
SURANAREE UNIVERSITY OF TECHNOLOGY

Ph.D. in Applied Mathematics with Specialization in the Mathematical Finance and Actuarial Mathematics

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The School of Mathematics at Suranaree University of Technology offers a new track of its Ph.D. in Applied Mathematics with specialization in the mathematical finance and actuarial mathematics. The instructional component of the program consists of eight courses, which can be taken over four semesters of full-time course work. Four of these are core courses. They are required to ensure students preparedness to begin research in the mathematics of finance. Students generally take the core courses in their first two semesters of residence. These core courses can be waived for students who have passed equivalent courses at other universities. Students are also required by the Mathematics Department to pass a Preliminary Examination, covering topics in the core courses. The core courses are the following:

- **Real Analysis (4 credits).**
- **Functional Analysis (4 credits).**
- **Stochastic analysis (4 credits).**
- **Mathematics of Financial Derivatives (4 credits).**

The remaining four courses consist of Ph.D. seminars (2 credits) and three other courses to be selected from the following:

- **Stochastic Optimal Control and Investment (4 credits).**
- **Computational Method for Finance (4 credits).**
- **Continuous Time Finance (4 credits).**
- **Financial Time Series (4 credits).**
- **Risk Management (4 credits).**
- **Non-life Insurance Mathematics (4 credits).**
- **Life Insurance Mathematics (4 credits).**
- **Loss Reserving Method in Insurance (4 credits).**
- **Interest Rate Models (4 credits).**
- **The Credibility Theory (4 credits).**

The program is suitable for bright students with degrees in mathematics, statistics, economics, and physical or engineering sciences, who wish to pursue a career in academic research or finance industry. Since this program is in collaboration with Brunel University, students will have a chance to do research in London for at least four months. Moreover, SUT will seek internships for students in major companies.

Director of the Program: Professor Dr. Prasart Seubka
The following faculty in the Department of Mathematics, all of whom have research interest in finance, are affiliated with the Ph.D. program in the mathematical finance.
Professor Dr. Bhusana Premanoch
(Financial forecast)
Professor Dr. Pairote Sattayatham
(Nonlife insurance and real option analysis),
Assoc. Prof. Dr. Prapasri Aswakun, Chair, School of Mathematics
(Computational Finance)
Assist. Professor Dr. Eckart Schulz

(Stochastic Calculus)

Current research interests of faculty include estimation of market parameters, modeling of risk analysis and extremal events.

Application Procedure
Application forms are available and all application materials can be downloaded from the university web site http://cia.sut.ac.th/web/newwebCIA/Graduate_Admissions.htm#form (English) and http://www.sut.ac.th/ces/admission/Graduate/From.html (Thai).
Examination guideline (Thai).
Alternatively, you may write to:
Registration Division, Office of Admissions,
Suranaree University of Technology,
111 Universiy Avenue, Nakhon Ratchasima, 30000, Thailand.
Telephone request: 044 224315 or 089 5849868
Email correspondence: pairote@sut.ac.th

Prerequisites
Applicants should have a very good working knowledge of

- **Statistical Method.**
- **Partial differential equations.**
- **Probability and random process.**
- **Mathematical statistics.**
- **Numerical Analysis.**

Applicants should also have facility with a programming language such as C or MATLAB

- **Students lacking these prerequisites will be advised to take the advanced undergraduate courses at the Department of Mathematics at**

Suranaree University of Technology.

- **Course description**

103642 Computational Methods for Finance
Prerequisites : Consent of the School of Mathematics
Computational techniques for solving mathematical problems arising in finance, Monte Carlo methods, randomness and pseudo random numbers, simulation of random variables, simulation of continuous time process, simulation of model with jumps, option pricing by simulation, variance reduction technique, PDEs and finite difference method, free boundary problems, solution methods for American options, multi-asset problems and exotic options.

103741 Mathematics of Financial Derivatives
Prerequisites : Consent of the School of Mathematics
An introduction to arbitrage-based pricing of derivative securities, by including the topics on arbitrage, risk-neutral valuation, the log-normal hypothesis, binomial trees, the Black-Scholes formula and applications, the Black-Scholes partial differential equation, American options, one-factor interest rate models, swaps, caps, floors, and other interest-based derivatives, credit, risk and credit derivatives.

