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1. Overview

The Department of Mechanical and Industrial Engineering (M&IE) in the College of Engineering (COE) and the Department of Agricultural Economics and Economics (DAEE) in both the College of Agriculture (COA) and College of Letters and Science (CLS) at Montana State University (MSU), Bozeman campus, propose the creation of a new program, Financial Engineering (EFIN).

Financial Engineering is fundamentally a multidisciplinary field that emphasizes the creation of new financial economic instruments as well as the combining of existing instruments to manage risk, create strategic business opportunities, lower costs, and access new markets. The management of risk is essential in today's highly leveraged domestic markets and the global business environment. Successful market, credit, and production risk management requires complex financial economic modeling and analysis. This program provides students an excellent opportunity to enter this relatively new profession.

The program's intentions are to maintain the high quality of education provided to our students, increase responsiveness to workforce development needs by developing a new program in a high demand field, increase job placement rates, and to expand outreach to top academic achievers graduating from Montana high schools. The faculty in the departments offering the program has both academic and professional experience to assure success for students enrolled in the financial engineering program. The faculty's established contacts with industry leaders will facilitate student internships and employment. Relatively limited resources will be needed because the proposed program relies on an innovative combination of existing courses. As the program grows, we anticipate seeking one new FTE for each Department.

The goal of the EFIN program is to produce highly skilled graduates that are readily employable in sophisticated financial and credit management markets. These graduates will have rigorous training in financial economics, engineering mathematics, and actuarial methods:

- Mathematics similar to many engineering fields, further expanded to include more statistics and probability theory
- Financial economics with a solid background in classical economic theory and markets (capital, commodity, and derivative)
- Software engineering and modeling

The program will produce graduates that have the skills demanded by firms using complex financial instruments and strategies. The use of financial engineering techniques is relatively new and, until recently, was limited to financial centers. However, the use of these financial engineering techniques is now pervasive in regional firms. Regional firms require these skills to compete in the larger and more complex nationwide and international markets.

Financial engineers are commonly employed in banking, corporate finance, insurance companies, securities, mining, agricultural businesses, and other industries that require sophisticated financial management skills. Because of the increased complexity and sophistication of business risk management, and to remain competitive, regional industries as well as national and international firms will employ financial engineers. The International Association of Financial Engineers has been operating since 1992, and maintains a "core body of knowledge" for the field.

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We anticipate that the program, after start up, will attract about 95 majors (cross-institutional comparisons provided in Section C). No other financial engineering programs exist in the Montana University System or in the Pacific Northwest region. Geographically, the closest undergraduate programs are in California. This is an opportunity for the MUS to develop a highly recognizable, prestigious program that provides solid employment opportunities and serves the top students in the region.

2. Provide a one paragraph description of the proposed program. Be specific about what degree, major, minor or option is sought.

Montana State University seeks approval to establish a new degree, Bachelor of Science in Financial Engineering, including both a major and minor in Financial Engineering. These programs are to be offered jointly by the Department of Mechanical and Industrial Engineering and the Department of Agricultural Economics and Economics. Financial Engineering is a multidisciplinary field that emphasizes the creation of financial economic instruments to manage risk and create strategic business opportunities. The program integrates financial economics with the rigorous mathematics and analysis techniques of engineering. This program provides individuals the background for careers in industries that require the strong quantitative and analytical skills necessary for sophisticated financial and credit management. These industries include banking, corporate finance, securities, manufacturing, mining, oil and gas, agricultural business, timber, and others. Since backgrounds in both economics and engineering are required for financial engineering, the Department of Mechanical and Industrial Engineering and the Department of Agricultural Economics and Economics will jointly manage and house the program. The two departments have outlined agreements for working together that will ensure that this fundamentally interdisciplinary program offers skills in economics and engineering in an integrated manner so that students will be highly competitive for employment in this sophisticated and technical field.

3. Need

A. To what specific need is the institution responding in developing the proposed program?

The use of secondary markets, derivatives, and other risk-management and capital obtaining techniques are necessary even for regional firms to be competitive. The financial engineering program will provide students with the skills to provide these services to local, regional, national, and international firms. This program is designed for highly-dedicated students interested in a financial engineering career. Students will need to meet the rigorous academic requirements of the College of Engineering, while obtaining a substantially deeper understanding of economics and financial markets than traditional engineering disciplines.

