

July 22, 2015

MEMORANDUM

TO: State Board of Regents

FROM: David L. Buhler

SUBJECT: Weber State University – Bachelor of Science and Master of Science in Computer Engineering

Issue

Weber State University (WSU) requests approval to offer a Bachelor of Science (BS) and a Master of Science (MS) in Computer Engineering that can be combined into a five-year BS/MS program, effective Fall Semester 2015. These programs were approved by the institutional Board of Trustees on March 24, 2015.

Background

The proposed BS and MS programs in Computer Engineering will be supported by WSU's Department of Computer Science and the Department of Engineering. Both of these departments reside within WSU's College of Applied Science and Technology. The Computer Science and Engineering programs currently offer both undergraduate associate and baccalaureate degrees, including existing BS programs in computer science and electrical engineering. These two existing programs are accredited by the Accreditation Board for Engineering and Technology (ABET). The institution plans to seek ABET accreditation for the new BS Computer Engineering program.

The proposed programs have been designed so that no new undergraduate courses will need to be developed. The BS program combines existing courses from the computer science and electrical engineering programs that provide the necessary preparation for baccalaureate degree requirements. The MS program will require development of five required courses and 11 elective courses. It is anticipated that existing labs and institutional infrastructure will be sufficient to support both programs. Students enrolled in the BS program may apply for the MS program prior to completion of the BS degree and complete both BS and MS degrees within five years.

To support the development and instruction of the programs, WSU intends to hire two additional full-time faculty members in the first three years to add to the current 10 full-time faculty in the computer science and engineering departments. Funding for these two faculty members will come from the Engineering and Computer Science Initiative with matching funds provided by the institution. Current faculty in these two

departments possess relevant doctoral degrees and associated academic and industry experience such that all graduate courses listed in the BS and MS programs can be taught upon program implementation.

The new BS and MS programs will provide students the opportunity to receive credentials that are in demand in WSU's service region. Hill Air Force Base (HAFB) has need for computer engineers that are currently not being met with the local supply of qualified individuals. Hill Air Force Base often must recruit outside the state to fill its positions. In addition to HAFB staffing requirements, companies that supply engineering services to HAFB as well as other aerospace companies within WSU's service region need qualified computer engineers. It is anticipated that the need for program graduates will increase as HAFB prepares for and implements the new Falcon Hill National Aerospace Research Park and develops and implements support for the new F-35 fighter jet. Additionally, other regions within the state need more people prepared for computer engineering careers.

Data from the Utah Department of Workforce Services (Information Data Viewer available on-line at <http://jobs.utah.gov/jsp/wi/utalmis/gotoOccinfo.do>) show the following state-wide wage and employment projection for occupations related to computer engineering.

SOC Code	Occupation	Percent Estimated Annual Growth Rate	Estimated Annual Openings	Median Annual Wages
11-3021	Computer and Information Systems Managers	3.1	120	\$111,930
15-1121	Computer Systems Analysts	3.8	180	\$70,960
15-1131	Computer Programmers	2.1	240	\$76,190
15-1132	Software Developers, Applications	4.1	350	\$85,090
15-1133	Software Developers, Systems Software	3.6	150	\$91,190
15-1142	Network and Computer Systems Administrators	2.5	130	\$69,220
15-1143	Computer Network Architects	2.3	20	\$85,100

Universities in other parts of the country offer combined BS/MS computer engineering programs that can be completed within a five-year time frame. Weber State University's option for a combined BS/MS Computer Engineering program was developed after reviewing similar programs offered by the University of Massachusetts, the University of Washington, and Villanova University.

Similar programs currently offered within USHE include:

- Utah State University: BS and MS degrees in Computer Engineering
- University of Utah: BS in Computer Engineering; Computer Engineering tracks for students enrolled in the MS in Computing and the Electrical and Computer Engineering programs
- Utah Valley University: BS in Computer Engineering

The WSU proposed programs have been reviewed by institutional stakeholders within USHE. Support for the program was expressed by Dixie State University and Southern Utah University. Academic leaders from the University of Utah and Utah State University expressed concerns centered on the following issues:

1. The University of Utah and Utah State University have capacity to add more students to existing Computer Engineering programs.

2. WSU's current and relatively new Electrical Engineering program needs time to mature before related programs are added.
3. The WSU MS program in Computer Engineering should be taught by faculty who are research-active.

Weber State University responded to these concerns as follows:

1. Capacity issue - While extra capacity is available within existing programs, employers in WSU's service area are not able to hire enough graduates to meet the demand. Students who reside and/or work in WSU's service region have not shown a tendency to travel to either Logan or Salt Lake City to enroll in programs that prepare them for computer engineering positions.
2. Maturity of WSU's Electrical Engineering program - This program has grown enrollments and graduates over the last couple of years. It is a viable and strong program. It is accredited by ABET and is taught by faculty with terminal degrees in the discipline. The institution plans to hire two new terminally qualified faculty members to support the program.
3. Research-active faculty for MS program - There is agreement by WSU that research-active faculty members add value to graduate-level programs. Weber State University offers a number of successful graduate programs. Graduate faculty members who teach in the Computer Engineering program will be active in research appropriate to the institution's mission as a regional university.

