UNIVERSITY *of* WASHINGTON

Michael K. Young
President

March 10, 2014

Dean Elaine Scott
School of Science, Technology, Engineering and Mathematics
University of Washington, Bothell
Box 358538

Dear Elaine:

Based upon the recommendations of the Executive Council, the General Faculty Organization has recommended approval of a Bachelor of Science in Mechanical Engineering degree. A copy of the approval is attached.

I am writing to inform you that the School of Science, Technology, Engineering, and Mathematics is authorized to specify these requirements beginning autumn quarter 2014.

The new requirements should be incorporated in printed statements and in individual department websites as soon as possible. The *General Catalog* website will be updated accordingly by the Registrar's Office.

Sincerely yours,

Michael K. Young
President

Enclosure

cc: Dr. Steven Collins (with enclosure)
Mr. Robert Corbett (with enclosure)
Ms. Virjean Edwards (with enclosure)

301 Gerberding Hall • Box 351230 • Seattle, Washington 98195-1230 • 206.543.5010 • Fax 206.616.1784 • president@uw.edu

DEC 04 2013

UNIVERSITY OF WASHINGTON

CREATING AND CHANGING UNDERGRADUATE ACADEMIC PROGRAMS

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After college/school/campus review, send a signed original and 1 copy to the Curriculum Office/FCAS, Box 355850.

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College/Campus UW Bothell	**Department/Unit** School of STEM	**Date** 9/16/2013

New Programs

- ☐ Leading to a Bachelor of ~~Science~~ Mechanical Engineering in _____ degree.
- ☒ Leading to a Bachelor of _____ degree with a major in ~~Mechanical Engineering~~.
- ☐ Leading to a _____ Option within the existing major in _____.
- ☐ Leading to a minor in _____

Changes to Existing Programs

- ☐ New Admission Requirements for the Major in _____ within the Bachelor of _____.
- ☐ Revised Admission Requirements for the Major in _____ within the Bachelor of _____.
- ☐ Revised Program Requirements for the Major in _____ within the Bachelor of _____.
- ☐ Revised Requirements for the Option in _____within the major in _____.
- ☐ Revised Requirements for the Minor in _____.

Other Changes

- ☐ Change name of program from _____ to _____.
- ☐ Change delivery method or location of program.
- ☐ New or Revised Continuation Policy for _____.
- ☐ New Honors Requirements for _____.
- ☐ Eliminate program in _____.

Proposed Effective Date: **Quarter:** ☒ Autumn ☐ Winter ☐ Spring ☐ Summer **Year: 20 14**__

Contact Person: Steven Collins	Phone: 352-5356	Email: swcollin@uw.edu	Box: 358538

EXPLANATION OF AND RATIONALE FOR PROPOSED CHANGE

For new program, please include any relevant supporting documentation such as student learning outcomes, projected enrollments, letters of support and departmental handouts. (*Use additional pages if necessary*).

Please see attached proposal.

OTHER DEPARTMENTS AFFECTED

List all departments/units/ or co-accredited programs affected by your new program or changes to your existing program and acquire the signature of the chair/director of each department/unit listed. Attach additional page(s) if necessary. *See online instructions.

Department/Unit:	Chair/Program Director:	Date:
Department/Unit:	Chair/Program Director	Date:

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College/Campus	Department/Unit	Date
UW Bothell	School of STEM	9/16/2013

New Programs

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- ☒ Leading to a Bachelor of Science degree with a major in Mechanical Engineering.
- ☐ Leading to a _____ Option within the existing major in _____.
- ☐ Leading to a minor in _____

Changes to Existing Programs

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Department/Unit:	Chair/Program Director:	Date:
Mechanical Engineering UW Seattle		12/9/13
Department/Unit:	Chair/Program Director	Date:

UdW 1503 (01/13)

CATALOG COPY

Catalog Copy as currently written. Include only sections/paragraphs that would be changed if your request is approved. Please cross out or otherwise highlight any deletions.

PROPOSED CATALOG COPY

Reflecting requested changes (Include exact wording as you wish it to be shown in the printed catalog. Please underline or otherwise highlight any additions. If needed, attach a separate, expanded version of the changes that might appear in department publications). **Please note:** all copy will be edited to reflect uniform style in the General Catalog.

Mechanical engineering involves the harnessing of nature's energy to perform useful work that meets societal needs. Applications range from power generation and transportation technologies to robotics, medical devices, and heating/cooling—virtually any process or device that employs mechanical motion and transfer of energy. Mechanical engineers analyze problems that might be solved by a mechanical technology, design devices and systems, perform simulation and testing, oversee manufacturing, and ensure compliance with safety, societal norms, and applicable laws. The mechanical engineering curriculum at UW Bothell provides strong foundations in solid mechanics, thermal fluids, mechanical
h elective courses in energy, biomechanics, and other subjects.
blem solving are emphasized across the curriculum, culminating
Required courses in ethics and professional practice cultivate
n communications, while also preparing graduates for
be well prepared for employment in industry, public and nonprofit

FIRST SIGNATURE IN WRONG SPOT HENCE SIGN & DATE HERE ↓

Claire P Scott	Date: 10/22/13
	Date: 10-5-13
	Date:
Faculty Council on Academic Standards/ General Faculty Organization/Faculty Assembly Chair:	Date:

POST TRI-CAMPUS APPROVAL (when needed)

Faculty Council on Academic Standards/ General Faculty Organization/Faculty Assembly Chair: Jerelyn Resnick	Date: 11-5-13

Jerelyn Resnick 1-31-14

UW Bothell
Routing: Form 1503

This routing form and a copy of the proposal should accompany the Program Proposal Form 1503.

I. **Committee and/or Department Approval**
II. **GFO Executive Council**
III. **Academic Council**

Proposal: Bachelor of Science in Mechanical Engineering

I. School		
Dean: Elaine Scott		
Claire P Scott	10/22/13	
Signature	*Date*	
II. GFO EXECUTIVE COUNCIL		
Chair : ~~Curriculum~~ Jerelyn Resnick		
Signature Jerelyn Resnick	11-5-13 *Date*	
III. ACADEMIC AFFAIRS		
Vice Chancellor: Susan Jeffords		
	11.25.13	
Signature	*Date*	

UNIVERSITY OF WASHINGTON

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College/Campus	Department/Unit	Date
UW Bothell	School of STEM	9/16/2013

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Contact Person:	Phone:	Email:	Box:
Steven Collins	352-5366	swcollin@uw.edu	358538

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Department/Unit:	Chair/Program Director:	Date:
Mechanical Engineering UW Seattle		12/9/13
Department/Unit:	Chair/Program Director	Date:

UoW 1503 (01/13)

University of Washington Bothell
Application for a New Degree

Bachelor of Science
In Mechanical Engineering

School of Science, Technology, Engineering, and Mathematics
October 2013

Contents

I. Overview

The University of Washington (UW) Bothell proposes to offer a Bachelor of Science in Mechanical Engineering (BSME) to start fall 2014. Designed to comply with ABET[1] accreditation criteria, the BSME curriculum emphasizes hands-on experience, collaborative problem solving, and societal implications in the design, production, and implementation of mechanical and thermal fluid systems. It also complements the existing Bachelor of Science in Electrical Engineering (BSEE) major by providing additional learning and research opportunities in biomedical engineering and in power engineering, where electrical and mechanical technologies interweave. Prerequisites may be met through coursework at UW Bothell, another four-year institution, or a community college. Graduates will be prepared for a wide variety of careers inside and outside of engineering, or for continuation of study at the graduate level.

A. Program Description

The BSME program will join the fast-growing BSEE, launched in 2009, and proposed BS in Computer Engineering to increase the campus' capacity in engineering education. Designed to comply with criteria established by the Engineering Accreditation Council of ABET, the program will, from the start, have in place an assessment process to ensure its timely progression to accreditation.[2] Consistent with ABET standards for mechanical engineering programs, UW Bothell's curriculum will require its students to apply mathematics, science, and engineering principles "to model, analyze, design, and realize physical systems, components, or processes," preparing them "to work professionally in both thermal and mechanical systems areas."[3] Given the campus's proximity to a vibrant medical device industry and the growing interest statewide in renewable energy, biomechanical engineering and energy will be areas of strategic focus in the curriculum. Finally, the program will incorporate in its curriculum and course designs recommendations of the National Academy of Engineering's "Engineer of 2020" report[4] and those of the American Society of Mechanical Engineering's (ASME) Center for Education Task Force.[5]

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[1] Headquartered in Baltimore, MD, ABET is an accreditation organization for programs in applied science, computing, engineering, and engineering technology. See http://www.abet.org.

[2] A program becomes eligible for review by ABET in the academic year following that of the graduation of the first student from the program.

[3] ABET, "Program Criteria for Mechanical and Similarly Named Engineering Programs," in Criteria for Accrediting Engineering Programs, 2012-13, at http://www.abet.org/DisplayTemplates/DocsHandbook.aspx?id=3143.

[4] Committee on the Engineer of 2020, Phase II, Committee on Engineering Education, National Academy of Engineering, *Educating the Engineer of 2020: Adapting Engineering Education to the New Century*, 2005.

[5] American Society of Mechanical Engineering, Center for Education Task Force, *Creating the Future of Mechanical Engineering Education, Phase 1 Report*, December 15, 2010.

According to the ASME, the successful mechanical engineers of the 21st century "will be individuals who, in addition to technical knowledge, also have depth in communication, management, global team collaboration, creativity, and problem-solving skills." In response to globalization and rapid technological change, mechanical engineers will also "need to better understand the global marketplace in terms of economics user needs, values, and culture," while gaining practical experience in state-of-the-art mechanical engineering applications. For nearly 25 years, UW Bothell has served the region with an expanding array of educational programming tuned to meet many of the very same challenges. With its commitment to delivering educational programming that is flexible and responsive to the changing needs of stakeholders, UW Bothell is excellently positioned to be at the forefront of mechanical engineering education.

In keeping with the campus mission and ASME goals, the vision and mission of the BSME program at UW Bothell will be as follows:

Vision: To graduate students who are exceptionally prepared to practice mechanical engineering mindful of their responsibility to society.

Mission: To provide the educational environment necessary to develop mechanical engineering graduates who are distinguished by their skills in design, analysis, hands-on engineering, problem solving, communication, and leadership; and who are keenly aware of their ethical responsibilities in a global society.

B. Relationship to Institutional Mission and School Priorities

In March 2013, UW Bothell launched its School of Science, Technology, Engineering, and Mathematics (STEM), in keeping with its strategic plan prepared by the STEM Task Force in 2008,[6] and overall strategic plan for the campus.[7] The Task Force plan targeted six STEM majors for initial development. Four have since been launched, in Biology, Climate Science and Policy, Electrical Engineering, and Mathematics. Rounding out the six are Chemistry and Mechanical Engineering, the implementation of which are expected to coincide with the opening of a new STEM Building on campus in 2014. The BSME described herein will thus move the campus toward fulfillment of the strategic plan that has guided the development of STEM degrees over the past five years.

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[6] "Report of the UWB STEM Task Force," April 7, 2008, at http://www.uwb.edu/getattachment/gfo/documents/stem-final-report.pdf.

[7] University of Washington Bothell, "21st Century Campus Initiative," at http://www.uwb.edu/21stcentury.

