### 1. Gender

<table>
<thead>
<tr>
<th>Response</th>
<th>Percent</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>63.4%</td>
<td>83</td>
</tr>
<tr>
<td>F</td>
<td>36.6%</td>
<td>48</td>
</tr>
</tbody>
</table>

answered question 131, skipped question 1

### 2. U.S. Citizen/permanent resident

<table>
<thead>
<tr>
<th>Response</th>
<th>Percent</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>65.6%</td>
<td>86</td>
</tr>
<tr>
<td>No</td>
<td>34.4%</td>
<td>45</td>
</tr>
</tbody>
</table>

answered question 131, skipped question 1

### 3. Marital status

<table>
<thead>
<tr>
<th>Response</th>
<th>Percent</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>35.1%</td>
<td>46</td>
</tr>
<tr>
<td>Single</td>
<td>64.9%</td>
<td>85</td>
</tr>
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</table>

answered question 131, skipped question 1
### 4. Children

<table>
<thead>
<tr>
<th>Response</th>
<th>Percent</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>82.4%</td>
<td>108</td>
</tr>
<tr>
<td>Yes - Number of Children</td>
<td>17.6%</td>
<td>23</td>
</tr>
</tbody>
</table>

**answered question**: 131  
**skipped question**: 1

### 5. Race/Ethnicity

Redacted per FERPA

**answered question**: 129  
**skipped question**: 3
6. MTU Degree(s)

<table>
<thead>
<tr>
<th>Degree</th>
<th>Response Percent</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBA</td>
<td>4.5%</td>
<td>6</td>
</tr>
<tr>
<td>MEng</td>
<td>1.5%</td>
<td>2</td>
</tr>
<tr>
<td>MFor</td>
<td>0.0%</td>
<td>0</td>
</tr>
<tr>
<td>MS</td>
<td>65.9%</td>
<td>87</td>
</tr>
<tr>
<td>PhD</td>
<td>33.3%</td>
<td>44</td>
</tr>
<tr>
<td>Did not complete intended degree</td>
<td>2.3%</td>
<td>3</td>
</tr>
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</table>

answered question 132
skipped question 0

7. Graduate Degree Program(s)

<table>
<thead>
<tr>
<th>Program</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>125</td>
</tr>
</tbody>
</table>

answered question 125
skipped question 7

8. What was your financial situation while in Graduate School? (Check all that apply)

<table>
<thead>
<tr>
<th>Source</th>
<th>Response Percent</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRA</td>
<td>43.4%</td>
<td>56</td>
</tr>
<tr>
<td>GTA</td>
<td>48.1%</td>
<td>62</td>
</tr>
<tr>
<td>Fellow</td>
<td>15.5%</td>
<td>20</td>
</tr>
<tr>
<td>Self-supported</td>
<td>32.6%</td>
<td>42</td>
</tr>
<tr>
<td>Other (please specify)</td>
<td>19.4%</td>
<td>25</td>
</tr>
</tbody>
</table>

answered question 129
skipped question 3
9. If you were a GTA, please feel free to comment here about your overall teaching experience.

<table>
<thead>
<tr>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>answered question</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>skipped question</th>
</tr>
</thead>
<tbody>
<tr>
<td>89</td>
</tr>
</tbody>
</table>

10. Please provide information about your impressions of the quality of graduate education at Michigan Tech using the scale below