This program addresses specific goals and initiatives for the BORs' Strategic Plan for 2011. Specifically, this program aims to:

1. maintain the high quality of education provided to our students (Most important consideration);
2. increase responsiveness to workforce development needs by expanding and developing a program in a high-demand field in the state (Goal 2);
3. increase degrees and certificates awarded in high-demand occupational fields (Objective 2.1.2.);
4. increase job placement rates (Objective 2.1.3.);
5. expand outreach to top academic achievers graduating from MT high schools (Objective 1.4.2.).

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B. How will students and any other affected constituencies be served by the proposed program?

Due to their rigorous training, the demand for financial engineering graduates is high with a forecasted growth rate of 18% to 20% annually over the next seven years (Occupational Outlook Handbook, 2010-11 Edition). PayScale reports that the annual salaries of financial engineers range from \$74,000 to \$115,000. Duff & Phelps reports average salaries of \$97,000 with less than one year of experience. These high salaries indicate that employers demand students with these skills and that these students will be financially rewarded for successfully pursuing this rigorous course of study.

C. What is the anticipated demand for the program? How was this determined?

C.1. Overview

The faculty from the Departments of Mechanical and Industrial Engineering and Agricultural Economics and Economics performed benchmark analysis of other financial engineering programs around the United States and conducted interest surveys with students currently enrolled at MSU.

Information was gathered on the number of institutions with a financial engineering program, number of students per program, and the occupational outlook for financial engineers. This information was then compared to similar measures for Montana State University to develop the estimated demand for a financial engineering program at Montana State University.

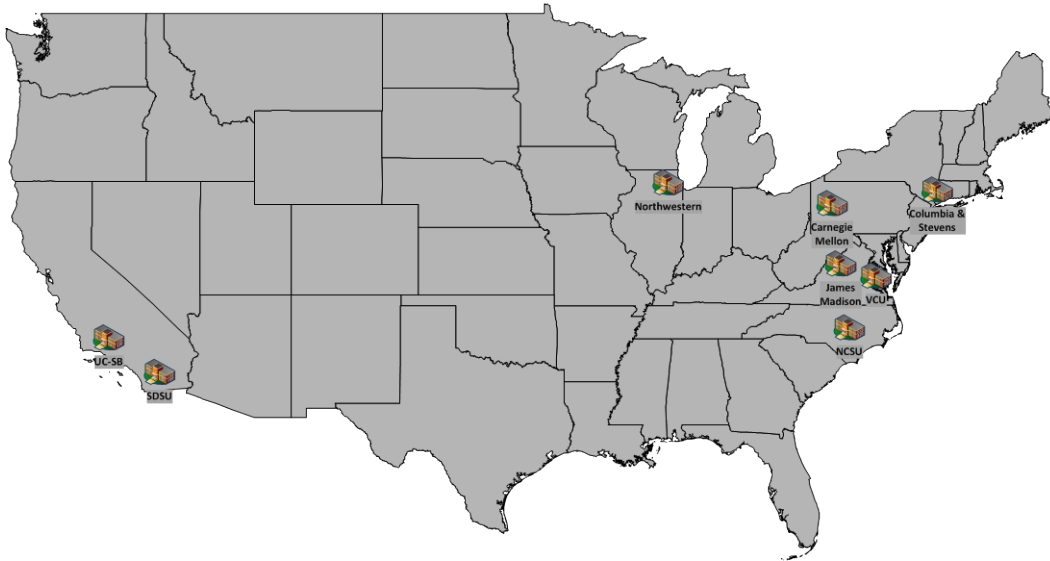
C.2. Number and Location of Competing Institutions

Based on information provided by the International Association of Financial Engineers, in the United States there are approximately nine undergraduate programs and 50 graduate programs conferring financial engineering or closely related degrees such as Financial Mathematics, Quantitative or Computational Finance, etc. Figure 1 illustrates the location of programs currently conferring bachelor's degrees in financial engineering, or related fields in the United States. Outside the United States, there are approximately ten undergraduate programs and at least 70 graduate programs offering financial engineering or related degrees.

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Figure 1 - Current Undergraduate Financial Engineering Programs



As illustrated in Figure 1, there are no financial engineering programs offered in the Northwest or Intermountain region. This relative lack of competition geographically combined with MSU's strong programs in Industrial Engineering and Economics makes MSU well positioned to develop a premier undergraduate program in Financial Engineering, attracting top students and further strengthening MSU's reputation for desirable graduates. Additionally, as shown, the competing programs are based in very large metropolitan areas, enabling MSU's program to focus on educating the types of graduates that are needed for mid-market firms with rural applications for financial engineers.

C.3. Benchmarking Size and Offerings of Competing Institutions

As previously stated, the majority of programs in financial engineering tend to focus on graduate education, often for working professionals. Despite an increasing demand for employees with the skill set of financial engineers, the number of undergraduate program offerings is relatively small. The relatively small number of programs mostly reflects the newness of the field. Table 1 contains a summary of all undergraduate programs in the United States.

