ASSAM UNIVERSITY: SILCHAR

DEPARTMENT OF STATISTICS

Curriculum

For

FYUG Programme

Under NEP-2020

w.e.f. 2023-24

Programme Objectives

Statistical Knowledge and Skills: The program aims to equip students with a deep understanding of statistical concepts, theories, and methodologies. This includes topics like probability, data analysis, inference, regression analysis, experimental design, and multivariate analysis.

Quantitative and Analytical Skills: Students are expected to develop strong quantitative and analytical skills that allow them to effectively analyze and interpret data, make informed decisions, and solve real-world problems using statistical techniques.

Data Collection and Management: The program emphasizes the importance of proper data collection, organization, and management. Students learn how to design surveys, experiments, and studies to ensure the quality and integrity of data.

Statistical Software and Technology: Students gain proficiency in using statistical software and technology tools, which are crucial for data analysis and visualization. Common software may include Excel, R and training on any high level language.

Research and Problem-Solving: The program encourages students to develop a research-oriented mindset, enabling them to formulate research questions, design experiments, analyze data, and draw meaningful conclusions. This skill set is valuable for both academia and various industries.

Communication Skills: Graduates are trained to effectively communicate complex statistical concepts and findings to both technical and non-technical audiences. This includes the presentation of results in the form of written reports and visualization.

Interdisciplinary Applications: Statistics is often applied in diverse fields such as economics, biology, social sciences, and more. The program aims to expose students to these interdisciplinary applications, and enabling them to apply statistical techniques in various contexts.

Ethical Considerations: Students are introduced to ethical considerations in statistical research and practice, emphasizing the importance of integrity, confidentiality, and responsible use of data.

Critical Thinking: The program encourages the development of critical thinking skills, allowing students to assess the validity of statistical claims and approaches, and to identify potential biases and limitations.

Preparation for Further Studies: For students interested in pursuing higher education or research, the program provides a solid foundation for advanced studies in statistics, data science, or related fields.

Employability: The program aims to enhance students' employability by equipping them with the skills and knowledge needed to work in industries that require data analysis and decision-making based on statistical insights.

Programme Specific Outcomes

PSO 1: Statistical Analysis Proficiency: Graduates should be able to apply a wide range of statistical techniques, including probability theory, hypothesis testing, regression analysis, and multivariate analysis, to analyze and interpret data from various domains.

PSO 2: Data Interpretation and Visualization: Graduates should possess the ability to effectively interpret and visualize complex datasets using appropriate statistical software and tools, and to present their findings through graphical representations and visualizations.

PSO 3: Research Design and Methodology: Graduates should be able to design experiments, surveys, and studies to collect relevant data, and apply appropriate statistical methodologies to analyze and draw valid conclusions from the collected data.

PSO 4: Statistical Software Proficiency: Graduates should be proficient in using statistical software such as R, Python, SAS, or other relevant tools to perform data analysis, modeling, and visualization tasks.

PSO 5: Problem-Solving and Decision-Making: Graduates should be adept at using statistical techniques to solve real-world problems, make informed decisions, and provide actionable insights to support decision-making processes.

PSO 6: Communication Skills: Graduates should be able to communicate effectively, both in written and oral formats, to convey complex statistical concepts and findings to different audiences, including non-technical stakeholders.

PSO 7: Interdisciplinary Application: Graduates should be able to apply statistical principles and techniques to a variety of interdisciplinary contexts, including fields like economics, social sciences, biology, and engineering.

PSO 8: Ethical and Professional Conduct: Graduates should demonstrate ethical awareness and professionalism in statistical research, data handling, and reporting, while adhering to ethical standards and guidelines.

PSO 9: Lifelong Learning and Adaptability: Graduates should exhibit a willingness and ability to engage in continuous learning and stay updated with emerging statistical methodologies, tools, and technologies.

PSO 10: Preparation for Further Studies and Research: Graduates interested in pursuing advanced studies or research in statistics, data science, or related fields should be well-prepared and equipped with the necessary foundational knowledge and skills.

