॥ सा विद्या या विमुक्तये ॥

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

'ज्ञानतीर्थ', विष्णुपुरी, नांदेड – ४३१ ६०६ (महाराष्ट्र राज्य) भारत

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA

Established on 17th September, 1994, Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accredited with'B++' grade

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विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरण २०२० नुसार पदवी द्वितीय वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२५–२६ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, दिनांक २७ मे २०२५ रोजी संपन्न झालेल्या मा. विद्यापरिषद बैठकीतील विषय क्रमांक १६/६१–२०२५ च्या ठरावानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील राष्ट्रीय शैक्षणिक धोरण–२०२० नुसारचे पदवी द्वितीय वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२५–२६ पासून लागू करण्यास मा. विद्यापरिषदेने मान्यता प्रदान केली आहे. त्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील बी. एस्सी द्वितीय वर्षाचे खालील विषयाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२५–२६ पासून लागू करण्यात येत आहेत.

01	B.Sc. Agriculture Microbiology	11	B.Sc. Physics
02	B.Sc. Botany	12	B.Sc. Seed Technology
03	B.Sc. Dairy Science	13	B.Sc. Horticulture
04	B.Sc. Electronics	14	B.Sc. Statistics
05	B.Sc. Environmental Science	15	B.Sc. Biochemistry
06	B.Sc. Fishery Science	16	B.Sc. Analytical Chemistry
07	B.Sc. Food Science	17	B.Sc. Agrochemical & Fertilizers
08	B.Sc. Geology	18	B.Sc. Industrial Chemistry
09	B.Sc./B.A. Mathematics	19	B.Sc. Industrial Microbiology
10	B.Sc. Microbiology		

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.:शै–१/एनइपी/विवत्रंविपदवी/२०२५–२६/११६
दिनांक ०५.०६.२०२५

सहाय्यक कुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत : माहितीस्तव तथा कार्यवाहीस्तव.
१) मा. कुलगुरू महोदयांचे कार्यलय, प्रस्तुत विद्यापीठ.
२) मा. प्र. कुलगुरू महोदयांचे कार्यलय, प्रस्तुत विद्यापीठ.
३) मा. आधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
४) मा. संचालक, परीक्षा व मुंल्यमापन मंडळ, प्रस्तुत विद्यापीठ.
५) मा. प्राचार्य, सर्व संबधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
६) सिस्टीम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. याना देवून कळविण्यात येते की, परिपत्रक अभ्यासक्रम संकेतस्थळावर प्रसिध्द करण्यात यावेत.

SWAMI RAMANAND TEERTHMARATHWADA UNIVERSITY, NANDED - 431 606 (MS)

(Credit Framework and Structure of Four Year UG Program with Multiple Entry and Exit Option as per NEP-2020)

UNDERGRADUATE PROGRAMME OF

SCIENCE & TECHNOLOGY

Major in **STATISTICS** and Minor in **DSM** (Subject)

Under the Faculty of Science & Technology

(Revised as per the Govt. of Maharashtra circular dt. 13th March 2024)

w.e.f. June -2025

Preamble:

The education in India, in general, is expanding manifolds. It is the challenge to ensure its quality to stakeholders to meet this challenge. The issue of quality needs to be addressed and taken forward in a systematic manner. For this we statisticians tried to modify our subject curriculum according to National Education Policy (NEP) 2020 to explore future brightness of stakeholders.

As I am Chairman, Board of Studies in Statistics, Swami Ramanand Teerth Marathwada University, Nanded, happy to state here that we all members made a curriculum and finalized it. The Program Educational Objectives were finalized for undergraduate programs in Statistics. I am thankful to our Dean of Science and Technology Dean Dr. M. K. Patil who has given us this opportunity.

The Program Educational Objectives finalized for undergraduate program in Statistics are listed below:

Program Educational Objectives (PEO):

PEO1: Students should be able to understand the fundamentals of statistical techniques and implement them.

PEO2: To develop a statistical view for better understanding and analytic ability.

PEO3: The ability to bring together and flexibly apply it to characterize, analyze and solve a wide range of problems with statistical models.

PEO4: The ability to communicate effectively in terms of technical and non-technical audiences.

Program Outcomes (PO):

PO1: Have fundamental knowledge and understanding of statistical theory at an applied level in the subject.

PO2: Acquire the **s**trong foundation of statistical concepts which will benefit them to become good academicians.

PO3: Use acquired statistical tools and techniques to address various real-life problems.

PO4: Gain the knowledge of software which has the wide range of opportunities in the various sectors viz., IT sector Quality control in industries, Business, Government and private sector etc.

PO5: Qualify various National / State level competitive exams viz. ISS, DSO, GATE, MPSC, UPSC, Banking etc.

Program Specific Outcomes (PSO):

On successful completion of the program students will able to:

PSO1: Understand and implement statistical models.

PSO2: Handle and analyze databases with computer skills.

PSO3: Describe complex statistical ideas to non-statisticians and can make practical suggestions for improvement.

PSO4: Get a wide range of statistical skills in problem-solving.

Course Outcomes (for all courses):

The course outcomes are the statement that describes the knowledge & abilities developed in the student by the end of course (subject) teaching. The focus is on development of abilities rather than mere content. There are 4 course outcomes of all courses defined here. These are to be written in specific terms and not in general. In addition to Program Educational Objectives, for each course of undergraduate program, objectives and expected outcomes from learner's point of view are also included in the curriculum to support the philosophy of outcome-based education. I believe strongly that small step taken in right direction will definitely help in providing quality education to the stake holders.

Chairman,
Board of Studies of the Statistics
Swami Ramanand Teerth Marathwada University, Nanded.

Details of the Board of Studies Members in the subject STATISTICS under the faculty of Science & Technology of S.R.T.M. University, Nanded

Sr. No	*Name of the Member*	*Designation*	*Address*	*Contact No.*
1.	Dr. A. A. Muley	Chairman	School of Mathematical Sciences, S.R. T. M. University, Nanded	7276114558
2.	Dr. S. V. Kawale	Member	Dr. B. A. M. University, Chhatrapati Sambhajinagar	9421303727
3.	Dr. V. S. Jadhav	Member	Sanjeevanee College, Chapoli	9604421675
4.	Dr. M. R. Fegade	Member	Digambarrao Bindu College, Bhokar	9922675834
5	Dr. Kishor Ingle	Invitee Member	Netaji Subhaschandra Bose College, Nanded	9096504102
6	Mr. D. N. Shinde	Invitee Member	DSM College, Parbhani	8668799217
7	Mr. Namdev Ambhure	UG MPUA u/s 40(2)(d)(E) Invitee Member & PG Student	School of Mathematical Sciences, SRTM University, Nanded	8552827030
8	Dr. Rajeshwar Ade	UG MPUA u/s 40(2)(d)(E) Invitee Member & PG Student	School of Mathematical Sciences, SRTM University, Nanded	9404623677
9	Ms. Charlewar Tejassri Ashok	UG MPUA u/s 40(2)(d)(E) Invitee Member & UPG Student	Digambarrao Bindu College, Bhokar	7887794098

B. Sc. Second Year Semester III*(Level 5.0)*

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ Week)	
			Theory	Practical	Total	Theory	Practical
Major	SSTACT1201	Probability and Discrete Distributions	02	--	**08**	02	--
	SSTACP1201	Practical-III	-	02			04
	SSTACT1202	Applied Statistics	02	--		02	--
	SSTACP1202	Practical-IV	-	02			04
Minor	SSTAMT1201	Elementary Probability and Discrete Distributions	02	--	**04**	02	--
	SSTAMP1201	Practical (Based on Minor)	-	02			04
Generic Electives *(from other Faculty)*	SSTAGE1201	Time Series Analysis and Index Numbers **(Basket 2 of respective Faculty)**	02	--	**02**	02	--
Skill Based Course (related to Major)	SSTAVC1201	Introduction to Scilab	--	02	**02**	--	04
		Total Credits	**08**	**08**	**16**	**08**	**16**

