

# ACTS:7730 Advanced Topics in Actuarial Science/Financial Mathematics - Stochastic Analysis for Insurance, Finance, and Risk Management

## Instructor: Dr. Qihe Tang

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Course Schedule: 12:30 – 1:50 P.M., Tuesday and Thursday, E120 AJB

Office Hours: 10:30–11:30 A.M., Monday, Wednesday and Friday, or by appointment

## DEO: Dr. Joseph B. Lang

Department of Statistics and Actuarial Science

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## Course Description

In this topics course we shall learn basics in stochastic analysis in the context of insurance, finance, and risk management. Intended topics include:

- Brownian Motion Calculus
- Stochastic Differential Equations
- Diffusion Processes
- Martingales
- Calculus for Semimartingales
- Pure Jump Processes
- Change of Probability Measure
- Applications in Insurance, Finance, and Risk Management

The course is designed for graduate students or high-level undergraduate students with a good background in mathematics, probability, and statistics. It will stress the fundamentals and explore topics at a somewhat technical level. Nevertheless, the course will be made as self-contained as possible so that students who are strong in mathematics but have not taken advanced courses in probability and statistics can still follow.

An important feature of this course is that, while studying the intended topics, we shall look at some interesting research problems, either theoretical or applied, in the interdisciplinary area of statistics, insurance, and finance. The course is particularly suitable for those who desire to pursue a research topic in actuarial science and financial mathematics.

## Main References

- Klebaner, F. C. *Introduction to Stochastic Calculus with Applications* (3rd edition). Imperial College Press, London, 2012. [PDF of the 2nd edition available on internet]

- Shreve, S. E. *Stochastic Calculus for Finance I - the Binomial Asset Pricing Model*. Springer-Verlag, New York, 2004. [PDF available on internet]
- Shreve, S. E. *Stochastic Calculus for Finance II - Continuous-time Models*. Springer-Verlag, New York, 2004. [PDF available on internet]
- Øksendal, B. *Stochastic Differential Equations* (6th edition). Universitext. Springer-Verlag, Berlin, 2003. [PDF available on internet]
- Protter, P. E. *Stochastic Integration and Differential Equations* (2nd edition). Springer-Verlag, Berlin, 2005. [PDF available on internet]
- Cont, R.; Tankov, P. *Financial Modelling with Jump Processes*. Chapman & Hall/CRC, Boca Raton, FL, 2004. [PDF available on internet]
- Karatzas, I.; Shreve, S. E. *Brownian Motion and Stochastic Calculus* (2nd edition). Springer-Verlag, New York, 1991.
- A list of papers and book chapters selected from the recent literature of insurance, finance and risk management.

## Evaluation System

Each student has the option to choose an A/B/C/D grade or an S/U grade, but needs to inform me of the option by the end of September. For those who choose an A/B/C/D grade, the grades will be given based on the following:

- Three homework assignments: 60%  
You are *not* allowed to discuss homework problems with other students. *What you hand in must ultimately be your own work.*
- One final project: 30%  
At the beginning of November, a list of papers and book chapters selected from the recent literature of insurance, finance and risk management will be released. Each student will be asked to pick up one from the list, to study it and make a 30-minute presentation.
- Class attendance and engagement in discussions: 10%

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For the CLAS (College of Liberal Arts and Sciences) policies and procedures, please click the link: <http://clas.uiowa.edu/faculty/teaching-policies-resources-syllabus-insert>