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>Rating Average</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>The courses offered were useful to me as I pursued my degree</td>
<td>0.0% (0)</td>
<td>5.7% (7)</td>
<td>8.1% (10)</td>
<td><strong>56.9% (70)</strong></td>
<td><strong>29.3% (36)</strong></td>
<td><strong>4.10</strong></td>
</tr>
<tr>
<td>The courses offered were taught well</td>
<td>0.8% (1)</td>
<td>2.4% (3)</td>
<td>11.4% (14)</td>
<td><strong>63.4% (78)</strong></td>
<td><strong>22.0% (27)</strong></td>
<td><strong>4.03</strong></td>
</tr>
<tr>
<td>I had access to the equipment/facilities I needed to complete my degree</td>
<td>2.5% (3)</td>
<td>1.6% (2)</td>
<td>14.8% (18)</td>
<td><strong>43.4% (53)</strong></td>
<td><strong>37.7% (46)</strong></td>
<td><strong>4.12</strong></td>
</tr>
<tr>
<td>The equipment/facilities I used were well maintained</td>
<td>2.5% (3)</td>
<td>3.3% (4)</td>
<td>10.8% (13)</td>
<td><strong>46.7% (56)</strong></td>
<td><strong>36.7% (44)</strong></td>
<td><strong>4.12</strong></td>
</tr>
<tr>
<td>The equipment/facilities I used were safe</td>
<td>0.0% (0)</td>
<td>3.3% (4)</td>
<td>6.6% (8)</td>
<td><strong>38.8% (47)</strong></td>
<td><strong>51.2% (62)</strong></td>
<td><strong>4.38</strong></td>
</tr>
<tr>
<td>I received the mentoring I needed to successfully complete my degree from my advisor or another person</td>
<td>3.3% (4)</td>
<td>5.7% (7)</td>
<td>11.5% (14)</td>
<td><strong>38.5% (47)</strong></td>
<td><strong>41.0% (50)</strong></td>
<td><strong>4.08</strong></td>
</tr>
<tr>
<td>I received the mentoring I needed to successfully prepare for my career from my advisor or another person</td>
<td>4.1% (5)</td>
<td>9.8% (12)</td>
<td><strong>14.8% (18)</strong></td>
<td><strong>45.1% (55)</strong></td>
<td><strong>26.2% (32)</strong></td>
<td><strong>3.80</strong></td>
</tr>
<tr>
<td>The library facilities (including interlibrary loan) met my needs</td>
<td>2.5% (3)</td>
<td>5.0% (6)</td>
<td>12.4% (15)</td>
<td><strong>45.5% (55)</strong></td>
<td><strong>34.7% (42)</strong></td>
<td><strong>4.05</strong></td>
</tr>
<tr>
<td>Overall, my interactions with faculty at Michigan Tech were positive</td>
<td>2.5% (3)</td>
<td>2.5% (3)</td>
<td>3.3% (4)</td>
<td><strong>50.8% (62)</strong></td>
<td><strong>41.0% (50)</strong></td>
<td><strong>4.25</strong></td>
</tr>
<tr>
<td>Overall, my interactions with staff at Michigan Tech were positive</td>
<td>0.8% (1)</td>
<td>1.6% (2)</td>
<td>6.6% (8)</td>
<td><strong>46.7% (57)</strong></td>
<td><strong>44.3% (54)</strong></td>
<td><strong>4.32</strong></td>
</tr>
<tr>
<td>Overall, my interactions with other graduate students were positive</td>
<td>0.8% (1)</td>
<td>1.7% (2)</td>
<td>5.8% (7)</td>
<td><strong>42.5% (51)</strong></td>
<td><strong>49.2% (59)</strong></td>
<td><strong>4.38</strong></td>
</tr>
<tr>
<td>Overall, my interactions with undergraduate students were positive</td>
<td>0.8% (1)</td>
<td>1.7% (2)</td>
<td>19.0% (23)</td>
<td>46.3% (56)</td>
<td>32.2% (39)</td>
<td>4.07</td>
</tr>
<tr>
<td>I found the Graduate School Office staff to be helpful</td>
<td>0.8% (1)</td>
<td>0.8% (1)</td>
<td>8.2% (10)</td>
<td>52.5% (64)</td>
<td>37.7% (46)</td>
<td>4.25</td>
</tr>
<tr>
<td>I would recommend Michigan Tech to others who are interested in graduate school</td>
<td>1.6% (2)</td>
<td>5.7% (7)</td>
<td>8.2% (10)</td>
<td>51.6% (63)</td>
<td>32.8% (40)</td>
<td>4.08</td>
</tr>
</tbody>
</table>

11. Comments

<table>
<thead>
<tr>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>answered question</th>
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<tr>
<td>32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>skipped question</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
</tr>
</tbody>
</table>

12. Do you have any suggestions on how graduate education at Michigan Tech could be improved?

<table>
<thead>
<tr>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>39</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>answered question</th>
</tr>
</thead>
<tbody>
<tr>
<td>39</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>skipped question</th>
</tr>
</thead>
<tbody>
<tr>
<td>93</td>
</tr>
</tbody>
</table>
Sample rejection letter with additional text for insertion

Thank you for your interest in Michigan Technological University. After careful review of your application by the graduate committee for the [INSERT GRADUATE PROGRAM NAME HERE] program, we regret to inform you that we are unable to accept you as a student for the following reason(s): [INSERT ADDITIONAL TEXT HERE - SEE 1, 2, 3, 4, 5, 6, 7, 8 below]

We want to assure you that competition for admission to Michigan Tech’s graduate programs is very intense and we are only able to accept a limited number of students each year. We wish you success in your search for a graduate program and in your future professional career.

Thank you again for your interest in Michigan Tech.

1) Your application file was not complete because we never received your ____________________________ which is/are required by the graduate program to which you applied. Please supply the missing documents if you wish to have your application reconsidered.

2) Your application for admission was received after the deadline. Please contact Carol Wingerson (ctwinger@mtu.edu; 906-487-2327) if you wish to be considered for entry during a future semester or year.

3) Your transcripts indicate that your grade point average is below the value required by the program to which you applied. If you feel that there are extenuating circumstances that should be considered please contact Carol Wingerson (ctwinger@mtu.edu; 906-487-2327).

4) You lack a prerequisite. Specifically you need ____________________________ for admission into the program.

5) You received a low score on a required admissions test. Your application for admission can be reconsidered if you take the ____________________________ test again and receive a higher score. If you feel that there are extenuating circumstances that should be considered please contact Carol Wingerson (ctwinger@mtu.edu; 906-487-2327).

6) Your application for admission was not accepted because the program is currently full. Please contact Carol Wingerson (ctwinger@mtu.edu; 906-487-2327) if you wish to be considered for a future semester or year.

7) Other (as indicated by review committee).

8) No specific reason was provided by the program’s review committee. You may contact Dr. [INSERT NAME OF GRADUATE PROGRAM DIRECTOR HERE with email and phone] to discuss your application if you would like more information.
APPLICATION REVIEW DECISION FORM

Accept

___ Accept with Michigan Tech support.

___ Accept without Michigan Tech support at this time. (Support may be offered later.)

Reject (Please check all reasons that apply.)

1) ___ Incomplete file – list missing item(s)

2) ___ Received after deadline – indicate date of next deadline

3) ___ Low GPA

4) ___ Lack of prerequisites – list

5) ___ Low test score(s) (GRE, GMAT, TOEFL, IELTS) (Please circle appropriate test name(s).)

