

**MICHIGAN STATE
UNIVERSITY**

January 28, 2011

MEMORANDUM

TO: Dr. Douglas Estray, Associate Provost for Undergraduate Education
and Dean of Undergraduate Studies

FROM: Dr. Linda O. Stanford, Associate Provost for Academic Services

RE: Request for a New Bachelor of Science Degree in Actuarial Science
For Transmittal to the University Committee on Academic Policy UCAP)

The request referenced above is being sent to the University Committee on Academic Policy (UCAP) in accordance with the *Bylaws for Academic Governance*, 4.4.

UCAP Response Requested:

Please ask the UCAP to consider the request referenced above and provide consultative commentary. Please mail the related materials referenced under the heading Attachments at the end of this memorandum to the UCAP members.

After receiving UCAP's consultative response, the Provost will make a determination to forward or not to forward the request to the University Committee on Curriculum for its approval of curriculum and degree requirements.

If you have any questions, please call Joy Speas, University Curriculum Administrator, at 5-8420.

Thank you.

Attachments:

1. Request to Establish a New Academic Program form dated December 9, 2010: Bachelor of Science Degree in Actuarial Science and attachments.



**University
Curriculum and
Catalog**

176 Administration Bldg.
East Lansing, MI
48824-1046

517-355-8420
Fax: 517-353-1935

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COLLEGE OF NATURAL SCIENCE

1. Request to establish a **Bachelor of Science** degree in **Actuarial Science** in the Department of Mathematics. The University Committee on Academic Policy (UCAP) will consider this request.

- a. **Background Information:**

In order to become an Associate of the Society of Actuaries (ASA) and beyond that a Fellow of the Society of Actuaries (FSA) one must pass a series of 8-10 rigorous actuarial exams given by the Society of Actuaries (SOA) or the Casualty Actuarial Society.

The current Specialization in Actuarial Science as formulated by a committee of faculty from finance, mathematics, and statistics and probability decided that, given the approximate 15 to 20 credit limitation for specializations, the specialization should continue to focus on passing the first two actuarial exams, SOA Exam P/1 and SOA Exam FM/2, in order to remain competitive in the job market. Each year approximately 7-9 actuarial students pass either SOA Exam 1 or SOA Exam 2 or both.

Many peer institutions in the Big Ten already offer bachelor's degree programs in actuarial science, and some even master's programs. Many schools offer courses preparing them for the first five SOA Exams, P/1, FM/2, MLC/3, MFE/3, and C/4. In order to develop a successful actuarial program at MSU we examined existing programs at peer institutions. To remain competitive in the current job market MSU should seriously consider expanding the Specialization in Actuarial Science into a bachelor's program which would allow us to offer course work for Exam MLC/3, Exam MFE/3, and Exam C/4.

In order to do this the following four components must be considered: 1) *Students*: presently enrollment in all of our actuarial courses is healthy. An average of between 65 to 75 actuarial students are enrolled in the specialization and each year approximately 15 to 20 complete the specialization; 2) *Courses*: Currently the required courses in the actuarial specialization prepare students for Exam P/1, Exam FM/2 and part of Exam MLC/3. We need to offer new courses or expand current courses in order to fully prepare for Exam MLC/3, Exam MFE/3, and Exam C/4. The Actuarial Science Committee recommends that in addition to current available courses covering material for SOA Exams P/1 and FM/2, new courses are needed to cover the rest of the material for SOA Exam MLC/3, SOA Exam MFE/3, and SOA Exam C/4; 3) *Faculty*: currently we are already stressed in terms of staffing our actuarial classes. With the added courses for the bachelor's degree it is impossible to staff all the courses with the existing faculty. Neither mathematics nor statistics have any faculty whose specialty is in actuarial science research. To elevate the program to the next level and to eventually achieve national prominence there is a pressing need to hire a faculty member who is dedicated solely to the program and to cover the three new proposed courses; 4) *Features of the proposed new program*: It must include all Validation by Educational Experience (VEE) courses required by SOA for the ASA designation, assumes that the Specialization in Actuarial Science is retained, and it prepares students for SOA Exam P/1, Exam FM/2, Exam MLC/3, Exam MFE/3, and Exam C/4.

- b. **Academic Programs Catalog Text:**

The Bachelor of Science degree in Actuarial Science prepares students to work in insurance companies, banks, investment firms, government agencies, hospitals, and business firms where there is a need to weigh the financial consequences of risk. Course work is designed to provide the academic background for successful completion of five of the examinations of the Society of Actuaries (SOA): Exam P/1, Exam FM/2, Exams MLC/3 and MFE/3, and Exam C/4, including completion of the Validation by Educational Experience (VEE) course work in applied statistics, corporate finance, and economics. Completion of these SOA exams and VEE courses is required for those intending to become an Associate of the Society of Actuaries.

Requirements for the Bachelor of Science Degree in Actuarial Science

1. The University requirements for bachelor's degrees as described in the *Undergraduate Education* section of this catalog; 120 credits, including general elective credits, are required for the Bachelor of Science degree in Actuarial Science.

The University's Tier II writing requirement for the Actuarial Science major is met by completing Mathematics 309 or 496. Those courses are referenced in item 3. below.

Students who are enrolled in the College of Natural Science may complete the alternative track to Integrative Studies in Biological and Physical Sciences that is described in item 1. under the heading *Graduation Requirements* in the College statement. Certain courses referenced in requirement 3. below may be used to satisfy the alternative track.

2. The requirements of the College of Natural Science for the Bachelor of Science degree.

The credits earned in certain courses referenced in requirement 3. below may be counted toward College requirements as appropriate.

