unit I	
	b	Based on Unit I	
	c	Based on Unit I	
	d	Based on Unit I	
Q. 2	Answer ***any two*** of the following		**10**
	a	Based on Unit II	
	b	Based on Unit II	
	c	Based on Unit II	
	d	Based on Unit II	
Q. 3	Answer ***any two*** of the following		**10**
	a	Based on Unit I	
	b	Based on Unit I	
	c	Based on Unit II	
	d	Based on Unit II	

**(2 questions of 5 marks each / 5 questions of 2 marks can be asked with 50% options)

Marks Distribution and Passing Criterion for Each Semester

Theory					Practical		
Course Code	**Internal**	**Min marks for passing**	**Theory Examination**	**Min marks for passing**	**Course Code**	**Practical Examination**	**Min marks for passing**
23BUST1T1	20	08	30	12	**23BUST1P1**	50	20
23BUST1T2	20	08	30	12			

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Semester I
(Statistics-Minor)

Course Code 23BUST1T3	Course Title **Descriptive Statistics - 1**	Credits 2	No. of hours

Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to

- Understand technique of data collection and its presentation.
- Emphasize the need of numerical summary measures for data analysis.
- Apply Statistical concepts using R software.

Unit I :	**<u>Types of Data and Data Condensation:</u>** **Types of data**: Qualitative and Quantitative data, Geographical, Time series data, Cross-section data, Discrete and Continuous data. **Types of Characteristics**, **Different types of scales**: nominal, ordinal, interval and ratio. **Collection of Data**: Concept of population and sample. Finite and Infinite population, Notion of SRS, SRSWOR and SRSWR **Primary data**: Concepts of Questionnaire and a schedule, distinction between them, problems collecting data through the Questionnaire. Secondary data. Their Merits and Demerits. **Elementary Categorical Data Analysis:** Preparation of tables with two or three factors (variable/attributes) of classification, Verification for consistency. Requisites of a good table. Independence and Association for 2 attributes in a 2×2 table using Yule's coefficient of colligation and coefficient of association. Relationship between two coefficients.	**15**
Unit II :	**Classification of Data and Measure of Central Tendency:** **Classification and Data Presentation:** Frequency distribution of discrete and continuous variables. Cumulative frequency distribution. Graphical representation of frequency distribution by Histogram, Frequency polygon, Cumulative Frequency Curve and Ogives. Diagrammatic representation using Bar diagrams and Pie Chart. Stem and leaf diagram, Dot plot. **Measures of Central Tendency:** Concept of central tendency of data. Requirements of good measure. Location averages: Median, Mode, and Partition Values: Quartiles, Deciles, and Percentiles. Mathematical averages: Arithmetic mean (Simple mean, Weighted mean, and Combined mean), Geometric mean, and Harmonic mean. Relation Between Arithmetic mean, Geometric mean, and Harmonic mean. Empirical relation between mean, median and mode. Merits and demerits of using different measures &their applicability.	**15**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Descriptive Statistics	Welling, Khandeparkar, Pawar, Naralkar	Manan Prakashan		
2	Descriptive Statistics	Shah R.J	Sheth Publications	8th	
3	Descriptive Statistics	Milan Gholba,Sudha Phatak, Madhavi Jardosh	Vipul Prakashan	1st	
4	Fundamentals of Mathematical Statistics	S.C. Gupta V.K. Kapoor	Sultan Chand and Sons		

Course Code 23BUST1T4	Course Title **Statistical Methods - 1**	Credits 2	No. of hours

Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to

- Solve probabilities using various definitions and rules of the probabilities.
- Understand the difference between discrete and continuous random variables.
- Understand mean, variance and other properties of some standard discrete distributions.
- Apply Statistical concepts using R software.