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Table 1 - Summary of Current Undergraduate Financial Engineering Programs

Name of University	Program Size	Program College	COE Size	Graduate Degrees
Columbia University	300	Engineering	1425	MS
Northwestern University	120	Engineering	1440	MS Analytics
Stevens Institute of Technology	92	Technology	N/A	MS, PhD
Carnegie Mellon University	73	Joint - Science & Business	N/A	MS
University of California - Santa Barbara	64	Letters & Science	N/A	PhD
James Madison University	58	Business	N/A	
Virginia Commonwealth University	~40	Business	N/A	
North Carolina State University	New	Sciences	N/A	MS
San Diego State University	Unknown	Sciences	N/A	

By reviewing the programs in Table 1, we see that the four most successful programs in terms of enrollments are housed in engineering or technology schools or are joint programs, with an average program size of nearly 150 students. By comparison, programs housed in business and sciences tend to be substantially smaller, with an average program size of over 50. Based on these demographics, by proposing a joint program housed in engineering and economics MSU’s financial engineering program is positioned well for successful enrollment.

It should be noted, though, that directly comparing MSU to Columbia is tenuous given the maturity of the program and their graduate education in the field of financial engineering. In the near term, MSU does not intend to offer graduate studies focused in the field, which may detract from our ability to grow a successful program. This potential risk is offset by MSU’s existing graduate offerings in Economics (MS Applied Economics) and Industrial Engineering (MS Industrial and Management Engineering, PhD Engineering – Industrial Engineering Option) which could be tailored within their respective departments for the student wishing to continue education in the field of financial engineering.

Of the comparison programs, only one is a land grant university, North Carolina State University. However, this program is new and currently has only handful of students enrolled. As such, it is not a useful benchmark for the proposed program at MSU.

As discussed in section C.2, programs in financial engineering tend to focus on graduate education, often for working professionals. However, this fact should not be interpreted as a lack of demand for undergraduate students with skills to work as financial engineers. In fact, as shown by the letters of support included in Appendix A, there is substantial regional and national interest for undergraduate students with these skills.

C.4. Occupational Outlook

Table 2 contains industry outlooks from the Occupational Outlook Handbook, 2010-11 Edition. Financial engineering is not listed in the manual. Therefore, the analysis is based on the closest occupation to financial engineering, financial analyst. This industry is expected to increase employment by 50,000 new jobs in the next seven years. The subgroup of financial analysts most closely associated with financial engineering are those working in securities, commodity contracts, and other financial investments and related activities. Employment in this field is expected to account for 11,000 of the new jobs in the field.

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Table 2 - Financial Engineering Related Occupational Outlook

Industry Code	Industry	2008			2018			Employment Change (Percent)
		Employment (000's)	Percent of Industry	Percent of Occupation	Employment (000's)	Percent of Industry	Percent of Occupation	
13-2051	Financial Analysts							
TOT001	Total employment, all workers	250.6	.17	100	300.3	0.18	100	49.6 (19.81)
523000	Securities, commodity contract, and other financial investments and related activities	63.2	7.36	25.21	74.9	7.81	24.94	11.7 (18.51)
523900	Other financial investment activities	37.2	10.70	14.85	43.8	11.24	14.59	6.7

C.5. Overall Demand

As noted, there are relatively few financial engineering programs currently in the United States, and none in the Pacific Northwest. The most successful programs in terms of enrollment are housed in Schools of Engineering or are joint programs.

Although there are no direct comparisons for the proposed program at MSU, we can use this data to make inferences about the projected future size of the program. As noted above, the proposed program will share many of the same characteristics of the most successful current programs. Based on the current size of MSU's College of Engineering (approximately 2200 undergraduates) and the Industrial Engineering program (approximately 90 undergraduates), it appears reasonable to exclude the top program, Columbia University, as an outlier, and benchmark the proposed program against the next top three programs. Based on that analysis, it is reasonable to assume that the proposed program will enroll a similar number of students as these programs (95 students) upon full enrollment. This estimate is further supported through an interest survey of current students at MSU. The survey contacted students currently enrolled in Agricultural Business, Economics, Industrial Engineering, General Engineering and University Studies programs and found 55% of respondents were interested or very interested in including aspects of financial engineering in their undergraduate education. The committee believes this estimate is conservative as programs housed outside of engineering are included in the average.

