

Ph.D QUALIFYING EXAM CONTENTS

Financial Mathematics Program:

The exam consists of 4 parts described below:

I. Probability Theory:

Probability spaces. Independence. Conditional probability. Product probability spaces. Random variables and their distributions. Distribution functions. Mathematical expectation (Integration with respect to a probability measure). Moments and generating functions. Conditional expectation. Linear estimation. Gaussian vectors. Various convergence concepts. Central Limit Theorem. Laws of large numbers.

Main References:

1. Elements of Probability Theory, Hayri K rezliođlu and Azize Bastiyali Hayfavi, ODTU, 2001
2. Probability and Measure, 3rd Edition Billingsley P.

Other References:

1. Probability , Shiryaev, Albert Nikolaevich., New York: Springer-Verlag, 1996
2. An introduction to probability theory and its applications, Feller, W., New York, John Wiley & Sons 1968 : Volume I, Volume II.

II. Principals of Financial Derivatives:

Derivative and Financial Markets. The Structure of Options Markets. Principles of Option Pricing. Option Pricing Models. Basic Option Strategies. Advanced Option Strategies. The Structure of Forward and Futures Markets. Principles of Spot Pricing. Principles of Forward and Futures Pricing. Futures Hedging Strategies. Advanced Futures Strategies. Options on Futures. Foreign Currency Derivatives. Swaps and Other Interest Rate Agreements.

Main References: Chance, D.M. An Introduction to Derivatives and Risk Management, 5th Edition, Harcourt College Publishers, USA, 2001.

III.Financial Economics:

Expected Utility Theory and Choice under Uncertainty. State Preference Theory. Mean-Variance Portfolio Theory. The Capital Asset Pricing Model (CAPM). Arbitrage Pricing Theory (APT)

Structure of a General Equilibrium Model of a Finite (Agentd, Goods, Horizon). Economy

Features of the Arrow-Debreu Framework. Role of Market Completeness. Risk Neutral Pricing.

Dynamic Portfolio Optimization and Dynamic General Equilibrium. Efficient Capital Markets.

Market Microstructure. Empirics and Puzzles

Main References:

1. Huang, C. and H. Litzenberger (1988): Foundations For Financial Economics, Prentice Hall
2. Ingersoll, J. E. (1987): Theory Of Financial Decision Making, Rowman and Littlefield Publishers
3. Lengwiler, Y. (2004): Microfoundations Of Financial Economics, Princeton University Press
4. Maureen, O. (1997): Market Microstrucutre Theory, Blackwell Publishers

IV. Stochastic Calculus for Finance:

Discrete time models, Martingales and arbitrage opportunities, complete markets, European options, option pricing, stopping times, the Snell envelope, American options. Continuous time models: Brownian motion, stochastic integral with respect to the Brownian motion, the It  Calculus, stochastic differential equations, change of probability,

representation of martingales; pricing and hedging in the Black-Scholes model, American options in the Black-Scholes model; option pricing and partial differential equations; interest rate models; asset models with jumps.

Main References:

1. Introduction to Stochastic Calculus Applied to Finance, D. Lamberton and B.Lapeyre Chapman & Hall, 1996
2. Arbitrage Theory in Continuous Time, T. Björk Oxford University Press, 1998.
3. Elementary Stochastic Calculus With Finance In View, Thomas Mikosch., Singapore ; River Edge, N.J. : World Scientific Publ., 1998

Other References:

1. Stochastic Calculus For Finance, Shreve, Steven E., New York : Springer, 2004 : Volume I, Volume II.
2. [Stochastic Calculus : A Practical Introduction](#) , Durrett, R., Boca Raton : CRC Press, 1996.