

As Per NEP 2020

University of Mumbai



Title of the program

- A- U.G. Certificate in Statistics
- B- U.G. Diploma in Statistics
- C- B.A./B.Sc. (Statistics)
- D- B.A./B.Sc. (Hons.) in Statistics
- E- B.A./B.Sc. (Hons. with Research) in Statistics

Syllabus for

Semester – Sem I & II

Ref: GR dated 20th April, 2023 for Credit Structure of UG

(With effect from the academic year 2024-25
Progressively)

University of Mumbai



(As per NEP 2020)

Sr. No.	Heading	Particulars	
1	Title of program O: _____ A	A	U.G. Certificate in Statistics.
	O: _____ B	B	U.G. Diploma in Statistics.
	O: _____ C	C	B.A./B.Sc. (Statistics)
	O: _____ D	D	B.A./B.Sc. (Hons.) in Statistics.
	O: _____ E	E	B.A./B.Sc. (Hons. with Research) in Statistics.
2	Eligibility O: _____ A	A	passed Higher Secondary course with Mathematics/Statistics as subject. OR Passed Equivalent Academic Level 4.0 with mathematics/statistics
	O: _____ B	B	Under Graduate Certificate in Statistics OR Passed Equivalent Academic Level 4.5
	O: _____ C	C	Under Graduate Diploma in Statistics OR Passed Equivalent Academic Level 5.0
	O: _____ D	D	Bachelors of Statistics with minimum CGPA of 7.5 OR Passed Equivalent Academic Level 5.5
	O: _____ E	E	Bachelors of Statistics with minimum CGPA of 7.5 OR Passed Equivalent Academic Level 5.5
3	Duration of program R: _____	A	One Year
		B	Two Years
		C	Three Years
		D	Four Years
		E	Four Years
4	Intake Capacity R: _____	60	

5	Scheme of Examination R: _____	NEP 40% Internal 60% External, Semester End Examination Individual Passing in Internal and External Examination	
6	R: _____ Standards of Passing	40%	
7	Credit Structure Sem. I - R: _____ A Sem. II - R: _____ B	Attached herewith	
	Credit Structure Sem. III - R: _____ C Sem. IV - R: _____ D		
	Credit Structure Sem. V - R: _____ E Sem. VI - R: _____ F		
8	Semesters	A	Sem I & II
		B	Sem III & IV
		C	Sem V & VI
		D	Sem VII & VIII
		E	Sem VII & VIII
9	Program Academic Level	A	4.5
		B	5.0
		C	5.5
		D	6.0
		E	6.0
10	Pattern	Semester	
11	Status	New	
12	To be implemented from Academic Year Progressively	From Academic Year: 2024-25	

**Sign of the BOS
Chairman
Dr. Santosh Gite
Board of Studies in
Statistics**

**Sign of the
Offg. Associate Dean
Dr. Madhav R. Rajwade
Faculty of Science &
Technology**

**Sign of the
Offg. Dean
Prof. Shivram S. Garje
Faculty of Science &
Technology**

Preamble

This syllabus is framed as per National educational policy (NEP2020) to provide in depth basic knowledge with understanding of statistics subject to undergraduate students of first year of three-year Bachelor of Science degree course. The field of Statistics addresses how to collect, analyze and interpret results of collected data. There is growing demand for highly skilled statisticians in the 21st century in many fields including government, banking sector, health sciences, veterinary sciences, agricultural sciences, business and social sciences etc.

The course mainly focuses on how to gain core knowledge of subject and train students to solve real life problems. The course will be benefitting students for shaping their future as data scientist, Business analyst, Biostatisticians, investigators and teachers in government and private organization.

The thrust of the course is to prepare students to enter a promising professional life even after graduation, as also provide to them a platform for pursuing higher studies leading to post-graduate or doctorate degrees.

Objectives of the Programme.

1. To train the students to solve real life problems using statistical techniques.
2. Statistics graduates cultivate professional and ethical attitudes with effective communication skills, teamwork and multidisciplinary approach related to data analysis.
3. Statistics graduates shall be suitably employed in Central/State government organizations, financial and banking industries, corporate and insurance sectors for data analysis and drawing conclusions for socio-economic issues.
4. Statistics graduates can pursue Master's studies in Statistics, Quantitative Finance, Data Science, Operations Research, Actuarial Science and Population Studies in leading universities in India and abroad
5. To create a skilled workforce to meet the requirements of the society.

Learning Outcome: Student will learn

1. To understand the basic concepts of data and scale of measurement of data.
2. To understand comparison of data by using measures of central tendency and dispersion.
3. To explore relationship between two or more variables and predict the value by regression analysis.
4. To study probability structure of Discrete and continuous random variables for discrete and continuous distributions.
5. To make inferences about population from sample data.
6. To enable use of statistical techniques in time series, industry, demography, etc.
7. To understand and develop skill to solve real life problems by using MS Excel, R-programming.

• Structure of the course

The Board of Studies in Statistics, University of Mumbai, Mumbai in its meeting held on 20th November 2023 have discussed, finalized and unanimously accepted the revised syllabus as per NEP2020 prepared by committee. The titles of the papers for F. Y. B. Sc. (Statistics) are as given below.

