Subject Code: 01CT1401

Subject Name: Probability and Statistics

B. Tech. Year – II (Semester IV)

Objective:

To provide a foundation in probability theory and statistical method in order to solve applied problems and to prepare for more advanced courses in probability and statistics.

Credits Earned: 04 Credits

Course Outcomes: After completion of this course, student will be able to:

1. Understand the needs of probability and distribution
2. Apply the mathematical treatment for random variable and joint probability distribution
3. Draw various graphs for the descriptive statistical analysis for the given data set and develop basic inference sense from it.
4. Apply appropriate probability distribution model, central limit for the given test cases.
5. Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases also Learn non-parametric test such as the Chi-Square test for Independence as well as Goodness of Fit.
6. Perform Statistical analysis study like descriptive statistics, correlation and regression using professional software.

Pre-requisite of course:
Differential and Integral Calculus and Basic Integration

Teaching and Examination Scheme:

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial / Practical Marks		Total Marks
				E	I		V	T	
Theory	Tutorial	Practical		ESE	IA	CSE	Viva	Term Work	
03	01	00	04	50	30	20	25	25	150

Contents:

Unit	Topics	Hours
1	**Introduction to Probability** Classical and axiomatic definitions of probability, sample space, probability of an event, addition rule and conditional probability, multiplication rule, total probability, Bayes' theorm and independence.	06
2	**Random variable** Introduction to the concept, Discrete and continuous random variable: definitions and examples, Probability density function and cumulative distribution functions of continuous random variables, Probability mass function of discrete random variables, expected values and variance of discrete random variable.	08
3	**Probability distribution** Moments, probability and moment generating functions, Some special probability distributions: Uniform, Exponential, Poisson, geometric, Binomial and Normal distribution.	06
4	**Two – dimensional random variable** Joint distributions – Marginal and Conditional distributions, Covariance, regression, correlation, Independence of random variables.	06
5	**Transformation** Transformation of random variables of two dimensions, Central limit theorem (for independent and identically distributed random variables), convergence in probability. Introduction to statistics, Measure of central tendency (mean, median, mode) and measures of dispersion (standard deviation, mean deviation, range, variance etc.)	04
6	**Estimation** Consistency, Unbiasedness, the method of moments and the method of maximum likelihood estimation, confidence intervals for proportions, confidence intervals for parameters in one sample and two sample problems of normal populations.	06
7	**Testing of Hypotheses** Null and alternative hypotheses, the critical and acceptance regions, two types of error, power of the test, tests for one sample and two sample problems for normal populations, tests for proportions the most powerful test and Neyman- Pearson Fundamental Lemma, Chi square goodness of fit test and its applications.	06
	Total Hours	42

Suggested Text books / Reference books:

1. Introduction to Probability and Statistics for Engineers and Scientists, S. M. Ross, Academic Press, 2009.
2. Introduction to Probability and Statistics, J.S. Milton & J. C. Arnold, Cengage Learning, 2008
3. A First Course in Probability, S.M. Ross, Prentice Hall, 2001.
4. Introduction to Probability Theory and Statistical Inference, H.J. Larson, Wiley, 1982
5. Introductory Statistics, Neil A. Weiss, 10th Edition, Pearson

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	20%	30%	15%	10%	5%

Suggested List of Tutorial:

1. Plot different graph using excel.
2. Plot different graph using R and Python.
3. Write a program to generate random numbers for given range and find mean, median and mode using R/Python.
4. Calculation of deviation, variance, correlation coefficient and code for it.
5. Calculation on basics of probability concepts.
6. Examples on moment, Probability distributions.
7. Calculation of Binomial, Poisson, and Hyper Geometric.
8. Calculation of Gaussian, Standard, Normal distribution, Confidence interval and P test.
9. Simulation for continuous and discrete distributions.
10. Calculation on central limit theorem (with simulation).
11. Calculation on hypothesis problems (with simulation).
12. Calculation on chi square goodness fit test.
13. Case study on regression.
14. Case study on correlation.

Technology Supplementary Resources:

1. https://www.mathsisfun.com/data/
2. https://nptel.ac.in/courses/111/105/111105041/
3. https://www.coursera.org/browse/data-science/probability-and-statistics
4. https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-andstatistics- spring-2014/