6) ___ Program is full

7) ___ Other – (Please list reason(s))

8) ___ Reason for rejection not available.
Dean’s Fellowship Guidelines

Overview
Beginning in January 2009, the Graduate School will offer up to ten Dean’s Fellowships to assist with the recruitment of highly talented applicants to Michigan Tech’s PhD programs. Dean’s Fellowships will provide partial support for the recipient’s first year in a PhD program. The support will include a stipend of $2,000 per academic-year semester (fall and spring) as well as full summer support (stipend plus minimum full-time tuition and fees). The primary goal of the Dean’s Fellowship program is to support Michigan Tech’s strategic plan goal of being an inclusive and welcoming campus for faculty, students, and staff who bring rich, diverse perspectives to our teaching, learning, and research. The Dean’s Fellowship is intended to contribute to the development of a diverse academic community, which includes future faculty and others who will be leaders throughout their professional careers.

Eligibility Criteria
Students are eligible to be nominated for the fellowship if the following conditions have been met at the time of nomination:

1. Student has applied to and been accepted into a PhD program at Michigan Tech.
2. Student is a US citizen or permanent resident.
3. Student has been offered at least four years of support by the accepting department or graduate degree program. Support can be from a combination of internal and external sources. Funding provided through the Dean’s Fellowship program will supplement funding from another source (including internal funds) for the fall and spring semesters of the student’s first year but will provide full support (at the minimum level) during the summer semester following the student’s first academic year of study. Support may be terminated at any time if the student fails to make satisfactory progress toward their degree.
4. Student has been assigned a faculty mentor who will provide guidance as soon as the student enters Michigan Tech. The faculty mentor need not necessarily be the student’s research advisor, but the mentor must be able to provide guidance that will assist the student in making good progress toward their degree from the time that the student matriculates at Michigan Tech.
5. The department or program has a formal peer-mentoring program in place. Peer mentors should provide new students with information about the graduate experience at Michigan Tech. Peer mentors should make new students feel “at home” in graduate school at Michigan Tech and in the local community.

Nomination Process
Students must be nominated for the Dean’s Fellowship by the chair of the department or the graduate program director of the unit that has accepted the student. Nominations are due by March 15 each year. The Dean of the Graduate School will announce the recipients of the Dean’s Fellowship by April 7 each year. Nomination files will consist of the following:

1. A copy of the student’s application file.
2. A copy of the student’s acceptance and offer of support letter.
3. A statement by the department chair or graduate program advisor identifying the name of the faculty mentor and peer mentor that will be assigned to the student once s/he matriculates at Michigan Tech.
4. A statement of how the student will contribute to the goals enumerated in Michigan Tech’s Strategic Plan (http://www.mtu.edu/stratplan/).
Review Process
The credentials of nominees will be reviewed by a faculty panel convened by the dean of the Graduate School using the criteria listed below. Each nomination will be reviewed on an individual basis using a holistic approach.

The goals of Michigan Tech’s strategic plan will guide the evaluation process. These goals are:

1. Attract and support a world-class and diverse faculty, staff, and student population.
   1.1. Provide an outstanding work environment and support opportunities for all members of the Michigan Tech community.
   1.2. Increase the diversity of our faculty, staff, and students.
   1.3. Provide exceptional facilities and an aesthetically pleasing environment.
2. Deliver a distinctive and rigorous discovery-based learning experience grounded in science, engineering, technology, sustainability, and the business of innovation.
   2.1. Provide dynamic experiential learning that integrates instruction, research, and innovation in undergraduate and graduate programs.
   2.2. Develop undergraduate and graduate programs in new and emerging areas.
   2.3. Provide exemplary student life activities.
3. Establish world-class research, scholarship, and innovation in science, engineering, and technology that promotes sustainable economic development in Michigan and the nation.
   3.1. Increase interdisciplinary initiatives to expand knowledge and address societal needs.
   3.2. Promote economic development and innovation in Michigan and the nation.
   3.3. Address societal needs through global partnerships.

Additional criteria will also be considered during the evaluation of nominees. These include:

1. Is the nominating department taking steps to encourage applications from and participation by members of groups that are currently underrepresented on the Michigan Tech campus?
2. Are PhD students in the nominee’s graduate program publishing in peer-reviewed journals and making presentations at national and international professional conferences?
3. Is it likely that the nominating department or graduate program will continue to supplement the student’s stipend and provide summer support using funds obtained from external sponsors, research incentive accounts, the Michigan Tech fund, or departmental funds?
4. Does the nominee have an outstanding academic record?
5. Does the nominee have an ethnic/cultural background that is underrepresented in their discipline and/or is the applicant a first-generation college student?
6. Has the nominee demonstrated a commitment to diversity in their professional, personal, or educational endeavors (for example, by participating in activities that address racial and gender disparities and/or race relations in the US).
7. Does the nominee have family or individual financial status that would make it difficult to continue in graduate school without financial support from the University?
8. Will the nominee’s background, life challenges, or life experiences bring a unique prospective to the academic program to which s/he is applying?

