PROGRAM ANNOUNCEMENT

Institution:	New Jersey Institute of Technology
New Program Title:	Financial Engineering
Degree Designation:	Master of Science in Financial Engineering
Degree Abbreviation:	MSFE
CIP Code and Nomenclature (*if possible*): **If outside the classification indicate Not Applicable**	52.0899
Campus(es) where the program will be offered:	NJIT Newark Campus
Date when program will begin (month and year):	Fall 2008
List the institutions with which articulation agreements will be arranged:	To be determined

Is licensure required of program graduates to gain employment? □ Yes X No

Will the institution seek accreditation for this program? X Yes □ No

If yes, list the accrediting organization:

____AACSB – The American Association of Collegiate Schools of Business _

Program Announcement Narrative

Objectives page(s)_____
Need page(s)_____
Student Enrollments page(s)_____
Program Resources page(s)_____

1. ***Program Description and Objectives***

Briefly summarize the program and indicate its objectives; e.g., the nature and focus of the program, the knowledge and skills students will acquire, any cooperative arrangements with other institutions or external agencies in offering this program, etc.

Financial Engineering is a field that is growing in importance. It deals with designing quantitative models to support Wall Street (the sell side), in asset management (the buy side) and in insurance and non-financial companies. The program should provide skills and tools to understand the valuation and structuring of complex financial instruments which includes almost any kind of option on a financial security or contract (e.g. Eurodollar futures). Sell-side firms often have buy-side divisions. For example Morgan-Stanley has a division that manages hedge funds. Also on the buy-side insurers sell, for example, options on bond portfolios to banks and investment banks. Given that New York is a premier global financial center these students trained will have significant opportunities to practice and further develop their financial leadership skills. NJIT campus is located approximately 45 minutes from the Wall Street Financial District in lower Manhattan via Newark Light Rail and Path. New York is the premier global financial center. NJIT is a technologicaluniversity that could provide a 3 to 4 semester program in financial engineering to serve the finance community in Wall Street . Mechanical, electrical, chemical, civil engineering and actuarial students already at NJIT, who are attracted to the higher level of compensation in investment banking , would benefit from access to a Financial Engineering degree.
Graduates will seek jobs on Wall Street at investment and commercial banks, on the buy side such as Fidelity, CALPERS or TIAACREF, at hedge funds such as Caxton, at reinsurers such as Swiss Re or Munich Re, and non-financial companies. Possibly they may find opportunities at life and property and casualty insurers or insurance brokers such as Willis. Given that New York is still the premier global financial center (London, Tokyo, Hong Kong and Shanghai notwithstanding) there are probably more local opportunities with financial firms than with non-financial firms. To place our graduates, we will be competing locally with three elite and two lower-ranked financial engineering programs.

The following represents an extract from a recent and typical job announcement for those trained in financial engineering. This is from Deloitte's Capital Market Group.

AERD – Capital Markets
Risk Strategy & Analytics, Financial Services Industry
Quantitative Analysis

Senior ConsultantDeloitte's Capital Market Group is looking for a Senior Consultant to join its Quantitative Services Team. The Quantitative Services Team provides derivatives valuation and modeling expertise to Deloitte's clients in North America and worldwide. The Senior Consultant The program should provide skills and tools to understand the valuation of complex derivative instruments in areas of fixed income, equity, and credit derivatives for both internal and external clients, and will be involved in consulting projects related to complex derivatives modeling, model review, and derivatives pricing

Skills Seeking:

- Strong background in mathematical finance at the level of a Master's level degree in Mathematical Finance, Mathematics of Finance, Financial Engineering or Quantitative Finance is generally a prerequisite, although very strong undergraduates with necessary background and/or relevant work experience may be considered.

- Understanding of financial instrument valuation concepts is desired and experience with derivatives valuation in corporate setting is a plus. Applicants are expected to have strong analytical and computer skills. Quantitative Analysis Technical Skills (Visual Basic, C/C++, MATLAB, Monte-Carlo Simulations, Bloomberg, Fincad, ALM, Numerix, Savysoft, Principia, Summit) are a plus.

2. Need for the Program

a) If the program falls within the liberal arts and sciences and does not specifically prepare students for a career, provide evidence of student demand and indicate opportunities for students to pursue advanced study (if the degree is not terminal with regard to further education)

b) If the program is career-oriented or professional in nature, provide evidence of student demand, labor market need, and results of prospective employer surveys. Report labor market need as appropriate on local, regional, and national bases. Specify job titles and entry-level positions for program graduates, and/or indicate opportunities for graduates to pursue additional studies.

There is significant demand for students with a finance related background in the region. Financial services and its many related job responsibilities provide one of the fastest growing segments of the services industry in the region. The financial engineering aspect of these services is especially critical to the region and the financial services sector.

c) Describe the relationship of the program to institutional master plans and priorities.

The program is consistent with the plans for development of NJIT in the city, state and region.

d) List similar programs within the state and neighboring states and compare this program with those currently being offered.