The University of Utah also raised an efficiency concern citing a number of states that have engineering program ratios considerably below 1.0 per one million population. Utah's ratio is over 1.0. There was a question whether or not Utah can afford to expand engineering programs at other institutions. It should be noted that most of the states cited have populations much larger than Utah. Further, Utah's engineering and computer technology initiative created by the legislature through Utah Code 53B-6-105 states: "The increase in program capacity...shall include funding for ...new engineering and computer science programs." Weber State University has developed a financial proposal contained within the attached document that shows the proposed programs can be added through the support of engineering initiative funds and internal funds of the institution without the need to seek additional funding from the legislature.

After considering the concerns expressed by academic leaders from the University of Utah and Utah State University, as well as WSU's responses, the merits of WSU's proposal, and the current and anticipated labor market demand in WSU's service region, the Program Review Committee recommended that WSU's proposal move forward to the full Board for approval.

Policy Issues

The proposed program has been developed through established institutional procedures and Board of Regents policy. Chief academic officers as well as faculty in related departments from the Utah System of Higher Education institutions have reviewed the proposal and have provided input. There are no additional policy issues that need to be addressed relative to approval of the program.

Commissioner's Recommendation

The Commissioner recommends the Board of Regents approve the Bachelor of Science and Master of Science in Computer Engineering.

David L. Buhler
Commissioner of Higher Education

DLB/BKC
Attachment

Program Description – Full Template
Weber State University
Bachelor of Science in Computer Engineering and
Master of Science in Computer Engineering

Section I: The Request

Weber State University requests approval to offer a Bachelor of Science (BS) and a Master of Science (MS) in Computer Engineering that can be combined into a five-year BS/MS program, effective Fall Semester 2015. This program was approved by the institutional Board of Trustees on March 24, 2015.

Section II: Program Description

Complete Program Description

An increasing number of colleges and universities offer programs that permit students to obtain a combined BS/MS degree in Computer Engineering within a five-year time frame. These combined five-year programs provide students with the opportunity to obtain these degrees in less time than would be required when pursuing two degrees independently. In addition, these five-year programs typically offer a simplified process for admission to graduate coursework.

Weber State University proposes to offer a BS and a MS in Computer Engineering that can be combined into a five-year BS/MS program. The proposed program was developed after reviewing similar programs offered by:

The University of Massachusetts
The University of Washington
Villanova University

A broad variety of industries require individuals who have this degree. Weber State University's proposed BS/MS degree in Computer Engineering provides the basic fundamentals and depth of knowledge its graduates will be required to possess in order to meet the needs of these industries.

Purpose of Degree

The new BS/MS programs will provide students with the opportunity to receive a comprehensive degree in Computer Engineering designed to fill the looming need for engineers at Hill Air Force Base (HAFB) as well as to meet the staffing requirements for companies that supply engineering services to HAFB, particularly those companies that will be involved in the new Falcon Hill development. Additionally, this degree prepares graduates to meet many of the needs of local aerospace companies for engineers with a broad knowledge of computer engineering topics. These new programs will enhance the depth and breadth of the institution's undergraduate offerings while meeting the growing demands of the current student body.

In an effort to serve practicing professionals in the local Weber/Davis counties and to advance the Weber State core themes of Learning, Access, and Community, the proposed programs seek to offer high-demand undergraduate and graduate level degrees in close proximity to a workforce that would not otherwise consider pursuing these degrees due to time and distance considerations in attending the currently available programs. Since the courses included in the proposed degrees will be offered at night at the

Weber State Davis Campus, working professionals from the local community will have direct access to classes that would lead to an advanced high-tech degree.

Institutional Readiness

The administration of the new BS/MS program will be supported by two existing departments, Computer Science and Engineering, in conjunction with the College of Applied Science and Technology (COAST), which houses both departments. The Computer Science (CS) and Engineering programs currently offer both undergraduate associate and baccalaureate degree programs.

The existing Computer Science BS degree and the Electrical Engineering BS degree are ABET (Accreditation Board for Engineering and Technology) accredited. With only minor faculty reassignments and personnel enhancements as indicated in the following section, the new programs will not impact the undergraduate degrees offered by either the Computer Science or Electrical Engineering programs.

Departmental Faculty

At least ten current full-time WSU faculty are able to support the inception and continuation of the programs in an instructional and/or administrative capacity. Each of these faculty possess related degrees and associated academic and industry experience such that all graduate courses listed in the BS/MS program can be taught immediately. Initially, these faculty will rotate through graduate course assignments each semester as needed. Typical semester load requirements for faculty teaching graduate courses would include a single graduate course with undergraduate courses filling the remainder. Therefore, of the ten faculty, an equivalent of two FTE will be devoted toward teaching courses specific to the Computer Engineering program. The other eight FTE will teach Computer Science and Engineering courses, many of which will be cross-listed and will meet Computer Engineering undergraduate requirements.

To account for program growth, it is projected that a new hire in either Computer Science or Electrical Engineering would be required by the end of year one. By the end of year three, it is expected that an additional hire would be necessary. By the end of year five it is anticipated that a third new faculty member will be hired. All new hires will have sufficient credentials to teach undergraduate and graduate courses in the program and to work with and support graduate-level students.

