# IISER Pune - Course Content

| | |
|---|---|
| Semester | AUG 2025 |
| Open to Semester | 5,7,9,11,31,33 |
| Course Code | DS3324 |
| Course title | Markov Chain and its Application |
| Nature of Course | LE - Lecture |
| Credit | 4 |
| **Coordinator** and participating faculty (if any) | **Dr. Anup Biswas** |
| Pre-requisites | None |
| Objectives | This course is intended to introduce elementary probability theory and stochastic processes – without Kolmogorov's mathematical model of probability theory. Only the aspects related to the distributions or laws of random variables and Markov chains will be discussed. It will be helpful for students who want to see the applications of probability theory in fields such as genetics, engineering, management science, physical and social sciences, and operation research. Special emphasis is given to topics of discrete and continuous time Markov chain |
| Course content | Preliminary notions: Discrete and continuous distributions in one dimen-<br>sion, Expectation of a distribution using the distribution function. Indepen-<br>dence of events and distributions. Conditional distribution: Multi-dimen-<br>sional distribution, Conditional expectation of one component given the<br>realizations of others, Conditional probability, Baye's theorem Ap-<br>plications: Uniform priors, Poly's urn model, Bose-Einstein statistics, the k-<br>record values of discrete random variables. Markov chain - Discrete Time:<br>Chapman Kolmogorov equations, classification of states, limiting probabili-<br>ties, Applications – Gambler*s ruin problem, Branching processes, time<br>reversible Markov chain. The exponential distribution and the Poisson<br>process: counting processes, interarrival and waiting time distribution,<br>conditional distribution of arrival times, non-homogeneous |

| | |
|---|---|
| | Poisson<br>process. Continuous-time Markov chain: explosions, Reuter's criteria for<br>non-explosions, Kolmogov's backward and forward equations, Birth and<br>death processes, limiting probabilities, and time reversibility. Queueing<br>theory: a single server exponential queueing system, queueing system<br>with bulk service, open/closed system, the system M/G/1. |
| Evaluation / Assessment | Quiz 30%, Mid Sem 30%, End sem 40% |
| Suggested readings | 1. William Feller, An introducDon to the probability theory and its<br>applicaDons, Volume 1, Wiley India.<br>2. Sheldon M. Ross, IntroducDon to probability models, Academic Press.<br>3. Geofferey R. GrimmeO and David R. SDrzaker, Probability and random<br>processes, OXford University press.<br>4. Dimitri P. Bertsekas and John N. Tsitsiklis, IntroducDon to Probability,<br>Athena ScienDfic.<br>5. IntroducDon to StochasDc Processes: P. G. Hoel, S. C. Port and C.J. Stone<br>(1986) Waveland Press Inc. |
| When Next | Not Known |
| Date Uploaded | 2025-03-29 08:54:32 |