

**THE UNIVERSITY OF WISCONSIN-MILWAUKEE**  
**College of Engineering and Applied Science**

**FACULTY MEETING**

**Friday, November 2, 2018 10:30 a.m. EMS E180**

**MINUTES**

The meeting was called to order at 10:30 a.m. with Dean Brett Peters presiding.

**PRESENT:** Professors Abu-Zahra, Armstrong, Avdeev, Boyland, Bravo, Campbell-Kyureghyan, Cheng, Church, Cuzner, D'Souza, Dumitrescu, Goyal, Hanson, Helwany, Hu, Kouklin, Law, Li, Liao, Lopez, Mali, McRoy, Misra, Munson, Nosonovsky, Pashie, Patrick, Peters, Qu, M. Rahman, Ranji, Reisel, Rohatgi, Salowitz, Seifoddini, Sung, Titi, W. Wang, Y. Wang, Xu, J. Yu, Z. Yu, Zhang, J. Zhao, T. Zhao, Zheng

**EXCUSED:** Professors Amano, Dhingra, Ghorbanpoor, Ma, Qin, Sobolev, Tabatabai, Venugopalan, D. Yu

**GUESTS:** M. Andrew, D. Barth, N. Brown, C. Rafferty

***I. DEAN UPDATE***

The UW System has included funds for a new engineering building as part of its biennial budget request. If funds are made available, detailed planning for the building would begin. The building would be located where the Physics building currently stands, and would not replace the EMS building; rather it would be additional space primarily devoted towards education.

The campus continues to work through plans on how to assess progress in UWM's three strategic areas. Dean Peters provided an update on the proposed metrics, and included commentary on how CEAS was doing with respect to the metrics and on possible implications of these metrics on the college's future plans and initiatives.

***II. ANNOUNCEMENTS***

**A. EMS Building Assessment – Officer C. Rafferty, UWM Police**

Officer Rafferty provided an overview of the results of his safety assessment for the EMS building. He emphasized that it is important to be aware of people entering workspaces and to report suspicious activity to the police. Reports can be made at <https://uwm.edu/dos/reporit.com>.

**B. Transition to Canvas Update – Dylan Barth, CETL**

A review of the transition to Canvas from D2L was presented. D2L will no longer be available after the Fall 2019 semester, and so faculty should be working on transitioning their courses to Canvas. Resources are available to faculty as they work on the transition. These resources can be found at <https://uwm.edu/canvas/>.

C. United We Roar Campaign – N. Brown

Faculty and staff are strongly encouraged to participate in UWM's portion of the SECC campaign – United We Roar. Information on how to give can be found at <https://uwm.edu/secc/>

- D. Mike Andrew encouraged all faculty with whom he has not yet met to set up meetings with him as soon as possible.

**III. INFORMAL REPORTS** – See Attachment 1

**IV. DETERMINATION OF THE PRESENCE OF A QUORUM FOR FACULTY MEETING**

As 45 voting faculty members were present, a quorum was present.

**V. AUTOMATIC CONSENT BUSINESS**

- A. Minutes of the April 27, 2018 meeting

Dr. Misra asked that this item be removed from automatic consent. It is considered under New Business

- B. Minutes of the September 26, 2018 meeting

**VI. NEW BUSINESS**

- A. Alternative Instructor Qualifications Policy – See Attachment 2

**CEAS FAC. DOC.  
NO. 255**

Prof. Munson moved approval of the Alternative Instructor Qualification Policy.

The motion was seconded and approved on a voice vote.

- B. Request for Authorization to Implement a B.S. in Environmental Engineering – See Attachment 3

**CEAS FAC. DOC.  
NO. 256**

Prof. Misra moved approval of the Request for Authorization to Implement a B.S. in Environmental Engineering

The motion was approved on a voice vote.

- C. Notice of Intent: Request for Entitlement to Plan a B.A. in Computer Science – See Attachment 4

**CEAS FAC. DOC.  
NO. 257**

Prof. Boyland moved to approve the Notice of Intent: Request for Entitlement to Plan a B.A. in Computer Science.

The motion was approved on a voice vote.

D. Graduate Program Subcommittee Charter – See Attachment 5

Prof. Liao moved to approve the revised Graduate Program Subcommittee Charter.

Prof. Munson moved to refer the GPSC charter back to committee for revision.

The motion to refer the GPSC charter to committee was seconded and approved on a voice vote.

Prof. McRoy moved to include in the current GPSC membership a representative from the Biomedical Engineering Department-Like Body.

The motion was seconded and approved on a voice vote.

E. Minutes of the April 27, 2018 meeting

Prof. Boyland moved to approve the minutes of the April 27, 2018 meeting.

The motion was seconded and approved on a voice vote.

Dr. Qu indicated that the Mechanical Engineering Department would address the issue of two representatives from the department on the APC.

**VII. GENERAL DISCUSSION**

Prof. Patrick raised the issue of the metrics for research only including funding coded in Category 4. Dean Peters indicated that he thought this issue was under study by campus leadership.

**VIII. ADJOURNMENT**

Meeting Adjourned at 12:08 p.m.

John R. Reisel, Secretary  
CEAS Faculty

JRR  
Attachments

## INFORMAL REPORTS

Office of Student Services – Todd Johnson

The CEAS enrollment figures can be found on the following two pages. A summary of these is as follows:

**CEAS Enrollment Summary – Fall 2018**

	<b>2017</b>	<b>2018</b>	<b>Dif</b>
<b>Bachelors</b>	1854	1865	+11
<b>UG Special</b>	6	4	-2
<b>Masters</b>	202	195	-7
<b>Doctoral</b>	212	200	-12
<b>Non-Degree</b>	14	13	-1
<b>Total</b>	2288	2277	-11

Career Services – Juli Pickering

No Report

Curriculum Committee – Prof. A. Rahman

No Report

Graduate Program Subcommittee – Prof. Liao

No Report

Academic Planning Committee – Prof. Misra

APC met twice since the beginning of this semester. Major actions included recommendations to approve a proposal for the CSI and the NOI for BA in CS. The committee also got an update on the faculty salary compression and retention exercise conducted recently. Program assessment is next on the agenda.

