Semester – I (Major)

Course Name: Descriptive Statistics and Probability- I

Course Code: BSCSTSMJ101

Course Type: MAJOR **Course Details: MJC- 1**

Course Type: **Discipline Specific Core (Theoretical+Practical)**				L-T-P: 3-0-4	
Credit: 5	Full Marks: 100	CA		ESE	
		Practical	Theoretical	Practical	Theoretical
		30	15	20	35

- ## Descriptive Statistics:

Introduction: Nature of Statistics, Uses of Statistics, Statistics in relation to other disciplines, Abuses of Statistics, Statistics in India, and A historical note.

Types of Data: Concepts of population and sample, quantitative and qualitative data, cross-sectional and time- series data, discrete and continuous data, different types of scales. Primary data, Secondary data.

Presentation of data: Scrutiny of data, frequency and non-frequency data, Textual and tabular presentation of data with one or more factors of classification, diagrammatic representation frequency distributions and cumulative frequency distributions and their graphical presentations, histograms, frequency polygons, frequency curves and ogives, Box-plot, Stem and Leaf.

Univariate data: different measures of location, mean, median, mode, different measures of dispersion, range, MD, SD, QD, relative dispersion, moments, factorial moments, skewness and kurtosis. Sheppard's correction and Charliers' check, outlier Detection.

- ## Probability -I:

Random Experiment: Trial, event, outcome, mutually exclusive events, equally likely and exhaustive, Sample point, Sample space, Different types of events.

Definition of probability: Classical and relative-frequency approach to probability, limitations of Classical definition, Geometric definition of Probability, Kolmogorov's Axiomatic definition. Examples based on classical approach, repeated trials and geometric definition of probability.

Some theorems on Probability: Probability of union and intersection of events, Poincare's theorem, Boole's Inequality, Theorem of total probability.

Conditional probability and Independence of events, theorem of compound probability, Bayes' Theorem and its applications.

Random Variables : Definition of discrete and continuous random variables, cumulative distribution function (c.d.f.) and its properties, probability mass function (p.m.f.) and probability density function (p.d.f), Expectation and Moments, Dispersion, Skewness, Kurtosis, Quartiles.

Probability Inequalities: Markov's and Chebyshev's inequalities, Uniqueness and Inversion Theorems (without proof), Weak Law of Large numbers, (without proof) and Central Limit Theorem (without proof).

List of Practical:

1. Diagrammatic representation of statistical data problems based on simple and subdivided bar diagrams, pie diagrams.
2. Graphical representation of statistical data.
3. Computation of measures of central tendency and dispersion. Use of an appropriate measure and interpretation of results.
4. Moments, Measures of skewness and kurtosis, Box plot, Q-Q plot, stem and leaf plot.
5. Theory of Attributes: Nominal scale, ordinal scale, classification.
6. Consistency of data up to 2 attributes. Concepts of independence and association of two attributes.
7. Yule's coefficient of association (Q), interpretation. Examples and Problems.
8. Application problems based on Bayes Theorem.
9. Application problems based on Classical Definition of Probability.

Suggested Readings:

1. Gun, A.M., Gupta, M.K. and Dasgupta, B. (2013). Fundamental of Statistics, Vol I , World Press, Kolkata.
2. Gun, A.M., Gupta, M.K. and Dasgupta, B. (2011). Fundamental of Statistics, Vol II, World Press, Kolkata.
3. B. L.Aggarwal, Basic Statistics.
4. B. L.Aggarwal, Programmed Statistics.
5. Miller, I. and Miller, M. (2006). John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
6. Mood, A.M. Graybill, F.A. and Boes, D.C. (2011). Introduction to the Theory of Statistics, 3rd Edn., Tata McGraw-Hill Pub. Co. Ltd.

Suggested OnlineLinks/Readings:

- http://heecontent.upsdc.gov.in/SearchContent.aspx
- https://swayam.gov.in/explorer?searchText=statistics
- https://nptel.ac.in/course.html
- https://www.edx.org/search?q=statistics
- https://www.coursera.org/search?query=statistics&

Semester – I (Minor)

Course Name: Descriptive Statistics and Probability- I

Course Code: BSCSTSMN101

Course Type: MINOR **Course Details: MNC- 1**

Course Type: **Discipline Specific Core (Theoretical+Practical)**				L-T-P: 3-0-4	
Credit: 5	Full Marks: 100	CA		ESE	
		Practical	Theoretical	Practical	Theoretical
		30	15	20	35

- ## Descriptive Statistics:

Introduction: Nature of Statistics, Uses of Statistics, Statistics in relation to other disciplines, Abuses of Statistics, Statistics in India, and A historical note.

Types of Data: Concepts of population and sample, quantitative and qualitative data, cross-sectional and time- series data, discrete and continuous data, different types of scales. Primary data, Secondary data.

Presentation of data: Scrutiny of data, frequency and non-frequency data, Textual and tabular presentation of data with one or more factors of classification, diagrammatic representation frequency distributions and cumulative frequency distributions and their graphical presentations, histograms, frequency polygons, frequency curves and ogives, Box-plot, Stem and Leaf.

Univariate data: different measures of location, mean, median, mode, different measures of dispersion, range, MD, SD, QD, relative dispersion, moments, factorial moments, skewness and kurtosis. Sheppard's correction and Charliers' check, outlier Detection.

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Random Experiment: Trial, event, outcome, mutually exclusive events, equally likely and exhaustive, Sample point, Sample space, Different types of events.

Definition of probability: Classical and relative-frequency approach to probability, limitations of Classical definition, Geometric definition of Probability, Kolmogorov's Axiomatic definition. Examples based on classical approach, repeated trials and geometric definition of probability.