B. Sc. Second Year Semester III *(Level 5.0)*

Examination Scheme

[20% Continuous Assessment (***CA***) and 80% End Semester Assessment (***ESA***)]***(For illustration we have considered a paper of 02 credits, 50 marks, need to be modified depending on credits assigned to individual paper)***

Subject (1)	Course Code (2)	Course Name (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA			
			Test I (4)	Test II (5)	Average of T1 & T2 (6)	Total (7)	CA (8)	ESA (9)	
Major	SSTACT1201	Probability and Discrete Distributions	10	10	10	40	--	--	50
	SSTACP1201	Practical-III	--	--	--	--	20	30	50
	SSTACT1202	Applied Statistics	10	10	10	40	--	--	50
	SSTACP1202	Practical-IV	--	--	--	--	20	30	50
	SSTAMT1201	Elementary Probability and Discrete Distributions	10	10	10	40	--	--	50
	SSTAMP1201	Practical (Based on Minor)	--	--	--	--	20	30	50
Generic Electives *(from other Faculty)*	SSTAGE1201	Time Series Analysis and Index Numbers **(Basket 2 of respective Faculty)**	10	10	10	40	--	--	50
Skill Based Course (related to Major)	SSTAVC1201	Introduction to Scilab	--	--	--	--	20	30	50

B. Sc. Second Year Semester IV *(Level 5.0)*

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	SSTACT1251	Continuous and Exact Sampling Distributions	02	--	**08**	02	--
	SSTACP1251	Practical-V	-	02			04
	SSTACT1252	Fundamentals of Statistical Inference	02	--		02	--
	SSTACP1252	Practical-VI	-	02			04
Minor	SSTAMT1251	Survey Sampling	02	--	**04**	02	--
	SSTAMP1251	Practical (Based on Minor)	-	02			04
Generic Electives *(from other Faculty)*	SSTAGE1251	Statistical Quality Control **(Basket 2 of respective Faculty)**	02	--	**02**	02	--
Skill Based Course (related to Major)	SSTAVC1251	Introduction to Python	--	02	**02**	--	04
		Total Credits	**08**	**08**	**16**	**08**	**16**

B. Sc. Second Year Semester IV *(Level 5.0)*

Examination Scheme

[20% Continuous Assessment (CA) and 80% End Semester Assessment (ESA)](For illustration we have considered a paper of 02 credits, 50 marks, need to be modified depending on credits assigned to individual paper)

Subject (1)	Course Code (2)	Course Name (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA			
			Test I (4)	Test II (5)	Average of T1 & T2 (6)	Total (7)	CA (8)	ESA (9)	
Major	SSTACT1251	Continuous and Exact Sampling Distributions	10	10	10	40	--	--	50
	SSTACP1251	Practical-V	--	--	--	--	20	30	50
	SSTACT1252	Fundamentals of Statistical Inference	10	10	10	40	--	--	50
	SSTACP1252	Practical–VI	--	--	--	--	20	30	50
	SSTAMT1251	Survey Sampling	10	10	10	40	--	--	50
	SSTAMP1251	Practical (Based on Minor)	--	--	--	--	20	30	50
Generic Electives *(from other Faculty)*	SSTAGE1251	Statistical Quality Control **(Basket 2 of respective Faculty)**	10	10	10	40	--	--	50
Skill Based Course (related to Major)	SSTAVC1251	Introduction to Python	--	--	--	--	20	30	50

B.A. / B.Sc. Second Year (SEMESTER-III)

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ Week)	
			Theory	Practical	Total	Theory	Practical
Major	SSTACT1201	Probability and Discrete Distributions	02	--	**08**	02	--
	SSTACP1201	Practical-III	-	02			04
	SSTACT1202	Applied Statistics	02	--		02	--
	SSTACP1202	Practical-IV	-	02			04
Minor	SSTAMT1201	Elementary Probability and Discrete Distributions	02	--	**04**	02	--
	SSTAMP1201	Practical (Based on Minor)	-	02			04
Generic Electives *(from other Faculty)*	SSTAGE1201	Time Series Analysis and Index Numbers **(Basket 2 of respective Faculty)**	02	--	**02**	02	--
Skill Based Course (related to Major)	SSTAVC1201	Introduction to Scilab	--	02	**02**	--	04
		Total Credits	**08**	**08**	**16**	**08**	**16**

B.A. / B.Sc. Second Year (SEMESTER-III)

SSTACT1201 Probability and Discrete Distributions

(Maximum No. of Periods 30)

Programme: Diploma Course in Statistics Class: B.A./B.Sc. II	Year: Second Level 5.0	Course Type DSC	Semester: III
Prerequisites: This course does not require any pre-requisite.			
Course Code: SSTACT1201	Course Title: **Probability and Discrete Distributions**		

Course Objectives: The course objectives for a course on probability & discrete distributions in statistics typically include the following:

- To understand basic concepts of probability and its importance.
- To understand the nature of random variables and expectations.
- To explore the nature of Uniform, Binomial and Poisson discrete distributions.
- To understand Hypergeometric, Negative Binomial and Geometric discrete distributions.

Course Outcomes(CO's): At the end of the course the student should be able to:

CO1: Understand the basic concepts of probability theory.

CO2: Understand the nature of random variables and able to compute expectations.

CO3: Understand Uniform, Binomial and Poisson discrete distributions and able to explore their properties.

CO4: Understand Hypergeometric, Negative Binomial and Geometric distributions and able to explore their properties.

Credits: 2	DSC-5
Max. Marks: 50	Min. Passing Marks:20
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 2-0-0	

Module No.	Unit No.	Topic	No. of Lectures
1.0	**1**	**Probability**	**6**
	1.1	Basic Concepts of Probability, random experiments, trial, outcome, sample space, event, mutually exclusive and exhaustive events, equally likely and favourable outcomes.	
	1.2	Mathematical, Statistical, axiomatic definitions of probability. Conditional Probability and independence of events	
	1.3	Addition and multiplication theorems of probability for two and more events.	
	1.4	Bayes theorem and its applications in real life problems.	
2.0	**2**	**Random Variable & Mathematical Expectation**	**10**
	2.1	Definition: Random variable, discrete and continuous random variables, Probability mass function, Probability density function, Distribution function and its properties.	

	2.2	Various measures of central tendency, dispersion, skewness and kurtosis for probability distribution. Definitions: Bivariate random variable joint, marginal and conditional distributions, independence of random variables.	
	2.3	Mathematical expectation of a random variable and function of a random variable. Properties of expectation, properties of variance and covariance. Variance of linear combination of random variables.	
	2.4	Definitions of Moment generating function, Cumulant generating function, probability generating function and their properties.	
3.0	**3**	**Uniform Binomial and Poisson Distribution**	
	3.1	Uniform Distribution: Definition, Mean, Variance and Moment Generating Function, real life examples. Bernoulli distribution: Definition, Mean, Variance and moment generating function, real life examples.	
	3.2	Binomial Distribution: Definition, Moments, moment generating function, cumulants, additive property, its recurrence relation, mode, real life examples.	**7**
	3.3	Poisson distribution: Definition, Moments, Mode, recurrence relation for moment, moment generating and Cumulant generating function.	
	3.4	Additive property, its recurrence relation, real life examples.	
4.0	**4**	**Hypergeometric, Negative Binomial and Geometric Distribution**	
	4.1	Hypergeometric distribution: Definition, Mean and variance, Relation with Binomial distribution, its recurrence relation, real life examples.	
	4.2	Negative Binomial Distribution: Definition, moment generating function, cumulants, moments, Relation between negative binomial and binomial distribution.	**7**
	4.3	Geometric Distribution: Definition, moments, moment generating function, mean, variance, lack of memory property	
	4.4	Real life applications of geometric distribution.	
		Total No. of Lectures =	**30**

Text Books:

1. Fundamentals of Mathematical Statistics: S.C. Gupta & V.K. Kapoor, 11thEdition, (2002), Sultan Chand & Sons, New Delhi.
2. A First Course in Probability: Sheldon Ross, 6th Edition, (2012), Persons.
3. A Text Book of Statistical Methods-II: Mrs. S.D. Deshmukh, Surendra B. Ghatpande, First Edition, (2008), Vision Publication, Pune.
4. A Text Book of Discrete Probability Distributions & Time Series: P.G. Dixit, P.S. Kapre, First Edition, (2009), Nirali Publication, Pune.

