

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 Framework**  
**B. Sc. - I (Statistics)**

**Implemented from**  
**Academic Year 2024-25**

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's  
**New Arts, Commerce and Science College, Ahmednagar**  
**(Autonomous)**  
**Board of Studies in Statistics**

Sr. No.	Name	Designation
1.	Dr. A. A. Kulkarni	Chairman
2.	Prof. S. Kawale	Vice-Chancellor Nominee
3.	Dr. A.K. Khamborkar	Academic Council Nominee
4.	Dr. A.J. Shivagaje	Academic Council Nominee
5.	Dr. S.B.Pathare	Alumni
6.	Mr. Vijay Narkhede	Invited Member
7.	Dr. B. K. Thorve	Member

8.	Prof. K. B. Mane	Member
9.	Prof. B. P. Kharat	Member
10.	Prof. M. Z. Shaikh	Member
11.	Prof. S. S. Bansode	Member
12.	Prof. S.S. Dhadiwal	Member
13.	Prof. V. V. Khajekar	Member
14.	Prof. D. D. Kale	Member
15.	Dr. S.D Jagtap	Member
16.	Dr. B.P. Thakur	Member
17.	Prof. S.A Tarate	Member
18.	Dr.N.T Shelke	Member

## 1. Prologue/ Introduction of the programme:

It is known that in economic activities are of three types, agriculture, industrial and service. In the same way the subject Statistics is a SERVICE SCIENCE having potential to address the problems in these three fields. In research application of Statistics is mandatory. In the present days, apart from traditional field of career, Data Science, Data Analytics, Data Mining, Data Visualization are the upcoming field of career for Statistics students. In these field student must have mathematical ability, statistical thinking, computer (Software and programming) knowledge and communication (Verbal and written). These points are taken into consideration to design the syllabus and examination pattern of Statistics. In addition to academics, the department takes care to arrange a series of lectures on interview skills, preparation of CV, improve communication skill and overall personality development. The students are given the task of event management so that they can practice the principles of management such as leadership, creativity, communication, time management, group activity, team work, etc. In general, through curricular, co-curricular and extra-curricular activities student in three years is developed as thought provoker, problem solver, technologically sound, with command on communication, strong self-confidence.

B. Sc. in Statistics program is of three years' duration and B.Sc. in Statistics Honours with four year duration having semester pattern for all the years. The important feature of the syllabus is that, all practical's from first year to third year will be conducted on computer using MS-EXCEL/ R Suit, Python programming and Tableau.

The course on Tableau will give an opportunity to learn thousands of various data presentation types and to present the complex data by easy way. The practical examinations of all courses will be on computer. In short, maximum exposure is given to students to work on computer and evaluate them on computer.

The syllabus is framed with appropriate weightage of theory, applied and skill enhancement courses. After receiving B.Sc. degree, student is expected to have minimum knowledge of various courses and student will have ability to analyze the data with relevant interpretation of results. After completion of B.Sc. honours students get maximum knowledge about statistics, so that student can handle any big data.

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

Students enrolled in the program complete a curriculum that exposes and trains students in a full range of essential skills and abilities. They will have the opportunity to master the following objectives.

1. Student will achieve the skill of understanding the data.
2. Student will be able to develop the data collection instrument.
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.

**Programme Framework: Credit Distribution**

Level / Difficulty	Sem	Subject-1 (Selected as Major)						Subject-2		Subject-3		(SEC)	GE/OE		IKS	AEC	VEC	CC	Total
		T		P				T	P	P	T	P	T	P					
Certificate 4.5 / 100	I	02		02				02	02	02	02	-	02		02	02	02	02	22
	II	02		02				02	02	02	02	02	-	02	--	02	02	02	22
		<b>Credits Related to Major</b>																	
		<b>Core</b>		<b>Elective</b>		<b>VSC</b>	<b>FP / OJT / CEP/ RP</b>	<b>Selected as Minor</b>											
		T	P	T	P	P	P	T	P	-	P	T	P	-	-	-	-	-	
Diploma 5.0 / 200	III	04	02	--		02	02	02	02	-	02	02		-	02	-	02	22	
	IV	04	02	--		02	02	02	02	-	02		02	--	02	-	02	22	
Degree 5.5 / 300	V	06	04	02	02	2	2	02	-	-	-	-	-	02	-	-	-	22	
	VI	06	04	02	02	2	4	02	-	-	-	-	-	-	-	-	-	22	
<b>Total</b>		<b>24</b>	<b>16</b>	<b>04</b>	<b>04</b>	<b>08</b>	<b>10</b>	<b>10</b>	<b>08</b>	<b>04</b>	<b>04</b>	<b>06</b>	<b>08</b>	<b>04</b>	<b>08</b>	<b>04</b>	<b>08</b>	<b>132</b>	
6.0/400 Honours	VII	08	06	02	02	-	RM-04											22	
	VIII	08	06	02	02		OJT-04											22	
6.0/400 Honours with Research	VII	06	04	02	02		RM-04 RM-04											22	
	VIII	06	04	02	02		RM-08											22	
<b>Total</b>		<b>40/36</b>	<b>28/24</b>	<b>08</b>	<b>08</b>	<b>08</b>	<b>18/26</b>	<b>10</b>	<b>08</b>	<b>04</b>	<b>04</b>	<b>06</b>	<b>04</b>	<b>04</b>	<b>04</b>	<b>08</b>	<b>04</b>	<b>08</b>	<b>176</b>

