

Stochastic Processes

1.1 Course Number: MA 331

1.2 Contact Hours: 3-0-0 Credits: 09

1.3 Semester-offered: 3rd Year-Even

1.4 Prerequisite: Probability & statistics

1.5 Syllabus Committee Member: Dr. C. Kundu (convener), Dr. M.K. Rajpoot, Dr. A.

Kumar, Dr. G. Rakshit.

2. **Objective:** This course develops the mathematical theory of random variables and random processes for Telecom Engineers. The goal is to teach the theoretical concepts and techniques for solving problems that arises in practice. Beginning with the random variables, this course leads to the concept of stochastic process and linear filtering of random processes.

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Stochastic processes	Introduction, Classification and examples of stochastic processes, Bernoulli process, Poisson process, Gaussian process, Renewal process, Stationary process, Brownian motion.	8
2	Random Walk	Introduction and examples, simple random with unrestricted, two absorbing barriers, one absorbing barrier, two reflecting barriers and one reflecting barrier.	6
3	Discrete time Markov chain	Definition, n-step transition probability, States classification, Limiting probabilities, Distribution of times between states, Irreducible finite chains with aperiodic states, Reducible chains (Finite Markov chains with absorbing states).	8
4	Continuous time Markov chain	Definition, Chapman-Kolmogorov equation, Birth-Death process, Special cases of Birth-Death process, Markov chains with absorbing states.	6
5	Renewal process	Definition, Examples, Renewal equation, Renewal theorems, Application of renewal process.	6
6	Queuing Models	Introduction to queuing models, M/M/1; M/M/c and Erlang loss models. Steady state solutions. State dependent parameters.	6
		Total	40

4. Readings

4.1 Textbooks:

- *Stochastic Processes* by Sheldon Ross, Wiley.
- *Theory of Stochastic Processes* by Cox and Miller, Chapman & Hall.

4.2 Reference books:

- ✓ *Stochastic Processes in Science, Engineering and Finance* by Frank Beichelt, Chapman & Hall.
- ✓ *Probability and Statistics with Reliability, Queueing and Computer Science Applications* by Kishor S. Trivedi, Wiley.

5 Outcome of the Course:

At the end of the course the students will be able to apply different stochastic processes to solve an engineering problem having stochastic in nature.