Some theorems on Probability: Probability of union and intersection of events, Poincare's theorem, Boole's Inequality, Theorem of total probability.

Conditional probability and Independence of events, theorem of compound probability, Bayes' Theorem and its applications.

Random Variables : Definition of discrete and continuous random variables, cumulative distribution function (c.d.f.) and its properties, probability mass function (p.m.f.) and probability density function (p.d.f), Expectation and Moments, Dispersion, Skewness, Kurtosis, Quartiles.

Probability Inequalities: Markov's and Chebyshev's inequalities, Uniqueness and Inversion Theorems (without proof), Weak Law of Large numbers, (without proof) and Central Limit Theorem (without proof).

List of Practical:

10. Diagrammatic representation of statistical data problems based on simple and subdivided bar diagrams, pie diagrams.
11. Graphical representation of statistical data.
12. Computation of measures of central tendency and dispersion. Use of an appropriate measure and interpretation of results.
13. Moments, Measures of skewness and kurtosis, Box plot, Q-Q plot, stem and leaf plot.
14. Theory of Attributes: Nominal scale, ordinal scale, classification.
15. Consistency of data up to 2 attributes. Concepts of independence and association of two attributes.
16. Yule's coefficient of association (Q), interpretation. Examples and Problems.
17. Application problems based on Bayes Theorem.
18. Application problems based on Classical Definition of Probability.

Suggested Readings:

7. Gun, A.M., Gupta, M.K. and Dasgupta, B. (2013). Fundamental of Statistics, Vol I , World Press, Kolkata.
8. Gun, A.M., Gupta, M.K. and Dasgupta, B. (2011). Fundamental of Statistics, Vol II, World Press, Kolkata.
9. B. L.Aggarwal, Basic Statistics.
10. B. L.Aggarwal, Programmed Statistics.
11. Miller, I. and Miller, M. (2006). John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
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- https://nptel.ac.in/course.html
- https://www.edx.org/search?q=statistics
- https://www.coursera.org/search?query=statistics&

Semester – II (Major)

Course Name: Bivariate Data Analysis and Probability- II.

Course Code: BSCSTSMJ201

Course Type: MAJOR Course Details: MJC- 2

Course Type: **Discipline Specific Core (Theoretical+Practical)**				L-T-P: 3-0-4	
Credit: 5	Full Marks: 100	CA		ESE	
		Practical	Theoretical	Practical	Theoretical
		30	15	20	35

- ## Bivariate Data Analysis:

Correlation and Regression: Meaning of correlation, scatter diagram, Karl Pearson's correlation coefficient and its properties, probable error of Correlation Coefficient. Correlation Ratio, Intra–class Correlation, Multiple and Partial Correlation– Yule's

Notation, Coefficient of Multiple Correlation- Properties of Multiple Correlation Coefficient, Coefficient of Partial Correlation.

Rank correlation – Spearman's and Kendall's measures (tied and untied case).

Regression: Concept of Linear regression and properties of regression coefficient, plane of regression, standard error of Estimate and residual variance, R^2, Principles of least squares, Fitting of polynomial and exponential curves.

Association between two attributes: Contingency table, Marginal and Conditional independence. Odds ratio, Properties of odds ratio, Relative Risk, Relationship between odds ratio and relative risk.

- ## Probability II:

Probability distributions of a few standard discrete random variables: Uniform, Binomial, Poisson, Geometric, Hyper-geometric and Negative Binomial distribution.

Probability distributions of a few standard continuous random variables: Rectangular, Normal, Exponential, Gamma, Beta-I, Beta-II, Cauchy and log-Normal distribution.

Fitting of univariate standard probability distributions with the data.

Bivariate probability distributions: Properties of pmf, pdf and cdf of bivariate random variables. Marginal and conditional distributions, Sum and Product rules of expectations, Conditional expectation.

Bivariate Normal (BVN) distribution and its properties. Marginal and conditional pdf

List of practical:

1. Application problem based on correlation (Pearson) and regression.
2. Application of rank correlation (both ties and non ties)
3. Fitting of polynomial and exponential curves by least square method.
4. Computing odd ratio and relative risk.
5. Fitting of univariate (binomial, poisson, geometric, hypergeometric, negative binomial, normal) distributions and computation of expected frequencies, mean variance, m.g.f.
6. Problems based on area property of normal distribution.
7. To find the ordinate for given area of normal distribution.
8. Application based problem on BVN.

Suggested Readings:

1. S. C. Gupta and V. K.Kapoor. Fundamentals of Mathematical Statistics.
2. Gun, A.M., Gupta, M.K. and Dasgupta, B. (2011). Fundamental of Statistics, Vol II, World Press, Kolkata.
3. B. L.Aggarwal. Basic Statistics.
4. Ross, S, Prentice Hall. A First Course in Probability.
5. Feller, W, John Wiley. An Introduction to Probability Theory and its Applications.

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Semester – II (Minor)

Course Name: Bivariate Data Analysis and Probability- II.

Course Code: BSCSTSMN201

Course Type: MINOR Course Details: MNC- 2

Course Type: **Discipline Specific Core (Theoretical+Practical)**				L-T-P: 3-0-4	
Credit: 5	Full Marks: 100	CA		ESE	
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Bivariate probability distributions: Properties of pmf, pdf and cdf of bivariate random variables. Marginal and conditional distributions, Sum and Product rules of expectations, Conditional expectation.

Bivariate Normal (BVN) distribution and its properties. Marginal and conditional pdf

List of practical:

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10. Application of rank correlation (both ties and non ties)
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13. Fitting of univariate (binomial, poisson, geometric, hypergeometric, negative binomial, normal) distributions and computation of expected frequencies, mean variance, m.g.f.
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