Faculty Senate – Prof. Reisel

The Senate passed a number of items, including a recommendation to further revise the Smoking and Tobacco-Free Campus Policy (to broaden the policy from prohibiting not only smoking on campus but to also ban nearly all tobacco use on campus), the replacement of SAAPs 45.5 and 45.7 with a comprehensive UWM Policy on Research Misconduct, and establishing policies and procedures for study abroad programs.

## Table 1: Enrollment Facts At A Glance College of Engineering and Applied Science

### Fall 2018

	UWM						UGRD				GRAD				
	Total	Freshman	Sophomore	Junior	Senior	Special	Total	Master	Doctoral	Non Degree	Total	Master	Doctoral	Non Degree	Total
Total	2,277	269	354	361	881	4	1,869	195	200	13	408	195	200	13	408
Men	1,895	220	303	296	757	3	1,579	151	156	9	316	151	156	9	316
Women	382	49	51	65	124	1	290	44	44	4	92	44	44	4	92
Residents	1,686	228	287	282	731	1	1,529	97	48	12	157	97	48	12	157
Non Residents	567	37	63	72	142	3	317	98	151	1	250	98	151	1	250
Minnesota Recip	24	4	4	7	8		23		1		1		1		1
African Amer	47	8	4	8	23		43		4		4		4		4
Amer Indian	3				1		2		1		1		1		1
Latino/a	50	4	8	9	24		45		4		5		4		5
SE Asian Amer	38	12	10	3	12		37		1		1		1		1
Multi Ethnic Targetec	209	32	45	42	79	1	199	8	1	1	10	8	1	1	10
Targeted Subtotal	347	56	68	62	139	1	326	13	7	1	21	13	7	1	21
Asian Amer	89	6	20	13	28		67	15	5	2	22	15	5	2	22
International	408	7	30	38	84	3	162	99	144	3	246	99	144	3	246
Other Race	1								1		1		1		1
Multi Ethnic Not Targ	38	6	10	6	14		36	1	1		2	1	1		2
White	1,380	192	226	240	612		1,270	65	39	6	110	65	39	6	110
Unknown	14	2		2	4		8	2	3	1	6	2	3	1	6
Average Age	23.9	18.4	20.7	22.2	24.8	33.3	22.6	27.0	31.8	34.3	29.6	27.0	31.8	34.3	29.6
Age 25+ Men	591	3	26	39	273	2	343	94	146	8	248	94	146	8	248
Age 25+ Women	108		1	8	33		42	24	39	3	66	24	39	3	66
New	337	240	12				252	61	17	7	85	61	17	7	85
First Generation Stuc	564	68	106	121	268	1	564	0	0	0	0	0	0	0	0
Advanced Standing	133	3	41	50	36	3	133								
Continuing	1,765	21	293	304	830		1,448	133	178	6	317	133	178	6	317
Reentry	42	5	8	7	15	1	36	1	5		6	1	5		6
Online Only	47	1	2	9	17		29	8	10		18	8	10		18
FTE	1,976	260	331	324	753	3	1,671	130	170	5	305	130	170	5	305
Average Credits	12.2	14.5	14.0	13.5	12.8	11.0	13.4	8.0	5.9	4.5	6.9	8.0	5.9	4.5	6.9
Full Time	1,775	260	328	316	699	3	1,606	111	57	1	169	111	57	1	169
Part Time	502	9	26	45	182	1	263	84	143	12	239	84	143	12	239

**Table 1: Enrollment Facts At A Glance****College of Engineering and Applied Science****Fall 2017**

	UWM					UGRD					GRAD		
	Total	Freshman	Sophomo	Junior	Senior	Special	Total	Master	Doctoral	Non Degree	Total		
Total	2,288	249	363	398	844	6	1,860	202	212	14	428		
Men	1,936	209	300	341	747	5	1,602	156	165	13	334		
Women	352	40	63	57	97	1	258	46	47	1	94		
Residents	1,693	207	287	326	717	1	1,538	93	51	11	155		
Non Residents	570	38	70	67	118	5	298	109	160	3	272		
Minnesota Recip	25	4	6	5	9		24	1	1		1		
African Amer	54	4	8	9	28		49	4	4	1	5		
Amer Indian	3				3		3						
Latino/a	48	8	7	7	21		43	4	1		5		
SE Asian Amer	44	8	9	4	22		43	1	1		1		
Multi Ethnic Targeted	177	31	45	30	63		169	5	1	2	8		
Targeted Subtotal	326	51	69	50	137		307	9	7	3	19		
Asian Amer	93	14	11	17	29		71	14	8		22		
International	431	11	39	41	65	5	161	115	152	3	270		
Other Race	1							1	1		1		
Multi Ethnic Not Targ	32	8	6	6	11		31	1	1		1		
White	1,396	165	236	281	600	1	1,283	63	42	8	113		
Unknown	9		2	3	2		7		2		2		
Average Age	23.8	18.5	20.5	22.1	24.8	26.3	22.6	26.8	31.6	32.6	29.4		
Age 25+ Men	616	3	20	56	272	1	352	98	154	12	264		
Age 25+ Women	105		2	2	32		36	27	42		69		
New	333	217	16	1			234	62	29	8	99		
First Generation Stud	580	81	110	134	255	0	580	0	0	0	0		
Advanced Standing	159	11	56	51	36	5	159						
Continuing	1,757	18	284	342	792		1,436	139	177	5	321		
Reentry	39	3	7	4	16	1	31	1	6	1	8		
Evening Only	68		2	6	10	1	19	26	15	8	49		
FTE	2,014	238	342	364	729	5	1,678	127	204	6	336		
Average Credits	12.3	14.3	14.1	13.7	13.0	11.8	13.5	7.5	6.7	4.9	7.0		
Full Time	1,815	241	340	352	681	5	1,619	107	86	3	196		
Part Time	473	8	23	46	163	1	241	95	126	11	232		

