



University Senate TRANSMITTAL FORM

Senate Document #:	16-17-19
PCC ID #:	16010
Title:	Establish a Master of Quantitative Finance
Presenter:	Andrew Harris, Chair, Senate Programs, Curricula, and Courses Committee
Date of SEC Review:	October 19, 2016
Date of Senate Review:	November 2, 2016
Voting (highlight one):	<ol style="list-style-type: none">1. On resolutions or recommendations one by one, or2. In a single vote3. To endorse entire report
Statement of Issue:	<p>The Robert H. Smith School of Business proposes to offer a new Master of Quantitative Finance program. Students in this program will develop a rigorous understanding of how to apply mathematical and statistical models to financial securities and markets. The financial crisis on Wall Street and around the globe has shown that financial decision-making depends on building sophisticated models that facilitate better pricing of securities and more sophisticated risk management. The Smith School currently offers a Master of Finance degree, which will continue to be offered. The Master of Finance, which trains students interested in corporate finance and investment banking, is not sufficient for students interested in working in hedge funds or corporate risk management, which require significantly more mathematical and statistical modeling skills. Other universities have begun to offer programs in Quantitative Finance as prospective students are increasingly choosing finance programs that feature training in sophisticated computational and mathematical skills.</p> <p>The proposed program will require 36 credits composed of required courses and electives. Required courses include the following: BUSI640 Financial Management (2 Credits); BUFN650 Financial Mathematics (2 Credits); BUFN741 Advanced Capital Markets (2 Credits); BUFN745 Financial Programming (2 Credits);</p>

	<p>BUFN750 Valuation in Corporate Finance (2 Credits); BUGN758N and 758O Financial Econometrics I & II (2 Credits); and BUFN761 Derivative Securities (2 Credits). The elective courses (20 credits) will be offered in fields related to Asset Management, Advanced Mathematical Finance, Risk Management, Corporate Finance, and other areas in Finance. With the approval of the academic advisor, students may also choose up to 8 electives in related fields.</p> <p>No additional resources are requested for this program. The existing administrative and faculty resources that exist for the current Master of Finance program are sufficient to offer this program.</p> <p>This proposal was approved by the Graduate School Programs, Curricula, and Courses committee on September 26, 2016, and was approved by the Senate Programs, Curricula, and Courses committee at its meeting on October 7, 2016.</p>
Relevant Policy # & URL:	N/A
Recommendation:	The Senate Committee on Programs, Curricula, and Courses recommends that the Senate approve this new degree program.
Committee Work:	The committee considered this proposal at its meeting on October 7, 2016. Michael Faulkender, Associate Professor of Finance, and Mike Marcellino, Assistant Dean of M.B.A. and M.S. programs for the Smith School, presented the proposal and responded to questions from the committee. After discussion, the committee voted unanimously to recommend the proposal.
Alternatives:	The Senate could decline to approve this new program.
Risks:	If the Senate declines to approve this new program, the university will lose an opportunity to use existing resources to create an academic program that meets a growing need in quantitative finance.
Financial Implications:	There are no significant financial implications with this proposal.
Further Approvals Required:	If the Senate approves this proposal, it would still require further approval by the President, the Board of Regents, and the Maryland Higher Education Commission.

**THE UNIVERSITY OF MARYLAND, COLLEGE PARK
PROGRAM/CURRICULUM/UNIT PROPOSAL**

- Please email the rest of the proposal as an MSWord attachment to pcc-submissions@umd.edu.

PCC LOG NO.	16010
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- Please submit the signed form to the Office of the Associate Provost for Academic Planning and Programs, 1119 Main Administration Building, Campus.

College/School:

Please also add College/School Unit Code-First 8 digits: **01202900**
Unit Codes can be found at: <https://hyperion.umd.edu/reports/units.htm>

Department/Program:

Please also add Department/Program Unit Code-Last 7 digits: **1291501**

Type of Action (choose one):

- | | |
|---|---|
| <input type="checkbox"/> Curriculum change (including informal specializations) | <input checked="" type="checkbox"/> <i>New academic degree/award program</i> |
| <input type="checkbox"/> Curriculum change for an LEP Program | <input type="checkbox"/> New Professional Studies award iteration |
| <input type="checkbox"/> <i>Renaming of program or formal Area of Concentration</i> | <input type="checkbox"/> New Minor |
| <input type="checkbox"/> <i>Addition/deletion of formal Area of Concentration</i> | <input type="checkbox"/> Request to create an online version of an existing program |
| <input type="checkbox"/> <i>Suspend/delete program</i> | |

Italics indicate that the proposed program action must be presented to the full University Senate for consideration.

Summary of Proposed Action:

The Robert H. Smith School of Business proposes launching a Masters in Quantitative Finance (MQF) program designed to provide students with a rigorous understanding of how to apply mathematical and statistical models to financial securities and markets. The financial crisis on Wall Street and around the globe has forever changed the way we think about finance. Now more than ever, financial decision making depends on building sophisticated models that facilitate better pricing of securities and more sophisticated risk management. Students who complete the MQF degree will possess the knowledge and skills necessary to address the challenges confronting financial decision makers and financial market participants.

Departmental/Unit Contact Person for Proposal: _____

APPROVAL SIGNATURES - Please print name, sign, and date. Use additional lines for multi-unit programs.

1. Department Committee Chair MARK TARANTO Mark Taranto
2. Department Chair V. Muzum Vojislav Makismovic
3. College/School PCC Chair Michael Faulkender M. Faulkender 7/13/2016
4. Dean A. J. Triantis, ALEX TRIANTIS, 7/14/2016
5. Dean of the Graduate School (if required) _____
6. Chair, Senate PCC _____
7. University Senate Chair (if required) _____
8. Senior Vice President and Provost _____

PROPOSAL FOR
NEW INSTRUCTIONAL PROGRAM
UNIVERSITY OF MARYLAND AT COLLEGE PARK, MARYLAND
MASTERS IN QUANTITATIVE FINANCE (MQF)

ROBERT H. SMITH SCHOOL OF BUSINESS

DEAN Alex Triantis

MASTERS IN QUANTITATIVE FINANCE

Award to Be Offered Fall 2017

I. OVERVIEW and RATIONALE

A. Briefly describe the nature of the proposed program and explain why the institution should offer it. [You may want to refer to student demand, market demand for graduates, institutional strengths, disciplinary trends, synergy with existing programs, and/or institutional strategic priorities.]

Goal and Contribution to the Strategic Plan

The Robert H. Smith School of Business proposes launching a Masters in Quantitative Finance (MQF) program designed to provide students with a rigorous understanding of how to apply mathematical and statistical models to financial securities and markets. The financial crisis on Wall Street and around the globe has forever changed the way we think about finance. Now more than ever, financial decision making depends on building sophisticated models that facilitate better pricing of securities and more sophisticated risk management. Students who complete the MQF degree will possess the knowledge and skills necessary to address the challenges confronting financial decision makers and financial market participants.

The Robert H. Smith School of Business houses one of the strongest academic finance departments in the world as well as the Center for Financial Policy (CFP). The research and experience of the faculty are particularly suited to attract some of the brightest students in the world who are seeking a more thorough understanding of how to rigorously model financial issues and markets. Faculty and staff currently affiliated with the Robert H. Smith School of Business and the Center for Financial Policy hold appropriate degrees in finance, mathematics, and economics that are relevant and necessary for the Quantitative Finance Master's degree. One of our faculty members, Dilip Madan, was previously the Managing Editor of the academic journal *Mathematical Finance* and is still a member of the advisory board for that journal.