**B.Sc. Programme Framework: Course Distribution**

Level / Difficulty	Sem	Subject-1 (Selected as Major)						Subject-2		Subject-3		(SEC)	GE/OE		IKS	AEC	VEC	CC	Total
		T		P				T	P	P	T	P	T	P					
Certificate 4.5 / 100	I	01		01				01	01	01	01	-	01		01	01	01	01	11
	II	01		01				01	01	01	01	01	-	01	--	01	01	01	11
		Credits Related to Major						Selected as Minor											
		Core		Elective		VSC	FP / OJT / CEP/RP												
		T	P	T	P	P	P	T	P	-	P	T	P	-	-	-	-	-	
Diploma 5.0 / 200	III	02	01	--		01	FP-01	01	01	-	01	01		-	01	-	01	11	
	IV	02	01	--		01	CEP-01	01	01	-	01		01	--	01	-	01	11	
Degree 5.5 / 300	V	03	02	01	01	01	FP-01	01	-	-	-	-		01	-	-	-	11	
	VI	03	02	01	01	01	OJT-01	01	-	-	-	-		-	-	-	-	10	
<b>Total</b>		<b>12</b>	<b>08</b>	<b>02</b>	<b>02</b>	<b>04</b>	<b>04</b>			<b>02</b>	<b>02</b>	<b>03</b>	<b>04</b>	<b>02</b>	<b>04</b>	<b>02</b>	<b>04</b>	<b>65</b>	
6.0/400 Honours	VII	03	03	01	01	-	RM-01											09	
	VIII	03	03	01	01		OJT-01											09	
6.0/400 Honours with Research	VII	02	02	01	01		RM-01 RM-01											08	
	VIII	02	02	01	01		RM-01											07	
<b>Total</b>		<b>18/16</b>	<b>14/12</b>	<b>04</b>	<b>04</b>	<b>04</b>	<b>06/07</b>	<b>06</b>	<b>04</b>	<b>02</b>	<b>02</b>	<b>03</b>	<b>04</b>	<b>02</b>	<b>04</b>	<b>02</b>	<b>04</b>	<b>83/80</b>	

**B. Sc. -Statistics: Credit and Course Distribution in Brackets**

Level / Difficulty	Sem	Subject-1							Total
		T		P					
4.5	I	02 (01)		02 (01)				04(02)	
	II	02 (01)		02 (01)				04(02)	
		Credits Related to Major							
		Core		Elective		VSC	FP / OJT/ CEP	IKS	
		T	P	T	P	P	P	T	
5.0	III	04(02)	02(01)	--		02(01)	FP-02(01)		10(05)
	IV	04(02)	02(01)	--		02(01)	CEP-02(01)		10(05)
5.5	V	06(03)	04(02)	02(01)	02(01)	02(01)	FP-02(01)	02(01)	20 (10)
	VI	06(03)	04(02)	02(01)	02(01)	02(01)	OJT-04(01)		20(09)
<b>Total</b>		<b>12</b>	<b>08</b>	<b>(02)</b>	<b>(02)</b>	<b>04</b>	<b>04</b>	<b>(01)</b>	<b>33</b>
6.0	VII	03	03	(01)	(01)	-	RM-04(01)		22(09)
	VIII	03	03	(01)	(01)		OJT-04(01)		22(09)
6.0	VII	(02)	(02)	(01)	(01)		RM-04(01) RP-04(01)		22(08)
	VIII	(02)	(02)	(01)	(01)		RM-08(01)		22(07)
		<b>18/16</b>	<b>14/12</b>	<b>04</b>	<b>04</b>	<b>04</b>	<b>06/07</b>	<b>(01)</b>	<b>51/48</b>

