

10KS5244MS: FINANCIAL ENGINEERING, MS

In Workflow

1. U Program Review (dforgacs@illinois.edu; eastuby@illinois.edu; aledward@illinois.edu)
2. 1422 Head (thurston@illinois.edu; hcraddoc@illinois.edu; crook2@illinois.edu)
3. 1260 Head (l-chan2@illinois.edu)
4. KM Dean (peecher@illinois.edu; mlschltz@illinois.edu)
5. KP Committee Chair (mch@illinois.edu; bsnewell@illinois.edu; danko@illinois.edu; amccul2@illinois.edu; kcp@illinois.edu)
6. KP Dean (candyd@illinois.edu)
7. University Librarian (jpwilkin@illinois.edu)
8. Grad_College (agrindly@illinois.edu; jch@illinois.edu; lowry@illinois.edu)
9. Provost (kmartens@illinois.edu)
10. Senate EPC (bjlehman@illinois.edu)
11. Senate (jtempel@illinois.edu)
12. U Senate Conf (none)
13. Board of Trustees (none)
14. IBHE (none)
15. DMI (eastuby@illinois.edu; aledward@illinois.edu; dforgacs@illinois.edu)

Approval Path

1. Tue, 08 Oct 2019 22:22:17 GMT
Deb Forgacs (dforgacs): Approved for U Program Review
2. Tue, 08 Oct 2019 23:44:01 GMT
Rakesh Nagi (nagi): Approved for 1422 Head
3. Wed, 09 Oct 2019 00:27:04 GMT
Louis Chan (l-chan2): Approved for 1260 Head
4. Wed, 09 Oct 2019 19:12:02 GMT
Mark Peecher (peecher): Approved for KM Dean
5. Tue, 17 Dec 2019 18:58:34 GMT
Harry Dankowicz (danko): Approved for KP Committee Chair
6. Tue, 17 Dec 2019 20:54:10 GMT
Candy Deaville (candyd): Approved for KP Dean
7. Tue, 17 Dec 2019 21:06:14 GMT
John Wilkin (jpwilkin): Approved for University Librarian
8. Tue, 04 Feb 2020 18:30:36 GMT
Allison McKinney (agrindly): Approved for Grad_College
9. Tue, 04 Feb 2020 20:51:07 GMT
Kathy Martensen (kmartens): Approved for Provost
10. Mon, 10 Feb 2020 18:55:41 GMT
Barbara Lehman (bjlehman): Rollback to Provost for Senate EPC
11. Mon, 10 Feb 2020 21:35:52 GMT
Kathy Martensen (kmartens): Rollback to KP Dean for Provost
12. Wed, 12 Feb 2020 18:50:42 GMT
Candy Deaville (candyd): Rollback to KP Committee Chair for KP Dean
13. Tue, 10 Mar 2020 19:48:23 GMT
Keri Pipkins (kcp): Approved for KP Committee Chair
14. Tue, 10 Mar 2020 20:06:04 GMT
Candy Deaville (candyd): Approved for KP Dean
15. Tue, 10 Mar 2020 21:13:49 GMT
John Wilkin (jpwilkin): Approved for University Librarian
16. Wed, 11 Mar 2020 16:39:19 GMT
Allison McKinney (agrindly): Approved for Grad_College
17. Thu, 12 Mar 2020 16:58:12 GMT
Kathy Martensen (kmartens): Approved for Provost

History

1. Apr 4, 2019 by Deb Forgacs (dforgacs)
2. Sep 13, 2019 by Mary Lowry (lowry)

Date Submitted: Tue, 08 Oct 2019 22:12:10 GMT

Viewing: 10KS5244MS : Financial Engineering, MS

Changes proposed by: Rhonda McElroy

Proposal Type

Proposal Type:

Major (ex. Special Education)

This proposal is for a:

Revision

Proposal Title:

if this proposal is one piece of a multi-element change please include the other impacted programs here. *example: A BS revision with multiple concentration revisions*

Revision of the Curriculum Requirements for the M.S. in Financial Engineering, Department of Industrial & Enterprise Systems Engineering, The Grainger College of Engineering

EP Control Number

EP:20.150

Official Program Name

Financial Engineering, MS

Effective Catalog Term

Fall 2020

Sponsor College

Grainger College of Engineering

Sponsor Department

Industrial and Enterprise Systems Engineering

Sponsor Name

Deborah Thurston, Interim Department Head

Sponsor Email

thurston@illinois.edu

College Contact

Harry Dankowicz, Associate Dean for Graduate, Professional and Online Programs

College Contact Email

danko@illinois.edu

Program Description and Justification

Justification for proposal change:**Program Description:**

The Department of Industrial & Enterprise Systems Engineering in The Grainger College of Engineering and the Department of Finance in Gies College of Business is requesting a curriculum revision to the professionally-oriented Financial Engineering Master's degree program. The revised curriculum enables students to gain depth and breadth in the field of financial engineering through a more flexible elective coursework requirement than the existing curriculum. The proposed curriculum is outlined below. See attached Appendix A for details.

28 credit hours of Core coursework

16 credit hours of Elective coursework

4 credit hours of Professional Development

Justification:

The MSFE program was designed before, during, and after the major US financial crisis in 2008. That environment embraced a focus on derivatives, particularly options, securitization, and derivative valuation. The world of financial engineering has changed rapidly in recent years and has become increasingly complex. Machine learning and data analytics are now at the crux of "quant" operations.

