Financial Engineering

The Berkeley Master of Financial Engineering (MFE) degree is a full-time, one-year graduate degree offered by the Haas School of Business. Students enrolled in the MFE Program learn to use theoretical finance, mathematics, and computer programming skills to make pricing, hedging, trading, and portfolio management decisions.

Graduates of the MFE Program find positions in commercial and investment banking, insurance and reinsurance, corporate treasuries, corporate strategy, and money management. Specializations include risk management, asset/liability modeling/optimization, security structuring, derivative valuation and trading, consulting, asset management, research, option-based securities valuation, special hedging, and real-option investment analysis.

Admission to the University

Uniform minimum requirements for admission

The following minimum requirements apply to all programs and will be verified by the Graduate Division:

1. A bachelor's degree or recognized equivalent from an accredited institution;
2. A minimum grade-point average of B or better (3.0);
3. If the applicant comes from a country or political entity (e.g. Quebec) where English is not the official language, adequate proficiency in English to do graduate work, as evidenced by a TOEFL score of at least 570 on the paper-and-pencil test, 230 on the computer-based test, 90 on the iBT test, or an IELTS Band score of at least 7 (note that individual programs may set higher levels for any of these); and
4. Enough undergraduate training to do graduate work in the given field.

Applicants who already hold a graduate degree

The Graduate Council views academic degrees as evidence of broad research training, not as vocational training certificates; therefore, applicants who already have academic graduate degrees should be able to take up new subject matter on a serious level without undertaking a graduate program, unless the fields are completely dissimilar.

Programs may consider students for an additional academic master's or professional master's degree if the additional degree is in a distinctly different field.

Applicants admitted to a doctoral program that requires a master's degree to be earned at Berkeley as a prerequisite (even though the applicant already has a master's degree from another institution in the same or a closely allied field of study) will be permitted to undertake the second master's degree, despite the overlap in field.

The Graduate Division will admit students for a second doctoral degree only if they meet the following guidelines:

1. Applicants with doctoral degrees may be admitted for an additional doctoral degree only if that degree program is in a general area of knowledge distinctly different from the field in which they earned their original degree. For example, a physics PhD could be admitted to a doctoral degree program in music or history; however, a student with a doctoral degree in mathematics would not be permitted to add a PhD in statistics.
2. Applicants who hold the PhD degree may be admitted to a professional doctorate or professional master's degree program if there is no duplication of training involved.

Applicants may only apply to one single degree program or one concurrent degree program per admission cycle.

Any applicant who was previously registered at Berkeley as a graduate student, no matter how briefly, must apply for readmission, not admission, even if the new application is to a different program.

Required documents for admissions applications

1. **Transcripts:** Upload unofficial transcripts with the application for the departmental initial review. Official transcripts of all college-level work will be required **if admitted**. Official transcripts must be in sealed envelopes as issued by the school(s) you have attended. Request a current transcript from every post-secondary school that you have attended, including community colleges, summer sessions, and extension programs.
   If you have attended Berkeley, upload unofficial transcript with the application for the departmental initial review. Official transcript with evidence of degree conferral ***will not*** be required if admitted.
2. **Letters of recommendation:** Applicants can request online letters of recommendation through the online application system. Hard copies of recommendation letters must be sent directly to the program, not the Graduate Division.
3. **Evidence of English language proficiency:** All applicants from countries in which the official language is not English are required to submit official evidence of English language proficiency. This requirement applies to applicants from Bangladesh, Burma, Nepal, India, Pakistan, Latin America, the Middle East, the People's Republic of China, Taiwan, Japan, Korea, Southeast Asia, and most European countries. However, applicants who, at the time of application, have already completed at least one year of full-time academic course work with grades of B or better at a U.S. university may submit an official transcript from the U.S. university to fulfill this requirement. The following courses will not fulfill this requirement: 1) courses in English as a Second Language, 2) courses conducted in a language other than English, 3) courses that will be completed after the application is submitted, and 4) courses of a non-academic nature. If applicants have previously been denied admission to Berkeley on the basis of their English language proficiency, they must submit new test scores that meet the current minimum from one of the standardized tests.

