

Probability and Random Processes (15B11MA301)

Lecture-1



Department of Mathematics
Jaypee Institute of Information Technology, Noida

Course Description

Module No.	Title of the Module	Topics in the Module
1.	Probability	Three basic approaches to probability, conditional probability, total probability theorem, Bayes' theorem.
2.	Random Variables	One dimensional random variables (discrete and continuous), distribution of a random variable (density function and cdf). MGF and characteristic function of a random variable and its utility. Bivariate random variable, joint, marginal and conditional distributions, covariance and correlation.

Module No.	Title of the Module	Topics in the Module
3.	Probability Distributions	Bernoulli, binomial, Poisson, negative binomial, geometric distributions. Uniform, exponential, normal, gamma, Earlang and Weibull distributions.
4.	Reliability	Concept of reliability, reliability function, hazard rate function, mean time to failure (MTTF). Reliability of series, parallel, series-parallel, parallel-series systems.

Module No.	Title of the Module	Topics in the Module
5.	Random Processes I	Introduction, Statistical description of random processes, Markov processes, processes with independent increments. Average values of random processes. Strict sense and wide sense stationary processes, their averages. Random walk, Wiener process. Semi-random telegraph signal and random telegraph signal process. Properties of autocorrelation function.
6.	Random Processes II	Ergodic processes. Power spectral density function and its properties. Poisson processes. Markov chains and their transition probability matrix (TPM).

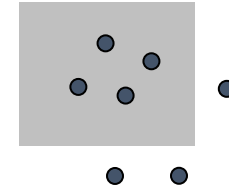
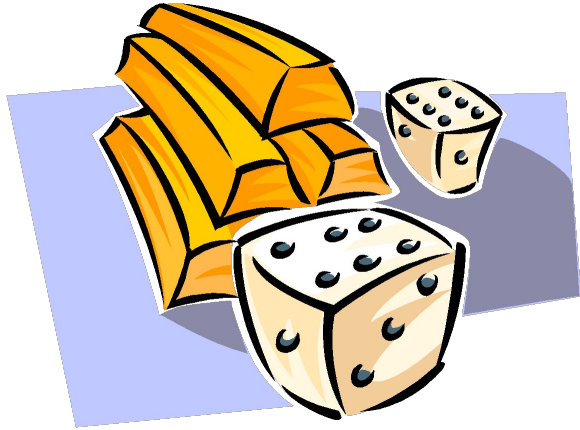
Course Outcomes

After pursuing the above mentioned course, the students will be able to:		COGNITIVE LEVELS
C201.1	explain the basic concepts of probability, conditional probability and Bayes' theorem	Understanding Level (C2)
C201.2	identify and explain one and two dimensional random variables along with their distributions and statistical averages	Applying Level (C3)
C201.3	apply some probability distributions to various discrete and continuous problems.	Applying Level (C3)
C201.4	solve the problems related to the component and system reliabilities.	Applying Level (C3)
C201.5	identify the random processes and compute their averages.	Applying Level (C3)
C201.6	solve the problems on Ergodic process, Poisson process and Markov chain.	Applying Level (C3)

Recommended Books

1.	Veerarajan, T., Probability, Statistics and Random Processes, 3 rd Ed. Tata McGraw-Hill, 2008.
2.	Papoulis, A. & Pillai, S.U., Probability, Random Variables and Stochastic Processes, Tata McGraw-Hill, 2002.
3.	Ross, S. M., Introduction to Probability and Statistics for Engineers and Scientists, 4th Ed., Elsevier, 2004.
4.	Palaniammal, S., Probability and Random Processes, PHI Learning Private Limited, 2012.
5.	Prabha, B. and Sujata, R., Statistics, Random Processes and Queuing Theory, 3rd Ed., Scitech, 2009.

Origins of Probability



The study of probabilities originally came from gambling!

Why are probabilities important?

- They help you to make good decisions, e.g.,
Decision theory
- They help you to minimize risk, e.g.,
Insurance
- They are used in average-case time complexity analyses of
Computer algorithms.
- They are used to model processes in
- Engineering.



Probability theory is a study of **random** or unpredictable experiments and is helpful in investigating the important features of these random experiments.

In many different fields of science and technology, it has been observed that, under a long series of experiments, the proportion of the time that an event occurs may appear to approach a constant. It is these constants that probability theory aims at predicting and describing as quantitative measures of the chance of occurrence of events.

- An experiment whose outcome or result can be predicted with certainty is called a **deterministic experiment**.
- Although all possible outcomes of an experiment may be known in advance, the outcome of a particular performance of the experiment cannot be predicted owing to a number of unknown causes. Such an experiment is called a **random experiment**.
- A random experiment is an experiment that can be repeated over and over, giving different results.

e.g A fair 6-faced cubic die, the no. of telephone calls received in a board in a 5-min. interval.

Thank You