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

Sr. No.	Year	Semester	Level	Course Type	Course Code	Title	Credits
1.	I	I	4.5	DSC-01	BS-ST 111T	Descriptive Statistics I	02
2.	I	I	4.5	DSC-02	BS-ST 112P	Practical I	02
3.	I	II	4.5	DSC-03	BS-ST 121T	Basics of Probability	02
4.	I	II	4.5	DSC-04	BS-ST 122 P	Practical II	02
5.	II	III	5.0	DSC-05	BS-ST 231T	Continuous Probability Distribution I	02
6.	II	III	5.0	DSC-06	BS-ST 232T	Discrete Probability Distributions I	02
7.	II	III	5.0	DSC-07	BS-ST 233P	Practical III (231, 232)	02
8.	II	III	5.0	VSC-01	BS-ST 234P	Descriptive Statistics II (Practical)	02
9.	II	III	5.0	FP-01	BS-ST 235P	Field Project	02
10.	II	IV	5.0	DSC-08	BS-ST 241T	Discrete Probability Distributions II	02



11.	II	IV	5.0	DSC-09	BS-ST 242T	Continuous Probability distribution II	02
12.	II	IV	5.0	DSC-10	BS-ST 243P	Practical IV(241, 242)	02
13.	II	IV	5.0	VSC-02	BS-ST 243P	Statistical Methods (Practical)	02
14.	II	IV	5.0	CEP-01	BS-ST 245P	Community Engagement Project	02
15.	III	V	5.5	DSC-11	BS-ST 351T	Distribution Theory I	02
16.	III	V	5.5	DSC-12	BS-ST 352T	Design of Experiments	02
17.	III	V	5.5	DSC-13	BS-ST 353T	Theory of Estimation	02
18.	III	V	5.5	DSC-14	BS-ST 354P	Practical V ( 351, 352)	02
19.	III	V	5.5	DSC-15	BS-ST 355P	Practical VI ( 353, 356)	02
20.	III	V	5.5	DSE-01	BS-ST 356T	Sampling Theory	02
21.	III	V	5.5	DSE-02	BS-ST 357P	Practical VII (OR)	02
22.	III	V	5.5	VSC-03	BS-ST 358P	Data Analytics	02
23.	III	V	5.5	FP-02	BS-ST 359P	Field Project	02
24.	III	V	5.5	IKS-02	BS-ST 360T	Statistical Heritage and Systems in India	02
25.	III	VI	5.5	DSC-16	BS-ST 361T	Distributions Theory II	02
26.	III	VI	5.5	DSC-17	BS-ST 362T	Testing of Hypothesis	02
27.	III	VI	5.5	DSC-18	BS-ST 363T	Basics of Regression and Time series	02
28.	III	VI	5.5	DSC-19	BS-ST 364P	Practical VIII (361, 363)	02
29.	III	VI	5.5	DSC-20	BS-ST 365P	Practical (Reliability Theory)	02
30.	III	VI	5.5	DSE-03	BS-ST 366T	Statistical Process Control	02
31.	III	VI	5.5	DSE-04	BS-ST 367P	Practical IX (363, 366)	02
32.	III	VI	5.5	VSC-04	BS-ST 368T	Python Programming	02
33.	III	VI	5.5	OJT-01	BS-ST 369T	OJT	04

**B. Sc. Statistics (Honours)**

34.	IV	VII	6.0	DSC-21	BS-ST 471T	Linear Algebra	03
35.	IV	VII	6.0	DSC-22	BS-ST 472T	Probability Distributions	03
36.	IV	VII	6.0	DSC-23	BS-ST 473T	Sampling Theory and Methods	02
37.	IV	VII	6.0	DSC-24	BS-ST 474P	Practical -X (Based on 471, 472))	02
38.	IV	VII	6.0	DSC-25	BS-ST 475P	Practical -XI (Based on 473)	02
39.	IV	VII	6.0	DSC-26	BS-ST 476TP	Practical -XII ( SQL)	02
40.	IV	VII	6.0	DSE-05	BS-ST 477T	Exploratory Multivariate Analysis / Data Mining	02
41.	IV	VII	6.0	DSE-06	BS-ST 478P	Practical XIII (Based on MS-ST517 T)	02
42.	IV	VII	6.0	RM-01	BS-ST 479T	Research Methodology	04
43.	IV	VIII	6.0	DSC-27	BS-ST 481T	Statistical Inference	03
44.	IV	VIII	6.0	DSC-28	BS-ST 482T	Regression Analysis -II	03
45.	IV	VIII	6.0	DSC-29	BS-ST 483T	Probability Theory	02