Financial engineering programs at peer institutions and at Illinois have seen a decline of applications in recent years with the cause being attributed to too few or no courses being offered in machine learning, data analytics, or artificial intelligence. Surveys from corporate partners and alumni echo this concern. In response to those demands, the MSFE program proposes a modified curriculum to better align our graduates with the current needs of the marketplace. To meet those demands, the proposed curriculum provides an appropriate balance of both core requirements and electives. While core courses remain a requirement, increasing the number of elective courses positions the program to be more responsive to the varying and diverse educational backgrounds of students interested in the MSFE program.

To maintain the ranking of 5th best program in the nation and remain competitive with our peer institutions, the MSFE program at Illinois must be responsive to the changing demands and trends the financial world expects of graduates from a program of our caliber. The proposed curriculum will allow the program to produce a pipeline of graduates with relevant and diverse skills that employers can rely on to be prepared to meet their needs. One unique characteristic of the MSFE program is the offering of courses in Chicago, a world leading financial hub. Increasing the number of electives in the program also then increases the opportunities for students to learn and network in a real world environment.

Corresponding Degree

MS Master of Science

Is this program interdisciplinary?

Yes

Interdisciplinary Colleges and Departments (list other colleges/departments which are involved other than the sponsor chose above)

College

Gies College of Business

Department

Finance

Do you need to add an additional interdisciplinary relationship?

No

Academic Level

Graduate

CIP Code

143701 - Operations Research.

Is This a Teacher Certification Program?

No

Will specialized accreditation be sought for this program?

No

Admission Requirements**Is this revision a change to the admission status of the program?**

No

Enrollment**Describe how this revision will impact enrollment and degrees awarded.**

The goal of this curriculum revision is to remain competitive to maintain the current enrollment in the program. The program is looking to increase enrollment by 15-20 additional students with the curriculum revision. If enrollment does increase, then the graduation rate will also increase.

Estimated Annual Number of Degrees Awarded**What is the matriculation term for this program?**

Fall

Delivery Method

Is this program available on campus and online?

No

This program is available:

On Campus

Budget

Are there budgetary implications for this revision?

No

Will the program or revision require staffing (faculty, advisors, etc.) beyond what is currently available?

No

Resource Implications

Facilities

Will the program require new or additional facilities or significant improvements to already existing facilities?

No

Technology

Will the program need additional technology beyond what is currently available for the unit?

No

Non-Technical Resources

Will the program require additional supplies, services or equipment (non-technical)?

No

Resources

Faculty Resources

Please address the impact on faculty resources including any changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc. Describe how the unit will support student advising, including job placement and/or admission to advanced studies.

There are no negative implications on faculty resources for either of the proposed changes.

Library Resources

Describe your proposal's impact on the University Library's resources, collections, and services. If necessary please consult with the appropriate disciplinary specialist within the University Library.

This proposed change will not impact the University Library.

Instructional Resources

Will there be any reduction in other course offerings, programs or concentrations by your department as a result of this new program/proposed change?

No

Does this new program/proposed change result in the replacement of another program?

No

Does the program include other courses/subjects impacted by the creation/revision of this program?

No

Financial Resources

Will the unit need to seek campus or other external resources?

No

Will an existing tuition rate be used or continue to be used for this program?

Yes

Is this program requesting self-supporting status?

No

Program Regulation and Assessment

Briefly describe the plan to assess and improve student learning, including the program's learning objectives; when, how, and where these learning objectives will be assessed; what metrics will be used to signify student's achievement of the stated learning objectives; and the process to ensure assessment results are used to improve student learning. (Describe how the program is aligned with or meets licensure, certification, and/or entitlement requirements, if applicable).

Existing program.

Is the career/profession for graduates of this program regulated by the State of Illinois?

No

Program of Study

"Baccalaureate degree requires at least 120 semester credit hours or 180 quarter credit hours and at least 40 semester credit hours (60 quarter credit hours) in upper division courses" (source: <https://www.ibhe.org/assets/files/PrivateAdminRules2017.pdf>). For proposals for new bachelor's degrees, if this minimum is not explicitly met by specifically-required 300- and/or 400-level courses, please provide information on how the upper-division hours requirement will be satisfied.

All proposals must attach the new or revised version of the Academic Catalog program of study entry. Contact your college office if you have questions.

Revised programs

ep0976 Fin Eng.pdf

MSFE Curriculum Revision-Appendix A.pdf

Attach a side-by-side comparison with the existing program AND, if the revision references or adds "chose-from" lists of courses students can select from to fulfill requirements, a listing of these courses, including the course rubric, number, title, and number of credit hours.

Catalog Page Text

Catalog Page Text: Description of program for the catalog page. This is not official content, it is used to help build the catalog pages for the program. Can be edited in the catalog by the college or department.

Covering topics in finance, economics, numerical methods, stochastic calculus, and computer programming, the MSFE is a rigorous, three-semester, 48-credit, resident degree program with a summer internship opportunity. Details on the program may be found at msfe.illinois.edu. For additional details and requirements refer to the program's Web site and the Graduate College Handbook.

