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

F A C U L T Y   M E E T I N G

Friday, March 4, 2022   10:30 A.M.   Virtually by Microsoft Teams

M I N U T E S

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

PRESENT: Professors Abu-Zahra, Amano, Armstrong, Boyland, Chang, Cheng, Church, Cuzner, Dabagh, D'Souza, El-Hajjar, Graettinger, Helwany, Hu, Jang, Kate, Kouklin, Law, Li, Liao, Ma, Mali, McRoy, Misra, Munson, Niu, Nosonovsky, Otieno, Petering, Peters, Pillai, Premnath, Qu, M.Rahman, Rammer, Reisel, Rohatgi, Salowitz, Seifoddini, Sung, Tabatabai, Titi, L.Wang, W.Wang, Y.Wang, Zhang, J.Zhao, T.Zhao

EXCUSED: Professor Venugopalan
GUEST: S. Ibarra

I.   DEAN UPDATE

CEAS has received a Bronze Award from the ASEE Diversity Recognition Program. Christine Cheng is taking a leadership role for the diversity steering committee moving forward.

The CEAS faculty hiring is proceeding, with large pools of applicants in most of the areas. Interviews will begin soon and faculty are encouraged to participate in the interview process.

The renovations of areas in the EMS building is continuing, with an anticipated completion date in early summer. Additionally, advocacy for a new engineering building continues, with meetings planned next week with the UW System and some members of the Board of Regents.

UWM has maintained its Carnegie R1 status. FY23 is likely to be the next year for data collection, and so efforts will be made to maximize research expenditures, research personnel employment, and Ph.D. graduates during FY23.

A summary of the Faculty Misconduct of Yue Liu was provided, along with a discussion of the changes that the campus is enacting to help prevent such activity in the future.

II.   ANNOUNCEMENTS

A. Santiago Ibarra from ANSYS provided a summary of the ANSYS training programs that are available to faculty and students. For more information, he can be reached at Santiago.Ibarra@ansys.com .

III.   INFORMAL REPORTS – See Attachment 1

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

As 48 voting faculty members were present, a quorum was present.

V.   AUTOMATIC CONSENT BUSINESS

A. Minutes of the January 28, 2022 Meeting

B. New Courses – See Attachment 2

C. B.S. in Electrical Engineering Program Changes – See Attachment 3

D. B.A. in Computer Science Program Changes – See Attachment 4

VI.   NEW BUSINESS

A. Notice of Intent to Plan a B.S. in Engineering – See Attachment 5   *CEAS FAC DOC. NO. 286*

Prof. Otieno moved to approve the Notice of Intent to Plan a B.S. in Engineering. The motion was seconded. Following discussion the motion passed on a voice vote.

B. Notice of Intent to Plan a M.S. in Connected Systems – See Attachment 6   *CEAS FAC DOC. NO. 287*

Prof. Petering moved to approve the Notice of Intent to Plan a M.S. in Connected Systems. The motion was seconded and passed on a voice vote.

C. Revision of CEAS Committee Structure – See Attachment 7   *CEAS FAC DOC. NO. 288*

Prof. Petering moved to approve the revisions to the CEAS Committee Structure. The motion was seconded.

Associate Dean Munson moved to amend the charter for the CEAS Academic Committee to add "2d. The Committee on Academics shall review all new and revised graduate courses submitted, and recommend on their approval to the CEAS faculty through the CEAS Coordinating Committee." The motion to amend was seconded and passed on a voice vote.

The amended motion passed on a voice vote.

VII.   GENERAL DISCUSSION - None

VIII. ADJOURNMENT

Meeting Adjourned at 11:45 a.m.

John R. Reisel, Secretary
CEAS Faculty

JRR
Attachments

INFORMAL REPORTS

Office of Student Services – Todd Johnson

No Report

Career Services – Juli Pickering

No Report

Curriculum Committee – Prof. Church

The Curriculum Committee met and approved various course changes, changes to the Electrical Engineering B.S., and changes to the Computer Science B.A.

Graduate Program Committee – Prof. Law

No Report

Academic Planning Committee – Prof. Petering

During its first meeting of the semester on Feb 17, the APC approved three things:

1. The formation of CEAS Qualifying Examination Assessment Committee
2. A Notice of Intent (NOI) to establish a "BS in Engineering" degree within the college
3. A Notice of Intent (NOI) to establish a "MS in Connected Systems" degree within the college

The APC also discussed how it might draft language to help advise CEAS departments regarding (1) the assignment of teaching timeslots to assistant professors and (2) the assignment of Friday teaching timeslots to faculty. No action was taken regarding these issues, but they may come up again in a future meeting.

Faculty Senate – Prof. Reisel

In its January meeting, the Faculty Senate approved the authorization to implement a B.S. in Data Analytics. In its February, the Senate approved the first set of changes to P&P related to school/college realignment, a resolution in recognition of UW System Interim President Tommy Thompson, and a resolution endorsing the UWM Climate Action – Carbon & Resilience Plan.