The BSME program also aligns with the UW Bothell mission, vision, and core values. The preface of the mission states that UW Bothell will "provide access to excellence in higher education through innovative and creative curricula, interdisciplinary teaching and research, and a dynamic community of multicultural learning." The campus has developed this mission by offering practical, problem-based curricula, developing and deploying innovative pedagogy, forging partnerships with community and business organizations, and reaching out to students whose work, family, and other commitments make it difficult to enroll in traditional full-time programs. The BSME program will further it by preparing students to work across disciplines, be attentive to local and global contexts, and leverage diversity in the pursuit of solutions that achieve just and sustainable outcomes.

A distinctive feature of the major is the Engineering Professional Development series of courses—The Citizen Engineer, Professional Engineer, and Business of Technology—which are taken in the fourth year. Together with the science, technology, and society elective, these courses provide opportunities to develop advanced technical writing and communication skills, situate engineering in the business and diverse societal contexts, foster ethical awareness and capacity for ethical analysis, and cultivate a reflective, critical disposition toward engineering practice. Another feature is the integration of visual arts practice and engineering design within the Design and Computational Analysis series taken in second and third years. These experiences speak directly to the campus mission to "Emphasize and develop critical thinking, writing, and information literacy, in order to graduate students with life-long learning skills," as well as the mission to "Encourage and support collaborative, interdisciplinary, and cross-program initiatives."

No less important is the emphasis given to cultivation of diverse perspectives, as well as efforts to recruit and retain students from under-represented groups. After rising quickly in the 1970s and 80s, the percentage of Bachelors Degrees awarded to women in engineering disciplines in the US leveled off in the late 1980s at 18 to 20 percent, according to statistics compiled by the National Center for Education Statistics.[8] Indeed, the proportion fell by two percentage points to 18.1 percent from 2001 to 2009 before recovering to 18.4 percent in 2010.[9] Mechanical engineering is even lower than the average of all engineering fields: 11.5 percent of 2010 graduates with Bachelors Degrees were women. Other indicators of diversity suggest even more serious challenges for engineering education. The

[8] See http://nces.ed.gov.

[9] National Science Foundation, National Center for Science and Engineering Statistics, 2013, *Women, Minorities, and Persons with Disabilities in Science and Engineering: 2013*, Special Report NSF 13-304, Table 5-2, available at http://www.nsf.gov/statistics/wmpd/.

proportion of black students actually fell from 7.0 percent of enrolled undergraduate engineering students in 1999 to 5.4 percent in 2009, while Hispanic students comprise 10.1 percent of the total.[10] Surveys of the intended majors expressed by college freshmen show a similar pattern. In 2010, while 17.9 percent of freshmen males intended to major in engineering, only 4.0 percent of females expressed the same inclination, a gap that is similar across racial and ethnic groups.[11] The UW Bothell BSME program will adopt a strategic, aggressive approach to these problems, as has the BSEE program, approximately 20 percent of whose students are female, well above the national average. Diversity in society and workplace is emphasized throughout the curriculum, and the first course in the fourth-year Professional Development series is designed to fulfill the university-wide diversity requirement. In addition, the School will pursue opportunities to partner with K-12 and other external partners working to rectify these imbalances. Reinforcing these efforts will be pedagogies the literature finds to be consistent with retention of women and other historically under-represented groups, such as greater focus on design and hands-on projects, especially in the early courses. Such practices support the campus mission to "build an inclusive and supportive community of learning and incorporate multicultural content and diverse perspectives on ethnic and racial groups, gender, sexual orientation, social class, and special needs." By working with external partners, they also further the mission to "Foster productive relationships with the employment community and promote a strong public service commitment."

II. Documentation of Need for Program

A. Regional, State, and National Demand

For many years, American businesses have complained of difficulty hiring qualified engineers and other technical professionals. Concern over the future of America's industrial competitiveness and capacity to sustain the human resources needed in an innovation-driven economy brought an onrush of high-profile reports, among the most influential of which was the National Academy of Science's *Rising Above the Gathering Storm* report in 2007.[12] The third of its four recommendations is the following: "Develop, recruit, and retain top students, scientists, and engineers from both the U.S. and abroad." Since 2008, the Obama Administration, through its economic stimulus, Educate to Innovate, and other programs,

[10] Ibid, Table 2-9.
[11] Ibid, Table 2-8.
[12] National Academy of Sciences, Committee on Prospering in the Global Economy of the 21st Century, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future* (Washington, DC: National Academy Press, 2007).

has targeted the expansion of capacity in science, technology, engineering, and mathematics (STEM) as a federal priority.

Despite being home to some of the country's largest engineering and information technology companies, Washington State has fared little better than the nation as a whole in preparing its own residents for careers in STEM fields. According to their 2010 "State New Economy Index", the Information Technology & Innovation Foundation and Kauffman Foundation ranked Washington State second among all states in both the percentage of scientists and engineers in its workforce and in its overall New Economy Score.[13] Even so, the state has had a low rate of degree production in STEM fields relative to the number of jobs requiring such degrees. Citing a 2005 study by the National Center for Higher Education Management Systems, the Washington State Academy of Sciences reports that the state produces 29.8 engineers for every 1,000 engineering positions, ninth among ten peer states, meaning that a large majority of the employed engineers in the state received their degrees from institutions in other states.[14] Nor has the importation of workers succeeded in closing the gap between labor supply and demand. A study in 2013 by the Boston Consulting Group identified 25,000 job openings in Washington State that have not been filled because of a shortage of workers with the desired set of skills; 80 percent of these unfilled positions are in STEM fields and health care. Closing this "skills gap" would, according to the study, result in the creation of 160,000 new jobs, lower unemployment by two percentage points, and generate an additional $ 720 million in state tax revenues.[15]

Labor market imbalances might reasonably be expected to self-correct over time through rising wages. However, the number of engineering graduates has not kept pace with numbers of graduates in other fields. While the number of graduates with Bachelors Degrees in all fields nearly doubled between 1971 and 2009, those with Bachelors Degrees in engineering rose by 69 percent, according to the National Center for Educational Statistics. Astonishingly, the number actually fell in absolute terms from 1986 to 2001. Even though the trend has been upward over the past decade, engineering continues to lag other fields in the number of new Bachelors Degrees: just 4.5 percent of degrees were in engineering in 2010,

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[13] A state's overall score is computed from twenty-six indicators that assess the state's economic structure. See the full report at http://www.kauffman.org/uploadedfiles/snei_2010_report.pdf.

[14] *STEM Education in Washington State: The Facts Matter*, Summary of the Proceedings of a Symposium, Rising Above the Gathering Storm: STEM Education in Washington State, Washington State Academy of Sciences, December 2011.

[15] The Boston Consulting Group and Washington Roundtable, Great Jobs Within Our Reach: Solving the Problem of Washington State's Growing Jobs Skills Gap, Seattle, March 2013, at http://www.waroundtable.com/waskillsgap/.

compared with 4.7 percent in 2001.[16] The trend in Washington State appears to be similar but with the falloff in degrees even more pronounced than in the nation as a whole since after 2001.[17] During this era of accelerating technological change and intensifying global competition, a continuation of this trend would not augur well for America's economy or the standard of living of its citizens.

In mechanical engineering, the supply of new graduates has grown steadily, if slowly, since 2001, while demand in the job market has remained robust. According to the U.S. Department of Labor, Bureau of Labor Statistics *Occupational Outlook Handbook*, (OOH)"... prospects for mechanical engineers overall are expected to be good, they will be best for those with training in the latest software tools, such as Advanced Visualization Process (AVP). AVP allows engineers and designers to take a project from the conceptual phase directly to a finished product, eliminating the need for prototypes."[18] OOH charts national growth projections for the period of 2012 – 2020 at nine percent, (9%) for Mechanical Engineers.[19] For example, the application of 3D printing to rapid prototyping is revolutionizing product design, spurring demand for engineers skilled in using this and related emerging technologies.

O*NET classifies Mechanical Engineering as a *"Green"* occupation and reports, "This is a Green Enhanced Skills occupation — green economy activities and technologies are likely to cause significant change to the work and worker requirements. New tasks, skills, knowledge, credentials may be needed. Employment demand remains the same, but there is potential for an increase."[20] Mechanical engineers may work in the following green economy sectors:

- Energy Efficiency,
- Green Construction,
- Renewable Energy Generation,
- Research, Design, and Consulting Services, and
- Transportation
- Medical Devices

The National Association of Colleges and Employers publishes data annually on college graduates. The 2012 report shows that the average starting salary for graduates with engineering degrees is at the top

[16] Figures in this paragraph are from the National Center for Educational Statistics and National Science Foundation.
[17] Paul Sommers et al, *Indicators for the Washington Innovation Economy*, Prepared for the Washington State Economic Development Commission, June 2010.
[18] Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, 2012-13 Edition, Mechanical Engineers, on the Internet at http://www.bls.gov/ooh/architecture-and-engineering/mechanical-engineers.htm (visited March 2013).
[19] *Ibid.*
[20] O*NET: http://www.onetonline.org/help/green/17-2141.00 (visited March 2013).

of the salary list with an average salary of $ 62,000.[21] OOH reports the median annual wage of mechanical engineers was $ 78,160 in 2010.

The demand for mechanical engineers and growth in the occupation is strong in Washington State, as it is across the STEM fields (Table 1). The website Engineerjobs.com lists a high number of job openings specific to Mechanical Engineering in the state with 370 job listing statewide, over 250 job listings for the Seattle area, and more than 130 job listings for Everett.[22]

Table 1: Mechanical Engineers - Washington State

Region	Statewide	Snohomish	King
	89,540.00	96,274.00	90,878.00
Average hourly wage - March 2012	43.00	46.00	44.00
Short-term trend	growth	growth	growth
Long-term trend	growth	growth	growth
Estimated employment - 2010	5,839	896	2,468
Average annual total openings: 2010 - 2020	292	38	150
Average annual growth rate: 2010 -2020	2%	2%	2%

Among the state's premier technology sectors is medical devices and equipment. According to the Washington Research Council, the Seattle-Tacoma-Bellevue Metropolitan Area ranks 17th nationally in employment in the medical device sector. Three-quarters of the employment in the state's 249 medical device firms is concentrated in the Puget Sound Region. In particular, Snohomish County has an extraordinary concentration of employment in the electromedical apparatus manufacturing sector. The proportion of the county's employment in this sector is more than 16 times that of the nation as a whole, which is indicative of the region's specialization in this technology.[23] As a founding member of the Bothell Biomedical Manufacturing Innovation Zone, UW Bothell has been a key partner working with local medical device firms to address future educational and workforce needs. By providing opportunities for specialized coursework and undergraduate research in biomechanical and biomedical

[21] NACE: http://www.naceweb.org/uploadedFiles/NACEWeb/Research/Salary_Survey/Reports/SS_Jan2013_ExecSummary.pdf
[22] Engineerjobs.com: http://www.engineerjobs.com/jobs/mechanical-engineering/washington/ (visited March 2013).
[23] As calculated using the Bureau of Labor Statistics' Location Quotient Calculator at http://data.bls.gov/location_quotient/ControllerServlet.

engineering, the Mechanical and Electrical Engineering majors deepen the campus' contribution to the vitality of this important local industry.

