MATH 582 – Mathematical Finance II: Continuous Time

Course Description from Bulletin: This course is a continuation of MATH 485/548. It introduces the student to modern continuous time mathematical finance. The major objective of the course is to present main mathematical methodologies and models underlying the area of financial engineering, and, in particular, those that provide a formal analytical basis for valuation and hedging of financial securities. (3-0-3)

Enrollment: Elective for AM and other majors

Textbook(s): Steven E. Shreve, *Stochastic Calculus for Finance II: Continuous--Time Models*, Springer;
Marek Musiela and Marek Rutkowski, *Martingale Methods in Financial Modelling*, 2nd Edition, Springer

Other required material: None

Prerequisites: MATH 485/548; MATH 481/542, or consent of an instructor

Objectives:

1. Students will understand the basic principles of mathematical finance in continuous time such as pricing and hedging, use of self-financing portfolios, the two fundamental theorems of asset pricing. etc.
2. Students will understand the role of risk neutral probability measure and its relation with a chosen numeraire asset.
3. Students will understand the use of stochastic analysis for semimartingales (conditional expectations, filtrations, Ito formula, stopchastic exponent, changes of measure) in mathematical finance.
4. Students will understand application of basic principles of mathematical finance for pricing and hedging of typical financial securities (such as options, futures and forwards).
5. Students will learn the basics of the theory of American type contingent claims, and game type contingent claims in continuous time.

Lecture schedule: 3 50 minute (or 2 75 minute) lectures per week

Course Outline:	Hours
1. Analysis of the Black-Scholes-Merton equation	9
2. Risk--Neutral Pricing and Benchmark Models in Continuous Time	9
3. American and Game Type Derivative Securities	9
4. Change of Numeraire and Foreign Market Derivatives	6
5. Exotic Options	6
6. Volatility Risk	3
7. Modeling with Jump Processes	3

Assessment:		
	Homework	0-10%
	Quizzes/Tests/Projects	45-50%
	Graduate Project	0-10%

Final Exam	45-50%

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