NEW COURSES

ELECENG 140   Intro to Embedded Computing I: Digital Logic and Microprocessors, 3 cr. U
Embedded computing is the engineering of systems and software for computers
embedded in products and devices. Embedded computers interface to electronic
devices and physical systems, including consumer products, industrial systems,
medical devices and vehicles of all types. Embedded Computing I: Digital Logic and
Microprocessors will lay the foundation for modern computing and for understanding
higher-level programming, such as in the C programming language, in terms of the
bits and gates that carry out the computation. A module on Matlab use and
programming is also included.
Prereq: Math 116(P) or Math 231(C)

ELECENG 240   INTRO TO EMBEDDED COMPUTING II: C PROGRAMMING FOR
EMBEDDED APPLICATIONS, 4 cr., U
Building on the foundation laid in EE 140, Embedded Computing II: C Programming
for Embedded Applications introduces C programming concentrating on tools and
methods suitable for firmware and embedded software development and with a focus
on how programming constructs used are realized on a model computer. Student
programming is done on an industrial development board. A module on JAVA
programming is also included.
Prereq: EE 140(P)

ELECENG 340   EMBEDDED SYSTEMS I: C and C++ PROGRAMMING FOR EMBEDDED
APPLICATIONS, 3 cr., U
Realizing embedded applications with specific hardware requirements, including
digital I/O, analog I/O, precision timing, serial and wireless communications; Project
design and execution; C and C++ Programming.
Prereq: ElecEng 141(P)

ELECENG 440   EMBEDDED SYSTEMS II: ADVANCED EMBEDDED SYSTEMS, 3 cr. U
Real time operating systems for embedded microcontroller systems; implementation
of multitasking, synchronization and protection; major project.
Prereq: EE 340(P)

B.S. in Electrical Engineering Program Change

The revised B.S. in Electrical Engineering curriculum can be found on the following pages.

ELECTRICAL ENGINEERING, BSE

History

1. Aug 18, 2018 by clmig-jwehrheim
2. Sep 18, 2018 by Emily Kuhnen (ebilicki)
3. Oct 11, 2019 by Brian Armstrong (bsra)
4. Apr 17, 2020 by Emily Kuhnen (ebilicki)
5. Jun 30, 2020 by Emily Kuhnen (ebilicki)
6. Jun 8, 2021 by Todd Johnson (johnsont)
7. Jul 30, 2021 by Lisa Mcgovern (mcgoverl)

Changes saved but not submitted

Viewing: Electrical Engineering, BSE

Last approved: Fri, 30 Jul 2021 19:45:27 GMT

Last edit: Wed, 09 Feb 2022 02:15:35 GMT

Is this a new sub-major, minor, area of interest, specialization, area, concentration, emphasis, field, focus, option, sequence, or track?
No

Title of program:
Electrical Engineering, BSE

Program Level:
Undergraduate Only

Program Type:
Major

Department or Functional Equivalent

Units:
Electrical Engineering

College, School, or Functional Equivalent

Units:
College of Engineering and Applied Science

Proposed Effective Catalog:
2022-2023

Proposed Effective Term:
Fall 2022

Minimum Credit Hours Required:
120

Summary of proposed changes or request:
Add honors in the major.
Update Embedded Computing curriculum.

Program Curriculum (for the Catalog)

Electrical Engineering Curriculum

The minimum number of credits required to complete the Bachelor of Science in Engineering with a major in Electrical Engineering is 120.

Code	Title	Credits
Engineering Core (14 credits)		
EAS 200	Professional Seminar	1
ELECENG 101	Fundamentals of Electrical Engineering [3]	3
ELECENG 140	Intro to Embedded Computing I: Digital Logic and Microprocessors	3

ELECENG 240	Intro to Embedded Computing II: C Programming for Embedded Applications	4
ELECENG 301	Electrical Circuits I	3
Major Requirements (33 credits)		
ELECENG 305	Electrical Circuits II	4
ELECENG 310	Signals and Systems	3
ELECENG 330	Electronics I	4
ELECENG 335	Electronics II	4
ELECENG 340	Embedded Systems I: C and C++ Programming for Embedded Applications	3
ELECENG 361	Electromagnetic Fields	3
ELECENG 362	Electromechanical Energy Conversion	4
ELECENG 420	Random Signals and Systems	3
ELECENG 596	Capstone Design I	3
ELECENG 597	Capstone Design II	2
Mathematics Requirement (16 credits) [1]		
MATH 231	Calculus and Analytic Geometry I	4
MATH 232	Calculus and Analytic Geometry II	4
MATH 233	Calculus and Analytic Geometry III	4
ELECENG 234	Analytical Methods in Engineering	4
Chemistry Requirement (5 credits)		
CHEM 105	General Chemistry for Engineering	5
or CHEM 102	General Chemistry	
Physics Requirement (10 credits)		
Select one of the following options:		10
Option 1:		
PHYSICS 219 & PHYSICS 220	Physics I: Calculus-Based, Studio Format and Physics II: Calculus-Based, Studio Format	
Option 2:		
PHYSICS 209 & PHYSICS 214	Physics I (Calculus Treatment) and Lab Physics I (Calculus Treatment)	
PHYSICS 210 & PHYSICS 215	Physics II (Calculus Treatment) and Lab Physics II (Calculus Treatment)	
Technical Electives - Select 18 credits from approved lists		**18**
GER Distribution Requirement (15 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		
Free Electives (9 Credits)		**9**
Students must also satisfy Oral and Written Communication (OWA) Part A [2]		**0-6**
Students must also Satisfy the UWM Foreign Language requirements [2]		**0-8**
Total Credits		120

[1] MATH 221, MATH 222 and two free electives may substitute for MATH 231, MATH 232 and MATH 233

[2] See General Education Requirements (http://catalog.uwm.edu/policies/undergraduate-policies/#generaleducationtext).

