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, April 23, 2021   10:30 A.M.   Virtually by Microsoft Teams

A G E N D A

I.   DEAN UPDATE

II.   ANNOUNCEMENTS

A. 2021-22 CEAS Committee Representatives – See Attachment 1

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 March 5, 2021 meeting

B. New Courses and Course Changes – See Attachment 3

C. Revision to Electrical Engineering B.S. Program. – See Attachment 4

D. Revision to the Civil and Environmental Engineering B.S. Program – See Attachment 5

E. Revision to the Computer Science B.A. Program – See Attachment 6

F. Graduation

"*The faculty recommends to the Board of Regents those students whose names are submitted by the Office of the Registrar as having completed the requirements for the degree of Bachelor of Science or Bachelor of Arts in their respective majors.*"

VI.   SPECIAL ORDER OF BUSINESS – Nominations

A.   Awards and Recognition Committee

Faculty: Only members of Biomedical Engineering, Civil and Environmental Engineering, and Mechanical Engineering may be nominated. One member is to be elected.

Nominations Already Received:

Professor Mahsa Dabagh – Biomedical Engineering

Continuing Members:

Professor Hugo Lopez – Materials Science & Engineering
Professor Hamid Seifoddini – Industrial & Manufacturing Engineering

VII. NEW BUSINESS

   A. Notice of Intent to Plan a Ph.D. Program in Mechanical Engineering – See Attachment 7

   B. Honors in the Major – Mechanical Engineering – See Attachment 8

   C. Honors in the Major – Electrical Engineering – See Attachment 9

   D. Academic Planning Committee Charter Revision – See Attachment 10

   E. Certificate in Artificial Intelligence and Machine Learning – See Attachment 11

VIII. GENERAL DISCUSSION

IX. ADJOURNMENT

John R. Reisel, Secretary
CEAS Faculty

JRR
Attachments

CEAS COMMITTEES FOR 2021-22

	TERM EXPIRES
1) **CURRICULUM COMMITTEE**	
Professor Ben Church – Materials Science and Engineering	2023
Professor – Computer Science	2023
Professor Hamid Seifoddini – Industrial Engineering	2023
Professor Priya Premnath – Biomedical Engineering	2023
Professor Roshan D'Souza – Mechanical Engineering	2022
Professor Habib Tabatabai – Civil and Environmental Engineering	2022
Professor Rob Cuzner – Electrical Engineering	2022
2) **GRADUATE PROGRAM COMMITTEE**	
Professor Jacob Rammer – Biomedical Engineering	2023
Professor – Civil and Environmental Engineering	2023
Professor Jaejin Jang – Industrial Engineering	2023
Professor – Electrical Engineering	2023
Professor Mukul Goyal – Computer Science	2022
Professor Krishna Pillai – Mechanical Engineering	2022
Professor Hugo Lopez – Materials Science and Engineering	2022
3) **ACADEMIC PLANNING COMMITTEE**	
Professor Nidal Abu-Zahra – Materials Science & Engineering	2024
Professor– Electrical Engineering	2024
Professor Christine Cheng – Computer Science	2023
Professor Rani El Hajjar – Civil and Environmental Engineering	2023
Professor Matthew Petering – Industrial Engineering	2022
Professor Ilya Avdeev – Mechanical Engineering	2022
4) **SCHOLASTIC APPEALS COMMITTEE**	
Professor – Computer Science	2023
Professor Jaejin Jang – Industrial Engineering	2023
Professor Nathan Salowitz – Mechanical Engineering	2023
Professor Yi Hu – Electrical Engineering	2022
Professor Pradeep Rohatgi – Materials Science and Engineering	2022
Professor Hani Titi – Civil and Environmental Engineering	2022
5) **AWARDS AND RECOGNITION COMMITTEE**	
Professor	2023
Professor Hugo Lopez – Materials Science and Engineering	2022
Professor Hamid Seifoddini – Industrial Engineering	2022
Dr. Mohamed Yahiaoui – Academic Staff Representative	2022