Credit Structure (Sem. I & II)

**Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship
OR Continue with Major and Minor**

Credit Structure (Sem. III & IV)

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

B.A./B.Sc. (Statistics)

Credit Structure (Sem. V & VI)

R: _____ E										
Level	Semester	Major	Minor	OE	VS C, SE C (VSEC)	AEC, VEC, IKS	OJT, FP,CE P, CC, RP	Cum. Cr./ Sem.	Degree / Cum. Cr.	
5.5	V	10 Advance Probability Theory Theory of Estimation-I Biostatistics The Indian History of Statistics (IKS) Practical-V	4 Optimization Techniques(2) Practical Based on Minor (2)	Advanced operation Research OR Acturial Statistics OR Demography and Official statistics OR Introduction to Survival analysis OR Introduction to Time Series Analysis. Practical based on each elective courses	Hands on training on PYTHON programi ng	VSC: 2		FP/CEP: 2	22	UG Degree 132
R: _____ F										
	VI	10 Introducti on to Regressi on Analysis Testing of Hypothes is	4 Predictive Data Analysis (2) Practical Based on Minor(2)	4 Introduction of six Sigma OR Elements of Data Science OR				OJT :4	22	

		Stochastic Process and Queuing Theory		Advanced Survival Analysis OR Advanced Time series Analysis						
		Design of Experiment-II		Practical based on each electives course						
		Practical I-VI								
	Cum Cr.	48	8	18	12	8+6	8+4+2	8+6+4	132	
Exit option: Award of UG Degree in Major with 132 credits OR Continue with Major and Minor										

[Abbreviation - OE – Open Electives, VSC – Vocation Skill Course, SEC – Skill Enhancement Course, (VSEC), AEC – Ability Enhancement Course, VEC – Value Education Course, IKS – Indian Knowledge System, OJT – on Job Training, FP – Field Project, CEP – Continuing Education Program, CC – Co-Curricular, RP – Research Project]

**Mandatory
Sem-I**

Course Name: Fundamentals of Statistics-I

Type: Theory

Vertical: Major

Credit: 2 credit

Hours allotted: 30 hrs

(1 credit= 15 Hours for Theory or 30 Hours of Practical work in a semester)

Marks: 50

SEMESTER 1		
FUNDAMENTALS OF STATISTICS-I		
CO1: Students will be able to, 1. Understand the meaning of statistics and scope of statistics. 2. Understand techniques of data collection and its presentation. 3. Compute various measures of central tendencies and measures of dispersion. 4. Summarize data through central tendencies and measures of dispersion. 5. Understand the behavior of data using skewness and kurtosis. OC1: on successful completion of the course Students Should be able to, 1. Calculate arithmetic mean, Geometric mean and Harmonic Mean 2. Differentiate between qualitative and quantitative data through scale of measurement. 3. Construct graphs and diagrams from data and interpret the result. 4. Compute Skewness and Kurtosis of the data to describe nature of data distribution.		
Unit	Types of Data and Data Condensation	Lectures

I	• Definition and scope of Statistics • Types of Characteristics, Different types of scales: nominal, ordinal, interval and ratio. • Collection of Primary data: concept of a questionnaire and a schedule, Secondary data • Types of data: Qualitative and quantitative data; Time series data and crosssection data, discrete and continuous data. • Tabulation. • Dichotomous classification- for two and three attributes, verification for consistency, ultimate class frequencies, fundamental set of class frequencies. • Association of attributes: Yule's coefficient of association Q. Yule's coefficient of Colligation γ, relationship between Q and γ.	10
Unit	Classification of Data and Measures of central tendency	Lectures
II	Classification of Data and Measure of central tendency. • Univariate frequency distribution of discrete and continuous variables. Cumulative frequency distribution. • Graphical representation of frequency distribution by Histogram, frequency polygon, Cumulative frequency curve. Stem and leaf diagram. • Concept and Requirements of good measures of central tendency. • Mathematical averages Arithmetic mean (Simple, weighted mean, combined mean), Effect of change of origin and scale on arithmetic mean. Geometric mean, Harmonic mean, relation between Geometric mean, Harmonic mean. Arithmetic mean.. • Geometric mean of ratio of two series is the ratio of their geometric means. • Positional averages: Median, Mode, and Partition Values: Quartiles, Deciles, and Percentiles. Graphical representation of mode, median and partition values. • Empirical relation between mean, median and mode • Merits and demerits of using different measures & their applicability	10

Unit	Measures of Dispersion, Skewness & Kurtosis	Lectures
III	• Concept and requirements of good measures of dispersion. • Absolute and Relative measures of dispersion: Range, Quartile Deviation, Mean absolute deviation, Standard deviation, Coefficient of variation, Variance and Combined variance, Raw moments and central moments , relation between them and their properties. Merits and Demerits of measures of dispersion. • Concept of Skewness and Kurtosis: Measures of Skewness: Karl Pearson's, Bowley's and Coefficient of skewness based on moments. Measures of Kurtosis based on moments. • Box Plot	10

References.

- 1 Agarwal B.L. : Basic Statistics, New Age International Ltd.
- 2 Spiegel M.R. : Theory and Problems of Statistics, Schaum' s Publications series.Tata McGraw-Hill.
- 3 Kothari C.R. : Research Methodology, Wiley Eastern Limited.
- 4 Goon A.M., Gupta M.K., Dasgupta B. : Fundamentals of Statistics, Volume II :The World Press Private Limited, Calcutta.
- 5 Elhance D. N, Elhance V, Aggarwal B. M, Fundamentals of Statistics, Kitab Mahal Daryaganaj New Delhi, 2018.
- 6 Grewal P. S, Methods of Statistical Analysis, Sterling Publishers, 1990
- 7 S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons

Format of Question Paper:
Internal Continuous Assessment: (20 marks)

Assignment/viva Quizzes, Class Tests, presentation, project, assignment etc	Class Test	Total
05	15	20

Semester End Examination: (30 marks)

Semester End Examination will be of 30 marks of 01 hour duration covering entire syllabus of the semester. Examiners should frame sub questions for Q.1, Q2 and Q3. Each question carrying 15 marks. Attempt any two out of three questions.

Theory Question Paper Pattern:

Q 1	Max. marks: 15	Attempts any two questions out of Three.
Q 2	Max. marks: 15	
Q 3	Max. marks: 15	

**Mandatory
Sem-I**

Course Name: Statistical Methods-I.