Energy is another sector primed for growth in Washington State. With hydroelectric generation supplying more than 60 percent of the state's electric power, Washington has long been a leader in clean energy. To reduce the environmental footprint of its energy infrastructure, the state is aggressively developing capabilities in wind, solar, biomass, tidal, and small-scale hydropower resources. Washington ranks tenth among the fifty states in clean energy jobs, reckons the Brookings Institution, with metropolitan Seattle hosting leading industry clusters in green architecture and construction services, professional environmental services, and smart grid.[24] The state has numerous policy incentives and a renewable energy portfolio standard in place that are likely to sustain business investment in the sector. Since mechanical engineering at its core is concerned with energy conversion, the BSME extends the campus's capacity to contribute not only to the region's energy needs, but also to the larger societal transition to a cleaner energy future. In this, the BSME will complement the Electrical Engineering program's focus on electric power and renewable energy.

B. Student Demand

Although the skills gap described above might be interpreted as implying a lack of demand for STEM degrees in Washington State, the experience at UW suggests that this is emphatically not the case. In the words of UW Computer Science Professor Ed Lazowska, "In Washington, the gap is due to lack of program capacity, not lack of student interest."[25]

According to statistics compiled by the College of Engineering at UW Seattle,[26] the number of applications to the College across all engineering majors rose from 1,236 in 2006-06 to 2,226 in 2012-13, an increase of 80 percent. Offers, by contrast, increased only 29 percent. Meanwhile, the average GPA of accepted students rose from 3.4 to 3.59. The Department of Mechanical Engineering reports a similar trend over the same period: applications nearly doubled, while offers increased 39 percent. According to Professor Per Reinhall, Department Chair, this year the Mechanical Engineering Department will take in around 150 students out of 400-450 applicants; many of those the department is forced to reject are

[24] Brookings Institution, *Sizing the Green Economy: A National and Regional Green Jobs Assessment*, Metropolitan Policy Program, 2011.
[25] Ed Lazowska, "STEM Education in Washington: The Facts of the Matter," at http://lazowska.cs.washington.edu/STEM.pdf.
[26] See http://data.engr.washington.edu.

thought likely to be successful as mechanical engineering majors.[27] By opening additional space to aspiring mechanical engineers at UW, the BSME program at UW Bothell will help to alleviate a capacity constraint that is now turning away many qualified students.

The experience of UW Bothell's Electrical Engineering program is further evidence of potential demand. From 24 students at its inception in 2009, admissions into the EE program jumped to 50 in 2012 and to 75 in 2013; the major currently has 145 enrolled students. Actual enrollments have exceeded projections by 50 percent or more each year, evidence of a pent-up demand for engineering majors that UW Bothell is well positioned to meet.

To quantify potential interest in engineering degree programs, Academic Affairs at UW Bothell has collected information from current and potential students using a Catalyst survey. The survey was opened in spring 2011 and is still available on the UW Bothell website; any prospective or current student visiting the UW Bothell website may respond to it. The survey asks respondents to check majors in which they have an interest, choosing from among Civil Engineering, Computer Engineering, Electrical Engineering (Everett), Mechanical Engineering, and Physics. With 141 responses, Mechanical Engineering has attracted by far the most interest, with Civil Engineering second garnering 60 responses. Of the total responders,

- 14 % were UWB students.
- 56 % were planning to enter as freshman or transfer from CCs.
- 97 % were interested in the BSME program.
- 83 % thought it important that UW Bothell offer the BSME.
- 20 % were from Bellevue College, 18 % Cascadia CC, 23 % Edmonds CC, and 15 % UW Seattle.
- 48 % were residing in Snohomish County, 38 % in King, and 20% elsewhere.

Comments left by responders include the following:

"Please make this degree an option. Otherwise, I have to transfer to UW Seattle in order to pursue the career I want."

"I am currently trying to pursue engineering at the University of Washington Seattle, but I would love to see a mechanical engineering degree open at UW Bothell to save money and live at home."

"I love the region and would definitely apply for admission to UWB if they offered a Bachelor of Science degree in Mechanical Engineering. Please offer this degree. Thank you."

[27] Personal communication with Professor Per Reinhall, Chair, Department of Mechanical Engineering, UW Seattle, August 9, 2013.

"Offering this degree is absolutely crucial to my career plans. I chose UWB with the hopes that this degree would be a possibility for me."
"I work at Boeing currently and having mechanical engineering or aeronautics at UWB would be very convenient."

The Admissions staff gathers information from prospective students (students who have completed applications but are not registered) and new students (both freshmen and transfers) who have registered to attend UW Bothell. The application includes intended major as a question. The report for the end of July 2013 for registered applicants notes that 80 students indicated that their intended program of study was Mechanical or Electrical Engineering. It should be noted that the ability to capture data on planned degree programs is limited because there is not enough specific program information to share with students until a degree is approved and developed. Nonetheless, anecdotal information from admissions staff and advisors suggests strong student interest in the development of a BSME program at UW Bothell.

C. Relationship to Regional and Other Institutions

The UW Bothell BSME program is a fully integrated, four-year degree that complements other programs in the region by leveraging the resources, history, and institutional culture that distinguish UW Bothell as a campus. It is also designed to facilitate entry of transfer students from pre-engineering programs at Cascadia Community College and other community colleges and universities. The following is a selection of regional and other institutions that offer the BSME and whose programs have been analyzed in relation to the proposed degree.

UW Seattle

UW Seattle's ABET-accredited Mechanical Engineering is the third largest engineering program in the College of Engineering, behind Electrical Engineering and Computer Science & Engineering. In 2012-13 it enrolled a total of 110 admitted students. As described above, the program has seen significant, steady growth in number of applicants, with increasing numbers of qualified applicants being turned away because of capacity constraints. The curriculum provides comprehensive coverage of the major subfields of mechanical engineering, including energy conversion, noise and vibration, instruments and controls, mechatronics, manufacturing, fluid mechanics, combustion, and heat transfer. Students take advantage of opportunities for undergraduate research in the Department's ten specialized laboratories for investigation of composite materials, manufacturing systems, fluid mechanics, combustion, heat

transfer, and other subjects. While the UW Bothell BSME curriculum provides the same foundations in the core fields of fluid mechanics, thermodynamics, solid mechanics, and mechanical design as does the Seattle program, it adopts a project-based curriculum, where courses in each main subject area progress from fundamentals to applications and open-ended design. In addition, rather than being taught separately, thermodynamics, fluid mechanics, and heat transfer are integrated in each course of a three-course thermal fluids series, which builds from fundamentals to application and design. Another distinguishing feature is the embedding of the major in UW Bothell's signature interdisciplinary culture, as embodied, for example, in the first year Discovery Core curriculum. In planning the major, UW Bothell has received valuable advice and encouragement from Mechanical Engineering in Seattle; and we will work together to harness our complementary strengths in pursuit of excellence befitting the UW brand.

Seattle University

The goal of Seattle University's ABET-accredited Bachelor of Science in Mechanical Engineering is to cultivate in its graduates technical competence along with awareness of social responsibilities. The curriculum provides a strong foundation in the core subjects of mathematics, sciences, engineering theory, and practice, as well as in written and oral communications, while also encouraging life-long intellectual achievement through personal reflection. While SU and UW Bothell both cover the core technical areas of the field, SU requires additional coursework in theology, religion, and philosophy. Both schools require substantial coursework in ethics, written and oral communications, and professional development with the aim of developing well-rounded engineers. Unlike UW Seattle and UW Bothell, SU requires that its ME students take the Fundamentals of Engineering exam, which is the first of two exams engineers are required to take to obtain professional licensure. UW Bothell will encourage students to take the exam, and prep them for it, but it does not at this time intend to make the exam mandatory for graduation.

Seattle Pacific University

Seattle Pacific University does not offer a major in Mechanical Engineering. It does, however, offer the General Engineering Major with Mechanical Engineering Focus. Foundational course requirements in mathematics, science, and engineering correspond closely to those offered at UW Bothell. Also similar to UW Bothell, SPU integrates thermodynamics, heat transfer, and fluid mechanics across a three-course thermodynamics-fluid mechanics series. Another point of similarity is strong encouragement for students to take the Fundamentals of Engineering exam in the final year without making it a graduation

requirement. A distinctive feature of the SPU program is the requirement that majors participate in an internship related to engineering. There is also a 3-2 Transfer Program that allows students to receive an engineering degree from UW or WSU after three years of study at SPU. A significant point of difference with UW Bothell is SPU's emphasis on Christian values and Christ-centered community. UW Bothell's program shares with SPU a focus on ethical practice and responsible stewardship of the environment, but from a perspective not attached to any particular religious or philosophical worldview.

Washington State University

WSU offers an ABET-accredited BSME through its School of Mechanical and Materials Engineering. The School of MME aims to graduate engineers who have "hands-on design and research experience, and possess the communication and critical thinking skills that will allow them to function successfully as members of interdisciplinary technical teams in the professional global arena." After taking foundational courses in the third year, students in the fourth year focus on integration of fundamental principles in such applied areas as aerospace engineering, manufacturing, materials, controls, mechanical design, and thermal design. A distinctive feature of the program is its fostering of interdisciplinary research between materials science and mechanical engineering, which contributes to the School's strengths in nanomaterials, power MEMS, and computational materials science. The School offers the BSME at four campuses around the state: Pullman and Tri-cities offer the full four-year curriculum, while Bremerton and Everett offer only the upper division courses. The Everett program was launched in fall 2012, in cooperation with local community colleges that provide the lower division of the curriculum. Although UW Bothell and WSU Everett serve an overlapping catchment area, UW Bothell's program has the advantage of providing both a seamless curriculum for students entering as freshmen, and a convenient point of entry for transfer students from other universities and community colleges. Students at UW Bothell, moreover, have the opportunity to take courses in other Schools and programs offered at UW Bothell and the other UW campuses.

Other Institutions

Several universities outside the state were studied over the course of preparing the proposal. In particular, the principal author of this proposal made site visits to Olin College of Engineering and University of Michigan Dearborn. Olin's program was chosen because of its strong liberal arts orientation, focus on the undergraduate experience, and innovative pedagogy. Olin's ABET-accredited BSME is rooted in the "Olin Triangle" of strong science and mathematics fundamentals, entrepreneurship, and liberal arts. The classroom environment stresses project-based design and

hands-on learning, collaboration and teamwork, and cultivation of intrinsic motivation in students. Insights from Olin's experience inform key elements of the UW Bothell BSME program, especially the emphasis on design-build, self-directed learning, and integration of liberal arts and business components. University of Michigan Dearborn was chosen because of it similarity to UW Bothell in terms of relationship with a flagship campus and close ties with local industries. Important differences are Dearborn's much longer history, having been founded in 1959, and stronger dependence on a single industry, automobiles (Ford Motor Company hires more engineers from the Dearborn campus than it does from Ann Arbor.) Dearborn's program embraces the notion of the mechanical engineer as a designer and builder of physical things who is comfortable working with both people and machines. Although UW Bothell's program does not focus as strongly on manufacturing, it does take to heart an important insight learned from Dearborn's experience: that mechanical engineering is, ultimately, concerned with using expertly controlled processes to make finely designed machines and devices.