Reference Books:

1. Mathematical Statistics: H.C. Saxena, Sultan Chand & Sons, New Delhi.
2. New Mathematical Statistics, Arora Sanjay and Bansilal, Styaprakashan 16/ 7698, First Edition, New Market, New Delhi (1989).
3. Statistics: A Beginners Text Volume – II, B.R. Bhat T. Shivenkataramena K.S. Madhav Rao.(New Age International (p) Ltd.
4. Introduction to Discrete Probability and Probability Distributions:Madhav B. Kulkarni, Surendra B. Ghatpande. (SIPE Academy, Nasik).
5. Statistics Using R Hardcover- Sudha G. Purohit , Sharad D. Gore, Shailaja R. Deshmukh(2008) Alpha Science International Ltd.
6. Statistical Computing Using R Software-Vishwas R. Pawgi (2022) Nirali Pub.

B.A. / B.Sc. Second Year (SEMESTER-III)

SSTACP1201 DSC-6: PRACTICAL -III (Theory Based Practical on DSC-5)

Programme: Diploma Course in Statistics Class: B.A./B.Sc. II	Year: Second Level 5.0	Course Type DSC	Semester: III
Prerequisites: This course does not require any pre-requisite.			
Course Code: SSTACP1201	Course Title: Practical –III (Theory Based Practical on DSC-5)		
Course Objectives: • To understand the nature of discrete frequency data. • To learn implementation of some discrete distributions. • To compute and find discrete probability distributions. • To check fitness of discrete probability distributions. **Course Outcomes:** After completion of the course students will able to: **CO1:** Find frequency distribution of datasets. **CO2:** Represent the data distribution using graphical and diagrammatic manner. **CO3:** Apply discrete probability distributions. **CO4**: Test discrete probability distributions and check the validity of the distributions.			
Credits: 2	DSC-6		
Max. Marks: 50	Min. Passing Marks:20		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 0-0-4			

Practical-III (Theory Based Practical on DSC-5)		
Sr. No.	**Title of Experiments**	**No. of Experiments**
1	Computation of basic probability	1
2	Computation of expectation of random variables	1

3	Visualization of density plot of Uniform distribution using R	1
4	Visualization of density plot of Binomial distribution using R	1
5	Visualization of density plot of Poisson distribution using R	1
6	Visualization of density plot of Hypergeometric distribution using R	1
7	Visualization of density plot of Negative Binomial distribution using R	1
8	Visualization of density plot of Geometric distribution using R	1
9	Fitting of Uniform Distribution.	1
10	Fitting of Binomial Distribution.	1
11	Fitting of Poisson Distribution	1
12	Fitting of Hyper - Geometric Distribution	1
13	Fitting of Negative Binomial Distribution	1
14	Fitting of Geometric Distribution	1

B.A. / B.Sc. Second Year (SEMESTER-III)

SSTACT1202 **DSC-7: Applied Statistics**

(Maximum No. of Periods 30)

Programme: Diploma Course in Statistics Class: B.A./B.Sc. II	Year: Second Level 5.0	Course Type DSC	Semester: III
Prerequisites: This course does not require any pre-requisite.			
Course Code: SSTACT1202	Course Title: **Applied Statistics**		

Course Objectives:

- To learn multiple, partial correlation and regression.
- To learn basic components and methods of time series models.
- To learn fundamentals of index number and applications.
- To learn consumer index numbering.

Course Outcomes (CO's): After completion of the course students will able to:

CO1: Understand correlation and able to apply basic regression to real life data.
CO2: Understand basics of time series methods.
CO3: Understand fundamentals of index number and its usage.
CO4: Understand consumer index numbers and its real life applications.

Credits: 2	DSC-7
Max. Marks: 50	Min. Passing Marks:20
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 2-0-0	

Module No.	Unit No.	Topic	No. of Lectures
1.0	**1**	**Multiple and Partial Correlation Coefficient**	**8**
	1.1	Multiple and Partial Correlation (for trivariate data), Yule's Notation, Plane of Regression	
	1.2	Residuals and its Properties, Variance of the residual.	
	1.3	Coefficient of Multiple Correlation, Properties of Multiple correlation coefficient	
	1.4	Coefficient of partial correlation, examples on it.	
2.0	**2**	**Time Series**	**8**
	2.1	Introduction of time series, its components (Trend, Seasonal variation, Cyclical variation, Irregular), Difference between seasonal and cyclical variation	
	2.2	Analysis of time series, Models of time series, Uses of time series.	
	2.3	Measurement of Trend: Graphic method, method semi-averages, method curve fitting by principle of least square, method of exponential curve, method of second degree parabola, method of moving averages, merits and demerits of measurement of trends.	
	2.4	Measurement of Seasonal Fluctuations: Method of simple averages, Ratio to trend, Ratio to moving average.	
3.0	**3**	**Index Numbers**	**7**
	3.1	Introduction, Definition, Problems involved in the construction of Index Numbers, Types of Index Numbers, Construction of Index Number	
	3.2	Calculation of price and quantity index numbers, simple (unweighted) Aggregate method, Weighted Aggregates Method	
	3.3	Some Specific Index Numbers: Laspeyre's price Index, Paasche's price Index, Drobish-Bowley price Index numbers	
	3.4	Marshall Edgeworth price Index Irving Fisher's Ideal Index number, Average of Price relatives, weighted average relatives.	
4.0	**4**	**Consumers Index Number**	**7**
	4.1	Chain Indices, procedure of construction of chain indices. The criteria of a good Index Numbers	
	4.2	Unit Test, Time Reversal Test, Factor reversal test, Circular Test, Quantity Index numbers,	
	4.3	Value Index numbers, Uses and Limitations of Index Number. Main steps in construction of consumers Index Numbers,	
	4.4	Weighted Aggregates methods, and Method of Weighted price relatives. Base shifting, splicing and Deflating of Index Numbers, Uses of consumers Index Number.	
		Total No. of Lectures =	**30**

Text Books:

1. Fundamentals of Mathematical Statistics: S.C. Gupta & V. K. Kapoor,11th Edition, (2002), Sultan Chand & Sons, New Delhi.
2. Fundamental of Applied Statistics: S.C. Gupta, V. K. Kapoor, 14thRevised Edition, (2007), Sultan Chand & Sons, New Delhi.
3. Mathematical Statistics: J. K. Goyal, J. N. Sharma, 26th Edition, (2011), Krishna Prakashan Media (P) Ltd, Meerut.

Reference Books:

1. Goon A.M. Gupta, M.K. Dasgupta B.: Fundamentals of Statistics Vol. - II(1991), World Press Calcutta.
2. P.G. Dixit, P.S. Kapre, Statistics: (2003), Nirali Prakashan Pune.
3. B.R. Bhat T. Shirvenkatarmane K.I. Madhav Rao Statistics: A Beginner's Text Vol.-I, New Age International (P) Ltd.
4. S.P.Gupta: Statistical Methods, Chand & Son New Delhi
5. CroxtonF.E. and Cowden D.J., Applied General Statistics, (1969), Prentice Hall of India.

