

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

FACULTY MEETING

Friday, March 6, 2020 10:30 A.M. EMS E180

AGENDA

I. DEAN UPDATE

II. ANNOUNCEMENTS

- A. IT Purchasing Changes
- B. Microsoft Teams Telephony – See Attachment 1
- C. Update on Navigate
- D. UWM Police Safety Presentation

III. INFORMAL REPORTS – See Attachment 2

- A. Opportunity for questions regarding Informal Reports

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

V. AUTOMATIC CONSENT BUSINESS

- A. Minutes of the December 13, 2019 meeting
- B. New Course and Course Changes – See Attachment 3
- C. Industrial and Manufacturing Engineering Program Change – See Attachment 4
- D. Applied Math and Computer Science Program Change – See Attachment 5
- E. Biomedical Engineering Program Change – See Attachment 6

VI. NEW BUSINESS

- A. Establishment of a Biomedical Engineering Honors Designation – See Attachment 7
- B. Electrical Engineering Ph.D. Request for Authorization – See Attachment 8

VII. GENERAL DISCUSSION

VIII. ADJOURNMENT

John R. Reisel, Secretary
CEAS Faculty

JRR
Attachments

Microsoft Teams: UWM “Individual User” Telephony
February 11, 2020

I. Overview

In a campus-wide project, UWM will be moving from its obsolescent analogue telephone service to a comprehensive, unified communication/collaboration tool suite from Microsoft, **Teams**.

A service integrated with Office 365, the Teams suite will deliver services including digital telephone, audio- and video-conferencing, and instant messaging.

The Teams platform includes services historically provided by “**Skype for Business**,” a product that Microsoft has recently announced will be retired.

II. Phone Lines for Individual Faculty and Staff Users

On April 2, 2020, each UWM faculty and staff member will receive an individual Teams telephone number.

Not included in the Teams phone number rollout on April 2, 2020: Emeritus, sponsored accounts, students, student employees, Teaching Assistants, and other student employment positions.

Subsequent phases of the Teams project will address “departmental/shared phones” and “call center” phones.

Number “Porting”:

If a user has an individual UWM campus telephone number: during the rollout process, they will need to decide by April 30, 2020 whether they wish to (a) retain their current individual campus phone number; or (b) adopt their new Teams phone number.

Faculty or Staff “Use Case”	Result
Currently do not have a University-provided phone	You will receive a Teams phone number
Have an individual University-provided landline/desk (Centrex) phone	You will receive a Teams phone number and have a choice to retain your number or switch to the Teams number
Use a shared or departmental phone	You will receive a Teams phone number; the shared or department phone will stay active until the next phase of this project
Have a University-provided cell phone	You will receive a Teams phone number in addition to your University-provided cell phone

If individual UWM faculty and staff have questions about their particular phone “use case,” they should contact Telephone Services at (414) 229-5800 or telephone@uwm.edu.

Telephony Device:

- Faculty and staff will be able to pick up a University-provided corded **Jabra 40 headset** from the UWM TechStore with their UWM ID card. More information and the date when you can begin to pick up a headset will be communicated during the rollout.
- Additional device types will be available to purchase -- with departmental funds
 - Desk phone
 - Wireless option
- Only those telephony devices on UWM’s “recommended list” will be permitted.

III. Teams Calling

- Users may answer and make calls from any device upon which the Teams app is installed
- If an individual has been saved as a “contact,” that contact may be called with one click
- 4-digit extensions will no longer be supported
 - Users will need to dial UWM’s full 7-digit phone number, or click on their contact
- Voicemail will be set up automatically and will transcribe messages and will send users an email with an audio file and transcription

IV. How to Prepare for Teams

- Start using **Teams** today!
 - Faculty and staff already have access to Teams and can use it for online chat, virtual meetings, content collaboration and so much more. We have a variety of online resources designed to help you get started: uwm.edu/teams.
- Attend a **Demo**:
 - Want to see how calling works with Teams? We have several demonstrations planned and will be adding more throughout the spring semester. All dates can be found on our website: uwm.edu/teamsproject
 - February 12, 9-10 am, END 103
 - February 18, 1-2 pm, EMS E180
 - February 24, 1-2 pm, Union 191
 - February 26, noon-1 pm, ENG 105
 - March 3, 11 am-noon, CURT 175
- Teams **Drop-In**:
 - Have a question and need a little guidance? Stop by a Teams Drop-In and quickly get the help you need.
 - April 7, noon-2 pm, Bolton 230
 - April 9, 10 am-noon, Bolton 230
 - April 13, 10 am-noon Bolton 230
- Take a **Free Course**:
 - If you are interested in hands-on training and a more in-depth look at using Teams, please sign up for one of our free courses:
 - uwm.edu/learningtechniques

INFORMAL REPORTS

Office of Student Services – Todd Johnson
No Report

Career Services – Juli Pickering
No Report

Curriculum Committee – Prof. A. Rahman
No Report

Graduate Program Committee – Prof. Suzuki
Several CIM forms for courses were approved for consideration at this faculty meeting.

Academic Planning Committee – Prof. Patrick
No Report

Faculty Senate – Prof. Reisel

In its January meeting, the Faculty Senate met with Ray Cross, the outgoing President of the UW System. President Cross discussed various issues regarding the state of the UWM System. In the February meeting, the Senate heard reports on University Relations, the Office of Sustainability, and about the 2030+ Thinktank.

ATTACHMENT 3

NEW COURSE:

CIV ENG 525 MULTIPHYSICS FINITE ELEMENT ANALYSIS, U/G, 3 cr.
Students will learn software application to simulate single and multiphysics: heat transfer (thermo-), pore water movement (hydro-), concentration field (concentro or diffuso/convecto/advecto), flow in porous medium, stress and strain (mechano-), dynamics (dyno-), chemical reactions (chemo-)
Prereq: CivEng 463, or ME 463 or an equivalent Introduction to finite Element course

COURSE CHANGES (changes indicated in red and strikethrough)

BME 320 ENGINEERING OF BIOMEDICAL DEVICES I, U, 4 cr.
Physiological and biomechatronic systems, sensors and actuators, signal processing, hearing aid and implants. Laboratory experiments sessions included.
Prereq: jr st, BME 101(P) and BME ~~302(P)~~ **302(C)** or BME 101(P) and **MECHENG 302(C)**. ~~302(P)~~.

CIV ENG 725 **ADVANCED FINITE ELEMENT FORMULATION METHODS IN ENGINEERING**, G, 3 cr.
Formulation and assembly of **stiffness matrix**. ~~finite elements~~. Tools in numerical analysis, interpolation, integration. **Plates, two-dimensional, 3D solids, and parametric formulation problems. generalized field problems, nonlinearity of materials and/or geometry, transient and dynamics analysis.** ~~Trusses, beams, plates, two-dimensional problems. Generalized field problems: heat transfer, fluid flow. Emphasis on practical application~~
Prereq: Civ Eng 463, or MECHENG 463, or an equivalent introductory course in finite element method ~~grad-st~~

COMPSCI 317 DISCRETE INFORMATION STRUCTURES, U, 3 cr.
Introductory discussion of logic, proof techniques, sets, functions, relations, combinatorics, probability, and graphs.
Prereq: Math Placement Level 40 ~~grade of C~~ or **45, or earn a level 35 on the Math Placement test, or earn a C** or better in **Math 116(P) or 211(P); grade of C or better** in CompSci 250(P).