INFORMAL REPORTS

Office of Student Services – Todd Johnson
No Report

Career Services – Juli Pickering
No Report

Curriculum Committee – Prof. Church

The Curriculum Committee has approved additional Honors in the Major proposals as well as several course modifications, new courses, and program modifications. Most of these are on the agenda for the April CEAS faculty meeting while others are being considered by GPC. Several recent program modifications include a reduction in the number of required engineering credits along with an increase in engineering electives or free electives. These changes are generally assumed to benefit students by increasing program flexibility and making the program more approachable and accommodating for a wider range of students (transfer, under-prepared, or high-achieving). Programs pursuing these types of changes are reminded to consult with your program constituents (students, employers, advisory boards, etc.) and document feedback as part of your ABET processes.

Graduate Program Subcommittee – Prof. Law

GPC had a meeting on Feb. 26 discussing certificate programs from Civil and Electrical. Several Civil courses as well as the Mechanical PhD program were discussed. The qualifying exam results were also reviewed.

Academic Planning Committee – Prof. Abu-Zahra
No Report

Faculty Senate – Prof. Reisel

In its March meeting, the Senate met with UW System President Thompson, and heard about his plans for garnering support for the System. In its April meeting, the Senate endorsed a statement from the AFSA regarding the Atlanta murders, and approved changes to UWM P&P 5.20 regarding promotion to full professor procedures.

<u>NEW COURSES</u>

ELECENG 596   CAPSTONE DESIGN I, 3 cr., U
Introduction to a real-world design process and team project in simulated industrial environment. Each team develops solutions to complex real world design problems and reports results in professional writing and oral presentation.
Prereq: sr st; ElecEng 330(P), ElecEng 367(P), ElecEng 335(P)

ELECENG 597   CAPSTONE DESIGN II, 2 cr, U
Introduction to a real-world design process and team project in simulated industrial environment. Each team realizes a prototype project.
Prereq: sr st.; ElecEng 335(P), ElecEng 596(P)

<u>COURSE CHANGES</u>   (Changes Indicated in Red)

MECHENG 402   THERMO-FLUID ENGINEERING, 3 cr. U
Analysis and design of systems involving applications of thermodynamics, heat transfer, and fluid mechanics. Applications include heat exchangers, power generation, refrigeration systems, and environmental control.
Prereq: MechEng 321(P), MechEng 320(P) or 324(P) ~~& 321(P).~~

Revision to the Electrical Engineering B.S. Curriculum

The revisions to the Electrical Engineering Curriculum can be found on the following pages.

Electrical Engineering – BS Program Changes

* Modify the EE B.Sc. Program by adding Industrial Engineering 550 as a Group A Technical Elective

Justification:

The subject matter is highly relevant for electrical engineers. The current instructor, Dr. Aderiano da Silva of Rockwell Automation is a highly qualified instructor.

* Modify the EE B.Sc. Program reduce total elective credits from 24 to 18 with a minimum of 12 group A technical electives

Justification:

This is part of the EE department effort to reduce total credits to degree to 120, with 6 credits of truly free electives. This will benefit students by reducing time to degree.

* Modify the EE B.Sc. Program by removing the requirement for Materials Engineering 201. Amend the "Free Electives" item in the program description to read "Select 6 credits"

Justification:

This is also part of the effort to reduce the total credits and time to degree for the EE major.   The course content, behavior and processing of metals, alloys, ceramics and plastics, is not essential for Electrical Engineers.   Other degree programs, such as EE at UW Madison, do not include a required material science course.

With these two changes, a total of ten credits are removed from the EE curriculum. By combining with two current free electives, the total credits for the degree is reduced to 120, and the number of free electives is increased to 6.

The prerequisites for EE 481 will be amended to remove Material Science 201.