B.A. / B.Sc. Second Year (SEMESTER-III)

SSTACT1202 DSC-8: PRACTICAL -IV (Theory Based Practical on DSC-7)

Programme: Diploma Course in Statistics Class: B.A./B.Sc. II	Year: Second Level 5.0	Course Type DSC	Semester: III
Prerequisites: This course does not require any pre-requisite.			
Course Code: SSTACP1201	Course Title: Practical -IV (Theory Based Practical on DSC-7)		
Course Objectives: • Learn to apply correlation and regression. • Learn to compute data with time series models. • Learn to evaluate un-weighted and weighted index numbers. • Learn to evaluate cost of living index numbering. **Course Outcomes:** After completion of the course students will able to: **CO1:** Understand how to apply correlation and regression. **CO2:** To compute data with time series models. **CO3:** To evaluate un-weighted and weighted index numbers. **CO4**: To evaluate cost of living index numbering.			
Credits: 2	DSC-8		
Max. Marks: 50	Min. Passing Marks:20		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 0-0-4			

Practical-IV (Theory Based Practical on DSC-7)		
Sr. No.	**Title of Experiments**	**No. of Experiments**
1	Multiple correlation coefficient fitting of regression plane	1
2	Partial correlation coefficient	1

3	Measurement of trend by method of exponential smoothing	1
4	Measurement of trend by moving averages	1
5	Measurement of linear trend by method of least squares	1
6	Measurement of seasonal variation by method of simple averages	1
7	Measurement of seasonal variation by ratio to trend method	1
8	Measurement of seasonal variation by Ratio to moving average method	1
9	Unweighted Index Number	1
10	Weighted Index Number by Laspeyre's and Passche's Index number	1
11	Weighted Index number Fisher's Ideal Index formula	1
12	Cost of Living Index number.	1
13	Unit Test and Time Reversal Test	1
14	Factor reversal test and Circular Test	1

B.A. / B.Sc. Second Year (SEMESTER-III)

SSTAMT 1201 DSM-I: Elementary Probability and Discrete Distributions

(Maximum No. of Periods 30)

Programme: Diploma Course in Statistics Class: B.A./B.Sc. II	Year: Second Level 5.0	Course Type DSM	Semester: III
Prerequisites: This course does not require any pre-requisite.			
Course Code: SSTAMT1201	Course Title: **Elementary Probability and Discrete Distributions**		

Course Objectives: The course objectives for a course on probability & discrete distributions in statistics typically include the following:

- To understand basic concepts of probability and its importance.
- To understand the nature of random variables and expectations.
- To explore the nature of Uniform, Binomial and Poisson discrete distributions.
- To understand Hypergeometric, Negative Binomial and Geometric discrete distributions.

Course Outcomes(CO's): At the end of the course the student should be able to:

CO1: Understand the basic concepts of probability theory.

CO2: Understand the nature of random variables and able to compute expectations.

CO3: Understand Uniform, Binomial and Poisson discrete distributions and able to explore their properties.

CO4: Understand Hypergeometric, Negative Binomial and Geometric distributions and able to explore their properties.

Credits: 2	DSM-I
Max. Marks: 50	Min. Passing Marks:20
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 2-0-0	

Module No.	Unit No.	Topic	No. of Lectures
1.0	**1**	**Introduction to Probability**	**8**
	1.1	Basic Concepts of Probability, random experiments, trial, outcome, sample space, event, mutually exclusive and exhaustive events, equally likely and favourable outcomes.	
	1.2	Mathematical, Statistical, axiomatic definitions of probability. Conditional Probability and independence of events	
	1.3	Addition and multiplication theorems of probability for two and more events.	
	1.4	Bayes theorem and its applications in real life problems.	
2.0	**2**	**Random Variables and Expectation**	**8**
	2.1	Definition: Random variable, discrete and continuous random variables, Probability mass function, Probability density function, Distribution function and its properties.	
	2.2	Various measures of central tendency, dispersion, skewness and kurtosis for probability distribution. Definitions: Bivariate random variable joint, marginal and conditional distributions, independence of random variables.	
	2.3	Mathematical expectation of a random variable and function of a random variable. Properties of expectation, properties of variance and covariance. Variance of linear combination of random variables.	
	2.4	Definitions of Moment generating function, Cumulant generating function, probability generating function and their properties.	
3.0	**3**	**Uniform Binomial and Poisson Distribution**	**7**
	3.1	Uniform Distribution: Definition, Mean, Variance and Moment Generating Function, real life examples. Bernoulli distribution: Definition, Mean, Variance and moment generating function, real life examples.	
	3.2	Binomial Distribution: Definition, Moments, moment generating function, cumulants, additive property, its recurrence relation, mode, real life examples.	
	3.3	Poisson distribution: Definition, Moments, Mode, recurrence relation for moment, moment generating and Cumulant generating function.	
	3.4	Additive property, its recurrence relation, real life examples.	
4.0	**4**	**Hypergeometric, Negative Binomial and Geometric Distribution**	**7**
	4.1	Hypergeometric distribution: Definition, Mean and variance, Relation with Binomial distribution, its recurrence relation, real life examples.	

	4.2	Negative Binomial Distribution: Definition, moment generating function, cumulants, moments, Relation between negative binomial and binomial distribution.	
	4.3	Geometric Distribution: Definition, moments, moment generating function, mean, variance, lack of memory property	
	4.4	Real life applications of geometric distribution.	
		Total No. of Lectures =	**30**

Text Books:

1. Fundamentals of Mathematical Statistics: S.C. Gupta & V.K. Kapoor, 11thEdition, (2002), Sultan Chand & Sons, New Delhi.
2. A First Course in Probability: Sheldon Ross, 6th Edition, (2012), Persons.
3. A Text Book of Statistical Methods-II: Mrs. S.D. Deshmukh, Surendra B. Ghatpande, First Edition, (2008), Vision Publication, Pune.
4. A Text Book of Discrete Probability Distributions & Time Series: P.G. Dixit, P.S. Kapre, First Edition, (2009), Nirali Publication, Pune.

Reference Books:

1. Mathematical Statistics: H.C. Saxena, Sultan Chand & Sons, New Delhi.
2. New Mathematical Statistics, Arora Sanjay and Bansilal, Styaprakashan 16/ 7698, First Edition, New Market, New Delhi (1989).
3. Statistics: A Beginners Text Volume – II, B.R. Bhat T. Shivenkataramena K.S. Madhav Rao.(New Age International (p) Ltd.
4. Introduction to Discrete Probability and Probability Distributions:Madhav B. Kulkarni, Surendra B. Ghatpande. (SIPE Academy, Nasik).

B.A. / B.Sc. Second Year (SEMESTER-III)

SSTAMP 1201 DSM-2: PRACTICAL -I (Theory Based Practical on DSM-1)

Programme: Diploma Course in Statistics Class: B.A./B.Sc. II	Year: Second Level 5.0	Course Type DSM	Semester: III
Prerequisites: This course does not require any pre-requisite.			
Course Code: SSTAMP1201	Course Title: Practical -I (Theory Based Practical on DSM-1)		

Course Objectives:

- To apply and fit Binomial, Poisson, Negative binomial discrete distribution.
- To apply and fit Negative binomial, Geometric discrete distribution.
- To apply and fit Normal continuous distribution.
- To apply and fit Exponential continuous distribution.

Course Outcomes: After completion of the course students will able to:

CO1: Fit Binomial, Poisson, Negative binomial discrete distribution.
CO2: Fit Negative binomial, Geometric discrete distribution.
CO3: Fit Normal continuous distribution.
CO4: Fit Exponential continuous distribution.

Credits: 2	DSM-2
Max. Marks: 50	Min. Passing Marks:20
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 0-0-4	

Practical -I (Theory Based Practical on DSM-1)		
Sr. No.	**Title of Experiments**	**No. of Experiments**
1	Numerical problems based on addition theorem of probability	1
2	Numerical problems based on multiplication theorem of probability	1
3	Numerical problems based on conditional probability	1
4	Computation of expectation of random variables	1
5	Visualization of density plot of Uniform and Binomial distribution using R	2
6	Visualization of density plot of Poisson and Hypergeometric distribution using R	2
7	Visualization of density plot of Negative Binomial and Geometric distribution using R	2
8	Fitting of Uniform Distribution.	1
9	Fitting of Binomial Distribution.	1
10	Fitting of Poisson Distribution	1
11	Fitting of Hyper - Geometric Distribution	1

12	Fitting of Negative Binomial Distribution	1
13	Fitting of Geometric Distribution	1

B.A. / B.Sc. Second Year (SEMESTER-III)

SSTAGE1201 GE/OE: Time Series Analysis and Index Numbers

Programme: Diploma Course in Statistics Class: B.A./B.Sc. II	Year: Second Level 5.0	Course Type GE/OE For Basket 3	Semester: III
Prerequisites: - This course does not require any pre-requisite.			
Course Code: SSTAGE1201	Course Title: **Time Series Analysis and Index Numbers**		

Course Objectives:

The Learning Objectives of this course are as follows:

- To learn the concept of time series, its components, and their estimation.
- To understand the trend and applications of time series.
- To learn the concept, formulation, and application of index numbers.
- To learn the consumer price index number and its uses.