Unit requirements: 28 units

Curriculum

MFE 230A	Investments and Derivatives	3
MFE 230E	Empirical Methods in Finance	2
MFE 230Q	Introduction to Stochastic Calculus	2
MFE 230D	Derivatives: Quantitative Methods	2
MFE 230I	Fixed Income Markets	2,3
MFE 230V	Credit Risk Modeling	2
MFE 230H	Financial Risk Measurement and Management	2

MFE 230O	Applied Finance Project	1-3
Select 28 units of electives from the following:		28
MFE 230W	Accounting and Taxation of Derivatives	
MFE 230R	Advanced Computational Finance	
MFE 230J	Success and Failure in Financial Innovation	
MFE 230M	Asset-Backed Security Markets	
MFE 230G	Equity and Currency Markets	
MFE 230K	Dynamic Asset Management	
MFE 230P	Optimization Models in Finance	
MFE 230S	Behavioral Finance	
MFE 230L	Course Not Available	
MFE 230X	High Frequency Finance	
MFE 230T	Topics in Financial Engineering	
MFE 293	Individually Supervised Study for Graduate Students	

MFE Data Lab

Dedicated lab that includes the following resources: Bloomberg terminals (2), Access to DataStream, Thompson Reuters, High Frequency trading server with NYSE TAQ data, Software: Matlab, SPSS, Mathematica, SAS, Visual Studio, EViews, OneTick software, WIND software, Rotman Interactive Trader, FactSet, WRDS

High Frequency Trading Lab Manager and Lab Manager

Two staff members to assist students with lab and technical needs

Business and Economics Library at the Haas School of Business

Access to Financial Times, Wall Street Journal, and all library resources.

1. Extensive assistance with placement in internship and full-time positions
2. Workshops on job search skills, e.g. cover letter/resume writing, interviewing
3. Financial Practice Seminars with professionals who discuss career paths available, industry needs. Workshops on relevant skills, e.g. programming languages

For more information, visit our website (http://mfe.berkeley.edu/careers/internships.html) .

Financial Engineering

MFE 230A Investments and Derivatives 3 Units
The course discusses the basic theories of asset pricing. It begins with the standard discounted cash flow analysis, and generalizes this approach to develop the No Arbitrage Pricing Technique for security valuation. Topics will be fixed income securities, derivatives, contingent claims, basic principles of optimal portfolio theory, models of equilibrium asset pricing, including CAPM and related Factor Models.
Hours & Format

Summer: 8 weeks - 4 hours of lecture and 4 hours of lecture per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade.

Formerly known as: Business Administration 230A

MFE 230D Derivatives: Quantitative Methods 2 Units
This course emphasizes the pricing of derivatives in continuous time, from the formulation of the pricing problem to the implementation of computational and numerical solution techniques.
Rules & Requirements

Prerequisites: 230A-230B

Hours & Format

Fall and/or spring: 8 weeks - 4 hours of lecture and 4 hours of lecture per week

Summer: 10 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade.

MFE 230E Empirical Methods in Finance 2 Units
This course reviews probability and statistical techniques commonly used in quantitative finance. It includes a review of normal, lognormal, CEV distribution, estimation and nonparametric techniques commonly used in finance (MLE, GMM, GARCH). Students will be introduced to financial databases and estimation application software to estimate volatilities and correlations and their stability.
Rules & Requirements

Prerequisites: Business Administration 230A-230B

Hours & Format

Fall and/or spring: 8 weeks - 4 hours of lecture, 6 hours of lecture, and 1 hour of discussion per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade.

Instructor: Valkanov

Formerly known as: Business Administration 230E

MFE 230F The Design of Securities for Corporate Financing 1 Unit
The view of corporate finance presented in this course stems from an analysis of two related issues: 1) how firms create value, and 2) how corporate finance facilitates the process of value creation. As part of this process, we will examine the factors that help determine financial strategy, thereby putting the design of financial packages in perspective. In particular, the course focuses on how corporate financing needs lead to the need for financial engineering and spur financial innovation.
Rules & Requirements

Prerequisites: 230D

Hours & Format

Summer: 8 weeks - 2 hours of lecture and 2 hours of lecture per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade.

MFE 230G Equity and Currency Markets 2 Units
This course reviews various aspects of equity and currency markets and their relative importance. It provides models of and historical evidence on the average returns and volatility of returns on equities, on the trade-to-trade equity price behavior, on trading volume and patterns, and primary financial risks. Determination of spot and forward rates and volatility, volume, high frequency dynamics and dealer behavior are examined.
Rules & Requirements

Prerequisites: Business Administration 230A-230B

Hours & Format

Summer: 7.5 weeks - 4 hours of lecture and 4 hours of lecture per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade.

Formerly known as: Business Administration 230G

MFE 230H Financial Risk Measurement and Management 2 Units
This course examines risk measurement and management including market risk, credit risk, liquidity risk, settlement risk, volatility risk, kurtosis risk and other types of financial risks. Topics will include risk management techniques for different types of contracts and portfolios such as duration, portfolio beta, factor sensitivities, VAR, dynamic portfolio analysis and extreme value analysis and other risk management techniques.
Rules & Requirements

Prerequisites: Business Administration 230A-230B

Hours & Format

Summer: 7.5 weeks - 4 hours of lecture and 4 hours of lecture per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade.

