Course code: Course Title	Course Structure			Pre-Requisite
SE324: Probability and Statistics	L	T	P	NIL
	3	1	0	

Course Objective: To learn the language and core concepts of probability theory and understand basic principles of statistical inference.

S. NO	Course Outcomes (CO)
CO1	Elucidate the basic principles of probability and statistics.
CO2	Compute marginal and conditional distributions from joint distributions.
CO3	Perform operations on random variables.
CO4	Explain probability distribution function, probability density function and solve problems.
CO5	Understand sampling, error and perform hypothesis testing.

S. NO	Contents	Contact Hours
UNIT 1	**Introduction to Probability theory:** Through set and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability and Axioms, Probability as a Relative Frequency, Joint and Conditional Probability: Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem. Independent Events: Two Events, Multiple Events, Properties of Independent Events.	6
UNIT 2	**Random Variables:** Random Variable Concept, Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete and Continuous Random Variables, Mixed Random Variable. Distribution Function, Density Function: Existence, Properties of Density Functions. Gaussian Random Variable: Other Distribution and Density Examples: Binomial, Poisson, Uniform, Exponential, Rayleigh. Conditional Distribution and Density Functions: Conditional Distribution, Properties of Conditional Distribution, Conditional Density, Properties of Conditional Density.	8
UNIT 3	**Operations on Random Variables:** Expectation, Expected Value of a Random Variable, Expected Value of a Function of a Random Variable, Conditional Expected Value, Moments, Moments about the Origin, Central Moments, Variance and Skew / Chebychev's Inequality / Markov's Inequality, Chernoff's Inequality and Bound.	6
UNIT 4	Multiple Random Variables, Vector Random Variables, Joint Distribution and Its Properties, Joint Distribution Function, Properties of the Joint Distribution, Marginal Distribution Functions, Joint Density and Its Properties, Joint Density Function, Properties of the Joint Density, Marginal Density Functions, Conditional Distribution and Density, Statistical Independence, Distribution and Density of a Sum of Random Variables.	6
UNIT 5	**Sampling Distributions:** The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, Chi-Square, t and F-distributions. Descriptive Statistics: Graphical representation, measures of locations and variability. Estimation: Unbiasedness, consistency, the method of moments and the method of maximum likelihood estimation, confidence intervals for parameters in one sample and two sample problems of normal populations, confidence intervals for proportions, problems.	8

UNIT 6	**Testing of Hypotheses**: Null and alternative hypotheses, the critical and 8 acceptance regions, two types of error, power of the test, the most powerful test and Neyman-Pearson Fundamental Lemma, tests for one sample and two sample problems for normal populations, tests for proportions, Chi-square goodness of fit test and its applications, problems.	**8**
	TOTAL	**42**

REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Peyton Peebles, "Probability, Random Variables and Random Signal Principles", McGraw Hill Education, 4th Edition.	**2017**
2	Athanasios Papoulis, S Pillai, "Probability - Random Variables and Stochastic Processes", McGraw Hill Education, 4th Edition.	**2017**
3	Douglas Lind, William Marchal, Samuel Wathen, "Statistical Technics in Business and Economics", McGraw-Hill Education, 13th Edition.	**2007**
4	Roy D. Yates, David J. Goodman, "Probability and Stochastic Processes", Wiley, 3rd Edition.	**2014**
5	Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, "Probability and Statistics for Engineers and Scientists", Pearson, 9th Edition.	**2024**