

**Co-Terminal Degree Proposal**  
Bachelor of Science in Applied Mathematics  
Master of Mathematical Finance  
September 24, 2015

**Undergraduate Program**

Undergraduate Program Type: Bachelor of Science in Applied Mathematics

Total Credit Hours (including shared credit): 128 hours

Program Description: The objectives of the Applied Mathematics program are to prepare students for careers that utilize mathematics to address problems in science, engineering, and society and to prepare students for graduate study in mathematics.

Program Purpose: To combine the Applied Mathematics BS degree with the professional Masters in Mathematical Finance, so that strong undergraduates with an interest in the finance industry can advance toward their goals more quickly and smoothly. There are many undergraduate students who are interested in this career path, and this would motivate strong students both to come to IIT and to stay at IIT (rather than transfer away after a year or two).

Students who do not qualify for the co-terminal degree can instead do the BS in Applied Mathematics with a Specialization in Mathematical Finance, which directs students to take courses relevant to the finance industry, which will ready him or her for later pursuing a graduate degree in mathematical finance. The requirements for the specialization are a subset of the requirements for the co-terminal degree, except that MATH 481 and MATH 485 are replaced by the graduate versions of those courses, MATH 542 and MATH 548.

Program Benefits:

- Allow strong students to complete both degrees in 5 years and be better positioned in a competitive market. Normally it would take 6 years to earn both degrees.
- Help with recruitment and retention of strong undergraduate students.
- Reduced credit hour requirement by sharing 9 credits between the programs.
- Enable students with scholarships to use them toward the completion of a graduate degree (although this may depend on the exact terms of the specific scholarship).
- Simplify graduate admission procedure.
- Allow students to continue with graduate students at greater ease while the undergraduate material is still fresh in their mind.

Course Requirements: no new courses required.

The only changes from a standard BS in AM are:

- Minor must be Business or Entrepreneurship
- AM electives and Free electives must include MATH 476, MATH 478, and 3 graduate courses

Sample curriculum and program requirements as they would appear in the UG Bulletin:

	Credits
Applied Mathematics requirements	42
MATH 100, 151, 152, 230, 251, 252, 332, 350, 380, 400, (410, 430, 431, or 454), 475	
Applied Mathematics Electives (including MATH 476 and MATH 478, and possibly shared graduate courses)	18
Humanities and Social Science Requirements	21
Minor Subject requirements (Business or Entrepreneurship)	15
Interprofessional Projects	6
Computer Science Requirement (Two of CS 104, 115, 116) or (CS 105 and 201)	4
Science Requirement (PHYS 123)	4
Science Electives	9
Free Electives (3 shared graduate courses within free electives and AM electives)	9
<b>Total</b>	<b>128</b>

		Lect.	Lab	UG/Grad Credits
<b>First semester (fall)</b>				
MATH 100	Introduction to the Profession	3	0	2 / -
MATH 151	Calculus I	4	1	5 / -
CS 115	Object Oriented Programming I	2	1	2 / -
Hum 2xy		3	0	3 / -
Science Elective		3	0	3 / -
<b>Totals</b>		<b>15</b>	<b>2</b>	<b>16 / -</b>
<b>Second semester (spring)</b>				
MATH 152	Calculus II	4	1	5 / -
MATH 230	Introduction to Discrete Mathematics	3	0	3 / -
CS 116	Object Oriented Programming II	2	1	2 / -
PHYS 123	General Physics	3	3	4 / -
Hum/Social Sci.		3	0	3 / -
<b>Totals</b>		<b>15</b>	<b>5</b>	<b>17 / -</b>
<b>Summer</b>				
MATH 251	Multivariate & Vector Calculus	<b>4</b>	<b>0</b>	<b>4 / -</b>
<b>Third semester (fall)</b>				
MATH 252	Introduction to Differential Equations	4	0	4 / -
MATH 332	Elementary Linear Algebra	3	0	3 / -
MATH 475	Probability	3	0	3 / -
Minor (Business or Entrepreneurship)		3	0	3 / -
Science Elective		3	0	3 / -
<b>Totals</b>		<b>16</b>	<b>0</b>	<b>16 / -</b>
<b>Fourth semester (spring)</b>				
MATH 350	Introduction to Computational Mathematics	3	0	3 / -
MATH 476	Statistics	3	0	3 / -
MATH 380	Introduction to Mathematical Modeling	3	0	3 / -
Minor (Business or Entrepreneurship)		3	0	3 / -
Hum/Social Sci.		3	0	3 / -
Hum/Social Sci.		3	0	3 / -
<b>Totals</b>		<b>18</b>	<b>0</b>	<b>18 / -</b>
<b>Fifth semester (fall)</b>				

MATH 400	Real Analysis	3	0	3 / -
	Math Elective	3	0	3 / -
	Minor (Business or Entrepreneurship)	3	0	3 / -
	Hum/Social Sci.	3	0	3 / -
	Hum/Social Sci.	3	0	3 / -
	Free Elective	3	0	3 / -
	<b>Totals</b>	<b>18</b>	<b>0</b>	<b>18 / -</b>

