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 24, 2020 10:30 A.M. Virtually by Microsoft Teams

A G E N D A

I. DEAN UPDATE

II. ANNOUNCEMENTS

A. 2020-21 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 March 6, 2020 meeting

B. New Courses and Course Changes – See Attachment 3

C. M.S. Concentration in Industrial and Systems Engineering Changes – See Attachment 4

D. M.S. Concentration in Manufacturing Engineering Concentration Changes – See Attachment 5

E. M.S. Concentration in Occupational Biomechanics / Ergonomics Concentration Changes – See Attachment 6

F. Mechanical Engineering Curriculum Changes – See Attachment 7

G. 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 in their respective majors.*"

VI. SPECIAL ORDER OF BUSINESS – Nominations

A. Awards and Recognition Committee

Faculty: Only members of Biomedical Engineering, Industrial Engineering and Materials Engineering may be nominated. Two members are to be elected.

Nominations Already Received: None

Continuing Members:

Professor Ichiro Suzuki – Electrical Engineering and Computer Science
Dr. Mohamed Yahiaoui – Academic Staff Representative

B. Secretary of the CEAS Faculty

VII. NEW BUSINESS

A. Request for Authorization to Implement a B.S. in Data Science
- See Attachment 8

VIII. GENERAL DISCUSSION

IX. ADJOURNMENT

John R. Reisel, Secretary
CEAS Faculty

JRR
Attachments

ATTACHMENT 1

CEAS COMMITTEES FOR 2020-21

		TERM EXPIRES
1)	CURRICULUM COMMITTEE	
	Professor Roshan D'Souza – Mechanical Engineering	2022
	Professor ? – Civil and Environmental Engineering	2022
	Professor ? – Electrical Engineering	2022
	Professor Ben Church – Materials Science and Engineering	2021
	Professor Rohit Kate – Computer Science	2021
	Professor Hamid Seifoddini – Industrial Engineering	2021
	Professor Priya Premnath – Biomedical Engineering	2021
2)	GRADUATE PROGRAM COMMITTEE	
	Professor Ichiro Suzuki – Computer Science	2022
	Professor Krishna Pillai – Mechanical Engineering	2022
	Professor Hugo Lopez – Materials Science and Engineering	2022
	Professor Jacob Rammer – Biomedical Engineering	2021
	Professor Xiao Qin – Civil and Environmental Engineering	2021
	Professor Timothy Patrick – Industrial Engineering	2021
	Professor C.T. Law – Electrical Engineering	2021
3)	ACADEMIC PLANNING COMMITTEE	
	Professor Hossein Hosseini – Computer Science	2023
	Professor ? - Civil and Environmental Engineering	2023
	Professor Timothy Patrick – Industrial Engineering	2022
	Professor Ilya Avdeev – Mechanical Engineering	2022
	Professor Nidal Abu-Zahra – Materials Science & Engineering	2021
	Professor Dev Misra – Electrical Engineering	2021
4)	SCHOLASTIC APPEALS COMMITTEE	
	Professor ? – Electrical Engineering	2022
	Professor Pradeep Rohatgi – Materials Science and Engineering	2022
	Professor ? – Civil and Environmental Engineering	2022
	Professor Susan McRoy – Computer Science	2021
	Professor Matthew Petering – Industrial Engineering	2021
	Professor – Mechanical Engineering	2021
5)	AWARDS AND RECOGNITION COMMITTEE	
		2022
		2022
	Professor Ichiro Suzuki – Computer Science	2021
	Dr. Mohamed Yahiaoui – Academic Staff Representative	2021

ATTACHMENT 2

INFORMAL REPORTS

Office of Student Services – Todd Johnson

Advising Staff is Available - The advising staff continues to meet with students (by phone or video) and are accessible by email. If you have any questions, you can reach the advisors at ceas-adv@uwm.edu.

Computer Science & Engineering Tutoring - The CEAS Tutoring Center has moved online. https://uwm.edu/engineering/current-students/tutoring/
If you have any questions, you can reach Steven Anderson at ander675@uwm.edu.

Career Services – Juli Pickering
No Report

Curriculum Committee – Prof. A. Rahman
No Report

Graduate Program Committee – Prof.Suzuki
No Report

Academic Planning Committee – Prof. Patrick
No Report

Faculty Senate – Prof. Reisel

In its March meeting, the Faculty Senate approved the Authorization to Implement a B.A. in Computer Science and an Authorization to Implement a B.A. in Digital Arts and Culture. In its April meeting, the Faculty Senate approved an Authorization to Implement a B.S. in Freshwater Sciences, and an Authorization to Implement a Masters in Urban Design. The Senate also approved a change to the Final Examination Policy (SAAP 1-9) that sets up a process to allow for final examination periods to be longer than 2 hours.

ATTACHMENT 3

NEW COURSES

COMPSCI 620	UNDERGRADUATE SEMINAR IN ALGORITHMS, 1 cr., U Variable Topic Seminar Course in Algorithms. May retake for credit with different topic. Prereq: CompSci 535(P)
COMPSCI 820	ALGORITHMS SEMINAR, 1 cr., G Seminar in an advance topic in the area of computer algorithms. Retakable for up to 6 credits with a change of topics. Prereq: COMPSCI 535(P)
IND ENG 369	INTRODUCTION TO PROBABILITY AND STATISTICAL INFERENCE, 1 cr., U Required ADA accommodations will be accorded. Prereq: MAT 221 (P) or MAT 233 (P)
MECHENG 324	INTRODUCTION TO FLUID MECHANICS 4 cr., U Introduction to fluid mechanics, fluid statics, integral relations for a control volume, dimensional analysis and similarity, viscous flow in ducts, flow past immersed bodies, open-channel flow, a set of hands-on experiments. Prereq: jr st; MechEng 301(P), ElecEng 234(P), Civ Eng 202(P)
MECHENG 364	ADVANCED MECHANICS OF MATERIALS AND DESIGN OF MACHINE ELEMENTS 1, 3 cr., U Design processes, loads and stresses in 3 dimensions, stress and strain relations, 3 dimensional principle stresses, static failure criteria, fatigue failure criteria, and structural stability applied to the design of Machine Elements like shafts. Prereq: MechEng 110(P), 111(P), 302(P), Civ Eng 203(P), MatlEng 201(P)
MECHENG 368	DESIGN OF MACHINE ELEMENTS 2, 3 cr., U Application of static and fatigue failure criterion to the design of machine elements including: mechanical fasteners, fastener patterns, welds and bonding, mechanical springs, bearings, gears, clutches, and brakes. Prereq: MechEng 364(P)
MECHENG 379	INTRODUCTION TO MECHATRONICS, 3 cr., U Will not be offered to the special students Prereq: jr st & MechEng 302 (C)

