

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's  
New Arts, Commerce, and Science College, Ahmednagar  
(Autonomous)  
(Affiliated to Savitribai Phule Pune University, Pune)**



**National Education Policy (NEP)  
Choice Based Credit System (CBCS)**

**Programme Skeleton and Syllabus of  
Statistics (Minor)**

**Implemented from  
Academic Year 2023-24**

**New Arts, Commerce and Science College, Ahmednagar  
(Autonomous)**

**Board of Studies in Statistics**

Sr. No.	Name	Designation
1.	Dr. A. A. Kulkarni	Chairman
2.	Dr. S.D Jagtap	Member
3.	Dr. B.P. Thakur	Member
4.	Prof. S.A Tarate	Member
5.	Dr.N.T Shelke	Member
6.	Dr. A.K. Khamborkar	Academic Council Nominee
7.	Dr. A.J. Shivagaje	Academic Council Nominee
8.	Prof. S. Kawale	Vice-Chancellor Nominee
9.	Dr. S.B.Pathare	Alumni
10.	Mr. Anirudha Deshmukh	Industry Expert
11.	Dr. Vijay Narkhede	Invitee Member
12.	Dr. B.K. Thorve	Member
13.	Prof. K.B. Mane	Member

## **1. Prologue/ Introduction of the programme:**

The Statistics minor introduces students to the quantitative aspects of research. Courses in the minor programme will improve knowledge and working understanding of basic statistical techniques and methods in many areas including agriculture, business, education, finance, insurance sector, and different branches of computer science.

Statistics is the science of collecting, presenting, analysing and interpreting data and communicating these findings to the society. Statistics will help in assessing public opinions through surveys to forecasting business trends. Statistics plays vital role in clinical research. There is huge scope in present as well as in future across countless industries, the government and academia for people who can provide this essential skill set.

Statistics is the science of making inferences and decisions under uncertainty. It is increasingly relevant in the modern world due to the widespread availability of and access to unprecedented amounts of data and computational resources. Unlike classical Statistics, the need to process and manage massive amounts of data has become a key feature of modern Statistics.

The undergraduate minor subject in Statistics focuses on providing students with a working knowledge base in Statistics, probability, and computation tools along with an ability to perform data analysis which is helpful in life science and IT sector.

## **2. Programme Outcomes (POs)**

Students enrolled in the program complete a curriculum that exposes and trains them in a full range of essential skill sets and abilities. They will achieve the following objectives.

1. Student will achieve the skill of understanding the data.
2. Student will be able to develop the data collection methods.
3. Student will have skill to write a story using data visualization.
4. Student will understand the interdisciplinary approach to correlate the statistical concepts with concepts in other subjects.
5. Student will be made aware of history of Statistics and hence of its past, present and future role as part of our culture.
6. Students will demonstrate conceptual domain knowledge of the Statistics in an integrated manner.
7. Student will play the key role in management for effective functioning.

**Credit Distribution: B.Sc. Statistics including Minor and OE and other courses.**

	Type of Courses	III Yr	IV Yrs (Honours)	IV Yrs Research
Major Statistics	Discipline-Specific Courses (DSC)	46	74	66
	Discipline Specific Elective (DSE)	08	16	16
	Skill Enhancement Courses (SEC)	06	06	06
	Vocational Skill Courses (VSC)	08	08	08
	On-Job Training (OJT)	04	08	04
	Field Project (FP)	04	04	04
	Community Engagement and Service (CEP)	02	02	02
	Research project	00	00	12
	Research Methodology	00	04	04
Indian Knowledge System	02	02	02	
	Total (I, II and III Year)	80	124	124
Minor	Minor	20	20	20
Other Courses	Open Elective (OE)/ Multidisciplinary Courses	12	12	12
	Co-Curricular Courses	08	08	08
	Ability Enhancement Courses	08	08	08
	Value Education Courses	04	04	04
	Total	132	176	176

**Programme Framework (Courses and Credits): B.Sc. Statistics (Minor)**

Sr. No.	Year	Semester	Level	Course Type	Course Code	Title	Credits
1.	I	I	4.5	MNR-1	BS-MR101	Introduction to Basic Statistics	03
2.	I	II	4.5	MNR-2	BS-MR201	Statistics Using R	03
3.	II	III	5.0	MNR-3	BS-MR301	Python for Statistics	03
4.	II	IV	5.0	MNR-4	BS-MR401	Bio-Statistics	03
5.	III	V	5.5	MNR-5	BS-MR501	Statistical Model for Predictive and Forecast Analysis	04
6.	III	VI	5.5	MNR-6	BS-MR601	Statistical tools for Testing of Hypothesis	04
							<b>20</b>

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's**  
**New Arts, Commerce and Science College, Ahmednagar**  
**(Autonomous)**  
**Syllabus**  
**B.Sc. Statistics (Minor)**

Title of the Course: Introduction to Basic Statistics								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
MNR-1	BS-MR101 T/P	02	01	03	60	30	70	100

**Learning Objectives:**

1. To learn the scope of Statistics in different fields.
2. To understand about data collection methods, statistical tools and visualizations.
3. To learn various concepts of probability.
4. To understand the basic laws and axioms of probability.