The enrollment estimate also has margin of error (in both directions) due to various unknowns. First, being the only financial engineering program in the Pacific Northwest is expected to have a positive influence on enrollment due to lack of competition, however, it may also have a negative influence on program enrollment due to lack of awareness. Second, MSU's COE is larger than both Columbia and Northwestern who have substantially higher financial engineering enrollments, which points to potential for greater enrollments. However, since their Industrial Engineering programs are larger than ours, their higher

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enrollments may reflect other differences in student population. Third, the lack of a graduate program in financial engineering may have some adverse effect on enrollments. All of these influences are non-quantifiable using the available data.

Even with our conservative estimate of 95 students, this will place MSU's program as approximately the fourth largest program in the country at full enrollment. As indicated in later sections, using this conservative approach, the proposed program will have a positive effect on the financial success of MSU.

4. Institutional and System Fit

A. What is the connection between the proposed program and existing programs at the institution?

The financial engineering program is connected to the existing industrial engineering program in the College of Engineering and the economics program in the Department of Agricultural Economics and Economics. Financial engineering students are required to take a similar track of courses in analysis and mathematics to industrial engineering students in their program of study while replacing various engineering fundamentals courses with course work in economics and other areas of finance. Minor support to the program will be provided by MSU's College of Business (COB). An agreement has been reached between the committee and members of the COB finance faculty to allow financial engineering students to utilize senior level finance courses as professional electives.

B. Will approval of the proposed program require changes to any existing programs at the institution? If so, please describe.

Approval of the proposed financial engineering program will not require changes to any existing programs at MSU.

C. Describe what differentiates this program from other, closely related programs at the institution (if appropriate).

There are no other financial engineering programs in the MUS system. Nor are there other programs that could be deemed closely related in nature outside the core industrial engineering and economics programs described above.

Alternatives to a new undergraduate degree program were considered and evaluated. One option considered is to create a financial engineering option under one of the existing degree programs. This option is deemed infeasible because the number of credits required would exceed limits enacted by the Board of Regents. For example, a financial engineering option under BS in Industrial Engineering would require 30 credits in excess of the required 128 credits due to accreditation requirements of the BSIE degree. Another option considered is to start with a minor, see how popular it is, and then create a major degree program at some future date. However, to create the minor would still require creating at least two new courses along with an administrative structure, so the resource requirements would be comparable to that of the full degree program. In addition, a minor would not be nearly as marketable, would not likely attract new students to MSU and associated new revenues, and would not adequately meet the market needs outlined in the previous sections. We therefore conclude that the best path forward for MSU is an undergraduate major degree.

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D. How does the proposed program serve to advance the strategic goals of the institution?

The proposed program will support the specific goals of MSU's recently adopted strategic plan in the following ways:

Objective L.3: Increase job placement and further education rates – As discussed in section 3:C4, the demand for graduates with financial engineering skills is strong and growing. Students from the proposed programs will enjoy strong job prospects, similar to other high demand majors within current College of Engineering programs. The curriculum for the program, described in section 5.A., is designed to meet all prerequisites needed to pursue graduate education at other leading institutions offering programs in this field.

Objective E.2: MSU graduates will have global and multi-cultural understanding and experiences – The nature of financial engineering requires students to have a strong understanding of global markets which will be emphasized throughout the curriculum. Existing faculty relationships with international organizations including the World Bank and leading financial institutions are expected to provide student internships and project placements that offer hands-on experiences in global markets.

Objective I.1: Increase the integration of learning, discovery and engagement – Financial engineering is an application-based discipline. As such, faculty research projects will be largely community-based and will heavily utilize partnerships with undergraduate scholars to collect data and apply the methods of financial engineering to solve community issues.

Objective I.2 Increase work across disciplines – Financial engineering is fundamentally interdisciplinary, drawing heavily from financial economics and engineering. In fact, the differentiating skill of financial engineers is their ability to apply analysis techniques common in engineering to solve problems in financial economics. This synergistic approach provides students with the expertise for risk and capital management that their employers require to compete in large, complex, or international markets. The collaborative effort will occur at various levels. The design of courses most central to the degree will include input from both engineers and economists. The senior project will integrate coursework, such that students will use the developed skills to address real-world problems in an interdisciplinary manner. The senior project will involve research using both financial economics and engineering approaches in an integrated manner so that students develop the capacity to apply the skills learned from multiple disciplines. While the very heart of the proposed program is an interdisciplinary collaboration between two different departments of two different colleges within MSU, it is not the extent of the interdisciplinary nature of the proposal. In addition to this core collaboration, members of MSU's College of Business have been engaged to support certain areas of the education of financial engineering students through elective courses and further partnerships are being explored with the School of Business at the University of Montana. As the program expands and faculty members focus more on the area of financial engineering, it is expected that these additional collaborations will move beyond a focus on student learning to include interdisciplinary partnerships in discovery.

