SOPHIA COLLEGE FOR WOMEN (EMPOWERED AUTONOMOUS)

Affiliated to the University of Mumbai

Programme: Science

Statistics (Minor)

Syllabus for the Academic Year 2024-2025

based on the National Education Policy 2020

SOPHIA COLLEGE (AUTONOMOUS)

DEPARTMENT OF MATHEMATICS & STATISTICS

	SEMESTER 1		SEMESTER 2
TITLE	DESCRIPTIVE STATISTICS-1		DESCRIPTIVE STATISTICS-2
TYPE OF COURSE DSC/DSE	Minor		Minor
CREDITS	4		4

Preamble:

In the current context, possessing a solid understanding of various statistical concepts has become crucial. Statisticians are constantly in demand in the software, research, industry, and education sectors. The various statistics course syllabi have been designed so that students can become competent in an extensive spectrum of statistical processes at the completion of each course. These techniques can be applied to further research while also applying statistical tools appropriately to a diversity of data sets in order to derive some reliable results. Different environments require for different applications of statistics. Quantitative results in various areas of research are referred to as statistics. The study of statistics is an important domain of knowledge that focuses on various techniques of collecting, presenting, analyzing, and interpreting data. It is the science of data-driven learning. The subject provides tools to facilitate decision-making in uncertain situations. Decision-making can be rendered simpler by statistics, which measures uncertainties and chance. In addition to building the foundations for the development of essentially every contemporary field, its descriptive and inferential responsibilities offer a variety of unconventional career possibilities, from financial analysis to sports analysis. The main goal of the curriculum is to get students ready to enter into a promising professional life even after graduation. Large volumes of data have been processed by computers over the past 20 years, and more complex methods of statistical analysis may be applied efficiently resulting in reliable results. Therefore, a number of fields, including agriculture, business, management, economics, finance, insurance, education, biotechnology, and medical science, among others, rely heavily on statistical techniques and procedures. Statistics can be divided into three broad categories, (1) descriptive statistics, which summarizes and describes data; (2) inferential statistics, that arrives at decisions about the population based on sample; and (3) operations research, that utilizes statistics in the fields of industrial and management.

PROGRAMME OBJECTIVES	
PO 1	To teach students methods for effective data collection, organization, and summarization skills as well as analysis and interpretation approaches.
PO 2	Introduce students to regression analysis to model relationships between variables and make predictions.
PO 3	To provide students with a understanding of fundamental concepts - probability, random variables,

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	and distributions.
PO 4	Encourage students to use statistical techniques to solve practical issues and assess the reliability of statistical findings in order to develop their critical thinking abilities.

Programme: Science/Arts Statistics Minor	Semester – 1
Course Title: Descriptive Statistics-1	Course Code: SSTA111/ASTA111MN

COURSE OBJECTIVES:
1. To introduce the techniques of data collection and its presentation.
2. To emphasize the need for numerical summary measures for data analysis.
3. To learn to present the data graphically.
4. To understand and apply the descriptive techniques of statistical analysis to the given data

COURSE OUTCOMES:
Through this paper, the learner will be able to
1. Distinguish between different types of scales of the characteristics.
2. Compare the different types of data and describe various methods of data collection.
3. Construct Univariate and Bivariate frequency distribution , Cumulative frequency distribution.
4. Create appropriate graphical representation of the given data.
5. Compute and interpret the relation between the qualitative characteristics in the data.
6. Comprehend , compute and interpret the measures of central tendency and dispersion.
7. Identify the nature of skewness and kurtosis of the data -mathematically & graphically.

Lectures per week (1 Lecture is 60 minutes)	2
Total number of Hours in a Semester	30
Credits	2

Evaluation System	Semester End Examination	1 Hour	30 marks
	Internal Assessment	--	20 marks

PROGRAMME SPECIFIC OUTCOMES

PSO 1	The learner will be able to understand the fundamentals of statistics, including the key concepts of probability theory, probability distributions, distribution theory, statistical inference, significance testing, and operations research.
PSO 2	The learner will be able apply the concepts taught in the practicals and will be able to analyse and evaluate data as well as come to reliable conclusions. This will prepare pupils for real-world situations.
PSO 3	Apply statistical, operations research, probability theory, time series, designs of experiments, and other principles to real-world issues
PSO 4	Know how statistics are used in fields like finance, sociology, science, and economics, among others.
		1.1	Concept of population and sample. Finite , Infinite population ,Notion of SRS, SRSWOR	