COMPSCI 535 ALGORITHM DESIGN AND ANALYSIS, U/G, 3 cr.
Introduction to abstract data structures, analysis of time and space requirements of numerical and non-numerical algorithms methods for data manipulation.
Prereq: jr st; Math 211(P), 213(P), 221(P) or 231(P); C or better in ~~both~~ **CompSci 351(P) and either CompSci 317(P) or both of Math 341(P) and MthStat 361(P).** ~~& 351(P)~~.

- IND ENG 475 SIMULATION METHODOLOGY, U/G, 3 cr.
Fundamentals of ~~discrete-event~~ discrete simulation. Random number and random variable generation for simulation modeling and analysis using simulation software.
Prereq: Ind Eng ~~367(P)~~, ~~467(P)~~, CompSci ~~240(C)~~. ~~201(C)~~.
- IND ENG 580 ERGONOMICS, U/G, 3 cr.
Broad study of ergonomics principles and stresses in design and analysis of workplaces and physical environment; 2 hrs lec & 2 hrs lab/week.
Prereq: CIV ENG 201, IND ENG 367, IND ENG 470 jr-st.

ATTACHMENT 4

Industrial and Manufacturing Engineering B.S. Program Changes

See the following pages for the summary of the changes and the new curriculum sheet.

INDUSTRIAL ENGINEERING, BSE

In Workflow

1. CIM Registrar's Office (chinn@uwm.edu; ebilicki@uwm.edu)
2. CEAS Dean Programs (johnsont@uwm.edu; munson@uwm.edu)
3. Academic Affairs (candres@uwm.edu)
4. APCC Chair (candres@uwm.edu)
5. Provost's Office (candres@uwm.edu)
6. CAT Reminder (ebilicki@uwm.edu; chinn@uwm.edu; tarr@uwm.edu)

History

1. Aug 18, 2018 by clmig-jwehrheim
2. May 20, 2019 by Wilkistar Otieno (otieno)

Date Submitted: Fri, 14 Feb 2020 03:35:38 GMT

Viewing: Industrial Engineering, BSE

Last approved: Mon, 20 May 2019 16:15:57 GMT

Last edit: Fri, 14 Feb 2020 03:35:23 GMT

Changes proposed by: otieno

Is this a proposal to create a new submajor or concentration?

No

Title of program:

Industrial Engineering, BSE

Program Level:

Undergraduate Only

Program Type:

Major

Department or Functional Equivalent

Units:

Industrial and Manufacturing Engineering

College, School, or Functional Equivalent

Units:

College of Engineering and Applied Science

College, School, or Functional Equivalent Contact Information:

otieno@uwm.edu;

Proposed Effective Catalog:

2019-2020

Proposed Effective Term:

2199

Minimum Credit Hours Required:

120

Summary of proposed changes or request:

The following change is proposed:

1. Changed of total credits requirements from 125 to 120
2. Engineering Core course credits from 26 to 24.
3. In the engineering core box:
 - a) Deleted Civ Eng 202 Dynamics
 - b) Replaced Civ Eng 201 Statics with Civ Eng 203 Intro to Solid Mechanics and make Math 232 a co-requisite. Civ Eng 201 or 202 may also count toward Civ Eng 203 (to allow flexibility for transfer).

c) Removed Comp Sci 240 Intro to programming and replace with Comp Sci 202 Introduction to python. However, a student may chose to take (transfer) all other programming courses in place of Comp Sci 202. These courses include: Comp Sci 151, 240, 250, and ME 101

4. In the Industrial Engineering major box:

- a) Added Ind Eng 370 as a pre-requisite for Ind Eng 465 to increase student success and performance in 465
- b) Added all other programming courses in bullet 3(c) as alternative pre-requisites for Ind Eng 475
- c) Added all other Civ Eng Courses in 2(b) as alternative pre-requisites for Ind Eng 580

4. In the Mathematics requirements:

Added a footnote that Math 234 can count toward Elec Eng 234

5. In the Natural Sciences Box .

- a) Reduced the number of credits from 16-18 to 13.
- b) Removed the Chem 104 requirement
- c) Removed the Natural Science Elective requirement
- d) Increased free electives from 4 to 7

6. In the Tech Electives Box;

- a) Removed the Ind Eng 584 which is no longer offered
- b) Removed Bus Adm 330 to allow for the addition of a supply chain course following student feedback
- c) Removed Bus Adm 473 which is no longer being offered
- d) Added Bus Adm 370 which requires a statistics course hence the need to make 367 a pre-requisite
- e) Added a footnote to Study abroad credits to allow for 3 to 6 credits in order to be uniform with other departments in CEAS.

Program Curriculum (for the Catalog)

Industrial Engineering Curriculum

The minimum number of credits required to complete the Bachelor of Science in Engineering with a major in industrial engineering is 120. Engineering students may apply for major status with their academic advisor at any time they believe they meet the requirements. Admission to major is a graduation requirement. Programs may impose major status as a prerequisite for courses numbered 200 or above.

Code	Title	Credits
Engineering Core		
CIV ENG 203	Introduction to Solid Mechanics	4
EAS 200	Professional Seminar	1
COMPSCI 202	Introductory Programming Using Python (Added python to replace CompSci 240 (matlab))	3
ELECENG 301	Electrical Circuits I	3
IND ENG 111	Introduction to Engineering ¹	3
IND ENG 112	Engineering Drawing & Computer Aided Design/Drafting ¹	3
IND ENG 360	Engineering Economic Analysis	3
MATLENG 201	Engineering Materials	4
Major Requirements		
IND ENG 350	Manufacturing Processes	3
IND ENG 367	Introductory Statistics for Physical Sciences and Engineering Students	3
IND ENG 370	Introduction to Operations Analysis	3
IND ENG 455	Operations Research I	3
IND ENG 465	Operations Research II	3
IND ENG 470	Methods Engineering	3
IND ENG 475	Simulation Methodology	3
IND ENG 485	Senior Design Project	3
IND ENG 571	Quality Control	3
IND ENG 575	Design of Experiments	3
IND ENG 580	Ergonomics	3
IND ENG 583	Facility Layout and Material Handling	3
Mathematics Requirement ²		
Select one of the following Calculus sequences:		10-12
Sequence 1:		
MATH 231 & MATH 232 & MATH 233	Calculus and Analytic Geometry I and Calculus and Analytic Geometry II and Calculus and Analytic Geometry III	
Sequence 2:		