3. The following requirements for the major.

				CREDITS
a.			One course of at least 3 credits in biological science, entomology, microbiology, physiology, plant biology, or zoology.	
b.			One of the following groups of courses (8 or 10 credits):	
	(1)	CEM 141	General Chemistry	4
		CEM 142	General and Inorganic Chemistry	3
		CEM 161	Chemistry Laboratory I	1
	(2)	CEM 151	General and Descriptive Chemistry	4
		CEM 152	Principles of Chemistry	3
		CEM 161	Chemistry Laboratory I	1
	(3)	CEM 181H	Honors Chemistry I	4
		CEM 182H	Honors Chemistry II	4
		CEM 185H	Honors Chemistry Laboratory I	2
	(4)	LB 171	Principles of Chemistry I	4
		LB 171L	Introductory Chemistry Laboratory I	1
		LB 172	Principles of Chemistry II	3
c.			One of the following groups of courses (6 or 8 credits):	
	(1)	PHY 183	Physics for Scientists and Engineers I	4
		PHY 184	Physics for Scientists and Engineers II	4
	(2)	PHY 193H	Honors Physics I – Mechanics	3
		PHY 294H	Honors Physics II – Electromagnetism	3
	(3)	LB 271	Physics I	3
		LB 272	Physics II	3
d.			One of the following groups of courses (6 to 8 credits):	
	(1)	MTH 132	Calculus I	3
		MTH 133	Calculus II	4
	(2)	LB 118	Calculus I	4
		LB 119	Calculus II	4
	(3)	MTH 152H	Honors Calculus I	3
		MTH 153H	Honors Calculus II	3
e.			One of the following courses (3 or 4 credits):	
		LB 220	Calculus III	4
		MTH 234	Multivariable Calculus	4
		MTH 254H	Honors Multivariable Calculus	3
f.			One of the following courses (3 credits):	
		MTH 235	Differential Equations	3
		MTH 255H	Honors Differential Equations	3
		MTH 340	Ordinary Differential Equations I	3
g.			One of the following courses (1 credit):	
		MTH 490	Directed Studies	1
		MTH 491B	Teamwork Experience	1
h.			All of the following courses (21 credits):	
		MTH 309	Linear Algebra I	3
		MTH 360	Theory of Mathematical Interest	3

	MTH	458	Financial Mathematics for Actuaries	3
	STT	441	Probability and Statistics I: Probability	3
	STT	455	Actuarial Models I	3
	STT	456	Actuarial Models II	3
	STT	459	Construction and Evaluation of Actuarial Models	3
i.	One of the following courses (3 credits):			
	MTH	457	Introduction to Financial Mathematics	3
	STT	442	Probability and Statistics II: Statistics	3
j.	One of the following courses (3 credits):			
	MTH	491A	Actuarial Internship	3
	MTH	496	Capstone in Mathematics	3
k.	All of the following courses (18 credits):			
	ACC	230	Survey of Accounting Concepts	3
	EC	201	Introduction to Microeconomics	3
	EC	202	Introduction to Macroeconomics	3
	FI	311	Financial Management	3
	FI	321	Theory of Investments	3
	FI	379	Financial Derivatives (D)	3
l.	One of the following courses (3 or 4 credits):			
	CSE	131	Technical Computing and Problem Solving	3
	CSE	231	Introduction to Programming I	4

Effective Fall 2011.

View a Program		Main Menu
Joy Speas, RO	Thursday, 12/9/2010	
Program Name: Actuarial Science Program Degree: BS Sequence Number: 1	Program Request ID: 1637	
Effective Dates: Spring 2011 - Open Status: Interim Initial Action: New		
Requested Date: 11/20/2009 10:39:44 AM		
<p>1. Department/School/College: 32574 Department of Mathematics</p> <p>2. Name of Program: Actuarial Science Program</p> <p>3. Name of Degree: BS</p> <p>4. Type of Program: Major</p> <p>5. Effective Start Semester: <i>Spring 2011</i> <i>Fall</i></p> <p>6. Target student audience for the program: Students desiring careers as actuaries.</p> <p>7. Enrollment: What is the expected enrollment per year: 60 What is the minimum enrollment acceptable: 40</p> <p>8. Source of budget for the program: To align academic planning and curricular change, ALL requests for NEW funds must be included in the College's annual planning letter. Provost approval of new funds and the effective date for the new program must align. If funding is not approved, then the program request will not be forwarded to Academic Council. Internal reallocation, College reallocation If new funds, was this request included in the College's annual planning letter? Indicate yes or no. If no, then this is a department or college fund reallocation (If the program is implemented, no additional resources are required.).</p> <p>9. Projected Costs as compared to other programs in unit: Same</p> <p>10. Staff requirement: How many additional staff will be required: 1 Who will provide the primary instruction. Describe any external linkages(industry, government, etc.): Statistics (Shlomo Levental), Mathematics (Gabor Francsics)and Finance (Mark Schroder)</p>		

and one new specialist to be hired.

11. Will additional equipment be required:

Approximate cost: 0

Source of funding:

12. Will additional library materials be required:

Approximate cost: 500

Source of funding: Actuarial Science Account within Mathematics Department

13. Will additional space be required:

Type:

Approximate amount:

14. If the program requirements contain a named concentration, do you wish for the concentration to be noted on the student's transcript?:

No

15. Detailed Description:

Rationale for the proposed B.S. Actuarial Science Program:

ACTUARIAL EXAMS

In order to become an Associate of the Society of Actuaries (ASA) and beyond that a Fellow of the Society of Actuaries (FSA) one must pass a series of 8-10 rigorous actuarial exams given by the SOA or the Casualty Actuarial Society.

CURRENT ACTUARIAL PROGRAM

The Actuarial Specialization as formulated by a committee of faculty from finance, mathematics, and statistics-probability decided that, given the approximately 15-20 credit limitation for specializations, the specialization should focus on passing the first two actuarial exams, SOA Exam P/1 and SOA Exam FM/2, in order to remain competitive in the job market. Each year approximately 7-9 actuarial students pass either SOA Exam 1 or SOA Exam 2 or both. Last year at least 2 students passed one of the two parts of SOA Exam 3 prior to graduation.

PROPOSED BACHELORS PROGRAM IN ACTUARIAL SCIENCE

We have noted that many peer institutions in the Big 10 already offer bachelor's degree programs in actuarial science, and some even masters programs. Many schools offer courses preparing them for the first 5 SOA Exams, i.e. Exam P/1, Exam FM/2, Exams ML3, MFE/3, Exam C/4. In order to develop a successful actuarial program at MSU we need to examine existing programs at peer institutions. We looked at schools in the Big 10, the University of California, and the University of Texas, Austin. Most actuarial programs are administered either by the business school or by the mathematics department.

Since the MSU actuarial program is currently administered by the Department of Mathematics and most of its students are in mathematics, we have singled out two programs where actuarial programs are administered by their Mathematics Departments, first at Purdue University, second at the University of Texas, Austin. Both schools offer bachelor's degree in actuarial science and each prepares

students for the first five actuarial exams mentioned earlier. To remain competitive in the current job market we should seriously consider expanding the MSU Actuarial Specialization into a bachelors program in actuarial science which would allow us to offer course work for Exam MLC/3, Exam MFE/3, and Exam C/4. In order to do this we must consider the following four components:

1.) STUDENTS: Presently enrollment in all of our actuarial courses is healthy. In some cases, such as MTH 360, additional sections have been added. As mentioned earlier we have an average of between 65 to 75 actuarial students enrolled in the specialization and each year approximately 15 to 20 complete the specialization each year.