### Sixth semester (spring)

MATH 454	Graph Theory and Applications	3	0	3 / -
MATH 478	Numerical Methods for Differential Equations	3	0	3 / -
	Minor (Business or Entrepreneurship)	3	0	3 / -
	Science Elective	3	0	3 / -
	IPRO 397	3	0	3 / -
	<b>Totals</b>	<b>15</b>	<b>0</b>	<b>15 / -</b>

### Seventh semester (fall)

MATH 542	Stochastic Processes	3	0	3 / 3
MATH 548	Mathematical Finance I	3	0	3 / 3
MSF 505	Futures, Options, and OTC Derivatives	3	0	- / 3
	Free Elective	3	0	3 / -
	<b>Totals</b>	<b>12</b>	<b>0</b>	<b>9 / 9</b>

### Eighth semester (spring)

	Free Elective	3	0	3 / -
MATH 582	Mathematical Finance II	3	0	3 / 3
MSF 575	C++ with Financial Applications	3	0	- / 3
	IPRO 497	3	0	3 / -
	<b>Totals</b>	<b>12</b>	<b>0</b>	<b>9 / 6</b>

### Summer

Internship (or electives)

### Ninth semester (fall)

MATH 565	Monte Carlo Methods in Finance	3	0	- / 3
MSF 526	Computational Finance	3	0	- / 3
	Grad Elective	3	0	- / 3
	Minor (Business or Entrepreneurship)	3	0	3 / -
	<b>Totals</b>	<b>12</b>	<b>0</b>	<b>3 / 9</b>

### Tenth semester (spring)

MSF 566	Financial Time Series Analysis	3	0	- / 3
MSF 576	OOP and Algorithmic Trading Systems	3	0	- / 3
MATH 586	Theory and Practice of Fixed Income Modeling	3	0	- / 3
	Hum/Social Sci.	3	0	3 / -
<b>Totals</b>		<b>14</b>	<b>2</b>	<b>3 / 9</b>

<b>Total UG credit hour</b>	<b>128</b>
<b>Total Grad credit hours</b>	<b>33</b>

Competitive Programs: Most universities have a BS in Mathematics or Applied Mathematics. IIT's Master in Mathematical Finance has been ranked in the Top 25 in 2015 by the TFE Times and in 2013-2014 by QuantNet.

Market Analysis: None. This co-terminal degree combines two degrees which are already proven to have good employment opportunities for graduates.

Marketing and Advertising: The co-terminal degree will be another tool used to recruit undergraduate students to IIT, and advertising internally will recruit students for staying for a Masters degree.

Enrollment Estimates: 0-2 students/year

Retention Estimates: Students will only be admitted to the co-terminal program if they have already proven themselves to be very strong, so retention shouldn't be an issue.

Economic Analysis: No new costs. New revenue from tuition, but as the MMF program is already operating near capacity, don't expect much.

## Graduate Program

### Master of Mathematical Finance

#### Program Overview:

- a) Describe the objective of the new program:

The MMF program provides individuals interested in pursuing careers in financial risk management with advanced education in theoretical, computational, and business aspects of quantitative methodologies relevant to the financial industry. The co-terminal degree proposed will allow strong students to smoothly transition from a BS in Applied Math to the MMF while staying at IIT.

#### Program Justification:

- a) Provide a detailed discussion of why the program is needed:

To enable undergrads to complete both degrees in 5 years using undergraduate scholarships/funding. Graduates with both the BS in Applied Math and the Master in Mathematical Finance are expected to be more competitive and have better job prospects. Also, it will give our strongest students reason to stay at IIT.

- b) Provide a detailed description of the relationship of the proposed program to other degree programs offered by IIT and by the academic unit: The closest would be the BS in Applied Math with a Specialization in Mathematical Finance, which directs students to take courses relevant to the finance industry, which will ready him or her for later pursuing a graduate degree in mathematical finance. The requirements for the specialization are a subset of the requirements for the co-terminal degree, except that MATH 481 and MATH 485 are replaced by the graduate versions of those courses, MATH 542 and MATH 548.

- c) Provide an estimate of the expected number of students: 0-2 per year

#### Program Resources:

- a) Describe the personnel requirements necessary to offer the program: no additional
- b) Describe the facilities necessary to offer the program: no additional

#### Program Description:

- a) Provide the detailed degree requirements for the program:

See <http://science.iit.edu/mathematical-finance/academics>

b) Indicate the admission criteria for the program:

See <http://science.iit.edu/mathematical-finance/admission> for admission to the MMF. Students should have a GPA of 3.5 in order to apply.

c) Provide a timeline and schedule for offering the program: Fall 2016

Description of courses shared between Undergraduate and Graduate programs (a maximum of 9 credit hours may be shared coursework):

Any 3 graduate courses from the MMF, which will fit into the BS degree as Math Electives (if MATH courses) or Free Electives (if MSF courses).