The mission of the Robert H. Smith School of Business is to “create knowledge, promote a learning environment that fosters intellectual discovery, and equip current and future leaders to assess complex problems and deliver innovative solutions.” The University of Maryland College Park mission statement sets a goal to “continue to build a strong, university-wide culture of graduate and professional education” and to provide knowledge-based programs and services that are responsive to the needs of the citizens of the state and the nation. Faculty and students in the Masters of Quantitative Finance program will be exposed to the increasingly complex nature of financial products and markets. Given UMCP's proximity to the nation's capital, our facility in Washington DC, and the significant changes in financial regulation resulting from the Dodd-Frank financial reform bill, we are in a unique position to offer students opportunities unmatched by competitor institutions.

The School currently offers a Master of Finance (MFin) degree. The program generates a strong applicant pool every year and has been well-received in the marketplace, both for applicants and placement. However, some of our students would benefit from an even more mathematically rigorous program and degree. While students interested in corporate finance or investment banking are sufficiently served by the current degree program, those interested in working for hedge funds or doing financial institution risk management require significantly more mathematical and statistical modeling skills. This proposed degree program fills that gap in the school's degree portfolio. In addition, greater competition for these students necessitates ongoing innovation in our degree portfolio. We believe that demand for this proposed program will facilitate maintaining our graduate finance population at levels we have realized the past four years.

The Smith School also offers joint Specialty Masters and MBA degrees in several fields. We also seek to offer an option for a joint MQF-MBA degree.

This program is also an ideal path for some of our students to pursue PhD programs in finance. Many of our MFin graduates have gone on to pursue their PhD degree, including our own PhD program. Given that PhD programs in finance are highly mathematical, students obtaining an MQF degree would be even better prepared to pursue PhD level work. Having a Masters in Quantitative Finance will likely improve the marketability of our students seeking to pursue a PhD specializing in finance.

Market Demand for Graduates

In light of the financial crisis, employers are looking for finance specialists who have a thorough understanding of how to mathematically model financial products. Proper risk management conducted by financial institutions requires understanding the factors that will alter prices and the dynamics of the markets in which those securities trade. Hedge fund management is entirely about modeling the movements of securities and forming portfolios to trade on those movements in ways that mitigate risk but still generate trading profits. Both of these actions require sophisticated understanding of mathematical and statistical models that have been applied to financial products and markets. Many of our existing MFin students find placement in these jobs and we anticipate that an even more rigorous set of courses as well as better differentiating our students for potential employers will enhance the placement success that we have realized.

Student Demand

Business schools are undergoing a significant shift in the applicant pool for Master’s degree programs. Applications for traditional MBA programs that provide a general management focus have seen a sustained reduction nationwide. Contemporaneously, more students are seeking Master’s degrees that specialize in a particular business field, particularly finance and accounting. More recently, we are seeing even greater competition in the specialized Masters portfolios of schools. For instance, Washington University in St. Louis offer both a Master of Science in Finance as well as a Master of Science in Quantitative Finance. Georgetown University recently launched an online Master of Finance program. Schools such as Fordham University, Rutgers University, and the University of Minnesota currently or are about to offer Masters degrees in Quantitative Finance (CIP code 27.0305). In our most recent admissions cycle, five students declined our offer of admission so that they could instead attend the MQF program at Fordham University. We anticipate interest in this degree program to continue its growth and would like to be the premier institution offering such a degree.

Student demand for a Master’s in Finance program is high. For the 2015-2016 academic year, we received 1,128 applications and had 129 students register in our MFin program. For the 2014-2015 academic year, we received 1,380 applications. As these statistics demonstrate, the market is becoming more competitive and we must remain attractive. Admitted student statistics demonstrate the quality of students demanding this offering:

	Fall 2015	Fall 2014
Average GMAT	709	712
Average GPA	3.5	3.5

B. How big is the program expected to be? From what other programs serving current students, or from what new populations of potential students, onsite or offsite, are you expecting to draw?

Enrollment in our Master of Finance degree (MFin) has recently ranged between 129 and 220. Our goal is approximately 180 newly admitted students per year. If this new program is approved, we would anticipate staying at a goal of 180 students per year, with approximately 120 in the Master of Finance program and 60 in the Master of Quantitative Finance program.

Most of the students we attract to this program are international, primarily from East Asia. The strategic plan for this program seeks to expand domestic enrollment, primarily by targeting students receiving Bachelor's degrees in mathematics, statistics, and physics who are looking for an opportunity to apply their skill set to the financial industry. We have recently launched dual degree programs that facilitate UMCP undergrads getting their Bachelor's and Master of Finance degrees in four to five years. We would anticipate creating a dual degree option for the MQF, if approved.

II. CURRICULUM

A. Provide a full catalog description of the proposed program, including educational objectives and any areas of concentration.

The Masters in Quantitative Finance degree (MQF) is a professional degree for students wishing to pursue careers in money management, financial research, risk management, and financial market regulation. Core courses provide excellent fundamentals in the economic, statistical, and mathematical models used in the finance industry. Our electives will allow students the flexibility to become specialists within these career paths.

The proposed MQF program offered by the Robert H Smith School of Business will provide students with:

- a) Comprehensive knowledge of foundational financial concepts, products, and financial market structure necessary for engaging in any form of analytical financial analysis.
- b) In-depth understanding of the mathematical models that are widely used in pricing financial securities
- c) The statistical models used to parameterize these mathematical models
- d) Analytical skills including detailed financial modeling, the ability to design and empirically estimate financial relationships, and simulation methods to understand risk and return tradeoffs
- e) Knowledge of the legal and ethical issues related to financial management and an understanding of the role of all stakeholders when capital allocation decisions are made
- f) An understanding of the regulatory structure of financial markets and the role that policymakers and regulators play in the efficient operation of financial markets
- g) Skills that will endure beyond the next business cycle and that facilitate institutional sustainability, even during times of economic downturn
- h) Expertise in financial management that will make our students valuable contributors to a variety of employers and organizations in diverse communities

B. List the courses (number, title, semester credit hours) that would constitute the requirements and other components of the proposed program. Provide a catalog description for any courses that will be newly developed or substantially modified for the program.

Students will enter the MQF program with a Bachelor's degree. The proposed MQF program requires 36 credit hours comprised of core courses (16 credits) and electives (at least 20 credits). Completion of the degree is feasible within one academic year though many students may choose to spread their coursework over two academic years to offer an opportunity to gain experience from an internship during the summer.

The Smith School also offers joint Specialty Masters and MBA degrees in several fields. We also seek to offer an option for a joint MQF-MBA degree.

While not required, some students may pursue the option of writing a master's thesis as part of reaching their 36 credit hours requirement. Others may take advantage of experiential learning opportunities for

course credit. In both cases, such credit would be limited to 8 credit hours and be overseen by a faculty member. Appendix 2 provides a curriculum comparison of the Finance Programs offered by our peers.

Core Courses

Course descriptions are provided below. All core courses are currently 2 credits.

BUSI 640 Financial Management: The course outlines the financial concepts and mathematical techniques used to evaluate corporate decisions. The topics include the time value of money, valuation of common securities, discounted cash flow, estimating opportunity costs of capital, and capital structure. The objectives are to introduce the language and structure of finance and to develop the tools to analyze financial decisions.

BUFN 650 Financial Mathematics: Introduction to the mathematical models used in finance and economics with emphasis on pricing derivative instruments. Topics include elements from basic probability theory, distributions of stock returns, elementary stochastic calculus, Ito's Lemma, arbitrage pricing theory, and continuous time portfolio theory. Particular focus is on the financial applications of these mathematical concepts.

BUFN741 Advanced Capital Markets: Building upon the financial mathematics course, this class provides an introduction to the mathematical and statistical models used to price securities and analyze financial markets. Topics include portfolio theory, asset pricing, market efficiency, fixed income, options and futures.