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)

Changes saved but not submitted

Viewing: Electrical Engineering, BSE

Last approved: Tue, 30 Jun 2020 15:37:53 GMT

Last edit: Tue, 06 Apr 2021 16:43:47 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:
2021-2022

Proposed Effective Term:
Fall 2021

Minimum Credit Hours Required:
120

Summary of proposed changes or request:

* Reduce requirement by two Group A Tech Electives, total elective requriement 24 ->18
* Move MatlEng 201 from Required to Group B Tech Elective
Justification: Reduce total program to 120 credits with 6 free elective credits
* Add Ind Eng 550 as Group A Tech Elective
* EE 595 (5 cr) replaced with EE 596 (3 cr) and EE 597 (2 cr)
Justification: Having a 2-semester capstone experience will permit more time for successfully completing a prototype.

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 126. 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		
COMPSCI 240	Introduction to Engineering Programming	3
COMPSCI 241	C Programming for Embedded Systems	3
EAS 200	Professional Seminar	1
ELECENG 101	Fundamentals of Electrical Engineering	3
ELECENG 301	Electrical Circuits I	3
MATLENG 201	Engineering Materials	4
Major Requirements		
ELECENG 305	Electrical Circuits II	4
ELECENG 310	Signals and Systems	3
ELECENG 330	Electronics I	4
ELECENG 335	Electronics II	4
ELECENG 354	Digital Logic	3
ELECENG 361	Electromagnetic Fields	3
ELECENG 362	Electromechanical Energy Conversion	4
ELECENG 367	Introduction to Microprocessors	4
ELECENG 420	Random Signals and Systems	3
ELECENG 596	Capstone Design I	3
ELECENG 597	Capstone Design II	2
Mathematics Requirement [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		
CHEM 105	General Chemistry for Engineering	5
or CHEM 102	General Chemistry	
Physics Requirement		
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)	
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 6 credits		6
English Composition Requirement		
Satisfied by one of the following:		0-6
Earning a satisfactory score on the English placement test, or other appropriate test as determined by the English Department; 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] MATH 221, MATH 222 and two free electives may substitute for MATH 231, MATH 232 and MATH 233

Technical Electives

The electrical engineering program requires a total of 18 credits of technical electives, chosen as follows.

Group A Technical Electives

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 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	3
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		
MATLENG 201	Engineering Materials	4
Any PHYSICS course 300-level or above		

[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.

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

Key: 201

February 29, 2021 CEE General Body Actions

Action: CEE Curriculum Change
Move Civ Eng MechEng 301 Basic Engineering Thermodynamics from core courses to Category B Tech Elective. Request that ME remove Civ Eng Mech301 from being pre-requisite for Mech Eng 320 Fluid Mechanics.

Rationale:
The topics required for civil engineering courses from Mech Eng 301 are discussed in adequate detail in required chemistry course. Mech Eng 301 is still of interest for our students as a technical elective.

Action: CEE Curriculum Change
In our CEE curriculum replace Matl Eng 201 with Civ Eng 431 as the main course and move the course to the Civil Engineering Major courses. Keep Matl Eng 201 as acceptable replacement.

Rationale:
Civ Eng 431 is more relevant to civil engineering students as it emphasizes certain materials used in civil applications and should be highlighted first. Matl Eng 201 remains an acceptable alternative for students seeking a more general materials background.

Changes to the Computer Science – B.A. Program

Substitute for CompSci 150 (Survey of Computer Science) for any student who has already completed at least one course, from any institution, equivalent to a 300+ level CS course at UWM, can substitute any UWM Computer Science course level 200+, not already required in BA CS, for CS 150.

Notice of Intent, PhD in Mechanical Engineering

University of Wisconsin-Milwaukee

Degree: Doctor of Philosophy

Major: Mechanical Engineering

Department: Mechanical Engineering (ME)

School/College: College of Engineering and Applied Science (CEAS)

Mode of Delivery: Face to face

Institutional Contact: Devarajan Venugopalan, Associate Vice Chancellor, Academic Affairs, dv@uwm.edu

Program Description

Mechanical engineering is concerned with the application of physical principles to the analysis, design, and development of mechanical technologies. It includes renewable energy, energy storage, bio nanotechnology, vibration, flow and transport in porous media, automotive engineering, steam and nuclear power plants, tribology, composite-materials processing, water sensing and filtration, combustion, energy conservation, heat exchangers, HVAC, MEMS, computational fluid dynamics, mechanical design, smart materials, robotics, controls, and mechatronics, imaging, among other areas. Mechanical engineering is one of the fundamental engineering disciplines, and mechanical engineer careers take a diversity of forms.

