**M.S. in Financial Engineering**

Master's degree in Financial Engineering requires the completion of minimum of 10 courses (30 credits), the graduate seminar (non-credit) and the term project (non-credit). Students may select courses, in consultation with their advisors, from the following list of courses. Students must earn at least half of the credits required for the degree from among courses with the "FE" course code designation. Students may choose the remaining credits among courses from other graduate programs with the approval of advisor.

**Course List**

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| FE 501 | Financial Optimization Techniques | (3+0+0) 3 |
| FE 502 | Statistical Modeling | (3+0+0) 3 |
| FE 503 | Numerical & Simulation Techniques in Finance | (3+0+0) 3 |
| FE 504 | Introduction to Stochastic Calculus | (3+0+0) 3 |
| FE 521 | Financial Econometrics | (3+0+0) 3 |
| FE 522 | Financial Economics | (3+0+0) 3 |
| FE 541 | Derivative Securities | (3+0+0) 3 |
| FE 542 | Quantitative Asset Management | (3+0+0) 3 |
| FE 543 | Investment Banking and Brokerage | (3+0+0) 3 |
| FE 544 | Fixed Income Markets | (3+0+0) 3 |
| FE 545 | Corporate Finance and Risk Management | (3+0+0) 3 |
| FE 561 | Foundations of Financial Technology | (3+0+0) 3 |
| FE 581-589 | Special Topics in FE I - IX | (3+0+0) 3 |
| FE 500 | Graduate Seminar | Non-credit |
| FE 580 | Term Project (Dönem Projesi) | Non-credit |

**Course Contents**

**FE 501 Financial Optimization Techniques (3+0+0) 3**

The course introduces optimization concepts intended for coping with financial stochastic processes. The course involves both numerical analysis with commercial solvers and analytical approaches for gaining insights into underlying problems. The course covers three major optimization areas: convex optimization, non-convex optimization and stochastic programming. Conceptual frameworks and techniques are taught through applications and problems in financial engineering and management.

**FE 502 Statistical Modeling (3+0+0) 3**

This course focuses on the art and science of statistical modeling of processes applied to business, finance and economics. These may include models of aggregate economic activity, economic behavior of firm or behavior of financial assets. Topics include statistical inference; maximum likelihood estimation; method of moments; Bayesian estimation; least-squares estimation; robust estimation; kernel estimation; copula estimation; analysis of variance; linear regression models; multiple regression; logistic regression; quantile regression; time series estimation; unit root tests; bootstrapping.

**FE 503 Numerical & Simulation Techniques in Finance (3+0+0) 3**

Advanced numerical techniques for the solution of ordinary, partial and stochastic differential equations are presented. These techniques are analyzed both mathematically and using computer aided software that allows for the solution and the handling of such problems. In addition, the course introduces techniques for Monte Carlo simulation techniques and their use to deal with theoretically complex financial products in a tractable and practical manner. Both self-writing of software as well as using outstanding computer programs routinely used in financial and insurance industries will be used.

**FE 504 Introduction to Stochastic Calculus (3+0+0) 3**

This course covers the economic, statistical, and mathematical foundations of derivatives markets. The course presents the basic discrete-time and continuous-time paradigms used in derivatives finance including an introduction to stochastic processes, stochastic differential equations, Ito's Lemma, and key elements of stochastic calculus. The economic foundations of the Black-Scholes no-arbitrage paradigm are covered including an introduction to Girsanov's theorem and changes of measure, the representation of linear functionals, equivalent martingale measures, risk-neutral valuation, fundamental partial differential equation representations of derivatives prices, market prices of risk, and Feynman-Kac representations of solutions to derivatives prices. The role of market completeness and its implications for the hedging and replication of derivatives will be covered in depth.

**FE 521 Financial Econometrics (3+0+0) 3**  
Introduction to forecasting techniques; univariate and multi-variate time series; volatility dynamics; Box-Jenkins approach and ARIMA models; seasonal ARIMA models; martingales, random walks and non-linearity; stochastic variance models and ARCH processes; practical modelling and forecasting of financial time series; applications of neural networks and genetic algorithms.

**FE 522 Financial Economics (3+0+0) 3**

This course takes the student from the level of microeconomics principles to current theories and topics in financial economics. The course will survey and introduce assetpricing models.. ArrowDebreu and Radner general equilibirium theories are developed and combined with von Neumann-Morgenstern utility theory. Both static and dynamic models are explored. Asset pricing models with and without arbitrage opportunities are discussed. Asset prcing puzzles are investigated. ModiglianiMiller arguments on capital structure are introduced. Binomial option pricing model is developed.

**FE 541 Derivatives Securities (3+0+0)3**This course offers an introduction to derivatives markets. Derivatives are both exchange traded and over-the-counter securities. The derivatives markets are the world's largest and most liquid. This course will focus on the organization and role of put and call option markets, futures and forward markets, and their interrelations. The emphasis will be on arbitrage relations, valuation, and hedging with derivatives. The course will also cover the implementation of derivatives trading strategies, the perspective of corporate securities as derivatives, the functions of derivatives in securities markets, and recent innovations in derivatives markets.

**FE 542 Quantitative Asset Management (3+0+0) 3**  
This course emphasizes the application of state-of-the-art quantitative techniques to asset management problems. The course covers asset pricing models in depth, portfolio optimization and construction, and dynamic strategies such as pairs trading, long-term and short-term momentum trades, and strategies that address behavioral finance anomalies. The course also discusses major forms of asset management structures such as mutual funds, hedge funds, ETFs, and special investment vehicles, and examines some of the primary types of trading strategies used by these organizations.

**FE 543 Investment Banking and Brokerage (3+0+0) 3**

This course introduces an overview of Wall Street, the back office and general brokerage operations, investment banking and capital markets. The course covers subjects essential to understanding how products, once created, are distributed and sold. The course relies heavily on The Wall Street Journal, Financial Times and other trade publications. Topics include a brief history of Wall Street, an understanding of the major securities laws and how they have changed over time, basics of equity and debt securities, creation of debt and equity securities, and pricing and sale of debt and equity securities. The course seeks to understand how and where opportunities for creating new securities arise.

**FE 544 Fixed Income Markets (3+0+0)3**

This course provides a quantitative approach to fixed-income securities and bond portfolio management with a focus on fixed-income security markets. The course covers the pricing of bonds and fixed-income derivatives, the measurement and hedging of interest rate risk, dynamic models of interest rates, and the management of fixed income portfolio risk.

**FE 545****Corporate Finance and Risk Management  (3+0+0) 3**

Examination of a broad range of issues faced by corporate financial managers including analysis of the firm's investment and financing decisions, the impact on the firm of agency costs and asymmetric information, mergers and acquisitions,  private equity, and risk management strategies and tools.

## FE 561 Foundations of Financial Technology (3+0+0) 3

## This course introduces a framework with which to understand and leverage information technology. The technology components covered include telecommunications, groupware, imaging and document processing, artificial intelligence, networks, protocols, risk, and object-oriented analysis and design. the course also covers the entire technological-planning process specifically for financial institutions.

**FE 581–589 Special Topics in Financial Engineering I - IX (3+0+0) 3**

Study of special topics chosen among the recent developments inFinancial Engineering.

**FE 500 Graduate Seminar Non-credit**

Lectures given by graduate students, visiting professionals and faculty to introduce main research and application areas in Financial Engineering.

**FE 580 Term Project Non-credit**

In depth study of the MSc student on a research topic in Financial Engineering under the supervision of a faculty member.