Following review of the nominees’ qualifications, the panel will recommend to the dean of the Graduate School that each student 1) receive a Fellowship, 2) receive a Fellowship if sufficient funds are available, or 3) not receive a Fellowship. The dean of the Graduate School will review the panel’s recommendations and make the final decision about each nominee. The number of Fellowships ultimately awarded will depend on the size and quality of the pool of nominees and on the funds available to support the Dean’s Fellowship program each academic year.
October 31, 2008

Proposal to Alter Early Walk form for Doctoral Students
Proposed by Elizabeth Flynn

Background

Michigan Tech allows doctoral students to walk at graduation a term before they intend to complete all requirements for the PhD. The form they fill out to request this is signed only by the student’s advisor and the Assistant to the Dean of the Graduate School. The director of the graduate program or the chair of the department do not have to sign the form. There have been abuses of the early walk allowance in the past. In some cases, students have walked and celebrated a year and a half before their dissertations were deemed acceptable.

Dean Huntoon queried her list of other deans to see if other universities allow doctoral students to walk early. Of the 10 schools she has heard from so far, only 3 allow this. Those universities that do not permit doctoral students to walk early are: Tennessee State University, Howard University, the University of New Hampshire, Princeton University, the University of Illinois, Notre Dame, and Ohio University. Two that do allow doctoral students to walk early, East Tennessee State University and Towson State University, have considerably tighter restrictions than we have. Towson State requires confirmation from the program director that the requirements will be met the following term. East Tennessee State has a verification process to make certain that they will indeed be completing coursework. In addition, according to the Dean,

There is a stipulation of “August Graduate” and an explanation in the program that these students are participating one semester early and will only be receiving a diploma binder. The statement is also made as the candidates are presented as a group that August graduates are not receiving degrees. The program designation is useful because it is a record for the university’s purposes indicating how the student participated, and it also prevents a student from using the program as proof that he/she received a degree. If the August graduate waits until December, their degree has already been conferred on the August conferral date. The “August Graduate” designation is also used on the December program, but obviously without an explanation accompanying it.

The Dean of a third university that allows students to walk early chose to remain anonymous. This Dean responded as follows:

In the end, our philosophy is that the graduation ceremony is superficial and the graduation program indicates that. The real issue is receipt of the degree. Of course, we don’t allow students to retain hoods, and we plainly indicate in the graduation program that degrees presented have nothing to do with completion of requirements. We also don’t present “graduates” with an actual diploma.

Proposal

The early walk form should include a signature line for either the pertinent program director or chair of the department.
Proposal for a Master’s Degree Program in Computer Engineering

1 Introduction

1.1 General Description
This is a proposal to formally establish a Master of Science (MS) program in Computer Engineering (CpE) within MTU’s Department of Electrical and Computer Engineering (ECE). The mission of the proposed graduate program is to train engineers in the science and technology of this field and to recognize their achievement by creating an advanced Computer Engineering degree at Michigan Technological University. Graduates of the program will have the necessary skills and will be highly qualified to perform scientific and technologically advanced research to solve problems in the design, development, and implementation of complete computer-based systems and application domains.

1.2 Rationale
Computer Engineering (CpE) is a true hybrid discipline, born of two parent disciplines, Computer Science (CS) and Electrical Engineering (EE). It has, for decades, been recognized by the Accreditation Board for Engineering and Technology (ABET) as a separate discipline, with academic content distinct from both EE and CS [1].

1.2.1 National Trends
As of October 2006, there were 188 ABET-accredited CpE degree programs in the United States [2]. In addition, between 1996 and 2006, the number of programs in Computer Engineering and Technology increased 111%, making it the fastest growing single discipline reported by ABET [2].

Nationally, of the 252 universities with graduate engineering programs, the overwhelming majority offer Computer Engineering graduate degrees in one form or another. Most of these programs bundle CpE with either CS or EE under an umbrella title, such as Computer Science and Engineering, or Electrical and Computer Engineering. However, there are now 75 standalone Master’s Degree programs in Computer Engineering [3].

1.2.2 Related Graduate Programs
Michigan Tech currently offers MS degrees in CS, and EE. In addition, a proposal is in progress to establish an MS program Computational Science and Engineering (CS&E). CpE is currently bundled into the EE degree program.

This mix of computing disciplines is typical of programs at other universities. These inter-related disciplines can be defined by where their particular focus area lies within the broad spectrum of
computing topics. Although there can be considerable overlap between the different computing fields, the differences are best described relative to the “center of mass” of each field. For example:

- **Computer Science** traditionally focuses on the theoretical and software aspects of the *process of computing*, rather than on the computer system itself. While some computer scientists do delve into computer architecture, the center of mass is toward hardware-independent topics, with little emphasis on hardware architectures, and even less interest in electronic circuitry.

- **Electrical Engineering** traditionally represents the opposite extreme, focusing on the physics, electronics, circuitry, and related aspects of both analog and digital hardware, with little or no emphasis on software design, hardware/software integration, or computational theory.

- **Computational Science and Engineering** focuses on the *application and use* of high performance computing platforms to solve scientific and engineering problems. In this field, the computer is simply a tool used to achieve some research goal in an unrelated scientific or engineering field; thus, the computer system is merely a *means to an end*, not the end in itself.

- **Computer Engineering** treats a computer-based system as a continuum of knowledge spanning both sides of the traditional analog/digital systems boundary as well as the traditional hardware/software boundary. Thus, a Computer Engineer studies the *whole computer system* in its entirety, is equally comfortable working with both hardware and software, and has an intimate understanding of how the hardware and software interact with each other. S/he can thus integrate all of these technologies into a single system, write hardware-dependent software, evaluate hardware/software trade-offs, and engage in hardware/software co-design. These abilities make the Computer Engineer uniquely qualified to conceive, design, and build complete computer-based systems to serve a wide variety of applications.

