Financial Engineering

The objective of the M.S. in Financial Engineering program is to provide students with a strong education in advanced finance, risk management, and quantitative financial analysis tools, grounded in a common series of courses. This sequence will provide key concepts from financial theory, applied mathematics, and engineering. With these building blocks, program graduates will become instrumental in the creation of innovative solutions for real financial problems, using state-of-the-art analytical techniques and computing technology.

This program equips students with the necessary skill set to prepare for the Financial Risk Manager® examination offered by The Global Association of Risk Professionals (GARP). (http://www.garp.org/)

PREREQUISITES

Applicants must show basic competency in the following areas: investments, probability and statistics, and calculus. These courses will not count toward the master's degree. Examples are given from Lehigh courses; prerequisites do not need to be taken at Lehigh.

Investments-REQUIRED		
FIN 323	Investments (OR)	3
GBUS 420	Investments (OR)	3
Equivalent course		
Statistics and Probability-REQUIRED		
MATH 231	Probability and Statistics (OR)	3
ISE 328	Engineering Statistics (OR)	3
Equivalent introductory calculus-based statistics and probability course		
Calculus Series-REQUIRED		
MATH 021	Calculus I (AND)	4
MATH 022	Calculus II (OR)	4
Equivalent calculus series		
Financial Accounting-HIGHLY RECOMMENDED		
ACCT 108	Fundamentals of Accounting (OR)	3
ACCT 151	Introduction to Financial Accounting (OR)	3
GBUS 401	Financial Reporting for Managers and Investors (OR)	3
Equivalent accounting course		
Corporate Finance-HIGHLY RECOMMENDED		
FIN 328	Corporate Financial Policy (OR)	3
GBUS 419	Financial Management (OR)	3
Equivalent course		
Linear Algebra-HIGHLY RECOMMENDED		
MATH 205	Linear Methods (OR)	3
MATH 242	Linear Algebra (OR)	3-4
Equivalent course		
Calculus - HIGHLY RECOMMENDED		
MATH 023	Calculus III (OR)	4
Equivalent Course		

To those admitted without business coursework: Instructors teaching in the MFE Program's Coursework assume that all prospective students have met the prerequisite business foundation requirements. Although we only require an Investments course, we assume that the student has a background in financial accounting, introductory finance, corporate finance, and investments. Please note you will be competing against students within the classroom that have all these business foundation courses. You are encouraged to gain the necessary background by either taking these courses prior to coming to Lehigh or taking these foundation courses during your first term.

To those admitted without the quantitative coursework: Instructors teaching in the MFE Program's Coursework assume that all prospective students have met the prerequisite mathematics foundation requirements. Although we only require a 2-course Calculus series and a math-based Probability/Statistics course, we recommend an Advanced Calculus course, as well as a course in Linear Algebra. Please note you will be competing against students within the classroom that have all these additional foundation courses. You are encouraged to gain the necessary background by either taking these courses prior to coming to Lehigh or taking these foundation courses during your first term.

Required Courses

CORE: 6 courses (18 credits)		
MATH 467	Stochastic Calculus	3
MATH 312	Statistical Computing and Applications (OR)	3,4
STAT 410	Random Processes and Applications	
GBUS 421	Advanced Investments ((Fixed Income))	3
GBUS 422	Derivatives and Risk Management	3
ISE 426	Optimization Models and Applications	3
ISE 447	Financial Optimization	3
ELECTIVES: Choose 2 courses (6 credits) from one of the following 3 tracks		
Quantitative Risk Track		
MATH 468	Financial Stochastic Analysis	3
STAT 439	Time Series and Forecasting	3
GBUS 424	Advanced Topics in Financial Management (Risk Management)	3
Data Science & Financial Analytics Track		
ISE 465	Applied Data Mining	3
ISE 467	Mining of Large Datasets	3
ISE 444	Optimization Methods in Machine Learning	3
STAT 438	Linear Models In Statistics with Applications	3
CSB 442	Blockchain: Mathematical Foundations and Financial Applications	3
Financial Operations Track		
GBUS 426	Financial Markets and Institutions	3
GBUS 421 Advanced Topics: Security Analysis (3 credits)		
GBUS 424 Advanced Topics: Valuation (3 credits)		
ISE 413	Asset Valuation	3
Machine Learning Requirement: Choose 1 course (3 credits)		
CSE 326	Fundamentals of Machine Learning (OR)	3
CSE 426	Fundamentals of Machine Learning	
ISE 364	Introduction to Machine Learning	3
STAT 465	Statistical Machine Learning	3
Capstone: 1 course (3 credits)		
GBUS 485	Financial Engineering Practicum Capstone	3
Enrollment required each term (0 credits)		
GBUS 484	Financial Engineering Professional Development	0