Statement for Programs of Study Catalog

Code	Title	Hours
Required Courses		40
Core Coursework		28
FIN 500	Introduction to Finance	4
FIN 501	Economics of Stock Market Fundamentals (or FIN 580 Section FE)	
FIN 512	Financial Derivatives	4
FIN 516	Term Structure Models (Course revision from 4 to 2 credit hours)	2
FIN 517	Advanced Term Structure Models	
FIN 553	Machine Learning in Finance	2
IE 522	Statistical Methods in Finance	4
IE 523	Financial Computing	4
IE 524	Optimization in Finance	2
IE 525	Stochastic Calculus & Numerical Models in Finance	4
IE 526	Course IE 526 Not Found	
IE 517	Machine Learning in Finance Lab	2

Elective Coursework (approved by academic advisor)		16
Professional Development (choose from the following)		4
IE 527 or FIN 590	MSFE Professional Development Individual Study and Research	
Electives		4
ACCY 517	Financial Statement Analysis	
FIN 521	Advanced Corporate Finance	
FIN 580	Special Topics in Finance (Risk Measurements and Management)	
FIN 580	Special Topics in Finance (Advanced Portfolio Optimization)	
FIN 592	Empirical Analysis in Finance	
IE 510	Applied Nonlinear Programming	
IE 598	Special Topics (Section NS-Game Theory Models, Applications & Algorithms)	
SE 530	Multiattribute Decision Making	
FIN 583	Practicum	2
IE 597	Independent Study	2
Other independent study/internship with approval of advisor.		
Total Hours		48

Other Requirements

Requirement

Minimum 500-level Hours Required Overall: 44

A minimum of 36 credit hours must be taken from the University of Illinois Urbana-Champaign campus.

Minimum GPA: 2.75

EP Documentation

DMI Documentation

Banner/Codebook Name

MS: Financial Engineering

Program Code:

10KS5244MS

Degree Code

MS

Major Code

5244

Program Reviewer Comments

Barbara Lehman (bjlehman) (Mon, 10 Feb 2020 18:55:41 GMT):Rollback: being returned: flagged by CIM as having missing courses.

Kathy Martensen (kmartens) (Mon, 10 Feb 2020 21:35:52 GMT):Rollback: See EP comment – 6 courses showing as not found/new courses. Senate Ed Pol needs these courses to be approved to have a sense of what the program content will be, and thus cannot review the program proposal until the courses are reflected in their final, approved format.

Candy Deaville (candyd) (Wed, 12 Feb 2020 18:50:42 GMT):Rollback: See EP comment – 6 courses showing as not found/new courses. Senate Ed Pol needs these courses to be approved to have a sense of what the program content will be, and thus cannot review the program proposal until the courses are reflected in their final, approved format”, per Kathy Martens

Harry Dankowicz (danko) (Tue, 25 Feb 2020 19:21:26 GMT):FIN 55X Machine Learning in Finance has been approved as FIN 553 Machine Learning in Finance. IE 52X (2 credit hours) has been approved by the GCOE Executive Committee as IE 524 Optimization in Finance. IE 52X (4 credit hours) has been approved by the GCOE Executive Committee as IE 525 Stochastic Calculus & Numerical Models in Finance. IE 55X Machine Learning in Finance Lab has been taught twice as IE 598 Machine Learning in Finance Lab, and is currently undergoing evaluation by the GCOE Executive Committee as IE 517 Machine Learning in Finance Lab. Proposed syllabus is attached.

Harry Dankowicz (danko) (Tue, 25 Feb 2020 19:21:32 GMT):FIN 55X Machine Learning in Finance has been approved as FIN 553 Machine Learning in Finance. IE 52X (2 credit hours) has been approved by the GCOE Executive Committee as IE 524 Optimization in Finance. IE 52X (4 credit hours) has been approved by the GCOE Executive Committee as IE 525 Stochastic Calculus & Numerical Models in Finance. IE 55X Machine Learning in Finance Lab has been taught twice as IE 598 Machine Learning in Finance Lab, and is currently undergoing evaluation by the GCOE Executive Committee as IE 517 Machine Learning in Finance Lab. Proposed syllabus is attached.

Harry Dankowicz (danko) (Tue, 25 Feb 2020 19:21:56 GMT):FIN 55X Machine Learning in Finance has been approved as FIN 553 Machine Learning in Finance. IE 52X (2 credit hours) has been approved by the GCOE Executive Committee as IE 524 Optimization in Finance. IE 52X (4 credit hours) has been approved by the GCOE Executive Committee as IE 525 Stochastic Calculus & Numerical Models in Finance. IE 55X Machine Learning in Finance Lab has been taught twice as IE 598 Machine Learning in Finance Lab, and is currently undergoing evaluation by the GCOE Executive Committee as IE 517 Machine Learning in Finance Lab. Proposed syllabus is attached.

Key: 315

**EDUCATIONAL POLICY
COVER SHEET**

Item Number: EP.09.76	Charge Date: April 8, 2009	Source: Graduate College & College of ENGR and College of BUS
Title: Proposal from the Graduate College, College of Engineering and College of Business to establish the jointly offered Master of Science in Financial Engineering		
Paper Trail		
Subcommittee: <i>Subcommittee B</i>	Date Assigned:	
Documents Distributed/Date:	Reference in Minutes: Date/Notes <i>4/13/09 Unanimously approved as revised -</i> <i>4/14/09 2XC to RD for Senate</i>	
Final Disposition: <i>Approved by the Senate April 27, 2009 -</i>		

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

EP.09.76

Office of the Provost and Vice Chancellor
for Academic Affairs

Swanlund Administration Building
601 East John Street
Champaign, IL 61820



RECEIVED
APR 08 2009
OFFICE OF THE SENATE

April 6, 2009

Abbas Aminmansour, Chair
Senate Committee on Educational Policy
Office of the Senate
228 English Building, MC-461

Dear Professor Aminmansour:

Enclosed is a copy of a proposal from the Graduate College, College of Engineering and College of Business to establish the jointly offered Master of Science in Financial Engineering in the Departments of Industrial and Enterprise Systems Engineering and Finance.

This proposal has been approved by the Graduate College Executive Committee. It now requires Senate review.