Unit I :	**Elementary Probability Theory :** Probability: Trial, Random experiment, Sample point and Sample Space. Definition of an event. Operation of events, Mutually exclusive and exhaustive events. Classical (Mathematical) and Empirical and Axiomatic definitions of Probability and their properties. Theorems on Addition and Multiplication of probabilities. Independence of n events (n =2,3), pairwise and mutual independence for three event Conditional probability, Bayes theorem(with proof) and its applications.	15
Unit II :	**Concepts of Discrete random variable :** Univariate: Random variable, Definition and properties of Probability Mass Function and Cumulative Distribution Function of discrete random variable and their graphical representation. Expectation of a random variable. Theorems on Expectation & Variance. Raw and Central moments (definition only) and their relationship (up to order four). Concepts of Skewness and Kurtosis. Definition of Bivariate random variable, Joint probability mass function of two Discrete Random Variables. Marginal and Conditional Probability Distributions, Independence of two random variables, Theorems on Expectation &Variance, Covariance and Coefficient of Correlation. **Standard Discrete Probability Distributions:** Discrete Distributions: Degenerate distributions, Discrete Uniform distribution, Bernoulli distribution, Binomial distribution, Poisson distribution. Derivation of their mean and variance.	15

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Statistical Methods	Welling, Khandeparkar, Pawar, Naralkar	Manan Prakashan		
2.	Statistical Methods	Shah R.J	Sheth Publications		
3.	Statistical Methods	Milan Gholba, Sudha Phatak	Vipul Prakashan		
4.	Introduction to Mathematical Statistics	Hoel P.G.	Asia Publishing House		
5.	Probability	Pitan Jim	Narosa Publishing House		

Course Code 23BUST1P2	Course Title **Descriptive Statistics - 1 and Statistical Methods -1 Practical**	Credits 2
Practical No.	**Descriptive Statistics - 1 Practical's**	
1.1.1	Tabular Representation.	
1.1.2	Theory of Attributes.	
1.1.3	Classification of Data.	
1.1.4	Diagrammatic and Graphical Representation.	
1.1.5	Measure of Central Tendency	
1.1.6	Practical using R software: Classification of Data and Diagrammatic representation.	
1.1.7	Practical using R software: Measures of Central Tendency	
Practical No.	**Statistical Methods- 1 Practical's**	
1.2.1	Probability - I.	
1.2.2	Probability - II.	
1.2.3	Univariate Discrete Random variables.	
1.2.4	Expectation.	
1.2.5	Bivariate Discrete Random variables.	
1.2.6	Standard Discrete Probability Distributions - 1	
1.2.7	Standard Discrete Probability Distributions - 2	
1.2.8	Practical's Using R software: Discrete uniform, Binomial, Poisson and Hypergeometric distribution.	

Semester II
(Statistics-Minor)

Course Code	Course Title	Credits	No. of hours
23BUST2T3	**Descriptive Statistics – 2**	2	

Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to

- To analyses the data using Regression methods.
- Understand the shift of frequency curve.
- Understand concept of least square method.

Unit I :	**Measures of Dispersion, Skewness & Kurtosis:** **Concept of Dispersion**: Concept of dispersion. Requirements of good measure. Absolute and Relative measures of dispersion: Range, Quartile Deviation, Mean absolute deviation, Standard deviation. Variance and Combined variance, Raw and central moments up to fourth order and relations between them (with proof). Their properties. **Concept of Skewness and Kurtosis:** Measures of Skewness, Karl Pearson's, and Bowley's Coefficient of Skewness based on moments. Measure of Kurtosis, Box- Whisker Plot.	**15**
Unit II :	**Correlation and Regression Analysis:** **Correlation:** Scatter Diagram, Product moment correlation coefficient and its properties. Spearman's Rank correlation (With and without ties). **Regression Analysis:** Concept of linear regression. Principle of least squares. Fitting a straight line by method of least squares. Relation between Regression coefficients and Correlation Coefficient. **Fitting of Curves**: Fitting of curves reducible to linear form by transformation. Concept and use of coefficient of determination (R^2). Fitting a quadratic curve by method of least squares.	**15**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Descriptive Statistics	Welling, Khandeparkar, Pawar, Naralkar	Manan Prakashan		
2.	Descriptive Statistics	Shah R.J	Sheth Publications	8th	
3.	Descriptive Statistics	Milan Gholba,Sudha Phatak, Madhavi Jardosh	Vipul Prakashan	1st	
4.	Introduction to Mathematical Statistics	Hoel P.G.	Asia Publishing House		
5.	Fundamentals of Mathematical Statistics	S.C. Gupta V.K. Kapoor	Sultan Chand and Sons		

Course Code 23BUST2T4	Course Title **Statistical Methods - 2**	Credits 2	No. of hours

Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to

- Study the concept of continuous Probability distributions.
- Understand the nature of frequency curve.
- Get the clear ideas about continuous random variables using various examples?