In New York City, Columbia and New York Universities offer well-regarded financial engineering degrees. Within an hour of the city, Princeton University also offers a masters degree in financial engineering. Brooklyn Polytechnic and Rutgers offer M.S. degrees in financial engineering. We believe our program will differ from these in that the student population we attract differs, containing many first generation children, and our instruction will be more industry based than most of the other programs in the region.

Many other universities in the region also offer degrees in electrical engineering, chemical, mechanical or civil engineering, but they too are different due to our student population and Northern New Jersey location.

Most financial engineering programs emerged in university settings over the past twenty years. This makes financial engineering a relatively new field and thus poses some questions as to what a financial engineer is and does. Those that do know of it mostly quote press reports about the "quants" that populate financial engineering, with particular attention devoted to the relatively high salaries those with the degrees can command, at least relative to the compensation of their colleagues in other areas of engineering.

Graduates of the program will seek jobs on Wall Street (sell-side) and/or asset management firms (buy-side) such as insurance and non-financial companies. In general "buy-side" stands for firms or divisions of firms that manage investments, and "sell-side" stands for those firms or divisions of firms that sell financial products to the buy-side. Given that New York is the premier global financial center (London, Tokyo, Hong Kong and Shanghai notwithstanding) there are probably more local opportunities with financial firms than with non-financial firms. To place our graduates, we will be competing locally with three elite and two lower-ranked financial engineering programs.

Columbia, NYU and Princeton have FE programs that historically target front-office "quant" jobs on the trading floor of investment and money-center banks. Graduates from other elite schools in physics, math and chemical engineering also compete for these jobs. Many have a Ph.D. from the elite schools. In addition, other regional schools offer financial engineering programs , such as Baruch, Brooklyn Polytechnic and Rutgers.

Based on this research, we initially thought that NJIT should prepare FE graduates for the kinds of jobs that are not sought by graduates of FE programs at elite schools. We felt that we could better compete with Baruch, Brooklyn Polytechnic and Rutgers, who place NJIT grads in IT and back office jobs. Finally, we thought early on that NJIT grads would have a better chance with analytic programming jobs supporting trading or risk management. However, this logic changed when we help a meeting on May 31st on Wall Street with four advisors:

1. Executive Director Global Head of Prime Risk Services IT, UBS
2. Director of Quantitative Resources, Moore Capital
3. Head of Market Risk, Wachovia
4. Head of Interest Rate Risk Americas, Barclays

The purpose of the advisory board is fivefold: one, provide a reality check that we are teaching skills that firms will pay for; two, establish program credibility by showing that we have a reality check; three, providing lower level contacts from their firms to suggest projects for students to complete and show hiring managers; four, potentially provide contacts that may lead to funding sources; five; help connect with potential adjunct faculty.

The feedback we received was that if we start off the Masters FE program with small classes made up of our best students then NJIT's Masters in FE graduates could effectively compete with Masters graduates from any of the elite schools. Our students would have two advantages. First, since our students tend to be highly diverse, in terms of racial, religious and ethnic backgrounds they will be highly valued on Wall Street. Second, if we construct their educational experience to be more comprehensive, and broad-based, our graduates would have a second advantage. Our advisors agreed that it is rare to interview a job candidate who gives a description of a quantitative project (that the candidate has completed) that includes an explanation of the project context and approach used to complete the project.

Based on the feedback received, we believe that to establish a reputation that will help grow enrollment, we should admit students who will offer the most positive advertisement for the program. We anticipate beginning with 4 students that we can place in high level jobs at the end of this academic year, prior to the programming beginning. We have requests from many firms for many more graduates but will act to keep the reputation of the program as high as possible. We hope to begin the program with 10 students in its first year and then grow it by 50%year thereafter.

e) For doctoral programs only, supply a select list of distinguished programs nationally in this discipline.

3. *Students - Estimate anticipated enrollments from the program's inception until a steady state or optimum enrollment is reached.*

4. *Program Resources - Briefly describe the <u>additional</u> resources needed to implement and operate the program during the program's first five years, e.g., the number of full-time faculty, number of adjunct faculty, computer equipment, print and non-print material, etc.*

   a) Faculty – Will hire one additional FE faculty member in Spring, 2008.
   b) Computing Facilities/Equipment – Will require some additional equipment that can be secured via fund raising.
   c) Library – Print and Non Print Material – Will require some additional print and non-print material.
   d) Classrooms and Laboratories – will use existing classrooms.

5. Curriculum/Degree Requirements – Provide an outline of the curriculum including a list of the proposed courses and credits per course. Indicate the total number of credits in the degree program and for undergraduate programs, the number of general education credits.

Master of Science in Financial Engineering: 45 Credits

Applicants will be required to take an exam that they must pass before being admitted to the FE Program

Required Summer Reading Prior to First Course

Against the Gods: the Remarkable Story of Risk – Peter Bernstein, Capital Ideas – Peter Bernstein, How I Became a Quant – Barry Schachter and Richard Lindsey

An Introduction to the Mathematics of Financial Derivatives – Salih Neftci

1st Semester

1. Introduction to Financial Engineering I

Risk, pricing methodologies and arbitrage, trees and options pricing, trees and option pricing, practicalities, Ito calculus, risk neutrality and martingale measures, European options, continuous barrier options.