Sincerely,

Jason Kosovski
Assistant to the Provost
for Communication

JRK/dkk

Enclosures

c: I. Adesida
L. DeBrock
D. Dutta
D. Ikenberry
C. Livingstone
J. Pang
K. Tappenden
R. Wheeler

UNIVERSITY OF ILLINOIS
AT URBANA - CHAMPAIGN

Kelly A. Tappenden, Ph.D., R.D.
Associate Dean



Graduate College
202 Coble Hall, MC-322
801 South Wright Street
Champaign, IL 61820-6210
www.grad.uiuc.edu

December 9, 2008

Kristi Kuntz
Assistant Provost
Office of the Provost
207 Swanlund, MC-304

Dear Kristi:

Enclosed is the 'Proposal to establish a Master of Science degree program in Financial Engineering (or MSFE) to be jointly administered by the Department of Finance in the College of Business and the Department of Industrial and Enterprise Systems Engineering (IESE) in the College of Engineering'. Although multiple areas of strength were noted in the proposed program, two revisions requested by our review were:

- 1.) clarification on the stage of development of the new courses required in the proposal and assurance that faculty were available to teach these courses, and;
- 2.) the addition of a funding statement in the Programs of Study statement to clarify issues related to student aid and tuition expectations.

Upon revision, the Graduate College Executive Committee voted unanimously to approve this proposal.

I send it to you now for further review.

Yours truly,

Kelly Tappenden, Ph.D., R.D.
Associate Dean, Graduate College
Professor of Nutrition and Gastrointestinal Physiology

Enclosure

- c: I. Adesida
L. DeBrock
D. Ikenberry
J. Pang
R. Wheeler



ILLINOIS

UNIVERSITY OF ILLINOIS AT URBANA CHAMPAIGN

APPROVED BY UIUC SENATE

Proposal to the Senate Educational Policy Committee

Monday, September 8, 2008 (Latest revision: Monday April 13, 2009)

PROPOSAL TITLE: To establish a Master of Science degree program in Financial Engineering (or MS in FE) to be jointly administered by the Department of Finance in the College of Business and the Department of Industrial and Enterprise Systems Engineering (IESE) in the College of Engineering.

SPONSORS: Charles M. Kahn, Professor and Chair

Department of Finance

Telephone: (217) 333-2813

Email: c-kahn@illinois.edu

Jong-Shi Pang, Professor and Head

Department of Industrial and Enterprise Systems Engineering

Telephone: (217) 244-5703

Email: jspang@illinois.edu

COLLEGE CONTACT: Victoria L. Coverstone, Associate Dean

Graduate and Professional Education, College of Engineering

Telephone: (217) 333-0678

Email: vcc@uiuc.edu

Greg Northcraft

Associate Dean, College of Business

Telephone: (217) 333-4519

Email: northcra@illinois.edu

BRIEF DESCRIPTION: The MS in FE will be a rigorous, three-semester (48-credit hour), lock-step, residential degree program with a summer internship opportunity. The program will be operated under the principle of a stand-alone budget entity whose ownership is evenly divided between two separate Departments (and their respective Colleges). The program will generate tuition and fee revenue sufficient in scale to pay for associated faculty cost and expense and all other direct and indirect costs.

The driving force to initiate this program is to satisfy the growing demand for professionals with significant technical/quantitative training in this explosive sub-area of finance related to advanced financial instruments.

Successful applicants will have a Bachelors degree with one year of calculus, one semester of linear algebra and differential equations, one semester of programming (preferably in C/C++), and one semester of probability and statistics. Knowledge of basic finance is helpful but not necessary. Given the program's technical emphasis, most of the successful applicants will have completed a Bachelors degree in an engineering field, mathematics, physics, computer science or economics. The program expects that interested students with strong background but with minor deficiencies in some of the prerequisites may occasionally be admissible upon completion of some remedial courses.

Oversight of the curriculum will be provided by a joint faculty advisory committee composed of two faculty members from each sponsoring Department, who will be selected by the respective department Chair and Head. This committee, together with the Chair and Head of the two respective departments and a representative from the Dean's office of each of the two Colleges, will constitute an eight-member faculty advisory committee responsible for oversight of the degree and its curriculum. Curricular changes will come from this committee for review by appropriate channels in both Departments and Colleges before being forwarded to the campus for approval.

The curriculum will be drawn from four core areas of study: finance, stochastic modeling, computing and computational methods, and an applied practicum experience. The core will be supplemented with electives offered in the sponsoring Colleges and Departments and approved by the joint faculty advisory committee. All required courses will be offered by the two sponsoring departments; there is no dependency on courses from other departments. The proposed curriculum is summarized in Appendix A.

This degree, while technical in nature, is intended to be pragmatic such that it prepares students to be well-grounded and well-equipped to advance quickly in this field. To preserve this unique, cultural attitude, the program will have several important design elements. First, program operations will be managed by an Executive Director who will also serve as the Director of Graduate Studies for the program and a direct liaison to industry. Such relationships will lead to programmatic learning opportunities and will also assure the curriculum is both demanding and contemporary. Further, one course in the curriculum is designed as a "Practicum." The Executive Director will assist in helping serve as a bridge with industry to identify and maintain these "real-world" financial modeling problems.

The MS in FE will have an advisory board composed of practitioners with rotating terms. The board will be managed by the Executive Director and its mission will include: providing curricular and professional advice, being a source for summer internships, offering full-time employment opportunities, and assisting with development activities.

JUSTIFICATION: Financial Engineering (FE) is a relatively young, multidisciplinary field that pertains to the application of engineering approaches and methods to the analysis and management of financial problems, particularly in the financial asset arena. Common problems involve identifying and managing financial risk in asset portfolios

and the pricing of financial derivatives. Other applications exist in proprietary security trading operations, as well as all domains where risk is an important concern.