MECHENG 453 DESIGN THINKING STUDIO, 3 cr., U
This is an interdisciplinary course that will introduce students to a designer's mindset and will foster key design abilities in an experiential learning environment.
Prereq: None

COURSE CHANGES (Additions made in green. Deletions Indicated in Red)

MECHENG 270 ~~370~~ COMPUTER AIDED ENGINEERING LABORATORY, 2 cr., U
This course is intended to introduce students to mechanical ~~Mechanical~~ design and analysis using parametric CAE ~~state of the art CADD, kinematics, and FEA computer~~ tools. ME270's goal is for you to obtain a foundation in computer-aided design and analysis.
Prereq: MechEng 101(P) & 111(P);Math-231 (C). ~~111(P);Civ Eng 202(P) & 303(P); & ElecEng 234(P).~~

MECHENG 302 INTRODUCTION TO SYSTEM DYNAMICS ~~ANALYSIS AND MODELING OF DYNAMIC SYSTEMS~~, 3~~4~~ cr., U
Modeling and analysis of mechanical, electrical, electromechanical, fluid, and combinations thereof; ~~physiological systems;~~ laboratory experiments. ~~Jointly offered with & counts as repeat of BME 302.~~
Prereq: MechEng 101(P), ElecEng 234(P,C*), ~~234(P),~~ and Physics 210(P), Civ 202(P,C*) ~~210(P).~~

MECHENG 438 MECHANICAL ENGINEERING EXPERIMENTATION, 3 cr., U
Training and understanding data acquisition systems, experiment planning; sensor calibration; professional report writing and communication; industrial projects
Prereq: Ind Eng 369(P), MechEng 302(P), MechEng 360(P), MechEng 368(P). ~~sr st or cons instr; ElecEng 301(P); Ind Eng 467 or MthStat 467(P); MechEng 321(P), 360(P), 366(P).~~

MODIFIED VERSION UPDATED 04-01-2020

Formal name of concentration

Industrial and Systems Engineering

Degree Program

Master of Science in Engineering

Course Requirements

- Students must take at least 9 credits from the courses in Group A
- Thesis option students must complete at least 15 credits from Group A and B. These may include up to 3 credits each of Ind Eng 990 and Ind Eng 999.
- Non-thesis option students must complete at least 21 credits from Group A and B. These may include up to 3 credits each of Ind Eng 990 and Ind Eng 999.
- Any remaining credits in the MS in engineering program of study may be taken as approved electives by the major professor.
- Students without a bachelor's degree in industrial and/or Manufacturing Engineering or related professional experience will be required to take additional courses prior to entering to the program per major professor's recommendations.

Qualifying Courses: As listed in the table of approved courses

Group A

Course No.	Title
455	Operations Research I
465	Operations Research II
475	Simulation Methodology
575	Design of Experiments

Group B

550	Control of Automated Manufact. Systems
580	Ergonomics
583	Facility Layout and Material Handling
587	Lean Production Systems
716	Engineering Statistical Analysis
717	Operations Research for Engineering Management
740	Intelligent Manufacturing Systems
751	Flexible Manufacturing Systems
765	Operations Research Methods
768	Applied Stochastic Processes
880	CEAS Grad Seminar
777	Scheduling
890	Adv Topics Ind Eng: Global Logistics Management
890	Adv Topics Ind Eng: Connected Enterprise
890	Adv Topics Ind Eng: Time Series Analysis & Forecasting
890	Adv Topics Ind Eng: Advanced Discrete Event Simulation
890	Adv Topics Ind Eng: Project Management
890	Six Sigma
990	Master's Thesis
999	Advanced Independent Study

Compelling reasons for transcript designation

Due to diverse technical areas in engineering and common practice by most engineering institutions in the US, it is important that an area of concentration be listed in a student's academic records. This will describe the student's background better and will enhance employment opportunities for the student. It will also aid the department in tracking graduate students.

Older Version:
MODIFIED VERSION_11_30_2016

Formal name of concentration
Industrial and Systems Engineering

Degree Program
Master of Science in Engineering

General Requirements
A minimum of 15 credits of qualifying graduate courses in Industrial and Manufacturing Engineering; may include up to 3 credits each of Ind Eng 990 and Ind Eng 999

Qualifying Courses
Qualifying courses for the concentration are shown in the following table:

Course Offering Summary

Course No.	Title
575	Design of Experiments
580	Ergonomics
583	Facility Layout and Material Handling
716	Engineering Statistical Analysis
717	Operations Research for Engineering Management
765	Operations Research Methods
768	Applied Stochastic Processes
880	CEAS Grad Seminar
777	Scheduling
890	Adv Topics Ind Eng: Global Logistics Management
890	Adv Topics Ind Eng: Connected Enterprise
890	Adv Topics Ind Eng: Time Series Analysis & Forecasting
890	Adv Topics Ind Eng: Advanced Mathematical Programming
890	Adv Topics Ind Eng: Advanced Discrete Event Simulation
890	Adv Topics Ind Eng: Operations Research Modeling
990	Master's Thesis
999	Advanced Independent Study

Compelling reasons for transcript designation
Due to diverse technical areas in engineering and common practice by most engineering institutions in the US, it is important that an area of concentration be listed in a student's academic records. This will describe the student's background better and will enhance employment opportunities for the student. It will also aid the department in tracking graduate students.

