

**Request for Authorization to Plan (Notice of Intent)**  
**Bachelor of Science, Engineering**  
**University of Wisconsin-Milwaukee**

**Abstract**

The University of Wisconsin (UW)-Milwaukee proposes to establish a Bachelor of Science in Engineering (Engineering, BS) as a new degree program via its Department of Industrial & Manufacturing Engineering (IME). The Engineering, BS will be the second bachelor's degree offered by the department. The curriculum will meet ABET accreditation credit requirements for math, science, and engineering like the current Industrial Engineering major offered by the department. However, the required engineering courses will come from a wider range of engineering disciplines and students will choose specialized interdisciplinary tracks based on their educational interests and career goals. Such specializations may be driven by emerging cross-disciplinary technical fields (e.g., advanced manufacturing, connected systems) or by the desire to have an immersive interdisciplinary experience (e.g., engineering & pre-medicine, engineering & entrepreneurship).

The purpose of the program is to not only prepare students for future engineering jobs, but also attract new groups of students to the profession by creating new flexible and customizable pathways. The program is designed to facilitate partnerships with the over 100 minors, certificates and pre-professional programs offered by UWM; and with regional transfer partners (e.g., Milwaukee Area Technical College, Waukesha County Technical College, Gateway Technical College, Moraine Park Technical College). The program will also create pathways to support individuals who are already working in a technical field and need a bachelor's degree in engineering to enhance their skills and further their career.

Engineering, BS graduates will have diverse career opportunities and can pursue roles in research and development, project management, consulting, entrepreneurship, and engineering positions where interdisciplinary skills are highly valued. Occupational employment projections indicate continued demand for engineers. The U.S. Bureau of Labor Statistics projects the growth rate for engineers as much faster than the average growth rate for all occupations.

We do not anticipate any changes in tuition structure for this degree program or the need to create new engineering courses. The curriculum will be built utilizing existing courses offered by UW-Milwaukee.

**Program Identification**

**University Name:** University of Wisconsin-Milwaukee (UWM)

**Title of Proposed Academic Program:** Engineering, BS

**Degree Designation:** Bachelor of Science

**Suggested Classification of Instructional Programs (CIP) Code:** 14.0101

**Mode of Delivery:** Primarily face-to-face with some hybrid or online course options

**Department:** Industrial & Manufacturing Engineering

**Proposed Date of Authorization:** September 1, 2024

**Proposed Date of Implementation:** Fall 2025

## **PROGRAM INFORMATION**

### **Rationale:**

As described in a report by the Universities of Wisconsin in May 2023, “Wisconsin is in a war for talent that extends globally”. The Wisconsin workforce is becoming older with fewer younger workers entering the workplace. It is projected that the number of high school graduates will decline due to a relatively low birth rate and an aging population. The impact of the decline in the number of high school graduates on enrollment is further exacerbated by the falling participation rate of high school graduates who go on to college. With these significant demographic challenges and projected engineering workforce shortages, it will be crucial for educational institutions to adapt and be creative to provide the educated workforce needed for Wisconsin to remain competitive. A unique and non-traditional interdisciplinary engineering program like the Engineering, BS has the potential to attract more students to the engineering profession and meet the growing industry demand for engineers who can effectively tackle complex challenges that require a multidimensional approach.

Universities of Wisconsin, Office of the President, “Wisconsin and the UW System – Facts and Trends May 2023 (Online). Available: [https://www.wisconsin.edu/president/download/UWFactsTrends\\_May2023.pdf](https://www.wisconsin.edu/president/download/UWFactsTrends_May2023.pdf).

Many of the pressing challenges faced by society, such as climate change, sustainable development, energy management, and healthcare, are multifaceted and require a holistic understanding. These fields demand engineers who can integrate knowledge from different disciplines to develop efficient and sustainable solutions. Employers seek engineers who can apply their knowledge in diverse contexts, work on interdisciplinary projects, contribute to innovation, and work effectively in cross-disciplinary teams. A new interdisciplinary engineering program can cater to these emerging areas and produce graduates with these specialized skills.

### **Need as Suggested by Market Demand:**

The U.S. Bureau of Labor Statistics projects employment in engineering occupations to grow faster than the average for all occupations from 2022 to 2032, with about 188,000 openings each year on average, due to employment growth and the need to replace workers who leave the occupation permanently. The median annual wage for this group was \$83,700 in May 2022, which was much higher than the median wage of all occupations of \$46,310. The Wisconsin Department of Workforce Development projects employment growth in engineering occupations (Standard Occupation Classification 17-200) to be 11.4%

from 2020 to 2030 with estimated employment 42,466 in 2030. This is also faster than the projected 6.3% growth of all occupations in the state.