Type: Theory

Vertical: Major

Credit: 2 credit

Hours allotted: 30 hrs

(1 credit= 15 Hours for Theory or 30 Hours of Practical work in a semester)

Credit:2	SEMESTER I STATISTICAL METHODS-I	No. of Hours: 30
	CO2: Students will be able to, 1. Understand the concept of probability and its applications. 2. Differentiate between random and non-random experiment. 3. Understand the meaning of continuous and discrete random variable. 4. Understand discrete distributions and their properties. 5. Solve the examples of probability OC2: On successful completion of this course Students Should be able to, 1. Calculate probabilities and conditional probabilities. 2. Identify the types of events. 3. Compute the expectation of the univariate discrete random variable. 4. Write probability mass functions (pmf) of various discrete distribution and their real-life applications. 5. Apply the concept of probability in real-life situations.	
Unit	Elementary Probability Theory	Lectures

I	• Definitions: Trial, random experiment, sample point and sample space. • Definition of an event and different types of events: compound event, complementary event, equally likely events, certain event, impossible event, mutually exclusive and exhaustive events. • Different definitions of Probability: Classical (Mathematical), Empirical(Statistical) and Axiomatic definitions of Probability. Properties of probability • Conditional probability. • Independence of events, pairwise and mutual independence of three events. • Theorems (with proof)and their applications: i. Addition theorem on probability for two and three events ii. Multiplication theorem on probability for two events. iii. Bayes' theorem.	10
Unit	Discrete random variables	Lectures
II	• Random variable: discrete and continuous random variables. Definition and properties of probability mass function . cumulative distribution function. • Raw and Central moments (definition only) and their relationship. (up to order four). • Concepts of Skewness and Kurtosis and their uses for random variables. • Expectation and variance of a random variable. Theorems and properties on Expectation and variance of random variables with proof. • Joint probability mass function of two discrete random variables. • Marginal and conditional distributions. • Covariance and Coefficient of Correlation. Independence of two random variables.	10
Unit	Standard Discrete Probability Distributions	Lectures

III	• Definition and derivation of mean and variance of the following distributions: i. Discrete Uniform distribution ii. Bernoulli and Binomial distributions iii. Poisson distribution iv. Hypergeometric distribution v. Geometric distribution. • Recurrence relation for probabilities of Binomial and Poisson distributions. • Poisson approximation to Binomial distribution (only statement) and its applications.	10
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Reference Books

1. David S. : Elementary Probability, Cambridge University Press.
2. Hoel P.G. : Introduction to Mathematical Statistics, Asia Publishing House.
3. Hogg R.V. and Tannis E.P. : Probability and Statistical Inference. McMillan Publishing Co. Inc.
4. Pitman Jim : Probability, Narosa Publishing House.
5. Goon A.M., Gupta M.K., Dasgupta B. : Fundamentals of Statistics, Volume II : The World Press Private Limited, Calcutta.
6. Mukhopadhyay P. An Introduction to the Theory of Probability, World Scientific Publishing Company, 2011.
7. Grewal P. S, Methods of Statistical Analysis, Sterling Publishers, 1990
8. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons

Format of Question Paper:

Internal Continuous Assessment: (20 marks)

Assignment/viva Quizzes, Class Tests, presentation, project, assignment etc	Class Test	Total
05	15	20

Semester End Examination: (30 marks)

Semester End Examination will be of 30 marks of 01 hour duration covering entire syllabus of the semester. Examiners should frame sub questions for Q.1, Q2 and Q3. Each question carrying 15 marks. Attempt any two out of three questions.

Theory Question Paper Pattern:

Q 1	Max. marks: 15	Attempts any two questions out of Three.
Q 2	Max. marks: 15	
Q 3	Max. marks: 15	

Mandatory

Credit: 2	SEMESTER I Statistics Practical- I Practical based on Paper1 and paper2	No. of Hours: 60
	CO3: Students will be able to, 1. Understand the Consistency, Association of Attributes. 2. Differentiate between variables and attributes. 3. Compute various measures of central tendency and dispersion OC3: Students Should be able to, 1. Draw diagrams and graphs for frequency distribution 2. Compute moments, skewness, and kurtosis. 3. Find the probabilities of events and conditional probabilities. 4. Summarized data and find averages as well as the spread of the data using softwares.	
	List of Practicals Practical Based on paper-I	
	1. Classification and Tabulation 2. Practicals on theory of Attributes 3. Graphs and Diagrams 4. Measures of central tendency 5. Measures of dispersion 6. Skewness and Kurtosis 7. Probability 1 8. Probability 2 9. Univariate Discrete random variable 10. Bivariate Discrete random variable 11. Binomial Distribution 12. Poisson Distribution 13. Hypergeometric Distribution 14. Geometric distribution. 15. Practicals using EXCEL	

Reference Books

1. Medhi J. : Statistical Methods, An Introductory Text, Second Edition, New Age International Ltd.
2. Agarwal B.L. : Basic Statistics, New Age International Ltd.
3. Spiegel M.R. : Theory and Problems of Statistics, Schaum' s Publications series. Tata McGraw-Hill.
4. Kothari C.R. : Research Methodology, Wiley Eastern Limited.
5. David S. : Elementary Probability, Cambridge University Press.
6. Hoel P.G. : Introduction to Mathematical Statistics, Asia Publishing House.
7. Hogg R.V. and Tannis E.P. : Probability and Statistical Inference. McMillan Publishing Co. Inc.
8. Pitan Jim : Probability, Narosa Publishing House.
9. Goon A.M., Gupta M.K., Dasgupta B. : Fundamentals of Statistics, Volume II : The World Press Private Limited, Calcutta.
10. Elhance D. N, Elhance V, Aggarwal B. M, Fundamentals of Statistics, Kitab Mahal Daryaganaj New Delhi, 2018.
11. Mukhopadhyay P. An Introduction to the Theory of Probability, World Scientific Publishing Company, 2011.
12. Grewal P. S, Methods of Statistical Analysis, Sterling Publishers, 1990
13. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons.