2.) COURSES: Currently the required courses in the actuarial specialization prepare students for Exam P/1, Exam FM/2 and part of Exam MLC/3. So we need to offer new courses or expand current courses in order to fully prepare for Exam MLC/3, Exam MFE/3, and Exam C/4. Therefore, the Actuarial Science Committee recommends that in addition to currently available courses covering material for SOA Exams P/1 and FM/2 we need: a.) a new course MTH-STT 456 to cover the rest of the material needed for SOA Exam MLC/3.

b.) a new course MTH-STT 458 to cover material needed for SOA Exam MFE/3.
c.) a new course MTH-STT 459 to cover material needed for SOA Exam C/4.

3.) FACULTY: Currently we are already stressed in terms of staffing our actuarial classes. With the added courses for the bachelor's degree it is impossible to staff all the courses with the existing manpower. In particular, neither Mathematics nor Statistics have any faculty whose specialty is in actuarial science research. To elevate the program to the next level and to eventually achieve national prominence there is a pressing need to hire faculty members who are dedicated to the program. After carefully examining what it takes to create a competitive program in actuarial science and taking into account current economic conditions necessitating limited faculty hiring, the Actuarial Science Committee recommends hiring at least one new faculty in order to cover the three new courses proposed in part 2).

4.) FEATURES OF PROPOSED BS IN ACTUARIAL SCIENCE:

- a.) Includes all Validation by Educational Experience (VEE) courses required by SOA for the ASA designation.
b.) Assumes that Actuarial Science Specialization is retained and, therefore, the proposed bachelor's program includes all actuarial specialization requirements.
c.) Prepares students for SOA Exam P/1, Exam FM/2, Exam MLC/3, Exam MFE/3, and Exam C/4.

Assessing Student Outcomes

College: Natural Science
Department: Mathematics
Program or Major: Bachelor of Science in Actuarial Science
Program Level: Undergraduate
Contact Person: Albert Cohen

Inventory of Written Statements and Plans

1. Do you have a written mission statement or statement of purpose? **X**
yes no

If yes, please attach a copy or reference where this can be found: The degree prepares students for work in insurance companies, banks, investment firms, government work, hospitals, and business firms where there is a need to weigh the financial consequences of risk. The BS in Actuarial Science prepares students for four of the examinations of the Society of Actuaries (SOA): Exam P/1, Exam FM/2, Exam M/3, and Exam C/4, and requires students to complete the Validation by Educational Experience (VEE) course work in 1) applied statistics, 2) corporate finance and 3) economics.

2. Do you have a written statement of intended educational outcomes **yes** **no**

describing what a student should know or be able to do when they have completed this program?

a. Integrate across mathematics, statistics and finance to measure and price risk by:

1. Interpreting actuarial data
2. Critically analyzing actuarial data
3. Synthesizing actuarial data
- b. Participating and communicating effectively in teams
- c. Communicating effectively to clients/lay audiences concerning risk analyses
- d. Applying basic computational skills to actuarial data analyses

3. Do you have a written method of assessment for measuring student outcomes? **yes** **no**

4. Does your program have a separate accreditation process? **yes**
 no

If yes, please list all accrediting agencies below:

Assessment Methodologies

It is likely that some assessment measures are already in place in this program even if they are not identified as being part of a formal assessment plan. Listed below are some of the assessment methodologies you may be using. Indicate "**A**" if the method is currently being used; "**B**" if it is **not** being used but you are interested in using it; and "**C**" if the method of assessment does not apply to your program.

Direct Methods of Assessment

1. A Comprehensive Examinations
2. C Writing proficiency Examinations
3. A National Examinations assessing subject matter knowledge
4. C Graduate Record Exam General Test
5. C Graduate Record Exam Subject Test
6. C Certification Examinations
7. C Licensure Examinations
8. C Locally developed pre-test or post-test for subject matter knowledge
9. A Senior thesis or major project

- 10. A Portfolio evaluation of student work
- 11. A Capstone courses
- 12. C Audio or Video tape evaluations

Indirect Methods of Assessment

- 1. B Comparison or benchmarking with peer institutions
- 2. A Job placement of graduates
- 3. B Employer surveys
- 4. A Advisory groups from your profession
- 5. C Graduate school acceptance rates
- 6. C Student graduation/retention rates
- 7. B Exit interviews with students graduating or leaving the program
- 8. B Student satisfaction surveys
- 9. A Student course evaluations
- 10.C Focus group discussions
- 11.B Alumni surveys
- 12.B Alumni honors, awards, achievements
- 13.C Analysis of grade distributions
- 14.C Peer review of courses
- 15.B Peer review of program
- 16.B Curriculum/syllabus analysis
- 17.C Community service/volunteerism participation
- 18.C Other:

Does your program have an experiential learning component? X

yes **no**

If yes, how do you assess the student learning outcomes from that experience?

- 1. C Participate in a class designed to complement the experience
- 2. C Student journals
- 3. A Formal evaluation procedures from field-based supervisor
- 4. A Formal meetings between supervisor, student, and faculty
- 5. C Formal test of practical skills
- 6. C Other:

Implementation Plans

1. How has your department used any of the indicators above to improve services and programs for students?

We have incorporated some of the indicators into our requirements for the new BS Actuarial Science program.

Furthermore, when our program gets under way, we plan to use some of the assessment indicators mentioned above.

2. When you think about developing and implementing an assessment plan, what concerns do you have?

We have no concerns as yet.

return this form to: Kelly Funk 221 Administration Building

CATALOG COPY:

THE BACHELOR OF SCIENCE IN ACTUARIAL SCIENCE.

The Bachelor of Science in Actuarial Science is administered by the Department of Mathematics within the College of Natural Science. The major is open to any student in good standing. The degree prepares students for work in insurance companies, banks, investment firms, government work, hospitals, and business firms where there is a need to weigh the financial consequences of risk. The BS in Actuarial Science prepares students for four of the examinations of the Society of Actuaries (SOA): Exam P/1, Exam FM/2, Exam M/3, and Exam C/4, and requires students to complete the Validation by Educational Experience (VEE) course work in 1) applied statistics, 2) corporate finance and 3) economics. Completion of these SOA exams and VEE courses are required for those intending to become an Associate of the Society of Actuaries.

