

Fall 2019

MATH 691-101: Stochastic Processes with Applications

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MATH 691: Stochastic Processes with Applications

Fall 2019 Graduate 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 of 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 provides an introduction to the use of mathematical techniques in stochastic processes. We emphasize practical problem solving techniques without going into great mathematical detail. We will look at some applications in biology and finance.

Number of Credits: 3

Prerequisites: **MATH 662** is recommended, but not required.

Course-Section and Instructors

Course-Section	Instructor
Math 691-101	Professor J.MacLaurin

Office Hours for All Math Instructors: [Fall 2019 Office Hours and Emails](#)

Required Textbooks:

Title	<i>Handbook of Stochastic Methods</i>
Author	Crispin Gardiner
Edition	---
Publisher	Springer
ISBN #	978-3540707127
Additional Textbook	<i>Stochastic Processes. Theory for Applications</i> - Gallagher.

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Monday, November 11, 2019**. It will be strictly enforced.

COURSE GOALS

Course Objectives

- Be able to understand and analyze stochastic equations, without going into abstract mathematics.
- Be able to construct stochastic models of real-world phenomena.

Course Outcomes

- Students have improved problem-solving skills.
- Students have a broad understanding of how to construct a stochastic model.
- Students have an understanding of fundamental techniques for solving stochastic problems.

Course Assessment:

The assessment of objectives is achieved through homework, exams, and weekly quizzes.

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	30%
Quiz	10%
Midterm Exam	20%
Final Exam	40%

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.

Exams: There will be one midterm exam held in class during the semester:

Midterm Exam	October 17, 2019
Final Exam Period	December 14 - 20, 2019

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: To properly report your absence from a midterm or final exam, please review and follow the required steps under the DMS Examination Policy found here:

- http://math.njit.edu/students/policies_exam.php

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

ADDITIONAL RESOURCES

Accommodation of Disabilities: Disability Support Services (DSS) 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 contact Chantonette Lyles, Associate Director of Disability Support Services at **973-596-5417** or via email at lyles@njit.edu. The office is located in Fenster Hall, Room 260. A Letter of Accommodation Eligibility from the Disability Support 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 Disability Support Services (DSS) website at:

- <https://www.njit.edu/studentsuccess/accessibility/>

Important Dates (See: [Fall 2019 Academic Calendar](#), Registrar)

Date	Day	Event
September 3, 2019	T	First Day of Classes
September 13, 2019	F	Last Day to Add/Drop Classes
November 11, 2019	M	Last Day to Withdraw
November 26, 2019	T	Thursday Classes Meet
November 27, 2019	W	Friday Classes Meet
November 28-29, 2019	R-F	Thanksgiving Recess
December 11, 2019	W	Last Day of Classes
December 12, 13 2019	R & F	Reading Days
December 14-20, 2019	F - R	Final Exam Period

Course Outline

Weeks	Dates	Reading	Topic
1	9/5	Chapter 2	Course Overview. Probability Fundamentals. Chebyshev Inequality. Borel Cantelli Lemma.
2	9/12	Chapter 2	Law of Large Numbers. Gaussian Distribution. Central Limit Theorem.
3	9/19	Handout	Discrete-Time Markov Processes
4	9/26	Chapter 3	Continuous-Time Jump Markov Processes. Kurtz's Representation Formula. Brownian Motion.
5	10/3	Chapter 4	Stochastic Integrals. Continuous Time Markov Processes
6	10/10		Review
7	10/17		MIDTERM EXAM I
8	10/24	Chapter 4	Stochastic Differential Equations.
9	10/31	Chapter 5	Forward / Backward Fokker-Planck Equations
10	11/7	Chapter 6/7	Approximation of Jump-Markov Processes by SDE Diffusion Processes. Kurtz' Theorems.
11	11/14	Chapter 9	Martingale Inequalities. Kramer's Theorem.
12	11/21	Handout	Large Deviations of Stochastic Processes.
13	11/26	Handout	Applications in Finance / Biology
14	11/28		THANKSGIVING. No Class
	12/5		Review
	TBA		Final Exam