Semester wise list of Statistics DSC (Discipline Specific Core) Papers

SEMESTER	PAPER	NAME	CREDITS
I	**STADSC101**	Descriptive Statistics and Probability	3
	STADSC102	Calculus	3
II	**STADSC151**	Probability Distributions	3
	STADSC152	Descriptive Statistics and Probability Distributions	3

Semester wise list of Statistics DSM (Discipline Specific Minor) Papers

SEMESTER	PAPER	NAME	CREDITS	NAME
I	**STADSM101**	Basic Statistics and Probability	3	DSM 1
II	**STADSM151**	Statistical Methods and Probability	3	DSM 2

Semester wise list of Statistics SEC (Skill Enhancement Course) Papers

SEMESTER	PAPER	NAME	CREDITS
I	**STASEC-101**	Data Analysis using Microsoft Excel	3
II	**STASEC-151**	Statistical Data Analysis using R	3

Semester wise list of Statistics IDC (Interdisciplinary Course) Papers

SEMESTER	PAPER	NAME	CREDITS
I	**STAIDC101**	Introduction to Statistics	3
II	**STAIDC151**	Index Number and Time Series Analysis	3

DETAILED SYLLABI

DISCIPLINE SPECIFIC CORE COURSE: DSC- 101
(Descriptive Statistics and Probability)

(Credits: 03)
Contact Hours: 45
Full Marks = 100 [End Semester Exam (70) +Internal (30)]
Pass Marks = 40 [End Semester Exam (28) + Internal (12)]

Learning Objectives

- To understand the fundamental concepts and scope of statistics.
- To identify and classify different types of data and scales of measurement.
- To acquire knowledge and skills in data collection, classification, and tabulation.
- To apply appropriate statistical measures of central tendency and dispersion.
- To develop a solid understanding of probability theory and its applications.

Learning Outcomes

- Exhibit a clear understanding of the principles and limitations of statistics.
- Classification of data based on their type and scale of measurement.
- Collection of data from primary and secondary sources.
- Interpret measures of central tendency and dispersion.
- Apply probability concepts and to solve real life problems

UNIT I:

Statistical Methods: Definition, scope and limitations of Statistics. Concepts of statistical population and sample. Types of Data: quantitative and qualitative data, cross-sectional and time-series data, discrete and continuous data. Scales of measurement: nominal, ordinal, interval and ratio. Collection of Data: Primary data and Secondary data – its major sources. Classification and tabulation of data. Frequency distributions, cumulative frequency distributions and their graphical representations (Histograms, frequency polygon and cumulative frequency curves).

UNIT II

Measures of Central Tendency: mathematical and positional, partition values. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation. Graphical representation of various measures of location and dispersion (ogives, histograms and box plot). Moments: raw moments, central moments, absolute moments, factorial moments. Sheppard's corrections for moments. Measures of skewness and kurtosis.

UNIT III

Theory of attributes: Consistency and independence of attributes. Association of attributes: Yule's coefficient of association and coefficient of colligation. Principle of least squares and fitting of polynomials and exponential curves.

UNIT IV

Bivariate data: Scatter diagram, Karl Pearson's coefficient of correlation. Spearman's rank correlation coefficient (introductory with interpretation). Regression: lines of regression, properties of regression coefficients, angle between two regression lines. Coefficient of determination. Concepts of intra-class correlation coefficient and correlation ratio.

UNIT V

Probability: introduction, random experiment, sample point and sample space, event, algebra of events. Definition of probability: classical and statistical. Limitations of classical and statistical definition. Examples based on classical approach. Axiomatic definition of probability and problems based on it. Addition and multiplication theorems of probability. Conditional probability and theorem of total probability. Examples based on laws of addition, multiplication and conditional probability. Independent events: pairwise and mutual independence. Bayes' theorem and its applications.

SUGGESTED READINGS:

1. Feller, W. (1991). An introduction to probability theory and its applications, Volume 2 (Vol. 81). John Wiley & Sons.

2. Gun, A. M., Gupta, M. K., &Dasgupta, B. (2013). Fundamentals of statistics. World Press Private.

3. Gupta, S.C., & Kapoor,V.K.(2007). Fundamental of Mathematical Statistics, (11th ed., Reprint), Sultan Chand & Sons.

4. Mood, A. M., Graybill, F. A., &Boes, D. C. (2007). Introduction to the Theory of Statistics, (3rd ed.,Reprint).

5. Meyer, P. L. (1965). Introductory probability and statistical applications. Oxford and IBH Publishing.

DISCIPLINE SPECIFIC CORE COURSE: DSC-102
(Calculus)

(Credits: 03)
Contact Hours: 45 Hours
Full Marks=100 [End Semester Exam (70) +Internal (30)]
Pass Marks =40 [End Semester Exam (28) +Internal (12)]

Learning objectives

- To understand limits, continuity, and their properties.
- To develop proficiency in partial differentiation and total differentiation.
- To learn optimization techniques, including maxima and minima, constrained optimization with Lagrange multipliers, concavity and convexity analysis.
- To gain knowledge and skills in integral calculus, including integration techniques and variable transformations.
- To solve differential equations, including exact, linear, and partial differential equations and formulation of partial differential equations.

