MATH3425 Stochastic Modeling

Course Outline- 2025-2026 Spring

1. Instructor(s)

Name: Kani Chen

Contact Details: Office: Room 3426; Phone number 23587425; Email: makchen@ust.hk

2. Teaching Assistant(s)

Name: Ricky Chan

Contact Details:N/A

3. Meeting Time and Venue

Lectures:

Date/Time: Monday (12:00-13:50) and Wednesday (12:00-13:20)

Venue: Classroom 2404

Tutorials:

Date/Time: N/A

Venue: N/A

4. Course Description

Credit Points: 3

Pre-requisite: MATH2421

Exclusion: NIL

Brief Information/synopsis:

This course covers a wide scope of topics in stochastic processes, including Markov chains, Poisson processes, birth and death processes, renewal processes and Brownian motion. Students will investigate the fundamentals of these topics and become able to apply them to solve real problems in science and engineering.

5. Intended Learning Outcomes

Upon successful completion of this course, students should be able to:

No.	ILOs
1	Recognize and use appropriately important technical terms and definitions.
2	Identify and construct Markov processes and apply the limit laws.
3	Learn to apply the renewal processes and renewal functions to solve real problems.
4	Know the basic behavior of continuous time Markov processes including Poisson processes and law of rare events.

6. Assessment Scheme

a. Examination duration: 2 hrs

b. Percentage of coursework, examination, etc.:

Assessment	Assessing Course ILOs
20% by coursework	1, 2, 3
30% by midterm exam	1, 2,
50% by final exam	1, 2, 3, 4

c. The grading is assigned based on students' performance in assessment tasks/activities.

7. Student Learning Resources

Recommended Reading:

Text(s):

M. A. Pinsky and S. Karlin, "An Introduction to Stochastic Modeling", Academic Press.

8. Teaching and Learning Activities

Scheduled activities: 2 hrs 40 minutes (lecture)

9. Course Schedule

Keyword Syllabus:

- Fundamentals of probability theory: random variables, probability, independence and conditional probabilities, conditional expectations.
- Markov chains: definitions, transition probability matrices, first step analysis; branching processes and generating functions.
- Markov chains: regular transition probability matrices, limit theorems, examples.
- Poisson Processes: Poisson distribution and the Poisson process, the law of rare events,
- Continuous time Markov chains: birth-death processes.
- The renewal phenomena: definitions, examples, Poisson process viewed as renewal process, asymptotic theory.
- Introduction to Brownian motion, path properties and Ito integral.