Program Faculty Category	Program Faculty Headcount – Prior to Program Implementation	Faculty Additions to Support Program	Program Faculty Headcount at Full Program Implementation
With Doctoral Degrees (Including MFA and other terminal degrees, as specified by the institution)			
Full-time Tenured	10	3	13
Full-time Non-Tenured			
Part-time Tenured			
Part-time Non-Tenured			
With Master’s Degrees			
Full-time Tenured			
Full-time Non-Tenured			
Part-time Tenured			
Part-time Non-Tenured			
With Bachelor’s Degrees			
Full-time Tenured			

Program Faculty Category	Program Faculty Headcount – Prior to Program Implementation	Faculty Additions to Support Program	Program Faculty Headcount at Full Program Implementation
Full-time Non-Tenured			
Part-time Tenured			
Part-time Non-Tenured			
Other			
Full-time Tenured			
Full-time Non-Tenured			
Part-time Tenured			
Part-time Non-Tenured			
Total Headcount Faculty in the Program			
Full-time Tenured	10	3	13
Full-time Non-Tenured			
Part-time Tenured			
Part-time Non-Tenured			
Total Program Faculty FTE <i>(As reported in the most recent A-1/S-11 Institutional Cost Study for "prior to program implementation" and using the A-1/S-11 Cost Study Definition for the projected "at full program implementation.")</i>	2	3	5

Staff

The College of Applied Science and Technology currently employs a full-time advisor who will be available to counsel students on admissions, financial aid and tuition, course scheduling and registration, and other inquiries. Secretarial support for the program will be shared between current full-time administrative specialists in Computer Science and Engineering. Until substantial program growth is realized on the order of 250 student enrollments per year, a dedicated part- or full-time secretary position will not be necessary. Lab support will be provided by current COAST professional IT staff. No additional staff will be required.

Library and Information Resources

The WSU Stewart Library already has an extensive list of books, journals, and electronic media that supplies supporting material for Computer Science and Engineering, primarily through ongoing collaborations related to the associated undergraduate degree programs. The Stewart Library has also developed access to most of the electronic journals essential for following the latest developments in the discipline.

A dedicated library official, assigned to COAST, reviews the offerings regularly and solicits faculty for updates to available content. The expectation is that only a few more recommended journals or research tracts appropriate to a Master's level program in computer engineering would be needed to complete the library/electronic resources available to students.

Admission Requirements

Students will be required to complete a core of engineering, science, and computer science courses with a grade of C + or better before being allowed to take upper division courses.

Senior undergraduate students will be allowed to take up to two graduate core courses provided they meet the aforementioned standard. In order to take further graduate course work, students must apply for the graduate program, provide GRE scores, and demonstrate academic ability as expressed by their undergraduate grade point average; professional experience will also be considered. While students in the combined BS/MS program will be allowed to pursue the degrees concurrently, students may also pursue the degrees in sequence (i.e., complete all undergraduate course work before applying for graduate study).

Student Advisement

Academic advising will be provided through existing college and university advising services at Weber State University. Each student will receive individual advisement in planning his or her program of study.

Justification for Graduation Standards and Number of Credits

The BS program requires 124 credits graduate and is within the guidelines for baccalaureate degrees set by the University and the Board of Regents.

The MS in Computer Engineering program will require a minimum of 30 graduate semester credit hours beyond the 124 undergraduate credits. Given the program design and schedule, it is extremely unlikely that a graduating student will accrue more than 36 credit hours to earn the degree. A survey of similar programs indicated that the 30 credit hour minimum is a reasonable requirement for the MS degree.

External Review and Accreditation

The BS program in Computer Science and the BS program in Electrical Engineering are both accredited by ABET. Faculty members in each department are experienced in the program review process, including the importance of maintaining proper assessment instruments. The BS program will seek ABET accreditation as soon as it has graduates. Because of the departments' experience with ABET accreditation for its engineering and computer science programs, they are familiar with the ABET process and should be able to obtain accreditation upon application.

Projected Program Enrollment and Graduates; Projected Departmental Faculty/Students

The enrollment estimates come from surveys given to the current undergraduate students in Electrical Engineering and Computer Science. From these surveys it is projected that the BS/MS program will start with 25 declared majors in year 1, mainly from students who change their major to the new program, increasing to 80 by year 5.

Data Category	Current – Prior to BS/MS Program Implementation	PROJ YR 1	PROJ YR 2	PROJ YR 3	PROJ YR 4	PROJ YR 5
Data for Proposed Program						
Number of Graduates in BS/MS Program	X	0	15/5	25/10	35/15	45/20
Total # of Declared Majors in BS/MS Program	X	25	35	60	85	110
<p><i>Given the nature of the program, it is anticipated that most students will declare this major at the end of their sophomore year. Of the 110 majors in year 5, it is anticipated that 45 will be juniors, 45 seniors, and 20 in the fifth year of the program.</i></p>						

Departmental Data – For All Programs Within the Department						
Total Department Faculty FTE (as reported in Faculty table above)	X	2	3	4	4	5
Total Department Student FTE (Based on Fall Third Week)	X	25	35	60	85	110
Student FTE per Faculty FTE (ratio of Total Department Faculty FTE and Total Department Student FTE above)	X	12.5	11.67	15	21.25	22
Program accreditation-required ratio of Student FTE/Faculty FTE, if applicable: (Provide ratio here: _____)						

Expansion of Existing Program
N/A

Section III: Need

Program Need

Local and global economic and labor demands make it critical that Weber State expand its degree offerings with BS and MS degrees in Computer Engineering. Key regional players like Hill Air Force Base (Hill AFB) have indicated a strong need for a local computer engineering master’s degree both to meet current and projected labor demands at the base and to retain current base employees.