MATH 221 & MATH 222	Honors Calculus I and Honors Calculus II	
ELECENG 234	Analytical Methods in Engineering (Math 234 can preplace Elec Eng 234)	4
Natural Science Requirement		
Select one of the following options:		8-10
Option 1:		
CHEM 102 & CHEM 104	General Chemistry and General Chemistry and Qualitative Analysis	
Option 2:		
CHEM 105	General Chemistry for Engineering	
Approved Natural Science Elective (Minimum 3 credits) ³		
PHYSICS 209 & PHYSICS 210	Physics I (Calculus Treatment) and Physics II (Calculus Treatment)	8
GER Distribution Requirement		
Arts		3
Humanities		3
Social Science		6
ENGLISH 310	Writing, Speaking, and Technoscience in the 21st Century	3
Cultural Diversity - Arts, Humanities, or Social Science course must also satisfy UWM Cultural Diversity Requirement		
Free Electives		
Select 7 credits		4
English Composition Requirement		
Satisfied by one of the following: ²		0-6
Earning a satisfactory score on the English placement test; or		
Earning a grade of C or higher in ENGLISH 102; or		
Transferring a grade of C or higher in a course equivalent to ENGLISH 102 or higher expository writing course; or		
Foreign Language Requirement		
Satisfied by one of the following:		0-8
Two years of a single foreign language in high school;		
Two semesters of a single foreign language in college; or		
Demonstrate ability by examination.		
1	MECHENG 110 and MECHENG 111 may substitute for IND ENG 111 and IND ENG 112 for transferring students.	
2	Placement Examinations. Once admitted to UWM, most engineering students are required to take placement examinations in mathematics, English, and chemistry. Students with previous college-level credits in these areas may not be required to take placement exams. The placement exams are administered by the UWM Testing Center, Mellencamp Hall, Room B28, (414) 229-4689. The results of these tests help students determine the appropriate course in which to register. Background prerequisite courses may be required in addition to the courses listed above.	
3	Approved Natural Science Elective Courses	
	<ul style="list-style-type: none"> • Atmospheric Science 100 level or above • BIO SCI 150 or above • CES 210 • GEO SCI 100, GEO SCI 102, GEO SCI 150 or above • MATH 240 or MATH 300 level or above • Physics 300 level or above 	

Technical Electives

The industrial engineering program requires a total of 12 credits of technical electives, chosen from the following list. At least 6 credits must be in courses from IND ENG. All non-required IND ENG courses numbered 400-699 are approved technical electives.

Code	Title	Credits
Select at least 9 credits of the following:		
IND ENG 390	Senior Thesis	6-12
IND ENG 405	Product Realization	
EAS 497	Study Abroad:	
IND ENG 550	Control of Automated Manufacturing Systems	
IND ENG 572	Reliability Engineering	
IND ENG 582	Ergonomic Job Evaluation Techniques	
IND ENG 587	Lean Production Systems	
IND ENG 590	Topics in Industrial and Systems Engineering:	
IND ENG 699	Independent Study	

EAS 1	Engineering Co-op Work Period ¹	
BUS ADM 370	Introduction to Supply Chain Management (This course has a Business statistics prerequisite. The probability and statistics course Ind Eng 367 will count as the prerequisite)	3
MECHENG 301	Basic Engineering Thermodynamics	
MECHENG/ELECENG 474	Introduction to Control Systems	

¹ This option is open only to students who earn 3 or more credits of Co-op.

This change affects the following types of students (check all that apply):

- Continuing students
- New freshmen/transfers
- Reentry students
- Second degree/new major students
- Special students

Does this program request require a new program code?

No

Does this program request require a new plan code?

No

Does this program request require a new subplan code?

No

Is this a change to eliminate a program?

No

Key: 218

University of Wisconsin – Milwaukee
College of Engineering and Applied Science
INDUSTRIAL ENGINEERING CURRICULUM

The minimum number of credits required to complete the Bachelor of Science in Engineering with a major in Industrial Engineering is 120 credits. Students who need background preparation courses may need additional credits. See information below regarding placement examinations.

Engineering Core Courses (24 credits)

	<u>Credits</u>	<u>Prerequisite</u>	
EAS 100	CEAS Freshman Orientation (recommended only)	1	None
EAS 200	Professional Seminar	1	None
Ind Eng 111 ¹	Introduction to Engineering	3	Math 116(C), Admission to CEAS
Ind Eng 112 ¹	Engineering Drawing & CAD/Drafting	3	Math 116, Admission to CEAS
Ind Eng 360	Engineering Economic Analysis	3	Jr St
Civ Eng 203 ²	Introduction to Solid Mechanics	3	Math 232 (C)
Comp Sci 202 ³	Introductory Programming Using Python	3	Math Placement or Math 116
Elec Eng 301	Electrical Circuits I	3	Physics 210 (C)
Matl Eng 201	Engineering Materials	4	Chem 102 or 105

¹Mech Eng 110 & 111 may substitute for Ind Eng 111 & 112 for transferring students.

²Civ Eng 201, and Civ Eng 202 may substitute for Civ Eng 203

³Comp Sci 151, Comp Sci 202, Comp Sci 240, Comp Sci 250 or ME 101 may substitute for Comp Sci 202

Industrial Engineering Major (36 credits)

Ind Eng 350	Manufacturing Processes	3	MatlEng 201
Ind Eng 367	Intro Statistics for Physical Sciences & Engineering	3	B- or better Math 211 or 213; C or better Math 221 or 231
Ind Eng 370	Introduction to Operations Analysis	3	Math 233
Ind Eng 455	Operations Research I	3	Jr St, Math 233
Ind Eng 465	Operations Research II	3	Jr St, Ind Eng 367, Ind Eng 370
Ind Eng 470	Methods Engineering	3	Jr St, Ind Eng 367
Ind Eng 475	Simulation Methodology	3	CompSci 151, 202, 240, 250 or ME 101 (C), Ind Eng 367
Ind Eng 485	Senior Design Project	3	Sr St, Ind Eng 370, 455, 475, 465(C) 470(C), 571(C), 580(C), 583(C)
Ind Eng 571	Quality Control	3	Jr St, Ind Eng 367
Ind Eng 575	Design of Experiments	3	Ind Eng 367
Ind Eng 580	Ergonomics	3	Sr St, Civ Eng 203 (or Civ Eng 201)
Ind Eng 583	Facility Layout & Material Handling	3	Sr St, Ind Eng 370, 455 (C)

Mathematics (14-16 credits)

One of the following **Calculus** sequences must be completed:

Math 231-232-233	12	Math placement score, or previous course with at least "C" grade
Math 221- 222 (Honors)	10	
And Elec Eng 234 ¹ Analytical Methods in Engineering	4	Math 232*

¹ Math 234 can substitute Elec Eng 234

(16 credits typical: Math 231,232,233, ElecEng 234)

Natural Science Requirement (13 credits)

Chem 102	5	Chem 100* or Chemistry Placement; Math 105* or 108*
or		
Chem 105 and	5	
Physics 209 – 210	8	Physics 209: Math 232(C) Physics 210: Math 233(C), C- or better in Physics 209

General Education Requirements

Distribution Requirements (15 credits)

Art	3		
Humanities	3		
Social Science	6		
English 310	Writing, Speaking & Technoscience in the 21 st Century	3	English Competency
Cultural Diversity – One of the arts, humanities, or social science courses selected must also meet the UWM cultural diversity requirement.			

Free Elective

7

Competency Requirements

English Composition (0-6 credits)

The English Composition requirement is satisfied by:

- Earning a satisfactory score on the English placement test, **or**
- Earning a grade of C or higher in English 102, **or**
- Transferring a grade of C or better in a course equivalent to English 102 or higher level expository writing course

Foreign Language (0-8 credits) (for new freshman starting fall 1999)

The foreign language requirement can be completed with one of these options:

- Two years of a single foreign language in high school
- Two semesters of a single foreign language in college
- Demonstrate ability by examination

***C or better in prerequisite**

(C) Concurrent Enrollment in Designated Course

Admission to Major: 1. Complete Math 231 (or 221) with C or better grade. 2. Complete the English composition requirement (OWCA) 3. Complete Chem 100 with C or better grade or satisfactory placement score. 4. Obtain a minimum GPA as set by the department. A 3.00 GPA guarantees admission to any CEAS major. Courses may be repeated only once. No more than two courses may be repeated.