UNIT 1		and SRSWR.	10 hours
	1.2	Types of Characteristics, Different types of scales: nominal, ordinal, interval and ratio.	
	1.3	Collection of Primary data: concept of a questionnaire and a schedule, Secondary data	
	1.4	Types of data: Qualitative and quantitative data; discrete and continuous data.	
	1.5	Tabulation and Uni-variate frequency distribution of discrete and continuous variables. Cumulative frequency distribution, Bi-variate frequency distribution	
	1.6	Dichotomous classification- for two and three attributes, Verification for Consistency	
	1.7	Association of attributes: Yule's coefficient of association Q. Yule's coefficient of Colligation Y, relation between Q and Y(derivation).	
UNIT 2	2.1	Graphical representation of frequency distribution by Histogram, frequency polygon, Cumulative frequency curve.	10 hours
	2.2	**Measures of central tendency** a) Concept of central tendency of data. Requirements of good measure. b) Locational averages: Median, Mode, and Partition Values: Quartiles, Deciles, and Percentiles. c) Mathematical averages Arithmetic mean (Simple, weighted mean, combined mean), Geometric mean, Harmonic mean, d) Empirical relation between mean, median and mode e) Merits and demerits of using different measures & their applicability	
UNIT 3	3.1	**Measures of Dispersion:** a) Concept of dispersion. Requirements of good	10 hours

| | | measure.
b) Absolute and Relative measures of dispersion: Range, Quartile Deviation, Mean absolute deviation, Variance and Standard deviation.
c) Raw moments and central moments and relations between them and their properties
d) Concept of Skewness and Kurtosis:
Measures of Skewness: Karl Pearson's, Bowley's and Coefficient of skewness based on moments. Measure of Kurtosis,
e) Box Plot | |

References:

1. Agarwal B.L.: Basic Statistics, New Age International Ltd.
2. Spiegel M.R. : Tehory and Problems of Statistics, Schaum's Publications series, Tata Mc-Graw 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. Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, New Delhi.
6. Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
7. Gupta, S. C. and Kapoor, V. K. (1997). Fundamentals of Applied Statistics, Third Edition, Sultan Chand and Sons Publishers, New Delhi.
8. Freund, J. E. (1977). Modern Elementary Statistics. Fourth Edition, Prentice Hall of India Private Limited, New Delhi.
9. Purohit, S. G., Gore S. D., Deshmukh S. R. (2008). Statistics Using R, Narosa Publishing House, New Delhi.
10. Sarma, K. V. S. (2001). Statistics Made it Simple: Do it yourself on PC. Prentce Hall of India, New Delhi.

PRACTICAL Course Title: Descriptive Statistics -1	Course Code: SSTA111P/ASTA111MNP

COURSE OUTCOMES:
At the end of the course the learner will be able to
  1. Distinguish between different types of scales of the characteristics.
  2. Compare the different types of data and describe various methods of data collection.	

3. Construct Univariate and Bivariate frequency distribution , Cumulative frequency distribution.
4. Create appropriate graphical representation of the given data.
5. Compute and interpret the relation between the qualitative characteristics in the data.
6. Comprehend , compute and interpret the measures of central tendency and dispersion.
7. Identify the nature of skewness and kurtosis of the data -mathematically & graphically.

Lectures per week (1 Lecture is 120 minutes)		2	
Total number of Hours in a Semester		60	
Credits		2	
Evaluation System	Semester End Examination	2 Hours	50 marks
	Internal Assessment	--	

1	Tabulation
2	Attributes
3	Classification of Data
4	Diagrammatic representation.
5	Measures of central tendency
6	Measures of dispersion
7	Practicals using Excel and R i) Classification of Data and Diagrammatic representation. ii)Measures of central tendency iii)Measures of dispersion

ASSESSMENT DETAILS:

I.   **Internal Assessment (IA): 20 marks:** One activity /test/assignment each of 20 marks.

II. **Semester End Examination (SEE):** Theory exam of 30 marks – One hour duration

III. **Semester End Examination (SEE):** Practical exam of 50 marks – Two hours duration

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Programme: Science Statistics Minor	Semester – 2
Course Title: Descriptive Statistics-2	Course Code: SSTA122/ASTA122MN

COURSE OBJECTIVES:
1. Develop a clear understanding of the concept of correlation and its importance in statistics..
2. Perform regression analysis using real-world data to model relationships between variables and interpret the coefficients
3. Understand the process of choosing the best-fitting curve
4. Learn the basics of time series analysis, including trend, seasonality, and noise components.
5. Apply moving averages, exponential smoothing, and decomposition methods to analyze and forecast time-dependent data.
6. Understand the concept of index numbers and their applications in economics and business.