With recent talks of Boeing relocating jobs to Northern Utah and initiatives to build the regional aerospace cluster, the importance of having a well-educated workforce as a competitive advantage over other states and countries becomes integral to economic development in Utah. National trends project a growth of STEM jobs of 17% from 2008 to 2018. Currently, the United States meets its labor demands in the computer industry via foreign-born workers who comprise 18% of the total computer workforce. As globalization continues and wages increase in other countries, the practice of importing expert professionals may not be a viable long-term strategy, especially with foreign-born workers electing to stay in their respective countries.¹

Labor Market Demand

It is important to note several facts about the demand for engineers in Utah.

- Numerous studies document the shortage of engineers in Utah. While these studies may differ with regard to the precise size of the engineering shortage, there is no disagreement regarding the critical need for engineers in the state of Utah.

¹ Carnevale, Smith & Melton, 2011, STEM, Georgetown University Center on Education and the Workforce

- Depending upon the particular study and the region, computer engineers are near the top of the list of needed engineers.
- A survey by the Utah Technology Council finds that 24 percent of respondents' engineering openings in the state require a master's degree.
- A 2014 report by *USA Today*² concluded "Computer engineers . . . are expected to become the most lucrative and highest demand professions in the next three years, according to a *USA Today* analysis of workforce projections by Economic Modeling Specialists Intl., a division of CareerBuilder." The *USA Today* report further identified Ogden, Utah as a region with a significant gap between educational attainment and job openings in engineering.
- Hill Air Force Base, one of the state's largest employers, indicates a critical need for computer engineers.
- The proposed program will graduate 30 BS/MS students each year. Labor market demand should be more than sufficient to provide job openings for these students.

Regional Labor Demand

Hill Air Force Base personnel are concerned about its ability to recruit qualified candidates and has recently been able meet its current labor demand for engineers and scientists because of layoffs in high-tech companies. This trend is not likely to continue. As the economy improves, HAFB needs Weber State and other higher education institutions to produce more computer engineers so that it can meet its workforce demand. To do so, it reports the need to hire 755 Electrical and Computer Engineers over the next five years. Further, the base may need an additional 120 to 150 computer engineers per year should it be assigned parts of the F-35 software development project (Hill Air Force Base, 2014).³ This hiring surge associated with the F-35 project could begin in two to three years and is expected to last between five to eight years.

Hill Air Force Base has indicated that BS and MS degrees in Computer Engineering from WSU would be strategic to recruit and retain employees. As HAFB competes with private industry, it has needed to provide its employees with incentives to stay at the base, including support for continued education among its employees. Weber State University's proximity to HAFB and its close collaboration with base officials are expected to enable it to successfully provide the required BS and MS programs.

State Labor Demand

Data from the Utah Department of Workforce Services (Information Data Viewer available on-line at <http://jobs.utah.gov/jsp/wi/utalmis/gotoOccinfo.do>) show the following state-wide wage and employment projection for occupations related to computer engineering.

SOC Code	Occupation	Percent Estimated Annual Growth Rate	Estimated Annual Openings	Median Annual Wages
11-3021	Computer and Information Systems Managers	3.1	120	\$111,930
15-1121	Computer Systems Analysts	3.8	180	\$70,960

² *USA Today*, "Where the jobs are: Hot prospects for college grads" Hadley Malcolm and MaryJo Webster, 2014

³ Hill Air Force Base. (2014, Setember 9). Electronic Communication. *Rough Projections for Engineers and Scientists at Hill AFB Next 5-8 Yrs.* Layton, Utah, United States: Electronic Communication.

15-1131	Computer Programmers	2.1	240	\$76,190
15-1132	Software Developers, Applications	4.1	350	\$85,090
15-1133	Software Developers, Systems Software	3.6	150	\$91,190
15-1142	Network and Computer Systems Administrators	2.5	130	\$69,220
15-1143	Computer Network Architects	2.3	20	\$85,100

National Labor Demand

The Georgetown Center on Education and the Workforce published a comprehensive review of STEM that considered national trends in the labor market and graduation rates in STEM degrees. According to this study, STEM occupations are expected to grow at a rate of 17% in comparison to the total number of jobs that are expected to grow at a rate of 10% between 2008 and 2018. The only occupation cluster that is expected to grow at a faster rate than STEM occupations during this period of time is healthcare (Carnevale, Smith & Melton).

In 2018, computer occupations are expected to account for 51% of the total STEM occupations. The new and replacement computer occupations will require higher levels of education in 2018 than before. It is projected that 21% of the total new and replacement computer occupations will require graduate degrees, accounting for 255,200 of 1,219,700 new and replacement computer occupations. On average workers in computer occupations make \$73,000 a year, and STEM majors in general make more than \$500,000 over a lifetime than other majors, based on 2009 currency values (Carnevale, Smith & Melton).

