

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

ABSTRACT

The University of Wisconsin-Milwaukee (UWM) proposes to establish a Doctor of Philosophy (Ph.D.) in Mechanical Engineering. The establishment of this program supports UWM's mission to maintain high-quality graduate programs appropriate to a major urban doctoral university. Mechanical engineering has been a track within a college-wide Ph.D. in Engineering (established in 1986). Over the years, the track had a consistent enrollment of about 38 students. The current request is to elevate the track to a stand-alone degree that is more descriptive of the program of study. Graduates will benefit from a more recognizable credential making them more competitive in the job market. The proposed program will be more attractive to prospective students and will enhance graduate placement in positions that require a doctorate in the specific discipline of Mechanical Engineering. The proposed curriculum will be the same as in the current Mechanical Engineering track of the college-wide Ph.D. program. The program will be comprised of 66 graduate credits beyond the bachelor's degree and includes an approved minor area and doctoral thesis. No new courses nor new faculty/staff will be needed to implement this program. There are no planned changes in research foci – current areas of strength include renewable energy, rehabilitative robotics, power storage, tribology, optics, sensor development, structural health monitoring, and water filtration.

PROGRAM IDENTIFICATION

University Name

University of Wisconsin-Milwaukee

Title of Proposed Academic Degree Program

Mechanical Engineering

Degree Designations

Doctor of Philosophy

Mode of Delivery

Single institution; Face-to-face

Department or Functional Equivalent

Department of Mechanical Engineering

College, School, or Functional Equivalent

College of Engineering and Applied Science (CEAS)

Proposed Date of Implementation

August 2023

Projected Enrollments and Graduates by Year Five

Table 1 illustrates anticipated Ph.D. in Mechanical Engineering enrollments over the first five years of the program. Projections are reflective of enrollments in the Mechanical Engineering track of the current college-wide Ph.D. program that, for years 2016-2022, ranged between 33 and 42 students each year and averaging 38 Ph.D. students. Approximately 80% of these students enroll full-time. It is expected that approximately 36 students will be enrolled in the program each year, and 6 students will graduate each year. Significant enrollment changes are not anticipated after the Ph.D. in Mechanical Engineering program becomes a stand-alone program. However, the quality of graduate students joining the program is expected to improve once the degree awarded changes from Ph.D. in Engineering to Ph.D. in Mechanical Engineering. The small attrition rate built into the projections is consistent with the track’s experience in the past seven years.

Table 1: Five-Year Academic Program Enrollment Projections

Students/Year	Year 1	Year 2	Year 3	Year 4	Year 5
New Students	7	7	7	7	7
Continuing Students	33	33	33	33	33
Total Enrollment	40	40	40	40	40
Graduating Students	6	6	6	6	6

Tuition Structure

Standard tuition and fee rates for graduate students will apply. In 2022-23, tuition and fees for Wisconsin residents enrolled full-time for eight credits is \$6,114.67 per semester of which segregated fees total \$764.35 and tuition accounts for \$5,350.32 per semester. The corresponding non-resident tuition and segregated fees are \$12,830.19 for full-time enrollment of eight credits of which \$764.35 account for segregated fees and \$12,065.84 account for tuition. Tuition and fees for resident students enrolling part-time for three credits is \$2462.61 of which \$456.24 are for segregated fees and \$2,006.37 are for tuition. Credits taken in the College Engineering and Applied Science are assessed an additional “differential tuition” of \$21.63 per credit. Most full-time Ph.D. students in Engineering are graduate assistants and receive tuition remission as a benefit of their appointments.

