Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2023-2024

Course Handout Part II

Date: 11.08.2023

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 : Sayan Ghosh

Scope and Objective of the Course: A stochastic process is a random process. This course will provide an introduction to various stochastic processes, and will give an understanding of relevant mathematical principles, which will enable the students to construct predictive models and apply to real-world situations. It includes a review of elementary probability theory and detailed coverage of Poisson, Gaussian, Markov and Renewal processes.

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:

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	The Poisson process, Arrival processes, Properties of Poisson Processes, Combination of Poisson	Sections 2.1 - 2.5

	Poisson processes.	processes, Conditional Poisson Processes	
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
36-40	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:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Quizzes (2)	30 mins each	20%	To be announced	Open Book
Mid-semester	90 mins	30%	13/10 - 4.00 - 5.30PM	Closed Book
Assignment (1)	To be announced	10%	To be announced	Closed Book
Comprehensive	180 mins	40%	19/12 AN	Closed Book

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

Note: For the 1 credit practical class, related computational problems will be assigned at the end of each chapter.

Chamber Consultation Hour: To be announced in class.
Notices: Students will be notified 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