Course Title: ESI 6546 Stochastic Modeling and Analysis

Class Periods and Location: Mondays and Wednesdays (9:35 AM – 10:25 AM) Weil Hall 0279, & Thursdays (11:45 AM-12:35 PM), Weil Hall 0238
Academic Term: Spring 2026

Instructor: Dr. Fatemeh Nosrat
Email: f.nosrat@ufl.edu
Department: Industrial and Systems Engineering
Grading Scheme: Letter Grade, 3 credits

Office Hour: Wednesdays, 10:40 AM -11:40 AM, Weil Hall 417

Course Description
This course introduces fundamental concepts in Stochastic Process. Several main topics include Applied Probability Review, Poisson Process, Renewal Processes, Markov Chains, and Continuous-Time
Markov Chains.

Audience and Curriculum Placement

- **Audience:** *PhD students in Industrial and Systems Engineering, engineering students who need to develop expertise in stochastic modeling and analysis, and students who are majoring or minoring in AI, Applied Mathematics, Computer Science, Data Science, or related programs. Graduate students in medicine and healthcare analytics may also benefit if auditing.*
- **Curriculum Placement:** This is a required core course for the PhD program and is permanently listed in the graduate curriculum. IIt is not a special topics course, and it serves as a foundation for advanced coursework and research in stochastic modeling and AI applications.

Course Objectives

By the end of the course, students will be able to:

1. **Apply** stochastic modeling techniques—including Applied Probability, Poisson and Renewal Processes, Markov Chains, Continuous-Time Markov Chains, and Markov Decision Processes to analyze and interpret real-world datasets such as UF Health IDR.
2. **Analyze** complex stochastic systems by exploring uncertainty, dependencies, and structures in data-driven and AI-integrated stochastic models, and assess their implications for clinical decision-making.
3. **Evaluate** modeling assumptions, methodologies, and AI approaches to improve predictive accuracy, policy design, and decision-making under uncertainty.

4. **Create** innovative stochastic models and AI-integrated solutions through team-based projects, producing reports and presentations that may serve as the basis for academic publications and interdisciplinary research collaborations.

Reference Books

- Ross, S. M., Stochastic Process (2nd Edition), Wiley, 1996
- Ross, S. M., Introduction to Probability Models, 10th edition, Elsevier, 2007
- Kulkarni, V. G., Modeling and Analysis of Stochastic Systems, Chapman & Hall, 2009

Attendance Policy, Class Expectations, and Make-Up Policy Students

Attendance Policy, Class Expectations and Make-Up Policy
Attendance is required and will be collected via iClicker in class. You may have one unexcused absence without penalty. Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

In the event a student is unable to attend an exam because of a valid reason (UF-imposed curriculum requirement, religious holiday, jury duty, or a family/medical emergency), a make-up exam will be organized as soon as feasible for both the instructor and the student, provided that the instructor was given advanced notice of the situation. Students who miss an exam without advanced notice to the instructor (or without a valid reason for which such notice could not be given) will receive a F for the exam and will not be given a make-up exam. Make-up will not be given for homework. The instructor might extend the deadline or forgo homework for a student who has a valid reason (see above), provided that the instructor is given advanced notice.

Course Schedule (Tentative)

- **Weeks 1–3:** Applied Probability Review
- **Weeks 4–5:** Poisson Processes
- **Weeks 6–7:** Renewal Processes; Initial modeling.
- **Weeks 8–9:** Discrete-Time Markov Chains; transition matrices, steady-state and transient analysis.
- **Weeks 10–11:** Continuous-Time Markov Chains
- **Weeks 12–13:** Markov Decision Processes; policy formulation, value iteration, and data-driven estimation of transition probabilities.
- **Week 14-15:** Conceptual discussion of AI integration to enhance stochastic modeling and prediction, and introduction to reinforcement learning;

Prerequisite and Content: The prerequisite for this course is undergraduate probability. We will cover Chapters 1–6 and Chapter 8 from the Ross text.

Homework Assignments Four to Five homework assignments will be given during the course of the semester. You will need to answer and turn in all problems. All homework will count equally towards your homework average grade.

Workload and grades: Grades will be based upon five homework assignments, a midterm exam, a final exam, and final team-based project — percentages are shown below. Students may consult in groups of two or three on homework; however, every student must write up his/her own assignments. Do not work in a group larger than three people. If you do decide to work together with others, you may not simply copy someone else's work — you must be able to provide a detailed explanation of anything you write. You will need to answer and turn in all problems. All homework will count equally towards your homework average grade.

Grading Policy

Your class grade will be the better one of the following two schemes: 1. [90-100] A, [85-90) A-, [80-85) B+, [75-80) B, [70-75) B-, [65,70) C+, [60,65) C, [0,60) F 2. Top 40% A or A-, 40%-70% B+, others B or below In order to graduate, graduate students must have an overall GPA and an upper-division GPA of 3.0 or better (B or better). Note: a B- average is equivalent to a GPA of 2.67, and therefore, it does not satisfy this graduation requirement. Students Requiring Accommodations Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting a

- Homework 25%
- Midterm Exam (Date to be determined) 25%
- Final Exam 25%
- Project 25%

Course Evaluation

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu/evals. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/.