The United States Bureau of Labor Statistics (BLS) Occupational Outlook Handbook provides projections for occupations related to the proposed computer engineering programs. These include Computer Network Architects, Computer Programmers, Computer Systems Analysts, Network and Computer Systems Administrators, and Software Developers. Estimated ten year job growth from 2012 – 2022 ranges from 8% (Computer Programmers) to 25% (Computer Systems Analysts) with 2012 median earnings ranging from \$74,280 (Computer Programmers) to \$93,350 (Software Developers).⁴

Student Demand

Enrollment in both WSU's Computer Science and Electrical Engineering programs has shown strong student demand in recent years. Since 2010 enrollment in these two programs has grown by more than 300 students, representing a 46 percent increase.

	Fall 2010	Fall 2011	Fall 2012	Fall 2013	Fall 2014
Computer Science	575	645	765	754	774
Electrical Engineering	84	122	143	157	187
	659	767	908	911	961

These increasing enrollments have created a demand for expanded curricular and degree options. Enrollment projections contained in this proposal indicate that 80 students will be enrolled in the program at

⁴ <http://www.bls.gov/ooh/computer-and-information-technology/home.htm>

full implementation. This figure represents less than 10 percent of the current undergraduate Computer Science and Electrical Engineering majors. A survey of these undergraduate majors found that 57 percent of the students would be interesting in changing their major to the combined BS/MS in Computer Engineering.

Similar Programs

The following three universities offer similar master's-level programs as the proposed WSU computer engineering program: University of Utah; Utah State University; and Brigham Young University. At the University of Utah, the School of Computing (SOC) and the Department of Electrical and Computer Engineering (ECE) jointly offer a Bachelor of Science degree in computer engineering and a computer engineering track for students in SOC and ECE master's degree programs (University of Utah, 2014). Utah State University has both bachelor's and master's degrees in computer engineering (Utah State University, 2014). Brigham Young University has bachelor's degrees in electrical engineering and in computer engineering, but like the University of Utah offers a dedicated track in computer engineering for its master's and PhD programs. In addition, Utah Valley University offers a bachelor's in Computer Engineering.

The proposed program is designed to serve the educational needs of students, professionals, and local industry. The program seeks to address concerns from local technology organizations that qualified individuals in Weber and Davis Counties are deciding to not pursue an advanced computing degree because of the significant time and distance considerations in attending currently available programs. Given the substantial growth in the demand for computing professionals and managers, it is important to the state's economy that qualified individuals be provided a convenient, affordable opportunity to achieve their career goals in this field.

Collaboration with and Impact on Other USHE Institutions

Students with an Associate's Degree in Pre-Engineering with an emphasis in electrical and/or computer engineering from any USHE institution will be able to seamlessly transfer into the program and begin with the 3000-level courses. In addition, students with relevant course work in computer science will be able to transfer their courses into the program.

Benefits

The degree will help to address the severe shortage of engineers in Northern Utah and throughout the state.

Consistency with Institutional Mission

The BS and MS degrees in Computer Engineering fit within the mission of Weber State University wherein the following statement is made: "Weber State University provides associate, baccalaureate and master degree programs in liberal arts, sciences, technical and professional fields." The mission statement further adds: "Through academic programs, research, artistic expression, public service and community-based learning, the university serves as an educational, cultural and economic leader for the region." The BS and MS degrees in Computer Engineering are intended to meet the institution's ongoing commitment to the educational needs of businesses and industries in Northern Utah.

Program Assessment

The proposed programs are designed to prepare students for positions in advanced engineering analysis and design. The program consists of core and elective courses in computer engineering and a defense of a

formal extensive design project report. The program is designed to address the computer engineering staffing needs of both large and moderate-sized industries in Northern Utah and throughout the state including many of the computer engineering staffing needs at Hill Air Force Base. The institution plans to assess whether or not the programs meet this goal using several different methods of evaluation. The first method will involve surveying the students that are currently in the program to determine if the desired goals and the expectations of students are being met. The second method will consist of surveys of both graduates from the program and employers of those graduates. The graduates will be evaluated to determine whether or not the program met the needs of their current employer or other past employers and how the program might be improved. The employers themselves will be asked whether or not the program is meeting their needs for engineers. It is also planned to use the Senior Project courses to determine if students have gained the knowledge and skills they were to have acquired in their core courses. The results from these three sources of information will be analyzed and necessary changes will be implemented.

Expected Standards of Performance

As previously stated, it is planned to seek EAC of ABET accreditation for the undergraduate component of the degree as soon as possible. The specific outcomes that students will be required to meet are clearly specified by ABET. These include requiring a program seeking accreditation to demonstrate that its students have achieved various outcomes including such things as the ability to apply their knowledge of math, science and engineering, the ability to design a system, component or process, and the ability to identify, formulate and solve engineering problems.

In addition to meeting ABET requirements, students will be required to have a grade of C or better in all of their engineering courses as well as in all of their math and science courses. Furthermore, students may not repeat more than three lower division engineering courses and three upper division engineering courses at WSU in order to improve their grades.

One of the goals of this program is that students will acquire the knowledge needed to successfully complete the Fundamentals of Engineering (FE) exam. To assure that this goal has been met all students will be required to pass the FE exam prior to graduation.