Learning outcomes

- Apply properties of continuous functions and evaluate limits and continuity of functions.
- Computation of partial derivatives and differentials of functions.
- Apply optimization techniques to find extrema, solve constrained optimization problems, and analyze problems related to concavity and convexity.
- Evaluate definite integrals, use differentiation under the integral sign, and perform variable transformations.
- Apply differential equations of various orders and types and formulation of partial differential equation in practical problems.

UNIT I
Differential Calculus: limits of function, continuity of functions, properties of continuous functions, partial differentiation and total differentiation. Indeterminate forms: L-Hospital's rule, Leibnitz rule for successive differentiation. Euler's theorem on homogeneous functions.

UNIT II
Maxima and minima of functions of one and two variables, constrained optimization techniques (with Lagrange multiplier) along with some problems. Jacobian, concavity and convexity, points of inflexion of function, singular points.

UNIT III
Integral Calculus: review of integration and definite integral. Differentiation under integral sign, double integral, change of order of integration, transformation of variables. Beta and

Gamma functions: properties and relationship between them.

UNIT IV

Differential Equations: Exact differential equations, integrating factors, change of variables. Differential equations of first order and first degree. Higher order differential equations: linear differential equations of order *n*.

UNIT V

Solution of homogeneous and non-homogeneous linear differential equations of order *n* with constant coefficients. Different forms of particular integrals. Formation and solution of partial differential equations.

SUGGESTED READINGS:

1. Das, B. C., & Mukherjee, B. N. (2018). Integral calculus. U. N. Dhur& Sons Publications
2. Das, B. C., & Mukherjee, B. N. (2018). Differential calculus. U. N. Dhur& Sons Publications
3. Prasad, G. (1997). Differential Calculus. Pothishala Pvt. Ltd., Allahabad
4. Prasad, G. (2000). Integral Calculus. Pothishala Pvt. Ltd., Allahabad
5. Raisinghania, M. D. (2013). Ordinary and Partial Differential Equation. S. Chand Publishing
6. Piskunov, N. S. (1965). Differential and integral calculus. Routledge

DISCIPLINE SPECIFIC CORE COURSE: DSC-151
(Probability Distributions)
(Credits: 03)
Contact Hours: 45 Hours
Full Marks = 100 [End Semester Exam (70) +Internal (30)]
Pass Marks = 40 [End Semester Exam (28) + Internal (12)]

Learning objectives

- To understand random variables, their probability distributions (discrete and continuous), and their properties.
- To learn about two-dimensional random variables, including joint, marginal, and conditional distributions, and independence.
- To gain proficiency in transformation of random variables.
- To understand the concept of expectation, including its properties and applications.
- To familiarize with the concept of variance and covariance of random variables.

Learning outcomes

- Apply probability concepts to model and analyze random phenomena.
- Analyze and interpret the distributions of two-dimensional random variables and assess independence.
- Apply transformation of random variables to obtain new distributions.
- Applications of the addition and multiplication theorems.
- Uses of moments, cumulants, and characteristic functions.

UNIT I

Random variables: discrete and continuous random variables, p.m.f., p.d.f. and c.d.f., illustrations and properties of random variables, univariate transformations with illustrations. Two dimensional random variables: discrete and continuous type, joint, marginal and conditional p.m.f, p.d.f., and c.d.f., independence of variables, bivariate transformations with illustrations.

UNIT II

Mathematical expectation of random variables and its properties (addition and multiplication theorem of expectation), Variance and Covariance in terms of expectation and their properties, examples based on expectation and its properties. Expectation of bivariate random variable.

UNIT III

Moments and Cumulants: moment generating function, cumulant generating function and characteristic function. Uniqueness and inversion theorems (without proof) along with applications. Conditional expectation and variance.