[3] Any CEAS Freshman Engineering course or approved transfer Freshman Engineering course will meet the EE 101 requirement.

Technical Electives

The electrical engineering program requires a total of 18 credits of technical electives, chosen as follows. All non-required Electrical Engineering courses numbered 400-699 are Group A Technical Electives.

Code	Title	Credits
Group A Technical Electives		
Select at least 12 credits from the following:		12-18
BUS ADM 447	Entrepreneurship	
COMPSCI 459	Fundamentals of Computer Graphics	
COMPSCI 520	Computer Networks	
COMPSCI 530	Computer Networks Laboratory	

EAS 1	Engineering Co-op Work Period [1]	
EAS 497	Study Abroad: [2]	
ELECENG 410	Digital Signal Processing	
ELECENG 421	Communication Systems	
ELECENG 436	Introduction to Medical Instrumentation	
ELECENG 437	Introduction to Biomedical Imaging	
ELECENG 440	Embedded Systems II: Advanced Embedded Systems	3
ELECENG 451	Introduction to VLSI Design	
ELECENG 457	Digital Logic Laboratory	
ELECENG 458	Computer Architecture	
ELECENG 461	Microwave Engineering	
ELECENG 462	Antenna Theory	
ELECENG 464	Fundamentals of Photonics	
ELECENG 465	Broadband Optical Networks	
ELECENG 471	Electric Power Systems	
ELECENG 472	Introduction to Wind Energy	
ELECENG 474	Introduction to Control Systems	
ELECENG 481	Electronic Materials	
ELECENG 482	Introduction to Nanoelectronics	
ELECENG 490	Topics in Electrical Engineering:	
ELECENG 541	Integrated Circuits and Systems	
ELECENG 545	FPGA Embedded CPUs & Firmware Development	
ELECENG 562	Telecommunication Circuits	
ELECENG 565	Optical Communication	
ELECENG 568	Applications of Digital Signal Processing	
ELECENG 572	Power Electronics	
ELECENG 574	Intermediate Control Systems	
ELECENG 575	Analysis of Electric Machines and Motor Drives	
ELECENG 588	Fundamentals of Nanotechnology	
ELECENG 599	Senior Thesis	
IND ENG 360	Engineering Economic Analysis	
IND ENG 550	Control of Automated Manufacturing Systems	
MECHENG 301	Basic Engineering Thermodynamics	
MECHENG 321	Basic Heat Transfer	
Group B Technical Electives		**0-6**
Select up to 6 credits from the following:		0-6
Any ATM SCI course 100-level or above		
Any BIO SCI course 150-level or above		
Any CHEM course 200-level or above, or CHEM 104 [3]		
Any COMPSCI course 200-level or above		
Any MATH course 400-level or above, or MATH 313, MATH 321, or MATH 322		
Any PHYSICS course 300-level or above		
MATLENG 201	Engineering Materials	

[1]   Students who earn 3 or more credits of Co-op may use 3 of those credits as approved technical electives.

[2]   Students who earn 3 or more credits of Study Abroad may use 3 of those credits as approved technical electives.

[3]   Students who take CHEM 102 and CHEM 104 (equaling a minimum of 8 credits) may use up to 3 credits of CHEM 104 as Group B technical electives.

Honors

Honors in the Major

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

1. A 3.000 cumulative GPA in all UWM graded credits;
2. A 3.500 GPA over all CEAS courses counting toward the EE major;
3. A 3.500 GPA over all upper-division (300 level and higher) EE courses; and
4. At least one of the following:

    a. Successful completion of 3-cr of research experience via senior thesis (ELECENG 599).
    b. Participation in accelerated MS program with successful completion of 6 credits in approved courses for the EE concentration in MS in Engineering program.

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

NOTE: The Senior Thesis consists of working with a professor to define a project, perform the project, and write up results of the project to present to a three-professor committee for acceptance. A typical Senior Thesis report would be 15-30 pages consisting of project description, literature search, what was done, and conclusions.

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

Key: 201

B.A. in Computer Science Program Changes

The revisions to the B.A. in Computer Science are as on the following pages.