III. Curriculum

A. Objectives

The BSME major is a broad degree, striving as it does to cultivate in its students technical mastery, awareness and understanding of diverse and global contexts, and capacity to apply engineering know-how in sustainable, ethical, and socially responsible ways. Drawing from the National Academy of Engineering's *Engineer of 2020* report, the BSME program objectives are as follows:

1. Technical Competence
    a) Apply principles of engineering, basic science, and mathematics (including multivariate calculus and differential equations).
    b) Model, analyze, design, and realize physical systems, components or processes as they relate to thermal and mechanical systems.
2. Creativity and Design
    a) Exhibit practical ingenuity, aesthetic sense, and creativity in the design of thermal and mechanical systems given the reality of technical, economic, social, and environmental constraints.
    b) Demonstrate resilience, agility, and capacity for self-reflection.
3. Leadership and Ethical Awareness
    a) Identify and frame problems, putting them in a diverse and global operational context.

b) Cultivate leadership, communication, and professional skills in the ethical practice of mechanical engineering.

The BSME curriculum is designed to meet requirements set forth by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, telephone: (410) 347-7700. Each student completing the BSME degree will demonstrate mastery of the following competencies as established by ABET:

a) Ability to apply knowledge of mathematics, science, and engineering.
b) Ability to design and conduct experiments, as well as to analyze and interpret data.
c) Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d) Ability to function on multidisciplinary teams.
e) Ability to identify, formulate, and solve engineering problems.
f) Understanding of professional and ethical responsibility.
g) Ability to communicate effectively.
h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i) Recognition of the need for, and an ability to engage in life-long learning.
j) Knowledge of contemporary issues.
k) Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

B. General Degree Requirements

A total of 180-quarter credits are required to complete the BSME program. All major requirements and prerequisite courses must be completed with a minimum of a 2.0 GPA. Regardless of the number of mechanical engineering courses taken at another institution, at least 45 of the last 60 credits must be taken in residence at UW Bothell.

To be eligible for graduation, all UW Bothell students must fulfill the following general education requirements:[28]

- English Composition – 5 credits

[28] http://www.uwb.edu/registration/graduation/requirements/

- Additional Writing – 10 credits
- Quantitative Skills Requirement (QSR) – 5 credits
- Natural World (NW) – 15 credits
- Visual, Literary, and Performing Arts (VLPA) – 15 credits
- Individuals & Society (I&S) – 15 credits

Freshmen begin satisfying these requirements through the three-quarter Discovery Core series taken in the first year. The Discovery Core orients students to the campus's culture, engages them in the practice of learning across disciplines, and eases them into a learning community of faculty, support staff, and peers.[29] Transfer students may apply a maximum of 90 credits toward fulfilling general education and other lower division requirements for the major.[30] All students interested in the BSME should, in consultation with the STEM School and CUSP advisory staff, plan their Discovery Core and other elective courses to ensure that all graduation requirements are met in an efficient and timely manner.

C. Pre-Major Requirements

Students must complete at least 65 credits prior to admission to the BSME program. These include 15 credits of Discovery Core courses for students entering as freshmen (or their equivalents for those presenting transfer credits), along with 5 credits of English composition, as described above. The remaining 45 credits include courses in mathematics, science, and engineering fundamentals, as presented in Table 2 below.

[29] http://www.uwb.edu/cusp/first-year-discovery
[30] http://www.uwb.edu/admissions/transfer/guide/generalpolicy

Table 2: BSME Pre-Major Required Courses

A. Mathematics

UWB Course No.	Name	Credits	UWS Course Equivalent	Name	Credits
CUSP 124 OR equiv.	Calculus I	5	MATH 124	Calculus with Analytic Geometry I	5
CUSP 125 OR equiv.	Calculus II	5	MATH 125	Calculus with Analytic Geometry III	5
CUSP 126 OR equiv.	Calculus III	5	MATH 126	Calculus with Analytic Geometry III	5
	Total Mathematics	**15**		**Total Mathematics**	**15**

B. Science

Course No.	Name	Credits	UWS Course Equivalent	Name	Credits
B Chem 143/ 144 OR equiv.	General Chemistry I with lab	6	CHEM 142	General Chemistry	5
B Phys 121	Mechanics	5	PHYS 121	Mechanics	5
B Phys 122	Electromagnetism & Oscillatory Motion	5	PHYS 122	Electromagnetism	5
	Total Science	**15**		**Total Science**	**15**

C. Engineering Fundamentals

Course No.	Name	Credits	UWS Course Equivalent	Name	Credits
B ME 221	Fundamentals of Solid Mechanics I: Static forces and material properties	4	AA 210	Statics	4
B ME 222	Fundamentals of Solid Mechanics II: Deformable Bodies	5	CEE 220	Mech of Materials	4
B ME 223*	Fundamentals of Solid Mechanics III: Dynamics	5		Dynamics	4
	Total FSM:	**14**		**Total FSM:**	**12**

*May be in progress at the time of application.

D. Required Courses in the Major

After admission into the major, students take an additional 115 credits of courses, bringing the total number of credits to 180. These courses are organized into nine categories as shown in Table 3. Information in the table includes prerequisites, areas of knowledge, and an indication of whether the course is new or existing.

Table 3: Courses in the Major

A. Mathematics and Science

Course No.	Name	Credits	Pre-Requisites	Area	New/ Existing Course
ST MATH 307	Introduction to Differential Equations	5	CUSP 125	QSR	Existing
ST MATH 324	Multivariable Calculus	5	CUSP 126		Existing
ST MATH 390	Probability and Statistics in Engineering	5	CUSP 126	NW	Existing
B Chem 153/154 OR B BIO 180	General Chemistry II with lab OR B BIO 180	5	B Chem 142		Existing
B Phys 123	Waves	5	B Phys 122	NW	Existing
	Total:	25			

B. Engineering Computational Analysis & Design

Course No.	Name	Credits	Pre-Requisites	Area	New/ Existing Course
B ART 121 or B ART 131	Introduction to Drawing or Introduction to Arts Practice	5		VLPA	Existing
B ENGR 210	Computational Physical Modeling	5	ST MATH 307	NW	New
B ME 310	Introduction to 3D Graphical Modeling, Design & Analysis	5	B ME 222	VLPA	New
	Total:	15			

C. Fundamentals of Solid Mechanics

Course No.	Name	Credits	Pre-Requisites	Area	New/ Existing Course
B STEM 320	Fundamentals of Materials Science	5	B ME 222, B CHEM 142		New
	Total:	5			

D. Fundamentals of Electrical Engineering

Course No.	Name	Credits	Pre-Requisites	Area	New/ Existing Course
B EE 3XX	Electric Power and Machinery	5	CUSP 126; B PHYS 122		New
	Total:	5			

E. Thermal Fluid Systems Analysis

Course No.	Name	Credits	Pre-Requisites	Area	New/ Existing Course
B ME 331	Thermal Fluid Analysis I: Conservation Principles	5	B CHEM 143/144; ST MATH 307; B PHYS 121; B STEM 210 (pre-req or concurrent)		New
B ME 332	Thermal Fluid Analysis II: Applications	5	B ME 331; ST MATH 324		New
B ME 333	Thermal Fluid Analysis III: Analysis & Design	5	B ME332; B ME 310; ST MATH 390 (pre-req or concurrent)		New
	Total:	15			

Table 3: Courses in the Major (continued)

F. Mechanical Systems Design

Course No.	Name	Credits	Pre-Requisites	Area	New/ Existing Course
B ME 341	Mechanical Systems Design I: Design Selection of Components; Failure	5	B STEM 320		New
B ME342	Mechanical Systems Design II: System Dynamics	5	B ME 341; ENGR 210; B ME 223		New
B ME 343	Mechanical Systems Design III: Systems analysis and design	5	B ME 310, B ME 342		New
	Total:	15			

G. Engineering Professional Development

Course No.	Name	Credits	Pre-Requisites	Area	New/ Existing Course
B ENGR 371	Business of Technology	5			Existing
B ENGR 481	The Citizen Engineer: Engineering in a Diverse and Global Context	5	Junior Standing	I&S/ W/ D	New
B ENGR 482	The Professional Engineer: Management, Leadership, and Licensure	5	B ME 381	I&S	New
	Total:	15			

H. Capstone Design

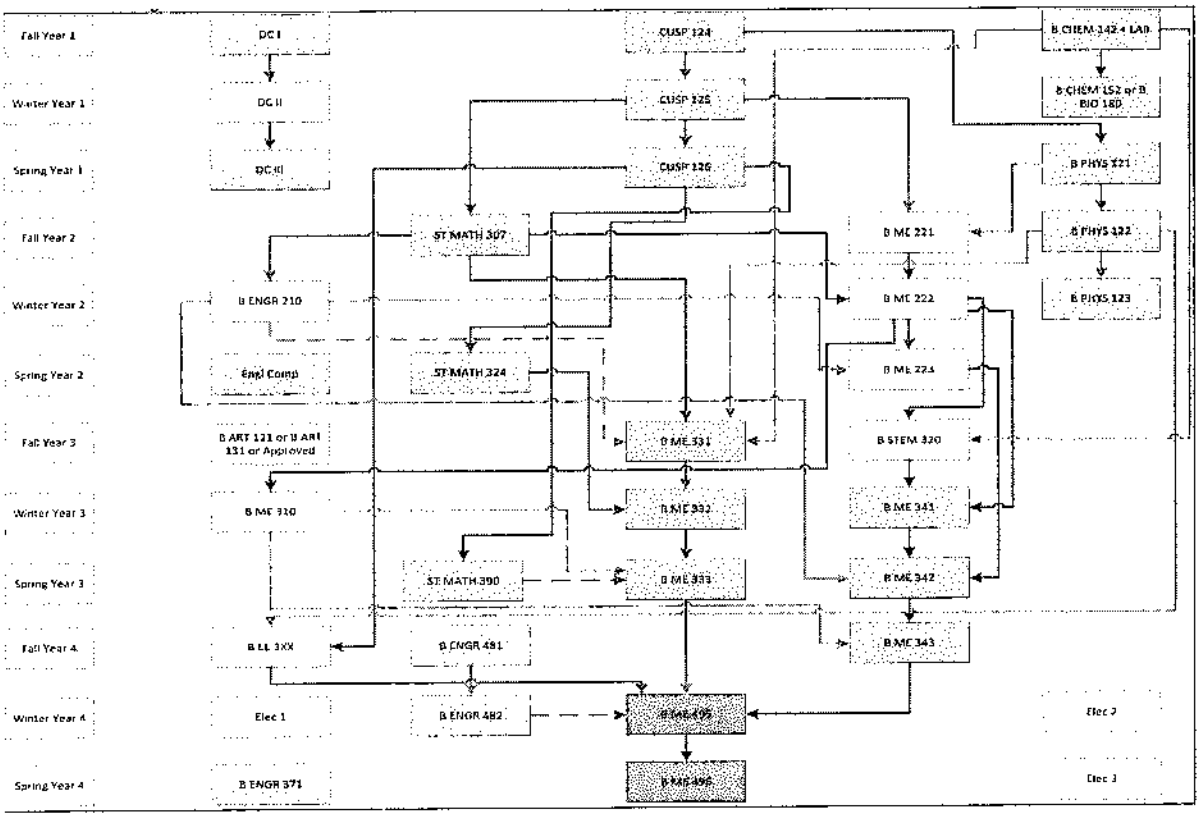
Course No.	Name	Credits	Pre-Requisites	Area	New/ Existing Course
B ME 495	Capstone Project in Mechanical Engineering I	2	B ME 382 (Pre req or concurrent); B ME 343; B ME 333; B EE 215		New
B ME 496	Capstone Project in Mechanical Engineering II	3	B ME 495		New
	Total:	5			

I. Electives

Course No.	Name	Credits	Pre-Requisites	Area	New/ Existing Course
	Engineering electives from approved list of courses	10	Varies		Both
	Science, Technology, and Society elective from approved list of courses	5	Varies	I&S	Existing
	Total:	15			

Figure 1 on the following page presents a color-coded flowchart of the curriculum, showing the sequencing of the courses over four years and the relationships among them. Lines connect courses taken in succession, their arrows pointing from more basic courses toward the ones for which they are prerequisite.