UNIT IV

Discrete Probability Distributions: Discrete Uniform, Bernoulli, Binomial, Poisson, Geometric, Negative Binomial and Hyper-geometric distributions.

UNIT V

Continuous Probability Distributions: Normal, Exponential, Uniform, Beta, Gamma, Cauchy, Weibull and Laplace distributions.

SUGGESTED READINGS:

1. Hogg, R.V., Tanis, E.A. &Rao J.M. (2005). Probability and Statistical Inference (7thed.).Pearson Education, New Delhi.
2. Freund, J. E., Miller, I., & Miller, M. (2006). John E.Freund's Mathematical Statistics: With Applications (7th ed.). Pearson Education, India.
3. Meyer, P.L. (1970). Introductory probability and statistical applications. Oxford &IBH Publishing, New Delhi
4. Bhattacharjee,D., & Das, D. (2010). Introduction to Probability Theory. Asian Books, New Delhi

DISCIPLINE SPECIFIC CORE COURSE: DSC-152 LAB
(Descriptive Statistics and Probability Distributions)
Full Marks=100 [End Semester Exam (70) +Internal (30)]
Pass Marks =40 [End Semester Exam (28) +Internal (12)]

(Credits: 03)
Contact Hours: 90 Hours

Learning objectives

- To develop skills in graphical representation of data.
- To compute measures of central tendency, dispersion, moments, and correlation coefficients.
- To gain proficiency in fitting curves, such as polynomials and exponential curves, to data.

Learning outcomes

- Interpret graphs of visually represented data.
- Interpret measures of central tendency, dispersion, moments, and correlation coefficients.
- Identification of best fitted model to a given set of data

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List of Practicals

1. Graphical representation of data.
2. Problems based on measures of central tendency.
3. Problems based on measures of dispersion.
4. Problems based on combined mean and variance and coefficient of variation.
5. Problems based on moments, skewness and kurtosis.
6. Fitting of polynomials, exponential curves.
7. Karl Pearson's correlation coefficient.
8. Correlation coefficient for a bivariate frequency distribution.
9. Fitting of lines of regression
10. Spearman rank correlation with and without ties.
11. Fitting of binomial distributions
12. Fitting of Poisson distribution.
13. Fitting of negative binomial distribution.

14. Fitting of suitable distribution.
15. Applications of Normal distribution.
16. Fitting of Normal distribution.

DISCIPLINE SPECIFIC MINOR COURSE IN STATISTICS: DSM-101
(Basic Statistics and Probability)
(Credits: 03)
Contact Hours: 45 Hours
Full Marks=100 [End Semester Exam (70) +Internal (30)]
Pass Marks =40 [End Semester Exam (28) +Internal(12)]

Learning objectives

- To develop skills in graphical representation of data.
- To understand measures of central tendency, dispersion, and combined mean and variance to analyze data.
- To understand moments, skewness, and kurtosis to assess the characteristics of data.
- To gain proficiency in fitting curves including polynomials and exponential curves to data.
- To understand correlation coefficients including Karl Pearson's correlation coefficient and Spearman rank correlation coefficient.

Learning outcomes

- Interpret various types of graphs used for data visualization.
- Interpret measures of central tendency, dispersion, and combined mean and variance to summarize and analyze data.
- Analyze the distributional properties of data using moments, skewness, and kurtosis.
- Interpret the results of fitted curves, such as polynomials and exponential curves to a data set.
- Interpret Karl Pearson's correlation coefficient and Spearman rank correlation coefficient to assess the strength and nature of relationships between variables.

UNIT I

Definition, scope and limitations of Statistics, concepts of statistical population and sample, quantitative and qualitative data, nominal, ordinal and time-series data, discrete and continuous data. Presentation of data by tables and diagrams, frequency distributions for discrete and continuous data, graphical representation of a frequency distribution by histogram and frequency polygon, cumulative frequency curves (inclusive and exclusive method).

UNIT II

Measures of central tendency: arithmetic mean, median, mode, geometric mean, harmonic mean, partition values. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, variance. Coefficient of dispersion: coefficient of variation. Moments: raw and central moments. Measures of skewness and kurtosis.

UNIT III

Bivariate data: scatter diagram, Karl Pearson's coefficient of correlation. Spearman's

rank correlation coefficient (Introductory with interpretation). Regression: lines of regression, properties of regression coefficients, angle between two regression lines. Principle of least-squares and fitting of linear equations, polynomials and exponential curves. Coefficient of determination.