46.	IV	VIII	6.0	DSC-30	BS-ST 484P	Practical-XIV (Machine Learning )	02
47.	IV	VIII	6.0	DSC-31	BS-ST 483P	Practical- XV (Based on MS-ST522)	02
48.	IV	VIII	6.0	DSC-32	BS-ST 484P	Practical- XVI (Based on Numerical Analysis)	02
49.	IV	VIII	6.0	DSE-07	BS-ST 485T	Inferential Multivariate Analysis /Categorical Data Analysis	02
50.	IV	VIII	6.0	DSE-08	BS-ST 485P	Practical- XVII (Based on MS-ST527)	02
51.	IV	VIII	6.0	OJT-02	BS-ST 486T	OJT	04

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**Syllabus**  
**B. Sc. -I (Statistics)**

Title of the Course: Descriptive Statistics I								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
<b>DSC-01</b>	<b>BS-ST 111T</b>	02	00	02	30	15	35	50

### Learning Objectives:

1. The students learn the Scope of statistics in different fields.
2. They understand about data collection methods
3. They learn different techniques of data visualizations.
4. They learn the elements of descriptive statistics

### Course Outcomes (Cos)

After completion of this course:

1. Students will be aware of the variety of fields in which Statistics is used widely.
2. Students will have acquired knowledge of data collection methods.
3. Student will also gain the silent knowledge of different data types.
4. Student will be able to apply different statistical tools to solve real life situations.

### Detailed Syllabus:

Unit-I	<b>Introduction of Statistics</b>	6
	Introduction to Statistics: Meaning of Statistics, Importance of Statistics, Scope of Statistics (Field of Industry, Medical Science, Economics, Social Science, Biological Science, Agriculture, Psychology, Clinical Trial, Computer Science, Insurance and finance) . Statistical Organizations in India and Maharashtra. Concepts of big data, properties of big data- velocity, volume, varsiety.	
Unit-II	<b>Sampling Methods</b>	9
	Types of data: Primary data, Secondary data, Categorical data, directional data, Binary data, time series data, Panel data, Cross sectional data. Image, Voice, Audio, Animated images, Text and Video data Data collection methods: Census (Scope and Limitation), Sample Survey register, questionnaire, interview method Types of characteristics: Variable and Attribute, scaling methods Sampling methods: Definition of population and statistical population, sample, Finite population, Infinite population, Homogenous population, Heterogeneous	

	<p>population</p> <p>Advantages of sampling over census.</p> <p>Definition of sampling unit and sampling frame.</p> <p>Sample selection ways: Non-random sampling and random sampling.</p> <p>Methods of achieving randomness.</p> <p>Sampling methods: Probability and Non probability sampling and their types (only description)</p> <p>Probability sampling: SRS, SRSWR, SRSWOR, Stratified, Systematic, Cluster sampling.</p> <p>Non-probability sampling: Judgment, Quota, Convenience, snowball sampling.</p>	
Unit-III	<b>Measures of Central Tendency</b>	9
	<p>Measures of Central Tendency: Concept and Definition of Central Tendency, Characteristics of good measures of Central Tendency.</p> <p>Types of central Tendency;</p> <p>Arithmetic Mean (A.M): Definition of Mean, formulae for ungrouped and grouped data (without proof), Properties of A.M., Trimmed AM, Weighted A.M.</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, merits and demerits.</p> <p>Harmonic Mean: Definition of H.M, formulae.</p> <p>merits and demerits of AM, Median, Mode, HM, GM, Relation between A.M, G.M and H.M</p> <p>Box and Whisker plot. Choice of average.</p>	
Unit-IV	<b>Measures of dispersion</b>	6
	<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</p> <p>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>	

		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))	
		Raw moments for grouped and ungrouped data, Central moments for grouped and ungrouped, effect of change of origin and scale. Relation between central moments and raw moments, up to 4 <sup>th</sup> order (without prof)	

**Suggested Readings/Material:**

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

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**Syllabus**  
**B. Sc. -I (Statistics)**

