MATH 477: Stochastic Processes
Spring 2025 Course Syllabus

NJIT Academic Integrity Code: All Students should be aware that the Department of Mathematical Sciences takes the University Code on Academic Integrity at NJIT very seriously and enforces it strictly. This means that there must not be any forms of plagiarism, i.e., copying or use of generative AI for homework, class projects, or lab assignments, or any form of cheating in quizzes and exams. Under the University Code on Academic Integrity, students are obligated to report any such activities to the Instructor.

COURSE INFORMATION

Course Description: This course introduces the theory and applications of random processes needed in various disciplines such as mathematical biology, finance, and engineering. Topics include discrete and continuous Markov chains, Poisson processes, as well as topics selected from Brownian motion, renewal theory, and simulation. Effective From: Spring 2009.

Number of Credits: 3

Prerequisites: Introductory Probability (Math 244 or Math 333), Linear Algebra (Math 337), and familiarity with basic ordinary differential equations.

Course-Section and Instructors:

Course-Section	Instructor
Math 477-102	Professor D. Horntrop

Office Hours for All Math Instructors: Spring 2025 Office Hours and Emails

Required Textbook:

Title	*Introduction to Probability Models*
Author	Ross
Edition	12th
Publisher	Academic Press
ISBN #	9780128143469

Additional References	S. Karlin and H. Taylor, A First Course in Stochastic Processes, contains a more theoretical treatment of many of the topics of this course. P. Hoel, S. Port, and C. Stone, Introduction to Stochastic Processes, is a classical introduction to stochastic processes. H. Taylor and S. Karlin, An Introduction to Stochastic Modeling, is similar in breadth and depth as our textbook.

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Monday, April 7, 2025**. It will be strictly enforced.

COURSE GOALS

Course Objectives

The focus of the course is on concepts and methods of stochastic processes for discrete- and continuous-time Markov chains, homogeneous and nonhomogeneous Poisson processes, and Brownian motion and related processes.

Course Outcomes

Students will understand and be able to use the following:

- Conditioning in probability and statistics
- Homogeneous and non-homogeneous Poisson processes
- Discrete and continuous Markov chains
- Brownian motion

Course Assessment: Will be based on regular homework, one midterm exam, and one final exam.

POLICIES

DMS Course Policies: All DMS students must familiarize themselves with, and adhere to, the Department of Mathematical Sciences Course Policies, in addition to official university-wide policies. DMS takes these policies very seriously and enforces them strictly.

Grading Policy: The final grade in this course will be determined as follows:

Homework and Quizzes	30%
Midterm Exam	35%
Final Exam	35%

Attendance Policy: Attendance at all classes will be recorded and is **mandatory**. Please make sure you read and fully understand the Math Department's Attendance Policy. This policy will be strictly enforced. If you know in advance that you will be absent from class for a legitimate reason, please tell me prior to your absence so that appropriate arrangements (if any) can be made. Tardiness to class is very disruptive of the classroom environment and should be avoided.

Religious Observance: NJIT is committed to supporting students observing religious holidays. Students must notify their instructors in writing of any conflicts between course requirements and religious observances, by the end of the second week of classes and no later than two weeks before the anticipated absence.

Homework: Homework assignments/projects will be given frequently. Each assignment must be turned in at the beginning of class. Late assignments are NOT accepted. Your work must be shown in order to receive credit. You should read the relevant sections of the textbook prior to class.

Quizzes: From time to time, quizzes may be given. Make up quizzes are NOT given.

Grading: The midterm examination will represent 35% of your grade. The final examination will be worth 35% of your grade. The remaining 30% of your grade will be determined by your homework and quizzes; in calculating this quantity, I will drop your one lowest homework or quiz score from throughout the semester.

Exams: There will be a midterm examination and a final examination. The midterm examination will occur before the "drop" deadline. The final examination date, time, and location will be determined by the university.

Midterm Exam	TBA
Final Exam Period	May 10 - May 16, 2025

The final exam will test your knowledge of all the course material taught in the entire course. Make sure you read and fully understand the Math Department's Examination Policy. This policy will be strictly enforced.

Makeup Exam Policy: There will be **NO MAKE-UP QUIZZES OR EXAMS** during the semester. In the event an exam is not taken under rare circumstances where the student has a legitimate reason for missing the exam, the student should contact the Dean of Students office and present written verifiable proof of the reason for missing the exam, e.g., a doctor's note, police report, court notice, etc. clearly stating the date AND time of the mitigating problem. The student must also notify the Math Department Office/Instructor that the exam will be missed.

Cellular Phones: All cellular phones and other electronic devices must be switched off during all class times.

ADDITIONAL RESOURCES

Math Tutoring Center: Located in the Central King Building, Lower Level, Rm. G11 (See: Spring 2025 Hours)

Further Assistance: For further questions, students should contact their instructor. All instructors have regular office hours during the week. These office hours are listed on the Math Department's webpage for Instructor Office Hours and Emails.

Accommodation of Disabilities: The Office of Accessibility Resources and Services (OARS) offers long term and temporary accommodations for undergraduate, graduate and visiting students at NJIT.

If you are in need of accommodations due to a disability please If you need an accommodation due to a disability please contact the Office of Accessibility Resources and Services at oars@njit.edu. The office is located in Kupfrian Hall, Room 201. A Letter of Accommodation Eligibility from the Office of Accessibility Resources and Services office authorizing your accommodations will be required.

For further information regarding self identification, the submission of medical documentation and additional support services provided please visit the Office of Accessibility Resources and Services (OARS) website at:

https://www.njit.edu/accessibility/

Important Dates (See: Spring 2025 Academic Calendar, Registrar)

Date	Day	Event
January 21, 2025	Tuesday	First Day of Classes
January 27, 2025	Monday	Last Day to Add/Drop Classes
March 16, 2025	Sunday	Spring Recess Begins
March 22, 2025	Saturday	Spring Recess Ends
April 3, 2025	Thursday	Wellness day
April 7, 2025	Monday	Last Day to Withdraw
April 18, 2025	Friday	Good Friday - No Classes
April 20, 2025	Sunday	Easter Sunday - No Classes Scheduled
May 6, 2025	Tuesday	Thursday Classes Meet
May 7, 2025	Wednesday	Friday Classes Meet
May 7, 2025	Wednesday	Last Day of Classes
May 8, 2025	Thursday	Reading Day 1
May 9, 2025	Friday	Reading Day 2
May 10 - May 16, 2025	Friday to Thursday	Final Exam Period

Course Outline

Subject Topic and Homework (HW) Assignment
Review of basic probability, common discrete and continuous distributions, moment generating functions, conditional probability
Discrete-time Markov chains, Chapman-Kolmogorov equations, classification of states, limiting probabilities, mean time in transient states, applications
Exponential distribution, Poisson processes.
Continuous-time Markov chains, birth and death processes, transition probabilities, time reversibility
Brownian motion, Gaussian processes, white noise, pricing stock options