The program may impose major status as a prerequisite for courses numbered 200 or above.

^^Placement Examinations: Students without previous college level credits in Math, Chemistry or English may be required to take placement exams. The results of these tests determine the appropriate course in which to register. Background prerequisite courses may be required in addition to the courses listed above.

Technical Electives – Industrial Engineering Major

The Industrial Engineering program requires a total of 9 credits of technical electives, chosen from the following list. At least 6 credits must be in courses from Ind Eng. All non-required IND ENG courses numbered between 400 and 699 are approved technical electives.

		<u>Credits</u>	<u>Prerequisite</u>
Ind Eng 390	Senior Thesis	1- 3	Sr St, Cons Instr
Ind Eng 405	Product Realization	3	Jr St, Ind Eng 350, 360, 370
Ind Eng 550	Control of Automated Manufacturing Systems	3	Jr St, ElecEng 234, 301
Ind Eng 555	Manufacturing Systems Integration	3	Jr St, Ind Eng 450(R)
Ind Eng 572	Reliability Engineering	3	Jr St, Ind Eng 467
Ind Eng 582	Ergonomic Job Evaluation Techniques	3	Sr St, Ind Eng 580
Ind Eng 587	Lean Production Systems	3	Ind Eng 350
Ind Eng 590	Topics in Industrial & Systems Engineering	1-3	Sr St
Ind Eng 699	Independent Study	1-3	Jr St, Cons Instr
Bus Adm 370	Introduction to Supply Chain Management	3	Jr St, Ind Eng 367
EAS 001	Co-op Work Period	3 ²	Prior Cons Co-op Dir
MechEng 301	Basic Engineering Thermodynamics	3	Math 233, Physics 209
MechEng 474/ ElecEng 474	Introduction to Control Systems	4	Sr St, Civ Eng 202*, ElecEng 234*, 301
EAS 497	Study Abroad Program	3 ²	Acceptance to a Study Abroad Program

²This option is only open to students who earn **3 or more** credits of Co-Op or study abroad

Approved Natural Science Elective Courses

Atmospheric Science (100 level or above)
 Biological Sciences (150 or above)
 Physics (300 level or above)
 Conservation & Environment Studies 210
 Geosciences (100, 102, 150 or above)
 Math (240, 300 or above)

***C or better in prerequisite**

(C) Concurrent Enrollment in Designated Course

**College of Engineering and Applied Science
 University of Wisconsin – Milwaukee
 P.O. Box 784
 Milwaukee, WI 53201**

Office of Student Services (414) 229-4667
 Engineering & Mathematical Science Building (EMS) Room E386

Department of Industrial and Manufacturing Engineering (414) 229-4967
 Engineering & Mathematical Science Building (EMS) Room 584

Web Site: www.ceas.uwm.edu

Applied Math and Computer Science Program Change

Rather than requiring CompSci 317, students make take CompSci 317 OR both Math 341 and Math 361.

Rationale: If an AMCS student takes Math 341 (required) and MthStat 361 (elective), then they have covered most of the material taught in CompSci 317.

Biomedical Engineering B.S. Program Change

Viewing: **Biomedical Engineering, BSE**

Last approved: Sat, 18 Aug 2018 14:34:34 GMT

Last edit: Thu, 07 Nov 2019 17:36:31 GMT

Reviewer Comments

Is this a proposal to create a new submajor or concentration?

No

Title of program:

Biomedical Engineering, BSE

Program Level:

Undergraduate Only

Program Type:

Major

Mode of Delivery:

Department or Functional Equivalent

	Units:
Biomedical Engineering	

College, School, or Functional Equivalent

	Units:
College of Engineering and Applied Science	

College, School, or Functional Equivalent Contact Information:

Proposed Effective Catalog:

Proposed Effective Term:

Minimum Credit Hours Required:

Summary of proposed changes or request:

Program Curriculum (for the Catalog)

(a) Biomedical Engineering Curriculum

The minimum number of credits required to complete the Bachelor of Science in Biomedical Engineering is 120. Students who need background preparation courses in math, English, and foreign language may need additional credits. Students must maintain an average GPA of at least 2.0 on all work attempted at the University and in all courses offered by the College. Engineering students may apply for major status with their academic advisor at any time they believe they meet the requirements. Students majoring in Biomedical Engineering must maintain an average GPA of at least 2.0 in all 300-level required major courses. Transferable courses will be included as appropriate. Advancement to major status is required for

graduation. Programs may impose major status as a prerequisite for courses numbered 200 or above.

Code	Course List Title	Credits
Engineering Core		
BME 101	Fundamentals of Biomedical Engineering	3
CIV ENG 201	Statics	3
CIV ENG 202	Dynamics	3
EAS 200	Professional Seminar	1
ELECENG 301	Electrical Circuits I	3
ELECENG 305	Electrical Circuits II	4
MATLENG 201	Engineering Materials	4
MECHENG 101	Computational Tools for Engineers	2
MECHENG 301	Basic Engineering Thermodynamics	3
Major Requirements		
BIO SCI 202	Anatomy and Physiology I	4
BIO SCI 203	Anatomy and Physiology II	4
Bio Sci 465	Biostatistics	3
or		
IndEng 367	Intro. Statistics for Physical Science & Engineering Students	3
KIN 270	Statistics in the Health Professions: Theory and Practice	3
BME 302	Analysis and Modeling of Dynamic Systems	4
BME 305	Introduction to Engineering Biomechanics	3
BME 310	Biomedical Signals and Systems	3
BME 320	Engineering of Biomedical Devices I	4
BME 325	Engineering of Biomedical Devices II	3
BME 385	Introduction to Biomaterials	3
BME 495	Biomedical Instrumentation Laboratory	3
BME 595	Capstone Design Project	4
ElecEng 310	Signals & Systems	3
Mathematics Requirement (14 to 16 credits) ¹		
Select one of the following Calculus sequences:		10-12
Sequence 1:		
MATH 231	Calculus and Analytic Geometry I	
& MATH 232	and Calculus and Analytic Geometry II	
& MATH 233	and Calculus and Analytic Geometry III	
Sequence 2:		
MATH 221	Honors Calculus I	
& MATH 222	and Honors Calculus II	
ELECENG 234	Analytical Methods in Engineering	4
Physics Requirement		
PHYSICS 209	Physics I (Calculus Treatment)	
& PHYSICS 214	and Lab Physics I (Calculus Treatment)	5
PHYSICS 210	Physics II (Calculus Treatment)	
& PHYSICS 215	and Lab Physics II (Calculus Treatment)	5
GER Distribution Requirement		

Course List		
Code	Title	Credits
Arts		3
Humanities		3
Social Science		6
ENGLISH 310	Writing, Speaking, and Technoscience in the 21st Century	3
Cultural Diversity - Arts, Humanities, or Social Science course must also satisfy UWM Cultural Diversity Requirement		
English Composition Requirement ¹		
The English Composition requirement is satisfied by:		0-6
Earning a satisfactory score on the English placement test; or		
Earning a grade of C or higher in ENGLISH 102 ; or		
Transferring a grade of C or higher in a course equivalent to ENGLISH 102 or higher expository writing course		
Foreign Language Requirement		
The foreign language requirement can be completed with one of these options:		0-8
Two years of a single foreign language in high school;		
Two semesters of a single foreign language in college; or		
Demonstrate ability by examination.		