## Alternative Instructor Qualifications Policy

College of Engineering and Applied Science  
(as required by UWM SAAP #S-77 of January 2018)

### Motivation

UWM Policy S-77 specifies a framework for defining minimum qualifications for instructors. The primary standard for instructor qualifications in S-77 is for the instructor to have suitable academic credentials:

- For graduate courses (G and U/G), this is a “terminal degree in the field or subject area relevant to the course taught.” For CEAS, this would be a Ph.D. in a relevant area of engineering, science, or mathematics. S-77 also calls for the instructor to have “a record of research, scholarship, or achievement appropriate to the program and degree offered”
- For undergraduate courses (U only), this would be a master’s degree or higher in a relevant discipline or program area.

Recognizing that some potential instructors do not always have those credentials, but may have experience that makes them qualified, S-77 allows for “Alternative Qualification.” S-77 calls for departments and/or schools/colleges to create written guidelines on minimum instructor experience and define a process for reviewing those alternate qualifications. This document provides that information.

### Minimum Threshold of Experience

Instructors for undergraduate (U) courses must meet the following minimum qualification standards:

- A bachelor’s degree in a domain relevant to the course, plus one of the following:
  - 18 semester credits of graduate-level academic coursework in the discipline or program area, or
  - 2 years of practical, clinical, or research experience in a relevant field.

Instructors for mixed undergraduate/graduate (U/G) courses must meet one of the following minimum qualification standards:

- A master’s degree in a domain relevant to the course, plus one of the following:
  - 18 semester credits of graduate-level academic coursework beyond the master’s degree and in the discipline or program area, or
  - 2 years of practical experience in a relevant field.
- A bachelor’s degree in a domain relevant to the course, plus one of the following:
  - 5 years of practical experience in a relevant field, or
  - Evidence of substantial relevant practical, clinical, or research experience in industry or government agencies.

Instructors for graduate-only (G) courses must meet one of the following minimum qualification standards:

- A master’s degree in a domain relevant to the course, plus one of the following:
  - 18 semester credits of graduate-level academic coursework beyond the master’s degree and in the discipline or program area, plus significant research or scholarly experience relevant to the course, or
  - 5 years of practical, clinical or research experience relevant to the course.
- A bachelor’s degree plus 10 years of practical, clinical or research experience relevant to the course.

In all of the above cases, the instructor may only be certified as qualified for specific courses, not for all courses in a program or faculty unit.

#### Process for reviewing and documenting alternative instructor qualifications

New or updated alternative instructor qualifications will be reviewed for approval by the department or department-like-body (DLB) offering the course. A department or DLB may further delegate this role to a subset of its faculty (e.g. Electrical Engineering faculty within EECS) and must do so formally at the start of each academic year. In addition, any such faculty unit may delegate the approval task to a subcommittee or individual (such as the chair). In the case of jointly-offered and cross-listed courses, only one of the participating faculty units (department, DLB, or delegated subset) must perform the review. In general, this should be the unit that is engaging the work of the instructor.

The faculty unit will be given the instructor's CV or resume and a draft Instructor Qualifications Verification Form (IQVF) that specifies how the instructor meets the minimum requirements. The faculty unit may modify the IQVF prior to formal consideration of approval. The faculty unit may grant or deny approval of the IQVF. The faculty unit may deny approval even when it can be argued that a potential instructor meets the minimum qualifications above.

Approved IQVFs will be stored in the department office in accordance with UWM records retention policy.



**University of Wisconsin-Milwaukee  
College of Engineering & Applied Science**

**Request for Authorization to Implement a Bachelor of Science  
in Environmental Engineering**

**A. ABSTRACT:**

The proposed Bachelor of Science (B.S.) in Environmental Engineering will be offered by the Environmental Engineering Program Department-like Body, within the College of Engineering & Applied Science. The program will require 125 credits of coursework that includes 21 credits of elective courses in a specialize track of the student's choice.

**B. PROGRAM IDENTIFICATION:**

**Institution Name**

University of Wisconsin-Milwaukee

**Title of Proposed Program**

Environmental Engineering

**Degree/major Designation**

B.S. Engineering/Environmental Engineering

**Mode of Delivery**

Primarily face-to-face classroom- and laboratory-based instruction

**Single Institution or Collaboration**

Single institution

**Projected Enrollment by Year Five**

91 students

**Tuition Structure**

Engineering undergraduate differential tuition

**Department or Functional Equivalent**

Civil and Environmental Engineering Department

**College, School or Functional Equivalent**

College of Engineering & Applied Science

**Proposed Date of Implementation**

January 3, 2020

## **C. INTRODUCTION:**

### **1. Why is the program being proposed? What is its relation to the institution's mission?**

According to the U.S Department of Labor Occupational Outlook Handbook (<https://www.bls.gov/ooh/architecture-and-engineering/environmental-engineers.htm>), Environmental engineers use the principles of engineering, soil science, biology, and chemistry to develop solutions to environmental problems. They are involved in efforts to improve recycling, waste disposal, public health, and water and air pollution control.

Occupational employment projections show a clear need for Environmental Engineers. The projection developed for Wisconsin by Labor Market Information (LMI) (<http://worknet.wisconsin.gov/worknet/daocprj.aspx?menuselection=da>) projected a 16.72% increase in employment for Environmental Engineers from 2014 to 2024. The U.S Department of Labor Occupational Outlook Handbook projected a nationwide 8% increase in employment for Environmental Engineers from 2016 to 2026.