Figure 1: Sequencing of Courses in the Mechanical Engineering Major



Students may progress through the program in different ways, depending on the level of mathematics and science preparation at the time of entry, whether the student is a freshman or transfer student, and other factors. One such four-year pathway for students entering as freshmen and prepared to start calculus and general chemistry in fall quarter is shown in Table 4.

Key
DC, Composition
Math
Science
Design & Computational Analysis
Thermofluid Science
Fundametals of Mechanics
Mechanical Design
Professional Development
Technical Electives
Engineering Design
Electrical Engineering

Table 4: Suggested Pathway for Students Entering as Freshmen

First Year – Pre Major

Fall		Winter		Spring	
Discovery Core I (VLPA)	(5)	Discovery Core II (I&S)	(5)	Discovery Core III (VLPA)	(5)
B CHEM 143/144 Gen Chem I	(6)	B CHEM 153/154 Gen Chem II or B BIO 180 Intro to Bio	(5)	B PHYS 121 Physics I	(5)
B CUSP 124 Calculus I	(5)	B CUSP 125 Calculus II	(5)	B CUSP 126 Calculus III	(5)
Quarter Total	**16 hours**	**Quarter Total**	**15 hours**	**Quarter Total**	**15 hours**

Year Total 46 hours

Second Year – Pre Major

Fall		Winter		Spring	
ST MATH 307 Intro to Differential Equations	(5)	B ENGR 210 Computational Physical Modeling	(5)	English Composition	(5)
B PHYS 122 Physics II	(5)	B PHYS 123 Physics III	(5)	ST MATH 324 Multivar Calculus	(5)
B ME 221 Statics	(4)	B ME 222 Deformable Bodies	(5)	B ME 223 Dynamics	(5)
Quarter Total	**14 hours**	**Quarter Total**	**15 hours**	**Quarter Total**	**15 hours**

Year Total 44 hours

Third Year – Mechanical Engineering

Fall		Winter		Spring	
B ART 121 Intro to Drawing, or B ART 131 Arts Practice	(5)	B ME 310 Intro to 3-D Modeling & Design	(5)	ST MATH 390 Probability and Statistics	(5)
B ME 331 Thermal Fluids I	(5)	B ME 332 Thermal Fluids II	(5)	B ME 333 Thermal Fluids III	(5)
B STEM 320 Materials Science	(5)	B ME 341 Mechanical Design I	(5)	B ME 342 Mechanical Design II	(5)
Quarter Total	**15 hours**	**Quarter Total**	**15 hours**	**Quarter Total**	**15 hours**

Year Total 45 hours

Fourth Year – Mechanical Engineering

Fall		Winter		Spring	
B ME 343 Mechanical Design III	(5)	B ME 495 Capstone I	(2)	B ME 496 Capstone II	(3)
B ENGR 481 Citizen Engineer	(5)	B ENGR 482 Professional Engineer	(5)	Elective 3 (engineering)	(5)
B EE 3XX Electric Power and Machinery	(5)	Elective 1 (engineering)	(5)	B ENGR 371 Business of Technology	(5)
		Elective 2 (social implications)	(5)		
Quarter Total	**15 hours**	**Quarter Total**	**17 hours**	**Quarter Total**	**13 hours**

Year Total 45 hours

Four-Year Total 180 hours

Variations on the above pathway are possible to meet the needs of students who require additional preparation in mathematics and science. For example, students may begin their course of study fall quarter of the freshmen year by taking pre-calculus (B CUSP 123), followed by Calculus I in winter,

Calculus II in spring, and Calculus III in summer. They would then be on track in fall of their sophomore year to begin the second year of the pre-major pathway shown in the previous table.

A five-year pathway is available for students requiring more extensive preparation in mathematics and science than is provided in the pathway shown in Table 4. Table 5 below gives an example of three years of pre-major coursework that would prepare students for admission into the major. Once admitted, students would complete the two years of coursework in the major through a pathway similar to that shown in Table 4.

Table 5: Suggested Pre-Major Pathway for Freshmen Beginning with College Algebra

First Year – Pre Major

Fall		Winter		Spring	
Discovery Core I (VLPA)	(5)	Discovery Core II (I&S)	(5)	Discovery Core III (VLPA)	(5)
B CHEM 139 Prep for Gen Chem	(5)	B CHEM 143/144 Gen Chem I	(6)	B CHEM 153/154 Gen Chem II or B BIO 180 Intro to Bio	(5)
B CUSP 122 Intro Elem Functions	(5)	B CUSP 123 Functions, Models	(5)	B CUSP 124 Calculus I	(5)
Quarter Total	**15 hours**	**Quarter Total**	**16 hours**	**Quarter Total**	**15 hours**

Year Total 46 hours

Second Year – Pre Major

Fall		Winter		Spring	
B PHYS 121 Physics I	(5)	B PHYS 122 Physics II	(5)	B PHYS 123 Physics III	(5)
B ART 121 Intro to Drawing, or B ART 131 Arts Practice	(5)	B ME 221 Statics	(5)	B ME 222 Deformable Bodies	(5)
B CUSP 125 Calculus II	(5)	B CUSP 126 Calculus III	(5)	English Composition	(5)
Quarter Total	**15 hours**	**Quarter Total**	**15 hours**	**Quarter Total**	**15 hours**

Year Total 45 hours

Third Year – Pre Major

Fall		Winter		Spring	
ST MATH 307 Diff Equations	(5)	B ENGR 210 Comp Modeling	(5)	Elective	(5)
B STEM 320 Materials Science	(5)	B ME 310 3-D Modeling & Design	(5)	ST MATH 324 Multivar Calculus	(5)
B EE 3XX Electric Power and Machinery	(5)	Elective	(5)	B ME 223 Dynamics	(5)
Quarter Total	**15 hours**	**Quarter Total**	**15 hours**	**Quarter Total**	**15 hours**

Year Total 44 hours

The major also flexibly accommodates transfer students applying to the major through the transfer of credits from other universities or community colleges. To qualify for admission, transfer students must have completed the approved equivalents of all pre-major courses shown Table 2, along with English Composition. It is also recommended that students have completed the courses that UW Bothell students normally take in the first two years that are not strictly required to be admitted into the major but must be completed as part of the major or as graduation requirements. These courses are General Chemistry II (B CHEM 153/154), Differential Equations (ST MATH 307), Multivariable Calculus (ST MATH 324), Physics III (B PHYS 123), 5-10 credits of VLPA courses, and 5-10 credits of I&S courses.

E. New Courses

The BSME curriculum builds on a foundation of first year science, mathematics, and Discovery Core courses already in place to support the campus's existing science, mathematics, computing, and engineering majors. In the second year, students intending to major mechanical engineering begin taking courses in solid mechanics and computational analysis that prepare them for the upper division mechanical engineering curriculum. These four new courses are Fundamentals of Solid Mechanics I, II, and III, and Computational Physical Modeling. In the third year students enter the core of the major, taking courses principally in Computational Analysis and Design, Thermal Fluid Systems Analysis, and Mechanical Systems Design. Seven of the nine courses taken in the third year will be new additions to the existing curriculum. In the fourth year, students finish the Thermal Fluid and Mechanical Systems series, add technical electives, and complete the Capstone and Professional Development series. A total of six new courses will be developed for the fourth year curriculum.

In sum, seventeen new courses will have to be developed. Descriptions for each new course are included below. Considerable thought has been given to the staging and staffing of these courses. Prior to the fall 2014 start date, the four second-year and seven third-year courses--a total of eleven courses--will be prepared and guided through the curriculum review process. The remaining six required courses will be developed during 2014-15. A hiring plan (Section V) has been established to ensure these courses will be taught at the moment they are needed.

B ME 221 Fundamentals of Solid Mechanics I: Statics (4 cr)
Applies vector analysis to equilibrium of rigid body systems and subsystems. Includes force and moment resultants, free body diagrams, internal forces, and friction. Analyzes basic structural and machine systems and components. Includes laboratory.

Prerequisites: minimum grade of 2.0 in ST MATH 126 or its equivalent, and minimum grade of 2.0 in B PHYS 121.

B ME 222 Fundamentals of Solid Mechanics II: Deformable Bodies (5 cr)
Introduction to the concepts of stress, deformation, and strain in solid materials. Development of basic relationships among loads, stresses, and deflections of structural and machine elements such as rods, shafts, and beams. Load-carrying capacity of these elements under tension, compression, torsion, bending, and shear forces. Includes laboratory.
Prerequisite: minimum grade of 2.0 in B ME 221.

B ME 223 Fundamentals of Solid Mechanics III: Accelerating Bodies (5 cr)
Kinematics of particles, systems of particles, and rigid bodies; moving reference frames; kinetics of particles, systems of particles, and rigid bodies; equilibrium, energy, linear momentum, angular momentum. Includes laboratory.
Prerequisite: minimum grade of 2.0 B ME 222.