Changes saved but not submitted

Viewing: **Computer Science, BA**

Last approved: 06/08/21 1:30 pm

Last edit: 12/15/21 3:22 pm

Catalog Pages Using this Program

Computer Science, BA

Reviewer Comments

Is this a new sub-major, minor, area of interest, specialization, area, concentration, emphasis, field, focus, option, sequence, or track?	No

Title of program: Computer Science, BA

Program Level: Undergraduate Only

Program Type: Major

Mode of Delivery: Face-to-Face

Department or Functional Equivalent

Units:
Computer Science

College, School, or Functional Equivalent

Units:
College of Engineering and Applied Science

College, School, or Functional Equivalent Contact

Information:

Ethan Munson, Associate Dean, CEAS, munson@uwm.edu

Proposed Effective Catalog:	**2022-2023** ~~2021-2022~~
Proposed Effective Term:	Fall 2022
Minimum Credit Hours Required:	120

Summary of proposed changes or request:

Allow students who have who have earned an Associate of Applied Science in Information Technology degree (and other related areas) to count the AAS as meeting the second major requirement. ~~Add footnote to allow substitution for CompSci 150.Organize footnotes.~~

Program Curriculum (for the Catalog)

Computer Science Curriculum

Minimum Credit Hours Required: 120

The program requires one semester of calculus (see Mathematics requirements below) and also 34 credits of major course requirements (22 credits of fixed courses and 12 credits of electives within the major). In addition, a student must either complete (or have completed) a second **major,or** ~~major, or~~ demonstrate two minor areas of concentration. The alternate major or minor areas of concentration must overlap no more than six credits total with major course requirements of this degree. Furthermore, at least fifteen credits of the major course requirements must be completed at UW-Milwaukee.

Mathematics Requirements

Choose one of the following:

MATH 211	Survey in Calculus and Analytic Geometry I	4
MATH 213	Calculus with Life Sciences Applications	4
MATH 221	Honors Calculus I	5
MATH 231	Calculus and Analytic Geometry I	4

Major Course Requirements

COMPSCI 150	Survey of Computer Science 1	3
COMPSCI 250	Introductory Computer Programming	3
COMPSCI 251	Intermediate Computer Programming	3
COMPSCI 317	Discrete Information Structures	3
COMPSCI 351	Data Structures and Algorithms	3

COMPSCI 395	Social, Professional, and Ethical Issues 2	3
COMPSCI 458	Computer Architecture 3	3
EAS 200	Professional Seminar	1
Technical Electives - Select 12 credits of COMPSCI 300 level or above		12
Total Credits		34

1COMPSCI 150 may be substituted by any non-required COMPSCI 200+ course for any student who has already completed a COMPSCI 300+ level course.

2COMPSCI 395 may be substituted by INFOST 120 or BUS ADM 393.

3COMPSCI 458 may be substituted by COMPSCI 315.

Second Major and Minor Areas of Concentration

For the purposes of this degree program, **an Associate** a "minor area of **Applied Science in Information Technology will** concentration" can be **considered as a "second major". Other Associate's degrees are subject to review by** any of the **department to be considered for satisfying the second major requirement.** following:

For the purposes of this degree program, a "minor area of concentration" can be any of the following:

An Associate's degree at UWM or another school;

A declared UWM Minor;

A declared UWM Certificate; or

At least fifteen credits of courses in a single curricular code (other than COMPSCI), of which at least six credits are at the 300-level or higher.

As described above, the two minor areas of concentration can overlap with the major course requirements by no more than six credits total.

Plan of Study

Honors

Benchmark

Advancement to
Major or Admission

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

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

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

ATTACHMENT 5

NOTICE OF INTENT TO PLAN A B.S. IN ENGINEERING
REQUEST FOR ENTITLEMENT TO PLAN A NEW PROGRAM

Name of the Proposed Degree: Engineering, BS
Institutional Setting: Dept. of Industrial & Manufacturing Engineering
College of Engineering and Applied Science
University of Wisconsin-Milwaukee
CIP Code: 14.0101
Mode of delivery: Face-to-face, hybrid, on-line
Other Required Approvals: None.
Institutional Contact Information: Dev Venugopalan, Associate Vice-Chancellor, UWM

Description
This Bachelor of Science in Engineering aims to support people who are already working in a technology field and need a bachelor's degree in engineering to enhance their skills and further their career. The curriculum will be more flexible, interdisciplinary, and customizable than the current engineering programs which are more focused on specific engineering disciplines. The program is being designed to facilitate the transfer of Associate in Applied Science students. The Wisconsin Technical College System (WTCS) has 16 campuses with 4,751 graduates with associate degrees in the technology, engineering, and related areas in 2020. (https://www.wtcsystem.edu/impact/publications/graduate-outcomes-report/) Ninety-four percent of the graduates from WTCS live and work in Wisconsin. The graduates from these schools are highly skilled and are already practicing their skills in industry. Many of the graduates consider continuing their education to earn a bachelor's degree in order to advance their skills, diversify their careers, or gain promotion and higher income.

However, many such students are discouraged from pursuing a bachelor's in engineering degree because traditional engineering programs often require three or more additional years of full-time study along with a large financial burden. Currently no engineering program in the UW System offers a program that allows students with associate degrees in technology to complete a bachelor's degree in engineering with only two years of additional study.