U.S. Bureau of Labor Statistics, "A-Z Index : Occupational Outlook Handbook," Office of Occupational Statistics and Employment Projections, 6 September 2023 (Online). Available: <https://www.bls.gov/ooh/a-z-index.htm>

State of Wisconsin, Department of Workforce Development, "Occupational Employment Projections" (Online). Available: <https://jobscenterofwisconsin/wisconsin>

An analysis of supply and demand (students graduated & employer need) for engineers was performed in 2022 for Wisconsin and the Midwest using data from Lightcast. The data shows there is a current shortage of engineering graduates to meet demand (Table 1). This data indicates there is a severe shortage of engineering graduates in all fields of engineering currently offered by UW-Milwaukee. The Engineering, BS will be offered by the Industrial & Manufacturing Department with many of the core courses drawn from the current Industrial Engineering major. The Lightcast data indicates over six openings per graduating student in Industrial Engineering related occupations in Wisconsin and the Midwest.

*Table 1: Lightcast degree completions and job openings for Wisconsin and the Midwest.*

Engineering Program	Degree Completions 2022		Jobs				Need	
	WI	Midwest	WI Positions	WI Annual Openings	Midwest Positions	Midwest Annual Openings	WI Job Openings/ Completions	Midwest Job Openings/ Completions
Environmental Engineering	42	492	4,393	479	49,280	5,114	11.40	10.39
Computer Science	286	10,414	58,241	5,894	687,327	71,753	20.61	6.89
Mechanical Engineering	896	10,675	15,766	1,347	183,015	15,597	1.50	1.46
Electrical Engineering	419	5,079	9,436	1,019	127,851	11,625	2.43	2.29
Biomedical Engineering	312	2,550	3,507	394	41,669	4,067	1.26	1.59
Civil Engineering	357	3,911	10,715	1,058	129,616	12,084	2.96	3.09
Industrial Engineering	232	2,248	14,506	1,402	144,720	15,628	6.04	6.95
Materials Engineering	98	873	5,326	613	63,146	6,733	6.26	7.71

**Need as suggested by Current Student Demand:**

In this challenging enrollment environment, engineering programs will need to find areas of opportunity to recruit and retain additional students. The Engineering, BS aims to attract students who may not complete a traditional discipline-specific engineering degree: 1) Students interested in multiple areas of

study. 2) Transfer students, including those with AAS degrees in engineering technology. 3. Students who have started college but left with no degree.

**Multidisciplinary:** UW-Milwaukee offers 213 degree programs. Many students want to attend a large university like UW-Milwaukee because of this wide array of programs and options. The engineering program gets many applicants who are interested in multiple areas of study. The traditional discipline-specific engineering majors are very sequential in nature and have very few if any free electives to allow students to pursue multiple areas of study without extending their time to degree. This forces students to choose only one engineering discipline or other areas they are mostly interested in. UW-Milwaukee also offers many pre-professional programs for students to prepare for graduate studies. There are students who would like to have a foundation in general engineering in readiness for a professional graduate degree (medicine, law, physical therapy, etc.), but find the specific courses they need in the pre-profession program do not fit into their current engineering degree. The Engineering, BS program will collaborate with other programs at UW-Milwaukee to create unique interdisciplinary study plans to allow students to pursue their multiple interests. There have already been conversations with the Doctor of Physical Therapy at UW-Milwaukee to create a pre-physical therapy concentration within the Engineering, BS with courses that are not normally in an engineering program. (e.g., General Biology, Human Anatomy, Human Physiology). The Engineering BS will take advantage of the wide range of program offerings offered by UW-Milwaukee to provide students with diverse skills and desired experiences.