Formerly known as: Business Administration 230H

MFE 230I Fixed Income Markets 2 or 3 Units
This course provides a quantitative approach to fixed income securities and bond portfolio management. Topics include fixed income security markets, pricing and uses for portfolio management or for hedging interest rate risk, bond mathematics, term structure measurement and theory, immunization techniques, and the modern theory of bond pricing, and derivative instruments.
Rules & Requirements

Prerequisites: 230D

Hours & Format

Fall and/or spring: 8 weeks - 3-4 hours of lecture per week

Summer: 8 weeks - 3-4 hours of lecture per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade.

MFE 230J Success and Failure in Financial Innovation 1 Unit
Students will participate in a series of case studies illustrating some of the major successes and failures of modern financial innovation. They will learn how to measure success and failure and discuss case studies in portfolio insurance, long-term capital management, mortgage-backed securitization, and corporate enterprise-wide risk control.
Rules & Requirements

Prerequisites: Business Administration 230A-230B

Hours & Format

Summer: 8 weeks - 2 hours of lecture and 2 hours of lecture per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade.

Formerly known as: Business Administration 230J

MFE 230K Dynamic Asset Management 2 Units
This course reviews portfolio theory and pricing models. It includes: risk models for international portfolio returns, models of optimal allocation of funds, exchange rate uncertainty and criteria for judging the performance of managers and models; different types of portfolios/instruments, different types of applications, and strategies to achieve various investment objectives.
Rules & Requirements

Prerequisites: Business Administration 230A-230B

Hours & Format

Summer: 7.5 weeks - 4 hours of lecture and 4 hours of lecture per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade.

Formerly known as: Business Administration 230K

MFE 230M Asset-Backed Security Markets 2 Units
This course extends the study of fixed income securities to advanced topics on mortage and other asset-backed securities. Topics will include basic mechanics of structuring deals for mortgage-related securities, credit cards, leases, and other debt markets and the risk management techniques employed in the securitization process for these assets. The valuation of pooled assets and derivative bonds using Monte Carlo and option pricing techniques, and trading strategies are also evaluated.
Rules & Requirements

Prerequisites: Business Administration 230D and 230I

Hours & Format

Summer: 7.5 weeks - 4 hours of lecture and 4 hours of lecture per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade.

Formerly known as: Business Administration 230M

MFE 230N Applied Finance Project 0.0 Units
Students will be required to complete an applied quantitative finance project that explores a quantitative finance problem that might be met in practice and involves the development or use of quantitative financial technique.
Rules & Requirements

Prerequisites: Participation requires prior approval of the supervising faculty

Hours & Format

Summer: 7.5 weeks - 6 hours of lecture and 6 hours of lecture per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade. This is part one of a year long series course. A provisional grade of IP (in progress) will be applied and later replaced with the final grade after completing part two of the series.

Formerly known as: Business Administration 230N-230O

MFE 230O Applied Finance Project 1 - 3 Units
Students will be required to complete an applied quantitative finance project that explores a quantitative finance problem that might be met in practice and involves the development or use of quantitative financial technique.

Rules & Requirements

Prerequisites: Participation requires prior approval of the supervising faculty

Hours & Format

Summer: 7.5 weeks - 6 hours of lecture and 6 hours of lecture per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade. This is part two of a year long series course. Upon completion, the final grade will be applied to both parts of the series.

Formerly known as: Business Administration 230N-230O

MFE 230P Optimization Models in Finance 2 Units
This course proposes a guided tour through optimization models arising in practical finance. These problems include ones that are traditionally associated with optimization, including asset and liability management, asset pricing, and portfolio optimization. We also describe optimization models arising in model calibration, predication and estimation, and risk analysis. The course includes some recent approaches to the analysis of other kinds of financial data, such as text (financial news) data.

Hours & Format

Summer: 6 weeks - 5 hours of lecture and 5 hours of lecture per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade.

Instructor: El Ghaoui

MFE 230Q Introduction to Stochastic Calculus 2 Units
The course introduces the students to techniques from stochastic analysis employed in mathematical finance. Topics include: stochastic processes, brownian motion, stochastic integral, differentials and Ito's formula; martingales.

Hours & Format

Summer: 8 weeks - 1-2 hours of lecture and 4 hours of lecture per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade.

