AC – 27/12/2023
Item No. – 6.6 (N)

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, Biostasticians, 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.

5) Credit Structure of the Program (Sem I, II, III, IV, V & VI)

Under Graduate Certificate in Statistics.

Credit Structure (Sem. I & II)

	R:_____A								
Level	**Semester**	**Major**		**Minor**	**OE**	**VSC, SEC (VSEC)**	**AEC, VEC, IKS**	**OJT, FP,CEP, CC, RP**	**Cum. Cr./ Sem.**	**Degree/ Cum. Cr.**
		Mandatory	**Electives**							
4.5	I	**M1** Fundamentals of Statistics (2 Cr) Practical-I (2 Cr) (M2,M3 of other two Subjects of 4 + 4 Credits)		**-**	**-**	VSC: 2Cr Data Analysis using EXCEL SEC:2Cr Statistical Analysis using Microsoft SQL-I	AEC:2, VEC:2, IKS:2	-	22	**UG Certificate 44**
	R:_____B									
	II	M1 Statistical Methods (2 Cr) Practical-II (2 Cr) (M2,M3 of other two Subjects of 4 + 4 Credits)		-	2	VSC:2Cr Data Analysis using advanced EXCEL SEC:2Cr Statistical Analysis using Microsoft SQL-II	AEC-2	CC-2	22	
	Cum Cr.	8	-	2	8	4+4	4+4+2	4	44	

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

Under Graduate Diploma in Statistics

Credit Structure (Sem. III & IV)

	R:_____C									
Level	**Semester**	**Major**	**Minor**	**OE**	**VSC SEC**	**AEC, VEC, IKS**	**OJT, FP,CEP, CC, RP**	**Cum. Cr./ Sem.**	**Degree / Cum. Cr.**	
5.0	III	6 Probability Distributions -2Cr Introduction to Sampling Theory-2Cr Practical-III-2Cr	4 Operation Research-I -2Cr Practical-III 2Cr	4	SEC-2 Operations Research-I	AEC-2	CEP/ FP:2 CC:2		22	**UG Diploma 88**
	R:_____D									
	IV	**6** Probability and Sampling distributions-2Cr Design of Experiment-2Cr Practical-IV-2Cr	4 Operation Research-II -2Cr Practical-IV 2Cr	4	VSC-2 Operations Research-II	VEC-2	FP/CEP-2 CC-2		22	
	Cum Cr.	20	16	10	12	12	10		88	
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**	**VSC, SEC (VSEC)**	**AEC, VEC, IKS**	**OJT, FP,CEP, CC, RP**	**Cum. Cr./ Sem.**	**Degree / Cum. Cr.**	
5.5	V	10+4 Advance Probability Theory-2Cr Theory of Estimation-I 2Cr Biostatistics- 2Cr Practical-V-2Cr Practical-VI-2Cr The Indian History of Statistics(IKS) -2Cr Practical-VII-2Cr	2 Introduction to Time Series Analysis.-2Cr)		VSC: 2 Hands on training on PYTHON programing 2Cr		FP/CEP:2 CC-2Cr		22	**UG Degree 132**
		R:_____F								
	VI	14+4 Introduction to Regression Analysis Testing of Hypothes					OJT :4		22	

		Is Stochastic Process and Queuing Theory Practical-VIII Practical-IX Design of Experiment-II Practical-X Advanced Time seriesAnalysis Practical-XI								

	Cum Cr.	52	18+ 8 M3	10	14	12	18		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

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	
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. Understand the concept of correlation and regression 6. Build a Simple Linear regression model to predict the response variable. **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. 5. To choose appropriate correlation method to data and interpret correlation between two variables. 7. To obtain regression coefficient using least square method of estimation and apply method to real life problem.	
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. • Primary data, 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'scoefficient of Colligation γ, relationship between Q and γ . • 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.	10
Unit	**Measures of central tendency, Dispersion, Skewness &Kurtosis**	**Lectures**
II	• 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.. • 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 ofmeasures of central tendency. • 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

Unit	Correlation and Regression Analysis	Lectures
III	• Scatter Diagram, product moment correlation coefficient and itsproperties. 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 anduse of coefficient of determination (R^2). • Fitting a quadratic curve by method of least squares.	10

Refrences.

