

Master of Science in Analytical Finance

Co-sponsored by the Perella Department of Finance, the Department of Industrial & Systems Engineering and the Department of Mathematics

Program Objective

The objective of the M.S. in Analytical Finance Program is to provide students with a rigorous education in advanced finance and quantitative financial analysis tools. The curriculum provides key concepts in financial theory, mathematical finance, and engineering decision-making. It is the goal of this program to produce professionals who are instrumental in creating innovative solutions for real financial problems using state-of-the-art analytical techniques and computing technology.

Introduction

The field of analytical finance is a quickly emerging area of study that integrates finance, applied mathematics, computing, and engineering. The M.S. in Analytical Finance program is a joint program among the Department of Industrial and Systems Engineering, the Perella Department of Finance, and the Department of Mathematics. The program is designed for two primary groups of students:

- Recent graduates from a mathematically rigorous undergraduate program such as computer science, economics, engineering, finance, mathematics, and the physical sciences (physics/chemistry). These students will need exposure to graduate topics that prepare them for entry into a first job in financial services and to be upwardly mobile within their firm or industry faster than other entrants without this degree.
- Early-to-mid-career professionals from industry, either to hone and further skills already learned on the job or to retool their quantitative skills, developing into financial services specialists.

Based on our survey of LU alumni and other professionals with engineering or technical undergraduate degrees who work in the financial industry, there are great demands for students who already have a strong quantitative education but need advanced courses focused specifically on the financial market environment. This program will fulfill a market demand for specialists in financial firms who can bridge the gap between financial analysts and technical professionals.

"The Financial Services industry is moving quickly from art to managed science and this program brings serious engineering techniques to Financial Services industry. It's the first program I have seen where engineers can uncover the complex problems of our rapidly evolving global capital markets in their own language."

-George Kledaras
Kledaras Technologies, Inc.
Lehigh Engineering '87

Program Learning Objectives

Analytical finance involves the application of financial modeling, mathematics and engineering in order to solve actual financial problems and make better financial decisions. The curriculum is intended for career opportunities in areas such as portfolio management, securities trading, investment banking, risk management and financial information systems.

Upon completing this MS program, a graduate will be able to add value to his/her firm's pricing, hedging, trading and portfolio management decisions by being able to:

1. Conceptualize real world problems with both mathematical tools/models and theories of investment instruments and financial portfolio management;
2. Demonstrate proficiency in locating/creating, managing and analyzing large scale data sets with advanced computing tools;
3. Integrate tools in probability/statistics, optimization, simulation and information technology, to design financial instruments, transactional systems, and technology-enabled solutions;
4. Bridge the knowledge and skill gaps between financial professionals (e.g., asset managers) and computing/execution professionals (e.g., IT specialists);
5. Communicate key empirical results within the context of the financial marketplace and macroeconomic environment to non-quantitative financial specialists.

Admission criteria:

Minimum requirements

An applicant must have an undergraduate degree from a mathematically rigorous program such as computer science, economics, engineering, finance, operations research, mathematics, or the physical sciences (physics/chemistry).

Background courses required

Some of these background courses will be available via the Web, such as Eco 1, 145, 401; Fin 225. Also, Acct 108 and 151, Eco 129, 145, 401, Math 21, 22, 23, 205 and 231 are usually offered every summer, though not on the Web.

Entrance Prerequisites (Examples given from Lehigh Courses)

<p>Must show basic competency in the following areas: (Does not count towards the 33 credit minimum degree requirement)</p>
<p><i>Finance:</i> (Fin 225 or IE 226) or an equivalent introductory course including investment and capital budgeting</p>
<p><i>Corporate Finance:</i> Fin 328 or GBUS 419 or an equivalent course</p>
<p><i>Investment & Portfolio Management:</i> Fin 323 or GBUS 420 or an equivalent course</p>
<p><i>Financial Accounting:</i> Acct 151 (and Fin 225); or, Acct 108 (and IE 226); GBUS 401 could replace Acct 151 or 108 or an equivalent accounting course</p>
<p><i>Economics:</i> Micro and macro principles (Eco 1); money, banking, and financial markets (Eco 129) or an equivalent course</p>
<p><i>Statistics:</i> Eco 145 or an equivalent introductory course including regression analysis</p>
<p><i>Mathematics:</i> Calculus (Math 21, 22, 23) or an equivalent calculus series; linear algebra (Math 43 or 205 or 242) or equivalent course</p>

Examination(s) (e.g., GRE, GMAT, etc.) required

Admission standards: An applicant must meet the minimum CBE, ISE, or MATH graduate entrance standards. CBE requires an acceptable GMAT score (current mean score is 615) and 3.0 undergraduate GPA; ISE requires GRE quantitative and analytical scores no less than 75% and 3.0 senior year GPA. Any exceptions will be reviewed and approved by the co-directors.