### 1.3 Projected Enrollment

While exact enrollment numbers are difficult to predict, estimates can be extrapolated from national trends in graduate enrollment, and from Michigan Tech’s own undergraduate enrollment statistics.

#### 1.3.1 National MS Trends

Nationally, of those universities offering standalone MS programs in CPE, 6.2% of all engineering MS degrees are in CPE [3].

#### 1.3.2 Michigan Tech BS Trends

Michigan Tech undergraduate enrollment statistics show similar trends at the Baccalaureate level [4], as seen nationwide at the MS level. Figure 1 shows the contribution of the CPE bachelor’s degree program to all first time freshmen enrolled in the College of Engineering. This figure shows that, following the startup transient in 2001, the contribution of the CPE program has oscillated about the 7% mark.
Figure 2 illustrates the impact of the CpE BS program and other computing majors on each other, in terms of Freshman Enrollment. In addition to CpE, CS, and EE, the chart includes Computer System Science (CSS) and Software Engineering (SE) majors in the CS department. It shows a startup transient in which CpE enrollment increased at the expense of EE and CS enrollment. This was primarily due to “defections” from the other majors into the new program. Following the startup transient, CpE enrollment stabilized at about 25% of all computing majors.
1.3.3 Enrollment Extrapolation
CpE faculty members in the ECE department are currently advising eight MS candidates under the auspices of the EE degree program. These students comprise 3% of engineering MS students and 10.4% of computing MS students. This is less than half of both the national MS trend and the MTU BS trend. Initially, these students will switch from EE to CpE. Based on national and local trends, it can be expected that initiation of a standalone MS program in CpE will attract an additional nine students, reaching steady state at about 17 MS students, given the current number of faculty.

2 Implementation
2.1 Planned Implementation Date
This program is intended to begin as soon as it is approved. At that time, currently enrolled students will be invited to change majors to CpE, subject to eligibility. New students will be accepted at the beginning of the first complete term following approval of this program.

2.2 Scheduling Plans
This program will be implemented through normally scheduled daytime classes.

2.3 Faculty
All faculty in the Department of Electrical and Computer Engineering are responsible for the success of all curricular programs in the department. Those expected to be most involved in the proposed graduate degrees in computer engineering include:

- Roger Kieckhafer specializes in fault-tolerant computing systems, including safety critical, high assurance and high integrity systems and the theoretical foundations of fault tolerance. He also does reliability modeling and formal design methods and does interdisciplinary research with the physics department.

- Tricia Chigan, an NSF Career award winner, studies computer/communication networks and network security. Her work includes vehicular ad hoc networks, wireless ad hoc and sensor networks, wireless network security, adaptive protocol design for cognitive radio networks, dependable computing and communication systems, and network resource allocation and management.

- Jindong Tan’s research focuses on robotic sensor networks and body area sensor networks; his research in robotic sensor networks investigates the coordination of mobile robots and sensor networks for coordinate sensing and communication. His research in body sensor networks focuses on ultra lower design for a hybrid of wearable, ingestible and implantable wireless miniature sensors, which collectively monitor the medical condition of a patient and provide physicians with immediate feedback. He collaborates with the departments of Biomedical Engineering, Cognitive and Learning Sciences, Computer Science, Civil and Environmental Engineering.

- Ashok Goel models interconnects, currently for nanoscale integrated circuits. He is the author of a highly acclaimed graduate text on VLSI interconnects.
• Shiyan Hu studies computer-aided design of VLSI circuits and combinatorial optimizations. He focuses on nanoscale circuit design challenges, such as interconnect optimization and design for manufacturability.

• Bo Chen works on distributed sensing and actuation systems. Current research of the Laboratory of Intelligent Mechatronic and Embedded Systems concerns developing an autonomous network framework for distributed sensing and actuation systems.

Curricula Vitae of the CpE faculty are at: [http://www.ece.mtu.edu/faculty/rmkieckh/Grad/](http://www.ece.mtu.edu/faculty/rmkieckh/Grad/).

2.4 Curriculum Design

All requirements for the number of credits required, credit distributions, theses, reports, examinations, acceptable grades, time-to-degree, and other degree requirements are identical to existing graduate school requirements policies and procedures [5], except as modified or enhanced by this proposal. In no case will any degree requirement be less stringent than required by the graduate school.

2.4.1 MS Plan Options

This program will implement Plans A, B, and D [5].

For Plans A and B, the student’s advisor shall determine whether the proposed research qualifies as a Plan A thesis or as a Plan B project.

For Plan C, the content and procedures of the oral examination shall comply with ECE department specifications for the oral portion of the PhD comprehensive examination [6, Sec II.3.b].

2.4.2 Admission Requirements

All applicants for full admission have completed courses in the set of prerequisite topics specified in Table 1. Applicants who have not completed all of the prerequisites may receive “provisional” admission and complete the missing topics at MTU. Those topics with an “MTU Equivalent” course at less than the 3,000 level may not be taken for MS degree credit, while those at or above the 3,000 level may count for degree credit within the constraints of all other applicable course distribution requirements.