VSC - Vocational Skill Course

Semester I

Heading	Particulars
Description of the Course:	Data Analysis using Excel
Vertical:	Vocational Skill Courses (VSC)
Type	Theory
Credits:	02
Hours Allotted:	30 hours
Marks Allotted:	50 marks
Course Objectives: Students will able to, CO 01. Know about Excel worksheet CO 02. Know how to format spreadsheet. CO 03. Learn different functions of Excel.	
Course Outcomes On successful completion of the course Students Should be able to, OC 01. Know Excel worksheet, spreadsheet and Excel window. OC 02. Know formatting of cell. OC 03. Know spreadsheet tools such as splitting, freezing, copying, pasting etc. OC 04. Know standard mathematical, financial, information functions of Excel. OC 05. Draw diagrams and graphs using Excel OC 06. Draw summary statistics using Excel.	
Modules	
Module I	Introduction to MS-Excel
Module II	Elementary Statistics using MS-Excel.
References	

Detailed Syllabus

Course Name: Data Analysis Using Excel

Module		Number of lectures
I	Introduction to MS-Excel - About Excel and Microsoft, Excel spreadsheet, excel window, title bar, menu bar, standard tool bar, formula bar, workbook and sheets. - Selecting rows and columns, inserting / deleting rows and columns, cell, cell address, cell formatting, conditional formatting, hiding/unhiding of columns and rows, use of paste and paste special. - Spreadsheet tools: moving between spreadsheets, inserting, deleting, renaming spreadsheets, splitting the screen, freezing pane, copying and pasting data between spreadsheets, protecting worksheets. - Range, entering information into a range, autofill, functionality using range.	15
II	Elementary Statistics using MS-Excel	15

	• Formula functions: financial functions, date and time functions, information functions, concatenate function, find function, text functions, ceiling, floor, round functions, trigonometric functions, elementary Mathematical functions. • creating different charts, formatting chart objects. • creating pivot tables, properties of pivot tables. • Elementary Statistical functions: finding arithmetic (average), geometric (geomean), harmonic means (harmean), median (median), mode (mode), partition values (percentile.exc, quartile.exc), coefficients of skewness (skew), kurtosis (kurt).	
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References:

- Salkind, Neil, J. (2015): Excel Statistics: A quick guide. Sage Publications.
- Walkenbach, J. (2015): Excel 2016 Bible: The comprehensive tutorial resource. Wiley.

Format of Question Paper:

Internal Continuous Assessment: (20 marks)

Assignment/viva Quizzes, Class Tests, presentation, project, assignment etc	Class Test	Total
05	15	20

Semester End Examination: (30 marks)

Semester End Examination will be of 30 marks of 01 hour duration covering entire syllabus of the semester. Examiners should frame sub questions for Q.1, Q2 and Q3. Each question carrying 15 marks. Attempt any two out of three questions.

Theory Question Paper Pattern:

Q 1	Max. marks: 15	Attempts any two questions out of Three.
Q 2	Max. marks: 15	
Q 3	Max. marks: 15	

Skill Enhancement Course (SEC)

Semester-I

Skill Enhancement Course(SEC)

Name of The Course: Statistical Analysis using Microsoft SQL-I

Sr.No.	Heading	Particulars
1	Description the course: Introduction: The SQL (structured query language) programming language is often used to pull data from the various tables in a database and to assemble the data in a format amenable to statistical analysis or review. The purpose of this course is to teach students how to extract data from a relational database using SQL so they can perform statistical operations. The focus is on structuring queries to extract structured data (not on building databases or methods of handling big data). This is an introductory course that will help students think “like” a relational database in order to manipulate matrices and vectors of data using SQL queries. It covers all techniques and tools used to collect all type of data, organize, manipulate, analyse and present it Usefulness: • SQL is a unique program, designed with inputs from eminent academicians and industry leaders, to focus on building skillsets for the growing requirement of data scientists in the industry. • SQL is widely used in business and in other types of database administration. • This course focuses on applied as well as theoretical aspects of Statistics along with subjects from Economics, Mathematics, Computers, IT, Commerce, Arts & Analytics. • Extensive use of SQL to solve practical problems and projects. • Opportunity to improve soft skills as well as scientific writing. • SQL upgrade students at par with international standards. Application, and Demand • Finance Industry: Financial Reporting, Risk Management, and regulatory Compliance. • Marketing and Social Media: Market research, consumer behaviour analysis. • Business statistics are used improve product quality, minimize defects, and optimize manufacturing processes. • It is used as Database Administration in Healthcare: Electronic Health Records, Data Retrieval and Analysis, Quality Improvement and Administrative Tasks. • Music industry: User optimizer analysis, Metadata Storage and	

	predictive data analyst. Job Prospects: SQL is used in marketing, healthcare, and finance for data and business analytics, development, and data science. Connection with Other Courses: This course focuses on applied as well as theoretical aspects of Statistics along with subjects from Economics, Mathematics, Computers, IT, Commerce, Arts & Analytics.	
2	Vertical:	Skill enhance
3	Type:	Theory
4	Credits:	2 credits (1 credit = 15 Hours for Theory in a semester)
5	Hours Allotted:	30 Hours
6	Marks Allotted:	50 Marks
7	Theory (2 Credit) Total No of Theory Hours: 30 Total Marks : 50 Course Objectives (CO): (List the course objectives) - Introducing students to SQL statistical concepts and techniques applicable to business Industry and other sectors. - Understanding the phenomenon of SQL in terms of data Storage and manipulation. - Providing students with the skills to collect, organize, and analyse data using SQL statistical tools. - This course provides a comprehensive introduction to the language of relational databases:	
8	Course Outcomes (OC): (List the course outcomes) - Increased marketability as a Data analyst & developer - Countless technological uses - Foundational knowledge for learning other programming languages - Secure future for Statistics with SQL - Many job opportunities and career advancements	