The undergraduate mechanical engineering program at UWM has been present (with some early changes in name) since the inception of the College of Engineering in the 1960s. The undergraduate mechanical engineering program has the second highest enrollment of the seven engineering programs at UWM (Biomedical, Civil & Environmental, Computer Science, Electrical, Materials, Industrial, and Mechanical), and graduates approximately 100 students each year. The department plays a key role in the college's mission to educate students to become creative problem solvers, and to act as a catalyst for improved economic development and quality of life in Wisconsin. With the fast paced changes in mechanical technology, the department is critical to the college and university to achieve the strategic goal of anticipating and responding to market demands in order to produce graduates who are prepared to address and adapt to the changing needs of the marketplace and society.

At the graduate level, currently there is a long-standing, college-wide PhD program, spanning all but one engineering disciplines of the college. (Recently, in the year 2020, the electrical engineering department was authorized to have its own PhD program.) In this college-wide program, each engineering discipline functions, essentially, as its own individual program. With this Notice of Intent, we plan to separate the ME portion of the remaining college-wide PhD program into its own program. The need for this action is detailed in the following section.

The proposed PhD program in Mechanical Engineering will essentially be the same as the ME portion of the remaining college-wide PhD program. Curricular areas will be unchanged (covering typical graduate-level mechanical engineering content). There is no planned change in research focus – current areas of strength include biorobotics, bioimaging, intelligent materials, computational fluid dynamics and power storage.

Our program serves graduate students that work full or part time in the Milwaukee area (place-bound), those that come to work with specific faculty on research, and those who have a desire to be in the Milwaukee area, as well as the foreign students. The PhD enrolment in the ME portion of the college-wide program for years 2016-2020 was 40, 41, 42, 38 and 40, for an average of 40 PhD students in the ME portion of the program. (The ME department awarded PhD degrees to 9 students in 2016, 6 students in 2017,8 students in 2018,5 students in 2019 and 5 students in 2020.)

Anticipated Program Outcomes: Typically, 5-9 PhD students graduate from the ME portion of the remaining CEAS PhD program. We do not expect any significant changes in that number after the ME program becomes a stand-alone program like the EE program. As stated below, the goal of this endeavor is to be able to attract higher-caliber students, and to greatly assist in data collection about the ME program.

Learning Outcomes of the ME PhD Program (same as the current remaining college-wide PhD 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.

The minimum degree requirement is 66 graduate credits beyond the Bachelor's degree with minimum credit distribution as follows: 21 credits in the major area; 9 credits in an approved minor area; 6 credits in mathematics and/or quantitative methods; 9 credits of approved electives; 3 credit CEAS Graduate Seminar (Ethics and Engineering Communication); 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.

Existing or anticipated resources required to deliver the program

Since this is essentially a splitting-off of an existing program, no additional resources are required. The college will still manage admissions processing, as occurs currently. Currently, there are 13 full-time faculties, two teaching staff, and several adjunct faculty supporting the program.

Alignment with Institutional Mission, Strategic Plan, and Existing Program Array

The current joint 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 ME program will serve the same purpose.

Need for the Program, and Relationship to Existing Programs

There is a local and national need for PhDs in Mechanical Engineering. Our PhD graduates have been able to find jobs that is commensurate with this market demand. We have been able to gather data on 42 PhDs graduated by the ME Department in last two decades. (Note that this data has not been gathered by UWM since we do not have a separate PhD program in ME, and is based essentially on the feedback provided by ME faculty). Out of our 42 PhD graduates for which the data is available, 14 of them took their first job as university faculty (at assistant professor or lecturer levels) in various engineering departments, 5 started work at corporate R&D, 11 were absorbed as senior/principal engineers in industry, 11 joined various universities as post-docs, and 1 started work as an executive director.