COURSE OUTCOMES:

Through this paper, the learner will be able to
1. Students will be able to calculate and interpret correlation coefficients (Pearson's and Spearman's) and use them to identify the strength and direction of relationships between two variables.
2. Students will be able to apply simple linear regression techniques to real-world data, interpret regression coefficients, assess the goodness of fit, and make predictions based on the regression model.
3. Students will demonstrate the ability to fit various curves (linear, polynomial, and non-linear) to data, select the most appropriate model, and evaluate the fit of the curve.
4. Students will be able to decompose time series data into trend, seasonal, and irregular components and apply time series methods (e.g., moving averages, exponential smoothing) to make forecasts for future data points.
5. Students will be able to compute and interpret index numbers, such as price indices and quantity indices, and understand their applications in measuring inflation, economic performance, and price changes over time.
6. Comprehend the construction and application of different index numbers.

Lectures per week (1 Lecture is 60 minutes)		2	
Total number of Hours in a Semester		30	
Credits		2	
Evaluation System	Semester End Examination	1 Hour	30 marks
	Internal Assessment	--	20 marks

UNIT 1	1.1	UNIT – I: <u>Correlation and regression analysis</u> Scatter Diagram, Product moment correlation coefficient and its properties. Spearman's Rank correlation.(With and without ties)	10 hours
	1.2	Concept of linear regression. Principle of least	

			squares. Fitting a straight line by method of least squares.	
		1.3	Relation between regression coefficients and correlation coefficient. Concept and use of coefficient of determination (R^2).	
		1.4	Fitting a quadratic curve by method of least squares.	
		1.5	Fitting of curves reducible to linear form by transformation.	
UNIT 2		2.1	<u>Time Series</u> Definition of time series and its component. Models of time series.	10 hours
		2.2	Estimation of trend by: i) Freehand curve method ii) method of semi average iii)Method of Moving average iv) Method of least squares(linear trend only)	
		2.3	Estimation of seasonal component by i) method of simple average ii) Ratio to moving average iii)Ratio to trend method (iv) Link Relative Method	
UNIT 3		3.1	<u>Index Numbers</u> a)Index numbers as comparative tool. Stages in the construction of Price Index numbers. b) Fixed base Index Numbers, Chain base Index Numbers. Base shifting, splicing c) Composite & Weighted Index Numbers. Laspeyre's, Paasche's, Marshal-Edgeworth's, Dorbisch & Bowley's and Fisher's Index Numbers formula. d) Quantity Index Numbers and Value Index Numbers Time reversal test, Factor reversal test, Circular test.	10 hours

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		e) Cost of Living Index Number, Concept of Real Income based on Wholesale Price Index Number , deflating.	

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 Mc-Graw Hill

3. Kothari C.R. : Research Methodology: Wiley Eastern Limited.

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7. Gupta, S. C. and Kapoor, V. K. (1997). Fundamentals of Applied Statistics, Third Edition, Sultan Chand and Sons Publishers, New Delhi.

8. Freund, J. E. (1977). Modern Elementary Statistics. Fourth Edition, Prentice Hall of India Private Limited, New Delhi.

9. Purohit, S. G., Gore S. D., Deshmukh S. R. (2008). Statistics Using R, Narosa Publishing House, New Delhi.

10. Sarma, K. V. S. (2001). Statistics Made it Simple: Do it yourself on PC. Prentce Hall of India, New Delhi.

PRACTICAL Course Title: Descriptive Statistics -2	Course Code: SSTA122P/ASTA111MNP
COURSE OUTCOMES: At the end of the course the learner will be able to 1. Students will be able to calculate and interpret correlation coefficients (Pearson's and Spearman's) and use them to identify the strength and direction of relationships between two variables. 2. Students will be able to apply simple linear regression techniques to real-world data, interpret regression coefficients, assess the goodness of fit, and make predictions based on the regression model. 3. Students will demonstrate the ability to fit various curves (linear, polynomial, and non-linear) to data, select the most appropriate model, and evaluate the fit of the curve. 4. Students will be able to decompose time series data into trend, seasonal, and irregular components and apply time series methods (e.g., moving averages, exponential smoothing) to make forecasts for	

future data points.

5. Students will be able to compute and interpret index numbers, such as price indices and quantity indices, and understand their applications in measuring inflation, economic performance, and price changes over time.
6. Comprehend the construction and application of different index numbers.

Lectures per week (1 Lecture is 120 minutes)		2	
Total number of Hours in a Semester		60	
Credits		2	
Evaluation System	Semester End Examination	2 Hours	50 marks
	Internal Assessment	--	

1	Correlation analysis
2	Regression analysis
3	Fitting of curve
4	Time series
5	Index number-I
6	Index number-II
7	Practical using Excel and R
	i) Correlation analysis
	ii) Regression analysis
	iii) Fitting of curve

ASSESSMENT DETAILS:

I. **Internal Assessment (IA): 20 marks:** One activity /test/assignment each of 20 marks.

II. **Semester End Examination (SEE):** Theory exam of 30 marks – One hour duration

III. **Semester End Examination (SEE):** Practical exam of 50 marks – Two hours duration