The proposed program will contribute to fulfill UWM's mission to meet the diverse needs of Wisconsin's largest metropolitan area by developing a high quality undergraduate program appropriate to a major urban doctoral university, attracting highly qualified students, furthering academic and professional opportunities at all levels for women, minority, part-time, and financially or educationally disadvantaged students, establishing and maintaining productive relationships with appropriate public and private organizations, and providing educational leadership in meeting future social, cultural, and technological challenges. According to the American Society for Engineering Education (ASEE), female enrollment in Environmental Engineering programs grew from 38.3% in 2005 to 47.4% in 2014, and is the engineering discipline with the highest female enrollment. The proposed program will augment existing relationships with over 200 water technology businesses in the region, academic programs and economic development organizations dedicated to the advancement of freshwater technologies (The Water Council, <https://thewatercouncil.com/why-milwaukee/>). The program distinctly responds to the College of Engineering and Applied Science's mission "to educate students to become creative problem solvers, conduct leading-edge research with global impacts, and act as a catalyst for improved economic development and quality of life in Wisconsin."

### **2. How does it fit into the institution's overall strategic plan?**

The proposed program will promote the development of solutions to environmental problems, including those related to water and energy. The program certainly fits the UWM Strategic Plan, which identified Technology, Energy and Water among top objectives under its themes and priorities of a) top-tier research university, b) sustainable prosperity in the community, region and beyond, c) academic planning, d) successful students: recruitment, retention, and remediation, e) financially sustained university, f) technology, g) physical aspects of campus, h) internationalization, i) faculty and staff attraction, development and retention, and j) community engagement. The program also fits the CEAS Strategic Goals of a) Creating a dynamic environment and infrastructure to enhance innovative research, b) Anticipating and responding to

market demands in order to produce graduates who are prepared to address and adapt to the changing needs of the marketplace and society, and c) Building partnerships with stakeholders and enhance awareness of CEAS strengths and accomplishments.

### **3. Do current students need or want the program?**

Many students are aware of potential growth of environmental engineering area. As a result, institutions with this program have exceptionally high enrollments. We have received enquiries from prospective students for quite some time about the availability of environmental engineering program at UWM. Since our intent to plan was circulated, student requests for the date of availability of this program have been continuous, including many enquiries from students belonging to underrepresented groups. Additionally, recently graduated students also provide important feedback regarding the needs of environmental engineering program based on the exit survey, such as “make environmental engineering an undergraduate degree, rather than a part of civil engineering”, “the environmental engineering courses are very limited”, and “having a course on air emissions for environmental people would be good”.

### **4. Does market research indicate demand?**

According to the Bureau of Labor Statistics, environmental engineering is projected to grow by 8% from 2016 to 2026. Many students are aware of potential growth of environmental engineering area. As a result, institutions with this program have high enrollments, particularly from female and minority Engineering students. We have received enquiries from prospective students for quite some time about the availability of environmental engineering program at UWM.

According to Labor Insight Jobs (Burning Glass Technologies), during the last 12 months (Aug. 01, 2017 - Jul. 31, 2018) there were 5,607 postings nationwide for candidates with a Bachelor's degree in Environmental Engineering. Of those opportunities, 58 were posted in Wisconsin, and over 600 in neighboring states. Meanwhile, the total number of degrees conferred during the same period by UW-Platteville and Marquette University was 28.

The most frequent locations of Wisconsin employers seeking environmental engineers were Milwaukee-Waukesha-West Allis (29 postings), Madison (15 postings), and Green Bay (6 postings). Some of the main nationwide employers seeking environmental engineers included Arcadis, AECOM Technology Corporation, Tetra Tech, CH2M Hill, Ghd Incorporated, Amec, CDM Smith, Fieldcore, US Air Force, and The Kleinfelder Group, Inc.

The 2016- 2026 National Change in Employment for environmental engineers projected by Burning Glass Technologies was 15.9%. Furthermore, nationwide there were an additional 1,909 and 209 postings for candidates with Master's and Doctoral degree in Environmental Engineering, respectively.

The UWM School of Freshwater Sciences conducted a survey designed to evaluate how undergraduate programs in freshwater sciences might best serve private and public needs in the water sector. There were 182 responses to the survey, and respondents described the area of the

water sector in which their organizations operate as government agency, manufacturing, environmental consulting and civil engineering, utilities, agriculture, food and beverage, water technology, hospitals and health care, and non-profit organizations.

The survey asked what content, subject matter, and training would their future workforce most benefit from having in the engineering and technology area. The most frequent responses included a) quality management, water processing, industrial treatment systems, chemical engineering, quality and performance standards; civil infrastructure, water supply and treatment, urban systems; c) sensors, monitoring systems, industrial systems and controls; d) hydrodynamics, hydraulics and fluid dynamics; e) material science and nanotechnology; f) product development and realization; and g) mechatronics and robotics. The proposed program will collaborate with the School of Freshwater Sciences by providing training on most of the aforementioned subject matters.

## **5. How does the program represent emerging knowledge, or new directions in professions and disciplines?**

Environmental engineering is an interdisciplinary program that prepares students to apply basic science and engineering analysis and design techniques to the environmental field. This requires fundamental understanding of the environmental systems functions to develop engineered solutions to solve the complex environmental issues. Thus, this brings a diverse group of professionals (from natural sciences, social sciences, and mathematics) together that in turn benefits engineering design. Numerous environmentally related grand challenges have been identified across the globe, such as energy, water resources, climate change, and environmental degradation. Environmental engineering is emerging as a field of significant potential to address these challenges to promote a sustainable and resilient society.