Objective A.2: Diversify the Student Body – Approximately half of all undergraduate programs in Financial Engineering worldwide are based outside the United States. This fact, when combined with the global nature of the work of financial engineers, points to a strong demand for these skills among international students who could be attracted to MSU. In the long term, it is expected that this program could attract international partnerships, similar to other programs that currently exist within the College of Engineering.

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E. Describe the relationship between the proposed program and any similar programs within the Montana University System. In cases of substantial duplication, explain the need for the proposed program at an additional institution. Describe any efforts that were made to collaborate with these similar programs; and if no efforts were made, explain why. If articulation or transfer agreements have been developed for the substantially duplicated programs, please include the agreement(s) as part of the documentation.

There are no similar programs offered in the MUS system and this program is not expected to create any duplication within the MUS. Certain topics included in the Colleges of Business at MSU and U of M will make good supporting coursework for students in the financial engineering program, as outlined in the program of study in Section 5. Members of both of these colleges have been approached for their support.

5. Program Details

A. Provide a detailed description of the proposed curriculum. Where possible, present the information in the form intended to appear in the catalog or other publications. NOTE: In the case of two-year degree programs and certificates of applied science, the curriculum should include enough detail to determine if the characteristics set out in Regents' Policy 301.12 have been met.

Preliminary course catalog, student performance and retention requirements are provided in the table below.

<u>FINANCIAL ENGINEERING MAJOR</u>				CORE
Course Name	Course Title	Fall	Spring	
Freshman Year				
CHMY 141	College Chemistry I		4	IN
<i>Take one of the following:</i>				
CLS 101	Knowledge and Community	3		US
COM 110	Public Communication	3		US
CSCI 111	Programming with Java 1	4		
CSCI 132	Basic Data Structures and Algorithms		4	
EFIN 101*	Introduction to Financial Engineering		1	
IA Elec	Inquiry Arts Elective	3		IA
M 171	Calculus I	4		Q
M 172	Calculus II		4	
PHSX 220	Physics I		4	CS
WRIT 101**	College Writing I	3		W
		17	17	
Sophomore Year				
CSCI 232	Data Structures and Algorithms		4	
ECNS 251***	Honors Economics	4		IS
ECNS 301	Intermediate Microeconomics with Calculus		3	
ECNS 309	Managerial Economics		3	
EGEN 325	Engineering Economic Analysis	3		
EIND 364	Principles of Operations Research I	3		
EIND 373	Production Inventory Cost Analysis		3	
M 221	Introduction to Linear Algebra	3		

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M 273	Multivariable Calculus	4	
M 274	Introduction to Differential Equations		4
		17	17
Junior Year			
ECNS 313	Money & Banking	3	
ECNS 406	Industrial Organization		3
EFIN 301*	Engineering & Economic Financial Management I		3
EIND 300	Engineering Management & Ethics	3	
EIND 354	Engineering Probability and Statistics I	3	
EIND 464	Principles of Operations Research II		3
EIND 457	Regression & Multivariate Analysis for Engineers		3
IH Elec	Inquiry Humanities Elective	3	IH
Professional Electives		3	3
		15	15
Senior Year			
D Elec	Diversity Elective		3 D
ECNS 4xx****	Econometrics I	3	
EIND 4xx****	Managerial Forecasting & Decision Analysis	3	
EFIN 401*	Engineering & Economic Financial Management II	3	
EFIN 499*	Financial Engineering Senior Project		3 R
Professional Electives		3	
Technical Electives		3	6
		15	12

* New Class

** Students exempt from MSU writing requirement should substitute WRIT 221.

*** May substitute ECNS 202 and ECNS 204.

**** New co-convened undergraduate courses, EIND 4xx with EIND 558, ECNS 4xx with ECNS 561.

Professional Electives: BFIN 420, BFIN 441, BFIN 452, BFIN 458, BFIN 466, ECNS 314, ECNS 403, ECNS 432, ECNS 345, EGEN 310, EIND 425, EIND 434, EGEN 492.

Technical Electives: CSCI 440, CSCI 446, CSCI 447, ECNS 501, ECNS 502, ECNS 562, EIND 422, EIND 458, EFIN 498*, M441,

STAT 408, STAT 436.

Note: May substitute EIND 373 and ECNS 345 as prerequisite for BFIN 352, BFIN 452, and BFIN 458.

A minimum of 125 credits is required for graduation; 42 of these credits must be in courses numbered 300 or above.