¹**Placement Examinations.** Once admitted to UWM, most engineering students are required to take placement examinations in mathematics, English, and chemistry. Students with previous college-level credits in these areas may not be required to take placement exams. The placement exams are administered by the UWM Testing Center, Mellencamp Hall, Room B28, (414) 229-4689. The results of these tests help students determine the appropriate course in which to register. Background prerequisite courses may be required in addition to the courses listed above.

Technical Electives

The Biomedical Engineering program requires a total of 15 credits of technical electives, chosen from the following list¹:

Course List		
Code	Title	Credits
BIO SCI 150	Foundations of Biological Sciences I	4
BIO SCI 152	Foundations of Biological Sciences II	4
BIO SCI 354	Introduction to Neuroscience I: From Neuron to Brain	3
BIO SCI 355	Introduction to Neuroscience II: From Brain to Behavior	3
BME 437	Introduction to Medical Instrumentation	3
BME 439	Introduction to Biomedical Optics	3
BME 585	Advanced Biomaterials	3
BME 599	Senior Thesis	3
BME 690	Topics in Biomedical Engineering:	3
BME 699	Independent Study	1-3
BUS ADM 447	Entrepreneurship	3
CHEM 102	General Chemistry	5
CHEM 104	General Chemistry and Qualitative Analysis	5
CHEM 343	Organic Chemistry	3
CHEM 344	Organic Chemistry Laboratory	2

Code	Course List Title	Credits
CHEM 345	Organic Chemistry	3
CIV ENG 303	Strength of Materials	4
COMPSCI 250	Introductory Computer Programming	3
EAS 1	Engineering Co-op Work Period (Can be retaken for a total of 3 credits.)	1
EAS 497	Study Abroad:	3
ELECENG 361	Electromagnetic Fields	3
ELECENG 410	Digital Signal Processing	3
ELECENG 436	Introduction to Medical Instrumentation	3
ELECENG 437	Introduction to Biomedical Imaging	3
IND ENG 360	Engineering Economic Analysis	3
IND ENG 584	Biodynamics of Human Motion	3
MECHENG 320	Introduction to Fluid Mechanics	3
MECHENG 370	Computer Aided Engineering Laboratory	2
MECHENG 474	Introduction to Control Systems	4
OCCTHPY 593	Introduction to Biomedical and Rehabilitation Instrumentation	3
OCCTHPY 620	Introduction to Assistive and Rehabilitation Technology	3
OCCTHPY 625	Design and Disability	3
PHYSICS 305	Medical Physics	3
PHYSICS 306	Introduction to Biophysics	3
PSYCH 254	Physiological Psychology	3

¹ The following courses are approved technical electives, but are currently inactive: [ELECENG 437](#), ELECENG 438, ELECENG 539.

Plan of Study

Honors

Benchmark

Advancement to Major or Admission

This change affects the following types of students (check all that apply):

New freshmen/transfers

Does this program request require a new program code?

No

Does this program request require a new plan code?

No

Does this program request require a new subplan code?

No

Is this a change to eliminate a program?

No

Should this program be added to any of the following:

A UW System database of majors and programs exists to serve four major system-wide electronic and paper sources of student information. Are there any keywords that can be indicated for this program on the UW System database?

Are there program aliases that can be indicated for this program on the UW System database? Click on the help bubble for additional information.

Attach File

ESTABLISHMENT OF A BIOMEDICAL ENGINEERING HONORS DESIGNATION

HONORS IN THE BME MAJOR

Students in the Biomedical Engineering who meet all of the following criteria can be awarded honors in the major upon graduation:

- I. A 3.000 cumulative GPA in all UWM graded credits;
- II. A 3.500 GPA over all CEAS courses counting toward the BME major;
- III. A 3.500 GPA over all upper-division (300 level and higher) BME courses; and
- IV. At least one of the following:
 - a. Successful completion of 3-cr of research experience via senior thesis (BME 599) and/or an approved independent study (BME 699).
 - b. Participation in accelerated MS program with successful completion of 6 credits in approved courses for the BME concentration in MS in Engineering program.

Students who believe they may qualify for honors in Biomedical Engineering should apply to the College of Engineering & Applied Science during their last semester of study.

**REQUEST FOR AUTHORIZATION TO
IMPLEMENT A DOCTOR OF PHILOSOPHY IN
ELECTRICAL ENGINEERING
AT UNIVERSITY OF WISCONSIN (UW-
MILWAUKEE) PREPARED BY UW-MILWAUKEE**

ABSTRACT

The University of Wisconsin-Milwaukee proposes to establish a Doctor of Philosophy in Electrical Engineering (Ph.D. EE). The undergraduate electrical engineering program at UWM has been present (with some early changes in name) since the inception of the College of Engineering in the 1960s. At the graduate level, currently there is a long-standing, college-wide doctoral program, Ph.D. in Engineering, with tracks in six engineering disciplines and computer science. Each track functions, essentially, as its own individual program. This request is to separate the EE track of the college-wide Ph.D. program into its own program. The need for this program primarily stems from a desire to make the program more attractive to prospective students and enhance graduate placement (the generic Ph.D. in Engineering makes the graduates in the individual tracks less competitive in the job market). The proposed Ph.D. program in Electrical Engineering will essentially be the same as the EE track of the existing college-wide Ph.D. program. Curricular areas will be unchanged, covering typical graduate-level electrical engineering content. No new courses are needed, and no new faculty/staff are needed for this program. There are no planned changes in research foci – current areas of strength include power systems and components, bio-optical imaging, and nanotechnology.

PROGRAM IDENTIFICATION

Institution Name

University of Wisconsin-Milwaukee

Title of Proposed Program

Electrical Engineering

Degree/Major Designations

Doctor of Philosophy

Mode of Delivery Single institution Face-to-face

Projected Enrollments and Graduates by Year Five

The Ph.D. enrollment in the EE portion of the current college-wide Ph.D. program for years 2015-2018 was 38, 43, 44, and 40, for an average of 41 Ph.D. students in the EE portion of the program. Approximately 80% of these students are full-time. We do not expect any significant changes in that number after the EE Ph.D. program becomes a stand-alone program.

Table 1: Five-Year Academic Program Enrollment Projections

Students/Year	Year 1	Year 2	Year 3	Year 4	Year 5
New Students	8	8	8	8	8
Continuing	33	33	33	33	33
Total Enrollment	41	41	41	41	41
Graduating	8	8	8	8	8

There is some attrition in the program due to, e.g., students failing the Ph.D. Qualifying Exam, poor academic performance, visa or funding issues, etc., but the numbers are quite small.