The field has emerged as the result of the ever growing complexity required in describing and solving these advanced business problems whose resolution requires fundamental economic principles and finance theory coupled with state-of-the-art mathematical methods, computational tools, and computer programming expertise. Within a short span of only two decades, FE has become a flourishing subfield characterized by its practical importance and deep intellectual value; indeed, several recent Nobel prizes in economics were awarded for works that have become the foundation of this field. Active research in finance, operations research, and mathematics is now being devoted to the study of many emerging issues associated with new financial instruments and other topics relating to risk assessment, risk measurement and optimization.

According to http://programs.gradschools.com/usa/financial_engineering.html, there are now 31 financial engineering or financial mathematics graduate programs in the U.S and many more international ones. This growth has been fueled by an active corporate community consisting of asset management companies (including mutual funds and hedge funds), insurance companies, and some advanced corporate treasury departments. Long-term trends in the financial services industry suggest a trend toward more quantitative analysis and methods.

In addition to quantitative finance, the same concepts can be applied to many other areas of engineering and business, including insurance, energy markets and commodity trading, financial services, business consulting, and government regulation. Lastly, the MSFE program also serves as an impetus for the two departments to develop a research focus in financial engineering that will enhance our research mission and doctoral programs.

BUDGETARY AND STAFF IMPLICATIONS

a. Additional staff and dollars needed

The present faculty members in both sponsoring departments have complementary expertise to cover all courses in the proposed curriculum (see attached course descriptions). On one hand, this program is a natural extension of the existing Master of Science in Finance (MSF) Program in the Finance Department, whose faculty can easily handle the core finance courses proposed here. On the other hand, the IESE Department has research and teaching expertise in computational finance, portfolio optimization, derivative pricing, stochastic calculus and computational methods. As the program develops, the two sponsoring departments plan to hire several additional tenured and tenure-track faculty in this area using resources generated from this degree program.

Aside from faculty, two types of staff support will be needed. One type involves an Executive Director and an Assistant Director. As mentioned elsewhere, the Executive Director will have deep familiarity with the needs of industry and will also serve as the Director of Graduate Studies. This person will also play a critical role in advising

students, maintaining corporate relationships, recruiting new students and overseeing student placements. The Director will have the responsibility for interacting with both faculty and students and maintaining overall satisfaction. The Director will also serve as a bridge between the leadership of the Finance and IESE Departments, however the Director will report to the joint faculty advisory committee.

A second layer of staff support will be needed in the area of clerical support. In the beginning, MSFE admissions will be administered by Finance and IESE personnel so that cost and production efficiencies can be realized. As the MSFE program grows and stabilizes, which we expect to happen after two to three years, it is expected that resources will be sufficient to expand this support as needed.

In the first two years of operation, the program will experience deficits and will be in need of seed funds. Such financial matters have been addressed between the two sponsoring departments and their respective colleges and with the Provost's Office; all units involved are committed to provide needed support to ensure the successful start of the program (see Appendices B1 and B2).

b. Internal reallocations

The MSFE joint faculty advisory committee will ensure that current student-teacher loads will not be significantly affected and that existing undergraduate and graduate programs will not be drawn down or adversely affected.

c. Effect on course enrollment in other departments

The program does not depend on courses offered through other departments; thus there will be no direct effect on course enrollment in other departments. Some students may be drawn to consider both the current MSF as well as this proposed program. Given this, the two programs will be managed in a cooperative way so as to not adversely affect operations of the MSF program.

d. Impact on the University Library

The program does not require additional library materials such as books, periodicals, etc.; thus, there will be no impact on the University Library; see Appendix C.

e. Impact on computer use, laboratory use, equipment, etc.

The program will supply students with computers, software and data sets funded through tuition and fees. There will be no negative impact on existing facilities, computer usage, laboratory usage or equipment.

DESIRED EFFECTIVE DATE: August 1, 2009

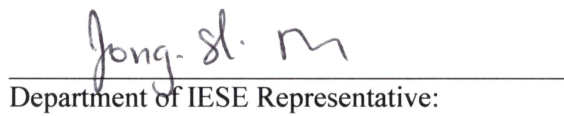
STATEMENT FOR PROGRAMS OF STUDY CATALOG: see Appendix D.

CLEARANCES:

Signatures:


Department of Finance Representative:

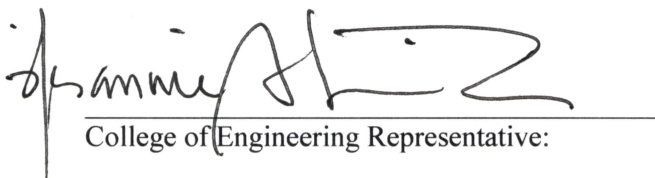
Sept 9, 2008
Date:


Department of IESE Representative:

Sept. 09, 2008
Date:


College of Business Representative:

9.9.08
Date:


College of Engineering Representative:

9/15/08
Date:


Graduate College Representative:

12/9/08
Date:

Provost Representative:

Date:

Educational Policy Committee Representative:

Date:

Appendix A

Proposed Curriculum for the MS Degree in Financial Engineering

Date: Monday September 08, 2008, (Latest revision, Monday April 13, 2009)

The prerequisites and proposed curriculum are as described below. All courses will have 4 graduate credit hours. Some courses will be cross listed with both the IE rubric in the IESE department and FIN rubric in the Finance department, but only where responsibility for the course is shared. The first rubric of the course indicates the primary department. All required courses in the MS in FE curriculum have been approved by the respective Colleges with the exception of the Financial Engineering Project, which occurs in the third semester of the program. Except for one elective course in the third semester, all courses are required and are expected to be taken in sequence in the indicated semesters. Thus, there is an implied prerequisite sequencing of the courses. Precise prerequisite statements will be developed as the courses are formalized.

