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**SECOND SEMESTER 2019-2020**

# Course Handout Part II

Date: 06.01.2020

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. Through the course the students will also learn to encapsulate random processes through algorithms.

**Textbook:**

1. Stochastic Processes-Theory for Applications, Robert G. Gallager, Cambridge University Press, First South Asia Edition 2016.

**Reference books**

1. Stochastic Processes, 2nd edition, Sheldon M. Ross, Wiley and Sons.
2. A First Course in Stochastic Processes, 2nd edition, Samuel Karlin and Howard E. Taylor, Academic Press.
3. Probability, Random Variables and Stochastic Processes, 4th edition, Athanasios Papoulis and Unnikrishna Pillai, McGraw-Hill.

**Course Plan:**

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| --- | --- | --- | --- |
| **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 Models, Bernoulli process, Expectation , Inequalities , Law of large numbers , Central Limit Theorem. | Sections 1.1 – 1.7 |
| 8-14 | To understand the definition and implications of Poisson processes. | The Poisson process, Arrival processes, Properties of Poisson Processes, Combination of Poisson processes, Conditional Poisson Processes | Sections 2.1 - 2.5 |
| 15-21 | To understand Gaussian processes. | Gaussian random variables, Gaussian random vectors, Properties of covariance matrices, Conditional PDFs for Gaussian random vectors, Brownian Motion | Sections 3.1 - 3.5 and 3.6.9 |
| 22-28 | To compute transition probabilities and their implications in Markov processes. | Definition of Markov chains, Classification of states, The matrix representation, Stochastic matrices, Markov chains with rewards, Applications in programming. | Sections 4.1 – 4.5 |
| 29-35 | To comprehend countable state Markov chains and application of Renewal theory | Renewal Processes, Renewal reward processes, Countable state Markov chains, Renewal theory applied to Markov chains. | Sections 5.1-5.4  Sections 6.1-6.3 |
| 36-42 | To gain knowledge of random walks and Martingales | Simple random walks, Integer-valued random walks, Martingales, Scaled Branching processes, Sub-Martingales and Super-Martingales | Sections 9.1, 9.6, 9.7 |

**Evaluation Scheme:**

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| --- | --- | --- | --- | --- |
| **Component** | **Duration** | **Weightage (%)** | **Date & Time** | **Nature of Component** |
| Midsem | 90 minutes | 30 | 5/3 3.30 - 5.00 PM | Closed Book |
| Programming Assignment- I |  | 10 | Before Midsem | Open Book |
| Programming Assignment- II |  | 10 | After Midsem | Open Book |
| Three quizzes will be taken. Best two will be taken into account. | 30 minutes for each quiz | 10 | To be announced through CMS. | Closed Book |
| Comprehensive | 3 Hours | 40 | 11/05 FN | Closed Book |

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

**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]

**INSTRUCTOR-IN-CHARGE**