Outcome of the program

1. Students will have an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

2. Students will have an ability to apply engineering concepts to produce solutions that meet specified needs with consideration of economic factors

3. Students will have an ability to communicate effectively with a range of audiences

4. Students will have an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

5. Students will have an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

6. Students will have an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7. Students will have an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Program level and contents

The program is a Bachelor of Science in Engineering. The curriculum consists of these:
A total of 120 credits are needed for the graduation: (1) 13 credits of math requirements including data analytics, (2) 9 credits of Natural Science (3) 4 credits for modern professional issues and engineering economy, (4) 12 credits from Engineering breadth (selected courses from multiple engineering disciplines), (5) 12 credits for engineering concentration areas, (6) 3 credits of senior capstone design, (7) 15 credits to meet GER Art, Humanities and Social Science distribution requirements, and (8) Free Electives – AAS or other college credits that do not fit in other categories. At this time, the program does not aim for ABET accreditation.

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. To accommodate the need of students, course offerings need to be flexible, possibly including alternating offering of courses in the evening or in asynchronous on-line mode. We anticipate that existing advising resources will prove sufficient.

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, graduate and continuing education programs, "further academic and professional opportunities at all levels for women, minority, part-time, and financially or educationally disadvantaged students," "encourage others from institutions in the University of Wisconsin System and from other educational institutions, and "provide educational leadership in meeting future social, cultural, and technological challenges."

Need for Program
The need for the portability of credits and credentials between UWS and WTCS has been recognized for a long time, and decades of mutual work between and among the two systems and institutions has led to a strong culture of support for transfer and student success among the public colleges and universities of Wisconsin. To facilitate degree achievement of people with AAS degrees, on November 21, 2019, Wisconsin Statutes, § 36.31(2m) (b), the State of Wisconsin 72-Credit Transfer Rule, became law. The statutory requirements went into effect on November 21, 2019. The Universal Credit Transfer Agreement (UCTA) between the University of Wisconsin System (UW System) and Wisconsin Technical College System (WTCS) satisfies the requirement expressed in the statute. (https://www.wisconsin.edu/transfer/download/UCTA_UWS_-WTCS_17Sep21.pdf)

While this law facilitates credit transfer from WTCS to UCTA, it aims at the transfer of the credits at the level of individual courses and for core general education courses. This agreement is primarily about general education; traditionally, technology students do not take many GER distribution courses. This proposed BS program offers students with science and technology background a more holistic degree program allowing them to graduate in two years complementing their prior education, hands-on skills, and current employment.

This program recognizes the need of many individuals to have stackable credentials as they progress through their career. Wisconsin technical colleges offer a dual credit option for high school juniors and seniors to

foster a head start of college education and offer technology certificates. The certificates give students job skills to start their career and credits toward an AAS degree if they choose to continue their education. This BS in Engineering is designed for those earning an AAS to continue their education further and recognizes their previous education and experience in a technology field.

Occupational employment projections show a clear need for engineers. The U.S. Department of Labor Occupation Outlook Handbook projects employment in architecture and engineering occupations to grow 6 percent from 2020 to 2030. About 146,000 new jobs are projected to be added. Most of the projected growth in this group is in the engineering occupations, as their services will be in demand in various areas such as rebuilding infrastructure, renewable energy, and robotics.

<div align="center">**Draft Proposed B.S. in Engineering Curriculum**</div>

College of Engineering & Applied Science
Engineering (BS)

Overview

This program offers individuals with previous education and experience in a technical field an opportunity to continue their education and earn an Engineering (BS). The curriculum provides a theoretical background in mathematics, natural science, and engineering to compliment the more hands-on and application-oriented education provided in Associate of Applied Science degree programs. The curriculum is interdisciplinary and flexible and can be completed in two years as a full-time student or on a part-time basis.

Admission Requirements
A successful applicant will have:
- An earned Associate of Applied Science degree in a technology area from an accredited university. Students with 60 earned college credits with at least two years of related industry experience will also be considered.
- A minimum combined grade point average of 2.0 for college credits taken.
- Prerequisite work in college algebra.

Engineering (BS) Curriculum

Minimum Credit Hours Required: 120

Mathematics Requirement – 10 credits		
Complete the following course:		
MATH 231	Calculus and Analytic Geometry I	**4**
Select two of the following: See UWM Academic Catalog for the math prerequisites of the engineering courses you want to include in your study plan or consult with an academic advisor.		**6**
MATH 205	Introductory Finite Mathematics	
MATH 212	Survey in Calculus and Analytic Geometry II	
MATH 232	Calculus and Analytic Geometry II	
MATH 233	Calculus and Analytic Geometry III	
MATH 234	Linear Algebra and Differential Equations	

