

Semester	ONE
Course	Major
Paper Code	C1ST230121T
Paper Title	Probability and Probability Distributions I
No. of Credits	4
Theory / Practical /Composite	Theory
Classes per week	4
Module	1

### Course Outcomes

1. <b>Remember</b> the fundamental concepts of probability, random experiments, sample spaces, events, and the classical, statistical, and axiomatic definitions of probability.
2. <b>Understand</b> the rules and laws of probability, including addition and multiplication rules, and the theoretical results related to occurrences of events
3. <b>Apply</b> the concepts of conditional probability, total probability, Bayes' theorem, and independence to solve real-life and theoretical probability problems.
4. <b>Analyse</b> univariate probability distributions (discrete and continuous) using probability mass/density functions, cumulative distribution functions, moments, quantiles, and measures of dispersion and shape.
5. <b>Evaluate</b> relationships between two random variables by examining joint, marginal, and conditional distributions, independence, correlation, and simple linear regression.
6. <b>Create</b> appropriate probability models for real-world phenomena by formulating random variables and selecting suitable univariate or bivariate probability distributions.

### Syllabus

Unit/Module	Content	No. of lectures	CO mapping	Cognitive levels
<i>Unit 1</i>	<b>Probability:</b> Introduction, random experiments, sample space, events. Definitions of Probability – classical, statistical and axiomatic.	5	CO1 CO2	K1 K2
<i>Unit 2</i>	<b>Rules of Probability and their Applications:</b> Derivation of the probability of at least one event out of $n$ events, $n (>1)$ being finite. Statement of the probabilities of at least $m$ and exactly $m$ out of $n$ events, $n (>m)$ being finite.	7	CO2 CO3	K2 K3
<i>Unit 3</i>	<b>Conditional Probability:</b> The concept of Conditional Probability, theorem of compound probability, theorem of total probability, Bayes theorem and its applications, independent events.	10	CO3 CO4	K3 K4
<i>Unit 4</i>	<b>Univariate probability distribution:</b> Random Variables – discrete and continuous. Concept of the probability distribution of a random variable.			

	Probability Mass and Density functions. Cumulative distributions function (CDF) and the statement of properties of CDF. Illustrations in both discrete and continuous situations. Moments and Quantiles. Measures of Central Tendency, Dispersion, Skewness and Kurtosis.	20	CO4 CO6	K4 K6
<b>Unit 5</b>	<b><i>Bivariate probability distribution:</i></b> Discrete and Continuous Joint Distributions. Bivariate Probability Mass and Density functions. Cumulative distributions function (CDF) and the statement of properties of CDF. Marginal and Conditional distributions. Independence. Correlation and Linear Regression.	10	CO5 CO6	K5 K6

### Reading/Reference list

1. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi .
4. S.M. Ross : A First Course in Probability.
5. K.L.Chung: Elementary Probability Theory with Stochastic Process.
6. <a href="https://www.coursera.org/learn/introductiontoprobability">https://www.coursera.org/learn/introductiontoprobability</a>
7. <a href="https://www.udemy.com/topic/statistics/">https://www.udemy.com/topic/statistics/</a>

### Evaluation

Marks	Theory CIA: 30 Semester Exam: 70	Practical (Not applicable)
Paper Structure for Semester Exam	Short Questions (5 Marks Each)	Long Questions (15 Marks Each)
	5 out of 7	3 out of 5

CO	CO Description	Cognitive levels
CO1	<b>Remember</b> the fundamental concepts of probability, random experiments, sample spaces, events, and the classical, statistical, and axiomatic definitions of probability.	K1
CO2	<b>Understand</b> the rules and laws of probability, including addition and multiplication rules, and the theoretical results related to occurrences of events	K2
CO3	<b>Apply</b> the concepts of conditional probability, total probability,	K3

	Bayes' theorem, and independence to solve real-life and theoretical probability problems.	
<b>CO4</b>	<b>Analyse</b> univariate probability distributions (discrete and continuous) using probability mass/density functions, cumulative distribution functions, moments, quantiles, and measures of dispersion and shape.	K4
<b>CO5</b>	<b>Evaluate</b> relationships between two random variables by examining joint, marginal, and conditional distributions, independence, correlation, and simple linear regression.	K5
<b>CO6</b>	<b>Create</b> appropriate probability models for real-world phenomena by formulating random variables and selecting suitable univariate or bivariate probability distributions.	K6