Proposal for

Bachelor of Science in Mechanical Engineering

Submitted by:

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College of Arts and Science

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I. Executive Summary

As UM-Flint continues to improve academic standards and program quality, it is crucial to recruit and retain highly qualified high school students. The B.S. in Mechanical Engineering (BSME) program will help attract academically well-prepared students to UM-Flint, as it is a highly visible and well-recognized engineering program among students, parents, high school counselors and employers.

The B.S. in Mechanical Engineering (BSME) program offers excellent prospects for UM-Flint to increase enrollment while serving the need of students and industrial infrastructures. The need for this type of technical workforce is critical for attracting industries in this part of the state to replace the declining automotive manufacturing industry base. The BSME graduates are also expected to develop new start-up companies, which is essential for economic development of southeast Michigan. The proposed new program can produce well-qualified graduates to help satisfy the local, state and national demand.

The overwhelming need for a discipline specific engineering program such as mechanical engineering has been recognized by the current students, parents, alumni and by regional industrial engineering employers. The proposed Bachelor of Science in Mechanical Engineering (BSME) will address the existing need.

II. Introduction

The engineering program at UM-Flint was started in 1962 with a Bachelor of Arts degree with a concentration in engineering science. In 1976, a pre-engineering program was added and a Bachelor of Science in Engineering Science degree was offered with engineering courses completed through Mott Community College. Since then, the B.S. in Engineering Science program has added several new courses and concentrations. The program has been offering all required courses for the Bachelor of Science in Engineering Science program since 1985.

The current B.S. Engineering Science program offers two different options: Option A and Option B. In Option A, students are required to take 24 credit hours of elective engineering courses. In Option B, three different concentrations are available: Computer Engineering, Managerial Engineering and Engineering Physics, where students are required to take 24 credit hours from disciplines appropriate to their concentrations.

A new initiative launched in fall 2007 is a 2+2, 3+2 guaranteed admit engineering transfer program between UM-Flint and U-M, Ann Arbor College of Engineering (CoE). The 2+2 option allows students to complete a discipline specific engineering program at the University of Michigan, Ann Arbor CoE after completion of two years at UM-Flint with a 3.0-3.5 GPA. The 3+2 option allows students to earn two bachelor degrees, one from UM-Flint and one from U-M, Ann Arbor CoE with three years of study at UM-Flint and two years of study at U-M, Ann Arbor and with the same GPA requirement as the 2+2 option.

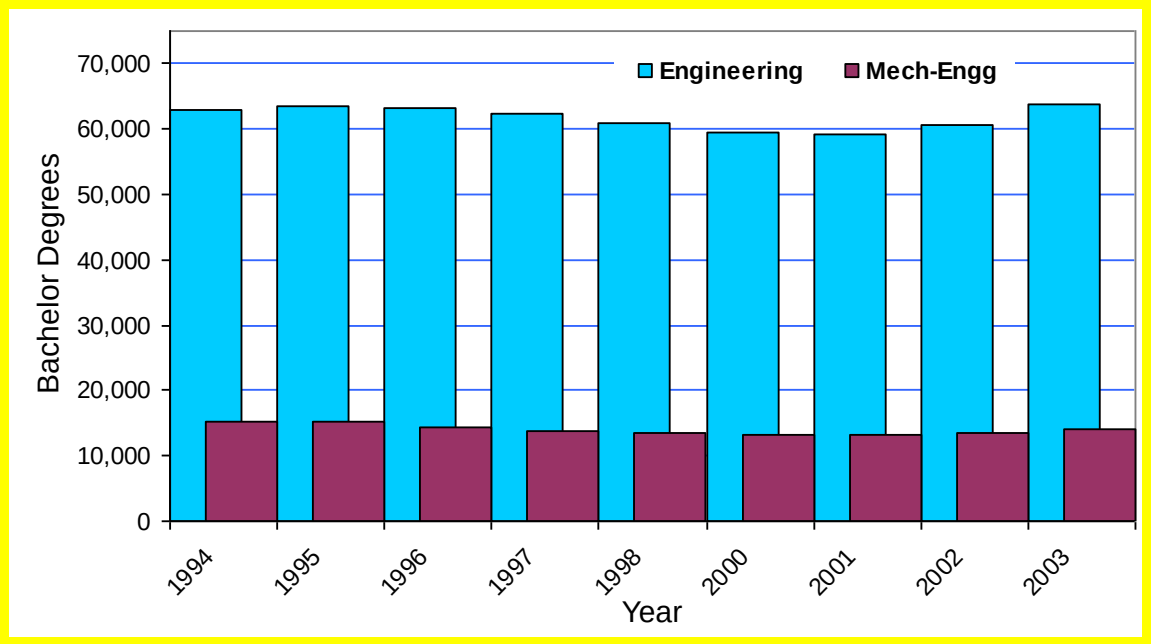
Currently, more that 130 students are enrolled at UM-Flint declaring Engineering Science as their major and an increasing number of students are expected to enroll in the 2+2, 3+2 guaranteed admit engineering transfer program because of the desire for a discipline specific program such as mechanical engineering. Transfer students from other institution are not eligible for the 2+2, 3+2 program because all courses must be taken at UM-Flint. Some of the students may not be eligible to transfer to U-M, Ann Arbor because they may not meet the GPA requirement. Those students may feel they must abandon their desire to obtain a discipline specific, well-recognized degree or transfer to other schools after their sophomore year in order to complete their course of study in mechanical engineering or another engineering discipline.