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

Credit: 2	**SEMESTER I** **Statistics Practical- I** **Practical based on** **Fundamental of Statistics**	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. Correlation analysis 8. Regression analysis 9. Practicals using EXCEL	60

Refrence Books

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.

VSC - Vocational Skill Course

Semester I

Heading	Particulars
Description of the Course:	**Data Analysis using Excel**
Vertical:	**Vocational Skill Courses (VSC)**
Type	**practical**
Credits:	**02**
Hours Allotted:	**60 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.	30
II	Elementary Statistics using MS-Excel	30

	• 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).	

Refrences:

- 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:**	Practical
4	**Credits:**	2 credits (1 credit = 30Hours for Practical in a semester)
5	**Hours Allotted:**	60 Hours
6	**Marks Allotted:**	50 Marks
7	**practical (2 Credit)** **Total No of Hours: 60Total** **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**	**20 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**	**20 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**	**20 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.

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.

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**	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 and its standard distributions 4. 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. 6. Compute mean, variance and standard deviations for continuousprobability distributions	
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.	**6**
Unit	**Discrete random variables and its Standard Probability Distributions**	**Lectures**
II	• Discrete 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 and its Properties 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. • Definition and derivation of mean and variance of the following distributions: • Discrete Uniform distribution • Bernoulli and Binomial distributions • Poisson distribution • Hypergeometric distribution • Geometric distribution. • Recurrence relation for probabilities of Binomial and Poisson distributions. • Poisson approximation to Binomial distribution (only statement) and its applications.	**10**
Unit	Continuous random variable and its Standard distributions	**Lectures**

III	• 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 (withoutproof). Normal approximation to Binomial and Poissondistribution (statement only). Properties of Normal curve. Use ofnormal tables. 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). • Sampling distribution of sample mean and sample proportion.(For largesample only) • Standard errors of sample mean and sample proportion. • Point and Interval estimate of single mean, singleproportion from sample of large size. • Point and interval estimate of difference between twomeans and proportions.	**14**

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. Pitan 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 II** **Statistics Practical -II** **Practical based on Statistical Methods**	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 Statistical Methods**	
	1. Index number-II Probability 1 2. Probability 2 3. Univariate and Bivariate Discrete random variable 4. Binomial Distribution 5. Poisson Distribution 6. Hypergeometric Distribution 7. Geometric distribution. 8. Continuous Random Variable 9. Uniform and Exponential Distribution 10. Normal Distribution and application of central limit theorem 11. Point and Interval Estimation. 12. Practical's using EXCEL	**60**

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'sPublications 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 InferenceMcMillan Publishing Co. Inc.

7 Goon A. M., Gupta M. K., Dasgupta B.: Fundamentals of Statistics,Volume II : The World PressPrivate 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, SultanChand and Sons Publishers, New Delhi.

11 Sarma, K. V. S. (2001). Statistics Made it Simple: Do it yourself on PC.Prentce 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	**practical**
Credits:	**02**
Hours Allotted:	**60 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.	30
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	30

Refrences

- 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:**	practical
4	**Credits:**	2 credits (1 credit = 30 Hours for Practcal in a semester)
5	**Hours Allotted:**	60 Hours
6	**Marks Allotted:**	50 Marks
7	**Practical (2 Credit)** **Total No of Hours: 60** **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**	**20 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**	**20 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**	**20 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.

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	40
		Journal and viva voce	10
		Grand Total Practical Marks	50

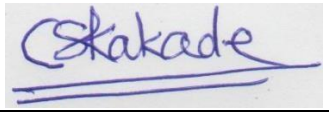
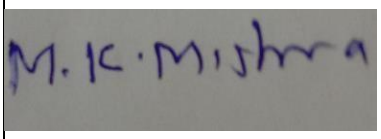
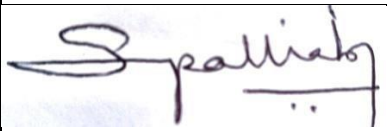
A student must have a certified journal before appearing for the practical examination.

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. Kakade	
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