Course Outcomes: After completion of the course students will able to:

CO1: Concept of time series, its components, and their estimation.
CO2: Learn the concept of time series, its components, and their estimation.
CO3: Understand the trend and applications of time series.
CO4: Learn the concept, formulation, the consumer price index number and applications and uses.

Credits: 2	GE/OE
Max. Marks: 50	Min. Passing Marks:20
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 2-0-0	

Module No.	Unit No.	Topics	No. of Lectures
1.0		**Time Series Analysis**	**8**
	1.1	Introduction to time series, Components of time series (Trend, Seasonal variation, Cyclical variation, Irregular)	
	1.2	Difference between seasonal and cyclical variation	
	1.3	Analysis of time series	
	1.4	Models of time series, Uses of time series	
2.0		**Measurement of Trend**	**7**
	2.1	Estimation of trend by free hand curve method, method of semi averages	
	2.2	Fitting a various mathematical curve, and growth curves.	
	2.3	Graphic Method, Method of exponential smoothing, Method of moving averages	
	2.4	Method of least squares, Merits and demerits of measurement of trends.	

3.0		**Seasonal Component**	**8**
	3.1	Ratio to Moving Averages and Link Relative method,	
	3.2	Deseasonalization. Cyclic Component: Harmonic Analysis.	
	3.3	Some Special Processes: Moving-average (MA) process and Autoregressive (AR) process of orders one and two	
	3.4	Estimation of the parameters of AR (1) and AR (2) – Yule-Walker equations.	
4.0		**Index Number**	
	4.1	Introduction to Index numbers, Problems in the construction of index numbers	**7**
	4.2	Construction of price and quantity index numbers: simple aggregate, weighted aggregate (Laspeyres, Paasche's, Drobish-Bowley, Marshall-Edgeworth's, Walsch and Fisher's Formula)	
	4.3	simple and weighted average of price relatives, and chain base method, Criteria for a good index number, Errors in the measurement of price and quantity index numbers	
	4.4	Consumer price index number, its construction, Uses and limitations of index numbers.	
		Total	**30**

Text Books:

1. Goon, Gupta and Dasgupta: Fundamentals of Statistics, World Press, (2018).
2. Gupta & Kapoor: Fundamentals of Mathematical Statistics, S Chand, (2020).
3. Gupta, S.C. and Kapoor, V.K. (2014). Fundamentals of Applied Statistics, 11th Ed., Sultan Chand.

Reference Books:

1. Kendal and Stuart: Advanced Theory of Statistics, PHI,(1994).
2. Gupta S C: Fundamentals of Statistics, Himalaya Publishing House, (2018).
3. Spiegel & Stephens, Statistics, Mc Graw Hill International, (2017).
4. Kapoor J N & Saxena H C: Mathematical Statistics, S Chand, (2010)
5. Croxton, Fredrick E, Cowden, Dudley J. and Klein, S. (1973): Applied General Statistics, 3rd Edition, Prentice Hall of India Pvt. Ltd.
6. Mukhopadhyay, P. (1999). Applied Statistics, New Central Book Agency, Calcutta.
7. Allen R.G.D. (1975): Index Numbers in Theory and Practice, Macmillan

B.A. / B.Sc. Second Year (SEMESTER-III)

SSTAVC1201 **INTRODUCTION TO SCILAB**
(Maximum No. of Periods - 30)

Programme: Diploma Course in Statistics **Class: B.A./B.Sc. II**	**Year: Second** **Level 5.0**	**Course Type SEV-I**	**Semester: III**
Prerequisites: --			
Course Code: SSTAVC1201	**Course Title: Introduction to SciLab**		

Course prerequisite:

This course requires basics of descriptive and inferential statistics knowledge.

Course Objectives:

- To understand basic terminology of Scilab.
- To perform basic matrix operations in Scilab.
- To plot a dataset using various graphical functions in Scilab.
- To understand and statistical analytical functions in Scilab.

Course Outcomes: After completion of the course students will able to:

CO1: To get familiar with Scilab.
CO2: Perform simple matrix operations in Scilab.
CO3: Plot various graphs in Scilab.
CO4: Understand and perform file operations using different functions.

Credits: 2	SVC-I
Max. Marks: 50	**Min. Passing Marks:20**
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 1-0-2	

Module No.	Unit No.	Topics	Hrs. Required to cover the contents
1.0		**Introduction to SciLab**	**8**
	1.1	Introduction, Scilab Environment, Install Scilab, Mailing list, Complementary resources	
	1.2	The general environment and the console	
	1.3	Scilab Programming Language, Script Files and Function Files	
	1.4	Functions in Scilab	
2.0		**Basic Matrix Operations**	**7**
	2.1	Simple numerical calculations, Matrix Operations, Sub-matrices	
	2.2	The menu bar, The editor, The graphics window, Windows management and workspace customization	
	2.3	Programming Variables, assignment and display	
	2.4	Loops	

3.0		**Graphical Plotting**	**8**
	3.1	Plotting Graphs, Plotting 3D Graphs	
	3.2	Supplements on matrices and vectors	
	3.3	Calculation accuracy	
	3.4	Solving differential equations	
4.0		**Functions**	**7**
	4.1	File Operations	
	4.2	Reading Microsoft Excel Files.	
	4.3	Statistics useful Scilab functions	
	4.4	Analyzing probability and statistics problems	
		Total=	**30**

Text Books:

1. Scilab A Hands On Introduction by Satish Annigeri P. Scilab Tutorial.
2. Campbell, S.L., Chancelier, J.P. and Nikoukhah, R., 2006. *Modeling and Simulation in Scilab/Scicos*. Springer.
3. Gomez, C. (ed.), 1999. *Scilab: A Free Software to Do Numerical Computations*. Springer.

Reference Books:

1. Introduction to Scilab: For Engineers and Scientists by Sandeep Nagar APRESS; 1st edition (2017)
2. SCILAB: A Begineer's Approach by Anil Kumar Verma, Cengage Learning India Pvt. Ltd.; First Edition (2018)
3. Programming in Scilab 4.1 (2008)by Vinu V. Das (Author)**,** NEW AGE.
4. Urroz, G.E., 2001. *Numerical Methods with Scilab For Science and Engineering*. Infinity Science Press.

B.A. / B.Sc. Second Year (SEMESTER-IV)

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	SSTACT1251	Continuous and Exact Sampling Distributions	02	--	**08**	02	--
	SSTACP1251	Practical-V	-	02			04
	SSTACT1252	Fundamentals of Statistical Inference	02	--		02	--
	SSTACP1252	Practical-VI	-	02			04
Minor	SSTAMT1251	Survey Sampling	02	--	**04**	02	--
	SSTAMP1251	Practical (Based on Minor)	-	02			04
Generic Electives *(from other Faculty)*	SSTAGE1251	Statistical Quality Control **(Basket 2 of respective Faculty)**	02	--	**02**	02	--
Skill Based Course (related to Major)	SSTAVC1251	Introduction to Python	--	02	**02**	--	04
		Total Credits	**08**	**08**	**16**	**08**	**16**

B.A. / B.Sc. Second Year (SEMESTER-IV)

SSTACT1251 Continuous and Exact Sampling Distributions
(Maximum no. of periods 30)

Programme: Diploma Course in Statistics Class: B.A./B.Sc. II	**Year: Second Level 5.0**	**Course Type DSC**	**Semester: IV**
Prerequisites: —			
Course Code: SSTACT1251	**Course Title: Continuous and Exact Sampling Distributions**		
Course Objectives: The Learning Objectives of this course are as follows: • To learn Uniform, exponential and Gamma distribution. • To learn Normal and Beta distribution. • To learn Chi-Square distribution its properties. • To learn t and F distribution and their properties. **Course Outcomes:** After completion of the course students will able to: **CO1:** Understand the nature of Uniform, exponential and Gamma distribution. **CO2:** Understand concept of Normal and Beta distribution. **CO3:** Understand Chi-Square distribution and its properties. **CO4:** Understand t and F distribution and their properties.			
Credits: 2	**DSC-09**		
Max. Marks: 50	**Min. Passing Marks:20**		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 2-0-0			