<b>Title of the Course: Practical I</b>								
<b>Year: I</b>				<b>Semester: I</b>				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-02	BS-ST 112P	00	02	02	60	15	35	50

Sr. No.	Title of the Practical	No. of Practical's
1	Diagrammatic Representation of Data	1
2	Graphical Representation of Data	1
3	Sampling Methods	1
4	Classification and Tabulation	1
5	Measures of Central Tendency for ungrouped data	1
6	Measures of Central Tendency for grouped data	1
7	Measures of Dispersion for ungrouped data	1
8	Measures of Dispersion for grouped data	1
9	Computation of Moments for ungrouped and grouped data.	1
10	Project	3
	<b>Total</b>	<b>12</b>

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**Syllabus**  
**B. Sc. -I (Statistics)**

Title of the Course: Basics of Probability								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DCS-03	BS-ST121T	02	00	02	30	15	35	50

**Learning Objectives:**

1. The students learn certain and uncertain situations.
2. The students learn the concept of probability.
3. The Students able to understand the basic laws and axioms of probability.
4. The students understand concept of random variable and their types.
5. The students learn concept of probability distributions.

**Course Outcomes (Cos):**

After completion of this course,

1. The course will give the overall idea about the uncertain situations that are expressed in probabilistic form.
2. Statistical thinking will help one's success in life and career by quantifying uncertainty using probability.
3. Student will learn the use of probability for better decisions.
4. student will get an opportunity to collect the data related to uncertain situation and interpret the probabilities.
5. Student will able to apply basic probability principles to solve real life problems.

Unit-I	Introduction to Probability	09
	<p>Basics of Probability: Counting Principles: Additive principle, multiplicative principle. Counting Rules: Permutations and combinations. Rules and relationship between Permutations and combinations (without proof). 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,</p>	

	<p>Partition of sample space. Algebra of events including De Morgan's rules and its representation in set theory notation.</p> <p>Occurrence of following events (with the help of listing and Venn diagram). Complement of an event, at least one of the two given events, At least one of the three given events, None of the given two events,</p> <p>None of the given three events, Simultaneous occurrence of the two events, Simultaneous occurrence of the three events, Mutually exclusive events (for two and three events), Mutually exhaustive events (for two and three events), mutually exclusive and exhaustive events (for two and three events), Partition of sample space, Exactly one event out of the two events, Exactly one event out of the three events, Verification of De Morgan's rules.</p>	
Unit-II	<b>Theory of Probability</b>	06
	<p>Classical definition of probability and its limitations. Equiprobable and non-equiprobable sample space, classical definition of probability, Addition theorem on probability, limitations of classical definition. Situations where classical definition of probability is applicable.</p> <p>Axiomatic approach of probability. Axioms of Probability, Situations where axiomatic approach of probability is applicable. Addition theorem on probability and its generalization. Various results on Probability Boole's inequality. Numerical examples and problems.</p>	
	<b>Conditional probability and Independence</b>	07
	<p>Definition of independence of two events,</p> <p><math>P(A \cap B) = P(A) * P(B)</math>, Pairwise independence and mutual independence for three events.</p> <p>Definition of conditional probability of an event. Results on conditional probability, Multiplication theorem.</p> <p><math>P(A \cap B) = P(B)*P(A B)</math>. Generalization to <math>P(A \cap B \cap C)</math>.</p> <p>Prior and posterior probabilities. Bayes' theorem. Applications of Bayes' theorem in real life. Concept of True positive (TP, Sensitivity), False positive (FP), True negative (TN, Specificity), False negative (FN). Numerical examples and problems</p>	
Unit-III	<b>Univariate Probability Distributions</b>	08
	<p>Univariate Probability Distributions (Defined on Discrete Sample Space): Univariate probability mass function (p.m.f): Concept and definition of a random variable. Types of random variable. Concept and definition of a discrete random variable. Probability mass function (p.m.f) and cumulative distribution function (c.d.f), <math>F(\cdot)</math> of discrete random variable, properties of</p>	