BUFN 745 Financial Programming: Building upon the statistical programming foundations in Econometrics, this course introduces students to advanced programming in Matlab, SAS, R, and Python with specific applications to financial modeling. Applications potentially include estimating interest rate models, developing derivatives pricing models, backtesting financial strategies using large datasets, and scraping of financial data off the internet. In addition, students will gain competency in financial platforms such as those provided by Bloomberg.

BUFN 750 Valuation in Corporate Finance: This is an advanced topics course in quantitative corporate finance focusing on valuation. The main objective is to apply the concepts covered in the introductory finance class through real-life applications (cases). The topics include building Pro Forma statements and forecasting future cash flows, dynamic cash flow models, estimating the cost of capital, implementing the Weighted Average Cost of Capital (WACC) and Adjusted Present Value (APV) methods, and using real options techniques (binomial and Black and Scholes models as well as Monte Carlo simulations) to value companies and projects.

BUFN 758N and 758O Financial Econometrics I/II: Introduces the skills and computing languages for analyzing financial data and testing financial models. The course includes linear optimization for use in factor models, the statistical properties of asset returns, event studies, time series analysis and models of stochastic volatility. The course will include theory mixed with several finance applications in widely used statistical languages.

BUFN 761 Derivative Securities: Introduces options and futures contracts, and the mathematical foundations of their valuation. Topics include binomial model, Black-Scholes model, delta hedging, and convexity. Derivative securities on various underlying assets (equities, indices, commodities, foreign exchange, etc.) are analyzed, using different application contexts.

Elective Courses

All BUFN courses listed below are 2 credit courses. In addition to these finance electives and upon approval of the academic advisor, students may take up to eight credits in related fields, including those referenced below. Elective courses within finance are listed by topic:

Asset Management

BUFN 760 Applied Equity Analysis: Applies financial models and statistical tools to the analysis and valuation of equity securities. In addition to focusing on economic (DCF based) analysis of corporations, the course covers topics such as the EIC (Economy/Industry/Company) framework, financial statement analysis, relative value analysis, and contingent value analysis. Students will apply statistical tools to value stocks and provide stock recommendations.

BUFN 762 Fixed Income Analysis: Focuses on economic and mathematical models of financial instruments whose market values are tied to interest rate movements. Develops tools such as discount functions, duration, convexity, and immunization to analyze the interest rate sensitivity and value of fixed income securities and portfolios. A variety of fixed income securities are examined, particularly zero coupon and coupon bearing bonds.

BUFN 763 Portfolio Management: Examines the theory and application of portfolio management techniques in detail, including the use of various asset classes in constructing efficient portfolios. Various risk and performance measurements for portfolios are examined, drawing on classic portfolio theory, as well as more recent index and factor models. The course develops tools for quantitative portfolio management, including computation and simulation methods.

BUFN 764 Quantitative Investment Strategies: Provides an advanced treatment of asset allocation strategies and performance evaluation. Quantitative techniques are applied to examine equity and fixed-income portfolio management strategies. The course provides a deeper understanding of the measurement of risk and its relationship to return, as well as of multi-factor models. Implementation issues, including statistical estimation, backtesting and portfolio construction, are covered, as are strategic versus tactical asset allocation, and performance evaluation.

BUFN 773 Institutional Asset Management: Examines how money is managed by organizations such as university endowments, pension funds, mutual funds, hedge funds, and private equity funds. Emphasizes the incentives professional money managers face within the context of the organizational structure in which they operate. Particular attention will be paid to compensation structures and monitoring mechanisms.

BUFN 774 Market Microstructure: The course examines---from theoretical, institutional, and empirical perspectives---how prices in speculative markets are determined by the interaction of traders. Topics covered include market making, informed trading strategies, liquidity, bid-ask spreads, transactions costs, market impact, price manipulation, and high-frequency trading. The course examines markets for equities, bonds, commodities, and foreign exchange. There are several empirical exercises using transactions data.

Advanced Mathematical Finance

BUFN 765 Fixed Income Derivatives: Introduces the use and valuation of fixed income assets such as exchange-traded bond futures and options, forward contracts on interest rates, fixed and floating rate bonds with embedded options, floating rate notes, caps, collars, floors, interest rate swaps, and mortgage

backed securities. Tools include the application of binomial option pricing trees, and the analysis of stochastic yield curves.

BUFN 766 Financial Engineering: Introduces and applies various computational techniques useful in the management of equity and fixed income portfolios and the valuation of financial derivatives and fixed income securities. Techniques include Monte Carlo Simulation and binomial/lattice pricing models. Emphasis is on bridging theory with the design of algorithms and models that can be directly applied in practice.

BUFN 767 Applied Conic Finance: This advanced course applies conic theory to the field of finance including applications such as portfolio theory, dynamic hedging, structured products, derivatives and construction of dynamic trading strategies.

Risk Management

BUFN 754 Corporate Risk Management: Explores the theory and practice of financial risk identification, modeling, statistical measurement, and mitigation of risk at financial and non-financial firms. Topics include hedging with options and futures, interest rate risk management, Value-at-Risk (VaR), Cashflow-at-Risk (CaR), Earnings-at-risk (EaR), credit risk, equity risk, commodities risk, exchange rate risk, and lessons from risk management disasters.

BUFN 772 Bank Management: Examines the economic role and regulation of banks and other financial institutions, and the structure of assets, liabilities and capital in these institutions. Tools are presented to analyze the various risks faced by banks, including interest rate risk, market risk, operational risk and off-balance sheet risk. Topics also include liquidity risk, liability risk, reserve management, deposit insurance, and capital requirements.

BUFN 758R Special Topics in Finance: Financial Risk Management: This course surveys the theory and practice of financial risk management focusing on identification, measurement, and mitigation of risks associated with financial institutions. It focuses on the risk of a stylized large systemically important financial institution (Sifi Bank) using synthetic transactions and portfolios allowing the student to directly apply various concepts using a variety of models and Excel/VBA tools to test their sensitivity to important changes in assumptions.

Corporate Finance

BUFN 751 Financial Strategy for Corporations: An advanced course in corporate finance, focusing on the issues that firms face when they plan to raise external capital from financial markets. The focus is on the financing problems faced by mid-market to large firms and on capital raised from public markets. The forms of external finance vary from simple debt or equity to more complex securities that bundle with an element of risk management.

BUFN 752 Financial Restructuring: Examines alternative ways to increase firm value through corporate restructuring, including domestic and international acquisitions, spin-offs, carve-outs, and leveraged buy-outs. Focus is on theory, practice, and empirical evidence related to each of these forms of restructuring, and emphasis is placed on mathematical models use to conduct valuation analysis and evaluate strategic considerations.

BUFN 753 Corporate Governance: Examines corporate governance and its impact on shareholder value. Topics include conceptual foundation for corporate governance, the role and duties of the board of directors, indicators of board effectiveness and best practices, design features of executive compensation

contracts, the significance and prevalence of stock options, the perverse incentives of stock options and controversy over compensation practices, corporate governance failures and anatomy of corporate scandals, the essentials of the Sarbanes-Oxley Act, Dodd-Frank, and other regulatory reforms.

BUFN 755 Entrepreneurial Finance and Private Equity: Explores advanced topics in corporate finance, with major emphasis on how financiers help firms plan for growth and develop finance strategies firms use for different types of securities at different points in the industry's and firm's life. Securities will include private financing and placements, Venture Capital (VC), Initial Public Offerings (IPOs), Private Equity and Leveraged Buyouts.

Other Finance Courses

BUFN 770 International Investment: Addresses exchange rates, international interest rates, exchange rate derivatives (such as forwards, futures, swaps, and options), and international stock markets. Applications may include dynamic exchange rate hedging, and portfolio optimization under country constraints.