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FINANCIAL ENGINEERING MINOR

Required Courses		Credits
ECNS 251**	Honors Economics	4
CHMY 141	College Chemistry I	4
M 221	Introduction to Linear Algebra	3
M 171	Calculus I	4
M 172	Calculus II	4
PHSX 220	Physics I	4
		23
Minor Courses		
ECNS 301	Intermediate Microeconomics with Calculus	3
ECNS 313	Money and Banking	3
EGEN 325	Engineering Economic Analysis	3
EFIN 101*	Introduction to Financial Engineering	1
EFIN 301*	Engineering & Economic Financial Management I	3
EFIN 401*	Engineering & Economic Financial Management II	3
EIND 354	Engineering Probability and Statistics I	3
EIND 364	Principles of Operations Research I	3
<i>Take one of following:</i>		
ECNS 309	Managerial Economics	3
ECNS 406	Industrial Organization	3
ECNS 4xx***	Econometrics I	3
<i>Take one of following:</i>		
EIND 457	Regression & Multivariate Analysis for Engineers	3
EIND 464	Principles of Operations Research II	3
EIND 4xx***	Managerial Forecasting & Decision Analysis	3
		28

* New Class

** May substitute ECNS 202 and ECNS 204.

*** New co-convened undergraduate courses, EIND 4xx with EIND 558, ECNS 4xx with ECNS 561.

By benchmarking other undergraduate programs, the faculty identified four courses (10 credits total) needed to cover a few specific topics or curricular needs not addressed by existing courses. EFIN 101 is a one-credit overview course intended to introduce prospective students to the emerging field of financial engineering. EFIN 301 and EFIN 401 cover the essential elements of the Financial Engineering Body of Knowledge. Students will be expected to apply tools, techniques, and fundamental concepts from other courses to specific application areas. EFIN 499 is a capstone experience where students will integrate the concepts they have learned throughout their program to a specific, real-world application. Students will also have the opportunity to complete an internship under EFIN 498 as an elective. Combining these courses with existing courses as shown above creates a program with comparable requirements to those of the undergraduate programs benchmarked. The steering committee (see Section B2 below) will review the courses regularly and make adjustments as necessary.

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B. Describe the planned implementation of the proposed program, including estimates of numbers of students at each stage.

B.1. Enrollment Analysis

Recent surveys of prospective students currently enrolled at MSU indicate a strong interest in the program, with 55% of respondents indicating they were interested or very interested in incorporating financial engineering into their undergraduate education. This strong interest occurred despite the fact that only 35% of respondents indicated they were familiar with financial engineering prior to receiving the information in the survey. Based on these polls and our own enrollment analysis (in section 3C), we expect the program to reach 95 students enrolled in the major within five years. The higher salaries of financial engineers will also attract students into this major. Below is a forecasted estimate of the number of majors for the first five years of the new program.

Table 5: Number of Majors by Years

Year	Number
1 st	30
2 nd	55
3 rd	75
4 th	90
5 th	95

B.2. Program Administration

A Memorandum of Understanding (MOU) outlines the broad parameters of cooperation between the two departments responsible for the proposed program (see Appendix B). A Financial Engineering Major Steering Committee (FEMSC) consisting of two Economics faculty members and two Industrial Engineering faculty members will be established to oversee and administer the program. The FEMSC will:

- Prepare new course proposals, and shepherd them through the approval process
- Market the EFIN program
- Oversee EFIN Courses, including coordination of content and teaching assignments
- Evaluate and improve the EFIN program
- Ensure catalog updates occur in a timely fashion
- Establish a process for assigning advisors and advising students
- Establish a process for degree certification, including selection of a degree certifying officer

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6. Resources

A. Will additional faculty resources be required to implement this program? If yes, please describe the need and indicate the plan for meeting this need.

As outlined in the course catalog description above, the majority of courses taken by financial engineering students already exist at MSU. However, the program requires two new 3-credit financial engineering lecture-based courses, one new 1-credit freshman seminar, an internship course, and a senior capstone course. In addition, two courses currently offered in an on-demand mode (EIND 373 and 558) will move to an annual offering. Finally, approximately four added sections will be required of existing classes once the program is at a full complement of students

