CS202: Probability and Statistics	**L**	**T**	**P**	**Engineering Mathematics and Fundamental of Programming.**
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Course Objective: The aim of this course is to provide students with a detailed understanding of probability and statistical methods. It focuses on enabling students to develop models, perform analyses, and deep knowledge based on data in real-world contexts.

S. No	Course Outcomes (CO)
CO1	Apply foundational principles of probability theory to solve problems in various contexts, demonstrating a solid understanding of experiments, sample spaces, events, and probability axioms.
CO2	Analyze and characterize random variables using their distribution and density functions, and apply key probability distributions to real-world scenarios.
CO3	Understand and apply the Central Limit Theorem in the context of sampling distributions, and develop competency in descriptive statistics and estimation techniques to analyze data.
CO4	Visualize the drawing details of public buildings viz school, hostel, and hospital.
CO5	Design and execute hypothesis tests for different statistical models, interpret the results, and understand their applications in testing theories and making predictions.

S. No	Contents	Contact Hours
UNIT 1	Probability Theory and Foundations: Introduction to Probability Theory: Set theory, experiments, sample spaces (discrete, continuous, and mixed), events, and axioms of probability. Probability as Relative Frequency: Understanding probability through the lens of relative frequency. Joint, Conditional Probability, and Bayes' Theorem: Deep dive into joint probability, conditional probability, total probability, Bayes' theorem, and their applications. Independent Events: Analysis of independence for two events, multiple events, and properties of independent events.	**10**
UNIT 2	Random Variables and Distribution Functions: Concept and Classification of Random Variables: Definition, discrete, continuous, and mixed random variables. Distribution and Density Functions: Exploration of existence, properties, Gaussian random variables, and examples including Binomial, Poisson, Uniform, Exponential, Rayleigh. Conditional Distributions and Densities: Conditional distribution, properties, conditional density, and their implications.	**10**

UNIT 3	Operations on Random Variables and Multiple Random Variables: Expectation and Moments: Expected value, moments about the origin, central moments, and understanding variance and skewness. Key Inequalities: Chebychev's, Markov's, Chernoff's inequalities and their significance. Introduction to Multiple and Vector Random Variables: Joint distribution, properties, joint density functions, marginal distribution and density functions.	**10**
UNIT 4	Sampling Distributions, Descriptive Statistics, and Estimation: The Central Limit Theorem: Its importance and implications for sampling distributions. Descriptive Statistics: Graphical representation, measures of location and variability. Estimation Methods: Unbiasedness, consistency, method of moments, maximum likelihood estimation. Confidence Intervals: Construction for parameters in one and two sample problems, including proportions.	**10**
UNIT 5	Hypothesis Testing and Advanced Topics: Testing of Hypotheses: Null and alternative hypotheses, types of error, power of the test, Neyman-Pearson Lemma. Tests for Normal Populations: One and two sample problems, tests for proportions. Chi-Square Goodness of Fit Test: Applications and problems. Introduction to Advanced Statistical Methods: Brief overview of regression analysis, ANOVA, and non-parametric tests to bridge students to further studies in statistics.	**8**
	Total	**48**