Section V: Finance

The institution's Computer Science and Electrical Engineering programs are currently supported by a combined budget of \$2,353,225. By the third year of the proposed programs, the total additional budget to support the programs is estimated to be \$543,893. The information below provides details regarding anticipated expenses and sources of revenue to support the programs.

Program Budget

Three-Year Budget Projection							
Program Data	Current Program Budget – Prior to New Program Implementation	Program Budget					
		Year 1		Year 2		Year 3	
		Addition to Budget	Total Budget	Addition to Budget	Total Budget	Addition to Budget	Total Budget
Personnel Expense							
Salaries and Wages		193,770	193,770	83,813	277,583	86,327	363,911
Benefits		83,321	83,321	36,040	119,361	37,121	156,482
Total Personnel Expense	\$	277,091	277,091	119,853	396,944	123,448	520,393
Non-Personnel Expense							
Travel						1,000	1,000
Capital				12,000	12,000	0	12,000
Library		4,000	4,000	0	4,000	0	4,000
Current Expense		4,500	4,500	0	4,500	2,000	6,500
Total Non-Personnel Expense		8,500	8,500	12,000	20,500	3,000	23,500
Total Expense <i>(Personnel + Current)</i>	\$	285,591	285,591	131,853	417,444	126,448	543,893
Program Funding							
Appropriated Fund (Tax + Tuition)		285,591	285,591	97,424	383,015	56,214	439,229
Other:							
Special Legislative Appropriation							

Grants and Contracts	see note						
Special Fees / Differential Tuition				34,429	34,429	70,235	104,664
Total Revenue	\$	285,591	285,591	131,853	417,444	126,449	543,893
Difference							
Revenue-Expense	\$	\$		\$		\$	
Program Instructional Cost / Student Credit Hour* <i>(as reported in institutional Cost Study for "current" and using the same Cost Study Definition for "projected")</i>			\$380.79	\$	\$386.52	\$	\$380.35

Note: The institution has a number of ongoing grants that will provide opportunities for the faculty and students involved in the program; however, the grants do not increase the "direct instructional expenses" of the program.

Reallocation

As previously noted, there will be no additional courses needed for the BS program. There will be an additional four new graduate courses per semester for the first year of the program. Starting in year two, an addition new course, CENG 6010, will be added so that five graduate courses per semester will be taught consistently to support the MS program for each subsequent year.

At least ten full-time current WSU faculty are able to support the inception and continuation of the programs in instructional and/or administrative capacities. Each of these faculty possess related degrees and associated academic and industry experience such that all undergraduate and graduate courses can be taught immediately. Thus, resources will not be reallocated as resources are currently in place to launch.

Impact on Existing Budgets

The current Computer Science and Electrical Engineering faculty will teach the courses required for the program. Since all the undergraduate courses are already taught the institution plans to manage initial growth by increasing class size rather than adding additional sections at the undergraduate level. Weber State has planned Engineering Initiative matching funds that will be used for the two new faculty hires anticipated in the first three years.

Section VI: Program Curriculum

All Program Courses (with New Courses in Bold)

Combined BS/MS Program

Course Prefix and Number	Title	Credit Hours
Required Courses		
<i>Computer Science and Electrical Engineering Required Courses (83 credit hours)</i>		
CS/CENG 1400	Fundamentals of Programming	4
CS/CENG 1410	Object-Oriented Programming	4
CS/CENG 2130	Computer Structures/Discrete Math	4

Course Prefix and Number	Title	Credit Hours
CS/CENG 2420	Intro to Data Structures & Algorithms	4
CS/CENG 2810	Computer Architecture/Organization	4
CS/CENG 3100	Operating Systems	4
CENG 6430	Advanced Algorithms	3
CENG 6610	Computer Architecture	3
EE/ENGR 1000	Intro to Engineering	2
EE/CENG 1270	Introduction to Electric Circuits	4
EE/CENG 2260	Fundamentals of Electric Circuits	4
EE/CENG 2700	Digital Circuits	4
EE/CENG 3000	Engineering Seminar	1
EE/CENG 3110	Microelectronics I	4
EE/CENG 3210	Signals and Systems	4
EE/CENG 3610	Digital Systems	4
EE/CENG 3710	Embedded Systems	4
EE/CENG 3890	Internship	2
EE/CENG 4010	Senior Project I	2
EE/CENG 4020	Senior Project II	2
EE/CENG 4100	Control Systems	4
CENG 6210	Digital Signal Processing	3
CENG 6010	Design Project	6
CENG 6110	Digital VLSI	3
<i>Support Courses Required (19 credit hours)</i>		
MATH 1220	Calculus II	4
MATH 2250	Linear Algebra/Differential Equations	4
MATH 3410	Probability and Statistics	3
PHYS 2220	Physics for Scientists/Engineers II	5
ENGL 3100	Professional and Technical Writing	3
Sub-Total		102
Elective Courses		
<i>Select 18 credit hours from the following (no more than 6 credits from 4xxx)</i>		
CS/CENG 4110	Concepts of Formal Languages	4
CS/CENG 4280	Computer Graphics	4
CS/CENG 4750	Advanced Software Engineering Methods	4
EE/CENG 4800	Special Topics	1-4
EE/CENG 4900	Individual Studies	1-4
CENG 6100	Distributed Operating Systems	3
CENG 6500	Artificial Intelligence and Neural Networks	4
CENG 6600	Machine Learning	3
CENG 6820	Compiler Design	4
CENG 6840	Formal System Design	3
CENG 6850	Parallel Programming and Architecture	3
CENG 6130	Advanced Semiconductor Devices	3
CENG 6220	Image Processing	3
CENG 6410	Communication Circuits and Systems	3
CENG 6420	Digital Communication	3
CENG 6710	Real-time Embedded Systems	3