REQUIREMENTS FOR THE BACHELOR OF SCIENCE DEGREE IN ACTUARIAL SCIENCE

1. The University requirements for bachelor's degrees as described in the Undergraduate Education section of this catalog; 120 credits, including general elective credits, are required for the Bachelor of Science in Actuarial Science degree.

The University's Tier II writing requirement for the Actuarial Science major is met by completing Mathematics 496 or Mathematics 309. Those courses are referenced in items 3.(g)1) and 3.(i).

Students who are enrolled in the College of Natural Science may complete the alternative track to integrative Studies in Biological and Physical Sciences that is described in item 1. under the heading Graduation Requirements in the College statement. Certain courses referenced in requirement 3 may be used to satisfy the alternative track.

2. The requirements of the College of Natural Science for the Bachelor of Science degree. The credits earned in certain courses referenced in requirement 3. below may be counted toward College requirements as appropriate.

3. The following requirements for the major:

Credits

(a) One course of at least 3 credits in biological science, entomology, microbiology, physiology, plant biology, or zoology.

(b) One of the following groups of courses (8 or 10 credits):

- (1) CEM 141 General Chemistry 4
CEM 142 General and inorganic Chemistry 3
CEM 161 Chemistry Laboratory I 1
- (2) CEM 151 General and Descriptive Chemistry 4
CEM 152 Principles of Chemistry 3
CEM 161 Chemistry Laboratory I 1
- (3) CEM 181H Honors Chemistry I 4
CEM 182H Honors Chemistry II 4
CEM 185H Honors Chemistry Laboratory I 2
- (4) LB 171 Principles of Chemistry I 4
LB 172 Principles of Chemistry II 4 3

- LB 171L Introductory Chemistry Laboratory I 1
- (c) One of the following groups of courses (6 or 8 credits):
- (1) PHY 183 Physics for Scientists and Engineers I 4
PHY 184 Physics for Scientists and Engineers II 4
 - (2) PHY 193H Honors Physics I-Mechanics 3
PHY 294H Honors Physics II-Electromagnetism 3
 - (3) LB 271 Physics I 3
LB 272 Physics II 3
- (d) One of the following groups of courses (6 or 7 or 8 credits):
- (1) MTH 132 Calculus I 3
MTH 133 Calculus II 4
 - (2) LB 118 Calculus I 4
LB 119 Calculus II 4
 - (3) MTH 152H Honors Calculus I 3
MTH 153H 3 Honors Calculus II 3
- (e) One of the following courses (3 or 4 credits)
- MTH 234 Multivariable Calculus 4
 - MTH 254H Honors Multivariable Calculus 3
 - LB 220 Calculus III 4
- (f) One of the following courses (3 credits)
- MTH 235 Differential Equations 3
 - MTH 255H Honors Differential Equations 3
 - MTH 340 Ordinary Differential Equations I 3
- (g) One of the following courses (1 credit)
- MTH 490 ~~Projects in Industrial Mathematics~~ 1 *Directed Studies*
 - MTH 491B Teamwork Experience 1
- (h) All of the following courses (21 credits):
- MTH 309 Linear Algebra I 3
 - MTH 360 Theory of Mathematical Interest 3
 - MTH 458 Financial Mathematics for Actuaries 3
 - STT 441 Probability and Statistics I *3 Probability*
 - STT 455 Actuarial Models I 3
 - STT 456 Actuarial Models II 3
 - STT 459 Construction and Evaluation of Actuarial Models 3
- (i) One of the following courses (3 credits):
- STT 442 Probability and Statistics II *3 Statistics*
 - MTH 457 Introduction to Financial Mathematics 3
- (j) One of the following courses (3 credits):
- MTH 496 Capstone in Mathematics 3
 - MTH 491A Actuarial Internship 3
- (k) The following course in the Department of Accounting and Information Systems (3 credits):
- ACC 230 Survey of Accounting Concepts 3
- (l) All of the following courses in the Department of Finance (9 credits):
- FI 311 Financial Management 3
 - FI 321 Theory of Investments 3
 - FI 379 Financial Derivatives *3 (D)*
- (m) Both of the following courses in the Department of Economics (6 credits):
- EC 201 Introduction to Microeconomics 3
 - EC 202 Introduction to Macroeconomics 3

(n) One of the following courses in the Department of Computer Science and Engineering(3 to 4 credits):

CSE 131 Technical Computing and Problem Solving 3

CSE 231 Introduction to Programming I 4

Note: No changes are required to the curriculum of the specialization except to the catalog description so that is why it is included in this document.

THE SPECIALIZATION IN ACTUARIAL SCIENCE

The Specialization in Actuarial Science, which is administered by the Department of Mathematics within the College of Natural Science, is available as an elective to students who are enrolled in any bachelor's degree program at Michigan State University. This specialization complements a number of fields such as mathematics, statistics and probability, finance and economics. It is intended to prepare students for work in insurance companies, banks, investment firms, government work, hospitals and business firms where there is a need to weigh the financial consequences of risk. The Specialization in Actuarial Science prepares students for two of the examinations of the Society of Actuaries (SOA): Exam P/1 and Exam FM/2. With the approval of the department that administers the student's degree program, courses that are used to satisfy the requirements for the specialization may also be used to satisfy the requirements for the bachelor's degree.

REQUIREMENTS FOR THE SPECIALIZATION IN ACTUARIAL SCIENCE

4. (a) All of the following courses(18 credits):

FI 311 Financial Management 3

FI 321 Theory of Investments 3

FI 379 Advanced Derivatives 3

MTH 360 Theory of Mathematical Interest 3

STT 441 Probability and Statistics I: Probability 3

MTH-STT 455 Actuarial Models I 3

(b) One of the following courses(3 credits)

MTH 457 Introduction to Financial Mathematics 3

STT 442 Probability and Statistics II: Statistics 3

With the approval of the department that administers the student's degree program, courses that are used to satisfy the requirements for the specialization may also be used to satisfy the requirements for the bachelor's degree.

Upon completion of the requirements for the Specialization in Actuarial Science, the student should contact the Chairperson of the Department of Mathematics and request certification for the completion of the specialization. After the certification is approved by the Chairperson of the Department of Mathematics and the Associate Dean of the College of Natural Science, the Office of the Registrar will enter on the student's academic record the name of the specialization and the date that it was completed. This certification will appear on the student's transcript.

16. Are there admissions requirements for this program?:

Grade or grade-point average requirements and if so in which course(s), portfolio requirement, audition, essay, etc. If there are not admission requirements other than those required by the University policy indicate "none".