Unit I :	**Continuous random variable :** **Basic concepts of continuous random variable.** Concept of Continuous random variable and properties of its Probability Density Function and Cumulative Distribution Function and their graphical representation. Expectation and variance of a random variable and its properties. Measures of location, dispersion, skewness and kurtosis. Raw and Central moments (simple illustrations).	**15**
Unit II :	**Continuous Probability Distributions:** Uniform Distribution, Exponential Distribution, Memory less property of Exponential Distribution and Normal Distribution Derivations of mean, median and variance for Uniform and Exponential distributions. Properties of Normal distribution and Normal Curve (without proof). Normal approximation to Binomial and Poisson distribution (statement only). Use of normal tables.	**15**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Statistical Methods	Welling, Khandeparkar, Pawar, Naralkar	Manan Prakashan		
2.	Statistical Methods	Shah R.J	Sheth Publications		
3.	Statistical Methods	Milan Gholba, Sudha Phatak	Vipul Prakashan		
4.	Introduction to Mathematical Statistics	Hoel P.G.	Asia Publishing House		
5.	Basic Statistics	Agarwal B.L.	New Age International Ltd		
6.	Fundamentals of Mathematical Statistics	S.C. Gupta V.K. Kapoor	Sultan Chand and Sons		
7.	Statistical Methods	Medhi J.:	New Age International Ltd	2nd	

Course Code 23BUST2P2	Course Title **Descriptive Statistics - 2 and Statistical Methods -2 Practical**	Credits 2
Practical No.	**Descriptive Statistics - 2 Practicals**	
2.1.1	Measures of Dispersion.	
2.1.2	Measures of Skewness	
2.1.3	Measures of Kurtosis	
2.1.4	Correlation analysis.	
2.1.5	Regression analysis.	
2.1.6	Fitting of curve .	
2.1.7	Practical using R Correlation analysis and Regression analysis.	
2.1.8	Practical using R Fitting of curve & Measures of Dispersion.	
Practical No.	**Statistical Methods – 2 Practical's**	
2.2.1	Continuous Random Variables.	
2.2.2	Expectation and variance of a random variable and its properties.	
2.2.3	Uniform and Exponential Distributions.	
2.2.4	Normal Distributions.	
2.2.5	Applications of Central Limit Theorem and Normal Approximation.	
2.2.6	Practical's Using R Uniform and Exponential Distributions.	
2.2.7	Practical's Using R Normal Distributions.	

Evaluation Scheme

Internals Examination: (Continuation Internal Assessment for each course/paper)

Internal Test	Project (Attending Seminars/Conference/workshops/any other and writing reports on it)	Attendance & Leadership qualities	Total
10	**05**	**05**	**20**

- **Internal Examination:**

Duration: 1 Hour **Total Marks: 10**

	Answer the following	**10**
Q. 1	Objective	05
Q. 2	Subjective	05

- **Theory Examination:**

Suggested Format of Question paper

Duration: $1\frac{1}{2}$ Hour **Total Marks: 30 (each paper 30 marks)**

- **All questions are compulsory**

Q. 1	Answer ***any two*** of the following		**10**
	a	Based on Unit I	
	b	Based on Unit I	
	c	Based on Unit I	
	d	Based on Unit I	
Q. 2	Answer ***any two*** of the following		**10**
	a	Based on Unit II	
	b	Based on Unit II	
	c	Based on Unit II	
	d	Based on Unit II	
Q. 3	Answer ***any two*** of the following		**10**
	a	Based on Unit I	
	b	Based on Unit I	
	c	Based on Unit II	
	d	Based on Unit II	

**(2 questions of 5 marks each / 5 questions of 2 marks can be asked with 50% options)

Marks Distribution and Passing Criterion for Each Semester

Theory					Practical		
Course Code	**Internal**	**Min marks for passing**	**Theory Examination**	**Min marks for passing**	**Course Code**	**Practical Examination**	**Min marks for passing**
23BUST1T3	20	08	30	12	**23BUST1P1**	50	20
23BUST1T4	20	08	30	12			