Module No.	Unit No.	Topic	No. of Lectures
1.0		**Uniform, Exponential and Gamma Distribution**	**8**
	1.1	Uniform Distribution: Definition, Moments, Moment generating function, Mean deviation about mean.	
	1.2	Exponential Distribution: Definition, Moment Generating function, lack of memory property.	
	1.3	Gamma Distribution: Moment Generating Function, Cumulant Generating Function	
	1.4	Limiting form of Gamma Distribution, Additive properties of Gamma Distribution	
2.0		**Normal Distribution & Beta Distribution**	**7**
	2.1	Normal distribution: Definition, limiting form of Binomial Distribution, Chief characteristics, Mode, Median, Quartiles,	

	2.2	Moment Generating Function and Cumulant Generating Function, moments	
	2.3	Additive property for Linear combination of two independent normal variables, Mean deviation about mean.	
	2.4	Beta Distribution of first and second kind: Definition, Constants, harmonic mean.	
3.0		**Chi-square Distribution**	
	3.1	Chi-square Distribution: Definition, derivation of Chi-Square Distribution using method of moment generating function.	**7**
	3.2	Moment generating function, Cumulant Generating Function,	
	3.3	Limiting form of Chi-Square Distribution for large degrees of freedom, Mode and Skewness of Chi- Square Distribution.	
	3.4	Additive property of Chi-Square Distribution, Chi-square probability curve.	
4.0		**t and F Distribution**	
	4.1	Students t Distribution: Definition, Derivation of student's t distribution, Fisher's t, distribution of Fisher's t.	**8**
	4.2	Constants (Moments) of Fisher's t- distribution, limiting form of t-distribution, graph of t- distribution.	
	4.3	F Distribution: Definition, derivation of Snedecor's F distribution, moments, mode of F- distribution and point of inflexion.	
	4.4	Relation between t & F distribution, F and Chi-Square distribution.	
		Total	**30**

Text Books:

1. Fundamentals of Mathematical Statistics: - S.C. Gupta & V.K. Kapoor,11th ed. (2002) Sultan Chand and sons New Delhi.
2. Descriptive Statistics: P.G. Dixit, Dr. Mrs. V. R. Prayag. D.L. Limaye, 4th ed. (2005),Niralipub.

Reference Books:

1. Freund J.E. Prentics -Mathematical Statistics Hall of India.
2. V.K. Rohatgi -An Introduction to Probability Theory and Mathematical statistics - (Wiely Estem ltd)
3. A.M. Goon, Gupta and DasGupta -Fundamentals of statistics volume-I (world press Kolkotta).
4. S.P. Gupta -Statistical methods -. (Sultan chand and sons Delhi)
5. Kulkarni M.B. Ghatpande S.B, Gore S.D., Common Statistical Tests. (Satyajeet Prakashan Pune-29)
6. Gopal K Kanji- 100 Statistical Tests(SAGE Publications)

B.A./ B.Sc. II (SEMESTER-IV)

SSTACP1251 DSC-10: PRACTICAL -V (Theory Based Practical on DSC-9)

Programme: Diploma Course in Statistics Class: B.A./B.Sc. II	Year: Second Level 5.0	Course Type DSC	Semester: IV
Prerequisites: This course requires the basics of Continuous distributions.			
Course Code: SSTACP1251	**Course Title: Practical -V (Theory Based Practical on DSC-09)**		

Course objectives: The Learning Objectives of this course are as follows:

- To learn practical implementation of Normal, t, F and Chi-Square distribution.
- Learn to fit the Normal distribution and check its goodness of fit.
- Learn to apply Chi-square, t and F in different situations.

Course outcomes: After completion of the course students will able to:

CO1: Apply Normal distribution and check its goodness of fit.
CO2: Apply Chi-square distribution and its goodness of fit test.
CO3: Apply appropriate t-distribution in various situations.
CO4: Apply appropriate F-distribution to test equivalence of variance.

Credits: 2	**DSC-10**
Max. Marks: 50	**Min. Passing Marks:20**
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 0-0-4	

Practical-V (Theory Based Practical on DSC-9)		
Sr. No.	**Title of Experiments**	**No. of Experiments**
1	Fitting of Normal distribution	1
2	Problems based on area property of Normal distribution	1
3	Chi-square test for population variance	1
4	Chi-square test for goodness of fit	1
5	Chi-square test for 2x2 contingency table also using Yates correction	1
6	Chi-square test for Independence of attributes	1
7	Chi-square test of Homogeneity of Correlation coefficients	1
8	t - Test for single mean	1
9	t - Test for difference of means	1
10	Paired t – test	1
11	t - Test for testing the significance of sample correlation coefficient	1
12	F-Test for equality of two population variances.	1

B.A. / B.Sc. Second Year (SEMESTER-IV)

SSTACT1252 DSC-11: Fundamentals of Statistical Inference

(Maximum no. of periods 30)

Programme: Diploma Course in Statistics Class: B.A./B.Sc. II	**Year: Second Level 5.0**	**Course Type DSC**	**Semester: IV**
Prerequisites: This course does not require any pre-requisite.			
Course Code: SSTACT1252	**Course Title: Fundamentals of Statistical Inference**		
Course Objectives: The Learning Objectives of this course are as follows: • To learn basic theory of estimator and their properties. • To learn the methods of estimation and hypothesis testing in decision making. • To learn the concept of optimal test and its significance. • To learn various techniques of nonparametric tests and their applications. **Course Outcomes: After completion of the course students will able to:** **CO1:** Understand and able to use the theory of estimator. **CO2:** Understand and can be able to apply methods of estimation and hypothesis testing in decision making. **CO3:** Understand and can be able to apply tests of significance. **CO4:** Understand and can be able to apply various nonparametric tests for different situations.			
Credits: 2	**DSC-11**		
Max. Marks: 50	**Min. Passing Marks:20**		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 2-0-0			

Module No.	Unit No.	Topic	No. of Lectures
1.0		**Introduction to Statistical Inference**	**8**
	1.1	Basic concepts: Statistic, Parameter, Sample Space. Estimate, Estimation	
	1.2	Properties of Estimators: Unbiasedness, Consistency, Efficiency	
	1.3	Sufficiency and the Factorization Theorem, Most Efficient Estimator	
	1.4	Minimum Variance Unbiased Estimator (MVUE)	
2.0		**Methods of Estimation and Hypothesis Testing Basics Testing of Hypothesis**	
	2.1	Method of Moments, Maximum Likelihood Estimation (MLE)	

	2.2	Introduction to Hypothesis Testing, Null and Alternative Hypotheses, Simple vs. Composite Hypotheses	**7**
	2.3	Types of Errors: Type I and Type II, Critical Region, Level of Significance, and P-value	
	2.4	Power of a Test, Unbiased Test and Unbiased Critical Region	
3.0		**Optimal Tests and Tests of Significance**	**7**
	3.1	Most Powerful Test, Uniformly Most Powerful Test	
	3.2	Neyman-Pearson Lemma, Likelihood Ratio Test (LRT) and its properties (without proof)	
	3.3	For Means: Single Mean, Difference of Means	
	3.4	For Proportions: Single Proportion, Difference of Proportions For Variances: Standard Deviations	
4.0		**Non-Parametric Tests and Applications**	**8**
	4.1	Sign Test, Wilcoxon Signed-Rank Test	
	4.2	Mann-Whitney U-Test, Run Test, Median Test, Spearman's Rank Correlation Test,	
	4.3	Kolmogorov-Smirnov Test (One-sample and Two-sample), Merits and Demerits of Non-Parametric Tests	
	4.4	Real-world problems, Data interpretation, Decision-making using inference	
		Total	**30**

Textbooks:

1. Casella, G., & Berger, R. (2024). Statistical inference. CRC press
2. Wasserman, L. (2013). All of statistics: a concise course in statistical inference. Springer Science & Business Media.
3. Lehmann, E. L., & Romano, J. P. (1986). Testing statistical hypotheses (Vol. 3). New York: Springer.
4. Alexander Mood, Graybill Franklin, Boes Duane (2017) Introduction to the Theory of Statistics. McGraw Hill Education; 3rd edition
5. Hollander, M., Wolfe, D. A., & Chicken, E. (2013). Nonparametric statistical methods. John Wiley & Sons.
6. Conover, W. J. (1999). Practical nonparametric statistics. john wiley & sons.
7. McElreath, R. (2018). Statistical rethinking: A Bayesian course with examples in R and Stan. Chapman and Hall/CRC.
8. Statistics, D. S. U. I. S., & Field, A. (2005). Discovering statistics using SPSS.