UNIT IV
Random experiment, sample point and sample space, event, algebra of events. Definition of probability: classical, relative frequency and axiomatic approaches to probability, merits and demerits of these approaches (only general ideas to be given).

UNIT V
Addition and multiplication theorems of probability, theorem of total probability, conditional probability. Examples based on laws of addition, multiplication and conditional probability. Independent events: pairwise and mutual independence. Bayes' theorem and its applications.

SUGGESTED READINGS

1. Freund, J. E. (2009). Mathematical Statistics with Applications (7thEd.). Pearson Education.
2. Goon, A.M., Gupta, M.K., & Dasgupta, B. (2005). Fundamentals of Statistics, Vol.I (8th Ed.). World Press, Kolkata.
3. Gupta, S.C., &Kapoor, V.K. (2007). Fundamentals of Mathematical Statistics (11th Ed.). Sultan Chand and Sons.
4. Hogg, R.V., Craig,A.T., & McKean, J. W. (2005). Introduction to Mathematical Statistics (6th Ed.). Pearson Education.
5. Mood, A.M., Graybill, F.A. and Boes, D.C. (2007). Introduction to the Theory of Statistics (3rd Ed.). Tata McGraw Hill Publication.

DISCIPLINE SPECIFIC MINOR COURSE IN STATISTICS: DSM-151
(Statistical Methods and Probability)
(Credits: 03)
Contact Hours: 45 Hours
Full Marks = 100 [End Semester Exam (70) +Internal (30)]
Pass Marks = 40 [End Semester Exam (28) +Internal(12)]

Learning objectives

- To develop skills in graphical representation of data.
- To understand measures of central tendency, dispersion, and combined mean and variance to analyze data.
- To understand moments, skewness, and kurtosis to assess the characteristics of data.
- To gain proficiency in fitting curves including polynomials and exponential curves to data.
- To understand correlation coefficients including Karl Pearson's correlation coefficient and Spearman rank correlation coefficient.

Learning outcomes

- Interpret various types of graphs used for data vizualization.
- Interpret measures of central tendency, dispersion, and combined mean and variance to summarize and analyze data.
- Analyze the distributional properties of data using moments, skewness, and kurtosis.
- Interpret the results of fitted curves, such as polynomials and exponential curves to a data set.
- Interpret Karl Pearson's correlation coefficient and Spearman rank correlation coefficient to assess the strength and nature of relationships between variables.

UNIT I

Definition, scope and limitations of Statistics, concepts of statistical population and sample, quantitative and qualitative data, nominal, ordinal and time-series data, discrete and continuous data. Presentation of data by tables and diagrams, frequency distributions for discrete and continuous data, graphical representation of a frequency distribution by histogram and frequency polygon, cumulative frequency curves (inclusive and exclusive method).

UNIT II

Measures of central tendency: arithmetic mean, median, mode, geometric mean, harmonic mean, partition values. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, variance. Coefficient of dispersion: coefficient of variation. Moments: raw and central moments. Measures of skewness and kurtosis.

UNIT III

Bivariate data: scatter diagram, Karl Pearson's coefficient of correlation. Spearman's rank correlation coefficient (Introductory with interpretation). Regression: lines of regression, properties of regression coefficients, angle between two regression lines. Principle of least-squares and fitting of linear equations, polynomials and exponential curves. Coefficient of determination.

UNIT IV

Random experiment, sample point and sample space, event, algebra of events. Definition of probability: classical, relative frequency and axiomatic approaches to probability, merits and demerits of these approaches (only general ideas to be given).

UNIT V

Addition and multiplication theorems of probability, theorem of total probability, conditional probability. Examples based on laws of addition, multiplication and conditional probability. Independent events: pairwise and mutual independence. Bayes' theorem and its applications.

SUGGESTED READINGS

6. Freund, J. E. (2009). Mathematical Statistics with Applications (7thEd.). Pearson Education.
7. Goon, A.M., Gupta, M.K., &Dasgupta,B. (2005). Fundamentals of Statistics,Vol.I (8th Ed.). World Press, Kolkata.
8. Gupta, S.C., &Kapoor, V.K. (2007). Fundamentals of Mathematical Statistics (11th Ed.). Sultan Chand and Sons.
9. Hogg, R.V., Craig,A.T., &McKean,J.W. (2005). Introduction to Mathematical Statistics (6th Ed.). Pearson Education.
10. Mood, A.M., Graybill, F.A. and Boes, D.C. (2007). Introduction to the Theory of Statistics (3rd Ed.). Tata McGraw Hill Publication.