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[Generic]

Preamble

VPM's B.N. Bandodkar College (Autonomous), Department of Statistics has proposed F.Y.B.Sc. Statistics (Generic) syllabus under Autonomy & as per the guidelines of NEP-2020. The B.Sc. Statistics programme is aimed to develop theoretical and analytical skills of the students so that they may be absorbed in the corporate world or able to inculcate in their major field. The main objectives of the course are:

- To get introduced to some statistical concepts that are relevant in the interpretation of measurements made on individuals, and in the interpretation of statistical study materials.
- To get Knowledge and understanding of basic statistical methods such as collecting data & its types, probability & correlation Analysis.
- To gain Knowledge and understanding to confidently read statistics and apply statistical methods within their working environment.
- To work effectively as a part of a team to achieve a common stated goal.
- To develop an aptitude to engage in continuing professional development.

Eligibility:
Passed 12th standard (HSC) of Maharashtra State Board / CBSE / ICSE board.

Discipline/Subject: Statistics

Degree Programme: B.Sc.

Specific Programme: Statistics (Generic)

Duration: 1 year (Including semesters I & II)

Level: 4.5

Qualification Title: UG certificate

Mode of Conduct:
Statistics Offline lectures / online lectures.

Program Specific Outcome
By the end of the programme, learners should be able to interpret, use and present information in written, graphical, diagrammatic and tabular terms. Enable efficient use of electronic devices to solve statistical problems. Develop the ability to use statistical knowledge and skills in other disciplines.

VPM's B. N. Bandodkar College of Science (Autonomous), Thane
F.Y.B.Sc. (Statistics-Generic)
Structure of Programme

Course Code	Course Title	No. of hours	Credits
23BUST1T5	Basics of Statistics I	**30**	**2**
Total		**30**	**2**

Course Code	Course Title	No. of hours	Credits
23BUST2T5	Basics of Statistics II	**30**	**2**
Total		**30**	**2**

Semester I
(Statistics-Generic)

Course Code 23BUST1T5	Course Title **Basics of Statistics I**	Credits 2	No. of hours

Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to

- Able to know contribution of different Scientists in the field of Statistics.
- Understand technique of data collection and its presentation.
- Emphasize the need of numerical summary measures for data analysis.

Unit I :	**History of Science:** Introduction: General History of Statistics, Aim and Scope of Statistics. Contributions of following Scientists in the field of Statistics: 1. Calyampudi Radhakrishna Rao (C.R.Rao). 2. Prasanta Chandra Mahalanobis (P.C. Mahalanobis). 3. Ronald Aylmer Fisher (R.A. Fisher) 4. Karl Pearson. **Types of data**: Qualitative and Quantitative data, Discrete and Continuous data. **Collection of Data**: Concept of population and sample, Finite and Infinite population. Primary data, Concepts of Questionnaire and a schedule, Secondary data.	**15**
Unit II :	**Classification and Data Presentation:** Frequency distribution of univariate and bivariate random variables. Graphical representation of frequency distribution by Histogram, Diagrammatic representation using Bar diagrams and Pie Chart. **Measures of Central Tendency:** Concept of central tendency of data. (Arithmetic averages, Location averages: Median, Mode, and Partition Values: Quartiles, Deciles, and Percentiles).	**15**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Descriptive Statistics	Welling, Khandeparkar, Pawar, Naralkar	Manan Prakashan		
2.	Descriptive Statistics	Shah R.J	Sheth Publications	8th	
3.	Descriptive Statistics	Milan Gholba,Sudha Phatak, Madhavi Jardosh	Vipul Prakashan	1st	
4.	Introduction to Mathematical Statistics	Hoel P.G.	Asia Publishing House		
5.	Fundamentals of Mathematical Statistics	S.C. Gupta V.K. Kapoor	Sultan Chand and Sons		

Semester II
(Statistics-Generic)

Course Code 23BUST2T5	Course Title **Basics of Statistics II**	Credits 2	No. of hours

Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to

- Solve probabilities using various definitions and rules of the probabilities.
- Understand the different concepts on discrete random variables.
- To analyse the data using Regression methods.