<table>
<thead>
<tr>
<th>Prerequisite Topic</th>
<th>MTU Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear Algebra</td>
<td>MA-2321</td>
</tr>
<tr>
<td>Differential Equations</td>
<td>MA-3521</td>
</tr>
<tr>
<td>Probability and Statistics</td>
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<tr>
<td>Discrete Math or Structures</td>
<td>CS-2311</td>
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<tr>
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<td>Computer Organization</td>
<td>CS-3421</td>
</tr>
<tr>
<td>Digital Logic</td>
<td>EE-2171 or 2173</td>
</tr>
<tr>
<td>Electronics</td>
<td>EE-3130</td>
</tr>
<tr>
<td>Microcontroller Interfacing</td>
<td>EE-3170 or 3173</td>
</tr>
</tbody>
</table>

Given the prerequisite topics listed, students with a baccalaureate degree in Computer Engineering from an accredited college or university will generally be eligible for full admission to this program. Those
with a degree in Computer Science, Electrical Engineering, or a closely related field, will usually be eligible for provisional admission. Applicants with degrees from other disciplines may be considered for provisional admission to the program on a case by case basis.

2.4.3 Required Courses
All students must participate in EE 5970, Computer Engineering Seminar, 1 cr.

The identity and total number of courses required to be taken must be approved by the student’s advisor.

2.4.4 Elective Course Distributions
In addition to graduate school requirements for MS course distributions [5], the following breadth criteria are required for all CpE MS degrees:

1. At least 10 credits in the ECE department from the list below, including the required seminar

   EE 4252 – Digital Signal Processing and Its Applications, 1 cr.
   EE 4255 – Wireless Communications, 3 cr.
   EE 4257 – Digital Image Processing, 3 cr.
   EE 4271 – VLSI Design, 4 cr.
   EE 4272 – Computer Networks, 3 cr.
   EE 5711 – Mathematical Techniques for Computer Networks, 3 cr.
   EE 5722 – Computer Networks, 3 cr.
   EE 5723 – Computer and Network Security, 3 cr.
   EE 5725 – Mobile Robotics & Mobile Robot Systems, 3 cr.
   EE 5726 – Embedded Sensor Networks, 3 cr.
   EE 5731 – Real-Time and Embedded Systems, 4 cr.
   EE 5751 – Verilog HDL Design, 3 cr.
   EE 5752 – Digital Storage Technologies, 3 cr.
   EE 5755 – Fault-Tolerant Systems, 3 cr.
   EE 5772 – Parallel Computer Organizations, 3 cr.

2. At least 6 credits in the CS department.

2.4.5 Program Completion Verification
Completion of all requirements shall be certified by the student’s advisor using a degree audit form. The completed form shall be forwarded to the ECE graduate program committee.

3 Resource Requirements

3.1 Courses
In addition to the courses above, new courses will be developed as technology changes and the program grows.

3.2 Library and Other Learning Resources
No new Library resources are required. The library already subscribes to online versions of the leading journals in this field.
3.3 **Computing Access Fee**
No fees are required beyond the existing laboratory and computing fees normally imposed for individual courses.

3.4 **Available and Needed Equipment**
The Department of Electrical and Computer Engineering has a full range of research facilities including several Sun workstations and PCs running both Linux and MS Windows. Each faculty member and graduate student has at least one PC, workstation and/or laptop in his/her office and/or lab. Other PCs and servers are available to students through several user laboratories throughout the building and across campus. Faculty and students also have access to a high-speed Linux cluster and a Beowulf cluster for research purposes. The Michigan Tech campus is completely networked, allowing wired and wireless access to all services from anywhere on campus, and to secure remote access via SSH, FTP and other protocols. A wide range of research-relevant application software is also available to both faculty and students.

No additional equipment is required for this program.

3.5 **Space**
No additional space is required for this program.

3.6 **Accreditation requirements**
Not Applicable

3.7 **Program Costs, Years 1, 2, and 3**
No additional costs will be imposed, as all faculty, equipment, and facilities are already in place.
4 References


5. “Master of Science”, Graduate School, Michigan Technological University, Apr 2008, [http://www.gradschool.mtu.edu/catalog/ms-science.html](http://www.gradschool.mtu.edu/catalog/ms-science.html).

Proposal for a Doctor of Philosophy Degree Program in Computer Engineering

1 Introduction

1.1 General Description
This is a proposal to formally establish a Doctor of Philosophy (PhD) program in Computer Engineering (CpE) within MTU’s Department of Electrical and Computer Engineering (ECE). The mission of the proposed graduate program is to educate engineers in the science and technology of this field and to recognize their achievement by creating an advanced Computer Engineering degree at Michigan Technological University. Graduates of the program will have the necessary skills and will be highly qualified to perform scientific and technologically advanced research to solve problems in the design, development, and implementation of complete computer-based systems and application domains.

1.2 Rationale
Computer Engineering (CpE) is a true hybrid discipline, born of two parent disciplines, Computer Science (CS) and Electrical Engineering (EE). It has, for decades, been recognized by the Accreditation Board for Engineering and Technology (ABET) as a separate discipline, with academic content distinct from both EE and CS [1].

1.2.1 National Trends
As of October 2006, there were 188 ABET-accredited CpE degree programs in the United States [2]. In addition, between 1996 and 2006, the number of programs in Computer Engineering and Technology increased 111%, making it the fastest growing single discipline reported by ABET [2].