DESCRIPTION OF PROGRAM

Overview of the Program

The program will be comprised of 66 graduate credits beyond the bachelor's degree including a minimum credit distribution of 21 credits in the major area of concentration in mechanical engineering; 9 credits in an approved minor area (within or outside of mechanical engineering); 6 credits in mathematics and/or quantitative methods; 9 credits of approved electives; 3 credits of CEAS Graduate Seminar [it is currently being offered as a combination of two courses: EAS 701 – Effective Academic Writing (1 credit) and EAS 702 – Prep Future Eng Professionals (2 credits)]; and 18 credits of doctoral thesis or dissertation. A minimum of 26 credits, excluding dissertation, must be at the 700 level or higher. A minimum of 33 credits (including thesis) must be completed in the Ph.D. program at UW-Milwaukee. A maximum of 33 credits can be considered for transfer from prior graduate work including a master's degree provided the course work fits the appropriate areas and the student has earned a grade of "B" or better in each course. Students entering the program without a prior applicable master's degree are limited to a maximum of 9 transfer credits.

Student Learning Program Outcomes

Student Learning Outcomes of the Ph.D. in Mechanical Engineering will be the same as those in the current college-wide Ph.D. Program. Students enrolled in the proposed program will:

- 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.

Program Requirements and Curriculum

This proposed program is housed within the College of Engineering and Applied Science (CEAS). It will follow the College's existing Ph.D. admission requirements, which are: (1) a Bachelor's or Master's degree in mechanical engineering; however, applicants with a B.S. or M.S. degrees outside of mechanical engineering may be admitted with no more than two prerequisite course deficiencies; (2) a minimum GPA of 3.0 in the highest degree granted based on a 4.0 scale; (3) a brief statement describing the applicant's professional goals and two letters of reference; (4) the Graduate Record Examination (GRE) score; (5) International students require proof of English language proficiency.

The Ph.D. in Mechanical Engineering program will consist of 66 graduate credits beyond the bachelor's degree, comprised of a minimum credit distribution of 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 credits of CEAS Graduate Seminar (Ethics and Engineering Communication); and 18 credits of doctoral thesis. A minimum of 26 credits, excluding dissertation, must be at the 700 level or higher.

Each student will construct their program of study in consultation with their major professor. The program of study will be tailored to each student based on their area of dissertation research and their prior academic background. Table 2 contains the listing of Mechanical Engineering courses that are available to students in the program. Graduate courses offered by other areas within UWM are also available to students as they complete their program of study. In general, courses will be offered face-to-face; however, a few courses may be delivered online.

Table 2: Graduate Course List for Mechanical Engineering

Course number	Title	Credits
MECHENG 405G	Product Realization	3
MECHENG 411G	Heat Transfer	3
MECHENG 415G	Modern Thermomanufacturing Processes	3
MECHENG 420G	Intermediate Fluid Mechanics	3
MECHENG 423G	Applied Fluid Mechanics	3
MECHENG 425G	Wind Turbine Aerodynamics	3
MECHENG 430G	Energy Modeling	3
MECHENG 432G	Internal Combustion Engines	3
MECHENG 434G	Air Conditioning System Design	3
MECHENG 435G	Power Plant Theory and Design	3
MECHENG 436G	Solar Engineering	3
MECHENG 451G	Applied Optics in Engineering	3
MECHENG 455G	Processing of Plastics	3
MECHENG 456G	Metal Casting Engineering	3
MECHENG 457G	Engineering Composites	3
MECHENG 460G	Nanomaterials and Nanomanufacturing	3
MECHENG 462G	Intermediate Design of Machinery	3
MECHENG 463G	Introduction to Finite Elements	3
MECHENG 465G	Friction and Wear	3
MECHENG 466G	Mechanics of Composite Materials	3
MECHENG 469G	Introduction to Biomedical Engineering	3
MECHENG 472G	Introduction to Wind Energy	3
MECHENG 473G	Applied Dynamics	3
MECHENG 474G	Introduction to Control Systems	3
MECHENG 475G	Vibrations in Mechanical Design	3