Unit I :	**Concept of Dispersion:** Concept of dispersion. Absolute and Relative measures of dispersion: (Range, Standard deviation). Variance and Combined variance, their properties. **Concept of Skewness and Kurtosis:** Measures of Skewness, Karl Pearson's, and Bowley's Coefficient of Skewness based on moments. Measure of Kurtosis. **Correlation Analysis:** Scatter Diagram, Product moment correlation coefficient and its properties. Spearman's Rank correlation.	**15**
Unit II :	**Elementary Probability Theory :** Trial, Random experiment, Sample point and Sample Space. Definition of an event. Operation of events, Mutually exclusive and exhaustive events. Classical (Mathematical) and Empirical and Axiomatic definitions of Probability and their properties. Theorems on Addition and Multiplication of probabilities and Independence of 2 events. Conditional probability, Baye's theorem (without proof) and its applications.	**15**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Descriptive Statistics	Milan Gholba,Sudha Phatak, Madhavi Jardosh	Vipul Prakashan	1st	
2.	Fundamentals of Mathematical Statistics	S.C. Gupta V.K. Kapoor	Sultan Chand and Sons		
3.	Research Methodology	Kothari, C.R	Wiley Eastern Limited		
4.	Statistical Methods	Milan Gholba, Sudha Phatak	Vipul Prakashan		

Evaluation Scheme

- **Internal Examination: Class Test/ Assignments/ Tutorial Project**

Duration: 1 Hour **Total Marks: 20**

	Answer the following	**20**
Q. 1		
Q.2		

- **Theory Examination:**

Suggested Format of Question paper

Duration: 2 Hours **Total Marks: 30**

- **All questions are compulsory**

Q. 1	Answer ***any two*** of the following		**10**
	a	Based on Unit I	
	b	Based on Unit I	
	c	Based on Unit I	
	d	Based on Unit I	
Q. 2	Answer ***any two*** of the following		**10**
	a	Based on Unit II	
	b	Based on Unit II	
	c	Based on Unit II	
	d	Based on Unit II	
Q. 3	Answer ***any two*** of the following		**10**
	a	Based on Unit I	
	b	Based on Unit I	
	c	Based on Unit II	
	d	Based on Unit II	

**(2 questions of 5 marks each / 5 questions of 2 marks can be asked with 50% options)

Marks Distribution and Passing Criterion for Each Semester

Theory				
Course Code	**Internal**	**Min marks for passing**	**Theory Examination**	**Min marks for passing**
23BUST1T5	20	08	30	12
23BUST2T5	20	08	30	12

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{Skill Enhancement Course (SEC)}

Preamble
The NEP 2020 envisages imparting like skills as well as technical and professional skills as a part of holistic education. B.N.Bandodkar College of Science (Autonomous), Department of Statistics has prepared Skill enhancement courses in Statistical and IT Domain to provide the kinds of skills to the students such as Computer related skills & Coding skills. With higher degree of hands on learning so as to equip them with the skills of their choices suitable to academic path they choose.

Eligibility:
A student who pursues undergraduate programme is offered a pull of Skill Enhancement Courses, from which he has to choose one course for each semester.

Credits : 2
Mode of Conduct: Offline lectures / online lectures / Hybrid mode.

Objectives of this course are as follows:

- To understand data and generate insights from it is by visualizing it using a range of data visualization tools available.
- To understand large volume of data, discover trends, communicate effectively with all stakeholders and influence decisions.
- To develop Business Analytics skillset about how to create effective charts and interactive dashboards is extremely useful.

Program Specific Outcome
By the end of the programme, learners should be able to interpret, use and present information in written, graphical, diagrammatic and tabular terms. Enable efficient use of electronic devices to solve statistical problems. Develop the ability to use statistical knowledge and skills in other disciplines.