Module 1:	Basics of SQL	10 hrs
1.1	Introduction, Installing SQL server, Data Types and Constraints in SQL: (1) Data type of Attribute, (2) Constraints. SQL for Data Definition: (1) CREATE Database, (2) CREATE Table. Relational data types. DESCRIBE Table Practice problem, Hands-on.	
1.2	ALTER Table: Add primary and foreign key to a relation, Add constraint UNIQUE to an existing attribute, Add an attribute to an existing table,	
1.3	Modify datatype and constraint of an attribute, Add default value to an attribute, Remove an attribute, Remove primary key from the table. DROP Statement, Practical problems, Hands-on.	
Module 2:	Operators, Clauses and Data Manipulation in SQL	10 hrs

2.1	Operators: AND, OR, NOT, UNION. UNION ALL, INTERSECT, EXCEPT, LIKE, BETWEEN. Syntax with practice problems.	
2.2	Clauses: WHERE, GROUP BY, ORDER BY, HAVING, HAVING Clause with GROUP BY and ORDER BY. Syntax with practice problems and Hands-on. INSERTION of Records, SELECT Statement to retrieve the data.	
2.3	QUERYING using Database OFFICE. Data Updation and Deletion: (1) Data Updation, (2) Data Deletion. Practice problem and Hands-on session.	
Model 3:	Statistical Data visualization and Measure of Central tendency with SQL	10 hrs
3.1	Data visualization: Bar chart, Pi-chart, Histogram and line diagram.	
3.2	Central tendency: Mean, median and Mode, Geometric mean and Harmonic mean.	
3.3	Practical problems, Hands-on based on 3.1 and 3.2.	

	Reference Books 1. SQL QuickStart Guide: The Simplified Beginner's Guide to Managing, Analysing data, walter shields 2. SQL All-in-One For Dummies.Allen GTaylor, 3rd edition 3. Sams: Teach Yourself SQL in 10 Minutes, 5th edition 4. SQL: The Ultimate Beginners Guide: Learn SQL Today. Steven Tale 5. Practical SQL, 2nd Edition: A Beginner's Guide to Storytelling with Data. 2nd edition. 6. Data analysis using SQL and EXCEL, 2nd edition. Gordon S.Linoff 7. Exploratory Data Analysis with SQL. Renée M. P. Teate 8. SQL Queries for Mere Mortals: A Hands-On Guide to Data Manipulation in SQL, John L. Viescas, 4th edition. 9. Wiley, Data Analysis using SQL and Excel, Gordon S. Linoff.
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Format of Question Paper:

Internal Continuous Assessment: (20 marks)

Assignment/viva Quizzes, Class Tests, presentation, project, assignment etc	Class Test	Total
05	15	20

Semester End Examination: (30 marks)

Semester End Examination will be of 30 marks of 01 hour duration covering entire syllabus of the semester. Examiners should frame sub questions for Q.1, Q2 and Q3. Each question carrying 15 marks. Attempt any two out of three questions.

Theory Question Paper Pattern:

Q 1	Max. marks: 15	Attempts any two questions out of Three.
Q 2	Max. marks: 15	
Q 3	Max. marks: 15	

SEMESTER - II

**Mandatory
Sem-II
Course Name: Fundamentals of Statistics-II**

Type: Theory

Vertical: Major

Credit: 2 credit

Hours allotted: 30 hrs

(1 credit= 15 Hours for Theory or 30 Hours of Practical work in a semester)

B.Sc.		
Part-I		
SEMESTER - II		
FUNDAMENTALS OF STATISTICS-II		
CO1: Students will be able to, 1. Understand the concept of correlation and regression. 2. Compute the correlation of bivariate data. 3. Interpret the relationship between two numeric variables. 4. Build a Simple Linear regression model to predict the response variable. 5. Analysis and interpretation of daily household and business-related data using tools like index numbers . OC1: On successful completion of this course students will be able to: • To choose appropriate correlation method to data and interpret correlation between two variables using scatter diagram, Karl Pearson's Product moment correlation coefficient, Spearman's Rank correlation coefficient. • To obtain regression coefficient using least square method of estimation and apply method to real life problem. • Understand Nature of time series data and solve real life problems using freehand curve method, semi average method, moving average method, least square method, etc.		
Unit	Correlation and Regression Analysis	Lectures

I	- Scatter Diagram, product moment correlation coefficient and its properties. Spearman's Rank correlation (With and without ties) - Concept of linear regression, principle of least squares, fitting a straight line by method of least squares. Derivation for acute angle between the two lines of regression. - Relation between regression coefficients and correlation coefficient. - Fitting of curves reducible to linear form by transformation. Concept and use of coefficient of determination (R^2). - Fitting a quadratic curve by method of least squares.	10
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Unit	Time Series Analysis	Lectures
II	- Definition of time series and its components. Models of time series. Estimation of trend by: i) Free hand curve method ii) Method of semi average iii) Method of Moving average iv) Method of least squares (linear trend only) - Estimation of seasonal component by i) method of simple average ii) Ratio to moving average iii) Ratio to trend method.	10
Unit	Index Numbers	Lectures
III	- Index numbers as comparative tool. Stages in the construction of Price Index Numbers. - Measures of Simple and Composite Index Numbers. Laspeyre's, Paasche's, Marshal-Edgeworth's, Dobisch & Bowley's and Fisher's Index Numbers. - Quantity Index Numbers and Value Index Numbers, Time reversal test, Factor reversal test, Circular test. - Fixed base Index Numbers, Chain base Index Numbers. Base shifting, splicing and deflating. - Cost of Living Index Number. Concept of Real Income based on Wholesale Price Index Number.	10

References:

1. Agarwal B. L, Basic Statistics, New Age International P Ltd. Delhi, 2015
2. Saxena S., Kapoor J. N., Mathematical Statistics, Sultan Chand & Sons, Delhi, 2010
3. Gupta S. P, Statistical Methods, Sultan Chand and Sons, New Delhi, 2002

4. Gupta S. C and Kapoor V. K Fundamental of Mathematical Statistics, S Chand & Sons, Delhi, 2008
5. Grewal P. S. Methods of Statistical Analysis, Sterling Publishers, 1990
6. Mukhopadyay P., An Introduction to the theory of Probability, World Scientific Publishing Company, 2011
7. S.C. Gupta and V.K. Kapoor, Applied Statistics, Sultan Chand and sons.