Reference Books:

1. Hogg, R. V., McKean, J. W., & Craig, A. T. (2013). Introduction to mathematical statistics. Pearson Education India.

2. Lehmann, E. L., & Casella, G. (2006). Theory of point estimation. Springer Science & Business Media.
3. Hollander, M., Wolfe, D. A., & Chicken, E. (2013). Nonparametric statistical methods. John Wiley & Sons.
4. Gupta, S. C., & Kapoor, V. K. (2020). Fundamentals of mathematical statistics. Sultan Chand & Sons.
5. Navidi, W. C. (2006). Statistics for engineers and scientists (Vol. 2). New York: McGraw-Hill.
6. Gowers, T., Barrow-Green, J., & Leader, I. (Eds.). (2010). The Princeton companion to mathematics. Princeton University Press.

B.A. / B.Sc. Second Year (SEMESTER-IV)

SSTACP1251 **DSC-12: PRACTICAL -VI**

(Theory Based Practical on DSC-11)

Programme: Diploma Course in Statistics Class: B.A./B.Sc. II	**Year: Second Level 5.0**	**Course Type DSC**	**Semester: IV**
Prerequisites: This course does not require any pre-requisite.			
Course Code: SSTACP1251	**Course Title: Practical -VI (Theory Based Practical on DSC-11)**		
Course objectives: The Learning Objectives of this course are as follows: • To estimate the data by method of moments and method of maximum likelihood. • To construct the confidence interval for mean and proportion. • To learn to apply a large sample test for single mean and difference of means. • To learn to apply various nonparametric tests in different situations. **Course outcomes: After completion of the course students will able to:** **CO1:** Understand and be able to estimate the data by method of moments and method of maximum likelihood. **CO2:** Understand and be able to construct the confidence interval for mean and proportion. **CO3:** Understand and be able to apply a large sample test for single mean and difference of means. **CO4:** Understand and be able to apply various nonparametric tests in different situations.			
Credits: 2	**DSC-12**		
Max. Marks: 50	**Min. Passing Marks:20**		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 0-0-4			

Practical-VI (Theory Based Practical on DSC-11)		
Sr. No.	**Title of Experiments**	**No. of Experiments**
1	Estimation by method of moments	1
2	Estimation by method maximum likelihood estimation	1
3	Construction of confidence interval for mean and proportion	1
4	Large sample test for single mean	1
5	Large sample test for difference of means	1
6	Large sample test for single proportions	1
7	Large sample test for difference of proportions	1
8	Wilcoxcon signed rank test	1
9	Sign test for single sample & two sample	1
10	Run Test	1
11	Median Test	1
12	Mann - Whitney U Test	1
13	Kolmogorov Smirnov - one sample and two sample tests.	1

B.A. / B.Sc. Second Year (SEMESTER-IV)

SSTAMT1251 **DSM-3: Survey Sampling**

(Maximum no. of periods 30)

Programme: Diploma Course in Statistics **Class: B.A./B.Sc. II**	**Year:** **Second** **Level 5.0**	**Course Type** **DSM**	**Semester: IV**
Prerequisites: This course does not require any pre-requisite.			
Course Code: SSTAMT1252	**Course Title: Survey Sampling**		

Course Objectives: The Learning Objectives of this course are as follows:

- To learn basic terminology of sample surveys.
- To learn different types of sampling.
- To learn the concept of simple random sampling.
- To learn Stratified and Systematic sampling methods.

Course Outcomes: After completion of the course students will able to:

CO1: Understand basic terminology of sample surveys.
CO2: Understand different types of sampling techniques.
CO3: Understand Simple random sampling with and without replacement.
CO4: Understand concept of Stratified and Systematic sampling methods.

Credits: 2	**DSM-03**
Max. Marks: 50	**Min. Passing Marks:20**
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 2-0-0	

Module No.	Unit No.	Topic	No. of Lectures
1.0		**Sample Survey:**	**8**
	1.1	Concepts of population and sample, sampling unit, sampling frame, Parameters and statistics, Sampling distribution	
	1.2	Principal steps in Sample survey.	
	1.3	Principles of Sample survey, sampling and non-sampling errors	
	1.4	Advantages of sampling over complete census, Limitations of sampling.	
2.0		**Types of sampling**	**7**
	2.1	Probability Sampling, Mixed Sampling. Purposive Sampling,	
	2.2	Sample size, Determination of sample size.	
	2.3	Random and non-random sampling	
	2.4	Methods of achieving randomness.	
3.0		**Simple Random Sampling**	**7**
	3.1	Simple random sampling with and without replacement, probability of selecting any specified unit in the sample,	
	3.2	Estimation of population mean and population mean square and variance, merits and demerits simple random sampling	
	3.3	Selection of simple random sample, Notation and terminology,	
	3.4	Simple random sampling of Attributes, Notation and terminology, theorems based on sample and population proportion	
4.0		**Stratified Random sampling and Systematic sampling**	
	4.1	Stratified Random sampling: Advantage, sampling from heterogeneous population, Notation and terminology	**8**
	4.2	Estimation of population mean and its variance. Allocation of sample size, Proportional allocation, Neyman (optimum) allocation.	
	4.3	Systematic sampling: Definition, sampling Interval, Notations and terminology, Variance of Estimated means,	
	4.4	Merit and demerits of Systematic sampling.	
		Total	**30**

Text Books:

1. Cochran W.G. (1977) :Sampling Techniques, John Wiley and Sons, New York.
2. Sukhtme P.V., Sukhatme B.V., Sukhatme S. and Asok C. (1984): Sampling Theory of Surveys with Applications, Indian Society of Agricultural Statistics, New Delhi.
3. Gupta S.C. and Kapoor V.K. (2010) Fundamental o f Applied Statistics, S. Chand and Sons, 4th Edition.

Reference Books:

1. Sampath S. (2000) : Sampling Theory and Methods, Narosa Publishing House, New Delhi.
2. Des Raj (2000) : Sample Survey Theory, Narosa Publishing House, New Delhi.
3. Murthy M.N. (1967) : Sampling Theory and Methods, Statistical Publishing Society, Calcutta.
4. Kish L (1965): Survey Sampling, John Wiley and Sons, New York.
5. Hansen M.H., Hurwitz W.N. and Madow W.G. (1975) : Sample Survey Method and Theory, Vol. I, Methods and Applications, Vol. II, New York and London, Wiley Publication.
6. Goon A.M., Gupta M.K. and Das Gupta B. (1986) : Fundamentals of Statistics, Vol. II, world Press, Calcutta.