		c.d.f., graphical representation of p.m.f. and c.d.f. Mode and median of discrete probability distribution. Numerical examples and problems.	
		<p>Mathematical Expectation (Univariate Random Variable): Definition of expectation (mean) of a random variable, expectation of a function of a random variable, m.g.f. and c.g.f. properties of m.g.f. and c.g.f.</p> <p>Definitions of variance, standard deviation(s.d.) and coefficient of variation(C.V.) of univariate probability distribution, effect of change of origin and scale on mean, variance and s.d.</p> <p>Definition of raw, central and factorial raw moments of univariate probability distribution, and their interrelations (without proof).</p> <p>Coefficients of skewness and kurtosis based on moments. Numerical examples and problems.</p>	
Unit-IV		<b>Bivariate Probability Distribution</b>	
		Discrete bivariate random vector or variable (X, Y): Joint p. m. f. and its properties, joint c. d. f. and its properties, probabilities of events related to random variables, marginal distribution.	
		<p>Independence of two random variables and its extension to k random variables. conditional distributions, mathematical expectation of bivariate random variable, expectation of function of r.v. <math>E[g(X, Y)]</math>,</p> <p>Theorems on expectation:</p> <p>i) <math>E(X + Y) = E(X) + E(Y)</math> &amp; <math>E(aX + bY + c)</math>  ii) <math>E(XY) = E(X) * E(Y)</math> if X and Y are independent and its generalization to k variables.</p> <p>Covariance, effect of change of origin &amp; scale on covariance, <math>Var(aX + bY + c)</math>, <math>corr(X, Y)</math>, effect of change of origin &amp; scale on correlation, independence Vs uncorrelatedness, conditional mean, proof of <math>E\{E[X Y = y]\} = E[X]</math> &amp; <math>E\{E[Y X = x]\} = E[Y]</math>, regression as a conditional expectation, conditional variance, raw &amp; central moments of bivariate random variable.</p>	
		<p>Moment Generating Function (MGF): definition, applications, <math>M_{X, Y}(t_1, t_2)</math>, properties, MGF of marginal distribution of random variables,</p> <p>Proofs of the following properties:</p> <p>i) <math>M_{X, Y}(t_1, t_2) = M_X(t_1, 0) M_Y(0, t_2)</math> if X and Y are independent r.v.s.,  ii) <math>M_{X+Y}(t) = M_{X, Y}(t, t)</math>  iii) <math>M_{X+Y}(t) = M_X(t) M_Y(t)</math> if X and Y are independent r.v.s.</p> <p>Deduction of joint moments.</p>	

	Probability Generating Function (PGF): applications and properties.	
	Cumulant Generating Function (CGF): applications and properties, deduction of central moment.	

**Suggested Readings/Material:**

1. Agarwal B. L. (2003). Programmed Statistics, second edition, New Age International Publishers, New Delhi.
2. Devore/ Peck: Statistics (The Exploration and Analysis of Data), Duxbury.
3. Gupta, S.C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
4. Hoel P. G. (1971). Introduction to Mathematical Statistics, John Wiley and Sons, New York.
5. Hogg, R. V. and Craig R. G. (1989). Introduction to Mathematical Statistics, Ed. 4. MacMillan Publishing Co., New York.
6. Mayer, P. (1972). Introductory Probability and Statistical Applications, Addison Wesley Publishing Co., London.
7. Statistical Methods: Welling, Khandeparkar, Pawar, Naralkar Manan Publications. First edition.
8. Theory and Problems of Statistics: Spiegel M.R. – Schaums Publishing Series, Tata Mcgraw - Hill. First edition
9. Rohatgi V. K. and Saleh A. K. Md. E. (2002): An Introduction to probability and statistics. John wiley & Sons (Asia)
10. Gupta V.K. & Kapoor S.C. Fundamentals of Mathematical Statistics. - Sultan & Chand
11. Mukhopadhyay P. (2006): Probability. Books and Allied (P) Ltd

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

Title of the Course: Practical II								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
<b>DSC-03</b>	<b>BS-ST 122P</b>	00	02	02	60	15	35	50

Sr. No.	Title of the Practical	No. of Practical's
1	<b>Sample space , Evnets and Venn Diagram</b>	1
2	Addition and Multiplication Principles of Probability	1
3	Computation of Probability of differnet events	1
4	Computation of probability using classical definition and Axiomatic Approach	1
5	Computation Conditional Probaility and Independence of Events.	1
6	Probabulity calculation using Multiplication theorem and Baye's Theorem	
7	Univariate Probability distribution( Drawing pmf, cdf and Computaion of mean, mode and median)	1
8	Univariate Mathematical Expectation	1
9	Computation of Probability of Bivariate Probability distribution and margianl probavility distribuion	1
10	Bivaraitte Mathematical Expectation	1
11	Project	2
		12