INTER DISCLIPLINARY COURSE IN STATISTICS: IDC-101

(Introduction to Statistics)
(Credits: 03)
Contact Hours: 45 Hours

Full Marks=100 [End Semester Exam (70) +Internal (30)]
Pass Marks =40 [End Semester Exam (28) +Internal(12)]

Learning objectives

- To understand statistical population, sample, data types, and effective data presentation.
- To compute measures of central tendency and dispersion.
- To analyze bivariate data using scatter diagrams and calculate correlation coefficients.
- To understand various statistical techniques to summarize and interpret data effectively.
- To understand the basic concepts of probability and apply them in solving problems.

Learning outcomes

- Classification and presentation of data using tables and diagrams.
- Interpret measures of central tendency and dispersion.
- Analyze bivariate data and determine the relationship between variables using scatter diagrams and correlation coefficients.
- Apply statistical techniques to summarize and interpret data accurately.
- Apply basic probability concepts to solve simple probability problems.

UNIT I: Data Representation
Concepts of a statistical population and sample. Quantitative and qualitative data, nominal, ordinal and time-series data, discrete and continuous data. Presentation of data by tables and by diagrams. Frequency distributions for discrete and continuous data, graphical representation of a frequency distribution by histogram and frequency polygon, cumulative frequency distributions (inclusive and exclusive methods).

UNIT II: Measures of Central Tendency
Concept of central tendency. Criteria for an ideal measure of central tendency. Arithmetic mean: computation for ungrouped and grouped data, combined mean. Median: computation for ungrouped and grouped data, graphical method, merits and demerits. Mode: computation for ungrouped and grouped data, graphical method, merits and demerits.

UNIT III: Measures of Dispersion
Concept of dispersion, criteria for good measure of dispersion. Range, quartile deviation, mean deviation, standard deviation, variance, coefficient of dispersion: coefficient of variation. Moments: raw and central moments. Measures of skewness and kurtosis

UNIT IV: Correlation and Regression
Bivariate data: Scatter diagram. Correlation and regression: Karl Pearson's coefficient of correlation, Spearman's rank correlation coefficient. Regression: lines of regression, properties of regression coefficients, angle between two regression lines. Principle of least-squares and fitting of straight line.

UNIT V: Elements of Probability

Probability: Introduction, random experiments, sample space, events and algebra of events. Mathematical (classical) definition of Probability and its limitations and applications.Statements and simple applications of addition and multiplication theorems.

SUGGESTED READINGS:

1. Goon, A.M., Gupta, M.K., & Dasgupta,B. (2003). An outline of Statistical Theory(Vol. I) (4th ed.). World Press, Kolkata.
2. Gupta, S.C., & Kapoor,V.K. (2007). Fundamentals of Mathematical Statistics (11th ed.). Sultan Chand and Sons.
3. Hogg, R.V., Craig, A.T., & McKean, J.W. (2005). Introduction to Mathematical Statistics (6th ed.). Pearson Education.
4. Bhattacharjee, D., & Bhattacharjee, D. (2008): B.Sc Statistics Vol-I. Kalyani Publication.

INTER DISCLIPLINARY COURSE IN STATISTICS: IDC-151
(Index Number and Time Series Analysis)
(Credits: 03)
Contact Hours: 45 Hours
Full Marks=100 [End Semester Exam (70) +Internal (30)]
Pass Marks =40 [End Semester Exam (28) + Internal(12)]

Learning objectives

- To understand and construct index numbers, both weighted and unweighted.
- To evaluate the limitations and applications of index numbers.
- To perform factor reversal and time reversal tests for index numbers.
- To understand chain index numbers for handling changing base periods and calculating consumer price index numbers.
- To introduce the basics of time series data, its components, and decomposition methods.

Learning outcomes

- Interpret index numbers using various methods.
- Represent the limitations and practical applications of index numbers.
- Apply factor reversal and time reversal tests to assess index number reliability.
- Use consumer price index numbers using chain index methods accurately.