## **D. DESCRIPTION OF PROGRAM:**

### **General Structure of the Program**

#### **Institutional Program Array**

The program is interdisciplinary and combines several disciplines of the College of Engineering and Applied Science, School of Freshwater Sciences, College of Letters and Sciences, and School of Public Health. The proposed program is designed on the basis of selected courses from engineering, biological sciences and other basic sciences. A limited number of new courses will be developed for this program, as detailed below. The program will be administered within the Department of Civil and Environmental Engineering of the College of Engineering and Applied Science. That department currently offers a Bachelor of Science in Civil Engineering with four areas of concentration: geotechnical, structural, transportation, and water resources and environmental engineering. The Bachelor of Science in Environmental Engineering program will have a significantly different curriculum from the existing Bachelor of Science in Civil Engineering, with changes in the engineering core courses, environmental engineering major courses, and technical electives. The core curriculum of the program will include courses in mathematics through differential equations, probability and statistics, calculus based physics,

chemistry, earth science, biology and fluid mechanics. The curriculum will prepare graduates to formulate material and energy balances, analyze the fate and transport of substances in and between air, water and soil phases; conduct laboratory experiments, and analyze and interpret the resulting data in more than just one environmental engineering focus area, e.g., air, water land, environmental health; design environmental systems that include considerations of risk, uncertainty, sustainability, life-cycle principles, and environmental impacts; and apply advanced principles and practice relevant to the program objectives.

### **Other Programs in the University of Wisconsin System**

The UW System offers programs in Environmental Engineering and Civil Engineering with option or emphasis in Environmental Engineering at UW-Madison and UW-Platteville. A program located in the UW System urban university that emphasizes topics relevant to southeastern Wisconsin and the Great Lakes watershed will complement the existing programs. UW-Madison offers an Environmental Engineering option within the Bachelor of Science in Civil Engineering program. Students who complete the Environmental Engineering option still receive an accredited BS degree in Civil Engineering and only the transcript will show that the student has complete the option. According to its Vice Provost for Academic Affairs, UW-Madison sees no problem with both Madison and Milwaukee offering such degrees, as the student interest and demand for graduates is sufficient to support both. UW-Platteville is the only campus that offers an ABET accredited Bachelor of Science in Environmental Engineering in Wisconsin. UWM is an urban university primarily serving the needs of SE Wisconsin. The majority of our students come from the greater Milwaukee area. These students either want or need to stay in Milwaukee. UWM not only serves new freshmen but many transfer students and working adults who are place bound in Milwaukee. These students cannot go other campuses. So even if other campuses have capacity to serve these students, it is not an option for these place bound students.

### **Collaborative Nature of the Program**

The proposed program will be built upon the strong existing interdepartmental collaborations within the College of Engineering and Applied Science, as well as with other departments/colleges across UWM (e.g., School of Freshwater Sciences, Department of Geoscience, Department of Geography, School of Public Health). We have also established strong relationships with water-related industries and organizations (e.g., A.O. Smith, Badger Meter, Wisconsin Department of Natural Resources, Milwaukee Metropolitan Sewage District, Water Quality Association, etc.) through Milwaukee Water Council and a NSF-funded Water Equipment and Policy Research Center. The Global Water Center and newly built Innovation Campus also serve as a catalyst to facilitate collaborative activities with the water companies/organizations.

### **Diversity**

Diversity and quality of student are crucial to the success of the proposed Environmental Engineering program. The mission statement of the University of Wisconsin-Milwaukee includes furthering academic and professional opportunities for women and minority students.

National trends indicate that Environmental Engineering is more attractive among the under-represented groups. Women are attracted to engineering disciplines that are more socially meaningful. According to ASEE, 50% of BS in Environmental Engineering were awarded to female students in 2014-2015, the highest among all engineering disciplines. The average female BS graduation in Civil Engineering was 22% and 20% among all engineering in the same year.

### **Student Learning Outcomes**

Upon the completion of the program, students are expected to have:

- a. an ability to apply knowledge of mathematics, science, and engineering,
- b. an ability to design and conduct experiments, as well as to analyze and interpret data,
- c. an 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. an ability to function on multidisciplinary teams,
- e. an ability to identify, formulate, and solve (environmental) engineering problems,
- f. an understanding of professional and ethical responsibility,
- g. an ability to communicate effectively (both orally and in writing),
- h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context,
- i. a recognition of the need for, and an ability to engage in life-long learning,
- j. a knowledge of contemporary issues (within environmental engineering profession), and
- k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Accreditation of engineering program requires a continuous assessment of the learning outcomes. Similar to existing engineering programs, this program will also be assessed in order to receive accreditation.

### **Programmatic Curriculum (119~126 credits)**

Students will be required to take at least 125 credits to fulfill the requirements of the program. As indicated in the table below, this includes 29 credits in engineering core courses, 26 credits in the environmental engineering major, 14 -16 credits in mathematics, 5 -10 credits in chemistry 8 credits in physics, 7 credits in other natural sciences and 15 in GER courses. Remaining 15 credits are assigned to five specialized tracks that students may select according to their interests. Some of these students may select a track in higher education while some other may select a broader spectrum and tracks in industrial applications. There will be more courses added to this group as the program expands.