Formerly known as: Business Administration 230Q

MFE 230R Advanced Computational Finance 2 Units
This course builds on the techniques learned in 230D, Quantitative Methods for Derivative Pricing. The focus is to gain a deeper analysis of numerical and computational issues in pricing and calibration. The orientation of the course is hands-on, with heavy use of computational techniques applied to case projects. The primary objective of this course is to prepare students to tackle the latest challenges in quantitative pricing that they are likely to encounter in cutting-edge financial institutions.

Rules & Requirements

Prerequisites: 230D

Hours & Format

Summer: 8 weeks - 2-4 hours of lecture and 2-4 hours of lecture per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade.

MFE 230S Behavioral Finance 1 or 2 Units
Over the last 25 years, psychologists have come to better understand the processes by which people make judgements and decisions. They have identified common judgement and decision heuristics and the biases associated with these. An understanding of one's own decision biases and those of others is an important tool for managers. Behavioral Decision Theory has also contributed to our understanding of financial markets. This course will discuss the common biases and heuristics.

Rules & Requirements

Prerequisites: 230D

Hours & Format

Fall and/or spring: 8 weeks - 4 hours of lecture, 4 hours of lecture, 1 hour of discussion, and 1 hour of discussion per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade.

MFE 230T Topics in Financial Engineering 1 - 5 Units
Advanced study in the field of finance engineering that will address current and emerging issues. Topics will vary with each offering and will be announced at the beginning of each term.
Rules & Requirements

Repeat rules: Course may be repeated for credit as topic varies. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1-6 hours of lecture per week

Summer: 8 weeks - 2-12 hours of lecture per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: The grading option will be decided by the instructor when the class is offered.

MFE 230V Credit Risk Modeling 2 Units
Focuses on the techniques currently used to model credit risk. The course will cover default probabilities, loss given default, correlation, credit portfolio analytics, bond valuation, loan valuation, and credit derivative valuation. Emphasis will be placed on model building, model validation, and interpreting model output. Students will be required to do some high-level programming in a package such as Matlab. Some empirical testing exercises will also be part of the project work.
Hours & Format

Summer: 8 weeks - 4 hours of lecture and 4 hours of lecture per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade.

MFE 230VA Credit Risk: Economic Concepts 1 Unit
Introduction to credit risk modeling and conceptual overview of current techniques. Covers default probabilities, loss given default, correlation, credit portfolio analytics, bond valuation, loan valuation, and credit derivative valuation. Prepares students who are interested in a second course that will focus on model building. Students not interested in the technical details of modeling but who desire an understanding of how credit risk modeling is used in practice will benefit from taking this course.
Hours & Format

Fall and/or spring: 6 weeks - 3 hours of lecture and 3 hours of lecture per week

Summer: 8 weeks - 4 hours of lecture per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade.

MFE 230VB Credit Risk: Quantitative Modeling 1 Unit
Focuses on the techniques currently used to model credit risk. The course will cover default probabilities, loss given default, correlation, credit portfolio analytics, bond valuation, loan valuation, and credit derivative valuation. Emphasis will be placed on model building, model validation, and interpreting model output. Students will be required to do some high-level programming in a package such as MATLAB. Some empirical testing exercises will also be part of the project work.
Hours & Format

Summer: 6 weeks - 3 hours of lecture and 3 hours of lecture per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade.

MFE 230W Accounting and Taxation of Derivatives 1 Unit
This course provides a framework to allow students the understanding of the accounting and tax issues related to derivatives and hedging. It also fulfills the needs of students seeking jobs in the corporate sector and/or seeking securities-structuring assignments in the financial services sector. A basic understanding of financial accounting is required.
Hours & Format

Summer: 8 weeks - 2.5 hours of lecture and 2.5 hours of lecture per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade.

MFE 230X High Frequency Finance 1 or 2 Units
This course introduces basic concepts of high frequency finance and discusses recent developments in market microstructure, electronic trading, and high frequency data modeling. Topics include trading basics and price discovery, distributional properties of financial time series, tick data analysis, trade direction algorithms, trading benchmarks, sources of risk, and trading strategies (including back-testing challenges, benchmark and hedging strategies, and arbitrage and program trading).
Hours & Format

Fall and/or spring: 10 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade.

MFE 293 Individually Supervised Study for Graduate Students 1 - 5 Units
Individually supervised study of subjects not available to students in the regular schedule, approved by faculty adviser as appropriate for the students' programs.

Rules & Requirements

Prerequisites: Graduate standing

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Summer: 8 weeks - 1-5 hours of independent study and 1-5 hours of independent study per week

Additional Details

Subject/Course Level: Masters in Financial Engineering/Graduate

Grading: Letter grade.