B STEM 320 Fundamentals of Materials Science (5 cr)
Fundamental principles of structure and properties of materials utilized in practice of engineering. Properties of materials are related to atomic, molecular, crystalline structure. Metals, ceramics, multiphase systems, and polymeric materials. Relationships between structure and electrical, mechanical, thermal, chemical properties. Includes laboratory.
Prerequisite: B CHEM 143

B ENGR 210 Computational Physical Modeling (5 cr) (NW)
Mathematical and computational methods for the analysis and simulation of biological, chemical, and mechanical processes. Introduction to MATLAB as a computational tool for creating models and analyzing data.
Prerequisite: ST MATH 307

B ME 310 3-D Modeling and Design (5 cr) (VLPA)
Design, representation, and analysis of three-dimensional objects using computational methods and computer-aided design (CAD). Topics include free hand sketching, optimization of design parameters, documentation and communication of design information using appropriate engineering standards and practices.
Prerequisite: B ME 222

B ME 331 Thermal Fluid Analysis I: Conservation Principles (5 cr)
Basic conservation principles of thermodynamics, fluid mechanics, and heat transfer. Fluid and thermal properties of materials and ideal gas equation of state. Conservation of mass, momentum and energy for closed and open systems.
Prerequisites: B CHEM 143, ST MATH 307, B PHYS 121; Prerequisite or concurrent: B ENGR 210

B ME 332 Thermal Fluid Analysis II: Applications (5 cr)
Transport processes; momentum and energy balances involving compressible and incompressible fluids; Bernoulli's equation and its applications; energy transfer as heat and work involving fluid flow. Includes laboratory.
Prerequisites: B ME 331, ST MATH 324

B ME 333 Thermal Fluid Analysis III: Analysis & Design (5 cr)
Analysis and design of systems combining principles of thermodynamics, fluid mechanics, heat, and momentum transfer. Topics include thermal systems modeling, process optimization, and hands-on application in a major design project.
Prerequisites: B ME 332, B ME 310, Prerequisite or concurrent: ST MATH 390

B ME 341 Mechanical Systems Design I: Component Selection, Analysis, and Failure (5 cr)
Mechanical analysis of machine components. Topics include fatigue and reliability analysis, advanced strength of materials, and hands-on applications in gears, bearings, screws, welds, springs, and power transmission systems. Includes laboratory.
Prerequisite: B STEM 320

B ME 342 Mechanical Systems Design II: System Dynamics (5 cr)
Input/output behaviors and dynamic response of electromechanical systems, subsystems, and elements. Topics include transfer functions, frequency response, stability, natural frequency and resonance, and block diagrams. Includes laboratory.
Prerequisites: B ME 341, B ENGR 210, and B ME 223

B ME 343 Mechanical Systems Design III: Systems Analysis and Design (5 cr)
Extension of B ME 342 to more complex electromechanical processes, including rotating machinery, actuators, propulsion, and biomechanical systems and devices. Culminates in a major design project.
Prerequisites: B ME 310, B ME 342

B ENGR 481 Engineering Professional Development I: The Citizen Engineer (5 cr) (W) (I&S) (D)
Examines the role of the engineer in the ethical application of technology in a diverse world. Historical and contemporary cases of invention, innovation, accidents, and disasters are used to probe social implications of engineering, ethical practice, and effective communication in a global context. Emphasizes writing and speaking. Designed to satisfy the new UW diversity requirement.
Prerequisite: Junior standing.

B ENGR 482 Engineering Professional Development II: The Professional Engineer (5 cr) (I&S)
Topics in the professional practice of engineering, including engineering economics, product development, project planning, leadership, management and organization, and legal and regulatory matters. Incorporates review for the Fundamentals of Engineering (FE) Exam required as a first step toward professional licensure.
Prerequisite: B ME 481

B EE 3XX Electric Power and Machinery (5 cr)
Fundamentals of electronic circuits and components, and their application in motors, generators, and other machinery used in industrial applications. Topics include DC and AC circuit design and analysis, operational amplifiers, diodes and transistors, digital logic, microprocessors, three-phase electricity, and rotating electrical machinery. Includes laboratory.
Prerequisites: B CUSP 126, B PHYS 122

B ME 495 Capstone Project in Mechanical Engineering I (2 cr)
First of a two-course sequence capstone design experience. Students design a system, component, or process with specific realistic design constraint such as cost, engineering standards, and societal impact.
Prerequisites: B ME 343, B ME 333, B EE 215; Prerequisite or concurrent: B ME 482

B ME 496 Capstone Project in Mechanical Engineering II (3 cr)
Second of a two-course sequence capstone design experience. Individual or small-team project that is representative of the solution to an open-ended design problem in mechanical engineering. May be undertaken as part of an industrial internship with direct supervision of the engineering faculty and industrial sponsor. Includes many aspects of an industrial research and development product development lifecycle.
Prerequisite: B ME 495

IV. Infrastructure Requirements

A. Facilities

The new Phase 3 Science and Academic Building (UW3), scheduled to open in August 2014, will serve as the venue for most of the BSME courses. Level two houses a lab and project room to support computer-aided design (CAD) classes, a design lab, engineering shop, and 60-seat classroom. Level three houses a lab dedicated to mechanical systems design and a general science lab that will be used for thermal fluid analysis. Each lab and the CAD classroom and has a capacity of 24 students. The budget for construction of UW3 allocates $ 642,600 for the procurement of equipment in 2013-14, and $ 275,400 for 2014-15.

Most of the required pre-major courses (51 of 65 credit hours) already exist in CUSP and STEM, where they serve as foundational courses for several science and engineering majors. Prospective BSME students will generate additional demand for these courses that may, in some cases, necessitate the offering of additional sections.

To support computational requirements in mechanical engineering, a bundle of hardware, software, and staff support services will need to be set into place. Included in the budget are funds to equip and maintain the CAD classroom in UW3 with 48 workstations running SolidWorks, with an additional 18 workstations to be located in the research lab. In addition, a total of 66 new licenses for Matlab will also be procured, as well as a 3-D projection system, 3-D printer, two laptops, and storage. Table 6 provides a breakdown of the IT budget, based on a proposal prepared by Information Technologies Director of Operations Tim Rhoades.

Table 6: Proposed Budget for IT Support

Item	Type	Number	Startup	Annual	Ownership	Notes
3D Projection	Equipment	1	$750	$190	IT	Moderate Quality 3D Projecter. The figures here represent 25 percent of total costs, which covers the expected fraction of useage by the BSME program. Replacement bulbs, mounting hardware, screen, and supplies not included. 4 year replacement cycle.
Storage	Equipment	1	$264	$264	IT	Cloud Based Storage (DropBox), @50 GB/Student, $11/per student. Figured for 24 FTE (NOTE: cost for 96 FTE = $1056/yr)
Workstations**	Equipment	66	N/A	$4,950	IT	Per Floor Plans UW 3, Factors one workstation per seat in CAD/GIS Labs, includes normal peripherals and dual monitors, $1,200/unit. 4 year replacement cycle. The expected fraction of useage by the ME program will be 25 percent.
Laptops	Equipment	2	$4,000	$1,000	IT	Recommended for Faculty use in machine shops and flexible teaching/research. $2,000/unit. 4 year replacement cycle
Matlab	Software	66	$29,766	$5,940	IT	Based off of most recent STEM Purchase @$451/unit (start up) and $90/unit (annual renewal). Student lab fees will cover the costs.
CAD Software	Software	66	$22,000	$4,356	IT	SolidWorks, estimates based off of UW ME spend of $2,250 annually for 34 systems ($66/seat). Final pricing requires consultation with vendor for product specifics and options selected. Student lab fees will cover the costs.
ImageJ	Software	66	N/A	N/A	IT	Free Scriptable Java app for scientific image processing.
Comsol*	Software	TBD	TBD	TBD	IT	Simulation Software, price requires consultation with vendor for product specifics. Multiple modules can be selected.
Abaqus*	Software	TBD	TBD	TBD	IT	Simulation Software, price requires consultation with vendor for product specifics. Multiple modules can be selected.
Ansys*	Software	TBD	TBD	TBD	IT	LCR Imgaing Software. Estimated pricing requires consultation with vendor for product specifics and options selected.
General HydroStatics (GHS)*	Software	TBD	TBD	TBD	IT	System Design Software, price requires consultation with vendor for product specifics. Multiple modules can be selected.
Mathematica*	Software	TBD	TBD	TBD	IT	Computational Software, Volume licensing requires consultation with vendor for product specifics.
Labview*	Software	TBD	TBD	TBD	IT	System Design Software, price requires consultation with vendor for product specifics. Multiple modules can be selected.
Tecplot*	Software	TBD	TBD	TBD	IT	Visualization Software, price requires consultation with vendor for product specifics. Multiple modules can be selected.
Advanced Systems Engineer	Staff	1	$20,100	$20,100	IT	.25 FTE, cost includes 34% benefits load. Work should include safety and security of computing systems in the lab environment. Also support for selected specialized software packages.
Student Support	Staff	1	$10,100	$10,100	STEM	15 hr/wk, $13/hr, for general support and specialized software tutoring. This could include technical support from QSC or Learning Technologies.
Total**			**$86,980**	**$46,900**		

* Recommended software packages are very configurable and can vary widely depending on the specific requirements selected for a given product. For the purposes of estimation a potential metric that could be used is that for UW ME, an overall annual software budget of ~$20,000. This quote considers 34 systems, and does not factor for initial costs of purchase or software that is donated to the program, or purchased by the greater College.

** Total does not include costs for recommended software packages marked with TBD costs or equipment marked with N/A costs; the latter are included CAD/GIS labs, which are included in the proposed UW3 equipment budget.

B. Support Services

As with other new majors, the BSME will draw upon existing support services at the UW Bothell campus. These include the Academic Transition Program, Counseling Services, Disability Resources for Students, Veterans Services, and Career Services.

The Teaching and Learning Center will experience a significant increase in demand for services as enrollment in the BSME program begins to ramp up. Consultation with TLC staff led to a determination that a total of 3.3 new staff FTE would be required to meet the demand for tutoring services. Of this total, 3 FTE would be for the Quantitative Skills Center and 0.3 FTE for the Writing Center.

For library support, Mechanical Engineering students will have access to essential databases and electronic resources through the UW Library.[31] Electronic books in mechanical engineering include online packages from Knovel, ENGNetBASE, ASM, Books 24X7, and IEEE-Wiley eBooks. These resources and more can be viewed at the Library's Research Guide for Mechanical Engineering at http://guides.lib.washington.edu/mechanicalengineering. Licensing arrangements require that the UWB Campus Library contribute to the periodical and electronic subscriptions of the UW Library in line with BSME program's projected student FTE.

The UW Bothell Campus Library currently has few book or media titles related to mechanical engineering. It will therefore be necessary to build a base collection and begin to add newly published materials as they become available. In particular, there are sets of standards in mechanical engineering, housed in the UW Seattle Engineering Library, that are Library Use Only; the UW Bothell Campus Library will need to procure these titles electronically or in hard copy.

Librarian instructional support will also be required to ensure that students achieve information literacy and capacity to conduct research in accordance with ABET learning outcomes. These instructional components are embedded in the Discovery Core courses (including Introduction to Engineering) for freshmen, as well as the Professional Practice and Capstone Project courses taken in the senior year.

Table 7 provides a breakdown of the budget for library resources and services as proposed by Science and Technology Librarian Beth Sanderson and Director of the UWB/CCC Campus Library Sarah Leadley.

[31] This section is adapted from the narrative portion of the library cost estimate provided by Science and Technology Librarian Beth Sanderson and Director of the UWB/CCC Campus Library Sarah Leadley.