No admissions requirements. Open to any MSU student.

DEPARTMENT LEVEL APPROVAL STATUS

Approved: Department of Mathematics
11/24/2010 3:13:48 PM by Teri Roache for Yang Wang, Chairperson

SIGNOFFS STATUS

Signed Off: Department of Accounting and Information Systems
11/24/2010 3:48:39 PM by Lynn Zelenski for Sanjay Gupta, Chairperson

Signed Off: Department of Computer Science and Engineering
12/1/2010 1:48:10 PM by Abdol Esfahanian for Matt W. Mutka, Acting Chairperson

Signed Off: Department of Economics
11/24/2010 3:20:13 PM by Margaret Lynch for Carl Davidson, Chairperson

No Response by: Department of Finance

Signed Off: Department of Statistics and Probability
11/24/2010 4:24:49 PM by Cathy Sparks for Hira L. Koul, Chairperson

Signed Off: Lyman Briggs College
11/30/2010 11:03:34 AM by Kelly Miilenbah for Elizabeth H. Simmons, Dean

→ need sign-off

COLLEGE LEVEL APPROVAL STATUS

Approved: College of Natural Science
12/9/2010 11:53:00 AM by Teri Roache for Kathryn M. Doig, Associate Dean

DEPARTMENT of MATHEMATICS

Yang Wang, Chairperson

Mathematics, which may partially be defined as the science of number and form, is a vital tool in all branches of knowledge the university covers, from accounting to zoology. Mathematics is also studied for its own sake by those who become fascinated by the results of modern mathematics and the making of new discoveries. The department offers a wide variety of courses that begin with extensions of high school mathematics and reach to the frontiers of mathematical knowledge.

Mathematics majors can build their programs in many different ways to pursue a career path of their choice. The department offers several Honors sequences, so that highly motivated mathematics students will find challenging programs. Students in mathematics, regardless of their major preferences, are encouraged to consult with the department before registration concerning the possibility of advanced placement or enrollment in honors sections.

Insert ①

UNDERGRADUATE PROGRAMS

Either a Bachelor of Arts or Bachelor of Science degree may be earned with a major in Mathematics or Computational Mathematics. ~~A Specialization in Actuarial Science is also available.~~

A Bachelor of Science and

Requirements for the Bachelor of Science Degree in Mathematics

1. The University requirements for bachelor's degrees as described in the *Undergraduate Education* section of this catalog; 120 credits, including general elective credits, are required for the Bachelor of Science degree in Mathematics.

The University's Tier II writing requirement for the Mathematics major is met by completing Mathematics 496 and Mathematics 309 or 310 or 418H. Those courses are referenced in items 3.c.(1) and 3.c.(3) below.

Students who are enrolled in the College of Natural Science may complete the alternative track to Integrative Studies in Biological and Physical Sciences that is described in item 1. under the heading *Graduation Requirements* in the College statement. Certain courses referenced in requirement 3. below may be used to satisfy the alternative track.

2. The requirements of the College of Natural Science for the Bachelor of Science degree.

The credits earned in certain courses referenced in requirement 3. below may be counted toward College requirements as appropriate.

3. The following requirements for the major:

CREDITS

a. The following courses outside the Department of Mathematics: 19 to 21

(1) One course of at least 3 credits in biological science, entomology, microbiology, physiology, plant biology, or zoology.

(2) One of the following groups of courses (8 or 10 credits):

- (a) CEM 141 General Chemistry 4
- CEM 142 General and Inorganic Chemistry 3
- CEM 161 Chemistry Laboratory I 1
- (b) CEM 181H Honors Chemistry I 4
- CEM 182H Honors Chemistry II 4
- CEM 185H Honors Chemistry Laboratory I 2

(3) Both of the following courses (8 credits):

- PHY 183 Physics for Scientists and Engineers I 4
- PHY 184 Physics for Scientists and Engineers II 4

b. First-year competency in a foreign language

or

For students who have been admitted to the teacher certification program, completion of the Professional Education Courses in the Department of Teacher Education.

c. A total of 38 credits in courses in the Department of Mathematics including: 38

(1) All of the following courses (17 credits):

- MTH 132 Calculus I 3
- MTH 133 Calculus II 4
- MTH 234 Multivariable Calculus 4
- MTH 309 Linear Algebra I 3

- MTH 496 Capstone in Mathematics 3
 The completion of Mathematics 496 fulfills the department's capstone course requirement.
- (2) A total of 24 credits in approved Mathematics courses at the 300 level or above. At least four of the approved Mathematics courses must be at the 400 level or above. Mathematics 415, 424, and 443 may not be used to fulfill the requirements of the major. The 300-400 level courses that are referenced in items 3.c. (1), 3.c. (3), 3.c. (4), and 3.c. (5) partially satisfy this requirement. Students may not use both Mathematics 309 and 314 to satisfy the requirement in 3.c.(2). One course from a list of approved cognates may be used to satisfy this requirement; the list is available in the Department of Mathematics. Statistics and Probability 430 is required for students in the teacher certification program. Either Statistics and Probability 430 or 441 may be substituted for one 300-level mathematics course.
- (3) One of the following groups of courses (6 credits):
- (a) MTH 310 Abstract Algebra I and
 Number Theory 3
 MTH 411 Abstract Algebra II 3
 Mathematics 414 or 417 or 418H or 481 may be substituted for Mathematics 411.
- (b) MTH 418H Honors Algebra I 3
 MTH 419H Honors Algebra II 3
- (4) One of the following pairs of courses (6 credits):
- (a) MTH 320 Analysis I 3
 MTH 421 Analysis II 3
 Mathematics 425 or 441 or 442 may be substituted for Mathematics 421.
- (b) MTH 428H Honors Analysis I 3
 MTH 429H Honors Analysis II 3
- (5) One of the following courses (3 credits):
- MTH 330 Higher Geometry 3
 MTH 340 Ordinary Differential Equations I 3
 MTH 432 Axiomatic Geometry 3
 Students in the teacher certification program must take either Mathematics 330 or 432. Students not in the teacher certification program must take Mathematics 340. Students not in the teacher certification program with prior credit in Mathematics 235 or 255H may substitute an approved 400-level Mathematics course for Mathematics 340.