Course Prefix and Number	Title	Credit Hours
	Sub-Total	18
	General Education Sub-Total	34
	Total Number of Credits (124 undergraduate + 30 graduate)	154

Program Schedule (combined BS/MS)

Year	Fall	Spring
1	EE/ENGR 1000 – Intro to Electronics Engineering MATH 1210 – Calculus I (satisfies QL Gen Ed) PHYS PS2210 – Physics for Scientists/Engineers I (Gen Ed) CS/CENG 1400 – Fundamentals of Programming Computer & Information Literacy Exams (Gen Ed)	EE/CENG 2700 – Digital Circuits MATH 1220 Calculus II PHYS 2220 – Physics for Scientists/Engineers II CS/CENG 1410 – Object-Oriented Programming
2	EE/CENG 1270 – Intro to Electric Circuits CS/CENG 2130 – Comp Structures (or Discrete Math) CS/CENG 2420 – Intro Data Structures & Algorithms ENGL EN2010 – Intermediate Writing (Gen Ed)	EE/CENG 2260 – Fundamentals of Electric Circuits MATH 2250 – Linear Algebra/Differential Equations ENGL 3100 – Professional & Technical Writing CS/CENG 2810 – Computer Architecture/Organization Gen Ed
3	EE/CENG 3110 -- Microelectronics I EE/CENG 3210 – Signals & Systems EE/CENG 3610 – Digital Systems EE/CENG 3000 – Engineering Seminar MATH 3410 – Probability And Statistics	EE/CENG 3710 – Embedded Systems CS/CENG 3100 – Operating Systems EE/CENG 3890 – Internship COMM HU2110 -- Interpersonal Communication (Gen Ed) Gen Ed
4	EE/CENG 4010 – Senior Project I EE/CENG 4100 Control Systems CS/CENG 4110 – Concepts of Formal Languages/Algorithms * CENG 6210 – Digital Signal Processing ECON SS2010 – Macroeconomics (Gen Ed)	EE/CENG 4020 – Senior Project II ** CENG 6710 – Real Time Embedded Systems * CENG 6610 – Computer Architecture (combined BS/MS) GenEd GenEd GenEd
5	CENG 6850 -- Parallel Programming and Architecture CENG 6410 – Communications Circuits and Systems CENG 6110 – Digital VLSI CENG 6010 – Design Project	CENG 6840 – Formal System Design CENG 6420 -- Digital Communications CENG 6430 – Advanced Algorithms CENG 6010 – Design Project

* The 5-year BS/MS degree will allow for students entering their senior year to take 2 graduate courses, with instructor or departmental consent that will count toward the MS degree. Students doing so will take an additional 24 credits the following year for completion of the MS degree. Students must apply and be accepted into the graduate program to select this track.

** Students may also take a graduate elective in lieu of an undergraduate elective in their senior year, with instructor or departmental consent, which will count toward the BS degree, not the MS degree. Students will have the option of completing all undergraduate coursework before beginning graduate coursework.

BS Only Program

Course Prefix and Number	Title	Credit Hours
Required Courses		
<i>Computer Science and Electrical Engineering Required Courses (65 credit hours)</i>		
CS/CENG 1400	Fundamentals of Programming	4
CS/CENG 1410	Object-Oriented Programming	4
CS/CENG 2130	Computer Structures/Discrete Math	4
CS/CENG 2420	Intro to Data Structures & Algorithms	4
CS/CENG 2810	Computer Architecture/Organization	4
CS/CENG 3100	Operating Systems	4
EE/ENGR 1000	Intro to Engineering	2
EE/CENG 1270	Introduction to Electric Circuits	4
EE/CENG 2260	Fundamentals of Electric Circuits	4
EE/CENG 2700	Digital Circuits	4
EE/CENG 3000	Engineering Seminar	1
EE/CENG 3110	Microelectronics I	4
EE/CENG 3210	Signals and Systems	4
EE/CENG 3610	Digital Systems	4
EE/CENG 3710	Embedded Systems	4
EE/CENG 3890	Internship	2
EE/CENG 4010	Senior Project I	2
EE/CENG 4020	Senior Project II	2
EE/CENG 4100	Control Systems	4
<i>Support Courses Required (19 credit hours)</i>		
MATH 1220	Calculus II	4
MATH 2250	Linear Algebra/Differential Equations	4
MATH 3410	Probability and Statistics	3
PHYS 2220	Physics for Scientists/Engineers II	5
ENGL 3100	Professional and Technical Writing	3
Sub-Total		84
Elective Courses		
<i>Select 6 credit hours from the following (6xxx courses may be taken with instructor approval)</i>		
CS/CENG 4110	Concepts of Formal Languages	4
CS/CENG 4280	Computer Graphics	4
CS/CENG 4750	Advanced Software Engineering Methods	4
EE/CENG 4800	Special Topics	1-4
EE/CENG 4900	Individual Studies	1-4
CENG 6100	Distributed Operating Systems	3
CENG 6500	Artificial Intelligence and Neural Networks	4
CENG 6600	Machine Learning	3
CENG 6820	Compiler Design	4
CENG 6840	Formal System Design	3
CENG 6850	Parallel Programming and Architecture	3
CENG 6130	Advanced Semiconductor Devices	3
CENG 6220	Image Processing	3
CENG 6410	Communication Circuits and Systems	3
CENG 6420	Digital Communication	3
CENG 6710	Real-time Embedded Systems	3