Engineering Core Courses (29 credits)	EAS 200 Professional Seminar (1) ( <i>Pre: none</i> ) Ind Eng 111 Introduction to Engineering (3) ( <i>Pre: Math 116 (c)</i> ) Ind Eng 112 Engineering Drawing & Computer Aided Design/Drafting (3) ( <i>Pre: Math 116</i> )
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	Ind Eng 360 Engineering Economic Analysis (3) <i>(Pre: Jr St)</i>
	Civ Eng 280 Computer-Based Engineering Analysis (3) <i>(Pre: math 226 or 231, compsci 132 or equivalent)</i>
	Comp Sci 240 Introduction to Engineering Programming (3) <i>(Pre: Math Placement Code of 40 or Math 116 (P))</i>
	Civ Eng 2XX Engineering Mechanics (3) (Note: new course that combines CivEng 201 and 202)
	MatlEng 201 Engineering Materials (4) <i>(Pre:chem 105 or 102 or 117)</i>
	MechEng 301 Basic Engineering Thermodynamics (3) <i>(Pre: Math 233, Physics 209)</i>
	MechEng 320 Introduction to Fluid Mechanics (3) <i>(Pre: MechEng 301(c), ElecEng 234, CivEng 2XX)</i>
Environmental Engineering Major (26 credits)	Civ Eng 311 Introduction to Energy, Environment and Sustainability (3) <i>(Pre: Jr St)</i> Civ Eng 411 Engineering Principles of Water Resources Design (3) <i>(Pre: Jr St, MechEng 320)</i> Civ Eng 413 Environmental Engineering (3) <i>(Pre:MechEng 320)</i> Civ Eng 412 Applied Hydrology (3) <i>(Pre: Jr St, MechEng 320, Math 233)</i> Civ Eng 511 Water Supply and Sewage (3) <i>(Pre: Jr St, CivEng 411)</i> Civ Eng 521 Water Quality Analysis (4) (Note: 1 more credit due to additional lab sessions) <i>(Pre: Jr St, CivEng 411)</i> Civ Eng XXX Air Quality (3) (New faculty needed) Civ Eng 495 Environmental Senior Design (4) <i>(Pre: CivEng 411, 413)</i>
Mathematics (14~16 credits)	One of the following Calculus sequences must be completed Math 231-232-233 (12) OR Math 221-222(Honors) (10), <i>(Pre: Math placement score, or previous course with "C" grade)</i> ElecEng 234 Analytical Methods in Engineering (4) <i>(Pre: Math 233 (P))</i>  Or 205 & 211
Chemistry (5-10 credits)	Chem 102&104 or 105 (suggested) <i>(Pre: Chemistry placement test)</i>
Physics (8 credits)	Physics 209-210

Other Natural Sciences (7 credits)

Bio Sci 150-level (4) (required)

Bio Sci 150-level or above (3)

Any Geo Sci course 300-level or above (3)

Atm Sci 330 (3)

General Education Requirements (15 credits)

Art (3)

Humanities (3)

Social Science (6)

English 310 (3)

### Technical Electives (15)

- Civ Eng 303 Strength of Materials (*Pre: CivEng 201, Math 233*)
- Civ Eng 335 Soil mechanics (*Pre: CivEng 303*)
- Civ Eng 490 Transportation engineering (*Pre: CivEng 280, Jr. St*)
- Civ Eng 492 Environmental Impact Assessment (*Pre: Sr St*)
- Civ Eng 555 Sustainable Construction Materials and Technology (*Pre: Jr St*)
- Civ Eng 480 Software Applications for Civil Engineering (*Pre: Jr St*)
- Civ Eng 610 Introduction to Water and Sewage Treatment (*Pre: Sr St, CivEng 413*)
- Civ Eng 614 Hazardous Waste Management (*Pre: jr st; CivEng 413*)
- Civ Eng 616 Computational Hydraulics and Environmental Flows (*Pre: Jr St, CivEng 411*)
- GEOG 215 Introduction to geographic information systems (*Pre: None*)
- Urb Plan 591 Introduction to Urban Geographic Information Systems (*Pre: Jr St, CivEng 411*)
- GEOSCI 400 Water quality (*Pre: jr st; Chem 102(P); Math 232(P); or cons instr.*)
- GEOG 403 Remote sensing (focus on hydrology?) (*Pre: Jr St & Geog 215*)
- GEOSCI 464/FRSHWTR 464 Chemical hydrogeology (*Pre: jr st; Chem 102(P).*)
- GEOSCI 562 Environmental Surface Hydrology (*Pre: jr st; Math 232(P); or cons instr.*)
- FRSHWTR 502 Aquatic ecosystem dynamics (*Pre: jr st; 1 sem calculus or algebra; 2 sem Physics, Chem, or Bio Sci; or cons instr.*)
- FRSHWTR 504 Quantitative freshwater analysis (*Pre: jr st; 1 sem calculus, Physics, Chem, & Bio Sci; or cons instr.*)
- FRSHWTR 506 Environmental health of freshwater ecosystems (*Pre: jr st*)
- FRSHWTR 510 Economics, Policy & Management of Water (*Pre: jr st*)
- ElecEng 430/Mech Eng 430 Energy Modeling (*Pre: jr st or cons instr*)



- Ind Eng 455 Operations research (*Pre: jr st; Math 233(P)*)
- Matl Eng 460 Nanomaterials and Nanomanufacturing (*Pre: jr st; MatlEng 201(P)*)
- Mech Eng 321 Basic Heat Transfer (*Pre: jr st; MechEng 301(P)*)
- Mech Eng 436 Solar Engineering (*Pre: jr st; MechEng 301 (P)*)
- PH 303: Climate Change, the Environment, and Human Health (*Pre: Sophomore standing*)

(New Courses)

- Civ Eng XXX Environmental fluid mechanics
- Civ Eng XXX Water resources management
- Civ Eng XXX Built environment

### **Time to Degree**

Students taking 15 credits per semester can finish the requirements in eight semesters. Students taking 12 credits per semester can finish the requirements in 10 semesters. Since engineering students are encouraged to co-op, this may add another year to their graduation time.

### **Program Review Process**

Academic Planning and Curriculum Committee reviews all undergraduate programs at the University of Wisconsin-Milwaukee. The details may be found at the following site.  
<http://www4.uwm.edu/secu/faculty/standing/apcc/upload/UWM-Program-Review-Schedule-2030-3.pdf>

Also, all existing engineering programs are accredited by ABET (Accreditation Board for Engineering and Technology). They have set eight criteria for such reviews: students, program educational objectives, student outcomes, continuous improvement, curriculum, faculty, facility and institutional support. The requirements include monitoring of student progress in attaining 11 outcomes, documenting processes for assessing and evaluating the extent to which student outcomes are being attained, and using this evaluation for continuous improvement. Students, alumni, and employers are included in the assessment process. An industrial advisory committee is involved for each engineering program. The proposed program will also have these assessments in order to have ABET accreditation.