SKILL ENHANCEMENT COURSES

DURATION: 45 Hours
TOTAL CREDITS FOR EACH COURSE: 2

List of the Skill Enhancement Courses: Learners will choose any one course amongst the follows:

1. Advanced Spreadsheets Tools
2. Basic IT Tools
3. Power BI
4. Tableau

CREDIT DISTRIBUTION & PRE-REQUISITE OF THE COURSE

Course Title & Code	Credits	Credit distribution of the course			Pre-requisite
		Lectures	Tutorial	Practical/Practice	
23BU1VEC7 Advanced Spreadsheets Tools	**2**	**1**	**0**	**1**	**NIL**
23BU1VEC8 Basic IT Tools	**2**	**1**	**0**	**1**	**NIL**
23BU2VEC7 Power BI	**2**	**1**	**0**	**1**	**NIL**
23BU2VEC8 Tableau	**2**	**1**	**0**	**1**	**NIL**

Course Code 23BU1VEC7	Course Title ADVANCED SPREADSHEETS TOOLS	Credits 2	No. of hours

Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to

- By studying this course, students will be able to draw analysis on data using spreadsheets to make decision.
- By studying this course, students will be able to make meaningful representations of data in the form of charts and pivot tables.
- By studying this course, students will be able to manage data in database tables and use the same for generating queries, forms and reports.

Unit I :	**INTRODUCTION TO SPREADSHEETS** Spreadsheets: Concept of worksheets and workbooks, creating, opening, closing and saving workbooks, moving, copying, inserting, deleting and renaming worksheets, working with multiple worksheets and multiple workbooks, controlling worksheet views, naming cells using name box, name create and name define; Exchanging data using clipboard, object linking and embedding. Printing and Protecting worksheets: Adjusting margins, creating headers and footers, setting page breaks, changing orientation, creating portable documents and printing data and formulae; Implementing file level security and protecting data within the worksheet; Understanding absolute, relative and mixed referencing in formulas, referencing cells in other worksheets and workbooks, correcting common formula errors, working with inbuilt function categories like mathematical, statistical, text, lookup, information, logical, database, date and time and basic financial functions.	**15**
Unit II :	**DATA ANALYSIS IN SPREADSHEETS** Consolidating worksheets and workbooks using formulae and data consolidate command; Choosing a chart type, understanding data points and data series, editing and formatting chart elements, and creating Sparkline graphics, Analyzing data using pivot tables: Creating. Formatting and modifying a pivot table, sorting, filtering and grouping items, creating calculated field and calculated item, creating pivot table charts, producing a report with pivot tables. Introduction to recording and execution of macros.	**15**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Microsoft Office Professional 2013	Swinford, E., Dodge, M., Couch, A., Melton	O'Reilly Media		2013
2.	Office 2019 for dummies	Wang W.	Pearson Education		2018
3.	Excel 2013 Charts & Graphs	Jelen, B.	Que.		2013
4.	Excel 2013 Pivot table Data Crunching	Alexander, M., Jelen, B.	Pearson Education		2013
5.	Access 2019 Bible	Alexander, M.,Kusleika, R.	Wiley		2018

Course Code 23BU1VEC8	Course Title **BASIC IT TOOLS**	Credits 2	No. of hours

Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to

- By studying this course, students will be able to use word-processor to generate documents with appropriate formatting, layout, review and referencing.
- To enable the student to analyse and present information in a meaningful manner.
- To enable students develop IT skills that are a pre-requisite in today's work environment.

Unit I :	**WORD PROCESSING** Introduction: Creating and saving your document, displaying different views, working with styles and character formatting, working with paragraph formatting techniques using indents, tabs, alignment, spacing, bullets and numbering and creating borders; Page setup and sections: Setting page margins, orientation, headers and footers, end notes and foot notes, creating section breaks and page borders; Working with tables: Creating tables, modifying table layout and design, sorting, inserting graphics in a table, table math, converting text to table and vice versa; Create newspaper columns, indexes and table of contents, Spell check your document using inbuilt and custom dictionaries, checking grammar and style, using thesaurus and finding and replacing text; Create bookmarks, captions and cross referencing, adding hyperlinks, adding sources and compiling and bibliography; Mail merge: Creating and editing your main document and data source, sorting and filtering merged documents and using merge instructions like ask, fill-in and if-then-else; Linking and embedding to keep things together.	**15**
Unit II :	**DATABASES** Introduction to Database Development: Database Terminology, Objects, Creating Tables, working with fields, understanding Data types, Changing table design, Assigning Field Properties, Setting Primary Keys, using field validation and record validation rules, Indexing, working with multiple tables, Relationships & Integrity Rules, Join Properties, Record manipulation, Sorting & Filtering: Select data with queries: Creating Query by design & by wizard (Select, Make Table, Append, Delete, Cross Tab, Update, Parameterized Query, Find Duplicate and Find Unmatched), Creating multi table queries, creating & working with table joins. Using operators & expressions: Creating simple & advance criteria; Working with forms: Creating Basic forms, working with bound, unbound and calculated controls, understanding property sheet, Working with Data on Forms: Changing Layout, creating Sub Forms, creating list box, combo box and option groups; Working with Reports: Creating Basic Reports, Creating Header & Footer, Placing Controls on reports, sorting & grouping, Creating Sub reports.	**15**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Microsoft Office Professional 2013	Swinford, E., Dodge, M., Couch, A., Melton	O'Reilly Media		2013
2.	Office 2019 for dummies	Wang W.	Pearson Education		2018