Table 7: Proposed Budget for Library Support

	FY 15	FY 17
STAFF		
Librarian	.10 FTE	.35 FTE
Salary and benefits	$6,700	$23,450
Student Hourly	48 hours	192 hours
Salary and benefits	$792	$3,168
OPERATIONS	$200	$500
TOTAL STAFF/OPERATIONS	$7,692	$27,118
COLLECTIONS		
E-resources (journals/databases)	$6,480	$6,868
Books/Media (includes Reserves)	$9,000	$9,450
TOTAL COLLECTIONS	$13,480	$14,218
TOTAL	$23,172	$41,336

NOTES:

- Personnel costs include benefits based on FY 13 rates
- Estimated costs do not include anticipated increases in fixed costs such as librarian promotions/merit
- Librarian FTE calculated at student-librarian ratio of 270-1
- Student hourly calculated at 2 hours per FTE @ $10/hour
- Operations costs = librarian professional development, supplies, etc. (pro-rated)
- E-Resources - inflation rate = 6% per year
- Books - inflation rate = 5% per year

V. Faculty

A. Current Faculty

The following are current faculty members within the STEM School who have expertise in areas covered in the BSME curriculum, and who are expected to contribute significantly to its implementation:

Elaine Scott, Ph.D., came to the University of Washington Bothell in August 2012 and is now Dean of the newly formed School of Science, Technology, Engineering and Mathematics. The School brings together the biological, computer, and physical sciences along with engineering and mathematics to provide excellence in education in a collaborative environment with ties to local industries. Prior to joining UW Bothell, she was professor and director of engineering programs at Seattle Pacific University, where she worked to expand their engineering programs with a focus on project-based learning. Before joining Seattle Pacific in 2006, Dr. Scott served as a professor in the department of mechanical engineering at Virginia Tech. There, she was responsible for the successful planning, development and initial leadership

of a new interdisciplinary, multi-institutional school, the Virginia Tech – Wake Forest University School of Biomedical Engineering and Sciences. Throughout her career she has taught numerous engineering courses, particularly in the thermo-fluid sciences. Dr. Scott holds bachelor and master degrees in agricultural engineering from the University of California, Davis, and doctoral degrees in agricultural engineering and in mechanical engineering from Michigan State University. Her research focuses on the characterization of heat transfer in complex materials with a focus on biological materials, including food products and biomedical applications, and she has authored over 100 journal and conference papers. She was a recipient of Virginia Tech's Philip & Sadie Sporn Award for Excellence in Teaching of Engineering Subjects and is a Fellow of the American Society for Mechanical Engineers. Dr. Scott will teach courses in the Thermal Fluids Analysis series and elective courses in the major.

Arnold S. Berger, Ph.D., is Division Chair of Engineering and Mathematics, and Associate Professor of Engineering and Mathematics in the UW Bothell School of STEM. His expertise is in digital design and embedded circuit design. He has a doctorate in Material Science from Cornell University. Dr. Berger has 22 years of industrial experience ranging from hardware design engineer to Director of Research and Development (R&D) at several companies, including HP, AMD and Applied Microsystems. He also has more than 12 years of teaching experience at UWB and other institutions. He is the Electrical Engineering degree program coordinator, and serves in many committees at the program and university level. Dr. Berger has published over 50 papers, holds four patents and authored two textbooks on computer architecture and embedded design. He is a senior member of IEEE, and an advisor for the newly established UWB IEEE student chapter. He will contribute to the BSME curriculum in materials science and technical elective courses in solid-state physics and metallurgy.

Lawrence Lam, Ph.D., is Lecturer in the Engineering and Mathematics Division of the UW Bothell School of STEM, where he teaches courses in Electrical Engineering. Holder of a doctorate in Electrical Engineering from University of Washington Seattle, he has over ten years of teaching experience. He has also worked for National Semiconductor as a device and process integration engineer, developing Bipolar and BiCMOS process modules. As a postdoc in the Cornell University Materials Science Department, he studied polysilicon grain growth and its application in thin film transistors and OLED display. Dr. Lam will contribute to the BSME curriculum in materials science and technical elective courses at the intersection of materials science, electrical, and mechanical engineering.

Pierre Mourad, Ph.D., begins his appointment as Associate Professor in the Engineering and Mathematics Division of the UW Bothell School of STEM in fall 2013. He has held appointments in the UW Seattle Departments of Bioengineering, Neurological Surgery, and Pediatric Dentistry, while also serving as Senior Principal Physicist at the Applied Physics Laboratory. Dr. Mourad's research in oceanography, atmospheric sciences, sonoluminescence, arctic and ocean acoustics, acoustic holography, and medical acoustics has generated more than twenty invention disclosures, and he is an inventor on three issued patents and another thirteen patent applications, all having to do with means of diagnosing or treating various diseases and disorders. His work on drug delivery and ultrasound technologies has been incorporated into several startup companies. Dr. Mourad holds a doctorate in Applied Mathematics from the University of Washington Seattle. He will teach the ME Project Capstone courses and technical electives in biomechanical and biomedical engineering.

Seungkeun Choi, Ph.D., is currently Assistant Professor in the Engineering and Mathematics Division of the UW Bothell School of STEM. Dr. Choi received the B.E. degree in Electrical Engineering in 1997 from the Soongsil University, Seoul, Korea. From 1997 to 1998 he was a semiconductor process engineer at the LG Semicon, Korea. He attended the Pennsylvania State University in University Park, PA where he received the M.S. in Electrical Engineering, specializing in image processing in 2000. He received the Ph.D. degree in Electrical and Computer Engineering with a minor in Mechanical Engineering from the Georgia Institute of Technology, Atlanta, GA, in 2007. His research interests range from the development of multidisciplinary sensors and actuators based on microelectromechanical systems (MEMS), to the design, fabrication and testing of lightweight, flexible optoelectronics devices such as photovoltaics and light-emitting diodes. Dr. Choi will be able to teach materials science and elective courses in microelectromechanical systems and related areas.

Steven W. Collins, Ph.D., P.E., is Associate Professor of Engineering and Mathematics in the UW Bothell School of STEM. Dr. Collins began his career as a process engineer with Philip Morris (now Altria) and Eastman Kodak after earning a Bachelor of Science in Chemical Engineering. Growing interest in the effects of policy and societal context on engineering spurred a shift to the social sciences, culminating in a doctorate in Foreign Affairs from University of Virginia. He has been a visiting researcher at several organizations in Japan and a research fellow at Japan's National Institute of Science and Technology Policy. His current research focuses on the role of policy and institutions in shaping technological change in the energy space, Asian perspectives in ethics and philosophy of engineering, and improved integration of technical and societal dimensions in engineering education. A licensed Professional

Engineer (PE) in Washington State in chemical engineering, Dr. Collins will contribute to teaching the Engineering Professional Development courses, Thermal Fluids Analysis, Introduction to Engineering, electives in energy, and the incorporation of diversity and global perspectives across the curriculum.

B. New Faculty

Four new full-time faculty members will need to be hired over the next three years to enable rollout of the 16 required courses in the curriculum. Needs are most acute in Year 1, 2014-15, at which time the program must deliver a total of 11 new courses. Of these, newly hired faculty will teach eight, while current faculty teach three. Year 2, 2015-16, will see rollout of the five new courses in the fourth year of the curriculum, of which newly hired faculty are expected to teach at least two. Costs of hiring and supporting these new faculty are included in the budget in Section IX.

In line with the planned rollout of courses, new faculty hires are proposed as follows:

Year 1 (2014-15) – Two hires
Associate Professor with Tenure, to teach Dynamics, Mechanical Design, and future electives.
Senior Lecturer, to teach Statics, Deformable Bodies, Computational Physical Modeling, and 3-D Modeling.

Year 2 (2015-16) – One hire
Assistant Professor, Tenure-Track, to teach Thermal Fluid Analysis, Professional Development, and future electives.

Year 3 (2016-17) – One hire
Assistant Professor, Tenure-Track, to provide further support in Thermal Fluid Analysis, Mechanical Design, or Computational Analysis, along with future electives.

It is expected that all four new hires will teach elective courses that further the School's strategic goal of building expertise in the fields of energy and biomedical engineering.

The following will apply to recruitment and hiring of new faculty members in the BSME program:

- We will hire new faculty members through national searches, by advertising in appropriate professional journals. We will advertise in *Science* and *The Chronicle of Higher Education*. Other journals may be appropriate for specific sub-areas of Mechanical Engineering.
- We will strive for faculty expertise in various areas of mechanical engineering, placing priority on the hiring faculty of excellent educators and scholars with expertise in their sub-discipline, with the goal of providing outstanding educational and research experiences for students across the breadth of mechanical engineering sub-disciplines. In hiring faculty, we will also seek candidates whose teaching will fit with the interdisciplinary nature of a UW Bothell education.
- We will solicit applications from candidates from historically under-represented groups in engineering by routinely contacting historically black colleges and universities and tribal colleges to publicize our searches. We will also post job ads on the web sites for SACNAS, HBCU, and other appropriate web sites.
- The mission of the Office of the Associate Vice Provost for Faculty Advancement (working in UW's Office of Minority Affairs and Diversity [OMA&D]) is to ensure that UW recruits, promotes and retains an excellent and diverse faculty. We will work with OMA&D to attract a pool of applicants that includes women and members of under-represented groups.
- Program materials, in hard copy and online will reflect and promote the diversity of the program.

VI. Administration

The BSME program will be housed in the Engineering and Mathematics Division of the School of Science, Technology, Engineering, and Mathematics.

The Division Chair of Engineering and Mathematics will appoint a Mechanical Engineering Degree Coordinator. The ME Degree Coordinator will work with the Division Chair to oversee ME course offerings, including all courses required for the BSME, to determine which courses will be offered and the frequency of offerings. The Degree Coordinator will consult with the STEM School Academic Advisor and Program Coordinator in preparing new course applications, submitting them for review to the appropriate curriculum review committees, and scheduling them once they have been approved. Finally, the Degree Coordinator will make recommendations to the appropriate Division and School committees about the ME curriculum, staffing, admissions, and assessment.

The Engineering and Mathematics faculty as a whole will serve as a curriculum, assessment, and admissions committee. They will meet regularly to review the curriculum and evaluate student progress through the program. They will also develop and maintain the list of approved elective courses, determine standards for admission to the major, review applications to the major, and ensure that the program objectives are being met.

In terms of staff support, the STEM School currently has a Program Administrator (Christine Howard), Program Coordinator (Lorrie Cain), and Academic Advisor (Sharon Meriwether), who provide staff support to all the divisions. Majors and pre-majors in Mechanical Engineering will place an added burden on the staff. Supported is therefore requested for 0.5 FTE for recruiting and other administrative support, and this is included as a line item in the Budget in Section IX.

VII. Students

A. Student Population and Projected Enrollments

The BSME program will initially accept 24 students for fall 2014, with enrollment ramping up during the startup phase through 2019-20. Once steady state has been achieved in 2020, admissions are projected to be 72 students per year, with 144 total student FTE in the major. Table 8 below shows the planned admissions of students during the start-up period. Students meeting the prerequisite requirements who wish to begin the major in fall quarter will apply at the start of the preceding spring quarter.

Table 8: Projected Student Admissions and Enrollment in the Major

	Admissions	Total FTE in Major
2014-15	24	24
2015-16	24	48
2016-17	48	72
2017-18	48	96
2018-19	72	120
2019-20	72	144

B. Diversity Plan

The STEM School is committed to building and sustaining a diverse student population, in accordance with principles articulated by the University of Washington at large and UW Bothell in particular. In light of this commitment, the following actions will be taken:

- Develop, in consultation with local and national experts, a set of assertive recruitment and outreach practices designed to reach traditionally underserved populations. These include recruitment fairs, information forums, and partnerships with community colleges and K-12;
- Establish and maintain mutually productive relationships with professional organizations to increase enrollments from underrepresented populations;
- Ensure that the program's marketing materials are designed to attract diverse applicants;
- Visit and pursue opportunities for collaboration with high schools in ethnically and culturally diverse areas;
- Build relationships with the region's Gear-Up, Upward Bound, MESA (Math, Engineering, Science Achievement) and HAAP (Hispanic academic Achievers Program), that spark student interest and encourage participation in the BSME program;
- Work with Washington State Achievers (funded by the College Success Foundation) advisors/mentors or other scholarship programs to recruit and retain scholarship recipients to the proposed program;
- Identify industry mentors and establish culturally relevant internships for underrepresented students (e.g., minority owned businesses, businesses located in the student's home community, etc.);
- Regularly assess recruitment/retention efforts with regard to underrepresented populations;
- Continually monitor the program's culture of appreciation and respect towards diversity, and work toward continuous improvement of that culture.