MODIFIED VERSION 04-01-2020

Formal name of concentration
Smart Manufacturing

Degree Program
Master of Science in Engineering

Course Requirements

- Students must complete at least 9 credits from courses in Group A.
- Thesis option students must complete at least 15 credits from Group A and Group B. These may include up to 3 credits each of Ind Eng 990 and Ind Eng 999.
- Non-thesis option students must complete at least 21 credits from Group A and Group B. These may include up to 3 credits each of Ind Eng 990 and Ind Eng 999.
- Any remaining credits in the MS in engineering program of study may be taken as approved electives by the major professor.
- Students without a degree in industrial and/or Manufacturing Engineering or related professional experience may be required to take specific courses prior to entering to the program per major professor's recommendations.

Qualifying Courses: As listed in the table of approved courses

Group A

Course No.	Title
550	Control of Automated Manufact. Systems
587	Lean Production Systems
590/890	Connected Enterprise
751	Flexible Manufacturing Systems

Group B

455	Operations Research I
465	Operations Research II
470	Methods Engineering
475	Simulation Methodology
571	Advanced Quality Control
572	Reliability Engineering
575	Design of Experiments
582	Ergonomic Job Evaluation Techniques
583	Facility Layout and Material Handling
716	Engineering Statistical Analysis
717	Operations Research for Engineering Management
777	Scheduling
880	CEAS Grad Seminar
890	Adv Topics Ind Eng: Sustainable Energy Systems & Industrial Management
890	Adv Topics Ind Eng: Global Logistics Management
890	Adv Topics Ind Eng: Connected Enterprise
890	Adv Topics Ind Eng: Project Management
890	Six Sigma
890	Adv Topics Ind Eng: Advanced Discrete Event Simulation
990	Master's Thesis
999	Advanced Independent Study

Compelling reasons for transcript designation
Due to diverse technical areas in engineering and common practice by most engineering institutions in the US, it is important that an area of concentration be listed in a student's academic records. This will describe the student's background better and will enhance employment opportunities for the student. It will also aid the department in tracking graduate students.

Older Version:

MODIFIED VERSION_11_30_2016

Formal name of concentration

Manufacturing Engineering

Degree Program

Master of Science in Engineering

General Requirements

A minimum of 15 credits of qualifying graduate courses in Industrial and Manufacturing Engineering; may include up to 3 credits each of Ind Eng 990 and Ind Eng 999

Qualifying Courses

Qualifying courses for the concentration are shown in the following table:

Course Offering Summary

Course No.	Title
550	Control of Automated Manufact. Systems
571	Advanced Quality Control
575	Design of Experiments
582	Ergonomic Job Evaluation Techniques
583	Facility Layout and Material Handling
587	Lean Production Systems
716	Engineering Statistical Analysis
740	Intelligent Manufacturing Systems
751	Flexible Manufacturing Systems
880	CEAS Grad Seminar
890	Adv Topics Ind Eng: Sustainable Energy Systems & Industrial Management
890	Adv Topics Ind Eng: Connected Enterprise
990	Master's Thesis
999	Advanced Independent Study

Compelling reasons for transcript designation

Due to diverse technical areas in engineering and common practice by most engineering institutions in the US, it is important that an area of concentration be listed in a student's academic records. This will describe the student's background better and will enhance employment opportunities for the student. It will also aid the department in tracking graduate students.

UNIVERSITY of WISCONSIN
UWMILWAUKEE

College Engineering and Applied Science

April 05, 2020

To: The Graduate Curriculum Commitee
College of Engineering and Applied Science.

From: Wilkistar Otieno, Chairperson
Industrial and Manufacturing Department.

Subject: A Proposal for an IME Concentration Name Change From "Manufacturing Engineering" to "Smart Manufacturing".

On behalf of the Industrial and Manufacturing Engineering department, I am forwarding the proposal to change the name of one of the IME concentrations from "Manufacturing Engineering" to "Smart Manufacturing"

Rational: To better represent the current state of manufacturing.

Background: The Manufacturing Engineering Concentration was developed in the mid-90's as a response to the then emergence of Computer-Aided Manufacturing (CAD), Computer-Aided Process Planning (CAPP) and Computer-Integrated Manufacturing (CIM). In the current age of digital transformations in manufacturing or Industry 4.0 Revolution, smart manufacturing serves a better reflection of our plan to enrich the manufacturing curriculum with new courses that are already in place and additional courses and projects that will arise from departmental faculty collaborations with the Connected Systems Institute, the Midwest Energy Research Consortium, the Wisconsin Smart Cities Alliance and the Wisconsin Economic Development Consortium (WEDC)-funded UW-System Online IoT course modules project. This is a step toward our collaboration with other CEAS departments and departments in other UW-System to develop a truly an interdisciplinary AI-based manufacturing research and curriculum.

INDUSTRIAL AND MANUFACTURING ENGINEERING

OCCUPATIONAL BIOMECHANICS / ERGONOMICS MS CONCENTRATION

The Occupational Biomechanics/Ergonomics concentration provides the fundamental principles of musculoskeletal biomechanics and ergonomic design principles applied to injury prevention and rehabilitation. The curriculum offers a solid foundation in a wide variety of areas ranging from theoretical principles, laboratory testing for industrial and clinical applications as well as practical implementation. The program offers necessary knowledge to effectively design equipment, tasks, work environments and systems to maximize performance, comfort, job satisfaction and productivity while minimizing the risk of injury.

A unique aspect of the Occupational Biomechanics/Ergonomics concentration is that courses are not limited to engineering. Students may take courses in biostatistics, epidemiology, occupational therapy, public health policy administration and kinesiology — giving graduates an expanded view of the newest research in the areas of injury prevention and rehabilitation. You must meet **Graduate School Requirements** to enroll in this concentration.

Graduates of this concentration have the opportunity to work for manufacturing organizations, insurance companies, conduct government research and health care organizations.

Course Requirements:

- Students must complete at least 6 credits from **Group A**.
- Thesis option students must complete at least 18 credits combined from **Group A** and **Group B**. These may include up to 3 credits each of Ind Eng 990 and Ind Eng 999.
- Non-thesis option students must complete at least 24 credits combined from **Group A** and **Group B**. These may include up to 3 credits each of Ind Eng 990 and Ind Eng 999.
- Students must complete at least 2, but no more than 3 credits of IndEng 880.
- Any remaining credits in the MS in Engineering program of study may be taken as approved electives by the major professor.
- Students without a bachelor's degree in industrial engineering, Biomedical Engineering or related professional experience will be required to take additional courses prior to entering to the program per major professor's recommendations.