FINANCIAL ENGINEERING CERTIFICATE PROGRAMS

The M.S. in Financial Engineering Program offers three certificate programs to candidates in the MFE program. Certificates are available in Data Science & Financial Analytics, Quantitative Risk Management, or Financial Operations Research and may be earned by completing an additional two courses for a total of 36 credit hours. Candidates for the MFE degree do not need to apply initially for certificate programs. Students meet with any Program Director to select their certificate choice (if any) once they are enrolled in the program.

Certificate programs enhance skills and development by allowing additional exploration in three main functional areas.

For the three (3) proposed Certificate Programs, the description for the Catalog of the Certificate Programs are the following:

1. Data Science & Financial Analytics (DSFA) Certificate

The objective is to provide students with a unique skill set preparing them for careers in the interdisciplinary field of Data Science and Financial Analytics, with particular application to the financial services industry. Skills developed include working with massive data sets, data-driven analytical methodologies, SAS and R programming, Data Mining, and Machine Learning.

Curriculum: 12 Credits

ISE 465	Applied Data Mining (REQUIRED)	3
One of the two courses below:		3
ISE 467	Mining of Large Datasets (OR)	
ISE 444	Optimization Methods in Machine Learning	
AND		
MATH 312	Statistical Computing and Applications (REQUIRED)	3
One of two data-intensive finance courses below:		3
GBUS 422	Derivatives and Risk Management (OR)	
GBUS 424	Advanced Topics in Financial Management (Risk Management)	

2. Quantitative Risk Management (QRM) Certificate

The objective is to train students in the quantitative methodologies and regulatory practices that are essential for risk management functions within a financial institution. Prepares students for and reinforces material from the FRM examination. The Financial Risk Manager (FRM) designation is the premier certification for professionals in financial risk management. The two-part exam contains the following topics, many of which overlap the curriculum of the MSFE program: Financial Markets and Products, Valuation and Risk Models, Quantitative Analysis, Foundations of Risk Management, Market Risk, Credit Risk, Operational Risk, Risk Management and Investment Management, and Current Regulatory Issues. Furthermore, Lehigh's MSFE program is an Academic Partner of the Global Association of Risk Professionals (GARP) who administers the FRM certification.

Curriculum: 12 credits

GBUS 422	Derivatives and Risk Management	3
GBUS 424	Advanced Topics in Financial Management (Risk Management)	3
GBUS 426	Financial Markets and Institutions	3
ONE of the following MATH/STAT courses:		
STAT 434/MATH 334	Mathematical Statistics	3
MATH/STAT 461	Topics In Mathematical Statistcs	3
STAT 438/MATH 338	Linear Models In Statistics with Applications	3

3. Financial Operations Research

The objective is to provide the student with an understanding of the fundamental techniques underlying Operations Research Techniques that are of ubiquitous use in all areas of business today like Linear Programming, Game Theory, Dynamic Programming, Integer Programming, Nonlinear Programming, and Machine Learning.

Curriculum: 12 Credits

ISE 426	Optimization Models and Applications (REQUIRED)	3
ISE 447	Financial Optimization (REQUIRED)	3
Two (2) electives from the following courses:		
ISE 458	Topics in Game Theory (OR)	3
ECO 463	Topics in Game Theory	
ISE 455	Optimization Algorithms and Software	3
ISE 407	Computational Methods in Optimization	3
ISE 416	Dynamic Programming	3
ISE 444	Optimization Methods in Machine Learning	3
ISE 467	Mining of Large Datasets	

ADMISSIONS

Applications are accepted through the graduate online application system at https://www.applyweb.com/lehighg/index.ftl (https://www.applyweb.com/lehighg/). International students must have 16 years of schooling with four years at the university level to be considered for admission. Applicants whose native language is not English are required to take either the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS) exam.

Further information about the M.S. in Financial Engineering Program may be obtained by visiting https://business.lehigh.edu/academics/graduate/masters-programs/ms-financial-engineering (https://business.lehigh.edu/academics/graduate/masters-programs/ms-financial-engineering/), contacting the Graduate Programs Office of the College of Business (business@lehigh.edu) or one of the following Co-Directors:

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