Required textbook: The Concepts and Practice of Mathematical Finance – Mark Joshi,

2. Math 477 - (modified to be a 500 course) Stochastic Processes (3-0-3) Prerequisites: Math 244 or Math 333 and Math 337. This course introduces the theory and applications of random processes needed in various disciplines such as mathematical biology, finance, and engineering. Topics include discrete and continuous Markov chains, Poisson processes, as well as topics selected from Brownian motion, renewal theory, and simulation.

3. Optimization Models and Methods for Financial Engineering
By: George R Widmeyer

Optimization models play an increasingly important role in financial decisions. This course explores how linear, quadratic, integer and stochastic optimization models, methods and software can be applied to solve problems in finance. It presents the theory and efficient solution methods for all major classes of optimization problems. Applications include asset pricing, arbitrage detection, financial volatility estimation, portfolio optimization, constructing an index fund, and option pricing. The course uses examples, exercises and case studies.

Optimization problems, linear programming, LP models for cash flow matching, LP models for asset pricing and arbitrage, nonlinear programming, NLP models and volatility estimation, quadratic programming, QP models and portfolio optimization, Conic optimization tools, conic optimization in finance, integer programming, integer programming and index fund construction, dynamic programming, DP and option pricing, DP and asset-backed securities, stochastic programming, SP and value-at-risk, SP and asset/liability management, robust optimization, robust optimization in finance.

Required textbook: Optimization Methods in Finance – Gerard Cornuejols and Reha Tutuncu, Cambridge University Press, 2007.

4. Math 646 - Time Series Analysis (3 credits) Prerequisite: Math 661 or departmental approval. Time series models, smoothing, trend and removal of seasonality. Naive forecasting models, stationarity and ARMA models. Estimation and forecasting for ARMA models. Estimation, model selection, and forecasting of nonseasonal and seasonal ARIMA models.

5. Monte Carlo Simulation

By Marvin Nakayama, CIS 661

Probability basics, random numbers, generating discrete random numbers, generating continuous random numbers, discrete event simulation, statistical analysis of simulated data, variance reduction techniques, statistical validation techniques and simulation-based optimization methods.

Required textbook: Simulation Modeling and Analysis– Averill Law

2nd Semester

1. Mathematical Finance or a similar course from the Math Department

General probability theory, information and conditioning, Brownian motion, stochastic calculus, risk-neutral pricing, connections with partial differential equations, exotic options, American derivative securities, change of numeraire, term-structure models.

Required textbook: Required textbook: Stochastic Calculus for Finance II – Steven Shreve

2. Introduction to Financial Engineering II

Multi-look exotic options, static replication, multiple sources of risk, options with early exercise features, interest rate derivatives, exotic interest rate derivatives, incomplete markets and jump-diffusion processes, stochastic volatility, variance gamma models, smile and exotic options.

Required textbook: The Concepts and Practice of Mathematical Finance – Mark Joshi

3. Math 647 - Time Series Analysis II (3 credits) Prerequisite: Math 646. Continuation of Math 646. Covers methods of time series analysis useful in engineering, the sciences, economics, and modern financial analysis. Topics include spectral analysis, transfer functions, multivariate models, state space models and Kalman filtering. Selected applications from topics such as intervention analysis, neural networks, process control, financial volatility analysis.

4. Term-structure models

Introduction to Bond Markets, Arbitrage-Free Pricing, Discrete-Time Binomial Models, Continuous-Time Interest Rate Models, No-arbitrage Models, Multifactor Models, Forward Measure Approach, Market Models, Numerical Methods, Credit Risk and Model Calibration.

Required textbook: Interest Rate Models: An Introduction – Andrew Cairns

5. Applications Programming for Financial Engineering I (Mathematica)

Cash Account Evolution, Stock Price Evolution, European Style Options, Stock Market Statistics, Implied Volatility for European Options, American Style Stock Options, Optimal Portfolio Rules, Advanced Trading Strategies

Required textbook: Computational Financial Mathematics using Mathematica – Srdjan Stojanovic

3rd Semester (2 only including project)

1. Applications Programming for Financial Engineering I (Matlab)

Motivation, Financial Theory, Basics of Numerical Analysis, Numerical Integration: Deterministic and Monte Carlo Methods, Finite Difference Methods for Partial Differential Equations, Convex Optimization, Pricing Equity Options, Option Pricing by Monte Carlo Methods, Option Pricing by Finite Difference Methods, Dynamic Programming

Required textbook: Numerical Methods in Finance and Economics: a Matlab-based Introduction – Paolo Brandimarte

2. Credit Risk and Credit Derivatives

Corporate Liabilities s Contingent Claims, Endogenous Default Boundaries and Optimal Capital Structure, Statistical Techniques for Analyzing Defaults, Intensity Modeling, Rating-Based Term-Structure Models, Credit Risk and Interest-Rate Swaps, Credit Default Swaps, CDOs and Related Products

Required textbook: Credit Risk Modeling: Theory and Applications – David Lando

Project (6 credit hours)

3. Elective