Nationally, of the 252 universities with graduate engineering programs, the overwhelming majority offer Computer Engineering graduate degrees in one form or another. Most of these programs bundle CpE with either CS or EE under an umbrella title, such as Computer Science and Engineering, or Electrical and Computer Engineering. However, there are now 40 standalone Doctoral Degree programs in Computer Engineering [3].

1.2.2 Related Graduate Programs
Michigan Tech currently offers PhD degrees in CS, EE, and Computational Science and Engineering (CS&E). CpE is currently bundled into the EE degree program.

This mix of computing disciplines is typical of programs at other universities. These inter-related disciplines can be defined by where their particular focus area lies within the broad spectrum of computing topics. Although there can be considerable overlap between the different computing fields, the differences are best described relative to the “center of mass” of each field. For example:
• **Computer Science** traditionally focuses on the theoretical and software aspects of the *process of computing*, rather than on the computer system itself. While some computer scientists do delve into computer architecture, the center of mass is toward hardware-independent topics, with little emphasis on hardware architectures, and even less interest in electronic circuitry.

• **Electrical Engineering** traditionally represents the opposite extreme, focusing on the physics, electronics, circuitry, and related aspects of both analog and digital hardware, with little or no emphasis on software design, hardware/software integration, or computational theory.

• **Computational Science and Engineering** focuses on the *application and use* of high performance computing platforms to solve scientific and engineering problems. In this field, the computer is simply a tool used to achieve some research goal in an unrelated scientific or engineering field; thus, the computer system is merely a *means to an end*, not the end in itself.

• **Computer Engineering** treats a computer-based system as a continuum of knowledge spanning both sides of the traditional *analog/digital systems* boundary as well as the traditional *hardware/software* boundary. Thus, a Computer Engineer studies the *whole computer system* in its entirety, is equally comfortable working with both hardware and software, and has an intimate understanding of how the hardware and software interact with each other. S/he can thus integrate all of these technologies into a single system, write hardware-dependent software, evaluate hardware/software trade-offs, and engage in *hardware/software co-design*. These abilities make the Computer Engineer uniquely qualified to conceive, design, and build complete computer-based systems to serve a wide variety of applications.

1.3 **Projected Enrollment**

While exact enrollment numbers are difficult to predict, estimates can be extrapolated from national trends in graduate enrollment, and from Michigan Tech’s own undergraduate enrollment statistics.

1.3.1 **National PhD Trends**

Nationally, of those universities offering standalone doctoral programs in CpE, 5.2% of all engineering doctoral degrees are in CpE [3].

1.3.2 **Michigan Tech BS Trends**

Michigan Tech undergraduate enrollment statistics show similar trends at the Baccalaureate level [4], as seen nationwide at the PhD level. Figure 1 shows the contribution of the CpE bachelor’s degree program to all first time freshmen enrolled in the College of Engineering. This figure shows that, following the startup transient in 2001, the contribution of the CpE program has oscillated about the 7% mark.
Figure 2 illustrates the impact of the CpE BS program and other computing majors on each other, in terms of Freshman Enrollment. In addition to CpE, CS, and EE, the chart includes Computer System Science (CSS) and Software Engineering (SE) majors in the CS department. It shows a startup transient in which CpE enrollment increased at the expense of EE and CS enrollment. This was primarily due to "defections" from the other majors into the new program. Following the startup transient, CpE enrollment stabilized at about 25% of all computing majors.
1.3.3 Enrollment Extrapolation
CpE faculty members in the ECE department are currently advising 10 PhD candidates under the auspices of the EE degree program. These students comprise 4.8% of engineering PhD students and 15.4% of computing PhD students. This is about 93% of the national PhD trend and about 59% of the MTU Engineering trend and 70% of the MTU Computing majors trend, based on BS enrollment. Initially, the existing students will switch from EE to CpE. Based on national and local trends, it can be expected that initiation of a standalone PhD program in CpE will attract an additional one to seven students, reaching steady state at up-to 17 PhD students, given the current number of faculty.

2 Implementation

2.1 Planned Implementation Date
This program is intended to begin as soon as it is approved. At that time, currently enrolled students will be invited to change majors to CpE, subject to eligibility. New students will be accepted at the beginning of the first complete term following approval of this program.

2.2 Scheduling Plans
This program will be implemented through normally scheduled daytime classes.

2.3 Faculty
All faculty in the Department of Electrical and Computer Engineering are responsible for the success of all curricular programs in the department. Those expected to be most involved in the proposed graduate degrees in computer engineering include:

- Roger Kieckhafer specializes in fault-tolerant computing systems, including safety critical, high assurance and high integrity systems and the theoretical foundations of fault tolerance. He also does reliability modeling and formal design methods and does interdisciplinary research with the physics department.

- Tricia Chigan, an NSF Career award winner, studies computer/communication networks and network security. Her work includes vehicular ad hoc networks, wireless ad hoc and sensor networks, wireless network security, adaptive protocol design for cognitive radio networks, dependable computing and communication systems, and network resource allocation and management.

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• Bo Chen works on distributed sensing and actuation systems. Current research of the Laboratory of Intelligent Mechatronic and Embedded Systems concerns developing an autonomous network framework for distributed sensing and actuation systems.

Curricula Vitae of the CpE faculty are at: http://www.ece.mtu.edu/faculty/rmkieckh/Grad/.