As discussed above, at present there is a college-wide PhD program In Engineering and Applied Science. The mechanical engineering portion of that program has approximately 37 PhD. The proposed program is simply to split off the mechanical engineering portion of that existing program, to become a PhD in Mechanical Engineering. Department faculty feel that this is an appropriate move for several reasons. First, there is some student reluctance to have a PhD degree that is, officially, in Engineering, rather than in Mechanical Engineering. We feel that a more specific degree name would aid in attracting top PhD student candidates to the program. Second, department faculty would like more autonomy in administering the program, including scheduling and evaluation of the PhD Qualifying Exam. Third, having a combined college-wide program makes it difficult to collect data on our (ME) students and graduates, as all PhD 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 PhD program adversely affects us in rankings, such as US News and World Reports and similar venues. We do not appear in these rankings of mechanical engineering PhD programs simply because we do not have a PhD in mechanical engineering (despite the fact that we, essentially, do have such a program of longstanding nature).

Impact on other programs in the UW System: We do not expect that this program will have any effect on the ME PhD 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 ME PhD 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, not impact the program at Madison.

Admission Requirements
Admission standards will be the same as current admission standards for Engineering PhD.

HONORS IN THE Mechanical Engineering MAJOR

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

- A 3.000 cumulative GPA in all UWM graded credits;
- 3.500 GPA over all CEAS courses counting toward the Mechanical Engineering major;

and

- At least one of the following:
  - Taking 15 Mechanical Engineering elective credits (MechEng 400 Level or Higher)
  - Participation in a three elective credit research (MECHENG 699) supervised by a Mechanical Engineering faculty member leading to a presentation to be defended before a three member committee

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

HONORS DESIGNATION - EE MAJOR

Students in Electrical 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 EE major;

   III. A 3.500 GPA over all upper-division (300 level and higher) EE courses; and

   IV. At least one of the following:

        a. Successful completion of 3-cr of research experience via senior thesis (EE 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.

- 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.

Revisions to the APC Charter

The revised APC Charter can be found below. Changes are indicated in red.

ACADEMIC PLANNING COMMITTEE

1. Membership

> The Academic Planning Committee shall consist of seven (7) voting members and the CEAS Dean as an ex-officio, non-voting member. The Electrical Engineering and Computer Science Department shall use the established . 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)   Make recommendations to the dean regarding the development of long-range plans and goals for the school or college consistent with the preservation of high quality teaching, research, and service.

    b)   Review academic program plans and related budgetary proposals regarding positions prepared by departments or their functional equivalents.

    c)   Afford departments or their functional equivalents ample opportunity to present information and position statements during programmatic and budgetary discussions.

    d)   Advise the dean regarding criteria and priorities for budget adjustments.

    e)   Advise a department (or its functional equivalent) and the dean in the event department and dean disagree over specific programmatic or budgetary decisions regarding open faculty positions or positions occupied by probationary faculty.

3. Rules and Procedures

    a)   The Academic Planning Committee shall operate under Robert's Rules of Order, except where they may conflict with special rules which the Committee may adopt.

    b)   Meetings are called by the chair at the request of the Dean, or two members of the Committee, or as the chair deems necessary.

    c)   A quorum to conduct official business is four of the voting members.

4. Membership Election Procedures for the Academic Planning Committee

    a)   Faculty Eligibility: All faculty with 50% or more academic appointment in the College are eligible to vote in committee membership elections and hold membership on the Academic Planning Committee. Department chairpersons may vote and hold positions. The Dean and Assistant Deans and Associate Deans may not.

    b)   Election of Department Representatives

        1)   The election of a departmental representative is by majority vote of the eligible members of each department. Electrical Engineering and Computer Science faculty are to be divided into two groups, each of which elect a representative. No faculty member shall vote for more than one representative.