The proposed BSME program will replace Option A of the current B.S. Engineering Science program. The proposed BSME program will also allow 2+2, 3+2 students intending to transfer to U-M, Ann Arbor CoE's Mechanical Engineering program to complete their degree at University of Michigan-Flint if circumstances merit. The program requirements include 39 credit hours of mathematics and science, 15 credit hours of prerequisite engineering courses, 3 credits of English, 48 credits of required engineering courses and 24 credits of elective mechanical engineering courses, 129 total credit hours. These requirements are similar to the current B.S. Engineering Science Program, Option A, except for a few core and mechanical engineering elective courses.

III. Needs Assessment

The current engineering workforce in the U.S. is aging. Increasing international competition and workforce mobility, combined with a surge in international collaboration in engineering is reshaping the global engineering landscape. The National Science Foundation (NSF) strategic plan 2006-2011 put a strong emphasis on building a greater capacity in the science and engineering workforce to sustain U.S. technological leadership within the broader global context [1]. To meet the continuing strong demand for engineers, it will be important that every American have an opportunity to achieve a degree in STEM (Science, Technology, Engineering and Mathematics) disciplines.

The graph in Figure 1 shows the number of students receiving Bachelor of Science degrees in engineering and mechanical engineering between 1994 and 2003 in the U.S. The number of students receiving a B.S. in Engineering in 1994 was 63,012 compared to 64,675 in 2004 (2.6% increase). The number of students receiving a B.S. in Mechanical Engineering in 1994 was 15,297 compared to 14,368 in 2004 (6% decrease). Statistical data of science and engineering degrees conferred between 1966 and 2004 shows an alarming trend of decline in engineering graduates [2]. This data indicates a need for the introduction of new programs to attract students to engineering. Figure 1 shows a comparison of the number of Bachelor degrees in Mechanical Engineering to be approximately 23% of bachelor degrees in all engineering discipline between 1994-2003.



Source: National Center for Education Statistics (NCES), no data available for 1999

Figure 1: Undergraduate Engineering and Mechanical Engineering Degrees in the U.S.

According to the 2008 Occupational Outlook Handbook of U.S. Department of Labor [3], overall job opportunities for engineers are expected to be good in the coming years. A bachelor's degree in engineering is required for most entry level engineering jobs. Engineers held 1.5 million jobs in the U.S. in 2006 and the projected employment is expected to grow at the rate of 11% between 2006 and 2016. From among 18 different engineering specialties listed in the handbook, mechanical engineers held 22% of all engineering jobs.

Although engineers in Michigan have traditionally been concentrated in slower growing or declining manufacturing industries, the competitive pressures and rapidly advancing technology will force companies to improve product design and performance. Employers will heavily rely on engineers to meet these global competitive challenges. A 2007 survey conducted by the National Association of Colleges and Employers (NACE) ranked bachelor degrees in mechanical engineering as number two among the top ten degrees in demand in 2008 [4]. Accounting was ranked number one. Another survey by NACE indicates the average starting salary of mechanical engineers with a bachelor's degree is $54,128. That is one of the top salaries among all engineering disciplines.

Michigan Department of Labor and Economic Growth data for employment forecasts by occupational groups indicates architecture and engineering jobs will grow by 10% from 132,010 in 2004 to 145,200 in 2014 [5]. The average income of engineers in Michigan is $69,230 compared to the U.S. average of $66,190. Table 1 shows that the expected number of engineering job increase in Flint and state of Michigan. Between 2004 and 2006, the number of engineers in the Michigan workforce increased from 91,600 to 99,680 (8.8% increase).