GROUP A

IND ENG 580: Introduction to Ergonomics	3 cr U/G
IND ENG 575: Design of Experiments	3 cr U/G
IND ENG 890: Research Methods in Engineering	3 cr U/G

GROUP B

IND ENG 880: Bioengineering Seminar	1 cr U/G
IND ENG 582: Ergonomic Job Analysis Techniques	3 cr U/G
IND ENG 716: Engineering Statistical Analysis	3 cr G
IND ENG 890: Advanced Topics in Ind Eng: Connected Enterprise	3 cr U/G
IND ENG 890: Advanced Topics in Ind Eng: Project Management	3 cr U/G
KIN 527: Kinesiology & Biomechanics of Normal & Abnormal Movement	3 cr U/G
KIN 720: Applied Research Methods in Biomechanics	3 cr G
KIN 740: Musculoskeletal: Spine	3 cr G
OCCTHPY 625: Design & Disability	3 cr U/G
OCCTHPY 704: Musculoskeletal Analysis and Occupational Function	3 cr G
PH 711: Intermediate Biostatistics	3 cr G
PH 759: Applied Quantitative Methods for Studying Population Health Disparities	3 cr G

Old Version:

INDUSTRIAL AND MANUFACTURING ENGINEERING

OCCUPATIONAL BIOMECHANICS / ERGONOMICS

MS CONCENTRATION

The Occupational Biomechanics/Ergonomics concentration provides the fundamental principles of musculoskeletal biomechanics and ergonomic design principles applied to injury prevention and rehabilitation. The curriculum offers a solid foundation in a wide variety of areas ranging from theoretical principles, laboratory testing for industrial and clinical applications as well as practical implementation. The program offers necessary knowledge to effectively design equipment, tasks, work environments and systems to maximize performance, comfort, job satisfaction and productivity while minimizing the risk of injury.

A unique aspect of the Occupational Biomechanics/Ergonomics concentration is that courses are not limited to engineering. Students may take courses in biostatistics, epidemiology, occupational therapy, public health policy administration and kinesiology — giving graduates an expanded view of the newest research in areas of injury prevention and rehabilitation. You must meet **Graduate School Requirements** to enroll in this track.

Graduates of this track have the opportunity to work for manufacturing organizations, insurance companies, conducing government research and health care organizations.

Course Requirements:

- Students must complete at least 6 credits from **Group A**.
- Thesis option students must complete at least 18 credits combined from **Group A** and **Group B**.
- Non-thesis option students must complete at least 24 credits combined from **Group A** and **Group B**.
- ~~Students need to must complete at least 2, but no more than 3 credits of IndEng 880.~~
- Any remaining credits in the MS in Engineering program of study may be taken as free electives.

GROUP A

IND ENG 580: Introduction to Ergonomics	3 cr U/G
IND ENG 590/890: Research Methods in Engineering	3 cr U/G
OCCTHPY 625: Design & Disability	3 cr G

GROUP B

IND ENG 880: Bioengineering Seminar	1 cr U/G
IND ENG 575: Design of Experiments	3 cr U/G
IND ENG 582: Ergonomic Job Analysis Techniques	3 cr U/G
KIN 520: Advanced Biomechanics - Neuromechanics	3 cr U/G
IND ENG 780: Advanced Ergonomics - Low Back Pain	3 cr G
IND ENG 783: Advanced Ergonomics in Upper Extremity	3 cr G
IND ENG 716: Engineering Statistical Analysis	3 cr G
IND ENG 890: Advanced Topics in Ind Eng: Human Factors Engineering	3 cr U/G
IND ENG 890: Advanced Topics in Ind Eng: Instrument in Ergonomics & Biomech	3 cr U/G
IND ENG 890: Advanced Topics in Ind Eng: Connected Enterprise	3 cr U/G
MATLENG 710: Advanced Mechanical Behavior of Materials	3 cr G
PH 711: Intermediate Biostatistics	3 cr G
PH 759: Applied Quantitative Methods for Studying Population Health Disparities	3 cr G
PH 777: Survey of Quantitative Research and Methods	3 cr G
KIN 720: Applied Research Methods in Biomechanics	3 cr G
KIN 725: Interdisciplinary Themes in Biomechanics	3 cr G