**Course Outcomes (Cos):**

1. Student will achieve the skill of understanding the data
2. Students will be aware of the variety of fields in which Statistics is used widely.
3. Student will also gain the knowledge of computational tools
4. Student will learn the use of probability for better decisions
5. The course will give the overall idea about the uncertain situations that are expressed in probabilistic form

**Detailed Syllabus:**

Unit-I	<b>Introduction of Statistics</b>	5
	<p>Introduction of Statistics: Meaning of Statistics, Importance of Statistics, Scope of Statistics (Field of Industry, Medical Science, Economics, Social Science, Biological Science, Agriculture, and Psychology, Clinical Trial, Decision Theory).</p> <p>Concepts of big data, properties of big data- velocity, volume, variety, verity Applications: Fraud detection in Banking, Customer churn</p> <p>Types of data: Primary data and Secondary data.</p> <p>Data collection methods: register, questionnaire, interview method</p> <p>Categorical data, directional data, Binary data, time series data, Panel data and, Cross sectional data. Image, Voice, Audio, Animated images, Text, Video data.</p> <p>Sampling Methods:                      Definition of population and Sample. Types of sampling method (Probability and Non probability sampling and their types (only description))</p>	

Unit-II	<b>Measures of Central Tendency and Dispersion</b>	12
	<p>Measures of Central Tendency: Concept and Definition of Central Tendency, Characteristics of good measures of Central Tendency.</p> <p>Types of central Tendency: Arithmetic Mean (A.M): Definition of Mean, formulae for ungrouped and grouped data (without proof), Trimmed AM, Weighted AM.</p> <p>Median: Definition of Median, Formulae for ungrouped and grouped data, Graphical data representation,</p> <p>Partition values: Quartiles, Deciles, Percentiles, Quantiles, and their interrelationship</p> <p>Mode: Definition of Mode, formulae for ungrouped and grouped data. Graphical Representation. Empirical relation between mean, median and mode</p> <p>Partition values: Quartiles, Deciles, Percentiles, Quantiles, and their interrelationship</p> <p>Geometric mean: Definition of G.M, formulae</p> <p>Harmonic Mean: Definition of H.M, formulae merits and demerits of AM, Median, Mode, HM, GM, Relation between A.M, G.M and H.M.</p> <p><b>Measures of dispersion:</b></p> <p>Measures of Dispersion: Concept and Definition of dispersion</p> <p>Characteristics of good measures of Dispersion.</p> <p>Types of Dispersion: Absolute and relative measures of dispersion</p> <p>Range: Definition, formula of range, for ungrouped and grouped data, merits and Demerits of range Coefficient of range</p> <p>Mean deviation: definition, formula. for ungrouped and grouped data Merits and demerit.</p> <p>Coefficient of mean deviation, minimal property of MD.</p> <p>Variance and Standard deviation: definition, formula. for ungrouped and grouped data.</p> <p>Merits and demerit, combined variance. Minimal property of variance (Mean square Deviation, coefficient of quartile deviation and coefficient of mean deviation, coefficient of variation (C.V)</p>	
Unit-III	<b>Introduction of Probability</b>	7
	<p>Definition of Probability, Concept of deterministic and non-deterministic models (Random experiments).</p> <p>Definitions of sample space and types of sample space: Sample space, Types of sample space: finite, countably infinite and uncountable. Real life examples.</p> <p>Definitions of Event and types of event: Event and concept of occurrence of an event Elementary event, complement of an event, certain event, impossible event, Relative complement event, Mutually exclusive events or Disjoint events (for two and three events), mutually Exhaustive events (for two and three events), mutually exclusive and exhaustive events, Partition of sample space. Algebra of events including De Morgan's rules and its representation in set theory notation.</p>	

Unit IV		<b>Conditional Probability and Independence.</b>	6
		Definition of conditional probability of an event. Results on conditional probability. Definition of independence of two events, $P(A \cap B) = P(A) * P(B)$ , Pairwise independence and mutual independence for three events, Multiplication theorem $P(A \cap B) = P(B)*P(A B)$ . Generalization to $P(A \cap B \cap C)$ .  Prior and posterior probabilities. Bayes' theorem. Applications of Bayes' theorem in real life.	

