

Course No	Course Name	L-T-P-Credits
MA 407	Probability Theory	3-1-0: 4

Prerequisite: NIL

Course Objectives: The objective of the course is to provide foundations of probability theory commonly used in various applications of science and engineering.

Course Outcomes: After successful completion of the course, students will be able to:

1. Understand the fundamental set theory upon which probability theory is based.
2. Apply probability theory, Bayes theorem in solving real life problems.
3. Understand random variables, various discrete & continuous distributions and calculate mean, variance, moments of standard distributions.
4. Understand the law of large numbers and know how this law is used to model various random phenomena. Recognize the importance of the central limit theorem and its connection with weak law of large numbers.
5. Understand joint distribution and use this to calculate probability.
6. Understand (in)dependency of random variables through joint distribution and correlation coefficient.

SYLLABUS

Module	Contents	Hours
I	Probability: Classical, relative frequency and axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Bayes' theorem and independence.	7
II	Random variables: Discrete, continuous and mixed random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments, moment generating function, Chebyshev's inequality.	9
III	Special distributions: Binomial, geometric, Poisson, uniform, exponential, normal; functions of a random variable.	9
IV	Limit theorems: Weak law of large numbers, central limit theorem.	2
V	Joint distributions: Joint, marginal and conditional distributions, product moments, correlation, independence of random variables, bivariate normal distribution, simple correlation, regression.	9

Essential Readings:

1. S. M. Ross, “Introduction to Probability Models”, Elsevier, 11th edition, 2014.
2. V. K. Rohatgi and A. K. Md. E. Saleh, “An Introduction to Probability and Statistics”, Wiley, 2nd edition, 2008.

Supplementary Readings:

1. W. W. Hines, D. C. Montgomery, D. M. Goldsman and C. M. Borror, “Probability and Statistics in Engineering”, Wiley, 4th edition, 2008.
2. J. S. Milton and J. C. Arnold, “Introduction to Probability and Statistics”, McGraw Hill Education; 4th edition, 2017.
3. B.L.S. Prakasa Rao, “A First Course in Probability and Statistics”, Cambridge University Press, 2010.