- Analyze time series data, identify its components, and apply appropriate decomposition methods.

UNIT I: Index Number-I
Definition, Problems in the construction of index numbers, weighted and unweighted index numbers including Laspeyre's, Paasche's, Marshall- Edgeworth and Fisher's. Limitations and applications of index number.

UNIT II: Index Number-II
Factor reversal and time reversal tests. Chain index numbers, Consumer price index numbers: applications and limitations.

UNIT III: Time Series-I
Introduction to time series data, application of time series on various fields. Components of a time series, Decomposition of time series.

UNIT IV: Time Series-II
Trend: Estimation of trend by free hand curve method, method of semi averages, fitting of various mathematical curves. Method of moving averages.

UNIT V: Time Series-III
Seasonal Component: Estimation of seasonal component by Method of simple averages, Ratio to Trend, Ratio to Moving Averages and Link Relative method.

SUGGESTED READINGS:

1. Goon A.M., Gupta M.K., & Dasgupta, B.(2002). Fundamentals of Statistics,Vol.I&II (8th ed.).The World Press, Kolkata.
2. Gupta,S.C., & Kapoor,V.K.(2008). Fundamentals of Applied Statistics (4th ed., reprint). Sultan Chand and Sons.
3. Mukhopadhyay, P. (2011). Applied Statistics, (2nd ed., Revised reprint). Books and Allied.
4. Bhattacharjee, D., & Bhattacharjee, D. (2008): B. Sc Statistics Vol-II. Kalyani Publication.

SKILL ENHANCEMENT COURSE IN STATISTICS: SEC-101T
(Data Analysis using Microsoft Excel)
(Credits: 03)
Contact Hours: 60 Hours
Full Marks = 70[End Semester Exam (50) +Internal (14+6 (Attendance))]
Pass Marks = 28[End Semester Exam (20) + Internal (8)]

Learning objectives:

- To introduce Microsoft Excel and its key features to students.
- To introduce the basic data entry and editing techniques.
- To acquaint with importing and exporting data in Excel.

- To introduce basics of data analysis and handling of missing observations.

Learning outcomes:

- Apply and utilize its features of Microsoft Excel for data management and analysis.
- Apply Microsoft Excel and utilize its key features to identify and remove duplicate entries in a data set.
- Creating plots and chats of various types and editing legends
- Perform data analysis and interpret their significance
- Assess model fit and interpret simple linear regression fit.
- Apply vlookup function to join data tables
- Apply pivot tables and present their uses in data analysis.

UNIT I

Introduction to Microsoft Excel and its features, Basic data entry and editing techniques, Importing and exporting data, Sorting and filtering data, Removing duplicates, Data validation and data cleaning, handling missing data.

UNIT II

Creating charts and graphs in Excel, Bar charts, line graphs, pie charts, and scatter plots, Customizing charts and adding visual elements, Formatting and labeling axes, Adding trend lines to graphs. Frequency polygon and ogives and their use in locating central value of the data set.

UNIT III

Introduction to descriptive statistics, calculation and interpretation of measures of central tendency and partition values, measures of dispersion, computation of skewness and kurtosis using Excel functions. Introduction to Excel formulae and functions for statistical calculations, interpretation of descriptive statistics in the context of data analysis.

UNIT IV

Fitting of a straight line to data, fitting of higher-order polynomials of different degrees to data, Assessing model fit and interpreting regression results. Prediction using regression models, checking assumptions of regression analysis and finding the equation of best fit.

UNIT V

Introduction to bivariate analysis, calculation of correlation coefficient in Excel (Karl Pearson and Spearman), Introduction to logical and relational operators in Excel, Using vlookup to join datasets, Introduction to pivot tables and their applications in data analysis.