ELECENG 234	Analytical Methods in Engineering	
MATH 240	Matrices and Applications	
MATH 305	Introduction to Mathematical and Computational Modeling	
MATH 313	Linear Programming and Optimization	
MATH 315	Mathematical Programming and Optimization	
MATH 341	Seminar: Introduction to the Language and Practice of Mathematics	
Natural Science Requirement – 10 credits See UWM Academic Catalog for the natural science prerequisites of the engineering courses you want to include in your study plan or consult with an academic advisor.		
Select 10 credits including at least 1 laboratory credit from the following:		**10**
BIO SCI 150	Foundations of Biological Sciences I	
BIO SCI 152	Foundations of Biological Sciences II	
BIO SCI 202	Anatomy and Physiology I	
BIO SCI 203	Anatomy and Physiology II	
CHEM 102	General Chemistry	
CHEM 104	General Chemistry and Qualitative Analysis	
CHEM 105	General Chemistry for Engineering	
PHYSICS 120	General Physics I	
PHYSICS 121	General Physics Laboratory I	
PHYSICS 122	General Physics II	
PHYSICS 123	General Physics Laboratory II	
PHYSICS 209	Physics I	
PHYSICS 210	Physics II	

PHYSICS 214	Lab Physics I	
PHYSICS 215	Lab Physics I I	
Engineering Requirement – 30 credits		
Complete the following courses:		
IND ENG 367	Introductory Statistics for Physical Sciences and Engineering Students	**3**
IND ENG 405 or MECHENG 405	Product Realization	**3**
Select at least 12 credits from the following: See UWM Academic Catalog for the prerequisites of the engineering elective courses you want to include in your study plan or consult with an academic advisor.		**12**
CIV ENG 202	Dynamics	
CIV ENG 203	Introduction to Solid Mechanics	
COMPSCI 240	Introduction to Engineering Programming	
COMPSCI 241	C Programming for Embedded Systems	
IND ENG 360	Engineering Economic Analysis	
MATLENG 201	Engineering Materials	
MECHENG 101	Computational Tools for Engineers	
MECHENG 270	Computer Aided Engineering Laboratory	
Engineering Electives - Select at least 12 credits from any 300-level or above course offered by the College of Engineering & Applied Science. See the UWM Academic Catalog with list of courses and prerequisites.		**12**
GER Distribution Requirement – 15 credits		
Arts		**3**
Humanities		**6**

Social Science		**6**
Cultural Diversity - Arts, Humanities, or Social Science course must also satisfy UWM Cultural Diversity Requirement		
Students must also satisfy Oral and Written Communication (OWC) Requirement and Foreign Language Requirement		
Elective Requirement – 55 credits		
Select 55 credits from the following:		**55**
Any technology credits earned as part of an approved Associate of Applied Science degree. A list of approved programs is maintained by the department.		
ENGLISH 101	Introduction to College Writing	
ENGLISH 102	College Writing and Research	
Any course to satisfy the UWM Oral and Written Communication Requirement		
Any course to satisfy the UWM Foreign Language Requirement		
Any non-required course offered by the College of Engineering & Applied Science.		
Any Biology, Chemistry, Math, Physics credits not used to satisfy another requirement		
Other credits as approved by the department.		
	Total Credits	**120**

Notice of Intent, MS in Connected Systems
University of Wisconsin-Milwaukee

Proposed Degree: Master of Science in Connected Systems
Department: Industrial and Manufacturing Engineering (EME)
School/College: College of Engineering and Applied Science (CEAS)
Mode of Delivery: Face to face (with a few courses offered face to face and online)
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            Manufacturing Engineering

Program Description
The Industrial and Manufacturing Engineering at the University of Wisconsin –Milwaukee proposes a new Master of Connected Systems Program. The proposed program curriculum is multidisciplinary encompassing courses in the College of Engineering and Applied Science (CEAS), Lubar School of Business (LSB), and School of Information Science (SOIS). The courses will be project-driven and certainly, as needed they will be team-based. The proposed program will be key to strengthen the already thriving partnership with UWM's Connected Systems Institute (CSI) and local industries. Course case examples and projects will leverage the use of the software and hardware (particularly the testbeds) in the CSI. The program will stimulate industry-funded course projects and most importantly thesis and dissertation projects which will contributes towards UWM's goal of maintaining its R1 status. Before the impact of the Covid-19 pandemic enrolments, our MS in Industrial Engineering concentrations, graduated about 24 students per year. We envision that this new interdisciplinary MS program will attract more students, especially engineers who are working in the southeast Wisconsin region. They are our target group, in addition to our graduates from the Bachelor of Science in Industrial Engineering program, who will be encouraged to apply for the accelerated BS/MS track.

Structure of the Proposed Program:
The department hopes to enroll 20 new students per year during the first two years and 30 students per year subsequently. For students to be admitted into the program, they will need to demonstrate proficiency through courses, exams and industry-related experience in Linear algebra, Statistics, English and Computer Literacy. Those without will need to take at least 6 credits in UWM before admission into the MS program. These remedial courses will not count toward the MS degree.

This 30-credit program will be completed in a year (if full-time) or two years (if part-time). The program's requirements entail 18 credits of core courses as follows: (i) three 1-credit stacked courses in introduction to digital manufacturing (CEAS and LSB); (ii) three 1-credit stacked courses on automation, networking, and security (CEAS); (iii) four 3-credits courses in data acquisition and management (already offered in LSB), machine learning (already offered in CEAS), process and workflow management (already offered in LSB); (iv) a 3-credit capstone project. The remaining 12 credits (four 3-credits courses) will be electives which can be selected from one (if a student chooses to specialize in an area) or a mix thereof, from three main

categories namely, enterprise resource management (ERP)/supply chain, cybersecurity in manufacturing, mechatronics/robotics and digital twins and artificial intelligence/ machine.

