

**FIRST SEMESTER 2022-2023**

# Course Handout Part II

29-08-2022

In addition to Part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

*Course No.* : MATH F424

## Course Title : Applied Stochastic Process

## Instructor-in-Charge : Nirman Ganguly, Department of Mathematics

**Scope and Objective of the Course:** A stochastic process is a random process. The course will enable students to construct predictive models and apply to real situations.

**Textbook:**

1. Stochastic Processes, 2nd edition, Sheldon M. Ross, Wiley and Sons.

**Reference books**

1. A First Course in Stochastic Processes, 2nd edition, Samuel Karlin and Howard E. Taylor, Academic Press.
2. Probability, Random Variables and Stochastic Processes, 4th edition, Athanasios Papoulis and Unnikrishna Pillai, McGraw-Hill.
3. Stochastic Processes-Theory for Applications, Robert G. Gallager, Cambridge University Press, First South Asia Edition 2016.

**Course Plan:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lecture No.** | **Learning objectives** | **Topics to be covered** | **Chapter in the Text Book** |
| 1-7 | To learn the characteristics of probability models and fundamental inequalities. | Probability, Random Variables, Conditional Expectation, Generating Functions, Limit Theorems | Sections 1.1 – 1.8 |
| 8-14 | To understand the definition and implications of Stochastic and specially Poisson processes. | Essential examples: Random Walks ,The Poisson process, Interarrival and Waiting Time Distributions, Compound Poisson Random Variables and Processes | Sections 2.1 - 2.5 |
| 15-21 | To understand Renewal Theory and Discrete Time Markov Chains. | Renewal Theory, Markov Chains, Chapman-Kolmogorov Equations, Classification of States, Gambler’s Ruin Problem | Sections 3.1-3.3  Sections 4.1-4.4 |
| 22-28 | To understand Continuous Time Markov Chains. | Continuous Time Markov Chains, Birth and Death Processes, Computing Transition Probabilities | Sections 5.1 – 5.5 |
| 29-35 | To gain knowledge of Martingales | Martingales, Stopping Times, Azuma’s Inequality for Martingales, Submartingales and Supermartingales | Sections  6.1-6.4 |
| 36-40 | To comprehend Brownian motions | Brownian motions, Wiener Process, Variations on Brownian Motion | Sections 8.1-8.3 |

**Evaluation Scheme:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Component** | **Duration** | **Weightage (%)** | **Date & Time** | **Nature of Component** |
| Mid-Sem | 90 minutes | 30 | 31/10 11.00 - 12.30PM | Closed Book |
| Project- I |  | 10 | **To be announced through CMS.** | Open Book |
| Project- II |  | 10 | **To be announced through CMS.** | Open Book |
| Quiz (2) | 30 minutes for each quiz | 5+5 | **To be announced through CMS.** | Closed Book |
| Comprehensive | 3 Hours | 40 | 17/12 AN | Closed Book |

**Note:**

**1. Total marks with all the evaluation components taken together will be 100.**

1. **For the 1 credit practical class, related problems will be assigned which will form constituents of Project I and II.**

**Chamber Consultation Hour:** To be announced in class.

**Notices:** Students will be notified only through CMS.

**Make-up Policy:** Make-up for any component of evaluation will be given only in genuine cases of absence. [Prior permission is required]

**Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**INSTRUCTOR-IN-CHARGE**