Tuition Structure

Standard tuition and fee rates will apply. For full-time enrollment, a resident student will pay a tuition of \$5,271.28 per semester and segregated fees of \$753.65 for a total of \$6,024.93 per semester. For students enrolling part-time, one-semester resident tuition is \$658.91 per credit and segregated fees are based on the number of credits enrolled. For three-credit enrollment, the resident tuition and segregated fees are a total of \$2,666.52 and for six-credit enrollment the total is \$4681.59. The corresponding nonresident tuition and segregated fees are \$12,641.17 for full-time enrollment, \$5,147.61 for three-credit enrollment, and \$9,643.77 for six-credit enrollment. Segregated fees for non-resident students are the same as the resident rate. There are separate rates for Minnesota w/ Reciprocity and Midwest Student Exchange, which fall between the resident and non-resident rates. Credits taken in the College Engineering and Applied Science are assessed an additional “differential tuition” which is currently \$21.63 per credit. The majority of PhD students in Engineering are graduate assistants and have their tuition remitted.

Department or Functional Equivalent

Department of Electrical Engineering and Computer Science

College, School, or Functional Equivalent

College of Engineering and Applied Science

Proposed Date of Implementation

August 2020

DESCRIPTION OF PROGRAM

Overview of the Program

The program will be comprised of 66 graduate credits beyond the Bachelor’s degree with minimum credit distribution as follows:

- 21 credits in electrical engineering topics
- 9 credits in an approved minor area (within or outside of EE)
- 6 credits in mathematics and/or quantitative methods
- 9 credits of approved electives
- 3 credits of CEAS Graduate Seminar (Ethics and Engineering Communication, EE700)

- A minimum of 26 credits, excluding dissertation, must be at the 700 level or higher
- 18 credits of doctoral thesis
- A minimum of 33 credits (including thesis) must be completed in the Ph.D. program at UWM.

A maximum of 33 credits may be considered for transfer from prior graduate work, including a Master's degree earned at UWM or elsewhere provided the course work taken falls within the appropriate areas and has earned a grade of "B" or better. Students entering the program without an applicable Master's degree are limited to a maximum transfer of 9 credits for courses taken elsewhere.

Student Learning Outcomes and Program Objectives

Learning Outcomes of the EE Ph.D. Program (same as the current college-wide Ph.D. Program):

- Apply advanced knowledge of mathematics, science, and engineering to solve complex problems.
- Use modern tools or techniques to solve complex problems, conduct research, and analyze and interpret data.
- Demonstrate proficiency and competency in the area of specialization.
- Identify, formulate, and solve complex problems with an original and/or significant contribution to the field.
- Demonstrate a familiarity with research in a related or complementary discipline.
- Use quantitative methods appropriate to the field of research.
- Understand academic, professional and ethical responsibility.
- Communicate effectively via technical writing and oral presentations.

Assessment of Outcomes

Outcome (a) is assessed through achievement of the Ph.D. Qualifying Examination.

Outcome (b) is assessed through the dissertation proposal hearing.

Outcome (c) is assessed through the Qualifying Examination and achieving a grade of B or higher in program of study.

Outcome (d) is assessed in the preliminary examination (identify and formulate), in the thesis (solve) and in any published results.

Outcome (e) is assessed through achieving required B or higher average in selected course work (9 minor credits) and in the preliminary examination.

Outcome (f) is assessed in the program of study's inclusion of appropriate course work with a grade of B or higher.

Outcome (g) is assessed in the required ethics and communication course(s) being developed with a grade of B or higher.

Outcome (h) is assessed in the Dissertation Proposal hearing and the Dissertation Defense.

Program Requirements and Curriculum

This proposed program is housed within the College of Engineering and Applied Science (CEAS). It will follow the College's **existing Ph.D. admission requirements**, which are:

- Bachelor's or Master's degree in electrical engineering.
- If you have BS or MS degrees outside of electrical engineering, you may be admitted with

- no more than two course deficiencies.
- Minimum GPA of 3.0 in the highest degree granted based on a 4.0 scale.
- A brief statement describing your professional goals (i.e., Statement of Purpose, SoP) and two letters of reference.
- The Graduate Record Examination (GRE) is required for all international and domestic applicants.
- International students require proof of English language proficiency.

Credits

The electrical engineering doctoral program consists of 66 graduate credits beyond the Bachelor's degree, as described above. Courses are chosen by the student in consultation with her/his advisors. The number of credits and scope of the course work is comparable to other institutions (UW-Madison EE doctoral program requires 51 credits, whereas Univ. of Minnesota EE doctoral program requires 64 credits).

Course format

In general, courses will be offered face-to-face; however, a few courses are delivered online.

Graduate Course List

ELECENG 410G Digital Signal Processing
ELECENG 420G Random Signals and Systems
ELECENG 421G Communication Systems
ELECENG 430G Energy Modeling
ELECENG 436G Introduction to Medical Instrumentation
ELECENG 437G Introduction to Biomedical Imaging
ELECENG 439G Introduction to Biomedical Optics
ELECENG 451G Introduction to VLSI Design
ELECENG 457G Digital Logic Laboratory
ELECENG 458G Computer Architecture
ELECENG 461G Microwave Engineering
ELECENG 462G Antenna Theory
ELECENG 464G Fundamentals of Photonics
ELECENG 465G Broadband Optical Networks
ELECENG 471G Electric Power Systems
ELECENG 472G Introduction to Wind Energy
ELECENG 474G Introduction to Control Systems
ELECENG 481G Electronic Materials
ELECENG 482G Introduction to Nanoelectronics
ELECENG 490G Topics in Electrical Engineering:
ELECENG 541G Integrated Circuits and Systems
ELECENG 545G FPGA Embedded CPUs & Firmware Development
ELECENG 562G Telecommunication Circuits
ELECENG 565G Optical Communication
ELECENG 568G Applications of Digital Signal Processing
ELECENG 572G Power Electronics
ELECENG 574G Intermediate Control Systems
ELECENG 575G Analysis of Electric Machines and Motor Drives
ELECENG 588G Fundamentals of Nanotechnology
ELECENG 699G Independent Study
ELECENG 700 CEAS Graduate Seminar

ELECENG 701 Advanced Linear System Analysis
ELECENG 710 Artificial Intelligence
ELECENG 711 Introduction to Machine Learning
ELECENG 712 Image Processing
ELECENG 713 Computer Vision
ELECENG 716 Tomography: Imaging and Image Reconstruction
ELECENG 717 Tomography: Image Quality and Artifact Correction
ELECENG 718 Nonlinear Control Systems
ELECENG 721 Digital Communications
ELECENG 733 Sensors and Systems
ELECENG 737 Medical Imaging Signals and Systems
ELECENG 741 Electromagnetic Fields and Waves
ELECENG 742 Electromagnetic Wave Theory
ELECENG 755 Information and Coding Theory
ELECENG 758 Advanced Computer Architecture
ELECENG 760 Computer Systems Performance Evaluation
ELECENG 762 Fault-Tolerant Computing
ELECENG 765 Introduction to Fourier Optics and Optical Signal Processing
ELECENG 766 Introduction to Nonlinear Optics
ELECENG 781 Advanced Synchronous Machinery
ELECENG 810 Advanced Digital Signal Processing
ELECENG 816 Optimal Control Theory
ELECENG 819 Adaptive Control Theory
ELECENG 872 Computer Analysis of Electric Power Systems
ELECENG 880 Bioengineering Seminar
ELECENG 888 Candidate for Degree
ELECENG 890 Special Topics:
ELECENG 990 Masters Thesis
ELECENG 998 Doctoral Thesis
ELECENG 999 Advanced Independent Study

(b) Program Requirements (the following are UWM Graduate School requirements)

Major Professor as Advisor

The Graduate School requires that the student must have a major professor to advise, supervise, and approve the program of study before registering for courses. The GPSC or its delegates will assign the incoming student to an initial Program Advisor at the time of admission. Prior to the completion of 12 credits (9 credits for part-time students), the student must select a major professor who will be the student's thesis advisor. The student, in consultation with the major professor, develops a proposed program of studies which is submitted to the Graduate Program Subcommittee for approval. For subsequent changes, the student must file a revised program of study for approval.