Learning Outcomes of the MS in Connected Systems Program (same as the current college-wide MS Program):

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

Existing or anticipated resources required to deliver the program:
The proposed multi-disciplinary program will leverage courses that already exist in the College of Engineering and Applied Science, the Lubar School of Business and the School of Information Science. Of the 30 credits, only 1-credit of the required courses and 6 credits (2 courses) of the electives will be created. It is noted here that even without the additional 2 new elective courses, the MS program will be able to sufficiently offer the required credits for degree completion. Hands-on learning will be key to this MS program. The combined hardware (computer labs, automation drives, and CSI testbeds), and software in CEAS, LSB and SOIS, will be sufficient to provide the required hands-on learning.

This program is being created with the consultation of the Interim CSI Executive Director, the CSI Industry Advisory Board, the CSI Academic Advisory Board, and the IME Industry Advisory Board. All the faculty teaching the existing courses and those identified for the new courses are committed to the success of the MS-Connected Systems program. There are plans to recruit three faculty members, (i) a professor of advanced manufacturing (in CEAS), (ii) a professor in the area of Internet of Things and (iii) a Rockwell Automation Endowed Chair of Supply Chain Management (LSB). These three faculty members will be part of the faculty offering courses, advising students and spearheading industry-related research initiatives.

External Approvals Required
The graduate programs at the College of Engineering and Applied Sciences are accredited by the Higher Learning Commission. Accreditation will be sought during the next

Lubar School of Business is accredited by the Association to Advance Collegiate Schools of Business (AACSB). Currently, however, this MS will not be within the scope of our AACSB accreditation.

No external approval is required before initiating the program.

Alignment with Institutional Mission

The proposed program responds to the following aspects of UWM Select Mission Statement, which can be found at https://uwm.edu/mission/:

To fulfill its mission as a major urban doctoral university and to meet the diverse needs of Wisconsin's largest metropolitan area, the University of Wisconsin–Milwaukee must provide a wide array of degree programs [...]. Fulfilling this mission requires the pursuit of these mutually reinforcing academic goals:

- *To develop and maintain high quality undergraduate, graduate, and continuing education programs appropriate to a major urban doctoral university.*
- *To attract highly qualified students who demonstrate the potential for intellectual development, innovation, and leadership for their communities.*
- *To further academic and professional opportunities at all levels for women, minority, part-time, and financially or educationally disadvantaged students.*
- *To promote public service and research efforts directed toward meeting the social, economic and cultural needs of the state of Wisconsin and its metropolitan areas.*
- *To provide educational leadership in meeting future social, cultural, and technological challenges.*

The proposed program will also fulfill CEAS mission which is *"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."*

Need for the Program

The proposed program is response to the recent national workforce need for engineers who understand and can solve problems related to system connectivity in the era of industry 4.0. Key aspects of industry 4.0, which are incorporated into the proposed degree curriculum include internet of things, data acquisition and management, operation technology (OT) networking and security, cybersecurity, machine learning tools for business analytics, process control and asset management, and the ethical social-economical aspects of connected systems. A recent quick search of indeed.com returned upwards of 4,000 jobs in systems engineering and system analysist (searched on 02/01/22). In Wisconsin there are upwards of 850 jobs using this search most of which are in manufacturing. In addition, filling systems analysts/engineering positions, graduates of the proposed program will still be able to obtain jobs is logistics, and supply chain, automation, and data analytics.

Admission Requirements

Admission standards will be the same as current admission standards for Engineering MS program.

Similar Programs:

There are no similar MS in Connected Systems program in the greater Milwaukee region. There are, related courses which constitute parts of the proposed MS program. They include: (i) UWM-IME's MS in Industrial Engineering; recently approved UWM's MS in Data Science, (ii) a newly proposed MS in Digital Supply Chain (UWM LSB), newly created MS in Business Analytics (UW-River Falls), MS in Systems Engineering and Analytics (UW-Madison).

COMMITTEE ON ACADEMICS

1.   Membership:
The Committee on Academics shall consist of seven (7) voting members and the CEAS deans as ex-officio, non-voting members. The Electrical Engineering and Computer Science Department shall establish a division of faculty into electrical engineering or computer science faculty for the purpose of electing a representative for each group. The other departments shall each have one representative.