        2)   Elections shall occur each spring in time to be announced at or before the April College faculty meeting.

    c)   Election of the Academic Planning Committee Chairperson

    The members of the Academic Planning Committee shall meet annually prior to the May faculty meeting to elect a chairperson for the next academic year from among its members. (Note: The Chairperson shall be eligible to vote on all matters coming before the Committee.)

    d)   Terms of Office

    Terms of office shall be for three (3) years and shall begin at the start of the academic year. In order to provide for committee continuity and staggered terms of office, terms will begin in the following order (with 2021-22 being Year 1)

Biomedical Engineering	Year 1
Electrical Engineering	Year 1
Materials Science & Engineering	Year 1
Industrial and Manufacturing Engineering	Year 2
Mechanical Engineering	Year 2
Civil and Environmental Engineering	Year 3
Computer Science	Year 3

    e)   Filling Vacancies for Unexpired Terms

        1)   Should a vacancy occur, the department concerned shall elect a new representative (who will take office immediately) to complete the term of the vacated position.

        2)   Should the Chairperson position become vacant, the vacancy shall be filled according to the preceding rules after which the committee shall elect a new chairperson to complete the unexpired term of the original chairperson.

CERTIFICATE IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

I.   PROGRAM IDENTIFICATION

1.1   Title of Proposed Graduate Certificate: Artificial Intelligence (AI) and Machine Learning (ML)

1.2   Department(s) or Functional Equivalent(s) Sponsoring the Certificate: Department of Electrical Engineering and Computer Science

1.3   College(s), School(s) or Functional Equivalent(s) Sponsoring the Certificate :

College of Engineering and Applied Science

1.4   Timetable for Initiation: Fall 2021 or Spring 2022

II.   RATIONALE

Artificial intelligence (AI) and machine learning (ML), the technical foundation for the now familiar buzz words such as "data science" and "big data," are revolutionizing our lives and economy. As a result, there has been a great increase in the interest in AL and ML education inside universities and across many sectors of the economy, including agriculture, health care and manufacturing. Indeed, many (if not all) sectors of the economy, not just the Tech sector, now need workers with relatively deep knowledge and advanced skills in AI/ML. To address such needs, we propose a 15-credit graduate certificate in AI/ML, consisting of two required foundation courses and three elective courses from a number of application areas. This certificate is aimed at both degree-seeking graduate students and working professionals who want to learn new technical skills, and to make it easier for the latter, we plan to develop asynchronous online versions of the courses in addition to their in-person or synchronous online versions.

If successful, the certificate can produce a number of benefits, such as
1) Allowing interested students and working professionals to acquire ``deep" knowledge and skills in AI/ML that will lead to more economic opportunities and career success.
2) Enhancing the local economy, as many of our graduate students and alumni work for companies and businesses in Wisconsin.
3) Strengthening the existing UWM AI/ML cluster, fostering new research collaborations and connections to local companies (e.g., through teamwork in class projects with working professionals).
4) Increasing UWM enrollment of both traditional and non-traditional students, by increasing UWM visibility and opportunity for study associated with job types, such as "Computer and Information Research Scientist", that are growing much faster than average according to the US Bureau of Labor Statistics.

III.   INSTITUTIONAL CONTEXT

3.1   Relationship to Mission of Institution

The proposed certificate will address the UW System Mission Statement by developing human resources and by developing in students' professional and technological expertise. It will address the UW System Doctoral Cluster Mission Statement because it will be a program that leads to a professional degree at the post-baccalaureate level and because it is designed to promote the economic development of the state. It will address the UWM Select Mission Statement by developing and maintaining a high-quality graduate program and by attracting highly qualified students who demonstrate the potential for intellectual development, innovation, and leadership for their communities. It will also address important aspects of the goals of the recently completed 2030 planning exercise, especially efforts to: a) "Infuse entrepreneurship, design thinking, and data science into faculty research and graduate and undergraduate education; and b) "Strengthen sustaining partnerships with community, industry and other academic institutions", as this effort will offer another pathway for accelerated BS/MS undergraduates, or STEM graduates in industry, to pursue a data science related graduate certificate that will also earn them advanced standing towards a master of science degree in the future.