SKILL ENHANCEMENT COURSE IN STATISTICS: SEC-101L
(Data Analysis using Microsoft Excel)

Full Marks=30 [End Semester Exam (30)]
Pass Marks =12 [End Semester Exam (12)]

1. To draw histogram, bar diagram, frequency polygon, pie chart, ogives and line diagram in Excel.
2. Sorting data in ascending and descending order and hence find the median.
3. To compute mean, median and mode in Excel
4. To compute combined mean and combined variance in Excel
5. To compute variance and standard deviation in Excel.
6. To compute partition values, skewness and kurtosis in Excel.
7. To compute correlation and lines of regression in Excel.
8. To find the Predicted values using regression models in Excel.
9. Fitting of polynomial and exponential curve in Excel.
10. Finding equation of best fit using Excel

SUGGESTED READINGS:

1. Moore, D.S., McCabe,G.P., &Craig,B.A.(2014). Introduction to the Practice of Statistics. W.H.Freeman.
2. Levine, D.M., Berenson, M.L., & Krehbiel, T.C. (2008). Statistics for Managers Using Microsoft Excel (5thed.). Prentice Hall.
3. Bhattacharjee D.(2010): Practical Statistics Using Microsoft Excel. Asian Books, NewDelhi.

SKILL ENHANCEMENT COURSE IN STATISTICS: SEC-151T
(Statistical Data Analysis using R)
(Credit: 03)
Contact Hours: 60 hours
Full Marks = 70 [End Semester Exam (50) +Internal (14 + 6(Attendance))]
Pass Marks = 28 [End Semester Exam (20) + Internal (8)]

Learning Objectives:

- To introduce R programming language and its key features to students.
- To introduce the basic R syntax and data types.
- To provide guidance on importing data into R from various file formats.

- To acquaint with basic of data analysis and handling of missing observations.

Learning Outcomes:

- Apply the fundamentals of R and its features for data analysis and interpretation.
- Proficiently apply basic R syntax and effectively work with different data types
- Explore data visualization in R and its importance in data analysis
- Interpret the result of bivariate data analysis techniques including cross tabulation and scatter plot.
- Interpreting the result of a fitted linear regression model.

UNIT I

Introduction to R and its features, Installing R and R-Studio, Basic R syntax and data types, Importing data into R from various file formats (e.g., CSV, Excel, text files), Problems faced in case of missing data and data cleaning techniques.

UNIT II

Introduction to data visualization in R, Basic plotting functions in R, Creating and customizing various types of plots, including: Histograms, Pie charts, Frequency polygons, Frequency curves, Bar charts, Box plots. Adding labels, titles, and legends to plots, saving and exporting plots.

UNIT III

Measures of central tendency: Mean, median, and mode, weighted mean, Geometric mean, Measures of dispersion: Range, variance and standard deviation, Coefficient of variation, Interquartile range, Percentiles and quartiles.

UNIT IV

Measures of skewness: Coefficient of skewness and its interpretation, Measures of kurtosis: coefficient of kurtosis. Introduction to bivariate analysis: Cross tabulation, scatter plots. Pearson's and Spearman's correlation coefficient.

UNIT V

Simple linear regression, fitting of regression models in R, Evaluating regression models, Least Squares method, interpreting regression result and prediction using fitted regression model.

SKILL ENHANCEMENT COURSE IN STATISTICS: SEC-151L
(Statistical Data Analysis using R)

Full Marks=30 [End Semester Exam (30)]
Pass Marks =12 [End Semester Exam (12)]

1. Plotting simple graphs in R (Histograms, Bar Diagram, Pie Diagram, Boxplot, Stem-leaf, ogives).
2. Adding labels, titles, and legends to plots, Saving and exporting plots.
3. Tabulation of raw data in R
4. To compute mean, median and mode for a grouped frequency data in R
5. To compute Geometric mean and Harmonic mean.
6. To compute mean, median, variance, covariance, standard deviation in R.
7. Computation of partition values, skewness and kurtosis in R.
8. To compute correlation and lines of regression in R.
9. Random number generation from different distributions in R.
10. Fitting of simple linear regression in R and its interpretation.
11. Fitting of polynomials and exponential curves in R.
12. Fitting of Binomial and Poisson distribution in R.
13. Problems based on selecting random sample in R (with and without replacement).
14. Problems based on plotting normal probability plot in R (P-P plot and Q-Q plot).

SUGGESTEDREADINGS:

1. Gardener,M. (2012). Beginning R:The Statistical Programming Language. Wiley Publications.
2. Braun, W.J.,& Murdoch, D.J. (2007). A First Course in Statistical Programming with R. Cambridge University Press. New York
3. Moore, D.S., McCabe, G.P., &Craig, B.A. (2014). Introduction to the Practice of Statistics. W.H. Freeman
4. Cho,M.J.,Martinez,W.L.(2014). Statistics in MATLAB: A Primer. Chapman and Hall/CRC

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