Table 1: Job Outlook for Engineers in Flint and Michigan (2004-2014)

City/State	Occupational Title	No. of Jobs in 2004	No. of Jobs Forecast in 2014	Percent Change
State of Michigan	Architecture and Engineering	132,010	145,200	10%
	Engineering Managers	9,290	10,200	9.8%
	Mechanical Engineers	19,710	22,290	13.1%
	Engineers, all others	29,390	31,300	6.5%
Flint and Surrounding Areas	Architecture and Engineering	2720	2890	6.2%
	Engineering Managers	135	150	8.8%
	Mechanical Engineers	335	365	8.3%
	Engineers, all others	365	390	6.8%

A recent report by the Center of Automotive Research (CAR) projects there will be considerable hiring by automotive industries in Michigan. CAR's forecast calls for 45,955 job openings by three automotive companies in the Detroit area between 2008 and 2016 [6]. Relevant to this proposal is that the forecast further states that regular and early retirements will be used to cut the number of skilled trade workers by as much as 45-47% by 2016 and that some of these jobs will be transformed into high-skilled engineering jobs. Auto industry in the Detroit area will hire approximately 8,850 new engineers in Michigan during 2008-2016 or 1,000 engineers per year. Steady growth in employment for mechanical engineers in the auto industry is expected. The educational requirement for these new engineers will be a four-year degree in engineering with knowledge, skills in computer-aided design (CAD), and computer-aided engineering (CAE).

In spite of the high demand for mechanical engineers, the number of bachelor degrees conferred by different universities in Michigan remains flat with 2,896 degrees conferred in 2005, 2,923 degrees conferred in 2006 and 2,876 degrees conferred in 2007. Figure 2 summarizes the number of Bachelor degrees in mechanical engineering (BSME) offered by other universities in Michigan.

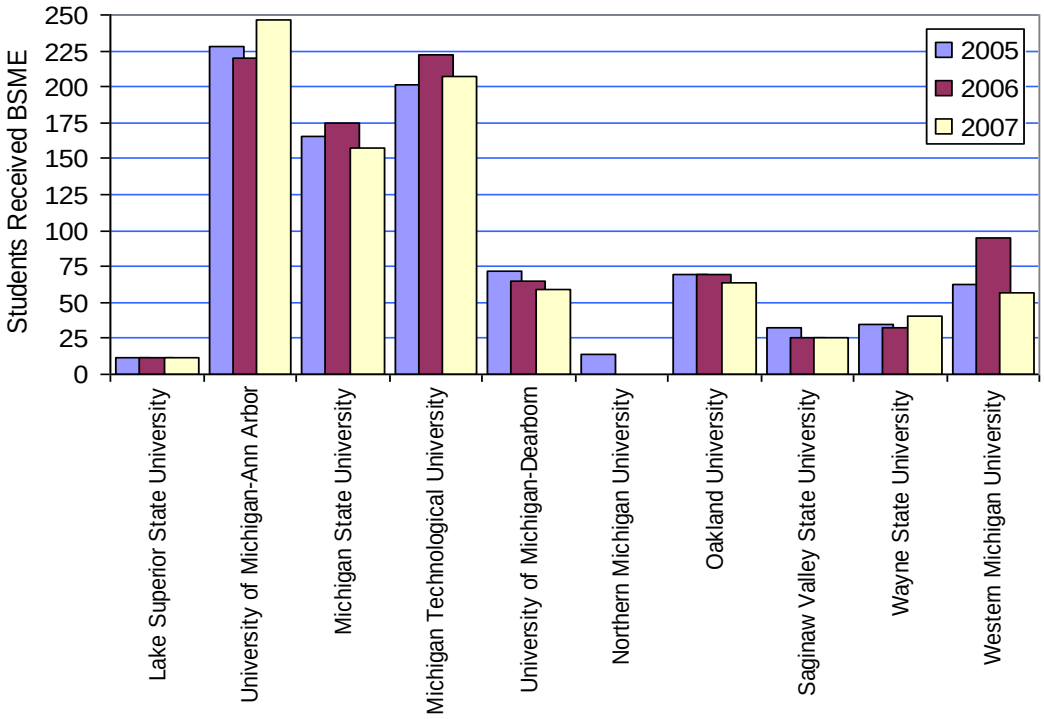


Figure 2: Bachelor Degree in Mechanical Engineering Offered by Michigan Universities

The UM-Flint Engineering Science program faculty has considered offering a discipline specific engineering program for several years. To evaluate the demand for discipline specific undergraduate engineering degrees, a survey was conducted among the students enrolled in UM-Flint's Engineering Science program. The purpose of this survey is to assess which engineering discipline is of greatest interest to the student. The student surveys conducted during 1999, 2003, 2004 and 2007 clearly demonstrate the largest percentage of students are interested in mechanical engineering followed by electrical engineering. The result of the surveys conducted among 248 students is included in Appendix 1 of this proposal.

