FINANCIAL ENGINEERING (FRE-UY)

FRE-UY 2503 Valuation and Financial Engineering (3 Credits)
Typically offered Fall
This course introduces mathematically qualified students to the foundational theories of finance, together with the practical exposure to financial modeling, financial risk management, and the creation of financial products to solve problems for economic agents (financial engineering). Students should have a background in multivariate calculus, constrained optimization, linear algebra and basic differential equations. | Prerequisites: MA-UY 2114 and MA-UY 2224 and (MA-UY 1044 or MA-UY 2034).
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No
Prerequisites: MA-UY 2114 and MA-UY 2224 and (MA-UY 1044 or MA-UY 2034).

FRE-UY 3523 Mathematics in Financial Engineering (3 Credits)
Typically offered Fall
This course introduces the mathematical foundations of modern financial engineering through the discrete-time binomial asset-pricing model. We develop the key ideas of no-arbitrage, replication, risk-neutral pricing, state prices, and martingales in a rigorous but accessible discrete-time setting. Topics include the one-period and multiperiod binomial models, probability theory on coin-toss spaces, state-price deflators and change of measure, pricing and optimal exercise of American options, random walks and first-passage times, and interest-rate-dependent securities such as bonds and interest-rate derivatives. The course is designed for undergraduates in mathematics, statistics, or engineering with an interest in financial engineering, and it provides a solid conceptual and mathematical bridge to continuous-time models and stochastic calculus. Knowledge of Python proficiency required. | Prerequisites: One of (MA-UY.2114, MATH-UA.123, MATH-UA.133) AND (MA-UY.1044, MA-UY.2034, MA-UY.3054, MATH-UA.140, MATH-UA.148) AND One of (MA-UY.2224, MA-UY.3014, MA-UY. 3514, MATH-UA.333, MATH-UA.338)
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No
Prerequisites: (MA-UY 2114 or MATH-UA 123 or MATH-UA 133) AND (MA-UY 1044 or MA-UY 2034 or MA-UY 3054 or MATH-UA 140 or MATH-UA 148) AND (MA-UY 2224 or MA-UY 3014 or MA-UY 3514 or MATH-UA 333 or MATH-UA 338).

FRE-UY 3543 Stochastic Processes with applications to Financial Data Science (3 Credits)
Typically offered Fall and Spring
This course provides mathematical foundations in Markov random processes. and applications of this knowledge to Financial engineering. This course is part of the Finance minor offered by the Department of Finance and Risk Engineering. Following a general introduction to the Markov property and the basic concepts of Markov Chains, a number of quantitative modeling approaches will be introduced: synchronizing automata, random walks, Markov Chain Monte Carlo, Hidden Markov Models, and reinforcement learning. Financial applications to bond credit ratings, default events, asset price models, volatility models, trading strategies, market dynamics, order book, and price formation will be covered. | Perquisites: One of {MA-UY.2114, MATH-UA.123, MATH-UA.133} AND One of {MA-UY.1044, MA-UY.2034, MA-UY.3054, MATH-UA.140, MATH-UA.148} AND One of {MA-UY.2224, MA-UY.3014, MA-UY. 3514, MATH-UA.333, MATH-UA.338} AND One of {CS-UY.1114, CSCI-UA.101}
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No
Prerequisites: MA-UY 2114 or MATH-UA 123 or MATH-UA 133 AND MA-UY 1044 or MA-UY 2034 or MA-UY 3054 or MATH-UA 140 or MATH-UA.