Format of Question Paper:

Internal Continuous Assessment: (20 marks)

Assignment/viva Quizzes, Class Tests, presentation, project, assignment etc	Class Test	Total
05	15	20

Semester End Examination: (30 marks)

Semester End Examination will be of 30 marks of 01 hour duration covering entire syllabus of the semester. Examiners should frame sub questions for Q.1, Q2 and Q3. Each question carrying 15 marks. Attempt any two out of three questions.

Theory Question Paper Pattern:

Q 1	Max. marks: 15	Attempts any two questions out of Three.
Q 2	Max. marks: 15	
Q 3	Max. marks: 15	

Mandatory
Sem-II
Course Name: Statistical Methods-II

Type: Theory

Vertical: Major

Credit: 2 credit

Hours allotted: 30 hrs

(1 credit= 15 Hours for Theory or 30 Hours of Practical work in a semester)

Credit:2	SEMESTER II STATISTICAL METHODS-II	No. of Hours:30
	CO2: Students will be able to, Understand the fundamental concepts of continuous probability distributions. Study the concept of estimate and estimator. Understand the concept of testing of hypothesis and large sample test. OC2: Students Should be able to, Explain the continuous probability distributions such as Uniform, Exponential, Normal distributions and apply to real life applications. Compute mean, variance and standard deviations for continuous probability distributions. Apply testing of hypothesis technique to solve statistical problems.	
Unit	Continuous Probability Distributions	Lectures
I	• Concept of continuous random variable, probability density function and its properties. Cumulative distribution functions of continuous random variables and its properties. • Definition and derivation of mean, variance and median of Uniform and Exponential distributions. Memory less property of Exponential distribution. • Normal distribution. Properties of Normal distribution (without proof). Normal approximation to Binomial and Poisson distribution (statement only). Properties of Normal curve. Use of normal tables.	10
Unit	Estimation	Lectures

II	• Sampling from a distribution: Concept of a statistic, parameter, estimate and estimator, sampling distribution of statistic. • Concept of bias and standard error of an estimator. • Central Limit theorem (statement only).	10
	• Sampling distribution of sample mean and sample proportion. (For large sample only) • Standard errors of sample mean and sample proportion. • Point and Interval estimate of single mean, single proportion from sample of large size. • Point and interval estimate of difference between two means and proportions.	
Unit	Testing of Hypothesis and Large Sample Test	Lectures
III	Testing of hypothesis: • Concept of hypothesis • Simple and composite hypothesis • Null and alternate hypothesis • Test statistic, Critical region, Types of error, Level of significance and power of the test. Large sample tests: • For testing specific value of population mean • For testing specific value in difference of two means • For testing specific value of population proportion • For testing specific value of difference of population proportion (development of critical region is not expected)	10

Reference Books

2. Agarwal B. L, Basic Statistics, New Age International P Ltd. Delhi, 2015
1. Saxena S., Kapoor J. N., Mathematical Statistics, Sultan Chand & Sons, Delhi, 2010
2. Gupta S. P, Statistical Methods, Sultan Chand and Sons, New Delhi, 2002
3. Kapoor V. K, Gupta S. C, Fundamental of Mathematical Statistics, S Chand & Sons, Delhi, 2008
4. Grewal P. S. Methods of Statistical Analysis, Sterling Publishers, 1990
5. Mukhopadhyay P., An Introduction to the theory of Probability, World Scientific Publishing Company, 2011

Format of Question Paper:
Internal Continuous Assessment: (20 marks)

Assignment/viva Quizzes, Class Tests, presentation, project, assignment etc	Class Test	Total
05	15	20

Semester End Examination: (30 marks)

Semester End Examination will be of 30 marks of 01 hour duration covering entire syllabus of the semester. Examiners should frame sub questions for Q.1, Q2 and Q3. Each question carrying 15 marks. Attempt any two out of three questions.

Theory Question Paper Pattern:

Q 1	Max. marks: 15	Attempts any two questions out of Three.
Q 2	Max. marks: 15	
Q 3	Max. marks: 15	

Mandatory

Credit: 2	SEMESTER II Statistics Practical -II Practical based on Paper1 and paper2	No. of Hours: 60
	CO3: Students will be able to, 1. Understand the basic concepts of regression analysis and correlation. 2. Analyze and interpret data from regression and correlation techniques. 3. Apply Uniform and Exponential and Normal distribution to solve real-life problems. OC3: on completion of this course Students Should be able to, 1. Apply concepts of the probability distributions 2. Write pdf for some standard probability distributions. 3. Compute and interpret the regression equation, regression coefficients and correlation coefficients 4. Analyze and interpret real – world data using regression and correlation techniques.	
	List of Practicals Practical Based on paper-II (Fundamentals of Statistics-II)	
	1. Correlation analysis 2. Regression analysis 3. Fitting of curve 4. Time series Analysis 5. Index number-I 6. Index number-II 7. Continuous Random Variable 8. Uniform and Exponential Distribution 9. Normal Distribution and application of central limit theorem 10. Point and Interval Estimation. 11. Testing of Hypothesis 12. Large Sample Test 13. Practical's using EXCEL	30

Reference Books

- 1 Medhi J.: Statistical Methods, An Introductory Text, Second Edition, New Age International Ltd.
- 2 Agarwal B. L.: Basic Statistics, New Age International Ltd.
- 3 Spiegel M. R.: Theory and Problems of Statistics, Schaum's Publications series. Tata McGraw-Hill.
- 4 Kothari C. R.: Research Methodology, Wiley Eastern Limited.
- 5 David S.: Elementary Probability, Cambridge University Press.
- 6 Hogg R. V. and Tannis E.P.: Probability and Statistical Inference McMillan Publishing Co. Inc.
- 7 Goon A. M., Gupta M. K., Dasgupta B.: Fundamentals of Statistics, Volume II : The World Press Private Limited, Calcutta.
- 8 Miller I. & Miller M (2006), John E. Freund's Mathematical Statistics with applications, 7th edition, Pearson Education Asia
- 9 Gupta, S. C. and Kapoor, V. K. (2002), Fundamentals of Mathematical Statistics, eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
- 10 Gupta, S. C. and Kapoor, V. K. (2004), Fundamentals of Applied Statistics, Third Edition, Sultan Chand and Sons Publishers, New Delhi.
- 11 Sarma, K. V. S. (2001). Statistics Made it Simple: Do it yourself on PC. Prentice Hall of India, New Delhi.