MECHENG 476G	Introduction to Robotics	3
MECHENG 479G	Advanced Mechatronics	3
MECHENG 490G	Topics in Mechanical Engineering	3
MECHENG 544G	New Product Development	3
MECHENG 546G	Global Innovation Management	3
MECHENG 574G	Intermediate Control Systems	3
MECHENG 584G	Biodynamics of Human Motion	3
MECHENG 699G	Independent Study	3
MECHENG 700	CEAS Graduate Seminar	3
MECHENG 701	Advanced Linear System Analysis	3
MECHENG 702	Advanced Engineering Thermodynamics	3
MECHENG 703	Principles of Combustion	3
MECHENG 706	Continuum Mechanics	3
MECHENG 707	Transport in Porous Media	3
MECHENG 710	Advanced Transport Processes	3
MECHENG 711	Thermal Radiation and Conduction	3
MECHENG 712	Convection Heat and Mass Transfer	3
MECHENG 714	Energy Transport in Microscale Systems	3
MECHENG 715	Numerical Methods in Engineering	3
MECHENG 718	Nonlinear Control Systems	3
MECHENG 721	Fundamentals of Fluid Flow	3
MECHENG 722	Advanced Fluid Mechanics	3
MECHENG 723	Computational Fluid Dynamics and Heat Transfer	3
MECHENG 725	Fluid Power and Turbomachinery	3
MECHENG 726	Mechanical Vibrations	3
MECHENG 732	Solidification Processing	3
MECHENG 733	Sensors and Systems	3
MECHENG 760	Dynamic Problems in Design	3
MECHENG 762	Mechanical Systems Analysis	3
MECHENG 765	Mechanical Reliability and Probabilistic Design	3
MECHENG 773	Advanced Dynamics	3
MECHENG 785	Optimization Methods in Engineering	3
MECHENG 816	Optimal Control Theory	3
MECHENG 819	Adaptive Control Theory	3
MECHENG 880	Bioengineering Seminar	3
MECHENG 888	Candidate for Degree	3
MECHENG 890	Advanced Topics in Mechanical Engineering	3
MECHENG 990	Masters Thesis	3
MECHENG 998	Doctoral Thesis	3
MECHENG 999	Advanced Independent Study	3

In addition to the course requirements indicated above, the following UW-Milwaukee Graduate School Requirements will apply.

Major Professor as Advisor

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

Residence

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

Qualifying Examination

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

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

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

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

- If the student passes both parts, then the student has passed the entire examination and will be permitted to proceed toward the Doctor of Philosophy degree.
- If the student fails both parts, then the student must take the entire exam again at its next offering.
- If a student passes only one of the two parts, then the student must take the examination again at its next offering but may choose to take only the part of the

examination that was not passed on the first attempt.

- If a passing grade is not obtained on the second attempt of the Qualifying Examination, the student will not be permitted to proceed toward the Doctor of Philosophy degree.

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

Doctoral Program Committee

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

Doctoral Preliminary Examination

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

Dissertation and Dissertator Status

The student must carry out a creative effort in the major area under the supervision of the major professor and report the results in an acceptable dissertation. The effort of the student and the major professor to produce the dissertation is reflected in the Ph.D. in

Mechanical Engineering program requirement that the student complete at least 18 credits of doctoral thesis.

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

Dissertation Defense

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

Time Limit

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

Assessment of Outcomes and Objectives

Assessment will be conducted using established assessment practices in the College of Engineering and Applied Science. The assessment method is the survey that is completed by each committee member after the dissertation defense. The assessment data will be reviewed by the Mechanical Engineering faculty to identify areas that need improvement. The continuous improvement process in place for all engineering programs will be followed in this program. Student learning outcomes will be assessed as follows:

- Outcome (a) is assessed through achievement of the Ph.D. Qualifying Examination.
- Outcome (b) is assessed through the dissertation proposal hearing.
- Outcome (c) is assessed through the Qualifying Examination and achieving a grade of B or higher in program of study.
- Outcome (d) is assessed in the preliminary examination (identify and formulate), in the thesis (solve) and in any published results.
- Outcome (e) is assessed through achieving required B or higher average in selected course work (9 minor credits) and in the preliminary examination.
- Outcome (f) is assessed in the program of study's inclusion of appropriate course work with a grade of B or higher.
- Outcome (g) is assessed in the required ethics and communication course(s) being developed with a grade of B or higher.
- Outcome (h) is assessed in the Dissertation Proposal hearing and the Dissertation Defense.