**List of the Practical:**

Sr. No.	Title of the Practical	No. of Practical's
1	Diagrammatic and Graphical Representation of Data	1
2	Measures of Central Tendency	1
3	Measures of Dispersion	1
4	Addition and Multiplication Principles of Probability	1
5	Computation of Probability of different events	1
6	Computation Conditional Probability and Independence of Events.	2
	<b>Total</b>	<b>7</b>

**Suggested Readings/Material:**

1. Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, New Delhi.
2. Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eleventh Edition, Sultan Chand and Sons Publishers, New Delhi.
3. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn. (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
4. Sarma, K. V. S. (2001). Statistics Made it Simple: Do it yourself on PC. Prentice Hall of India, New Delhi.
5. Snedecor G. W. and Cochran W. G. (1989). Statistical Methods, Eighth Ed. East-West Press.
6. Gupta, S. C. and Kapoor, V. K. (1997). Fundamentals of Applied Statistics, 3rd Edition, Sultan Chand and Sons Publishers, NewDelhi.
7. Mukhopadhyay P. (2015). Applied Statistics, Publisher: Books & Allied (P) Ltd.
8. Agarwal, B. L. (2003). Programmed Statistics, 2nd Edition, New Age International Publishers, NewDelhi.
9. Gore Anil, Pranjape Sharayu ,Kulkarni Madhav. Statistics for everyone. SIPF Academy Publisher, Nashik
10. Purohit, S. G., Gore S. D., Deshmukh S. R. (2008). Statistics Using R, Narosa Publishing House, NewDelhi.



**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's**  
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**Syllabus**  
**B.Sc. Statistics (Minor)**

Title of the Course: Statistics Using R								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
MNR-2	BS-MR201 T/P	02	01	03	60	30	70	100

**Learning Objectives:**

1. To learn different imputation tools in R.
2. To discriminate between hardware and software.
3. To understand the different data visualization using R.
4. To learn how to compute descriptive Statistics using R.
5. To gain overall logical thinking as a base of data science will be improved.

**Course Outcomes (Cos):**

1. Student will have sufficient computational skill through R- programming software.
2. Student will understand the difference in data visualization using R.
3. Student will understand the difference in output of analysis using R.
4. The overall logical thinking as a base of data science will be improved.
5. Student will have skill of result interpretation.

**Detailed Syllabus:**

Unit-I	<b>Introduction to R and imputation methods</b>	9
	Computer hardware, computer software, Differences Between Hardware and Software, History of R language, Why R Language, features of R Programming Language, advantages of R Programming Language.	
	R Preliminaries: Assignment operator, Vector bases of R, functions in R, acceptable object names in R. Methods of Data input: c function, sequence function and sequence operator, scan function, rep function, data.frame function, matrix function, class function, importing data from excel, resident data sets. Data accessing or Indexing: Accessing data from data frame, subset and transform, List	
Unit-II	<b>Graphical and Diagrammatic Representation of Data using R</b>	6
	Diagrams: Simple bar diagram, Subdivided bar diagram, Multiple bar diagram, Pie diagram, stem and leaf diagram.	

	Graphs: Boxplot, spike plot, histogram for both equal and unequal class intervals, frequency polygon, ogive curves, empirical distribution function, Saving the diagram and graphs using R	
Unit-III	<b>Basic Statistics using R</b>	9
	Use of R commands to compute measures of Central Tendency, dispersion, skewness and kurtosis Computations of following measures for all types of data.  Central tendency mean, mode, median, quartiles, deciles, percentiles, geometric mean and harmonic mean.  Dispersion: variance, standard deviation, coefficient of variation, mean deviation.  Skewness: Bowley's coefficient and Karl Pearson's coefficient of skewness.	
Unit- IV	<b>Probability Distribution and Its application using R</b>	6
	Plotting of p.m.f. and c.d.f. of Bernoulli, Binomial, Hypergeometric, Geometric distribution, Poisson distribution and its applications.	
	Plotting of p.d.f. and c.d.f. of Uniform distribution, Exponential, Normal distribution and its applications.	

**List of Practical:**

Sr. No.	Title of the Practical	No. of Practical's
1	Data Input Methods	1
2	Diagrammatic and Graphical Representation	1
3	Measures of Central Tendency	1
4	Measures of Dispersion	1
5	Measures of Skewness and Kurtosis	2
6	Plotting of probability mass function, cumulative distribution function.	1
	<b>Total</b>	<b>7</b>

**Suggested Readings/Material:**

1. Crawley, M.J. (2006). Statistics – An introduction using R. John Wiley London.
2. Purohit, S.G., Deshmukh, S.R. and Gore, S.D., (2015). Statistics using R. Alpha Science International.
3. Verzani, J., (2018). Using R for introductory Statistics. CRC press.
4. Schumacker, R.E., (2014). Learning Statistics using R. Sage Publications.