Requirements for the Bachelor of Arts Degree in Mathematics

1. The University requirements for bachelor's degrees as described in the *Undergraduate Education* section of this catalog; 120 credits, including general elective credits, are required for the Bachelor of Arts degree in Mathematics.
 The University's Tier II writing requirement for the Mathematics major is met by completing Mathematics 496 and Mathematics 309 or 310 or 418H. Those courses are referenced in items 3. c. (1) and 3. c. (3) below.
 Students who are enrolled in the College of Natural Science may complete the alternative track to Integrative Studies in Biological and Physical Sciences that is described in item 1. under the heading *Graduation Requirements* in the College statement. Certain courses referenced in requirement 3. below may be used to satisfy the alternative track.
2. The requirements of the College of Natural Science for the Bachelor of Arts degree.
 The credits earned in certain courses referenced in requirement 3. below may be counted toward College requirements as appropriate.
3. The following requirements for the major:

CREDITS

- a. The following courses outside the Department of Mathematics: 11
- (1) One course of at least 3 credits in biological science, entomology, microbiology, physiology, plant biology, or zoology.
- (2) The following course (4 credits):
 PHY 183 Physics for Scientists and Engineers I 4
- (3) One of the following courses (4 credits):
 CEM 141 General Chemistry 4
 CEM 181H Honors Chemistry I 4
- b. Second-year competency in a foreign language
 or
 For students who have been admitted to the teacher certification program, first-year competency in a foreign language and completion of the Professional Education Courses in the Department of Teacher Education.
- c. A total of 38 credits in courses in the Department of Mathematics including: 38
- (1) All of the following courses (17 credits):
- MTH 132 Calculus I 3
 MTH 133 Calculus II 4
 MTH 234 Multivariable Calculus 4
 MTH 309 Linear Algebra I 3
 MTH 496 Capstone in Mathematics 3
 The completion of Mathematics 496 fulfills the department's capstone course requirement.
- (2) A total of 24 credits in approved Mathematics courses at the 300-level or above. At least 4 of the approved Mathematics courses must be at the 400-level or above. Mathematics 415, 424, and 443 may not be used to fulfill the requirements

of the major. The 300-400 level courses that are referenced in items 3. c. (1), 3. c. (3), 3. c. (4) and 3. c. (5) partially satisfy this requirement. Students may not use both Mathematics 309 and 314 to satisfy the requirement in 3.c. (2). One course from a list of approved cognates may be used to satisfy this requirement; the list is available in the Department of Mathematics. Statistics and Probability 430 is required for students in the teacher certification program. Either Statistics and Probability 430 or 441 may be substituted for one 300-level mathematics course.

- (3) One of the following groups of courses (6 credits):
- (a) MTH 310 Abstract Algebra I and
 Number Theory 3
 MTH 411 Abstract Algebra II 3
 Mathematics 414 or 417 or 418H or 481 may be substituted for Mathematics 411.
 - (b) MTH 418H Honors Algebra I 3
 MTH 419H Honors Algebra II 3
- (4) One of the following pairs of courses (6 credits):
- (a) MTH 320 Analysis I 3
 MTH 421 Analysis II 3
 Mathematics 425 or 441 or 442 may be substituted for Mathematics 421.
 - (b) MTH 428H Honors Analysis I 3
 MTH 429H Honors Analysis II 3
- (5) One of the following courses (3 credits):
- MTH 330 Higher Geometry 3
 - MTH 340 Ordinary Differential Equations I 3
 - MTH 432 Axiomatic Geometry 3
- Students in the teacher certification program must take either Mathematics 330 or 432. Students not in the teacher certification program must take Mathematics 340. Students not in the teacher certification program with prior credit in Mathematics 235 or 255H may substitute an approved 400-level Mathematics course for Mathematics 340.

Requirements for the Bachelor of Science Degree in Computational Mathematics

1. The University requirements for bachelor's degrees as described in the *Undergraduate Education* section of this catalog; 120 credits, including general elective credits, are required for the Bachelor of Science degree in Computational Mathematics.
 The University's Tier II writing requirement for the Computational Mathematics major is met by completing Mathematics 309 or 310 and 496. Those courses are referenced in item 3. c. (1) below.
 Students who are in the teacher certification program are required to complete Mathematics 330 or 432 and Statistics and Probability 430.
 Students who are enrolled in the College of Natural Science may complete the alternative track to Integrative Studies in Biological and Physical Sciences that is described in item 1. under the heading *Graduation Requirements in the College* statement. Certain courses referenced in requirement 3. below may be used to satisfy the alternative track.
2. The requirements of the College of Natural Science for the Bachelor of Science degree.
 The credits earned in certain courses referenced in requirement 3. below may be counted toward College requirements as appropriate.
3. The following requirements for the major:

CREDITS

- a. The following courses outside the Department of Mathematics: . . . 27 or 29
 - (1) One course of at least 3 credits in biological science, entomology, microbiology, physiology, plant biology, or zoology.
 - (2) One of the following groups of courses (8 or 10 credits):
 - (a) CEM 141 General Chemistry 4
 CEM 142 General and Inorganic Chemistry 3
 CEM 161 Chemistry Laboratory I 1
 - (b) CEM 181H Honors Chemistry I 4
 CEM 182H Honors Chemistry II 4
 CEM 185H Honors Chemistry Laboratory I 2
 - (3) Both of the following courses (8 credits):
 CSE 231 Introduction to Programming I 4
 CSE 232 Introduction to Programming II 4
 - (4) Both of the following courses (8 credits):
 PHY 183 Physics for Scientists and Engineers I 4
 PHY 184 Physics for Scientists and Engineers II 4
- b. First-year competency in a foreign language
 or
 For students, who have been admitted to the teacher certification program, first-year competency in a foreign language and completion of the Professional Education Courses in the Department of Teacher Education.
- c. The following courses in the Department of Mathematics: 35
 - (1) All of the following courses (29 credits):
 - MTH 132 Calculus I 3
 - MTH 133 Calculus II 4
 - MTH 234 Multivariable Calculus 4
 - MTH 309 Linear Algebra I 3
 - MTH 310 Abstract Algebra I and Number Theory 3
 - MTH 320 Analysis I 3
 - MTH 451 Numerical Analysis I 3