B.A. / B.Sc. Second Year (SEMESTER-IV)

SSTAMP1251 DSM-4: PRACTICAL -II (Theory Based Practical on DSM-3)

Programme: Diploma Course in Statistics **Class: B.A./B.Sc. II**	**Year: Second** **Level 5.0**	**Course Type DSM**	**Semester: IV**
Prerequisites: This course does not require any pre-requisite.			
Course Code: SSTAMP1251	**Course Title: Practical -II (Theory Based Practical on DSM-3)**		
Course objectives: The Learning Objectives of this course are as follows: • To learn to draw Simple Random Sample with and without replacement and estimation of mean and variance of it. • To learn to estimate the mean and variance of Stratified sampling and its precision. • To learn to estimate the mean and variance of Systematic sampling. • To learn to estimate the efficiency of sampling methods and estimate the simple random sampling by theory of attributes. **Course outcomes: After completion of the course students will able to:** **CO1:** To draw SRSWOR and SRSWR estimation of mean and variance. **CO2:** To estimate the mean and variance of Stratified sampling and its precision. **CO3:** To estimate the mean and variance of Systematic sampling. **CO4:** To estimate the efficiency of sampling methods and estimate the SRS by theory of attributes.			
Credits: 2	**DSC-4**		
Max. Marks: 50	**Min. Passing Marks:20**		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 0-0-4			

Practical-II (Theory Based Practical on DSM-3)		
Sr. No.	**Title of Experiments**	**No. of Experiments**
1	Drawing Simple Random Sample with replacement	1
2	Drawing Simple Random Sample without replacement	1
3	Simple random sampling for Attributes	1
4	Estimation of population mean using SRS	1
5	Estimation of Variance using SRS	1
6	Estimation of population mean and variance Using Neyman allocations in Stratified random sampling	1
7	Estimation of population mean and variance Using Optimum allocations in Stratified random sampling	1
8	Estimation of gain in precision due to stratification	1
9	Determination of sample size in stratified sampling	1
10	Estimation of population mean in systematic sampling	1
11	Estimation of population variance in systematic sampling	1
12	Efficiency of sampling methods	1

B.A. / B.Sc. Second Year (SEMESTER-IV)

SSTAGE1251 GE/OE: Statistical Quality Control

Programme: Diploma Course in Statistics **Class: B.A./B.Sc. II**	**Year: Second** **Level 5.0**	**Course Type GE/OE** **For Basket 3**	**Semester: IV**
Prerequisites: - This course does not require any pre-requisite.			
Course Code: SSTAGE1251	**Course Title: Statistical Quality Control**		
Course Objectives: The Learning Objectives of this course are as follows: ● To learn the basics of statistical quality control. ● To learn control charts for variables for process control. ● To learn control charts for attributes for process control. ● To learn the concept of Acceptance Sampling Plan in the production process. **Course Outcomes: After completion of the course students will able to:** **CO1:** Understand basics of statistical quality control. **CO2:** Understand and able to apply charts for variables for process control. **CO3:** Understand and able to apply charts for attributes for process control. **CO4:** Understand and able to apply acceptance Sampling Plan in the production process.			
Credits: 2	**GE/OE-04**		
Max. Marks: 50	**Min. Passing Marks:20**		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 2-0-0			

Module No.	Unit No.	Topic	No. of Lectures
1.0		**Statistical Quality Control**	**8**
	1.1	Meaning and purpose SQC, Quality of product	
	1.2	Process control, product control	
	1.3	Assignable causes, Chance causes, Uses of SQC	
	1.4	Control charts, 3-sigma control limits, specification limits, natural tolerance process.	
2.0		**Control charts for Variables**	**7**
	2.1	Control Charts for variables:	
	2.2	Construction of X-bar and R chart; X-bar and sigma chart	
	2.3	Revision of control charts	
	2.4	Interpretation of X-bar and R Chart	
3.0		**Control Chart for Attributes**	**8**
	3.1	Defects, Defectives, fraction defective,	
	3.2	Control chart for fraction defective (p-chart)	
	3.3	Control chart for number of defectives(d chart),	
	3.4	Interpretation of charts, control chart for number of defects C-chart, Application of C-chart, Limitations of C-chart	
4.0		**Acceptance Sampling Plan**	
	4.1	Acceptance Sampling for attributes with rectification,	**7**
	4.2	Acceptance Quality level(AQL),Lot tolerance proportion defectives (LTPD)	
	4.3	Consumer's risk, Producer's risk	
	4.4	Introduction to Single and double Sampling Plan, Comparison between Single Sampling Plan and Double Sampling Plan	
		Total	**30**

Text Books:

1. Fundamentals of applied statistics-S. C. Gupta and V. K. Kapoor, Sultan Chand and Sons (2010)

Reference Books:

1. Berger, J. O. (2013). *Statistical decision theory and Bayesian analysis*. Springer Science & Business Media.
2. Grant, E. L., & Leavenworth, R. S. (1980). *Statistical quality control* (Vol. 7). New York: McGraw-Hill.
3. Mahajan, M. (1986). Statistical quality control. *Edition-1998, Dhanpat Rai & Sons, India*.
4. Montgomery, D. C. (2020). *Introduction to statistical quality control*. John wiley & sons.

B.A. / B.Sc. Second Year (SEMESTER-IV)

SSTAVC1251 SVC: Introduction to Python

Programme: Diploma Course in Statistics Class: B.A./B.Sc. II	**Year: Second Level 5.0**	**Course Type SEV-II**	**Semester: IV**
Prerequisites: --			
Course Code: SSTAVC1251	**Course Title: Introduction to Python**		
Course objectives: The Learning Objectives of this course are as follows: • To learn basic terminology of Python. • To learn basic control statements and loops. • To learn data importing in Python. • To learn data visualization in Python. **Course outcomes:** After completion of the course students will able to: CO1: Understand basics of installation and data framing in Python. CO2: Understand control statements and loops used in Python. CO3: Understand data processing Python. CO4: Understand and visualize data in Python.			
Credits: 2	SVC-II		
Max. Marks: 50	**Min. Passing Marks:20**		
Total No. of Lectures – Tutorials – Practical (in hours per week): L-T-P: 1-0-2			

Module No.	Unit No.	Topic	No. of Lectures
1.0		**Introduction to Python**	**8**
	1.1	Python setup and installation, Python arithmetic operations, Basic data types: integers, floats, strings, Booleans Variables and assignments, Lists, tuples, strings, Dictionaries and set	
	1.2	Creating arrays and n-dimensional arrays using np.array, Array operations: indexing, slicing, transpose, Mathematical operations on arrays	
	1.3	Creating Series and DataFrames, Operations on Series and DataFrames,	
	1.4	Reading and writing data: From and to Excel and CSV files	
2.0		**Control statements & Loop**	**7**

	2.1	if, if-else, if-else-if, while loop, for loop	
	2.2	Defining functions: def statement, Text data operations: len, upper, lower, slice, replace	
	2.3	Data Manipulation: Selecting random N rows, removing duplicate row(s), dropping a variable(s), Renaming variable(s), sub-setting data,	
	2.4	Creating a new variable(s), selecting of random fraction of row(s), appending row(s) and column(s), simulation of variables.	
3.0		**Data Processing**	**8**
	3.1	Data import and export,	
	3.2	Setting working directory, checking structure of Data,	
	3.3	Changing type of variable,	
	3.4	Data split into training and Test	
4.0		**Data Visualisation**	**7**
	4.1	Simple bar diagram, subdivided bar diagram, multiple bar diagram, pie diagram, Box plot for one and more variables, histogram, frequency polygon, scatter plot, correlation plot, Time series Time series visualization	
	4.2	Creating Dashboard, Comparison of Data Sets and Storytelling with using Panda Profiling,	
	4.3	Statistical Computing: Descriptive Statistics: Mean, Median, Mode, Standard Deviation, Variance	
	4.4	Coefficient of Variation, Skewness and Kurtosis, Correlation	
		Total	**30**

Text Books:

1. Mark Lutz: Programming Python, O'Reilly Media, 4th Edition.
2. Wes McKinney: Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, O'Reilly Media, 2nd Edition.

Reference Books:

1. Kenneth A. Lambert: The Fundamentals of Python: First Programs, 2011, Cengage Learning
2. Asha Jindal(Ed): Analyzing and Visualizing Data using Free Open Source Software: Python Programming with Case Studies, Shailja Prakashan and K. C. College, 2020.
3. Eric Matthes – *Python Crash Course*, No Starch Press, 2nd Edition
4. Jake VanderPlas – *Python Data Science Handbook*, O'Reilly
5. Allen B. Downey – *Think Python*, Green Tea Press.
6. Luciano Ramalho – *Fluent Python*, O'Reilly.