University of Wisconsin-Milwaukee
College of Engineering and Applied Science

ATTACHMENT 7

MECHANICAL ENGINEERING CURRICULUM

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

Engineering Core Courses (33 credits)		**Credits**	**Prerequisites**
Civ Eng 203	Introduction to Solid Mechanics	4	Math 232(P)
Civ Eng 202	Dynamics	3	Civ Eng 203(P), Math 233(C)
EAS 200	Professional Seminar	1	None
MatlEng 201	Engineering Materials	4	Chem 105(P) or 102(P), Math 231(C) or 221(C)
MechEng 101	Computational Tools for Engineers	2	Math 231(C) or 221(C)
MechEng 110	Engineering Fundamentals I	4	Math 115(C) or 231(C) or 225(C), Admission to CEAS.
MechEng 111	Engineering Fundamentals II	3	MechEng 110(P)
MechEng 270	Computer Aided Engineering Laboratory	2	MechEng 111(P), Civ Eng 202(C)
MechEng 301	Basic Engineering Thermodynamics	3	Math 233(P), Physics 209(P)
MechEng 302	Introduction to System Dynamics	3	MechEng 101(P), ElecEng 234(P,*), Physics 210(P), Civ Eng 202(P,*)
MechEng 324	Introduction to Fluid Mechanics	4	MechEng 301(C), Civ Eng 202 (P), Jr St
† Mechanical Engineering Major Courses (26 credits)			
Ind Eng 369	Introduction to Probability and Statistical Inference	1	Math 231 (P)
MechEng 379	Introduction to Mechatronics	3	Jr St & MechEng 302(C)
MechEng 321	Basic Heat Transfer	4	Jr St & MechEng 301(P)
Matl Eng 330	Materials and Processes in Manufacturing	3	Matl Eng 201(P)
MechEng 360	Mechanical Design	3	MechEng 101(P), 111(P), Civ Eng 202(P)
MechEng 364	Design of Machine Elements - I	3	MechEng 110(P), 111(P),302(P), Civ Eng 203(P), MatlEng 201(P)
MechEng 368	Advanced Mechanics of Materials and Design of Machine Elements - 2	3	MechEng 364 (P)
MechEng 438	Mechanical Engineering Experimentation	3	Sr St & MechEng 302 (P), 323 (P), 368 (P)
Mech Eng 405	Product Realization	3	Jr St & MechEng 302 (P), 323 (P), 360 (P), 368 (P), 270 (P)
		OR	
Mech Eng 496	Senior Design Project	3	Jr St & MechEng 302 (P), 323 (P), 360 (P), 368 (P), 270 (P)
††Mathematics (14-16 credits)			(16 credits typical: Math 231,232,233, ElecEng 234)
One of the following Calculus sequences must be completed: Math 231-232-233		12	Math placement score, or previous course with at least "B-" grade.
		OR	
Math 221- 222 (Honors)		10	
ElecEng 234	Analytical Methods in Engineering	4	Math 232 (P)
††Chemistry (5 credits)			
One of the following courses must be completed: Chem 105 (Suggested) or Chem 102		5	Chem 100* or Chemistry Placement; Math 105* or 108*
Physics (10 credits)			
Physics 209 & 214 (Lab), and Physics 210 & 215 (Lab)		10	Physics 209: Math 232(C) Physics 210: Math 233(C) C- or better in Physics 209
General Education Requirements			
Distribution Requirements (15 credits)			
Art		4	Art 318 or Art 316 or Art 313 or Art 478 suggested
Humanities		3	Commun 103 or Commun 105 suggested
Social Science		6	WGS 200 suggested
English 310 Writing, Speaking & Technoscience in the 21st Century		3	English competency

Cultural Diversity - One of the arts, humanities, or social science courses selected must also meet the UWM cultural diversity requirement.

Competency Requirements

††English Composition (0-6 credits)
The English Composition requirement is satisfied by:

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

Foreign Language (0-8 credits) (for new freshman starting fall 1999)
The foreign language requirement can be completed with one of these options:

1. Two years of a single foreign language in high school
2. Two semesters of a single foreign language in college
3. Demonstrate ability by examination

† Complete MechEng 101, 110, Chem 105 (or 102), Physics 209 & 214. 2. Complete Math 232 (or 222) with "C" or better grade. 3.Complete EAS 200. 4. Complete the English composition requirement. 5. Obtain a 2.33 GPA in all required math, science and engineering courses (Excludes: general education, prerequisites and orientation courses). The program may impose major status as a prerequisite for courses numbered 300 or above.

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

*** C or better in pre-requisite, (C) Concurrent enrollment in the designated course, (P) pre-requisite**

Elective credits: It is recommended that you consult your academic advisor for assistance in choosing appropriate elective courses. The Mechanical Engineering program requires a minimum of 15 elective credits which may be used towards:

ATTACHMENT 7

- Obtaining a recognized minor on campus
- Any CEAS 300 level and above course
- Any 200 level and above course in Math, Chemistry, Physics, Biology, or Geo Sciences excluding courses used as part Math, Physics, and Chemistry requirement
- Any course at the 200-level or above, with no more than 6 credits at the 200-level.
- English 101 and English 102
- Obtaining a transcript designated certificate in Mechanical Engineering
- Any course in the recommended list of courses shown below

MechEng 402	Thermal-Fluid Engineering	3	MechEng 323(P), 321(P)
MechEng 406	Design for Six Sigma (DFSS)	3	IndEng 367(P) or IndEng 369(P)
MechEng 407	Design for Reliability (DfR)	3	IndEng 367(P) or IndEng 369(P)
MechEng 411	Intermediate Heat Transfer	3	MechEng 321(P)
MechEng 420	Intermediate Fluid Mechanics	3	MechEng 323(P)
MechEng 423	Applied Fluid Mechanics	3	MechEng 320(P) or MechEng 323(P)
MechEng 424	Engineering for Energy Storage	3	MechEng 301(P)
MechEng 425	Wind Turbine Aerodynamics	3	MechEng 320(P) or MechEng 323(P)
MechEng 430	Energy Modeling	3	Jr St or con. instr
MechEng 432	Internal Combustion Engines	3	Jr St, MechEng 301(P)
MechEng 434	Air-conditioning System Design	3	MechEng 321(P)
MechEng 436	Solar Engineering	3	Jr. St., MechEng 301(P)
MechEng 435	Power Plant Design and Theory	3	Jr St, MechEng 301(P) (P)
MechEng 451	Applied Optics in Engineering	3	Physics 210(P)
MechEng 452	Nanobioimaging	3	Physics 210(P)
MechEng 453	Design Thinking	3	Jr St, BusAdm/MechEng 542(P), Admission to Major
MechEng 455	Processing of Plastics	3	MatlEng 201(P)
MechEng 456	Metal Casting Engineering	3	Jr St, MatlEng 201(P)
MechEng 457	Engineering Composites	3	Jr St, MatlEng 201(P)
MechEng 460	Nanomaterials and Nanomanufacturing	3	Jr St, MatlEng 201(P)
MechEng 462	Intermediate Design of Machinery	3	MechEng 368(P)
MechEng 463	Finite Element Methods	3	MechEng 302(P), 360(P), 368(P), 323(P), MatlEng 201(P)
MechEng 465	Friction and Wear	3	Jr St, MatlEng 201(P)
MechEng 466	Mechanics of Composite Materials	3	Jr St, CivEng 203(P)
MechEng 468	Intro. to Water Engineering	3	Sr std
MechEng 469	Intro. to Biomechanical Engineering	3	Jr St
MechEng 472	Intro. to Wind Energy	3	Jr. St or con. instr.
MechEng 473	Applied Dynamics	3	Jr St, CivEng 202(P)
MechEng 474	Introduction to Control Systems	4	MechEng 302(P,*)
MechEng 475	Vibrations in Mechanical Engineering	3	MechEng 302(P,*), CivEng 202(P), ElecEng 234(P)
MechEng 476	Intro. to Robotics	3	MechEng 302 (P), 360 (P)
MechEng 479	Advanced Mechatronics	3	Senior standing or consent of instructor; and MechEng 379(P)
MechEng 490	Topics in Mechanical Engineering	1-3	
MechEng 525	Multiphysics Finite Elements	3	CivEng 463, MechEng 463 or an equivalent finite elements course
MechEng 574	Intermediate Control Systems	3	MechEng 302(P), MechEng 474(P)
MechEng 699	Independent study	3	
CivEng 401	Intermediate Strength of Materials	3	CivEng 201(P)
IndEng 360	Engineering Economic Analysis	3	Jr St
IndEng 455	Operations Research 1	3	Jr. St. Math 233(P)
MatlEng 380	Engineering Basis for Material Selection	3	MatlEng 201(P)
MatlEng 410	Mechanical Behavior of Materials	3	Jr. St., MatlEng 201(P)
BusAdm 447	Entrepreneurship	3	Jr St, BusAdm 350(P)
EAS 001	Co-op Work Period	3	Prior Consent by Co-Op Director
EAS 497	Study Abroad	3	Acceptance to study abroad program