Foreign Language

There is no foreign language requirement for the degree.

Residence

The program residence requirement is satisfied either by completing 8 or more graduate credits in two consecutive semesters, exclusive of summer sessions, or by completing 6 or more graduate credits in each of three consecutive semesters, exclusive of summer sessions.

Qualifying Examination

Each student in the program must take and pass a Qualifying Examination to demonstrate that the student is qualified for doctoral-level work. The Qualifying Examination is a written exam and is structured in two parts: Part 1 and Part 2. The examination is offered twice a year during the regular academic year. The content of the examination varies among the major areas of the PhD in Engineering program.

Students entering with only a bachelor's degree or with a master's degree in an area unrelated to their major area may take the Qualifying Examination for the first time after earning 12 credits of graduate work at UWM and must successfully pass the exam before earning 30 credits of graduate work at UWM.

Students admitted after completing an appropriate master's degree must take this examination no later than the semester immediately after 18 credits of graduate work have been earned at UWM.

A student may take the Qualifying Examination twice. On the first attempt, the student must attempt both Part 1 and Part 2 of the examination.

- If the student passes both parts, then the student has passed the entire examination and will be permitted to proceed toward the Doctor of Philosophy degree.
- If the student fails both parts, then the student must take the entire exam again at its next offering.
- If a student passes only one of the two parts, then the student must take the examination again at its next offering, but may choose to take only the part of the examination that was not passed on the first attempt.
- If a passing grade is not obtained on the second attempt of the Qualifying Examination, the student will not be permitted to proceed toward the Doctor of Philosophy degree.

A student who fails the qualifying exam twice is subject to dismissal from the PhD in Engineering program. A student may appeal the failure and dismissal within 30 days of being notified of the failure. If the student does not appeal or the appeal is not granted, the College will recommend to the Graduate School that the student be dismissed. A student who is dismissed from the PhD in Engineering program because of failing the qualifying exam may not be enrolled in the PhD in Engineering program for a complete calendar year. This does not preclude the student from being enrolled in any other degree program offered by the University. A student who wishes to re-enroll in the program after a calendar year has passed must apply as any other student would, including payment of fees. A student readmitted after having failed the qualifying exam twice must take the qualifying exam in the first semester of matriculation and this will count as the student's first attempt at the exam. The student may appeal this requirement prior to the first scheduled day of classes. If the student fails the qualifying exam on this first attempt, the student is permitted the customary second attempt as described above. All appeals must be in writing and directed to the CEAS Associate Dean for Academic Affairs.

Doctoral Program Committee

The Doctoral Program Committee is proposed by the major professor in consultation with the student and the department. The Committee must include at least five graduate faculty (three from major area, one from minor area, and one from any area, including the major and minor areas). The last member may be a person from outside the University (such as another university, a research laboratory, or a relevant industrial partner), provided that person meets Graduate School requirements. The Committee may have more than five members, provided that the majority of the Committee members are from the student's major field.

Doctoral Preliminary Examination

A student is admitted to candidacy only after successful completion of the doctoral preliminary examination conducted by the Doctoral Program Committee. This examination, which normally is oral, must be taken before the completion of 48 credits of graduate work toward the Doctor of Philosophy degree in Engineering and should be taken within the first seven years in the program. Prior to the examination, the student must present a proposal for a doctoral dissertation project. The examination may cover both graduate course material and items related to the proposed dissertation project.

Dissertation and Dissertator Status

The student must carry out a creative effort in the major area under the supervision of the major professor and report the results in an acceptable dissertation. The effort of the student and the major professor to produce the dissertation is reflected in the PhD in Engineering program requirement that the student complete at least 18 credits of doctoral thesis.

After the student has successfully completed all degree requirements except the dissertation, the student may enter Dissertator Status. Achieving Dissertator Status requires successful completion of the Doctoral Preliminary Examination and prior approval of the student's advisor, the Doctoral Program Committee, and the GPSC of a dissertation proposal that outlines the scope of the project, the research method, and the goals to be achieved. Any proposal that may involve a financial commitment by the University also must be approved by the Office of the Dean. After having achieved Dissertator Status, the student must continue to register for 3 credits of doctoral thesis per semester during the academic year until the dissertation is completed.

Dissertation Defense

The final examination, which is oral, consists of a defense of the dissertation project. The doctoral defense examination may only be taken after all coursework and other requirements have been completed. The student must have Dissertator Status at the time of the defense.

Time Limit

All degree requirements must be completed within ten years from the date of initial enrollment in the doctoral program.

Diversity

According to the American Society for Engineering Education (ASEE), in 2018, 14.2% of earned Ph.Ds. in Electrical Engineering in the United States were awarded to women and 17.7% were awarded to persons from ethnic or racial minority groups^[1]. By comparison, currently, in the EE part of the common CEAS Ph.D. program, there are currently 10 female and 28 male students (i.e., 36% female). One of the male students is African American.

Internal and external efforts to maintain diversity in the graduate ranks in this and other STEM related programs have been proposed. The UW-Milwaukee STEM-Inspire, Wisconsin Alliance for Minority Participation, and McNair initiatives seek to improve retention and persistence in science, technology, engineering, and mathematics (STEM) fields of students from underrepresented backgrounds. The proposed EE doctoral program is very supportive of these initiatives, and we plan on continuing our strong support for female and under-represented groups.

Collaborative Nature of the Program

The program allows for a faculty member outside of Electrical Engineering to serve as dissertation supervisor. Typically, these are faculty members in Physics, or in another engineering discipline. In addition, properly-credentialed individuals from outside the UWM faculty may also serve as dissertation supervisors. In this case, properly-credentialed means someone holding a Ph.D. in a relevant science or engineering discipline.

In addition, doctoral students are required to take courses in a minor area, which typically encompasses other engineering disciplines, physical sciences, or mathematics.

Projected Time to Degree

A full-time student with a completed master's degree would typically complete the Ph.D. in 3-4 years. For a student entering with a baccalaureate degree, the time to complete the degree would typically be 4-5 years.

Program Review

According to established UWM policy, the program will be reviewed once after five years, and then every ten years henceforth.

JUSTIFICATION

Rationale and Relation to Mission

The current umbrella Ph.D. program, being focused on research and advanced education, clearly serves the broad UW-Milwaukee mission for discovery, research, and education, and supports the generation of new knowledge for the development and betterment of society. The new, split-off EE program will serve the same purpose.