BUFN 771 International Corporate and Project Finance: Focuses on the role of financial management in the multinational firm, and the financing and management of international projects. Topics include international capital budgeting, global cost of capital, project financing, and the measurement and management of exchange rate exposure by corporations.

BUFN 758? Special Topics in Finance: Experiential Learning Project: These courses allow students to work under the direction of a faculty member on applied projects done in partnership with outside organizations and corporations. Recent partners include Freddie Mac, Danaher, the World Bank, FINRA, and the Securities and Exchange Commission.

Electives outside of Finance:

AMSC 460 Computational Methods: Basic computational methods for interpolation, least squares, approximation, numerical quadrature, numerical solution of polynomial and transcendental equations, systems of linear equations and initial value problems for ordinary differential equations. Emphasis on methods and their computational properties rather than their analytic aspects. Intended primarily for students in the physical and engineering sciences.

AMSC612 Numerical Methods in Partial Differential Equations: Finite difference methods for elliptic, parabolic, and hyperbolic partial differential equations. Additional topics such as spectral methods, variational methods for elliptic problems, stability theory for hyperbolic initial-boundary value problems, and solution methods for conservation laws.

AMSC670 Ordinary Differential Equations I: Existence and uniqueness, linear systems usually with Floquet theory for periodic systems, linearization and stability, planar systems usually with Poincare-Bendixson theorem.

AMSC673 Partial Differential Equations I: Analysis of boundary value problems for Laplace's equation, initial value problems for the heat and wave equations. Fundamental solutions, maximum principles, energy methods. First order nonlinear PDE, conservation laws. Characteristics, shock formation, weak solutions. Distributions, Fourier transform.

AMSC674 Partial Differential Equations II: Boundary value problems for elliptic partial differential equations via operator-theoretic methods. Hilbert spaces of functions. Duality, weak convergence. Sobolev spaces. Spectral theory of compact operators. Eigenfunction expansions.

AMSC 808 Advanced Topics in Applied Mathematics

BUDT758B Special Topics in Decision, Operations and Information Technologies; Big Data

BUDT758P Special Topics in Decision, Operations and Information Technologies; Decision Analytics

BUDT758T Special Topics in Decision, Operations and Information Technologies; Data Mining and Predictive Analytics

STAT600 Probability Theory I: Probability space; distribution functions and densities; Poisson limit theorem; de Moivre-Laplace theorem; measure-theoretic definition of expectation; classification of measures on \mathbb{R} ; convergence of random variables; Radon-Nikodym theorem; L^p spaces; conditional probabilities; independence of events, sigma-algebras and random variables; Bayes' theorem; pi-systems and Dynkin systems; discrete Markov chains; random walks; gambler's ruin problem; Markov chains on a general phase space; Borel-cantelli lemmas; Kolmogorov inequality; three series theorem; laws of large numbers.

STAT601 Probability Theory II: Weak convergence of measures; characteristic functions; Central Limit Theorem and local limit theorem; stable laws; Kolmogorov consistency theorem (without proof); conditional expectations and martingales; optimal stopping theorem; convergence of martingales; Brownian motion; Markov processes and families; stochastic integral and Ito formula.

STAT650 Applied Stochastic Processes: Basic concepts of stochastic processes. Markov processes (discrete and continuous parameters), Random walks, Poisson processes, Birth and death processes. Renewal processes and basic limit theorems. Discrete time martingales, stopping times, optional sampling theorem. Applications from theories of stochastic epidemics, survival analysis and others.

STAT700 Mathematical Statistics I: Sampling distributions including noncentral chi-squared, t , F . Exponential families, completeness. Sufficiency, factorization, likelihood ratio. Decision theory, Bayesian methods, minimax principle. Point estimation. Lehmann-Scheffe and Cramer-Rao theorems. Set estimation.

STAT705 Computational Statistics: Modern methods of computational statistics and their application to both practical problems and research. S-Plus and SAS programming with emphasis on S-Plus. S-Plus objects and functions, and SAS procedures. Topics include data management and graphics, Monte Carlo and simulation, bootstrapping, numerical optimization in statistics, linear and generalized linear models, nonparametric regression, time series analysis.

Sample Student Schedule

Below are tables showing how a typical MQF student can complete the required coursework over a three-semester period as a full-time student and over a two-year time period as a full-time student. The courses listed below are all currently two-credit courses which are scheduled as half semester courses (7 weeks). The meeting times are one hour and fifty minutes in duration and meet twice a week so each course will meet the following total number of contact hours: 14 sessions X 1:50 per meeting = 25 hours & 40 minutes.

Student Schedule for Full-time MQF, completed in three semesters

Fall A	Fall B	Spring C	Spring D
BUSI 640* BUFN 758N* BUFN 650*	BUFN 741* BUFN 758O* BUFN 772	BUFN 750* BUFN 761* BUFN 745*	BUFN 753 BUFN 754 BUFN 762
BUFN 763 BUFN 774 BUFN 758R	BUFN 764 BUFN 765 BUFN 766		

Student Schedule for Full-time MQF, completed in two years

	Fall A	Fall B	Spring C	Spring D
First Year	BUSI 640* BUFN 758N* BUFN 650*	BUFN 741* BUFN 758O*	BUFN 750* BUFN 761* BUFN 745*	BUFN 754 BUFN 762
Second Year	BUFN 774 BUFN 763	BUFN 764 BUFN 765	BUFN 766 BUFN 773	BUFN 758R BUFN 753

*Core MQF Course

C. Describe any selective admissions policy or special criteria for students selecting this field of study.

Applicants to the MQF program must have completed all of the requirements for a baccalaureate degree prior to their acceptance into the program, with particular emphasis on the student having sufficient mathematical background. All applicants must submit: Transcripts from all undergraduate and graduate institutions that have been previously attended, Graduate Record Examination (GRE) scores or the Graduate Management Admissions Test (GMAT) scores, a complete online application form that includes a written essay articulating qualifications and motivation for pursuing advanced education, two letters of recommendation from supervisors or from professors competent to judge the applicant’s probability of success in graduate school.

In addition, an admissions interview may be required. After initial screening, the Admissions Office may select candidates for interviews which may be done in person or by telephone. Proof of English language proficiency (TOEFL or IELTS official scores) is also required unless the applicant has received an undergraduate or graduate degree from a select list of countries. For international student needing an F1 visa, a completed certification of finance form and supporting financial documentation are required.

In addition to Graduate School requirements, admission decisions for the MQF program will be based on the quality of previous undergraduate and graduate course work (if applicable), the strength of Graduate

Record Examination scores or the Graduate Management Admissions Test scores, the relevance of prior work and research experience, and the congruence of professional goals with those of the program. Students should submit application materials for the fall semester by April 1. This program does not accept applications for Spring semester admission.

D. STEM CERTIFICATION

STEM is an acronym for Science, Technology, Engineering, and Mathematics. The Master of Quantitative Finance (MQF) program is designed to prepare students for productive careers in our high-tech global economy, therefore numerous courses embrace and include the integration of one or more of these STEM areas, particularly technology and mathematics.

The foundation of financial securities analysis is a set of mathematical and statistical models that estimate the relationships between the risks of a security with its expected return. Mastering these models requires rigorous courses in mathematics, statistics, and computational methods, with applications to finance. Our proposed degree program exposes students to these tools, primarily focused on those commonly used in financial institutions.

The Master of Quantitative Finance (MQF) should qualify to be assigned an approved STEM Classification of Instructional Programs (CIP) code of 27.0305, Financial Mathematics.

III. STUDENT LEARNING OUTCOMES AND ASSESSMENT

List the program's learning outcomes and explain how they will be measured and assessed

Learning Outcome 1: Knowledge of Business Functional Areas. *Smith MQF graduate students understand key principles underlying the functional areas of finance.*

- o Rigorously model time value of money analyses and determine capital structure
- o Use mathematical and statistical models to characterize capital markets
- o Value financial securities
- o Analyze derivatives markets

Learning Outcome 2: Integrative Knowledge. *Smith MQF graduate students apply learned concepts*

- o Apply accounting concepts to discounted cash flow models
- o Apply concepts in Economics to defend valuation analyses

Learning Outcome 3: Analytical Thinking. *Smith MQF graduate students evaluate and articulate investment strategy and opportunities*

- o Evaluate investment opportunities using computational methods and simulations
- o Articulate economic trade-offs for investors in financial securities

Learning Outcome 4: Statistical Proficiency. *Smith MQF graduate students demonstrate statistical knowledge through interpreting financial models*

- o Apply statistical methods to financial decision making
- o Use economic techniques to parameterize financial models

For all learning objectives, the measures, criterion and method of assessment are:

Measure:	Students will be required to pass a set of questions delivered as part of the final exam in each core course.
Criterion:	At least 90% of students will receive an average rating of "Meets Standards" or better on the core course final exam questions. The Academic Director will meet with students rated below "Meets Standards" to help improve their performance or determine their continued participation in the program.
Assessment:	Every Year, starting in the 2017-2018 academic year.

IV. FACULTY AND ORGANIZATION

A. Who will provide academic direction and oversight for the program? [This might be a department, a departmental subgroup, a list of faculty members, or some other defined group.]

Primary oversight of this program will be provided by a faculty member assigned as the director of the program. A committee of faculty members has been created to address issues including admissions, academic policies, student activities, and internship / placement opportunities. The program would also be overseen by the chair of the finance department and the Dean's office.

The finance department of the Robert H Smith School of Business currently has 28 FTE faculty. Twenty-two of these are tenure / tenure track. All of these twenty-two faculty have doctoral degrees in economics, finance, or industrial engineering. Six additional clinical faculty also have graduate degrees in economics, finance, or business.

Finance Faculty Expected to Teach in the Proposed MFin Program

Alex Triantis, PhD, Professor of Finance and Dean

Teaching / research focus: corporate finance, risk management, real options

Course: BUSI 640 Financial Management

BUFN 750 Valuation in Corporate Finance

Vojislav Maksimovic, PhD, Dean's Chair Professor of Finance and Area Chair

Teaching / research focus: corporate finance, industrial organization, international finance

Course: BUFN 752: Corporate Restructuring

Michael Faulkender, PhD, Associate Professor of Finance and MFin Director

Teaching / research focus: empirical corporate finance, risk management, executive compensation

Course: BUFN 751 Financial Strategy For Corporations

Mark Taranto, PhD, Associate Clinical Professor and MFin Academic Director

Teaching / research focus: empirical corporate finance

Courses: BUFN 765 Fixed Income Derivatives

BUFN 766 Financial Engineering

Gurdip Bakshi, PhD, Dean's Professor of Finance

Teaching / research focus: asset pricing, international finance, fixed income, derivatives

Course: BUFN 740 Capital Markets

BUFN 770 International Investment

Steve Heston, PhD, Professor of Finance

Teaching / research focus: asset pricing, derivatives, volatility, international finance

Courses: BUFN 770 International Investment

BUFN 771 International Corporate and Project Finance

Albert "Pete" Kyle, PhD, Charles E. Smith Chair Professor of Finance

Teaching / research focus: asset pricing, market microstructure

Course: BUFN 774 Market Microstructure

Dilip Madan, PhD, Professor of Finance, former Managing Editor of *Financial Mathematics*

Teaching / research focus: asset pricing, mathematical finance, derivatives

Course: BUFN 767 Applied Conic Finance

Lemma Senbet, PhD, William E. Mayer Chair Professor of Finance
Teaching / research focus: corporate governance, financial institutions, international finance
Course: BUFN 753 Corporate Governance

N.R. Prabhala, PhD, Professor of Finance
Teaching / research focus: empirical corporate finance, executive compensation
Course: BUFN 751 Financial Strategy For Corporations

Haluk Unal, PhD, Professor of Finance
Teaching / research focus: financial institutions and banking, executive compensation
Course: BUFN 762 Fixed Income Analysis

Russ Wermers, PhD, Professor of Finance, Director: Center for Financial Policy
Teaching / research focus: empirical asset pricing, institutional money management
Courses: BUFN 764 Quantitative Investment Strategies

Mark Loewenstein, PhD, Associate Professor of Finance
Teaching / research focus: theoretical asset pricing, portfolio selection
Course: BUFN 763 Portfolio Management

Richmond Matthews, PhD, Associate Professor of Finance
Teaching / research focus: theoretical corporate finance, corporate governance
Course: BUFN 752 Corporate Restructuring

Cecilia Bustamante, PhD, Assistant Professor of Finance
Teaching / research focus: theoretical corporate finance
Course: BUFN 750 Valuation in Corporate Finance

Julien Cujean, PhD, Assistant Professor of Finance
Teaching / research focus: Asset Pricing, General Equilibrium, Information Economics, Liquidity
Course: BUFN 761: Derivative Securities

Francesco D'Acunto, PhD, Assistant Professor of Finance
Teaching / research focus: empirical corporate finance
Course: BUFN 755 Entrepreneurial Finance and Private Equity

Laurent Fresard, PhD, Assistant Professor of Finance
Teaching / research focus: empirical corporate finance, international corporate finance
Course: BUFN 750 Valuation in Corporate Finance
BUSI 640 Financial Management

William Mullins, PhD, Assistant Professor of Finance
Teaching / research focus: empirical corporate finance
Course: BUFN 751 Financial Strategy For Corporations

Alberto Rossi, PhD, Assistant Professor of Finance
Teaching / research focus: empirical asset pricing, financial econometrics
Courses: BUFN 758N Financial Econometrics I
BUFN 758O Financial Econometrics II

Shrihari Santosh, PhD, Assistant Professor of Finance
Teaching / research focus: empirical asset pricing
Courses: BUFN 740 Capital Markets

Yajun Wang, PhD, Assistant Professor of Finance
Teaching / research focus: theoretical and empirical asset pricing, market microstructure
Course: BUFN 740 Capital Markets

Liu Yang, PhD, Assistant Professor of Finance
Teaching / research focus: empirical corporate finance
Course: BUSI 640 Financial Management

David Kass, PhD, Clinical Professor
Teaching / research focus: corporate finance, industrial organization
Course: BUFN 752 Financial Restructuring

Elinda Kiss, PhD, Associate Clinical Professor
Teaching / research focus: financial institutions, bank regulation
Course: BUFN 772 Bank Management

Sarah Kroncke, MBA, Senior Lecturer
Teaching / research focus: investment banking, equity analysis
Courses: BUFN 760 Applied Equity Analysis

Cliff Rossi, PhD, Professor of the Practice
Teaching / research focus: financial institutions, risk management
Courses: BUFN 754 Corporate Risk Management
BUFN 761 Derivative Securities
BUFN 772 Bank Management

Susan White, PhD, Clinical Professor
Teaching / research focus: corporate finance, taxes and payout policy
Courses: To be Determined

B. If the program is not to be housed and administered within a single academic unit, provide details of its administrative structure. This should include at least the following:

Not applicable. All classes will be housed and administered within the Robert H Smith School of Business

V. OFF CAMPUS PROGRAMS

A. If the program is to be offered to students at an off-campus location, with instructors in classrooms and/or via distance education modalities, indicate how student access to the full range of services (including advising, financial aid, and career services) and facilities (including library and information facilities, and computer and laboratory facilities if needed) will be assured.

In addition to holding classes on the UMCP campus, some sections of the program may meet at our DC location in the US Department of Commerce building, our Baltimore facility in the Baltimore BioPark, or our facility at the Universities of Shady Grove. Those facilities already contain adequate classrooms, computer facilities, study rooms, and administrative space for academic advising, career advising, and student activity support.

B. If the program is to be offered mostly or completely via distance education, you must describe in detail how the concerns in Principles and Guidelines for Online Programs are to be addressed.

Currently, the program is structured to be entirely delivered in a traditional classroom setting. Over time, we may evaluate online learning opportunities, but nothing is currently scheduled. Should we move towards some courses being offered online, all online courses would adhere to the policies and concerns outlined in the University of Maryland document, Principles and Guidelines for Online Programs.

Program Development, Control and Implementation Would Be By Faculty - The faculty would have overall control over the design, development, and will have the overall bulk of any online academic instruction. Smith school technical support personnel would be available, as well as agreements with the off-campus sites for technical support during classroom hours. Support will be available to faculty during course development, as well as during the offering of the program.

VI. OTHER ISSUES

A. Describe any cooperative arrangements with other institutions or organizations that will be important for the success of this program.

Not applicable. All aspects of the program from admissions to academic programming to career advising will be provided by the Robert H Smith School of Business. While the program will reach out to local companies and institutions for guest speakers, internship opportunities, experiential learning projects, and job placement, no particular relationship is pivotal to the success of the program.

B. Will the program require or seek accreditation? Is it intended to provide certification or licensure for its graduates? Are there academic or administrative constraints as a consequence?

The University of Maryland's Robert H. Smith School of Business is already accredited by the AACSB (American Association of Collegiate Schools of Business). No accreditation is sought for this individual program.

VII. COMMITMENT TO DIVERSITY

Identify specific actions and strategies that will be utilized to recruit and retain a diverse student body.

The Robert H. Smith School of Business community is multifaceted at every level – students, staff and faculty represent a diverse blend of backgrounds, nationalities, ethnicities and experiences. About a dozen Smith School and student clubs are focused on bringing members together who have similar interests in gender, nationality, religion, and sexual orientation.

To attract the most diverse population possible for the proposed Master of Quantitative Finance program, Smith School recruiting staff will focus on domestic efforts. These efforts will be targeted at recruiting U.S. minorities and American women of all ethnicities.

Current efforts include:

- Representing Masters programs in U.S. MBA and Masters Fairs and Tours
- Representing Masters programs in International MBA and Masters Fairs and Tours
- Online Chats
- U.S. College Visits
- International College Visits
- GMASS-based Mailings
- GRE-based Mailings
- Direct Mail
- Email Campaigns
- Outreach to College and Campus Organizations and Clubs
- Participating in Career/Graduate Study Panels or Workshops
- Presentations at Professional Conferences
- Creation of "Leap Your Career Forward" for Current UMD Students Looking At MBA and Masters Study Post-Undergraduate Studies (An Annual Event)
- Advertising in UMD Campus Newspapers
- Masters Only Education Fairs (Fall And Spring) Throughout the U.S.
- Participation in a Masters-focused Business School Alliance
- Participant in Graduate Business Education Events Targeted for Underrepresented Populations, Particularly U.S. Minorities and Women

Future efforts include:

- Including Master's Level Programming in Marketing Content Targeted to U.S. Military/Veterans
- Outreach to College Organizations in the Washington, D.C. Area
- Enhancement of Website for All Masters Programs
- Inclusion of Spotlight and Vignettes of Masters Alumni and Current Students who Reflect Diversity
- Participation in Events Targeted for Women Seeking Graduate Study (General And Non-MBA Based Events)
- Social Media and Online Advertising within U.S. Markets
- Partnerships with Academic Testing Centers and Overseas Advisors For International Graduate Study
- Marketing Targeting Young UMD Alumni and Young University Of Maryland System Alumni

VIII. REQUIRED PHYSICAL RESOURCES

The proposed Masters in Quantitative Finance (MQF) program students will replace enrollment slots currently provided to our existing Masters of Finance (MFin) degree. We do not anticipate combined enrollment in these two programs in the future exceeding historic enrollment in our MFin program. The proposed program can be implemented in accordance with Section 11 206.1 in which programs developed under this provision can be implemented within existing resources of the campus. In proceeding with the submission of this program, the institution's president certifies that no new general funds will be required for the implementation of this master's-level program.

A. Additional library and other information resources required to support the proposed program. You must include a formal evaluation by Library staff.

The evaluation is attached.

B. Additional facilities, facility modifications, and equipment that will be required. This is to include faculty and staff office space, laboratories, special classrooms, computers, etc.

As this proposed program supplements a current program with no net growth in the number of students, and we do not at this time anticipate growing the combined programs beyond current scale, no additional facilities or facility modification is required. The School has adequate space in Van Munching Hall to house current faculty and students in the proposed program. No additional classrooms or computer laboratories are required.

C. Impact, if any, on the use of existing facilities and equipment. Examples are laboratories, computer labs, specially equipped classrooms, and access to computer servers.

See response to VIII.B above.

IX. RESOURCE NEEDS and SOURCES

Describe the resources that are required to offer this program, and the source of these resources. Project this for five years. In particular:

A. List new courses to be taught, and needed additional sections of existing courses. Describe the anticipated advising and administrative loads. Indicate the personnel resources (faculty, staff, and teaching assistants) that will be needed to cover all these responsibilities.

The following five courses will be added as part of this new program:

BUFN 650 Financial Mathematics: Introduction to the mathematical models used in finance and economics with emphasis on pricing derivative instruments. Topics include elements from basic probability theory, distributions of stock returns, elementary stochastic calculus, Ito's Lemma, and arbitrage pricing theory.

BUFN741 Advanced Capital Markets: Building upon the financial mathematics course, this class provides an introduction to the mathematical and statistical models used to price securities and analyze financial markets. Topics include portfolio theory, asset pricing, market efficiency, fixed income, options and futures.

BUFN 745 Financial Programming: Building upon the statistical programming foundations in Econometrics, this course introduces students to advanced programming in Matlab, SAS, R, and Python with specific applications to financial modeling.

BUFN 767 Market Microstructure: The course examines---from theoretical, institutional, and empirical perspectives---how prices in speculative markets are determined by the interaction of traders. Topics covered include market making, informed trading strategies, liquidity, bid-ask spreads, transactions costs, market impact, price manipulation, and high-frequency trading. The course examines markets for equities, bonds, commodities, and foreign exchange. There are several empirical exercises using transactions data.

BUFN 767 Applied Conic Finance: This advanced course applies conic theory to the field of finance including applications such as portfolio theory, dynamic hedging, structured products, derivatives and construction of dynamic trading strategies.

The faculty in the Robert H. Smith School of Business have the requisite degrees and knowledge to teach these courses. The existing administrative structure for the MFin program will be tasked with serving this new degree program. As we do not anticipate net additional students above our historical enrollment levels, we do not anticipate incremental resources being necessary.

B. List new faculty, staff, and teaching assistants needed for the responsibilities in A, and indicate the source of the resources for hiring them.

Faculty resources of the Robert H Smith School of Business and in particular the finance department of the School (as described herein) are adequate to cover the size of the proposed MQF program. Approval of this proposal would not alter the responsibilities of the faculty beyond those already generated by the MFin program that this proposal seeks to supplement.

C. Some of these teaching, advising, and administrative duties may be covered by existing faculty and staff. Describe your expectations for this, and indicate how the current duties of these individuals will be covered, and the source of any needed resources.

As described above, teaching, advising, and administrative duties will be handled by existing faculty members (who are already teaching and conducting research on finance topics).

D. Identify the source to pay the for the required physical resources identified in Section VIII. above.

No additional resources are required.

E. List any other required resources and the anticipated source for them.

Not applicable.

F. Provide the information requested in [Table 1](#) and [Table 2](#) (for Academic Affairs to include in the external proposal submitted to USM and MHEC).

Given that this degree supplements a degree already offered, there are no incremental revenues or expenses. We anticipate that absent the approval of this new program, our enrollment in our MFin program would decline. Approval of this program, we believe, will allow us to continue at our current scale.

Appendix 1: Peer Comparisons – Characteristics of Competitor Institutions

School	Number of Students	Percent International	Number of Credits	Elective Credits
Johns Hopkins University	500	90	36	12
George Washington University	93	83	48	0
Ohio State University	56	71	30	20
Arizona State	18	78	36	0
University of Rochester	188	*	28	12
Washington University in St Louis Mfin	32	28	30.5	7.5
Washington University in St Louis Quant Fin	20	90	39	3
Tulane	184	93	34	6
University of Southern California	50	40	36	9
Vanderbilt	50	26	32	18
Boston College	45	70	30	9
University of Illinois	*	*	40	24
Fordham University Quant Fin	*	76	36	21
Fordham University Global Fin	*	76	36	8
Brandeis University	*	*	44	20

* Data not obtained

Appendix 2: Peer Comparisons – Curriculum Content Comparisons of Finance Programs offered by MBA Ranked Peers

Key:

Bold - Class currently offered by UMCP as part of our core.

Italics – Class currently offered by UMCP but not as part of the core.

University Degree MBA Ranking	Curriculum/Required Classes	Prerequisites	Comments
MIT Masters in Finance #4	Finance Theory I <i>Corporate Fin Accounting</i> Analytics of Finance Electives: <i>Corporate Risk Management</i> Investments <i>Advanced Corporate Finance</i> Options and Futures <i>Fixed Income</i> <i>International (Cap Mkts)</i> <i>International (Corp)</i> <i>Analytics of Finance II</i> <i>Business Analysis/Fin Statements</i> <i>Mergers & Acquisitions</i> Valuation <i>Applied Fixed Income Strategies</i> Data Technologies for Quant Fin Retirement Finance Learning Project <ol style="list-style-type: none"> a. Financial Engineering b. Financial Management c. Research Practicum 	Suggested Math Background: Linear Algebra Calculus Probability Statistics Computer Literacy	Despite its reputation, this MIT degree is a general one comparable to ours. While students could get a more quantitative degree there, it is not required. They actually have fewer requirements. The Financial Engineering class looks different from ours, with teams assigned to tackle a problem for a sponsoring organization.

University Degree MBA Ranking	Curriculum/Required Classes	Prerequisites	Comments
UC Berkeley MFE #7	<p>28 units to graduate. 16 units required,</p> <p>Investments & Derivatives Empirical Methods in Finance <i>Intro to Stochastic Calculus</i> <i>Financial Institutions Seminar</i> <i>Derivatives: Quant Methods</i> <i>Fixed Income Markets</i> <i>Credit Risk Modeling</i> <i>Accounting/Taxation</i> <i>Derivatives</i> <i>Financial Institutions Seminar II</i> <i>Fin Risk Management</i> <i>Advanced Comp Finance</i> <i>Fin Innovation in Global Mkt</i> <i>International Equity/Currency</i> <i>Topics in Fin Eng</i> <i>Required Internship</i> <i>Finance Project</i> <i>ABS Markets</i> <i>Dynamic Asset Management</i> <i>Behavioral Finance</i> <i>Real Options</i></p>	<p>Programming experience in C or C++</p> <p>Background in Calculus, Linear Algebra, Differential Equations, Statistics and Numerical Analysis</p> <p>Training in Finance</p> <p>Language Skills</p>	<p>Berkeley's MFE is a very different degree from ours. It is not aimed at generalists, but is specifically designed for students who want to work as financial engineers who already have a strong quantitative background. Many of their students already have a MS in engineering or a PhD in a quantitative field.</p> <p>The first course combines our Capital Markets class and our Derivatives class. Quant Methods has some overlap with our Fin Engineering class, but also emphasizes continuous time models. Some of the material in the Credit Risk course is covered in Fixed Income Derivatives and Risk Management. Some of the topics in ABS Markets are covered in Fixed Income Derivatives.</p>

University Degree MBA Ranking	Curriculum/Required Classes	Prerequisites	Comments
UCLA MFE #15	<p>Earn 52 units through coursework and the hands-on applied finance project.</p> <p>Nov-Dec (Foundation): Fundamentals of Investments, Financial Accounting, and introduction to Econometrics.</p> <p>Jan-Mar (Winter): Corporate Finance, Stochastic Calculus, Empirical Methods in Finance, Derivatives.</p> <p>Mar-Jun (Spring): Financial Risk Management, Fixed Income Markets, Computational Methods in Finance, Quantitative Asset Management.</p> <p>Sep-Dec (Fall): Introduction to Credit Markets, Special Topics in Financial Engineering, Applied Finance Project.</p>	<p>Strong quantitative background including linear algebra, multivariate calculus, differential equations, numerical analysis, and advanced statistics and probability.</p> <p>Some experience or coursework in computer programming (C++) plus statistical and econometric modeling (MATLAB).</p>	<p>UCLA's MFE is very similar to the one at Berkeley. Originally, it was a joint program between the two schools.</p>

University Degree MBA Ranking	Curriculum/Required Classes	Prerequisites	Comments
University of Texas MS Finance #17	Required Financial Management Valuation Financial Accounting Statistics for Fin Applications <i>Security Analysis</i> <i>Practicum</i> Investments <i>Advanced Corporate</i> <i>Finance</i> <i>Financial Mkts and</i> <i>Institutions</i> Derivatives <i>Fixed Income</i> <i>Advanced Valuation</i> <i>Practicum II</i> <i>Raising Capital</i> <i>Alternative Investments</i> <i>Risk Management</i> <i>Global Fin Strategies</i>	Complete a three-credit-hour statistics course and a three-credit-hour economics course before beginning the program.	It looks like Texas has a lockstep program which incorporates many of the classes that we offer. It includes two practicums, but does not offer the flexibility that we have and may be a little less quantitative.

University Degree MBA Ranking	Curriculum/Required Classes	Prerequisites	Comments
<p>CMU MS-Computational Finance #18</p>	<p>It is unclear what is required. The program offers 25 courses. I see no corporate classes offered. There are many capital markets classes that look extremely quantitative. There are also a number of mathematics classes, IT classes and economics classes. There are two classes on Stochastic Calculus</p>	<p>An undergraduate degree in a technical discipline such as mathematics, computer science, engineering or economics.</p> <p>At least two full semesters of study in differential and integral calculus, the caliber of which is required of engineering, math or science majors as well as ordinary differential equations, linear algebra, and a calculus based probability course.</p> <p>Strong academic performance in mathematics and probability coursework.</p> <p>Be fluent in a general purpose programming language such as C or C++.</p> <p>Relevant professional experience is preferred but not required.</p>	<p>This program is nothing like ours. It is sponsored jointly by four different schools within the university.</p>

University Degree MBA Ranking	Curriculum/Required Classes	Prerequisites	Comments
University of Wisconsin Quantitative MFin #25	<p><i>Core</i> Microeconomics Econometrics I & II Investments Futures and Options <i>Derivatives</i> Theory of Finance I Independent Study Project Brownian Motion (Math) Computational Math (Math)</p> <p><i>Electives</i> <i>Security Analysis</i> Intermediate Investments Courses offered by Economics, Statistics, Mathematics and Real Estate-</p>	None.	Wisconsin's program seems lighter than ours on finance and heavier on mathematics and statistics than ours. It is more quantitative, but does not look very strong in terms of finance training.