VIII. Assessment Plan

The BSME program is being designed from the outset as an ABET- accredited program. The accreditation process will follow the requirements set by ABET for all new engineering degree programs. These are summarized as follows:

1. After the graduation of the first class of ME students (expected June 2016, for the class entering in the fall of 2014), UW Bothell will request from ABET and evaluation of its program.

2. The program subsequently will undertake an internal evaluation and complete a self-study questionnaire. The self-study documents the extent to which students, curriculum, faculty, administration, facilities, and institutional support meet the established criteria. Table 9 presents the criteria in force in 2013-14.

3. While the program conducts its self-examination, the appropriate ABET engineering commission forms an evaluation team that will visit the campus. A team chair and one or more program evaluators make up the evaluation team. Team members are volunteers from academe, government, and industry, as well as private practice.

4. During the on-campus visit, the evaluation team reviews course materials, student projects, and sample assignments and interviews students, faculty, and administrators. The team investigates whether the criteria have been met and addresses any questions raised in the self-study.

5. Following its campus visit, the team provides the school with a written report of the evaluation. This allows the program to correct any misrepresentations or errors of fact, as well as address any shortcomings in a timely manner.

6. At its annual meeting of all commission members, the final evaluation report is presented by the evaluation team, along with its recommended accreditation action. Based on the findings of the report, the commission members vote on the action and the school is notified of the decision. The information the school receives identifies strengths, concerns, weaknesses, deficiencies, and recommendations for improvements. Accreditation is granted for a maximum of six years. To renew accreditation, the institution must request another evaluation.

Table 9: ABET Criteria for Program Assessment[32]

Criteria	Indicators of Success
Students	Policies and procedures document student performance and progress toward achieving program objectives and meeting graduation requirements.
Program Educational Objectives	Program objectives are consistent with institutional mission and needs of program's various constituencies, and are periodically reviewed through effective processes involving the various constituencies.
Student Outcomes	Students meet program objectives and ABET learning outcomes, as listed in Part III.A. of this proposal.
Continuous Improvement	The program uses appropriate, documented processes to evaluate the extent to which student outcomes are being attained, and uses these results for continuous self-improvement.

[32] Adapted from "Criteria for Accrediting Engineering Programs, Effective for Reviews During the 2013-14 Accreditation Cycle," available at http://www.abet.org/

Curriculum	The curriculum specifies the required subject areas and devotes adequate attention to each.
Faculty	The faculty is of sufficient number, qualifications, diversity, and competencies to teach the program's curriculum, interact with students, and conduct program assessment.
Facilities	Classrooms, labs, and equipment are adequate to support attainment of program objectives and student learning outcomes.
Institutional Support	Institutional support, resources, and leadership are adequate to ensure quality and continuity of the program.

The BSME program will also implement the internal review that is required of all academic units at the University of Washington. The University Handbook, Section 12-28, specifies that these reviews be conducted at least once every ten years jointly by the Dean of the Graduate School and Dean of Undergraduate Academic Affairs in cooperation with the relevant School or College Dean.[33] Assessment will be conducted locally using multiple measures of assessment and formative evaluation, based on data collected for the continuous revision and improvement of the program. The following tools and data will be used to measure the effectiveness of the degree program in meeting is stated learning objectives:

1. Student Evaluation of each course.
2. Peer monitoring of instruction.
3. Course-embedded assessment.
4. Student focus groups and exit interviews.
5. Success of student-faculty research as reflected in presentations at conferences and co-authored abstracts and publications.
6. Monitoring of student retention within the program to evaluate, among other things, student preparation for the major, admission requirements, and the effectiveness of student support services.
7. Tracking of program alumni.
8. Program evaluation by an outside faculty evaluation group.

Table 10 below summarizes the elements and means of assessment used in the conduct of internal program reviews. Information obtained in the internal reviews will be documented so as to facilitate its use in the ABET self-study described above.

[33] http://www.grad.washington.edu/fac-staff/programreviews/existing.shtml

Table 10: UW Internal Program Assessment

Element	Assessment	Method	Frequency
Curriculum	▪ program coherence ▪ appropriate learning outcomes	a. student surveys (focus groups, exit interviews), b. alumni surveys, c. Major Field Test, d. course-embedded assessment	annually
Students	student learning outcomes ▪ assessment methods ▪ evidence of success	a. student surveys (course evaluations, focus groups, exit interviews), b. course-embedded assessment, c. Major Field Test, d. alumni surveys	quarterly course evaluations, annual student surveys
Enrollment	▪ enrollment and retention trends ▪ diversity of students	a. data from Office of Institutional Research, UWB Admissions b. recruitment goals	annually
Faculty	faculty active in: ▪ research ▪ teaching improvement ▪ professional organizations ▪ college governance: adequate staffing tenure promotions	a. faculty self-evaluations, b. personnel committee	annually
Resources	▪ adequate facilities ▪ sufficient equipment ▪ appropriate technology ▪ adequate program budget	a. faculty self-evaluation, budget/operations committee, b. student surveys (focus groups, research success), c. alumni success, alumni surveys	annually
Student Services	adequate support: ▪ recruitment ▪ admissions ▪ advising ▪ counseling ▪ retention	a. data from Office of Institutional Research, UWB Admissions (data on admissions, retention), b. student surveys	Annually
Academic Support	adequate support: ▪ Quantitative Skills Center ▪ Writing Center ▪ Library ▪ Information Technology ▪ Advising	a. student surveys, b. course-embedded assessment, c. student retention data d. advising report data	Annually

IX. Budget

Startup of the BSME program is projected to require $ 501,890 in new spending in 2014-15. A breakdown is provided in Table 11, which tabulates items discussed elsewhere in this proposal. An inflation rate of 3 percent is applied to recurring expenses, except for library collections, which use a 5 percent rate. Funds for equipment that will be used in the mechanical engineering laboratories are not included here because they are already in the UW3 equipment budget, as noted previously.

Table 11: Proposed Budget for Implementing the BSME Program

Item	2014-2015 Year 1	2015-2016 Year 2	2016-2017 Year 3	2017-2018 Year 4
New Faculty, Associate Professor (1.0 FTE), salary + benefits @ 27.2 %	127,200	131,020	134,950	138,990
New Faculty, Assistant Professor (1.0 FTE), salary + benefits @ 27.2 %		117,900	121,440	125,080
New Faculty, Assistant Professor (1.0 FTE), salary + benefits @ 27.2 %			121,450	125,100
New Faculty, Senior Lecturer (1.0 FTE), salary + benefits @ 27.2 %	101,760	104,810	107,960	111,200
Recruiting and Startup Package for New Tenure-Track Hires	100,000	103,000	106,090	
Recruiting and Startup Package for New Senior Lecturer Hire	15,000			
Recruiter/ Administrator (0.5 FTE), salary + benefits @ 33.6 %	33,400	34,400	35,430	36,500
Library Staff Salaries and Operations (0.10 FTE in Year 1 rising to 0.35 FTE at steady-state in Year 3) plus Student Hourly	7,690	7,920	27,120	27,930
Library Total Collections (Books/Media and E-resources)	13,480	14,220	15,000	15,830
Academic Support – Quantitative skills and writing tutors (3.3 FTE)	16,380	16,870	17,380	17,900
Workstations, 3D printer, CAD and modeling software, and IT staff support	86,980	46,900	48,310	49,760
TOTAL COSTS	**$ 501,890**	**$ 577,040**	**$ 735,130**	**$ 648,290**

Undergraduate Curriculum Review Process for New Programs

Bothell: Bachelor of Science in Mechanical Engineering degree (BST-20130916)

uwcr
uwcr
Board owner

Posted Jan 6, 2014 12:13 PM

Please review the attached 1503 pdf requesting to establish a Bachelor of Science in Mechanical Engineering degree at the Bothell campus and post comments by 5:00 pm on Friday, January 24th.

If you have any problems viewing the attachment or need disability accommodations, please contact the University Curriculum Office at uwcr@uw.edu.

Attachments:

BST-20130916.pdf 8.2M
Download View

Undergraduate Curriculum Review Process for New... > Bothell: Bachelor of Science in Mechanical Engi...

Your Tools

Undergraduate Curriculum Review Process for New Prograr

Board Participants Profile (anderap)

Bothell: Bachelor of Science in Mechanical Engineering degree (BST-20130

uwcr

Board owner

New! *Posted Jan 6, 2014 12:13 PM*

Please review the attached 1503 pdf requesting to establish a Bachelor of Scie Engineering degree at the Bothell campus and post comments by 5:00 pm on

If you have any problems viewing the attachment or need disability accommoc the University Curriculum Office at uwcr@uw.edu.

Attachments:

BST-20130916.pdf 8.2M
Download View

Undergraduate Curriculum Review Process for New... > Bothell: Bachelor of Science in Mechanical E

UNIVERSITY CAMPUSES UNDERGRADUATE PROGRAM REVIEW PROCEDURES**

CHECKLIST

Title of Proposal: Bachelor of Science in Mechanical Engineering degree

(BST-20130916)

Proposed by (unit name): School of STEM

Originating Campus:

___UW, Seattle

_X_UW, Bothell

___UW, Tacoma

I. **Phase I. Developed Proposal Review** (to be completed by Originating Campus' Academic Program Review body)

A. Review Completed by: (list name of program review body)

Chaired by:

11/05/13Date proposal received by originating campus's review body

12/04/13 Date proposal sent to University Registrar

01/06/14 Date proposal posted & email sent to standard notification list

01/31/14 Date of originating campus's curriculum body approval
(Note: this date must be 15 business days or more following date of posting)

B. _0____ Number of comments received. Attach the comments and a summary of the consideration and responses thereof : (1-2 paragraphs)

II. **Phase II. Final Proposal Review** (to be completed by FCTCP)

A. Review Completed by:
_x_ FCTCP subcommittee
___ FCTCP full council
Chaired by: William Erdly

2/11/14 Date request for review received from University Registrar
3/6/14 Date of FCTCP report

B. Review (attached)

YES NO
_x_ ___ Was notice of proposal posted on UW Website for 15 business days?
_x_ ___ Was notice of proposal sent to standard mailing list 15 business days in advance of academic program review?
_x_ ___ Were comments received by academic program review body?
_x_ ___ Was response to comments appropriate? (explain, if necessary)
___ _x_ Was final proposal reviewed by FCTCP within 14 days of receipt?
_x_ ___ Was there adherence to the University Campuses Undergraduate Program Review Process? (explain, if necessary)

Report slightly delayed as a high volume of proposals received.

C. Recommendation

_x_ Forward for final approval
___ Forward to Provost because of University issues (Explain)
___ Return to campus council because of insufficient review (Explain).

**Endorsed by Faculty Senate Executive Committee, 1/10/05, modified 1/31/06; These procedures apply to new undergraduate degrees, majors, minors (and certificates) and substantive changes to same