2.   Responsibilities:
   a.   The Committee on Academics shall be responsible for the policies concerning college-wide courses (carrying a curricular designation of EAS), and the supervision of undergraduate students who have not chosen a major. The Committee shall periodically review the college-wide courses and recommend changes and additions as needed to the CEAS faculty through the Coordinating Committee.

   b.   The Committee on Academics shall review and monitor all undergraduate programs and courses in CEAS. To carry out this responsibility, it shall

      1.   Periodically review the undergraduate programs of the College;

      2.   Review all new and revised undergraduate courses submitted and recommend on their approval to the CEAS faculty through the CEAS Coordinating Committee;

      3.   Review all proposals for new programs or for changes in existing programs and, if approved, submit to the CEAS Faculty through the CEAS Coordinating Committee;

   c.   The Committee on Academics shall be responsible for the administration of interdepartmental graduate programs, and for the students in those programs in CEAS, currently, the Master of Science in Engineering and Doctor of Philosophy in Engineering.   To carry out this responsibility it shall

      1.   Make planning and policy decisions regarding the programs;

      2.   Determining entrance requirements, program standards, and guidelines for all students entering the interdisciplinary programs;

      3.   Review and approve exceptional aspects of student programs of study, such as Ph.D. minors not on the list of automatically approved minors, and interdisciplinary programs of study that include substantial course work from outside the department (e.g. for PhD major area of concentration) or outside CEAS (e.g. for students in MS programs of study in concentrations that do not have this quality).

   d.   The Committee on Academics shall review all new and revised graduate courses submitted, and recommend on their approval to the CEAS faculty through the CEAS Coordinating Committee.

3.   Membership Election Procedures:

   a.   All Professors, Associate Professors, and Assistant Professors with 50% to 100% of their academic appointments in the College are eligible to vote in committee membership elections

and hold membership on the Committee on Academics. Visiting Professors are not eligible. Any individual faculty member may only represent one department at a time.

b. Elections for departmental representatives shall occur each Spring in time to be announced at or before the April College Faculty Meeting.

c. The Chair shall be elected annually by the Committee from its members at the first meeting of the academic year. The Chair shall be eligible to vote on all matters coming before the Committee.

d. Terms of Office

1. The terms of office of each member shall be for two years and shall start at the beginning of the contractual period for each academic year.

2. Unexcused absences from the Committee meetings for three consecutive times automatically vacates that position.

3. Elections shall be held according to the following schedule.

Representative	Year of Election
Biomedical Engineering	Odd
Civil & Environmental Engineering	Even
Computer Science	Odd
Electrical Engineering	Even
Industrial & Manufacturing Engineering	Odd
Materials Science & Engineering	Even
Mechanical Engineering	Odd

e. Filling Vacancies for Unexpired Terms:

1. Should a vacancy occur from among the departmental representatives, the procedures outlined in the "CEAS Committee Representative Replacement Policy" shall be followed. New members appointed following this policy will take office immediately.

2. If the Chairman's position becomes vacant, the vacancy shall be filled according to Section 3.e.1, after which the committee shall elect a new chairperson.

QUALIFYING EXAMINATION ASSESSMENT COMMITTEE

1.	Membership:
	The Qualifying Examination Assessment Committee shall consist of at least three (3) voting members and the CEAS deans as ex-officio, non-voting members. Each unit that participates in the Ph.D. in Engineering program will provide a committee member. Initially there are six members representing Biomedical Engineering, Civil Engineering, Computer Science, Industrial Engineering, Materials Engineering, and Mechanical Engineering. If a unit decides to no longer participate in the Ph.D. in Engineering program, the unit will forfeit its membership in the committee. Should the number of departments participating in the program drop below three (3), then the committee will be brought to three members by the addition of at large members from units with departmental Ph.D. programs.

2.	Responsibilities:
	a.	The Qualifying Examination Assessment Committee shall be responsible for assessing the performance of students in Ph.D. in Engineering program on the Qualifying Examination. Based on recommendations from the relevant departments, the Committee shall determine whether students pass or fail the parts of the examination and shall consider Step 1 of any student appeals of the examination result. The Committee may periodically review the state of the Qualifying Examination and make recommendations for policy changes to the Committee on Academics.

3.	Membership Election Procedures:

	a.	All Professors, Associate Professors, and Assistant Professors with 50% to 100% of their academic appointments in the College are eligible to vote in committee membership elections and hold membership on the Qualifying Examination Assessment Committee. Visiting Professors are not eligible. Any individual faculty member may only represent one unit at a time.

	b.	Elections for unit representatives shall occur each Spring in time to be announced at or before the April College Faculty Meeting.

	c.	The Chair shall be elected annually by the Committee from its members at the first meeting of the academic year. The Chair shall be eligible to vote on all matters coming before the Committee.

	d.	Terms of Office

		1.	The terms of office of each member shall be for two years and shall start at the beginning of the contractual period for each academic year.

		2.	Unexcused absences from the Committee meetings for three consecutive times automatically vacates that position.

		3.	Elections shall be held according to the following schedule.

Representative	Year of Election
Biomedical Engineering	Even
Civil & Environmental Engineering	Odd
Computer Science	Even
Industrial & Manufacturing Engineering	Odd

Materials Science & Engineering	Even
Mechanical Engineering	Odd

e. Filling Vacancies for Unexpired Terms:

  1. Should a vacancy occur from among the departmental representatives, the procedures outlined in the "CEAS Committee Representative Replacement Policy" shall be followed. New members appointed following this policy will take office immediately.

  2. If the Chairman's position becomes vacant, the vacancy shall be filled according to Section 3.e.1, after which the committee shall elect a new chairperson.