2.4 Curriculum Design
All requirements for the number of credits required, credit distributions, theses, reports, examinations, acceptable grades, time-to-degree, and other degree requirements are identical to existing graduate school requirements policies and procedures [5], except as modified or enhanced by this proposal. In no case will any degree requirement be less stringent than required by the graduate school.

2.4.1 Admission Requirements
All applicants for full admission must have completed courses in the set of prerequisite topics specified in Table 1. Applicants who have not completed all of the prerequisites may receive “provisional” admission and complete the missing topics at MTU. Those topics with an “MTU Equivalent” course at less than the 3000 level may not be taken for PhD degree credit, while those at or above the 3000 level may count for degree credit within the constraints of all other applicable course distribution requirements.

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<td>Microcontroller Interfacing</td>
<td>EE-3170 or 3173</td>
</tr>
</tbody>
</table>

Given the prerequisite topics listed, students with a Bachelor’s of Master’s degree in Computer Engineering from an accredited college or university will generally be eligible for full admission to this program. Those with a degree in Computer Science, Electrical Engineering, or a closely related field, will usually be eligible for provisional admission. Applicants with degrees from other disciplines may be considered for provisional admission to the program on a case by case basis.

2.4.2 Required Courses
All students must participate in EE 5970, Computer Engineering Seminar.
In addition, all PhD students must complete at least three Research Tools courses shown below within their first four semesters in residence (not including summers). A student may be exempted from any of these courses only if that student enrolls in a more demanding course in the same topic within the four-semester deadline. The identity and total number of courses required to be taken must be approved by the student’s advisor.

<table>
<thead>
<tr>
<th>Table 2: Required Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 5970, Computer Engineering Seminar, 1 cr.</td>
</tr>
<tr>
<td>three of the following four courses</td>
</tr>
<tr>
<td>EE 5710 – Research Tools for Computer Engineers—Experimental Statistics. 1 cr.</td>
</tr>
<tr>
<td>EE 5713 – Research Tools for Computer Engineers—Formal Methods, 1 cr.</td>
</tr>
<tr>
<td>EE 5714 – Research Tools for Computer Engineers—Hardware Implementation, 1 cr.</td>
</tr>
</tbody>
</table>

2.4.3 Elective Course Distributions
In addition to graduate school requirements for PhD course distributions [5], the following breadth criteria are required for all CpE PhD degrees:

1. At least 13 credits in the ECE department from the list below, including the required seminar

   EE 4252 – Digital Signal Processing and Its Applications, 4 cr.
   EE 4255 – Wireless Communications, 3 cr.
   EE 4257 – Digital Image Processing, 3 cr.
   EE 4271 – VLSI Design, 4 cr.
   EE 4272 – Computer Networks, 3 cr.
   EE 5711 – Mathematical Techniques for Computer Engineers, 3 cr.
   EE 5722 – Computer Networks, 3 cr.
   EE 5723 – Computer and Network Security, 3 cr.
   EE 5725 – Mobile Robotics & Mobile Robot Systems, 3 cr.
   EE 5726 – Embedded Sensor Networks, 3 cr.
   EE 5731 – Real-Time and Embedded Systems, 4 cr.
   EE 5732 – Real-Time System Design, 3 cr.
   EE 5751 – Verilog HDL Design, 3 cr.
   EE 5752 – Digital Storage Technologies, 3 cr.
   EE 5755 – Fault-Tolerant Systems, 3 cr.
   EE 5772 – Parallel Computer Organizations, 3 cr.

2. At least 9 credits in the CS department.

2.4.4 Comprehensive Examinations
Comprehensive Examinations shall be conducted in accordance with existing ECE Department procedures [6], with the subject matter customized for Computer Engineering topics.
2.4.5 Program Completion Verification
Completion of all requirements shall be certified by the student’s advisor using a degree audit form. The completed form shall be forwarded to the ECE graduate program committee.

3 Resource Requirements

3.1 Courses
In addition to the courses above, new courses will be developed as technology changes and the program grows.

These 1-credit research tools courses will be introduced when the Ph.D. program begins.

EE 5710 – Research Tools for Computer Engineers—Experimental Statistics
EE 5712 – Research Tools for Computer Engineers—Stochastic Processes, Modeling and Simulation
EE 5713 – Research Tools for Computer Engineers—Formal Methods
EE 5714 – Research Tools for Computer Engineers—Hardware Implementation

3.2 Library and Other Learning Resources
No new Library resources are required. The library already subscribes to online versions of the leading journals in this field.

3.3 Computing Access Fee
No fees are required beyond the existing laboratory and computing fees normally imposed for individual courses.

3.4 Available and Needed Equipment
The Department of Electrical and Computer Engineering has a full range of research facilities including several Sun workstations and PCs running both Linux and MS Windows. Each faculty member and graduate student has at least one PC, workstation and/or laptop in his/her office and/or lab. Other PCs and servers are available to students through several user laboratories throughout the building and across campus. Faculty and students also have access to a high-speed Linux cluster and a Beowulf cluster for research purposes. The Michigan Tech campus is completely networked, allowing wired and wireless access to all services from anywhere on campus, and to secure remote access via SSH, FTP and other protocols. A wide range of research-relevant application software is also available to both faculty and students.

No additional equipment is required for this program.

3.5 Space
No additional space is required for this program.

3.6 Accreditation requirements
Not Applicable

3.7 Program Costs, Years 1, 2, and 3
No additional costs will be imposed, as all faculty, equipment, and facilities are already in place.
4 References