The FEMSC has constructed projected costs and revenues for the financial engineering program. The per student tuition revenue is based on 70% in-state and 30% out-of-state students yield an average tuition costs of \$8,868 per student. This breakdown of in-state and out-of-state tuition is based on the demographics of the most recent freshman class at MSU. The long-run projected total revenue generation for all students in the major is \$842,414 per year and from only new students is \$421,207 per year. After subtracting expected program costs, the total net revenue to MSU is expected to be \$426,174, with \$58,967 contributed from net new students. These revenue forecasts do not include any estimated value for increased tuition due to students pursuing a minor in financial engineering. The split of existing vs. net new revenue was made using an assumption of 50% net new enrollments to MSU. This assumption is supported by data collected through the student interest survey, which found slightly more than 50% of respondents indicated that they would have been likely or very likely to stay in their current major if financial engineering had been an available degree program at the time they enrolled at MSU. We anticipate net revenue in the first year of \$210,604 for all students and that net revenue will rise to the long-run projection within 6 years. See Table 6 for the costs and revenues projection.

Funding for faculty to teach the additional courses in the program will come from existing sources. In particular, the departments are moving existing faculty lines to support the teaching required in the new program:

- In the case of DAEE, it is expected that senior faculty will develop and teach the new courses.
- For Industrial Engineering, a new faculty member is currently on reduced teaching load as part of his start-up agreement. As the start-up agreement ends he will assume the teaching of the new courses, and the department will continue existing coverage of current courses.
- MSU Foundation resources are available to the College of Engineering for curriculum development and will be used to fund program start-up.
- As the program grows, the departments will seek additional resources as necessary through the university's budget allocation process.

B. Are other, additional resources required to ensure the success of the proposed program? If yes, please describe the need and indicate the plan for meeting this need.

Existing MSU classroom facilities will be used for course delivery. The initial need for operational dollars and other expenses will be met with funds available through the MSU Foundation. Table 6 contains long run income and expense projections for the program.

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Table 6: Long-run Costs and Revenues Projection

<u>Revenue</u>		
Number of Majors		95
Total Number of New Students		47.5
Fraction of New MSU Students		0.5
Average Per Student Tuition ¹	\$ 8,868	
Total Revenue (all students)		\$ 842,414
Total Revenue (new students)		\$ 421,207
<u>Costs</u>		
Instructors		2
Total Salary	\$160,000	
Total Benefits @ 35%	\$ 56,000	
Total Faculty Compensation		\$ 216,000
Operations Costs		\$ 20,000
Subtotal		\$ 263,000
Ancillary Costs @ 48% ²		\$ 126,240
Total Cost		<u>\$ 362,240</u>
Projected Net Revenue Generation (All Majors)		\$ 426,174
Projected Net Revenue Generation (New Students)		\$ 58,967

¹ Average tuition is based on average tuition of in-state and out-of-state students. See table below.

² Ancillary costs include additional sections of other classes beyond those taught by new faculty and miscellaneous costs borne by other departments. These costs are due to having 47.5 more students at MSU and will be funded through the usual budgeting process

General Tuition Revenue

Resident Tuition	\$ 5,076	
Non-resident Tuition	\$ 17,714	
% Nonresident		30
Estimated Tuition Revenue	<u>\$ 8,868</u>	

7. Assessment

How will the success of the program be measured?

The success of the program will be measured on multiple fronts. This includes measurement of the program’s impact on the MUS system, the success of the program in achieving programmatic objectives, and success of the program in achieving programmatic outcomes. Specific actions for each of these measures are outlined below:

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A. Success of the program for the MUS system

In order to become a successful major at MSU, the program must attract and retain talented students. A key measure of this success is the number of students enrolled in the program. As outlined earlier in the document, at steady-state, the program is expected to attract 95 majors, with 50% of those students being new students to MSU. The program will be considered successful, in terms of student enrollments, if it obtains the following milestones:

- On track to reach break-even student enrollment (approximately 44 full-time students) in two years.
- At break-even student enrollment in year three.
- At 80% of expected steady state enrollment (76 students) by year five.

If these benchmarks of success are not reached, the program will be re-evaluated to determine whether changes are needed or to terminate the program. If the program is terminated, the FEMSC will develop a phase out plan. For example, EFIN 401 and 499 would continue for one year to allow upper division students to complete the major. Lower division students will be accommodated by advising them into an alternative degree program, e.g., a major Industrial Engineering with a minor in Economics, a major in Economics with a minor in mathematics, or a dual major in Industrial Engineering and Economics.

B. Success of the program in achieving programmatic objectives

In order to understand how well the program is meeting objectives, the following actions will be taken:

- Program mission objectives and outcomes will be set during year 1.
- Annual review by the faculty, department, and college administrators for progress against these objectives beginning in year 2.
- Implementation of placement survey beginning in year 4 (with first graduating class).
- Implementation of alumni survey regarding success against these objectives in year 6 (or two years following a graduation class of 10 or more).
- Implementation of employer survey regarding success against these objectives in year 6 (or two years following a graduation class of 10 or more).
- Formation of an external industry advisory board in year 1. Members of the board will advise on the development of the senior capstone course and provide ongoing insight and feedback on the program through annual meetings. Several industry members have already been approached about serving on such a board and indicated their interest.