**E. Institutional Commitment: attached separately.**

**University of Wisconsin System**  
**Cost and Revenue Projections For Newly Proposed Program**

	Items	Projections				
		2019	2020	2021	2022	2023
		Year 1	Year 2	Year 3	Year 4	Year 5
I	Enrollment (New Student) Headcount	31	34	38	41	45
	Enrollment (Continuing Student) Headcount	0	26	51	71	91
	Enrollment (New Student) FTE	31	34	38	41	45
	Enrollment (Continuing Student) FTE	0	26	51	71	91
II	<b>Total New Credit Hours (# new sections x credits per section)</b>	<b>3</b>	<b>6</b>	<b>9</b>	<b>12</b>	<b>12</b>
	<b>Existing Credit Hours</b>	<b>18</b>	<b>18</b>	<b>18</b>	<b>18</b>	<b>18</b>
III	FTE of New Faculty/Instructional Staff		1	1	2	2
	FTE of Current Fac/IAS	2	2	2	2	2
	FTE of New Admin Staff	1	1	1	1	1
	FTE Current Admin Staff					
V	<b>New Revenues</b>					
	<i>UWM Tuition (new credit hours x FTE)</i>	\$ 351,428	\$ 685,285	\$ 1,007,721	\$ 1,272,270	\$ 1,549,249
	<i>From Fees</i>					
	<i>Program Revenue - Grants</i>					
	<i>Program Revenue - Other</i>					
	<i>CEAS Marginal Tuition (not included in total revenue)</i>	\$153,537	\$299,397	\$543,739	\$736,409	\$936,503
	<i>CEAS Differential Tuition</i>	\$9,957	\$19,416	\$32,554	\$43,032	\$53,939
<i>Reallocation</i>						
	<b>Total New Revenue</b>	<b>\$ 361,385</b>	<b>\$ 704,701</b>	<b>\$ 1,040,275</b>	<b>\$ 1,315,302</b>	<b>\$ 1,603,188</b>
VI	<b>New Expenses</b>					
	<b>Salaries plus Fringes</b>					
	<i>New Faculty/Instructional Staff</i>		90,000	90,000	180,000	180,000
	<i>Cost to replace Current Fac/IAS Staff</i>	180,000	180,000	180,000	180,000	180,000
	<i>Other New Admin Staff</i>	50,000	50,000	50,000	50,000	50,000
	<i>Fringes</i>	94,300	131,200	131,200	168,100	168,100
	<b>Other Expenses</b>					
	<i>Facilities</i>		25,000	40,000	50,000	60,000
	<i>Equipment</i>		25,000	40,000	50,000	60,000
	<i>Other:</i>	15,000	15,000	30,000	40,000	50,000
	<b>Total Expenses</b>	<b>\$ 339,300</b>	<b>\$ 516,200</b>	<b>\$ 561,200</b>	<b>\$ 718,100</b>	<b>\$ 748,100</b>
VII	<b>Net Revenue</b>	<b>\$ 22,085</b>	<b>\$ 188,501</b>	<b>\$ 479,075</b>	<b>\$ 597,202</b>	<b>\$ 855,088</b>
<b>Narrative: Explanation of the Numbers and Other Ongoing Commitments that will Benefit the Proposed Program</b>						
Assumes 2 current FTE's based on 4 people (CEE Dept.) each moving .5 FTE to the Env Eng Program						

- a** - Number of students enrolled
- b** - To be based on 12 credits at the undergraduate level and 7 credits at the graduate level
- c** - Number of faculty/instructional staff providing significant teaching and advising for the program
- d** - Number of other staff providing significant services for the program

Signature by the Provost  
Date:

NOTICE OF INTENT  
REQUEST FOR ENTITLEMENT TO PLAN A NEW PROGRAM

## 1 Basic Information

Name of the Proposed Degree:	Bachelor of Arts in Computer Science
Institutional Setting:	College of Engineering and Applied Science University of Wisconsin-Milwaukee
Mode of delivery:	Face-to-face (traditional)
Other Required Approvals:	None.
Institutional Contact Information:	Ethan Munson, Associate Dean, CEAS munson@uwm.edu

## 2 Description

The College currently offers a Bachelor of Science in Computer Science. This degree program is ABET accredited and includes a comprehensive list of requirements including 65 credits of Computer Science, 13 credits of Mathematics and 12 credits of Natural Science. This program serves our students and local employers well but is too large to be combined with another major.

The proposed program is intended to permit students to combine interest in an alternate area (in humanities, arts, the professions or even natural science) with computer science in order to gain skills that increase their desirability with employers. Burning Glass (in a presentation dated May 26) found that adding software development or computer programming skills permits graduates to gain a 30+% salary premium over those without. (These two skill areas of the fourteen measured by Burning Glass achieved the largest bumps.) Their conclusion was that education should incorporate these skills even for those not in exclusive Computer Science degree programs.

Thus the proposed program will pare down the required courses to a minimum while maintaining strength in software development and computer programming, transferable skills particularly sought by employers. In particular the new program will require only half (30-33 credits) of the existing BS Computer Science program, only one mathematics course (calculus), and no science beyond University requirements. Breadth within Computer Science will be provided through the existing CompSci 150 course which surveys the whole field.

## 3 Resources

The new program uses existing courses and so setting up the new program will not require additional resources, until and unless enrollment increases substantially. New faculty lines will be needed as the program grows, and these lines can serve existing programs as well.

In order to encourage students to declare this major, program advisers, especially in CEAS, L&S, and PSOA will need information that can be presented. The new major

will fit nicely in UWM’s “metamajor” in Business, Industry, & Applied Technology. We anticipate that existing advising resources will prove sufficient.

## 4 Alignment with UWM’s Mission

The proposed new program fits well with UWM’s “Select Mission Statement” as seen online at <https://www4.uwm.edu/discover/mission.cfm>.

