

MATH 691 Introduction to Stochastic Processes

Spring 2022 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.

Please be sure you read and fully understand our [DMS Online Exam Policy](#).

COURSE INFORMATION

Course Description: This course provides an introduction to stochastic processes. It starts by overviewing probability theory, then covers finite-state Markov chains, Poisson Processes, Brownian Motion and stochastic differential equations. We will also look at the theory of martingales, and the ergodicity of Markov chains. Effective From: Spring 2022.

Number of Credits: 3

Prerequisites: [MATH 662](#)

Course-Section and Instructors:

Course-Section	Instructor
Math 691-002	Professor J. MacLaurin

Office Hours for All Math Instructors: [Spring 2022 Office Hours and Emails](#)

Required Textbook:

Title	<i>Introduction to Stochastic Processes</i>
Author	Lawler
Edition	2nd
Publisher	Chapman & Hall / SRC
ISBN #	978-1584886518

University-wide Withdrawal Date: The last day to withdraw with a W is **Monday, April 4, 2022**. It will be strictly enforced.

COURSE GOALS

Course Objectives

- Be able to understand the basics of probability theory.
- Be able analyze stochastic processes.

Course Outcomes

- Students have improved geometrical thinking and qualitative problem-solving skills.
- Students have a greater understanding of mathematical modeling as a means of unifying related concepts.
- Students are prepared for further study in mathematics and biology.

Course Assessment: The assessment of objectives is achieved through homework, exams, and a final project.

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	25%
Quiz and Attendance	15%
Midterm Exam I	20%
Midterm Exam I	20%
Final Project	20%

Your final letter grade will be based on the following tentative curve.

A	90 - 100	C	70 - 74
B+	85 - 89	D	60 - 69
B	80 - 84	F	0 - 59
C+	75 - 79		

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](#).

Quiz Policy: There will be a quiz roughly every second Friday. Some of the quizzes will be written, and some will be online.

Project: The final project will include an oral presentation made during the final exam period.

Exams: There will be two midterm exams held in class during the semester. Exams are held on the following days:

Midterm Exam I	March 11, 2022
Midterm Exam I	April 12, 2022

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

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**. I am also happy to schedule online meetings over Webex: my personal room is <https://njit.webex.com/meet/maclaurinjit.edu>

I can also consult you at different times: just send me an email to organize a meeting.

Additional Textbooks: Other textbooks include 'Essentials of Stochastic Processes' Third Edition, by R. Durrett. And 'Stochastic Processes' by Gallager, Cambridge University Press.

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

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 contact Scott Janz, Associate Director of Disability Support Services at 973-596-5417 or via email at scott.p.janz@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/studentsuccess/accessibility/>

Important Dates (See: **Spring 2022 Academic Calendar, Registrar**)

Date	Day	Event
January 18, 2022	Tuesday	First Day of Classes

January 22, 2022	Saturday	Saturday Classes Begin
January 24, 2022	Monday	Last Day to Add/Drop Classes
March 14, 2022	Monday	Spring Recess Begins
March 19, 2022	Saturday	Spring Recess Ends
April 4, 2022	Monday	Last Day to Withdraw
April 15, 2022	Friday	Good Friday - No Classes
April 17, 2022	Sunday	Easter Sunday - No Classes
May 3, 2022	Tuesday	Friday Classes Meet
May 3, 2022	Tuesday	Last Day of Classes
May 4 - May 5, 2022	Wednesday and Thursday	Reading Days
May 6 - May 12, 2022	Friday to Thursday	Final Exam Period

Course Outline

Week	Dates	Reading	Topic
1	1/18	Gallager Chapter 1.	Course Overview. Introduction to Probability Theory
			Introduction to Probability Theory
2	1/25	Chapter 1.	Finite Markov Chains
	1/27		
3	2/1	2	Countable Markov Chains.
	2/3		
4	2/8	3	Continuous time Markov Chains
	2/10		
5	2/15	4.1, 5	Optimal Stopping Theorem and Martingales
	2/17		
6	2/22	5 Continued	
	2/24		
7	3/1	8	Brownian Motion
	3/3		
8	3/8		Review
	3/10		MIDTERM EXAM I

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9	3/22	9	Stochastic Integration
	3/24		
10	3/29	Handout.	Stochastic Differential Equations
	3/31		
11	4/5	Handout	Special Topics (maybe Large Deviations, Girsanov's Theorem).
	4/7		
12	4/12		Review
	4/14		MIDTERM EXAM II
13	4/19		FINAL PROJECT
	4/21		
14	4/26		FINAL PROJECT
	4/28		
15	5/3		FINAL PROJECT

*Updated by Professor J. MacLaurin - 1/13/2022
Department of Mathematical Sciences Course Syllabus, Spring 2022*