Language requirement for international students

International students will have their English skills evaluated through the TOEFL and GMAT/GRE scores upon admission. If the TOEFL and GMAT/GRE scores do not meet our requirements, students may be required to take the summer English Immersion program offered by ESL and to submit new TOEFL and SPEAK scores. If the scores do not meet our requirements, the students must continue with ESL and may not take graduate level courses until they have met our English requirements. The TOEFL minimum score is 250 and the SPEAK minimum score is 230.

Admission deadline: Applications are due by June 1. When an application is received within two weeks before the start of fall classes, the student may be admitted on an associate student basis.

Presidential Scholars: Applications that will entail the use of a Presidential Scholarship should be submitted by April 1 of the prior spring semester to start in the summer or fall. A Presidential Scholar could be denied admission to the program due to space limitations.

The Program

All students enrolled in this Master of Science Program must successfully complete at least 33 graduate credit hours in a common set of analytical, financial, and computational courses. The program includes a capstone practicum project with a financial services firm. The students will have first hand experience solving real-world problems and make final presentations to a group of potential recruiters. The program design allows students to complete the course requirements in one calendar year provided the set of prerequisites are met.

Master of Science in Analytical Finance	
Course Requirements (33 credits minimum)*	
<i>Analytical Core</i>	
Math 467 (3 credits) Financial Calculus I	Stat 410 (3 credits) Random Process and Applications
Math 468 (3 credits) Financial Calculus II	Eco 415 (3 credits) Econometrics
IE 426 (3 credits) Optimization Models and Applications	
<i>Finance Core</i>	
GBUS 422 (3 credits) Derivatives and Risk Management	GBUS 473 (3 credits) International Finance
GBUS 421 (3 credits) Advanced Investments	
<i>Computing Core</i>	
Eco 424 (3 credits) Advanced Numerical Methods	IE 447 (3 credits) Stochastic Programming and Financial Analysis

Capstone Practicum
IE 441 (3 credits) Financial Engineering Projects

* Students with equivalent courses from an undergraduate degree program will be given credit for fulfilling the field requirement and will be permitted to replace the credits from the list of approved electives (see Table). The program director(s) must approve courses for each student's choice of electives.

Approved Electives		
GBUS 424 (3 credits) Adv. Topics in Financial Mgt	Eco 460 (3 credits) Time Series Analysis	IE 404 (3 credits) Simulation
GBUS 425 (3 credits)* Real Estate Finance & Investing	Eco 461 (3 credits) Forecasting	IE 409 (3 credits) Time Series Analysis
GBUS 426 (3 credits)* Financial Institutions	Eco 463/IE 458 (3 credits) Topics in Game Theory	IE 410 (3 credits) Design of Experiments
GBUS 431 (3 credits)* Quantitative Finance	Math 463 (3 credits) Advanced Probability	IE 411 (3 credits) Networks and Graphs
Eco 416 (3 credits) Econometric Theory	Stat 434 (3 credits) Mathematical Statistics	IE 413 (3 credits) Advanced Engineering Economy and Replacement Analysis
Eco 423 (3 credits) Real Options	Stat 438 (3 credits) Regression Analysis	IE 429 (3 credits) Stochastic Models and Applications

* Not currently offered

Sequence of courses		
<i>Summer (pre or post)</i>	<i>Fall</i>	<i>Spring</i>
GBUS 422 (3 credits) Derivatives and Risk Management	Math 467 (3 credits) Financial Calculus I	Math 468 (3 credits) Financial Calculus II
	GBUS 473 (3 credits) International Finance	GBUS 421 (3 credits) Advanced Investments
	IE 316 (3 credits) Optimization Models and Applications	IE 447 (3 credits) Stochastic Programming and Financial Analysis
	Eco 415 (3 credits) Econometrics	Eco 424 (3 credits) Advanced Numerical Methods
	IE 441 (3 credits) Financial Engineering Projects	Stat 410 (3 credits) Random Process and Applications