Prerequisites to the Program

(Students admitted to the program will have taken the GRE or GMAT tests and the TOEFL test for students from non-U.S. institutions. The prerequisites below are expected to be easily met by an undergraduate major in engineering, mathematics, computer science, or physics. Exceptional undergraduates majoring in economics will also be able to meet the prerequisites.)

1. 1 year of calculus
2. 1 semester of Linear Algebra
3. 1 semester of Differential Equations
4. 1 semester of Probability and Statistics
5. 1 semester of Programming (preferably in C/C++)
6. Knowledge of basic finance is helpful but not necessary.

The Curriculum

A digest of the courses proposed for the MSFE program follows, organized by the semester in which they will be offered.

First semester (Fall)

FIN 500. Introduction to Finance (4 hours): Introduction to financial markets, some of the most common securities traded in financial markets, and theories of valuation, with a brief overview of some of the important ideas in corporate finance. Net present and future value; internal rate of return; Gordon dividend model; fixed-income analysis; random cash flow; Markowitz' portfolio theory and diversification; Sharpe's capital asset pricing model; capital market line; free cash flow for equity evaluation; forward markets, futures and options; binomial and Black-Scholes option pricing; capital structure and corporate restructuring.

FIN 501. Financial Economics (4 hours): Standard models of consumer and producer behavior and the implications of these models for resource allocation and market efficiency. Basic tools of microeconomics, including optimization, comparative statics, and equilibrium. Macroeconomic principles and their applications to finance are highlighted throughout.

IE 522. Stat. Methods in Fin. Engrg (4 hours): Methods of statistical modeling of signals and systems with an emphasis on finance applications. Review of linear algebra, probability theory, and spectral analysis. Linear Time Invariant (LTI) models, ARX models, Least-squares methods, Maximum likelihood methods, non-parametric and frequency-domain methods, convergence, consistency and identifiability of linear models and asymptotic distribution of parameter estimates, and techniques of model validation. Principal Component Analysis (PCA) for dimension reduction, ARCH and GARCH processes and their related models, implementation/application and case-studies of Recursive Identification, and Monte Carlo Simulation.

IE 523. Financial Computing (4 hours): Review of Visual Basic (VB) programming: types and loops, macros, arrays, and objects. Review of C++: structures, classes, overloading, inheritance, and I/O. C++ standard libraries. Financial computing case studies. Illustrations of financial engineering topics using VB and illustrations of the same topics for financial markets using .NET.

Second semester (Spring)

IE 524. Optimiz for Financial Engrg (4 hours): Basic optimization methods for financial engineering, optimization modeling languages such as AMPL and GAMS, and optimization software including the NEOS server. Linear, quadratic, nonlinear, dynamic, integer, and stochastic programming and their applications to portfolio and asset management. Optimization using values-at-risk, conditional values-at-risk, and other risk measures.

IE 525. Numerical Methods in Finance (4 hours): Numerical methods for the pricing and risk management of financial derivatives. Monte Carlo simulation, variance reduction techniques, quasi-Monte Carlo methods, finite difference methods for ordinary differential equations and parabolic partial differential equations, explicit and implicit schemes, handling of various boundary conditions, and free boundary problems for American options.

FIN 512. Financial Derivatives (4 hours): Introduction to options, futures, swaps and other derivative securities; examination of institutional aspects of the markets; theories of pricing; discussion of simple as well as complicated trading strategies (arbitrage, hedging, and spread); applications for asset and risk management.

FIN 517. Credit Risk and Instruments (4 hours): Principal approaches to modeling credit/default risk and the most important credit derivatives and structured credit instruments, with a focus on using the modeling approaches to value collateralized debt obligations (CDOs) and synthetic CDOs. Approaches analyzed include copula-based models, reduced-form models, and ones based on ratings transitions. Principal methodologies for measuring portfolio credit risk, i.e., credit value-at-risk and the measurement of economic capital.

Summer internship (encouraged but not required)

Third semester (Fall)

IE 526. Stochastic Calculus in Finance (4 hours): A stochastic calculus approach to the pricing and risk management of financial derivatives: No-arbitrage pricing; the binomial model; Brownian motion; the Black-Scholes-Merton model; stochastic-volatility and jump models. Computational methods including numerical solutions of partial differential equations. Monte Carlo simulation and Fourier transform methods.

FIN 516. Term Structure Models (4 hours): The LIBOR market model (LMM), its calibration, implementation, and use in valuing interest rate derivatives, including interest rate exotics and American-style options with the LMM. Review of the simpler Hull-White, Black-Derman-Toy, and Black-Karasinski models that are still in widespread use. Applications of Monte Carlo methods (in the LMM) and finite-difference or "tree" methods (in the other models).

IE 527 / FIN 576. Financial Engineering Project (4 hours): Project-based course. Students work individually or in teams to develop solutions to problems in finance supplied by industry or by a faculty member associated with the MSFE program. A midterm and final report summarize the work of the term.

Some Electives (one to be taken in the third semester)

(GE 530) Multiattribute Decision Making

(IE 510) Applied Nonlinear Programming

(IE 598 NS) Game Theory Models, Applications and Algorithms

(IE to be designed) Risk Measurements and Management: Assessment and management of risks from a probabilistic perspective, covering basic principles of risk analysis, including identification, measurement, quantitative modeling of risk, axiomatic approaches, and decision making under uncertainty.

(IE to be designed) Advanced Portfolio Optimization: Development and formulation of portfolio optimization problems under uncertainty in single and multi-period settings; advanced optimization methods for solving these problems.