University Degree MBA Ranking	Curriculum/Required Classes	Prerequisites	Comments
Vanderbilt University MS in Finance #25	<p>Required Financial Economics I & II Financial Accounting Econometrics I & II <i>Financial Modeling</i> Corporate Valuation Derivatives</p> <p>Electives <i>Financial Reporting</i> <i>Game Theory</i> <i>Corp Fin Policy</i> <i>International Markets</i> <i>International Corporate</i> <i>Equities Markets</i> <i>Bond Markets</i> <i>Financial Institutions</i> <i>Real Estate I & II</i> <i>Active Portfolio Analysis</i></p>	At a minimum, it is expected that students will have completed one year of calculus as well as courses in statistics. It is helpful to have taken an introduction to economics course to help you understand the theory of economic principles.	The degree looks very similar to ours.

University Degree MBA Ranking	Curriculum/Required Classes	Prerequisites	Comments
Ohio State University Specialized Master- Finance #25	<p>Required Economics I & II Data Analysis I & II Intro Finance Leadership Corporate Finance Derivatives</p> <p>Electives Standard electives in Corporate Finance, Investments, Risk Management and Real Estate.</p>	None.	Ohio State requires MBA type classes outside of Finance and offers courses very similar to ours. We have more requirements. They do not offer Econometrics, and we do not offer Real Estate classes.

University Degree MBA Ranking	Curriculum/Required Classes	Prerequisites	Comments
University of Rochester MS in Finance #37	<p><i>Required without MBA</i> <i>MBA Economics</i> <i>MBA Statistics</i> Financial Accounting</p> <p>Required MBA Accounting Capital Budgeting <i>Economic Theory/Organizations</i> <i>Managerial Accounting</i> Investments Corporate Finance Business Communications</p> <p>Electives <i>Accounting/Economics classes</i> <i>Corporate Financial Policy</i> Derivatives <i>Financial Institutions</i> Cases in Finance <i>Investment Mgt/Trading Strat</i> <i>International Finance</i> Financial Information Systems <i>Fixed Income Securities</i> <i>Advanced Financial Economics</i> <i>Advanced Topics/Corporate Governance</i></p>	Students without an MBA must start in the Summer and take foundation classes	Rochester is one of our closest peers. It is a generalist degree. They require more core classes outside of finance and fewer inside finance.

University Degree	Curriculum/Required Classes	Prerequisites	Comments
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MBA Ranking			
Boston College MS Finance #37	<p>Required Investments Corporate Finance <i>Financial Institutions</i> Financial Econometrics Corporate Finance Theory <i>Portfolio Theory</i> Derivatives/Risk <i>Management</i> <i>Fixed Income</i> <i>Financial Policy</i></p> <p>Electives These were not listed on the page</p>	Calculus Linear Algebra Statistics Accounting	Boston College offers an MSF that looks pretty standard. However, they also offer a quantitative track that includes PhD level courses in economics and finance.

University Degree MBA Ranking	Curriculum/Required Classes	Prerequisites	Comments
Tulane University Master of Finance #43	<p>Required Financial Accounting Corporate Finance Financial Communications Valuation Investments <i>Fixed Income</i> Derivatives <i>Equity Analysis</i></p> <p>Electives Cases in Real Estate <i>International Finance</i> Real Estate Planning <i>Private Equity and VC</i> <i>Student Managed Fund</i> Energy/Environmental Econ Energy Markets</p>	Currently, the Tulane MFIN does not require any specific course prerequisites; however, the Admissions Committee will look for demonstrable quantitative skills. Typical candidates have business, economics, engineering or computer science academic backgrounds or have taken coursework in finance, statistics, economics, accounting, engineering, or some other quantitatively oriented field.	The degree looks very similar to ours.

University Degree MBA Ranking	Curriculum/Required Classes	Prerequisites	Comments
Michigan State University MS Finance #44	<i>Required</i> 30 Credits including 18 Credits in Finance. It must include Managerial Finance.	Cumulative GPA of 3.0 or higher. Have at least two years of full time work experience after earning the bachelor degree. This condition can be waived for exceptional candidates. Students should complete equivalents of MTH 124: Survey of Calculus I and STT 315: Introductory Probability and Statistics for Business. GMAT score (minimum of 600) (school code: QH0-5P- 69) or GRE score (minimum of 310 verbal and quantitative) is required.	There is no strong core, and they do not offer a large number of electives.

University Degree MBA Ranking	Curriculum/Required Classes	Prerequisites	Comments
University of Florida MS Finance #44	It is difficult to see the requirements, however, they offer standard MBA type classes.	None.	It looks like Florida's program is aimed at combined BS/MS students. The degree looks less quantitative than ours.

University Degree MBA Ranking	Curriculum/Required Classes	Prerequisites	Comments
American University MS Finance N/A	<p><i>Required</i></p> <p>Financial Management <i>Financial Modeling</i> Derivatives/Risk Management Quantitative Methods I & II <i>Fixed Income</i></p> <p>Electives Similar to our MBA electives</p>	None.	American requires courses similar to our core and to our MBA level courses. It does not look like it offers the same level of flexibility nor does it offer as many quantitative classes.

University Degree MBA Ranking	Curriculum/Required Classes	Prerequisites	Comments
George Washington MS Finance N/A	<p><i>Required</i></p> <p>Financial Econometrics <i>Global Financial Markets</i> I-Banking Cases Corporate Finance Investments <i>Fin Eng and Derivatives</i> <i>Market Regulation</i> Financial Theory and Research <i>Real Estate/Fixed Income</i> <i>Financial Institutions</i> Cases in Financial Modeling Advanced Fin Econometrics</p>	<p>Bachelor's degree with credit hours in:</p> <ul style="list-style-type: none"> • Advanced mathematics (6) (3 credits must be calculus) • microeconomics (3) • macroeconomics (3) • financial accounting (3) • managerial finance (3) • statistics (3) 	GW is a lockstep program that hits many of the same themes as our program. It is less flexible, and does not allow for deeper study as our program does.

University Degree MBA Ranking	Curriculum/Required Classes	Prerequisites	Comments
Princeton University Masters in Finance N/A (No MBA)	<p>Core</p> <p>Financial Investments</p> <p>Asset Pricing I</p> <p>Regression and Time Series</p> <p>Corp Fin/Fin Accounting</p> <p>Asset Pricing II</p> <p>Financial Econometrics</p> <p>Electives.</p> <p>Some electives are similar to our classes. Many are more quantitative.</p>	<p>A solid math background is required. At a minimum, we expect applicants to be familiar in mathematics with linear algebra, multivariable calculus, differential equations and with probability and statistics at the level of an intermediate undergraduate course. In addition, we offer incoming MFin students a two-week refresher course in mathematics and probability prior to the beginning of classes in the Fall semester. This course is required.</p>	<p>The Asset Pricing classes are more like our PhD level classes.</p> <p>Asset Pricing I:</p> <p>Topics include: no arbitrage, Arrow-Debreu prices and equivalent martingale measures, security structure and market completeness, mean-variance analysis, Beta-pricing, CAPM, and introduction to derivative pricing.</p> <p>Asset Pricing II</p> <p>Stochastic calculus and stochastic differential equations Topics include Brownian motion, martingales, and diffusions and their uses in stochastic volatility; volatility smiles; risk management; interest-rate models; and derivatives, swaps, credit risk, and real options.</p>