Degree Requirements: Students must maintain an average GPA of at least 2.0 on all work attempted at the University and in all courses offered by the College. Students majoring in Mechanical Engineering must maintain an average GPA of at least 2.5 in all 300-level and above courses in the Mechanical Engineering department. Transferable courses will be included as appropriate. Advancement to major status is required for graduation.

*** C or better in pre-requisite, (C) Concurrent enrollment in the designated course, (P) pre-requisite**

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ATTACHMENT 8

REQUEST FOR AUTHORIZATION TO IMPLEMENT A BACHELOR OF SCIENCE IN DATA SCIENCE AT UNIVERSITY OF WISCONSIN (UW-MILWAUKEE) PREPARED BY UW-MILWAUKEE

ABSTRACT

The University of Wisconsin-Milwaukee proposes to establish a Bachelor of Science in Data Science (B.S. in Data Science) , jointly offered by the College of Letters and Science and the College of Engineering and Applied Science. The development of program responds to the need to prepare students for careers in data science, data analytics, and related fields. Establishing the program will provide students with a solid foundation in statistical methods and programming techniques that are required in this field. Graduates will be better equipped to meet the challenging requirements of the profession for employment in areas that involve extensive data processing and data analysis. The program will be comprised of 120 credits, which will include required UWM general education courses, 24 credits of mandatory preparatory courses, 36 credits of mandatory advanced core courses, elective courses, and a capstone course or an internship at the end of the coursework.

PROGRAM IDENTIFICATION

Institution Name
University of Wisconsin-Milwaukee

Title of Proposed Program
Data Science

Degree/Major Designations
Bachelor of Science

Mode of Delivery
Single institution
Face-to-face

Projected Enrollments and Graduates by Year Five

Table 1 represents enrollment and graduation projections for students entering the program over the next five years. By the end of Year 5, it is expected 70 students will have enrolled in the program and 7 will have graduated. The average student retention rate is estimated at 75% every year, based on the average first-year attrition rate for UW-Milwaukee; this is a conservative estimate, since retention rates tend to be higher after the second year. Some students from closely related majors are expected to switch to the B.S. in Data Science,

and transfers from other colleges are also expected, but these numbers are hard to predict, so they are not included in Table 1.

Table 1: Five-Year Degree Program Enrollment Projections

Students/Year	2020	2021	2022	2023	2024
New Students	5	10	15	20	20
Continuing	0	4	11	19	28
Total Enrollment	5	14	26	39	48
Graduating	0	0	0	2	5

Tuition Structure

For students enrolled in the B.S. in Data Science program, standard tuition and fee rates will apply. For the current academic year, residential tuition and segregated fees total $4,799.21 per semester for a full-time student enrolled in 12-18 credits per semester. Of this amount, $4,045.56 is attributable to tuition and $753.65 is attributable to segregated fees. Nonresident tuition and segregated fees total $10,584.17 per semester for a full-time student enrolled in 12-18 credits per semester. Of this amount, $9,830.52 is attributable to tuition and $753.65 is attributable to segregated fees.

Classes at the College of Engineering and Applied Sciences have a differential tuition of $21.63 per credit.

Some preparatory courses at the College of Letters and Sciences offer online sections, which incur an additional $275 fee per course.

Department or Functional Equivalent

Department of Mathematical Sciences
Department of Electrical Engineering and Computer Science

College, School, or Functional Equivalent

College of Letters and Sciences
College of Engineering and Applied Sciences

Proposed Month and Year of Implementation

January 2021

DESCRIPTION OF PROGRAM

Overview of the Program

The program will be comprised of 120 credits, which will include required UWM general education courses, 24 credits of mandatory preparatory courses, 36 credits of mandatory advanced core courses, elective courses, and a capstone course or an internship at the end of the coursework.

Student Learning Outcomes and Program Objectives

The objective of the BS major degree in Data Science is to prepare students for careers in data science, data analytics or related fields. To accomplish this goal, students will gain a solid foundation in statistical methods and programming techniques via a wide range of courses available through the Department of Mathematical Sciences at the College of Letters and Science and the Computer Science Division at the College of Engineering and Applied Sciences.

Upon completion of the program, students will:

- Be able to integrate methods and concepts from mathematics, statistics and computer science to solve data science problems, including data management and extraction of meaning from data.
- Demonstrate critical thinking related to data science problems and concepts.
- Demonstrate oral and written communication skills related to data science.
- Demonstrate awareness of the ethical aspects of data science.

Program Requirements and Curriculum

For admission to the B.S. in Data Science program, students must meet the general requirements of admission to UW-Milwaukee, including a high school degree with 4 credits in English, 3 credits in Mathematics, 3 credits in Natural Science, 3 credits in History/Social Science, 2 credits in College Prep Electives, and 2 credits in Other Electives. Performance on ACT/SAT tests is considered, as is an application essay.