(FIN 521) Corporate Finance

(FIN 592) Empirical Analysis of Equity Returns [Currently taught as FIN 580 EA]

(ACCY 517) Financial Statement Analysis [or a comparable in Finance]



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Appendix B1

To: The Graduate College
Faculty Senate Education Policy Committee

From: Ilesanmi Adesida, Dean of the College of Engineering
Larry DeBrock, Interim Dean of the College of Business

Two handwritten signatures in blue ink. The first signature is 'IA' and the second is 'LDB'.

Subject: A Proposal to establish the degree Master of Science in Financial Engineering

Date: September 08, 2008

After extensive planning and collaboration, The College of Engineering and the College of Business most enthusiastically endorse the attached proposal seeking your approval to establish a new degree program called The Master of Science in Financial Engineering. This new and innovative program is being jointly proposed by the Department of Industrial and Enterprise Systems Engineering and the Department of Finance.

The two Colleges are committed to providing the fiscal and academic resources needed to ensure the successful launch of the program and to play an active, continuous oversight role in the subsequent operation of the program.

The development of this proposal has truly been a cross-campus collaboration involving numerous constituents including faculty, alumni and campus administration. The attached proposal has received requisite review and approvals by all Departmental and College faculty review committees within our respective units.

We look forward to hearing your comments and lending any further support we can toward this proposal.

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

Office of Provost and Vice Chancellor
for Academic Affairs

Swanlund Administration Building
601 East John Street
Champaign, IL 61820



APPENDIX B2

Date: September 9, 2008

To: Ilesanmi Adesida, Dean of the College of Engineering
Larry DeBrock, Interim Dean of the College of Business ✓

From: Michael Andrechak *Mike*
Associate Provost, Budget and Resource Planning

RE: The Proposal to Establish a Master of Science in Financial Engineering

I am writing to let you know that I have been involved in a review of the pro forma budget projections for this proposed self-supporting program. I find the projections to be plausible and realistic.

While a formal budget memorandum of understanding needs to be completed and executed between the various budget entities involved, I am comfortable that such an agreement will occur.

As such, the purpose of this letter is to assure you and others engaged in reviewing this matter that I view this proposal to be fiscally prudent and, as such, it has my general support.

c. Jong-Shi Pang
David Ikenberry

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

University Library
Office of University Librarian
and Dean of Libraries
230 Main Library, MC-522
1408 West Gregory Drive
Urbana, IL 61801



Received
AUG 11 2008
IESE

July 28, 2008

APPENDIX C

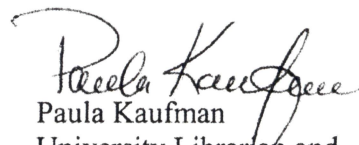
Jong-Shi Pang
Professor and Head, Department of Industrial and Enterprise Systems Engineering
117 Transportation Building
104 S. Mathews Ave.
Urbana, Illinois 61801

Dear Professor Pang:

Thank you for giving the University Library the opportunity to review your proposal to the Senate Committee on Educational Policy to establish a Master of Science degree program in Financial Engineering. Based upon the proposal that we reviewed, we understand that this program is to be jointly administered by the Department of Finance in the College of Business and the Department of Industrial and Enterprise Systems Engineering (IESE) in the College of Engineering.

Upon review of the proposal materials that you provided to the University Library on July 24th, 2008, the University Library does not believe that there will be a significant impact on its operations. However, if there are additional services or materials required as the program develops, we will be happy to discuss securing the requisite resources with the program sponsors.

Sincerely,


Paula Kaufman
University Librarian and
Dean of Libraries

c: David Ikenberry
Thomas Teper

Appendix D

Proposed Statement for the Graduate Programs of Study

Financial Engineering

www.msfe-illinois.edu *(to be created)*

msfe@illinois.edu *(to be created)*

Sponsoring Departments

Finance

Chair of Department: Charles M. Kahn
340 Wohlers Hall
1206 South Sixth Street
Champaign, IL, 61820
(217) 333-2813

Industrial and Enterprise Systems Engineering

Head of Department: Jong-Shi Pang
117 Transportation Building
104 South Mathews Avenue
Urbana, IL 61801
(217) 244-5703

Major: Financial Engineering

Degree offered: M.S.

Graduate Degree Programs

This Master of Science in Financial Engineering (MS in FE) degree program is jointly sponsored by the Department of Industrial and Enterprise Systems Engineering (IESE) in the College of Engineering and the Department of Finance in the College of Business. Graduates from this program receive the MS in FE degree awarded by the Graduate College. The MS in FE program complements other Finance and IESE graduate programs offered by the sponsoring departments.

Financial Engineering (FE) is a relatively young, multidisciplinary field that pertains to the application of engineering approaches and methods to the analysis and management of financial problems, particularly in the financial asset arena. Common problems involve identifying and managing financial risk in asset portfolios and asset positions and pricing of financial derivatives. Other applications exist in proprietary security trading operations, as well as in practically all practical domains where risk is an important concern. The field has emerged as the result of the ever growing complexity required in describing and solving these business problems whose resolution requires fundamental economic principles and finance theory coupled with state-of-the-art mathematical methods, computational tools, and computer programming expertise.

Admission

Successful applicants to the MS in FE Program will have a Bachelor's degree with one year of calculus, one semester of linear algebra and differential equations, one semester of programming (preferably in C/C++), and one semester of probability and statistics. Knowledge of basic finance and economics is helpful but not necessary. Given its technical emphasis, applicants to this program typically will have completed a Bachelor's degree in an engineering field, mathematics, physics, computer science, or economics that provides sufficient preparation to facilitate a fast-paced, in-depth learning environment.