Survey data will be collected and compared to standards and benchmarks agreed to by the faculty, department, and college administrators on a bi-annual basis.

C. Success of the program in achieving programmatic outcomes

In order to understand how well the program is meeting programmatic outcomes, the following actions will be taken:

- Outcomes specific course evaluations (student input) will be implemented during the first offering of each respective financial engineering course.
- Capstone project reviews (student, faculty, outside stakeholder input) will be implemented with the first capstone group (year 4).
- Senior exit interviews will be implemented in year 4.

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D. 5-Year program review

After five years, the program will be reviewed to determine if it is sustainable. Sustainability will be determined by student interest in the program and employability and success of graduates. Student interest will be measured as outlined in Section 7A. Employability and success of graduates will be measured using external review board feedback as outlined in Section 7B and senior exit interviews as outlined in Section 7C. Based on this review, at the end of five years, the resources committed to the program will be re-evaluated. If the program is deemed unsuccessful, it will be closed down as outlined in Section 7A. If the program is meeting and/or exceeding expectation and if resources are deemed insufficient, the departments may seek additional resources through the investment proposal process.

8. Process Leading to Submission

Describe the process of developing and approving the proposed program. Indicate, where appropriate, involvement by faculty, students, community members, potential employers, accrediting agencies, etc.

- The financial engineering program was first proposed by a senior faculty member in the DAEE upon receiving repeated requests from local firms for better quantitatively and analytically trained students with particular emphasis on applications in financial engineering. We investigated how many institutions and the number of current student enrolled currently in financial engineering programs. Preliminary external financial engineering program evaluation was conducting during the summer of 2010.
- After the preliminary program evaluation suggested that MSU would be at a comparative advantage to offer a financial engineering program, senior faculty discussed the proposal with community business leaders within Montana. They all indicated support for such a program. We have attached letters of support from some of these corporation's executive officers in the Appendix. Discussions occurred during Spring 2011, Summer 2011, and Fall 2011 semesters and continue currently with an expanding network.
- The DAEE approached the COE with a proposal to construct a new financial engineering major housed in the COE. A Financial Engineering Major Steering Committee (FEMSC) was formed immediately upon verbal approval from both sides. The FEMSC was charged to construct a major and minor in financial engineering with particular attention to resource requirements. The FEMSC provided enrollment and resource projects as well as a course catalog description to the DAEE's Resident Instruction Committee as well as the faculty of the COE. Preliminary discussions occurred during June 2011.
- The FEMSC meet with the U of M's College of Business Dean and MSU's College of Business finance faculty and Interim Dean to discuss the proposed major and potential courses that may benefit financial engineering majors. An agreement was reached between the FEMSC and members of MSU's finance faculty to allow financial engineering students to utilize senior level finance courses as professional electives. It is expected that U of M will be a partner in future research efforts related to Financial Engineering.

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- After resolving concerns from both faculties, a revised enrollment and resource projection as well as a course catalog description were provided to the general faculty during a faculty meeting for their approval. The vote was unanimous with proceeding with the proposed major. Faculty discussions occurred in August 2011.
- The proposed program has also been discussed with many students in the DAEE and the College of Engineering. A formal student interest survey of current students in DAEE, Industrial Engineering, General Engineering and University Studies was undertaken in March 2012. This survey found six current students who would be likely or very likely to change their current major to financial engineering, 12 students who would be likely or very likely to add financial engineering as a second major, and 26 students who would be likely or very likely to add financial engineering as a minor to their current major.
- Members of the FEMSC have discussed the financial engineering major with local business leaders, members of their professional networks and members of the College of Engineering advisory board. All of these discussions have yielded enthusiastic support for the program concept. At this time, the FEMSC has received a number of letters of support for the program as well as verbal interest from a number of prospective members to serve on the External Advisory Board upon Board of Regent approval for the degree program.
- The proposal was reviewed by the Department of Agricultural Economics and Economics, and received faculty approval in March 2012.
- The proposed program was brought to the College of Engineering Curriculum Committee in April 2012 for review. Concerns were raised and addressed through revisions to the proposal. The revised proposal with requested supporting documentation was submitted to the Committee in November 2012 with a request for approval. The program was approved unanimously on December 1, and feedback from the Committee incorporated into the proposal.