103742 Stochastic Optimal Control and Investment
Prerequisite : 103741 or consent of the School of Mathematics
An introduction to aspects of stochastic optimal control most relevant to finance and investment, discrete time models of investment, decisions under uncertainty, continuous time models involving the Brownian motion process and the Ito-process, dynamic programming, Bellmann's principle for optimality and its consequences, and optimal stopping. Investment opportunities and investment timing: basic models and solutions, sequential investment, learning curve and optimal production decisions.

103743 Continuous Models in Finance
Prerequisites : 103741 or consent of the School of Mathematics

A second course in arbitrage-based pricing of derivative securities. The Black-Scholes model and its generalizations: equivalent martingale measures, the martingale representation theorem, the market price of risk, applications including change of numeraire and the analysis of quantos. Interest rate models: the Heath-Jarrow-Morton approach and its relation to short-rate models. The volatility smile/skew and approaches to accounting for it: underlyings with jumps, local volatility models, and stochastic volatility models.

103744 Financial Time Series
Prerequisite: Consent of the School of Mathematics
Introduction to S-Plus and exploratory data analysis, continuous time processes, time series analysis, multivariate data analysis, and elements of the extreme value theory.

103745 Risk Management
Prerequisite : Consent of the School of Mathematics
This course examines financial risk measurement and management from the perspective of both a risk management department and of a trading desk manager with emphasis on the role of financial mathematics and modeling in quantifying risk. Topics include: Financial risk exposures, risk measurement techniques, risk management techniques, and Monte Carlo simulation to determine headge effectiveness. Extensive use will be made of examples drawn from real trading experience, with a particular emphasis on lessons to be learned from trading diaster

103622 Functional Analysis
Prerequisite: 103662 or consent of the school of mathematics
Review topological spaces, continuous mapping on compact spaces, compactness and total boundness, Arzela theorem, application of Arzela to Peono's theorem, normed space, Banach space, and bounded linear functional, the Han-Banach theorem for normed linear spaces, the L-p spaces, relationship between L-p spaces, approximation by continuous functions, Hilber spaces and some important examples, projection theorem, Bessel inequality, orthonomal basis, basis in L-2 spaces, conjugate in Banach and Hilbert spaces, Riesz representation theorem. second conjugate spaces and weak convergence.

103771 Stochastic Analysis

Prerequisite: 103671 or consent of the school of mathematics
Construction of stochastic processes, martingale and stopping time, Brownian motion, stochastic integration with respect to Brownian motion, the Grisanov theorem, local time of Brownian motion, Markov property of Ito diffusions, stochastic differential equation, and stochastic control.

103621 Measure and Integration
Prerequisite : 103521 and 103522 or consent of the School of Mathematics
The concept of measure spaces, measurable functions, integration of positive functions, Lebesgue's monotone convergence theorem, integration of complex functions, integration as a linear functional, Riesz representation theorem, Borel measure, Lebesgue measure, integration on product spaces, and the Fubini theore.

103771 Non-Life Insurance Mathematics
Prerequisite : Consent of the School of Mathematics
Model of the claim number process, premium calculation principles, pricing methods, the total claim distribution, ruin theory, and the calculation of loss reserves.

103772 Life Insurance Mathematics

Prerequisite : Consent of the School of Mathematics
Basic concept of life insurance: Life Annuities, benefit premiums, benefit reserves. Stochastic models for life insurance mathematics: Markov models, stochastic processes for interest rates and demography, cash flows and reserves, cover capital and Thiele's differential equation, Hattendorff's theorem, and unit-link policies.

103773 Loss Reserving Method in Insurance

Prerequisite : Consent of the School of Mathematics

Loss Reserving is one of the central topics in non-life insurance. Mathematicians need to estimate adequate reserves for all open claims. These claim reserves have a direct influence on most of financial statements such as calculation of premium and solvency margin. In this course, we present various methods to calculate loss reserves such as Stochastic chain ladder method, Bayesian method, Credibility method, Generalized linear model, and Bootstrap Methods.

103774 Interest Rate Models

Prerequisite : Consent of the School of Mathematics

In this course, we discuss some important models in theory of interest rate. Topic includes: Short-rate models, HJM models, LIBOR market models, pricing and hedging, numerical method, model calibration.

103775 The Credibility Theory

Prerequisite : Consent of the School of Mathematics

Topic includes: Introduction to credibility as a branch of Bayesian statistics, Buhlmann-Straub model, treatment of Large claims in credibility, and hierarchical credibility.