All applicants are expected to have a minimum grade point average of at least 3.25 (A=4.00) for the last two years of undergraduate study and a 3.50 for any previous graduate work completed. Scores on the Graduate Record Examination (GRE) general test are required of all applicants. All applicants whose native language is not English must submit a minimum Test of English as a Foreign Language (TOEFL) score of at least 103 (iBT), 257 (CBT), or 613 (PBT); or minimum International English Language Testing System (IELTS) academic exam scores of 7.0 overall and 6.0 in all subsections.

Degree Requirements

*For additional details and requirements refer to the Finance department's [programs Web site](#), the IESE department's [graduate programs Web site](#) and the [Graduate College Handbook](#).

Master of Science, Financial Engineering

	Required Hours
Required Courses:	
Core Courses	40
Project	4
Elective Graduate Coursework	4

Total Hours	48
Minimum 500-level Hours Required Overall	48
Other Requirements*	

Covering topics in finance, economics, numerical methods, stochastic calculus, and computer programming, the MSFE is a rigorous, three-semester, 48-credit, resident degree program with a summer internship opportunity. Twelve courses each of 4 graduate credits are required for graduation; they are expected to be taken in sequence in the respective semesters. Details on the program may be found at <http://www.msfe-illinois.edu>.

Appendix on Financial Aid

(Response to question from Graduate College review)

The MS in FE is structured to be a self-supporting, professional masters program. As such, financial aid sponsored by the program will generally be limited. In particular, we foresee limited use of full or partial tuition waivers, neither do we foresee the use of stipends or other non-tuition relief. Of course, the program will support and facilitate students applying for financial aid from all other available sources on their own terms. Over time, the program may receive corporate or alumni sponsorship. To the extent such support is sufficient in scale, the program might be able to begin offering scholarship support.

Appendix on Courses in the MS in Financial Engineering

(Response to question from Graduate College review; version April 13, 2009)

The MS in FE degree program consists of 12 graduate-level courses: 10 are required, 1 is an elective, and the remaining one is a project-based practicum course. Five required courses are listed with the FIN rubric; all have been approved at the campus level. The other 5 required courses are listed with the IE rubric; these have been approved by the College of Engineering and are currently awaiting campus approval. The elective course can be any one from a list of existing courses offered by the two departments; a small sample of such courses is given in the table below. The practicum course will soon be designed and submitted for approval in time for first offering in Fall 2011; the intent of this course is to allow students to work individually or in teams to develop solutions to problems in quantitative finance supplied by industry or by a faculty member associated with the MSFE program.

Courses	Status	R/E	Remarks
FIN 500	approved	R	currently being taught as FIN 520
FIN 501	approved	R	currently being taught as FIN 580 FE
FIN 512	existing course	R	
FIN 516	approved	R	50% overlap with FIN 515
FIN 517	approved	R	overlaps with offered courses; if necessary can be combined with FIN 514
IE 522	campus approval in process	R	80% overlap with GE 524
IE 523	campus approval in process	R	
IE 524	campus approval in process	R	taught as GE 598 JF in fall 2008
IE 525	campus approval in process	R	
IE 526	campus approval in process	R	being taught as GE 598 LF in spring 2009
IE 527/ FIN 576	new course	R	to be designed and approved in time for first offering in Fall 2011
FIN 521	existing course	E	
FIN 592	approval in process	E	currently being taught as FIN 580 EA
ACCY 517	existing course	E	
GE 530	existing course	E	
IE 510	existing course	E	
IE 598 NS	existing course	E	

Appendix A: Proposed Curriculum Revision

Current Requirements

Core Courses • FIN 500 or FIN 520: Introduction to Finance • FIN 501 or FIN 580 FE: Financial Economics • IE 522: Stat Methods in Fin ENGR • IE 523: Financial Computing • IE 524: Optimize for Financial ENGR • IE 525: Numerical Methods in Finance • FIN 512: Financial Derivatives • FIN 517: Credit Risk and Instruments • IE 526: Stochastic Calculus in Finance • FIN 516: Term Structure Models	40
Project • IE 527/FIN 576: Financial Engineering Project	4
Elective Graduate Coursework. Choose one of the following courses: • GE 530: Multi-attribute Decision Making • IE 510: Applied Nonlinear Programming • IE 598 NS: Game Theory Models, Application and Algorithms • FIN 521 Corporate Finance • FIN 592: Empirical Analysis of Equity Returns • ACCY 517: Financial Statement Analysis	4
Total Hours	48

Other Requirements

Requirement
Minimum 500-level Hours Required Overall: 44
Minimum GPA: 2.75

Proposed Revised Requirements

Requirements		Hours
Core Courses		28
- FIN 500: Introduction to Finance (4 hrs) - FIN 512: Financial Derivatives (4 hrs) - FIN 516: Term Structure Models (2 hrs) - FIN 553: Machine Learning in Finance (2 hrs) - IE 517: Machine Learning in Finance Lab (2 hrs)¹	- IE 522: Statistical Methods in Finance (4 hrs) - IE 523: Financial Computing (4 hrs) - IE524: Optimization in Finance (2 hrs) - IE 525: Stochastic Calculus & Numerical Models in Finance (4 hrs)	
Electives (approved by academic advisor)		16
Professional Development (choose from the following):		4
- FIN 583: Practicum (2 hrs) - IE 597: Independent Study (2 hrs) - Other independent study/internships with approval of advisor.		
Total Required Hours		48

Other Requirements

A minimum of 36 credit hours must be taken from the University of Illinois at Urbana-Champaign
Minimum GPA: 2.75

¹ This course was taught as *IE598: Machine Learning in Finance Lab* (2 hours) in Fall 2018 and Fall 2019.