Table 2 illustrates the program curriculum for the proposed program. The program requirements are comprised of 120 credits, of which there are 24 credits of preparatory courses, 36 credits of advanced core courses, electives, UW-Milwaukee general education requirements, and a mandatory capstone course or internship at the end of the coursework.

The general education requirements of UW-Milwaukee are also listed in Table 2. Some general education requirements are satisfied by the major requirements; for example, English 310 is a designated QL-B course, and Math 231 counts as a general education course in the Natural Sciences for breath requirement. The UW-Milwaukee foreign language requirement is completed through two years of a single foreign language in high-school, or two semesters of a single foreign language in college. The UW-Milwaukee cultural diversity requirement is completed by taking one course from the Arts, Humanities, or Social Sciences that is designated as satisfying UW-Milwaukee's cultural diversity requirement.

Table 2: Bachelor of Science in Data Science Program Curriculum

General education and breadth courses (approx. 33 credits):	
Oral and Written Communication Part A (grade C or better in English 102 or equivalent)	3 credits
Oral and Written Communication Part B (course designated as OWC-B)	3 credits
Quantitative Literacy Part A (grade C or better in Math 105)	3 credits
Quantitative Literacy Part B (course designated as QL-B)	3 credits
Arts	3 credits
Humanities	6 credits
Natural Sciences (including one lab or field experience)	6 credits
Social Sciences	6 credits
Preparatory courses (24-25 credits):	
Mathematics	
Math 231 (Calculus I)	4 credits
Math 232 (Calculus II)	4 credits
Math 233 (Calculus III)	4 credits
Math 234 (Linear Algebra) or 240 (Matrices)	4 or 3 credits
Computer Science	
CompSci 250 (Introductory Computer Programming)	3 credits
CompSci 251 (Intermediate Computer Programming)	3 credits
Statistics	
MthStat 215 (Elem. Stat.) or 216 (Intr. to Data Science)	3 credits
Core courses (36 credits):	
Statistics	
MthStat 361 (Introduction to Mathematical Statistics I)	3 credits
MthStat 362 (Introd. to Mathematical Statistics II)	3 credits
MthStat 563 (Regression Analysis)	3 credits
MthStat 566 (Computational Statistics)	3 credits
MthStat 568 (Multivariate Statistical Analysis)	3 credits
Computer Science	
CompSci 315 (Introduction to Computer Organization)	3 credits
CompSci 351 (Data Structures and Algorithms)	3 credits
CompSci 422 (Introduction to Artificial Intelligence)	3 credits
CompSci 411 or 425 (Introduction to Data Mining)	3 credits
CompSci 557 (Introduction to Database Systems)	3 credits
Communication and Ethics	
English 310 (Writing, Speaking and Technoscience)	3 credits
CompSci 395 or Philos 237 (Society, Tech. and Ethics)	3 credits
Capstone or Internship (choose one) (1-6 credits):	
MthStat 489 (Internship)	1-6 credits
Math 599 (Capstone Experience)	1 credit
CompSci 595 (Capstone Project)	4 credits

CompSci 599 (Senior Thesis)	3 credits
Elective courses (to reach 120 total credits):	
Recommended are courses with substantial data analysis, data processing, or computational content, such as the following: CompSci 317, 411, 423, 425, 444, 459, 469, 535 MthStat 562, 564, 565 Math 315, 318, 341, 571 InfoSt 120, 315, 465, 660, 661	
Total Credits	120 credits

Assessment of Outcomes and Objectives

All majors in the Department of Mathematical Sciences undergo an annual assessment of departmental learning outcomes, which is part of the campus-coordinated assessment exercise required for Higher Learning Commission (HLC) accreditation. In addition, courses in Computer Science are regularly assessed as part of the Accreditation Board for Engineering and Technology (ABET) accreditation process. The B.S. in Data Science, as a dual major offered by both the Department of Mathematical Sciences and the Department of Computer Science and Electrical Engineering, will be part of both assessment exercises. A specific assessment of the learning outcomes and objectives of the B.S. in Data Science program will also be conducted by regularly surveying graduates of the program.

Diversity

The B.S. in Data Science program seeks to prepare students from diverse backgrounds for a competitive job market, providing them with technical expertise that is in high demand but in short supply in the current marketplace. This will increase the participation of women and minorities in the STEM-related job market. The program curriculum includes courses that will offer students opportunities and learning activities to engage in diversity with respect to perspectives, theories, practices, and populations different from themselves, particularly some GER courses in the Humanities and the core courses on Ethics and Communication.

The Department of Mathematical Sciences participates in many initiatives designed to foster diversity among students: UW-Milwaukee's STEM-Inspire and WiscAMP programs, which seek to "improve the recruitment, retention, and graduation of underrepresented minorities in STEM majors" (https://uwm.edu/steminspire/); the regional M-cubed initiative (https://uwm.edu/m-cubed/), which includes southeastern Wisconsin's three primary public educational institutions (Milwaukee Public Schools, Milwaukee Area Technical College, and UW-Milwaukee), urban institutions with a large proportion of minority students, and has as its mission "to increase the retention, graduation, and career success of our students and provide a prepared workforce and citizenry for the Wisconsin economy"; the UW-system Math Initiative (https://www.wisconsin.edu/math-initiative/), which seeks to improve the success of students in developmental math courses and in their first credit-bearing math courses; and the Higher Education Regional Alliance (HERA, https://www.herawisconsin.org/), a consortium of higher

education institutions throughout southeast Wisconsin which is working to improve students' success in college generally, including mathematics. Faculty of the department also organize the Math Circle (https://uwm.edu/math/math-circle-uwm/), an outreach effort consisting of weekly sessions of problem solving and mathematical puzzles for students interested in mathematics in grades 5-12.

The Department of Computer Science and Electrical Engineering also participates in diversity-fostering initiatives. It is a founding institution in the BRAID initiative of AnitaB.org (https://anitab.org/braid-building-recruiting-and-inclusion-for-diversity/). One of the initiative's commitments is to build joint majors that encourage broader participation. The department also hosts the Girls Who Code Club during the academic year, a program led by computer science faculty to encourage school girls' interest in computing and all the opportunities it provides (https://uwm.edu/engineering/our-people/community/girls-who-code-club/).