IV. Planning Efforts

The proposed concentration fully supports the educational mission of the University of Michigan–Flint. At the University-level, the Chancellor has referred to the development of programs in areas with demonstrated needs as a campus imperative. This proposed mechanical engineering degree program will expand service to our constituents, both students and industry. It will address for many students within our service region the unmet educational need of a skilled specialization. Additionally, a large component of the 2+2, 3+2 engineering transfer program is a concentrated effort to attract underrepresented students to STEM fields of study and offering a discipline specific engineering program further supports the effort.

There is a strong interest at both the Department- and College- level to improve the current Engineering Science program by adding computer-aided engineering analysis courses such as Finite Element Analysis and Computational Fluid Dynamics. These courses are included in the BSME curriculum and the synergy between the BSME and current Engineering Science programs will result in an overall improvement of skill among all UM-Flint engineering students.

The program faculty has identified enrollment growth, especially in the discipline specific mechanical engineering, as one of its primary goals. The proposed concentration is expected to attract more students to UM-Flint for engineering.

V. Proposed Program

The proposed curriculum includes 29 credits from math, science and computer programming courses, 38 credits from core engineering courses, 24 credits from mechanical engineering elective courses, and required general education courses with a minimum of 129 credits required for graduation. Appendix B lists the courses in the BSME curriculum with course descriptions in Appendix C.

The proposed curriculum is consistent with the guidelines of the EAC/ABET (Engineering Accreditation Council/Accreditation Board for Engineering and Technology). After the first group of students graduate from the BSME program, UM-Flint will be eligible to apply for EAC/ABET accreditation review. The 129 credits can be completed in four years as shown in Appendix D and is consistent with other undergraduate mechanical engineering programs offered in Michigan and across the country.

Appendix E includes the mission and vision of the B.S. Mechanical Engineering program to produce engineers who are technically competent, creative, literate, and globally and socially aware to be successful in globally competitive environments. The program vision is to be one of the best engineering education programs in Michigan while providing students, staff and faculty with rewarding and satisfying experiences. The mission is to provide our customers with total confidence in our educational and professional expertise and to treat everyone with fairness and dignity.

The Mechanical Engineering program provides the course-work and industrial experience for students wishing to enter industry as a mechanical engineer. In addition to technical content, these courses provide practice in forming and working in teams, preparing and presenting oral and written technical reports, and developing advanced computer skills. Engineering design caps the program with students designing and constructing engineering projects.

VI. Assessment Plan

The proposed BSME program is designed to meet EAC/ABET accreditation requirement. The assessment plans in Appendix E shows how the courses in the program will meet ABET criteria for student learning outcomes.

VII. Required Resources

Faculty and Staff Requirements

There would be no additional faculty or staff requirements. All required courses are either currently being offered or are planned to be offered by the Computer Science, Engineering Science and Physics (CSESP) faculty within the College of Arts and Sciences. The Engineering Science program is currently in the process of hiring one tenure-track faculty as of fall 2008 who will also be able to serve as Mechanical Engineering program faculty. With increased enrollment of students, there will be a need for another faculty member in year two (2009-2010) or year three (2010-2011).

Equipment/Supply Needs

There would be no additional equipment or supply needs other than what might be needed for additional students.

Space Needs

There would be no additional space needs.

Budget Concerns

No additional funding would be needed for the B.S. Mechanical Engineering program. In fact, this program may very well bring additional student revenue and ensure enrollment growth in the engineering program, meeting the needs of the school, university and the nation.

VIII. Implementation Plan

We plan to implement the proposed B.S. Mechanical Engineering program in fall 2008 or as soon as it is approved by the various UM-Flint governing authorities and the Presidents Council. Projected enrollment levels in the BSME program is shown in Table 2 below:

Table 2: Projected Enrollment in B.S. Mechanical Engineering Program at UM-Flint

Year 1	2008-2009	25
Year 2	2009-2010	40
Year 3	2010-2011	50
Year 4	2011-2012	60
Year 5	2012-2013	75

REFERENCE:

[1] Investing in America's Future, National Science Foundations Strategic Plan 2006-2011, The Urban Institute, Washington, D.C. (NSF report no. 06-48)

[2] Detailed Statistical Tables of Engineering degrees: 1966-2004, National Science Foundation report NSF 07-307, January 2007.

[3] Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, 2008-2009 editions, engineers (**http://www.bls.gov**)

[4] National Association of Colleges and Employers annual survey (**www.NACE.org**)

[5] Michigan Department of Labor and Economic Growth, Labor Market information (**www.milmi.org**)

[6] Beyond the Big Leave- The Future of U. S. Automotive Human Resources, A report prepared by Center For Automotive Research (CAR), Ann Arbor, Michigan, February 2008