MTH 481	Discrete Mathematics I	3
MTH 496	Capstone in Mathematics	3
The completion of Mathematics 496 satisfies the capstone course requirement of the computational mathematics major.		
(2)	One of the following courses (3 credits):	
MTH 452	Numerical Analysis II	3
MTH 482	Discrete Mathematics II	3
(3)	One of the following courses (3 credits):	
MTH 235	Differential Equations	3
MTH 340	Ordinary Differential Equations I	3
d.	At least one of the following courses:	3
Students who select Mathematics 452 or 482 may count the credits toward either requirement 3.c.(2) or 3.d. but not toward both of those requirements.		
Approval of the Department of Computer Science and Engineering is required to enroll in Computer Science and Engineering 331 and 440.		
CSE 331	Algorithms and Data Structures	3
CSE 440	Introduction to Artificial Intelligence	3
MTH 360	Theory of Mathematical Interest	3
MTH 415	Applied Linear Algebra	3
MTH 416	Introduction to Algebraic Coding	3
MTH 441	Ordinary Differential Equations II	3
MTH 452	Numerical Analysis II	3
MTH 457	Introduction to Financial Mathematics	3
MTH 472	Mathematical Logic	3
MTH 482	Discrete Mathematics II	3
STT 351	Probability and Statistics for Engineering	3
STT 430	Introduction to Probability and Statistics	3
STT 441	Probability and Statistics I: Probability	3
STT 455	Actuarial Models	3
STT 461	Computations in Probability and Statistics	3

Requirements for the Bachelor of Arts Degree in Computational Mathematics

1. The University requirements for bachelor's degrees as described in the *Undergraduate Education* section of this catalog; 120 credits, including general elective credits, are required for the Bachelor of Arts degree in Computational Mathematics.

The University's Tier II writing requirement for the Computational Mathematics major is met by completing Mathematics 309 or 310 and 496. Those courses are referenced in item 3.c.(1) below.

Students who are in the teacher certification program are required to complete Mathematics 330 or 432 and Statistics and Probability 430.

Students who are enrolled in the College of Natural Science may complete the alternative track to Integrative Studies in Biological and Physical Sciences that is described in item 1. under the heading *Graduation Requirements* in the College statement. Certain courses referenced in requirement 3. below may be used to satisfy the alternative track.

2. The requirements of the College of Natural Science for the Bachelor of Arts degree. The credits earned in certain courses referenced in requirement 3. below may be counted toward College requirements as appropriate.

3. The following requirements for the major:

CREDITS

- a. The following courses outside the Department of Mathematics: 19
- (1) One course of at least 3 credits in biological science, entomology, microbiology, physiology, plant biology, or zoology.
 - (2) The following course (4 credits):
 PHY 183 Physics for Scientists and Engineers I 4
 - (3) One of the following courses (4 credits):
 CEM 141 General Chemistry 4
 CEM 181H Honors Chemistry I 4
 - (4) Both of the following courses (8 credits):
 CSE 231 Introduction to Programming I 4
 CSE 232 Introduction to Programming II 4
- b. Second-year competency in a foreign language.
 or
 For students, who have been admitted to the teacher certification program, first-year competency in a foreign language and completion of the Professional Education Courses in the Department of Teacher Education.
- c. The following courses in the Department of Mathematics: 35
- (1) All of the following courses (29 credits):
 MTH 132 Calculus I 3
 MTH 133 Calculus II 4
 MTH 234 Multivariable Calculus 4
 MTH 309 Linear Algebra I 3
 MTH 310 Abstract Algebra I and Number Theory 3
 MTH 320 Analysis I 3
 MTH 451 Numerical Analysis I 3
 MTH 481 Discrete Mathematics I 3
 MTH 496 Capstone in Mathematics 3
 The completion of Mathematics 496 satisfies the capstone course requirement of the computational mathematics major.
 - (2) One of the following courses (3 credits):

MTH 452	Numerical Analysis II	3
MTH 482	Discrete Mathematics II	3
(3)	One of the following courses (3 credits):	
MTH 235	Differential Equations	3
MTH 340	Ordinary Differential Equations I	3
d.	At least one of the following courses:	3
Students who select Mathematics 452 or 482 may count the credits toward either requirement 3.c.(2) or 3.d. but not toward both of those requirements.		
Approval of the Department of Computer Science and Engineering is required to enroll in Computer Science and Engineering 331 and 440.		
CSE 331	Algorithms and Data Structures	3
CSE 440	Introduction to Artificial Intelligence	3
MTH 360	Theory of Mathematical Interest	3
MTH 415	Applied Linear Algebra	3
MTH 416	Introduction to Algebraic Coding	3
MTH 441	Ordinary Differential Equations II	3
MTH 452	Numerical Analysis II	3
MTH 457	Introduction to Financial Mathematics	3
MTH 472	Mathematical Logic	3
MTH 482	Discrete Mathematics II	3
STT 351	Probability and Statistics for Engineering	3
STT 430	Introduction to Probability and Statistics	3
STT 441	Probability and Statistics I: Probability	3
STT 455	Actuarial Models	3
STT 461	Computations in Probability and Statistics	3

Insert (2)

MINOR IN MATHEMATICS

The Minor in Mathematics, which is administered by the Department of Mathematics, will broaden students' understanding and application of mathematical concepts to their chosen field of study.

The minor is available as an elective to students who are enrolled in bachelor's degree programs at Michigan State University other than the Bachelor of Arts and Bachelor of Science Degree in Mathematics. With the approval of the department and college that administer the student's degree program, the courses that are used to satisfy the minor may also be used to satisfy the requirements for the bachelor's degree. At least 12 unique credits counted towards the requirements for a student's minor must not be used to fulfill the requirements for that student's major.

Students who plan to complete the requirements of the minor should consult the undergraduate advisor in the Department of Mathematics.

Requirements for the Minor in Mathematics

	CREDITS
Complete the following (21 to 24 credits):	
1. One of the following courses (3 or 4 credits):	
LB 118 Calculus I	4
MTH 132 Calculus I	3
MTH 152H Honors Calculus I	3
2. One of the following courses (3 or 4 credits):	
LB 119 Calculus II	4
MTH 133 Calculus II	4
MTH 153H Honors Calculus II	3
3. One of the following courses (3 or 4 credits):	
LB 220 Calculus III	4
MTH 234 Multivariable Calculus	4
MTH 254H Honors Multivariable Calculus	3
4. All of the following courses (12 credits):	
MTH 309 Linear Algebra I	3
MTH 310 Abstract Algebra I and Number Theory	3
MTH 320 Analysis I	3
One 400-level mathematics course	3

SPECIALIZATION IN ACTUARIAL SCIENCE

The Specialization in Actuarial Science, which is administered by the Department of Mathematics within the College of Natural Science, is available as an elective to students who are enrolled in any bachelor's degree program at Michigan State University. This specialization complements a number of major fields such as mathematics, statistics and probability, finance, and economics. It is intended to prepare students for work in insurance companies, banks, investment firms, government work, hospitals and business firms where there is a need to weigh the financial consequences of risk. The Specialization in Actuarial Science prepares students for two of the examinations of the Society of Actuaries (SOA): Exam P/1 and Exam FM/2. With the approval of the department that administers the student's degree program, courses that are used to satisfy the requirements for the specialization may also be used to satisfy the requirements for the bachelor's degree.