**Transfer Students:** The Engineering, BS program will work with regional transfer partners on articulation agreements to encourage students to continue for a bachelor's degree in engineering. The need for the portability of credits and credentials between the Universities of Wisconsin and the Wisconsin Technical College System has been recognized for a long time, and decades of mutual work between and among the two systems and institutions has led to a strong culture of support for transfer and student success among the public colleges and universities of Wisconsin. To facilitate degree achievement of people with AAS degrees, on November 21, 2019, Wisconsin Statutes, § 36.31(2m) (b), the State of Wisconsin 72-Credit Transfer Rule, became law. In January 2024, UW-Milwaukee reached new transfer agreements with four regional technical colleges that will guarantee admission for their graduates. The agreements are with Milwaukee Area Technical College, Waukesha County Technical College, Moraine Park Technical College, and Gateway Technical College. All associate degree holders from the four colleges are guaranteed a seamless transfer of at least 60 credits toward a bachelor's degree at UWM. Interested students will only need to complete a brief intent form rather than a lengthier, formal admission application. While this law and the new agreements facilitate credit transfer, it aims at the transfer of the credits at the level of individual courses and for core general education courses. This agreement is primarily about general education; traditionally, technology students do not take many GER distribution courses. The Engineering, BS offers students with technology background a more holistic degree program allowing them to graduate in two years complementing their prior education, hands-on skills, and current employment. The program will offer a faster time-to-degree for those with an AAS in Engineering Technology than currently available with traditional engineering programs.

**Some College, No Degree:** In the United States, approximately two million people each year enter postsecondary education for the first time. Eight years later, one-third of those who started have not earned any formal credential and are no longer enrolled. This former student population, also known as the “some college, no degree” population, is an important indicator for an economy that demands more workers with education and training beyond high school. This population also is important as a source of possible enrollment growth for postsecondary institutions in many parts of the country that are struggling with recent declines. Former students themselves also reap great personal benefits from obtaining degrees and certificates. In Wisconsin, the “some college, no degree” population was estimated at 721,678 in 2020. The Engineering, BS, with its transfer friendly curriculum, will allow these students to count more of their previous credits which may encourage more to return to school to finish their degree.

### **Overview of the Program**

The curriculum is designed for the student to gain a comprehensive understanding of fundamental engineering principles, theories, and practices across various fields, allowing them to develop a broad knowledge base and a multidisciplinary perspective. The flexible nature of the program gives students the opportunity to pursue an engineering degree while simultaneously exploring other areas of interest. Students can choose an area of emphasis within engineering and from over 100 minors, certificates and pre-professional programs offered by UWM as part of their program of study. The Industrial & Manufacturing Engineering Department will get feedback annually from its Industrial Advisory Committee to ensure the program meets the needs of local engineering employers.

Throughout the program, students are encouraged to engage in experiential learning, research projects, and internships to apply interdisciplinary knowledge in real-world contexts. They gain practical skills, adaptability, and a strong problem-solving mindset that prepares them for the complex challenges of today's engineering landscape.

A total of 120 credits are needed for graduation: (1) 18 credits in math including probability and data analytics, (2) 12 credits of natural science (3) 45 credits of engineering including a 3-credit capstone course and 12 credits in an engineering emphasis area. (4) 15 credits to meet GER Art, Humanities and Social Science distribution requirements, and (5) 30 credits for interdisciplinary areas of study. The program meets the credit requirements in math, science, and engineering to be accredited by ABET.

### **Outcome of the program**

1. Students will have an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. Students will have an ability to apply engineering concepts to produce solutions that meet specified needs with consideration of economic factors
3. Students will have an ability to communicate effectively with a range of audiences
4. Students will have an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

5. Students will have an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. Students will have an ability to develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions
7. Students will have an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

**Projected Time to Degree:**

Full-time students can finish the 120-credit program in four years. The program can be completed on a part-time basis, with the time to degree variable based on the number of credits taken each semester. The transfer friendly curriculum will offer a faster time to degree for many returning students and those with an AAS in engineering technology than currently available with traditional engineering programs. Students with AAS degrees in engineering technology can finish the degree in two years.

**Accreditation:**

The program intends to meet the general criteria for engineering baccalaureate level programs and seek accreditation by the Engineering Accreditation Commission of ABET

**Institution and University of Wisconsin System Program Array**

The proposed new program fits well with UWM's "Select Mission Statement" as seen online at <https://uwm.edu/mission/> In particular, UWM seeks to "develop and maintain high quality undergraduate, graduate, and continuing education programs, "further academic and professional opportunities at all levels for women, minority, part-time, and financially or educationally disadvantaged students," "encourage others from institutions in the University of Wisconsin System and from other educational institutions, and "provide educational leadership in meeting future social, cultural, and technological challenges." This program would be the only general engineering type bachelor's degree offered in the University of Wisconsin System. The program will primarily serve industry needs in S.E Wisconsin and is not likely to impact other UW System engineering programs.

**Anticipated Resources:**

The new program combines existing courses in innovative ways, so setting up the new program will not require additional resources, until and unless enrollment increases substantially. New faculty lines will be needed as the program grows, and these lines can serve existing programs as well. We anticipate that existing advising resources will prove sufficient.