Projected Time to Degree

A full-time student taking the standard course load of five three-credit courses per semester will complete the requirements in eight semesters. For this, students will need a mathematics placement level that allows them to begin with pre-calculus or a higher math course. About 30% of entering UW-Milwaukee students achieve this level. Students needing additional math courses should still be able to complete the program in four years by taking coursework during the summer.

Program Review

In accordance with UW-Milwaukee policies and procedures, the program will be reviewed five years after implementation for the first time, and every ten years thereafter.

Accreditation

This program does not require special accreditation. It will be reviewed as part of the campus accreditation process by the Higher Learning Commission.

JUSTIFICATION

Rationale and Relation to Mission

The UW-Milwaukee Select Mission Statement (https://uwm.edu/mission/) states, in part, that "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 B.S. in Data Science will contribute directly to the mission of UW-Milwaukee by providing students with a thorough academic preparation to meet the challenging demands of the profession, by attracting students with strong STEM potential from diverse socioeconomic backgrounds in southeastern Wisconsin, and by fostering cooperation between UWM and the business community, for example, through the Northwestern Mutual Data Science Institute (https://innovation.northwesternmutual.com/northwestern-mutual-data-science-institute/).

Institutional Program Array

The proposed B.S. in Data Science will complement existing programs both at the Department of Mathematical Science and the Department of Electrical Engineering and Computer Science.

The department of Mathematical Sciences currently offers a B.A. in Actuarial Science and B.A./B.S. in Mathematics. The mathematics and statistics courses (Math and MthStat) listed in the proposed B.S. in Data Science curriculum are regularly offered by the department as part of those majors' curricula. However, the department does not currently offer a specific degree on statistics or data science, which would require a stronger programming coursework.

Similarly, the Department of Electrical Engineering and Computer Science offers B.A./B.S. in Computer Science, and the computer science courses (CompSci) listed in the proposed B.S. in Data Science curriculum are regularly offered by the department as part of those majors' curricula, but the department does not currently offer a specific degree on statistics or data science, which would require a stronger statistics coursework.

Both departments currently offer a joint B.S. in Applied Mathematics and Computer Science, but this degree is not specifically aimed at the market demands in the fields of data science and data analytics.

The proposed B.S. in Data Science seeks to combine the existing course offers of both departments, and the expertise of their faculty, into a new major that is specifically oriented to data science. Therefore, the proposed program will complement existing programs in both departments.

Other Programs in the University of Wisconsin System

There is currently only one major degree in data science offered at a UW institution, a B.S. in Data Science and Predictive Analytics at UW-River Falls. Two other institutions have recently received approval to plan major degrees in data science: B.A./B.S. in Data Science at UW-Madison and a B.S. in Data Science at UW-Platteville. UW-Stout offers a B.S. in Applied Mathematics and Computer Science that, unlike its homonymous at UW-Milwaukee, it has concentrations with stronger statistics and data science components, so it can be considered a closely related degree. There is also a minor offered by the Department of Computer Science at UW-Whitewater. No other undergraduate degrees in data science are currently offered at the UW system.

This program, then, will not create unnecessary duplication and will fill an unmet market need in the area of southeast Wisconsin.

Need as Suggested by Current Student Demand

Graduation data from the Department of Mathematical Sciences between Spring 2014 and Spring 2018 show that the department granted 48 B.A.s in Actuarial Science, 9 B.A.s or B.S.s in Mathematics with concentration in Applied Mathematics, 1 B.S. in Mathematics with concentration in Statistics, 2 B.S.s in Mathematics with concentration in Computational Mathematics, 8 B.A.s or B.S.s in Mathematics with concentration in Pure Mathematics, and 54 B.A.s or B.S.s in Mathematics without concentration specification (concentrations were discontinued in Fall 2017, so the last figure includes both students interested in pure or applied mathematics.) These data show that a large proportion of undergraduate students in the Department of Mathematical Sciences have shown interest in statistics, actuarial science or applied mathematics in recent years. Therefore, there has been a sustained student demand for applied math and statistics-related programs in recent years.

We expect that the proposed B.S. in Data Science will complement these majors, as well as the majors offered by the Department of Computer Science and Electrical Engineering, increasing the visibility of UW-Milwaukee in this area and giving us the opportunity to recruit students who would otherwise not attend UW-Milwaukee. It must be noted that, in the southeast Wisconsin region, only Marquette University offers a data science major degree; however, Marquette is a private catholic institution with a very different mission and student body than UW-Milwaukee.

Need as Suggested by Market Demand

The job outlook for mathematicians and statisticians in the Occupational Outlook Handbook of the Bureau of Labor Statistics (https://www.bls.gov/ooh/math/mathematicians-and-statisticians.htm) states that "employment of statisticians is projected to grow 34 percent from 2016 to 2026, much faster than the average for all occupations. Growth is expected to result from more widespread use of statistical analysis to make informed business, healthcare, and policy decisions. In addition, the large increase in available data from the Internet will open up new areas for analysis. (...) The amount of digitally stored data will increase over the next decade as more people and companies conduct business online and use social media, smartphones, and other mobile devices. As a result, businesses will increasingly need mathematicians to analyze the large amount of information and data collected." The handbook is very specific about data science, stating that "job opportunities are expected to be favorable for those with very strong quantitative and data analysis skills. Computer programming skills will remain important to many employers, as will be keeping up with new statistical methods and programming languages." According to this report there were 37,200 job positions for statisticians in the US in 2016, and this number is expected to grow to 49,800 in 2026.

For the state of Wisconsin, a labor market report generated at WisConomy, the Department of Workforce Development labor database (https://jobcenterofwisconsin.com/wisconomy/), shows that the number of job positions in Computer and Mathematical Occupations in the Professional, Scientific, and Technical Services industries is expected to grow from 17,299 in the year 2016 to 20,899 in 2026 (a 20.8% increase), and in the Finance and Insurance industries is expected to grow from 10,424 to 11,703 (a 12.3% increase) in the same period.

The recent creation of the Northwestern Mutual Data Science Institute at UW-Milwaukee and Marquette University also demonstrates the demand for data science programs in the region of southeast Wisconsin.