3.2   Relationship to/Impact on Other UWM Programs

To our knowledge, UWM does not have any programs that are very similar to the proposed certificate. This is because most of the courses in the certificate are highly specialized and only available in the Electrical Engineering and Computer Science curricula.

IV.   NEED

First, instructors have reported a high level of interest in AI/ML from our graduate students. In a recent semester, more than 50 students and/or working professionals from across UWM (not just the EECS Department) registered for the EE/CS 711 Introduction to Machine Learning, with additional students making inquiries that did not register, due to the lack of sufficient mathematics preparation. (Some of these additional students may find their way to CS 411, an AM/ML course that focuses more on applications and software development.) Even for students who were able to take EE/CS 711, however, it has been challenging for then to find out what courses to take next, if they want to continue and go deeper into the subject. The proposed certificate, in addition to providing a strong education program for the interested students, will also help direct students to clear paths to get this education. For example, a student interested in natural language processing (NLP) can take the two required courses and electives related to NLP, while a student interested in computer vision (CV) can do the same with electives related to computer vision. Indeed, as a part of the implementation of the certificate program, we will provide several suggested application areas or pathways to make it easier for students to navigate the course offerings.

Second, as mentioned in Section II, AI/ML is and will continue to have tremendous impact on our lives and economy and there is much interest and demand from companies and businesses in many, if not all, sectors of the economy for employees who have deep knowledge and hands-on skills in AI/ML – this is true nationally as well as locally. The proposed certificate is timely and addresses such interest and demand.

Finally, within the State of Wisconsin, the only related graduate certificate program is a data science certificate from Marquette University, which requires students to choose five out of eight 3-credit hour courses. These courses are a mixture of business, data analytics, and computer science (distributed system and database) courses. The program seems to be limited in its coverage of AI and machine learning, with a very limited number of electives. (UW Parkside offers a nine-credit certificate in Data Science for undergraduates.) Nationally, there are a number of data science programs that cover AI and machine learning in more depth and breadth, from well-known universities such as Harvard and Cornell, which offer a broad array of courses with specific focuses on machine learning, programming languages (e.g. Python, R), databases, and visualization tools (e.g. Tableau). Within the Midwest, we found several data science programs from universities such as Northwestern, UIUC, University of Chicago, IIT, DePaul, and UIC. However, other than a certificate program of UIUC (which is more math/stat oriented), the rest are complete bachelor or masters degree programs, such as UWM's own BS in Data Science. The proposed certificate program can attract non-degree seeking professionals and degree-seeking students who may not wish to pursue data science or EE/CS degrees, as well as EE/CS students who want to have a greater depth of knowledge in AI/ML.

V.   PROGRAM DESCRIPTION AND EVALUATION

5.1   Description:

5.1.1   Brief Narrative Description:
The program requires a total of fifteen credits. Six credits (two courses) will be in the general areas to provide and understanding of the theory and practice of machine learning. Another nine credits will be electives covering various application areas of machine learning, such as NLP, CV, reinforcement learning, AI techniques and algorithms, and software engineering for AI/ML.

5.1.2   Define the nature of the program
This certificate is multidisciplinary because it is suitable for graduate students/professionals from a wide variety of disciplines that involve data, quantitative analysis, and computing and should also be accessible to those with sufficient mathematical preparation.

5.1.3   Learning objectives and competencies: Students completing the certificate will
- Understand the theoretical and programming foundations for AI and machine learning
- Be capable of applying the theory and programming skills for problem solving in real-world applications
- Be able to acquire some expertise in at least one area of AI/Machine learning applications, such as NLP, CV, reinforcement learning, or finance.

5.1.4   List the mode(s) of instruction:
The program is designed for both synchronized (in-person or online) and asynchronous online delivery.

