

# STOCHASTIC MODELING

<b>CREDITS:</b>	<b>3</b>
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## OBJECTIVE:

- To learn the applications of stochastic modelling.
- To understand the techniques of stochastic modelling.

## **UNIT 1 - Introduction to Stochastic Processes** **9**

Basics of probability- random variables and distributions -sequence of random variables; Stochastic process-Definition, classification, Simple stochastic processes

## **UNIT 2 - Discrete-time Markov chains** **9**

Introduction, Definition and Transition Probability Matrix, Chapman-Kolmogorov Equations, Classification of States and Limiting Distributions: Limiting and Stationary Distributions, Limiting Distributions, Ergodicity and stationary distributions-Time Reversible Markov Chain, Application of Irreducible Markov chains in Queueing Models- Reducible Markov Chains

## **UNIT 3 - Continuous-time Markov chains** **9**

Definition, Kolmogorov Differential Equation and, Infinitesimal Generator Matrix, Limiting and Stationary Distributions, Birth Death Processes, Poisson processes: M/M/1 Queueing model, Simple Markovian Queueing Models: Applications of CTMC- Queueing networks, Communication systems, Stochastic Petri Nets

## **UNIT 4 - Brownian Motion** **9**

Definition and Properties, Processes Derived from Brownian Motion, Stochastic Differential Equation: Martingales: Conditional Expectation and filtration, Definition and simple examples,

## **UNIT 5 - Renewal Processes** **9**

Renewal Function and Equation, Generalized Renewal Processes , and Renewal Limit Theorems, Markov Renewal and Markov Regenerative Processes, Non Markovian Queues, Application of Markov Regenerative Processes: Branching Processes, Stationary and Autoregressive Processes.

**TOTAL: 45 PERIODS**

## OUTCOME:

- To facilitate solutions using stochastic modeling for business decision making.

## REFERENCES :

1. J Medhi, Stochastic Processes, 3rd edition, New Age International Publishers, 2009
2. Liliana Blanco Castaneda, Viswanathan Arunachalam, Selvamuthu Dharmaraja, Introduction to Probability and Stochastic Processes with Applications, Wiley, 2012.

3. Kishor S. Trivedi, Probability and Statistics with Reliability, Queuing, and Computer Science Applications, 2nd Edition, Wiley, 2002.
4. Introduction to Probability Models, Sheldon M. Ross, Academic Press, tenth edition, 2009.