VSC - Vocational Skill Course

Semester II

Heading	Particulars
Description of the Course:	Data Analysis Using Advance Excel
Vertical:	Vocational Skill Courses (VSC)
Type	Theory
Credits:	02
Hours Allotted:	30 hours
Marks Allotted:	50 marks
Course Objectives: Students will able to, CO 01. Know about advance concepts of MS-Excel. CO 02. Know how to write a macro in MS-Excel. CO 03. Learn advance statistical functions of MS-Excel.	
Course Outcomes On successful completion of the course Students Should be able to, OC 01. Know how to sort, filter in MS-Excel. OC 02. Know lookup, referencing and logical functions. OC 03. Know drawing scatter diagram and fit a simple linear regression using MS-Excel. OC 04. Know plotting of probability functions of standard statistical distributions. OC 05. Solve testing problems for one and two populations based on large sample.	
Modules	
Module I	Advance concepts of MS-Excel.
Module II	Advance Statistical analysis using MS-Excel
References	
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Detailed Syllabus

Course Name: Data Analysis Using Advance Excel

Module		Number of lectures
I	Advance concepts of MS-Excel. • Sorting, filtering, lookup and reference functions, logical functions, • Writing macro • advanced statistical functions like count, countif, countblank, maxifs, minifs, frequency, averageif, averageifs, confidence.norm, intercept.	15
II	Advance Statistical analysis using MS-Excel • Scatter diagram, correlation, simple linear regression, (pearson, correl, • Finding probabilities (prob), pmf/pdf, cdf plots for different parameters for binomial, Poisson, hypergeometric, normal distributions. Plots for convergence of binomial to Poisson, plots for application of central limit theorem (norm.dist, norm.inv, norm.s.dist, norm.s.inv, binom.dist, hypgeom.dist) • Large sample test	15

References

- Salkind, Neil, J. (2015): Excel Statistics: A quick guide. Sage Publications.
- Walkenbach, J. (2015): Excel 2016 Bible: The comprehensive tutorial resource. Wiley.

Format of Question Paper:

Internal Continuous Assessment: (20 marks)

Assignment/viva Quizzes, Class Tests, presentation, project, assignment etc	Class Test	Total
05	15	20

Semester End Examination: (30 marks)

Semester End Examination will be of 30 marks of 01 hour duration covering entire syllabus of the semester. Examiners should frame sub questions for Q.1, Q2 and Q3. Each question carrying 15 marks. Attempt any two out of three questions.

Theory Question Paper Pattern:

Q 1	Max. marks: 15	Attempts any two questions out of Three.
Q 2	Max. marks: 15	
Q 3	Max. marks: 15	

Semester-II
Skill Enhancement Course(SEC)
Name of The Course: Statistical Analysis using Microsoft SQL-II

Sr.No.	Heading	Particulars
1	Description the course: Introduction: The SQL (structured query language) programming language is often used to pull data from the various tables in a database and to assemble the data in a format amenable to statistical analysis or review. The purpose of this course is to teach students how to extract data from a relational database using SQL so they can perform statistical operations. The focus is on structuring queries to extract structured data (not on building databases or methods of handling big data). This is an introductory course that will help students think “like” a relational database in order to manipulate matrices and vectors of data using SQL queries. It covers all techniques and tools used to collect all type of data, organize, manipulate, analyse and present it Usefulness: • SQL is a unique program, designed with inputs from eminent academicians and industry leaders, to focus on building skillsets for the growing requirement of data scientists in the industry. • SQL is widely used in business and in other types of database administration. • This course focuses on applied as well as theoretical aspects of Statistics along with subjects from Economics, Mathematics, Computers, IT, Commerce, Arts & Analytics. • Extensive use of SQL to solve practical problems and projects. • Opportunity to improve soft skills as well as scientific writing. • SQL upgrade students at par with international standards. Application, and Demand • Finance Industry: Financial Reporting, Risk Management, and regulatory Compliance. • Marketing and Social Media: Market research, consumer behaviour analysis. • Business statistics are used improve product quality, minimize defects, and optimize manufacturing processes. • It is used as Database Administration in Healthcare: Electronic Health Records, Data Retrieval and Analysis, Quality Improvement and Administrative Tasks. • Music industry: User optimizer analysis, Metadata Storage and predictive data analyst. Job Prospects: SQL is used in marketing, healthcare, and finance for data and business analytics, development, and data science. Connection with Other Courses: This course focuses on applied as well as	

	theoretical aspects of Statistics along with subjects from Economics, Mathematics, Computers, IT, Commerce, Arts & Analytics.	
2	Vertical:	Skill enhance
3	Type:	Theory
4	Credits:	2 credits (1 credit = 15 Hours for Theory in a semester)
5	Hours Allotted:	30 Hours
6	Marks Allotted:	50 Marks
7	Theory (2 Credit) Total No of Theory Hours: 30 Total Marks : 50 Course Objectives (CO): (List the course objectives) - Introducing students to SQL statistical concepts and techniques applicable to business Industry and other sectors. - Understanding the phenomenon of SQL in terms of data Storage and manipulation. - Providing students with the skills to collect, organize, and analyse data using SQL statistical tools. - This course provides a comprehensive introduction to the language of relational databases:	
8	Course Outcomes (OC): (List the course outcomes) - Increased marketability as a Data analyst & developer - Countless technological uses - Foundational knowledge for learning other programming languages - Secure future for Statistics with SQL - Many job opportunities and career advancements	