Requirements for the Specialization in Actuarial Science

The student must complete all of the following courses (21 credits):

	CREDITS
1. All of the following courses (18 credits):	
FI 311 Financial Management	3
FI 321 Theory of Investments	3
FI 379 Advanced Derivatives (D)	3
MTH 360 Theory of Mathematical Interest	3
STT 441 Probability and Statistics I: Probability	3
STT 455 Actuarial Models	3
2. One of the following courses (3 credits):	
MTH 457 Introduction to Financial Mathematics	3
STT 442 Probability and Statistics II: Statistics	3

Upon completion of the requirements for the Specialization in Actuarial Science, the students should contact the Chairperson of the Department of Mathematics and request certification for the completion of the specialization. After the certification is approved by the Chairperson of the Department of Mathematics and the Associate Dean of the College of Natural Science, the Office of the Registrar will enter on the student's academic record the name of the specialization and the date that it was completed. This certification will appear on the student's transcript.

TEACHER CERTIFICATION OPTIONS

The mathematics disciplinary majors leading to the Bachelor of Arts and Bachelor of Science degrees are available for teacher certification.

A mathematics-elementary and mathematics-secondary disciplinary minor are also available for teacher certification.

Students who elect a mathematics disciplinary major or the mathematics-elementary or mathematics-secondary disciplinary minor must contact the Department of Mathematics.

For additional information, refer to the statement on *TEACHER CERTIFICATION* in the *Department of Teacher Education* section of this catalog.

GRADUATE STUDY

The Bachelor of Science degree in Actuarial Science prepares students to work in insurance companies, banks, investment firms, government agencies, hospitals, and business firms where there is a need to weigh the financial consequences of risk. Course work is designed to provide the academic background for successful completion of five of the examinations of the Society of Actuaries (SOA): Exam P/1, Exam FM/2, Exams MLC/3 and MFE/3, and Exam C/4, including completion of the Validation by Educational Experience (VEE) course work in applied statistics, corporate finance, and economics. Completion of these SOA exams and VEE courses is required for those intending to become an Associate of the Society of Actuaries.

Requirements for the Bachelor of Science Degree in Actuarial Science

1. The University requirements for bachelor's degrees as described in the *Undergraduate Education* section of this catalog; 120 credits, including general elective credits, are required for the Bachelor of Science degree in Actuarial Science.
 The University's Tier II writing requirement for the Actuarial Science major is met by completing Mathematics 309 or 496. Those courses are referenced in item 3. below.
 Students who are enrolled in the College of Natural Science may complete the alternative track to Integrative Studies in Biological and Physical Sciences that is described in item 1. under the heading *Graduation Requirements* in the College statement. Certain courses referenced in requirement 3. below may be used to satisfy the alternative track.
2. The requirements of the College of Natural Science for the Bachelor of Science degree.
 The credits earned in certain courses referenced in requirement 3. below may be counted toward College requirements as appropriate.
3. The following requirements for the major.

CREDITS

- a. One course of at least 3 credits in biological science, entomology, microbiology, physiology, plant biology, or zoology.
- b. One of the following groups of courses (8 or 10 credits):

(1)	CEM 141	General Chemistry	4
	CEM 142	General and Inorganic Chemistry	3
	CEM 161	Chemistry Laboratory I	1
(2)	CEM 151	General and Descriptive Chemistry	4
	CEM 152	Principles of Chemistry	3
	CEM 161	Chemistry Laboratory I	1
(3)	CEM 181H	Honors Chemistry I	4
	CEM 182H	Honors Chemistry II	4
	CEM 185H	Honors Chemistry Laboratory I	2
(4)	LB 171	Principles of Chemistry I	4
	LB 171L	Introductory Chemistry Laboratory I	1
	LB 172	Principles of Chemistry II	3
- c. One of the following groups of courses (6 or 8 credits):

(1)	PHY 183	Physics for Scientists and Engineers I	4
	PHY 184	Physics for Scientists and Engineers II	4
(2)	PHY 193H	Honors Physics I – Mechanics	3
	PHY 294H	Honors Physics II – Electromagnetism	3
(3)	LB 271	Physics I	3
	LB 272	Physics II	3
- d. One of the following groups of courses (6 to 8 credits):

(1)	MTH 132	Calculus I	3
	MTH 133	Calculus II	4
(2)	LB 118	Calculus I	4
	LB 119	Calculus II	4
(3)	MTH 152H	Honors Calculus I	3

	MTH	153H	Honors Calculus II	3
e.	One of the following courses (3 or 4 credits):			
	LB	220	Calculus III	4
	MTH	234	Multivariable Calculus	4
	MTH	254H	Honors Multivariable Calculus	3
f.	One of the following courses (3 credits):			
	MTH	235	Differential Equations	3
	MTH	255H	Honors Differential Equations	3
	MTH	340	Ordinary Differential Equations I	3
g.	One of the following courses (1 credit):			
	MTH	490	Directed Studies	1
	MTH	491B	Teamwork Experience	1
h.	All of the following courses (21 credits):			
	MTH	309	Linear Algebra I	3
	MTH	360	Theory of Mathematical Interest	3
	MTH	458	Financial Mathematics for Actuaries	3
	STT	441	Probability and Statistics I: Probability	3
	STT	455	Actuarial Models I	3
	STT	456	Actuarial Models II	3
	STT	459	Construction and Evaluation of Actuarial Models	3
i.	One of the following courses (3 credits):			
	MTH	457	Introduction to Financial Mathematics	3
	STT	442	Probability and Statistics II: Statistics	3
j.	One of the following courses (3 credits):			
	MTH	491A	Actuarial Internship	3
	MTH	496	Capstone in Mathematics	3
k.	All of the following courses (18 credits):			
	ACC	230	Survey of Accounting Concepts	3
	EC	201	Introduction to Microeconomics	3
	EC	202	Introduction to Macroeconomics	3
	FI	311	Financial Management	3
	FI	321	Theory of Investments	3
	FI	379	Financial Derivatives (D)	3
l.	One of the following courses (3 or 4 credits):			
	CSE	131	Technical Computing and Problem Solving	3
	CSE	231	Introduction to Programming I	4