Course Code 23BU2VEC7	Course Title POWER BI	Credits 2	No. of hours

Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to

- Describe the main concepts of data visualization.
- To determine the right type of graph for different types of data available or provided through hands on experience with handling real data sets.
- The read reports, charts, graphs, figure, maps and derive meaning from them.
- To create reports, data visualizations, and dashboards using Power BI and Tableau.
- To understand how to automate tasks, perform ETL, create data models, perform computations, and present insights using data visualization and dashboards.

Unit I :	**DATA PREPARATION:** Connecting to different data sets, Basic data prep and model on Power Query, Drill down and Tooltip, Al visuals (Q&A, Analyze, Decomposition) **DATA VISUALIZATION AND DASHBOARDS:** Inbuilt visuals, Custom visuals, Learn from existing reports, Visualization as a Tooltip, Final dashboard - putting it together Filter, slicer, bookmarks, buttons	**15**
Unit II :	**PERFORMING COMPUTATIONS:** Combine multiple files and folders, Merge and append, Custom calculations Conditional columns, Column from examples, Advanced Editor. DAX-Introduction to Measures, Calculated Columns vs. Quick Measures, Creating a Date Table, Time Intelligence Functions **POWER BI SERVICE:** Publishing to Power BI Service, Power BI data flows, Dashboards and Cross-Reporting.	**15**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	The Flowing Data Guide to Design, Visualization, and Statistics	Nathan Yau.		1st	
2.	The Definitive Guide to DAX	Marco Russo Alberto Ferrari		2nd	
3.	MIs for (Data) Monkey: A Guide to the M Language in Excel Power Query	Ken Puls & Miguel Escobar			
4.	Introduction to Mathematical Statistics	Hoel P.G.	Asia Publishing House		
5.	Fundamentals of Mathematical Statistics	S.C. Gupta V.K. Kapoor	Sultan Chand and Sons		

Useful Weblinks

- https://docs.microsoft.com/en-us/power-bi/
- https://powerbi.microsoft.com/en-us/customer-showcase/
- https://powerquery.microsoft.com/en-us/https://www.sqlbi.com/

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Course Code 23BU2VEC8	Course Title TABLEAU	Credits 2	No. of hours

Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to

- Able to know contribution of different Scientists in the field of Statistics.
- Understand technique of data collection and its presentation.
- Emphasize the need of numerical summary measures for data analysis.

Unit I :	**VISUALIZATIONS:** Introduction to Dimensions and Measures, Bar Chart, Line Chart, Table, Heat Map. Treemap, Packed Bubble, Tooltip	**15**
Unit II :	**CALCULATIONS:** Calculated Fields, Parameters, Introduction to Level of Detail (LOD) FINAL DASHBOARD- Animations, Tooltips, Dashboard and Stories	**15**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Tableau Your Data! Fast and Easy Visual Analysis with Tableau Software	Daniel G. Murray, , WILEY. Steve Wexler, Jeffrey Shaffer, Andy Cotgreave:			
2.	The Big Book of Dashboards- visualizing your data using real world business scenarios Practical Tableau	Wiley Ryan Sleeper			
3.	Cole Nussabaumer Knaflic: Storytelling with data- a data visualization guide for business professionals	Wiley			

Evaluation Scheme

Examination scheme and mode:

Total Marks: 50

Theory Assessment: 25 Marks

Exam (Practical): 25 Marks

**The Internal Assessment for the course may include Class participation, Assignments, Class tests, Projects, Field Work, Presentations, amongst others as decided by the faculty.