Module 1:	Measuring Spread of Distribution	10 hrs
1.1	Variability: Range, Inter-Quartile Range, Mean absolute Deviation, Mean Squared Deviation.	
1.2	Degree of freedom and Variance, Standard Deviation and Coefficient of variation using SQL.	
1.3	Practice problems and Hands-on with SQL.	
Module 2:	Bivariate Exploratory Data Analysis using SQL	10 hrs
2.1	The Chi-Square test: Goodness of fit testing, type and its applications, data analysis with chi-square.	
2.2	Concept of Exploratory Data Analysis its application.	
2.3	Practice problem and Hands-on with SQL.	
Model 3:	Case study on statistical analysis	10 hrs
3.1	(1) Case study on SQL	
3.2	(2)Case study on statistical data analysis	

	Reference Books 1. SQL QuickStart Guide: The Simplified Beginner's Guide to Managing, Analysing data, walter shields 2. SQL All-in-One For Dummies.Allen GTaylor, 3rd edition 3. Sams: Teach Yourself SQL in 10 Minutes, 5th edition 4. SQL: The Ultimate Beginners Guide: Learn SQL Today. Steven Tale 5. Practical SQL, 2nd Edition: A Beginner's Guide to Storytelling with Data. 2nd edition. 6. Data analysis using SQL and EXCEL, 2nd edition. Gordon S.Linoff 7. Exploratory Data Analysis with SQL. Renée M. P. Teate 8. SQL Queries for Mere Mortals: A Hands-On Guide to Data Manipulation in SQL, John L. Viescas, 4th edition. 9. Wiley, Data Analysis using SQL and Excel, Gordon S. Linoff.
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Format of Question Paper:

Internal Continuous Assessment: (20 marks)

Assignment/viva Quizzes, Class Tests, presentation, project, assignment etc	Class Test	Total
05	15	20

Semester End Examination: (30 marks)

Semester End Examination will be of 30 marks of 01 hour duration covering entire syllabus of the semester. Examiners should frame sub questions for Q.1, Q2 and Q3. Each question carrying 15 marks. Attempt any two out of three questions.

Theory Question Paper Pattern:

Q 1	Max. marks: 15	Attempts any two questions out of Three.
Q 2	Max. marks: 15	
Q 3	Max. marks: 15	

C) Practical Question Paper Pattern PER PRACTICAL COURSE:

	Time : 2 hours	Total marks = 50	Marks
	Practical Based on Paper I & II		40
	Journal and viva voce		10
	Grand Total Practical Marks (Paper I + II)		50

A student must have a certified journal before appearing for the practical examination.

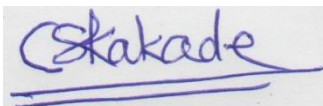
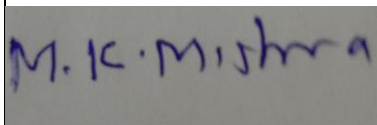
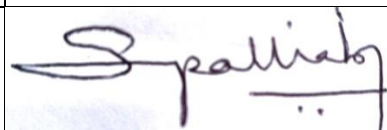
In case a student does not possess a certified journal, he/she is not qualified for journal marks

For each paper minimum 75% of the practical must be completed to the journal certified.

Letter Grades and Grade Points:

Semester GPA/ Programme CGPA Semester/ Programme	% of Marks	Alpha-Sign/ Letter Grade Result	Grading Point
9.00 - 10.00	90.0 - 100	O (Outstanding)	10
8.00 - < 9.00	80.0 - < 90.0	A+ (Excellent)	9
7.00 - < 8.00	70.0 - < 80.0	A (Very Good)	8
6.00 - < 7.00	60.0 - < 70.0	B+ (Good)	7
5.50 - < 6.00	55.0 - < 60.0	B (Above Average)	6
5.00 - < 5.50	50.0 - < 55.0	C (Average)	5
4.00 - < 5.00	40.0 - < 50.0	P (Pass)	4
Below 4.00	Below 40.0	F (Fail)	0
Ab (Absent)	-	Ab (Absent)	0

List of B.O.S, Members in Statistics.

Sr.No	Name	Signature
1.	Dr. Santosh P. Gite	
2.	Dr. C.S. Kakde	
3.	Dr. Manoj Mishra	
4.	Dr. Alok Dabade	
5.	Dr. Sujata Suvarnapatki	

Appendix B**Justification for B.A./B.Sc. (Statistics)**

1.	Necessity for starting the course:	Now a days, Statistics plays crucial role in all fields for analyze data using various statistical techniques. This program will focus and train the students in to analyze and interpretation of the real life data. This program is structured so that student will have in depth knowledge of statistics for pursuing their higher studies and also necessary skills in statistics for the employability in govt and private sector.
2.	Whether the UGC has recommended the course:	Yes
3.	Whether all the courses have commenced from the academic year 2023-24	This course will commence from 2024-25 as per NEP2020.
4.	The courses started by the University are self-financed, whether adequate number of eligible permanent faculties are available?:	Adequate number of faculties are available. It is not Self Financed.
5.	To give details regarding the duration of the Course and is it possible to compress the course?:	Duration of this program is three (3) year (Six Semesters). It is not possible to compress the course
6.	The intake capacity of each course and no. of admissions given in the current academic year:	Intake capacity of the course is as per university rule.
7.	Opportunities of Employability / Employment available after undertaking these courses:	Statistics graduates shall be suitably employed in Central/State government organizations, financial and banking industries, corporate and insurance sectors for data analysis and drawing conclusions for socio-economic issues.

**Sign of the BOS
Chairman
Dr. Santosh Gite
Board of Studies
in Statistics**

**Sign of the
Offg. Associate Dean
Dr. Madhav R. Rajwade
Faculty of Science &
Technology**

**Sign of the
Offg. Dean
Prof. Shivram S. Garje
Faculty of Science &
Technology**