5.1.5 Discuss whether this certificate program prepares students for gainful employment in a recognized occupation. If it does and is eligible for Title IV financial aid, supply the following information:
- Occupations the program prepares students to enter
- Occupational profiles
- Costs for books and supplies

N/A

5.2   Curriculum – Courses and Credits:

The program requires 15 total credits.

There are two required courses (6 cr. total):
- EE/CS711 Introduction to Machine Learning or CS411G Machine Learning and Applications
- CS557G Introduction to Database Systems or EE/CS 715 Programming for Machine Learning

The remaining 9 credits are electives to be selected from the provided list of EE/CS courses (see Appendix). Among the five courses, at least 3 must be from 700 level or above.

5.3   Admission requirements and procedures: The minimum G.P.A. for admission is 2.75 in a prior bachelor's or post-baccalaureate degree (or cumulative credits after admission to a dual bachelor-masters degree program.) Applicants should generally have a prior degree in science, engineering, computer science, economics, finance or any other area that requires academic preparation in math and programming. Applicants with other prior degrees will also be considered via holistic assessment of the academic record and professional experience, with a focus on substantial work experience in the quantitative analysis, programming, and adequate mathematics preparation for the required coursework.

5.4   Allowance for transfer credit (if any): The program follows the standard rules for certificates and allows up to three (3) credits of prior graduate level coursework to be transferred.

5.4   Completion requirements: Completion of the program requires achievement of a cumulative GPA in program courses of at least 3.00.

5.5   Time limit: Certificate requirements must be completed within three (3) years of initial enrollment in the program

5.6   Certificate conferral: The certificate will be confirmed upon completion of the certificate requirements.

5.7   Program Administration: The Certificate Program Representative will be Dr. Ethan Munson, Associate Dean for Academic Affairs. Curricular development and review will be conducted by the CEAS Graduate Program Committee. This committee includes one representative from each CEAS department, chosen by the departments' faculty. Program advising will be handled by the CEAS

Graduate Office, whose staff includes Therese Crary and by Graduate Faculty and Graduate Program Representatives from the EECS department.

5.8 **Participating Faculty:** All CEAS faculty and qualified instructional academic staff are able to participate in the program.

VI. RESOURCES

The program does not require any new facilities. Courses will be taught by current CEAS faculty and staff or by qualified adjunct instructors, where appropriate. The online courses will use the Fee-in-Lieu-of-Tuition (FILT) model. The current plan is to charge $933/credit.

VII. BULLETIN COPY

Submit copy for the *Graduate School Bulletin* following the template provided by the Graduate School.

Appendix: Course List for the proposed AI/ML certificate
Required Course (2)
COMPSCI 557G Introduction to Database Systems or COMPSCI 715 Programming for Machine Learning (currently under development)
COMPSCI/ELECENG 711 Introduction to Machine Learning

Electives (Take 3 with at least 2 from the Applications Electives and as least 2 from 700 level or above)
Application Electives
COMPSCI/ELECENG 712 Image Processing
COMPSCI/ELECENG 713 Computer Vision
COMPSCI 722 Artificial Intelligence Planning Techniques
COMPSCI 723 Natural Language Processing
COMPSCI 744 Text Retrieval and Its Applications in Biomedicine

ELECENG 574G Intermediate Control Systems
ELECENG 810 Advanced Digital Signal Processing
ELECENG/COMPSCI 811 advanced machine learning (already taught several times as a topic course ELECENG/COMPSCI 890 and will be made into a regular course)
ELECENG 816 Optimal Control Theory

MECHENG 476G Introduction to Robotics
IND ENG 717: Operations Research for Engineering Managers

Generic Electives
COMPSCI 411G Machine Learning and Applications
COMPSCI 422G Introduction to Artificial Intelligence
COMPSCI 423G Introduction to Natural Language Processing
COMPSCI 425G Introduction to Data Mining

ELECENG 420G Random Signals and Systems
ELECENG 474G Introduction to Control Systems

IND ENG 716: Engineering Statistical Analysis
IND ENG 590/890: Introduction to Connected Systems
IND ENG 590/890: Engineering Data Analytics.