浙江大學

MATH527

Stochastic Processes and Applications

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Instructor Contact Details

Lecturer-in-charge: Minzhi Zhao

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Consultation Time: Book appointment by sending email to: wlwyxy_29@zju.edu.cn

Teaching Times, Modes and Locations

Course Duration: 11 Jan 2026 to 30 Jan 2026
Modes: Face-to-face
Location: Huajiachi Campus, Zhejiang University via face-to-face

Academic Level

Undergraduate

Credit Points:

The course is worth 6 units of credit point.

Credit Hours

The number of credit hours of this course equals to the credits of a standard semester- long course.

Contact Hours

The course contains a total of 53 contact hours, which consists of orientation, lectures, seminars, quiz, discussion, research, case study, small tests, assignments, on-site field trip(s), in-class and after-class activities, revision, self-study, and final exam. Students will receive an official transcript which is issued by Zhejiang University when completing this course.

Enrolment Requirements

Eligibility requires enrollment in an overseas university as an undergraduate or postgraduate student, proficiency in English, and pre-approval from the student's home institution.

Course Description:

This unit introduces fundamental concepts and methods in the study of stochastic processes, which are used to model random phenomena evolving over time. Topics include discrete-time Markov chains, random walks, branching processes, Poisson processes, continuous-time Markov chains, basic queuing models, Brownian motion, and martingales. The focus is on developing a solid understanding of mathematical structures and using them to model and analyze real-world systems in areas such as finance, biology, physics, and computer science. This course provides essential preparation for more advanced studies in probability, statistics, and applied mathematics.

Prerequisite:

N/A

Learning Resources

- R.P. Dobrow, Introduction to Stochastic Processes with R, 2nd Edition, Wiley, 2021.

Learning Objectives

By the end of this course, you should be able to:

- Explain key concepts in probability theory and stochastic processes, including Markov chains, Poisson processes, Brownian motion, and martingales.
- Construct and analyze discrete- and continuous-time Markov chains from real-world problem settings and apply relevant limit theorems.
- Communicate mathematical reasoning clearly through logical, well-structured proofs and problem solutions.
- Model and solve practical problems involving Poisson processes, queues, and extinction probabilities.

Course Delivery:

- Face-to-face Lecture mode includes lectures, seminars, quiz, discussion, research, case study, small tests, assignments, on-site field trip(s), in-class and after-class activities, revision, and final exam.

The following course will be taught in English. There will also be guest speakers and optional field trips available for students who would like to enhance their learning experience. All courses and other sessions will be run during weekdays.

Topics and Course Schedule:

WK	Topic	Activities
1	Review of probability tools including moment generating functions, joint distributions, and random sums; introduction to stochastic processes.	Lecture; Tutorial
1	Fundamentals of discrete-time Markov chains, transition probabilities, and the Chapman-Kolmogorov equations.	Lecture; Tutorial
1	The classification of Markov chain states: periodicity, recurrence, and transience.	Lecture; Tutorial
1	Stationary and limiting distributions; absorption probabilities and expected return times.	Lecture; Tutorial
1	Random walks and branching processes, with focus on extinction probability and Gambler's ruin.	Lecture; Tutorial
2	Further analysis of branching process.	Lecture; Tutorial
2	In-class Test	Closed book
2	Overview of Poisson and exponential distributions	Lecture; Tutorial
2	Introduction to Poisson processes, interarrival and waiting times, and arrival time distributions.	Lecture; Tutorial
2	Splitting, merging, and extensions of the Poisson process, including nonhomogeneous and compound versions.	Lecture; Tutorial
3	Continuous-time Markov chains: generator matrices, embedded chains, and Kolmogorov equations.	Lecture; Tutorial
3	Basic queuing models including the M/M/1 and M/M/k queues with and without capacity limits.	Lecture; Tutorial
3	Introduction to Brownian motion and martingales; review of Weeks 7–11 content.	Lecture; Tutorial
3	Final review, discussion of assignments, and exam preparation.	Lecture; Tutorial
3	Revision	Tutorial
	Final exam	Closed book

Assessments:

Class participation	15%
In-class Test	15%
Assignments	20%
Final exam	50%

Grade Descriptors:

HD	High Distinction	85-100
D	Distinction	75-84
Cr	Credit	65-74
P	Pass	50-64
F	Fail	0-49

High Distinction 85-100

- Treatment of material evidences an advanced synthesis of ideas Demonstration of initiative, complex understanding, and analysis.
- Work is well-written and stylistically sophisticated, including appropriate referencing, clarity, and some creativity where appropriate.
- All criteria addressed to a high level.

Distinction 75-84

- Treatment of material evidences an advanced understanding of ideas Demonstration of initiative, complex understanding and analysis Work is well-written and stylistically strong.
- All criteria addressed strongly.

Credit 65-74

- Treatment of material displays a good understanding of ideas
- Work is well-written and stylistically sound, with a minimum of syntactical errors.
- All criteria addressed clearly.

Pass 50-64

- Treatment of material indicates a satisfactory understanding of ideas Work is adequately written, with some syntactical errors.
- Most criteria addressed adequately.

Fail 0-49

- Treatment of ideas indicates an inadequate understanding of ideas Written style inappropriate to task, major problems with expression.
- Most criteria not clearly or adequately addressed.

Academic Integrity

Students are expected to uphold the university's academic honesty principles which are an integral part of the university's core values and principles. If a student fails to observe the acceptable standards of academic honesty, they could attract penalties and even disqualification from the course in more serious circumstances. Students are responsible for knowing and observing accepted principles of research, writing and any other task which they are required to complete.

Academic dishonesty or cheating includes acts of plagiarism, misrepresentation, fabrication, failure to reference materials used properly and forgery. These may include, but are not limited to: claiming the work of others as your own, deliberately applying false and inaccurate information, copying the work of others in part or whole, allowing others in the course to copy your work in part or whole, failing to appropriately acknowledge the work of other scholars/authors through acceptable referencing standards, purchasing papers or writing papers for other students and submitting the same paper twice for the same subject.

This Academic Integrity policy applies to all students of the Zhejiang University in all programs of study, including non-graduating students. It is to reinforce the University's commitment to maintain integrity and honesty in all academic activities of the University community.

Policy

The foundation of good academic work is honesty. Maintaining academic integrity upholds the standards of the University. The responsibility for maintaining integrity in all the activities of the academic community lies with the students as well as the faculty and the University. Everyone in this community must work together to ensure that the values of truth, trust and justice are upheld.

Academic dishonesty affects the University's reputation and devalues the degrees offered. The University will impose serious penalties on students who are found to have violated this policy. The following penalties may be imposed:

- ✓ Expulsion
- ✓ Suspension
- ✓ Zero mark /fail grade
- ✓ Marking down
- ✓ Re-doing/re-submitting of assignments or reports, and
- ✓ Verbal or written warning.