Course Prefix and Number	Title	Credit Hours
Sub-Total		6
General Education Sub-Total		34
Total Number of Credits		124

Program Schedule (BS only)

Year	Fall	Spring
1	EE/ENGR 1000 – Intro to Electronics Engineering MATH 1210 – Calculus I (satisfies QL Gen Ed) PHYS PS2210 – Physics for Scientists/Engineers I (Gen Ed) CS/CENG 1400 – Fundamentals of Programming Computer & Information Literacy Exams (Gen Ed)	EE/CENG 2700 – Digital Circuits MATH 1220 Calculus II PHYS 2220 – Physics for Scientists/Engineers II CS/CENG 1410 – Object-Oriented Programming
2	EE/CENG 1270 – Intro to Electric Circuits CS/CENG 2130 – Comp Structures (or Discrete Math) CS/CENG 2420 – Intro Data Structures & Algorithms ENGL EN2010 – Intermediate Writing (Gen Ed)	EE/CENG 2260 – Fundamentals of Electric Circuits MATH 2250 – Linear Algebra/Differential Equations ENGL 3100 – Professional & Technical Writing CS/CENG 2810 – Computer Architecture/Organization
3	EE/CENG 3110 -- Microelectronics I EE/CENG 3210 – Signals & Systems EE/CENG 3610 – Digital Systems EE/CENG 3000 – Engineering Seminar MATH 3410 – Probability And Statistics	EE/CENG 3710 – Embedded Systems CS/CENG 3100 – Operating Systems EE/CENG 3890 – Internship COMM HU2110 -- Interpersonal Communication (Gen Ed) Gen Ed
4	EE/CENG 4010 – Senior Project I EE/CENG 4100 - Control Systems CS/CENG 4110 – Concepts of Formal Languages/Algorithms ECON SS2010 – Macroeconomics (Gen Ed) Gen Ed	EE/CENG 4020 – Senior Project II CENG 6710 – Real Time Embedded Systems GenEd GenEd GenEd

MS Only Program

Course Prefix and Number	Title	Credit Hours
Required Courses		
<i>Computer Engineering Required Courses</i>		
CENG 6430	Advanced Algorithms	3
CENG 6610	Computer Architecture	3
CENG 6210	Digital Signal Processing	3
CENG 6010	Design Project	6
CENG 6110	Digital VLSI	3
Sub-Total		18
Elective Courses		
<i>Select 12 credit hours from the following</i>		
CENG 6100	Distributed Operating Systems	3
CENG 6500	Artificial Intelligence and Neural Networks	4
CENG 6600	Machine Learning	3
CENG 6820	Compiler Design	4
CENG 6840	Formal System Design	3
CENG 6850	Parallel Programming and Architecture	3

Course Prefix and Number	Title	Credit Hours
CENG 6130	Advanced Semiconductor Devices	3
CENG 6220	Image Processing	3
CENG 6410	Communication Circuits and Systems	3
CENG 6420	Digital Communication	3
CENG 6710	Real-time Embedded Systems	3
Sub-Total		12
Total Number of Credits		30

Program Schedule (MS Only)

Year	Fall	Spring
1	CENG 6430 – Advanced Algorithms CENG 6210 – Digital Signal Processing CENG 6110 – Digital VLSI	CENG 6420 -- Digital Communications CENG 6710 – Real Time Embedded Systems CENG 6610 – Computer Architecture
2	CENG 6410 – Communications Circuits and Systems CENG 6010 – Design Project	CENG 6840 – Formal System Design CENG 6010 – Design Project

Section VII: Faculty

Existing Faculty

Fon Brown, PhD, Electrical Engineering, Utah State University, 1998, Associate Professor

Kyle Feuz, PhD, Computer Science, Washington State University, 2014, Assistant Professor

Kirk Hagen, PhD, Mechanical Engineering, University of Utah, 1989, Professor

Justin Jackson, PhD, Electrical Engineering, University of Utah, 2008, Associate Professor

Suketu Naik, PhD, Electrical Engineering, Kyoto University, 2011, Assistant Professor

Brian Rague, PhD, Computer Science, University of Utah, 2010, Professor

Christopher Trampel, PhD, Electrical Engineering, Iowa State University, 2012, Assistant Professor

Hugo Valle, PhD, Physics, Vanderbilt University, 2008, Assistant Professor

Larry Zeng, PhD, Electrical Engineering, University of New Mexico, 1988, Associate Professor

Yong Zhang, PhD, Electrical Engineering, West Virginia University, 2006, Assistant Professor

New Hires

Year 2: PhD in either Electrical Engineering or Computer Science

Year 3: PhD in either Electrical Engineering or Computer Science