In particular, UWM seeks to “develop and maintain high quality undergraduate . . . programs,” “attract highly qualified students,” “further academic and professional opportunities for women, minority, part-time, and financially or educationally disadvantaged students,” and “provide educational leadership in meeting future social, cultural, and technological challenges.”

The program that we intend to design would be crafted as a high-quality program that could attract students who wish to be challenged in two or more separate academic areas, in a way to boost the employment potential for students primarily working in arts or humanities. It is also common wisdom that these inter-disciplinary programs can attract a more diverse pool of students, not solely white, male, and middle-class.

Some Computer Science faculty report that having a more interdisciplinary skillset would be valuable, especially for applications related to the analysis of data from a variety of domains including health or environment (e.g. freshwater). Thus support for such connections would strengthen UWM’s mission.

## 5 Need for Program

Computer Science is increasingly forming connections across the academy. A renowned Computer Scientist wrote

Computation is worldly. Its about society, markets, people, brains, behaviors, perception, emotions. Computer Science is looking outwards now. I advise my undergrad students to take as many courses as they can: Economics, biology, sociology, humanities, linguistics, psychology. —Christos Papadimitriou

We’d like to support this long-term trend.

We received market research information from both Burning Glass and EAB. As mentioned above, the Burning Glass research indicates that candidates for non-software-oriented positions receive a substantial boost in pay offers if they bring documented software skills in their application.

We contracted with EAB for a market study on the demand for a Bachelor in Arts degree in Computer Science. The EAB research team profiled 7 universities with related programs. The researchers at EAB note that although most employers don’t distinguish the degrees, students with stronger and narrower technical skills prefer the full (B.S.) programs while the B.A. typically fills with those who were unable to complete the full program (typically because of lower math and science skills). Thus we feel confident that the program wouldn’t simply cannibalize the existing program.

The EAB report concludes:

Administrators at the University of Wisconsin-Milwaukee should expect strong student interest in a prospective B.A. in computer science program. Administrators at all profiled institutions report increased student interest in both B.A. and B.S. computer science degrees over the past five years. Contacts attribute the growth in interest for computer science degrees as a reflection of increased demand for computer science skilled professionals in the labor market.

To our knowledge, in Wisconsin, only UW-Madison and UW-Whitewater currently offer a BA in Computer Science. The BA at Madison requires more mathematics (15 credits versus 4 credits) than the one we anticipate implementing. The BA at Whitewater (“General Emphasis”) is more similar although it requires almost 40 credits if “Discrete Structures” is included. The BA at Madison anticipates being used as an “additional major” (as we also propose) and the BA at Whitewater requires that the student complete an additional minor major (as we also propose).

Thus the state already has two programs substantially similar to our proposed program, but the market demand for software developers and related fields is anticipated to climb (already 19% percent in the four years 2013–17 and an anticipated 13% additionally in the next ten years nationally, and 28% regionally), and Milwaukee as the largest metropolitan area of the state is a particular good place to center a degree with such affinity with industry. In conclusion, we see no problem with the increased competition, all programs should be able to thrive.

## GRADUATE PROGRAM SUBCOMMITTEE CHARTER

### 3.5 GRADUATE PROGRAM SUBCOMMITTEE (GPSC)

#### 3.5.1 Membership: The GPSC shall consist of:

- a. One member from each department to be selected by the voting members of the departmental faculty.
- b. The College Representative(s) of the University of Wisconsin-Milwaukee Graduate Faculty Council (GFC) as voting member(s).
- c. The dean and associate deans of CEAS serve in an ex-officio non-voting capacity.

#### 3.5.2 Responsibilities:

- a. Review all courses submitted by the department for graduate credit and submit them to the College Graduate Program Committee. After such approval, transmit the courses, through the Dean's Office, to the Graduate School for further action.
- b. The GPSC shall be responsible for the policies and those duties assigned to it by the College Graduate Program Committee, for the administration of interdepartmental programs, and for the students in those programs in CEAS, currently, the Master of Science and Doctor of Philosophy in engineering and computer science. Specifically, for these programs, the GPSC is responsible for:
  1. Planning and policy decisions regarding the programs.
  2. Determining entrance requirements, program standards, and guidelines for all students entering the program.
  3. Reviewing the qualifications of, and advising the Credentials Committee of the GFC and Graduate Dean, regarding the approval of faculty members of the respective departments to be authorized to direct dissertation research.
  4. Appoint student program advisors and review and approve individual student programs.
  5. Recommend to the Graduate School on admission, continuation, and graduation of students.
- c. The GPSC may delegate day-to-day administration of the graduate programs and responsible contact with the Graduate School to subcommittees or to administrative staff. In each case, the GPSC retains basic authority and responsibility.

#### 3.5.3 Election Procedures:

- a. Elections for departmental representatives shall occur each Spring in time to be announced at or before the April College Faculty Meeting.
- b. The Chair shall be elected annually by the Committee from its members at the first meeting after September 1. The Chair shall be eligible to vote on all matters coming before the Committee.
- c. The terms of office of each member shall be for two years and shall start September 1. Unexcused absences from the Committee meetings for three consecutive times automatically vacates that position.

<u>Representative</u>	<u>Year of Election</u>
Biomedical Engineering	Odd
Civil and Environmental Engineering	Odd
Computer Science	Even
Electrical Engineering	Odd
Industrial & Manufacturing Engineering	Odd
Materials Engineering	Even

Mechanical Engineering Even

- d. Should a vacancy occur from among the departmental representatives, the Committee shall immediately notify the Chair of the department concerned which then must elect a new member within one month to fill out the term of the vacated position.
- e. New members elected according to procedure (d) above shall take office immediately upon their election. Their term of office shall be the remainder of the term of office of the original member replaced.
- f. If the Chairman's position becomes vacant, the vacancy shall be filled according to the preceding rules, after which the committee shall elect a new chairperson.