As discussed above, at present there is a college-wide Ph.D. program in Engineering and Applied Science. The electrical engineering portion of that program has approximately 100 graduate students, divided roughly in half between Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) students. The proposed program is simply to split off the electrical engineering portion of that existing program, to become a Ph.D. in Electrical Engineering. Department faculty feel that this is an appropriate move for several reasons. First, there is some

student reluctance to have a Ph.D. degree that is, officially, in Engineering, rather than in Electrical Engineering. We feel that a more specific degree name would aid in attracting top Ph.D. student candidates to the program. Second, department faculty would like more autonomy in administering the program, including scheduling and evaluation of the Ph.D. Qualifying Exam. Third, having a combined college-wide program makes it difficult to collect data on our (EE) students and graduates, as all Ph.D. students in the college are, officially, in Engineering rather than Electrical Engineering. Related to data collection for our own internal purposes, the presence of a college-wide Ph.D. program adversely affects us in rankings, such as US News and World Reports and similar venues. We do not appear in these rankings of electrical engineering Ph.D. programs simply because we do not have a Ph.D. in electrical engineering (despite the fact that we, essentially, do have such a program of longstanding nature).

Institutional Program Array

As this is really just a continuation of the existing (EE track) of the Engineering Ph.D., there will be no impact on the program array of the institution.

Other Programs in the University of Wisconsin System

In Wisconsin, UW-Madison and UW-Milwaukee are the only two Ph.D. granting institutions. We do not expect that this program will have any effect on the EE Ph.D. program in Madison. Our student pool is largely drawn from two groups. One is engineers working in industry in Milwaukee. They choose UWM because it is convenient, and for them, Madison is too far to commute. The creation of a stand-alone EE Ph.D. program will not affect these students. The other main group is foreign students, but our program and the program at Madison have different admission criteria (which is the current situation, and which will not change in the proposed program). As such, it is clear that the proposed program will neither produce unnecessary duplication within the UW System, nor impact the program at Madison.

Need as Suggested by Current Student and Market Demand

Having had an average of 41 Ph.D. students in the EE portion of the program in recent years (a number which has been relatively stable for a considerable time), there seems to be a clear need for the program.

As a representative example, in the 2017-2019 span, there were 16 Ph.D. graduates in the EE portion of the Engineering Ph.D. program, for an average of approximately five per year. The following lists what they did immediately upon graduation:

Eight graduates went to work in industry (Johnson Controls, Rockwell Automation, Marshfield Clinic, Milwaukee Tool, Eaton Corporation, ASML HMI, Qlarant, Alta Devices). Four graduates became Post-Docs (Cornell, University of Calgary, University of Illinois at Urbana–Champaign, UW Madison). Two graduates went to the Global Energy Interconnection Research Institute (GEIRI). One graduate went to work for Minnesota State University, Mankato, and one graduate went to work at Indiana University (as a Senior Electronics Engineer).

Thus, there is clearly a market demand for UWM EE Ph.D. graduates.

ADDITIONAL DOCUMENTATION TO BE SUBMITTED:

Three additional documents must be submitted along with the Request for Authorization to Implement a Degree narrative to apei@uwsa.edu. These additional documents are:

- Cost and Revenue Projections Spreadsheet (Excel format)
- Cost and Revenue Projections Narrative (Word format)
- Institutional Letter of Commitment (PDF format)

These documents will be combined into one PDF document for the Board of Regents' packet later.

Cost and Revenue Projections Spreadsheet – Additional Document #1 (Excel format)

Cost and Revenue Projections Narrative – Additional Document #2 (Word format)

Institutional Letter of Commitment – Additional Document #3 (PDF format)

COST AND REVENUE PROJECTIONS NARRATIVE – Additional Document #2 (Word format)

Introduction

At the graduate level, currently there is a long-standing, college-wide PhD program in engineering, spanning the various engineering disciplines of the college. Each engineering discipline functions, essentially, as its own individual program. With this Request for Authorization, we request to separate the EE portion of the college-wide PhD program into its own program. The need for this action is detailed in the Notice of Intent and Request for Authorization (RFA). The proposed PhD Program in Electrical Engineering will essentially be the same as the EE portion of the existing college-wide PhD program. Curricular areas will be unchanged (covering typical graduate-level electrical engineering content), and there is no planned change in research focus – current areas of strength include power systems and components, bio-optical imaging, and nanotechnology.

Section I – Enrollment

There has been an average of 41 PhD students in the EE portion of the CEAS (college-wide) program in recent years (a number which has been relatively stable for a considerable time). In the 2017-2019 span, there were 16 PhD graduates in the EE portion of the CEAS PhD program, for an average of approximately five per year. We do not anticipate this changing subsequent to implementation of the stand-alone program.

Section II – Credit Hours

The program will be comprised of 66 graduate credits beyond the Bachelor's degree with minimum credit distribution as detailed in the RFA.

Section III – Faculty and Staff Appointments

There will be no additional faculty or staff needed.

Section IV – Program Revenues

There will be no additional revenue associated with the program, but, neither will there be any additional costs.

Tuition Revenues: No new revenues expected.

Program/Course Fees: No new fees or revenues expected.

Grants/Extramural Funding: No new grants or extramural funded included.

Program Revenue (PR): No new PR revenue expected.

General Program Revenue (GPR): No changes to GPR revenue.

Section V – Program Expenses

There are no new costs to the institution associated with the new program.

Expenses – Salary and Fringe: No new costs.

Other Expenses: None.

Section VI – Net Revenue

There are no new revenues and no new expenses with the name change.

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

Items		Projections				
		2020	2021	2022	2023	2024
		Year 1	Year 2	Year 3	Year 4	Year 5
I	Enrollment (New Student) Headcount	0	0	0	0	0
	Enrollment (Continuing Student) Headcount	41	41	41	41	41
	Enrollment (New Student) FTE	0	0	0	0	0
	Enrollment (Continuing Student) FTE					
II	Total New Credit Hours	0	0	0	0	0
	Existing Credit Hours					
III	FTE of New Faculty/Instructional Staff	0	0	0	0	0
	FTE of Current Fac/IAS					
	FTE of New Admin Staff	0	0	0	0	0
	FTE Current Admin Staff					
IV	Revenues					
	<i>From Tuition</i>	\$216,111	\$216,111	\$216,111	\$216,111	\$216,111
	<i>From Fees</i>	\$32,336	\$32,336	\$32,336	\$32,336	\$32,336
	<i>Program Revenue (Grants)</i>					
	<i>Program Revenue - Other</i>					
	<i>GPR (re)allocation</i>					
	Total New Revenue	\$248,447	\$248,447	\$248,447	\$248,447	\$248,447
V	Expenses					
	Salaries plus Fringes					
	<i>Faculty/Instructional Staff</i>					
	<i>Other Staff</i>					
	Other Expenses					
	<i>Facilities</i>					
	<i>Equipment</i>					
	<i>Remissions (assumes 80% receive remissions)</i>	\$172,889	\$172,889	\$172,889	\$172,889	\$172,889
<i>Other (please list)</i>						
	Total Expenses	\$172,889	\$172,889	\$172,889	\$172,889	\$172,889
VI	Net Revenue	\$75,558	\$75,558	\$75,558	\$75,558	\$75,558

Submit budget narrative in MS Word Format

Provost's Signature:

Date:

Chief Business Officer's Signature:

Date: