

<b>COURSE TITLE</b>	<b>PROBABILITY AND STATISTICS</b>
<b>COURSE CODE</b>	<b>01ML0403</b>
<b>COURSE CREDITS</b>	<b>5</b>

**Objective:**

- 1 This course exposes students to probability and statistics which is essential for their subsequent studies of Artificial intelligence and big data. The objective is to teach theoretical concepts and techniques for solving practical problems. Starting with probability, this course leads to the concepts of correlation, regression, estimation and testing of hypothesis.

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

- 1 Apply the fundamental principles of probability, conditional probability, and independence to solve real-world engineering and statistical problems
- 2 Analyze random variables and their associated probability distributions to determine probabilities and expected values for discrete and continuous cases
- 3 Analyze the relationship between two variables using correlation techniques and interpret the strength and direction of their association
- 4 Apply statistical methods to compute and interpret confidence intervals for population parameters in both single-sample and two-sample cases
- 5 Evaluate statistical hypotheses using appropriate parametric and non-parametric tests, including the Chi-Square Test for independence and goodness of fit.

**Pre-requisite of course:** Nil

**Teaching and Examination Scheme**

<b>Theory Hours</b>	<b>Tutorial Hours</b>	<b>Practical Hours</b>	<b>ESE</b>	<b>IA</b>	<b>CSE</b>	<b>Viva</b>	<b>Term Work</b>
3	2	0	50	30	20	25	25

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>Introduction to Probability</b> Sample space and events, Definitions of probability, Properties of probability, Conditional Probability, Bayes' theorem and independence	6
2	<b>Random variable Probability distribution</b> Discrete and continuous random variable, Distribution functions, Moments of random variables, Functions of random variable, Exponential Distribution, Poisson distributions, Binomial and Normal distribution, Law of large numbers; and central limit theorem	10

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
3	<b>Correlation and regression analysis</b> Definition, Assumption of Correlation, Bivariate Correlation, Partial Correlation, Pearson Correlation Coefficient, Assumption of Regression Analysis, Simple Regression Model, Multiple Regressions Model, Coefficient of regression and their properties, Applications of the concepts in engineering	12
4	<b>Estimation</b> Random sampling, Estimation of parameters, Confidence intervals for proportions, Confidence intervals for parameters in one sample and two sample problems of normal populations	5
5	<b>Testing of Hypotheses</b> Null and alternative hypotheses, The critical and acceptance regions, Types of error, Z- test for single proportion, Difference of proportions, Single mean, Difference of means, and Difference of standard deviations, t- Test for single mean, Difference of means, t- test for correlation coefficients, F- test for ratio of variances, Chi square goodness of fit test and its applications	12
<b>Total Hours</b>		<b>45</b>

#### **Suggested List of Experiments:**

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>Tutorial 1</b> Fundamentals of Sample Space, Events, and Probability Axioms	2
2	<b>Tutorial 2</b> Conditional Probability and Bayes' Theorem	2
3	<b>Tutorial 3</b> Discrete Random Variables with Distribution Functions	2
4	<b>Tutorial 4</b> Continuous Random Variables with Distribution Functions	2
5	<b>Tutorial 5</b> Standard Probability Distributions: Binomial and Poisson distribution	2
6	<b>Tutorial 6</b> Standard Probability Distributions Normal, Exponential	2
7	<b>Tutorial 7</b> Correlation Analysis: Types, Assumptions	2
8	<b>Tutorial 8</b> Karl Pearson's coefficient of correlation	2
9	<b>Tutorial 9</b> Spearman's Rank Correlation Coefficient	2
10	<b>Tutorial 10</b> Simple Regression analysis	2
11	<b>Tutorial 11</b> Multiple Regression and Regression Coefficients	2

### Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
12	<b>Tutorial 12</b> Hypothesis Testing: z-test, t-test, F-test, and Chi-Square Test	2
<b>Total Hours</b>		<b>24</b>

### Textbook :

- 1 Miller and Freund's Probability and Statistics for Engineers , Richard A Johnson, Prentice Hall of India. 9th Edition, 2018
- 2 Fundamentals of Mathematical Statistics, S. C. Gupta, V. K. Kapoor, Sultan Chand & Sons. 11th Edition, 2014
- 3 Probability and Statistics, Ravish R. Singh, Mukul Bhattnold, McGraw-Hill Education 2nd Edition, 2020
- 4 Probability & Statistics for Engineers & Scientists, Ronald E. Walpole, Pearson 9th Edition, 2021
- 5 An Introduction to Probability and Statistics, Rohatgi. , Wiley Third Edition, 2015

### References:

- 1 Applied Statistics and Probability for Engineers, Applied Statistics and Probability for Engineers, Douglas C. Montgomery, George C. Runger, John Wiley & Sons 6th Edition, 2016
- 2 Introduction to Probability and Statistics for Engineers and Scientists" by Sheldon Ross (6th Edition, Elsevier), Introduction to Probability and Statistics for Engineers and Scientists" by Sheldon Ross (6th Edition, Elsevier), Sheldon M. Ross, Elsevier 6th Edition, 2020
- 3 Introduction to Probability Theory and Statistical Inference, Introduction to Probability Theory and Statistical Inference, George G. Roussas, Academic Press 3rd edition, 2024

### Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as 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 / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
25.00	30.00	30.00	15.00		

### Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc .
- 2 The internal evaluation will be done based on continuous evaluation of students in the laboratory and class -room.

**Instructional Method:**

- 3 Practical examination will be directed toward the completion of semester for assessment of performance of understudies in laboratory.
- 4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

**Supplementary Resources:**

- 1 <http://mathworld.wolfram.com/>
- 2 [http:// en.wikipedia.org/ wiki/ Math](http://en.wikipedia.org/wiki/Math)