Diversity

The mission statement of the University of Wisconsin-Milwaukee includes furthering academic and professional opportunities for women and minority students. According to the Survey of Earned Doctorates report from the National Science Foundation, in 2020, 16% of earned Ph.Ds. in Mechanical Engineering in the United States were awarded to women¹ and 9.2 % were awarded to persons from underrepresented minority groups². By comparison, in the Mechanical Engineering track that is part of the common CEAS Ph.D. program, there are currently 3 female and 30 male students (i.e., 9.1% female). One of the male students is Hispanic.

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

The curriculum is similar to those in Ph.D. programs in mechanical engineering at other research institutions. The set of courses cover a common body of disciplinary topics as well as courses that reflect the research foci of the faculty in the department. Content and knowledge emphasizing professionalism, ethical conduct, and academic honesty will be delivered and assessed as part of the required CEAS Graduate Seminar in Ethics and Engineering Communication, which is currently being offered as a combination of two courses: EAS 701 – Effective Academic Writing (1 credit) and EAS 702 – Prep Future Eng Professionals (2 credits).

UW-Milwaukee's Guiding Values highlight the worth of diversity in all of its definitions and the university aims to support and value students, faculty and staff who are the heart of the University. The university values faculty and staff who embrace UW-Milwaukee principles of innovation, creativity and diverse perspectives within an inclusive and equitable environment. Although additional faculty hires associated with the delivery of this program are not anticipated, UW-Milwaukee is an Affirmative Action / Equal Opportunity Employer and integrates these principles into recruitment and hiring practices.

Collaborative Nature of the Program

Students are required to take courses in a minor area, which typically encompasses other engineering disciplines, physical sciences, or mathematics. Research topics for dissertation often involve a multidisciplinary approach. The program allows for a faculty member outside of Mechanical Engineering to serve as dissertation supervisor (i.e., major

¹ NSF, National Center for Science and Engineering Statistics (NCSES), Survey of Earned Doctorates, Table 15 (NSF 22300)

² NSF, National Center for Science and Engineering Statistics (NCSES), Survey of Earned Doctorates, Table 22 (NSF 22300)

professor, or committee chair). Typically, these are faculty members in another engineering discipline.

Projected Time to Degree

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

Program Review

Every degree program must undergo a periodic review to ensure quality and currency. At UW-Milwaukee graduate programs are reviewed by the Graduate Faculty Committee (GFC) on a ten-year cycle. New degree programs require a review in the fifth year of implementation of the program as required by Board of Regents policy. Additionally, GFC may require intermediate reviews based on the results of the regular review. The requirements include monitoring of student progress in attaining seven outcomes, documenting processes for assessing and evaluating the extent to which student outcomes are being attained, and using this evaluation for continuous improvement. Students, alumni, and employers are included in the assessment process. An industrial advisory committee is involved for each engineering program.

Accreditation

UW-Milwaukee does not need any approvals from the Higher Learning Commission or professional accrediting bodies to add this program to its array.

JUSTIFICATION

Rationale and Relation to Mission

The UW-Milwaukee Select Mission Statement³ emphasizes the development and maintenance of high-quality undergraduate, graduate, and continuing education programs appropriate to a major urban doctoral university; engagement in a sustained research effort that will enhance and fulfill the University's role as a doctoral institution of academic and professional excellence; the attraction of highly-qualified students who demonstrate the potential for intellectual development, innovation, and leadership for their communities; and service to and collaboration with the state of Wisconsin, its metropolitan areas, and the University of Wisconsin System.

The current umbrella Ph.D. program, being focused on research and advanced education, clearly serves the broad UW-Milwaukee mission for discovery, research, and education, and supports the generation of new knowledge for the development and betterment of society. The new, Ph.D. in Mechanical Engineering will serve the mission of UW-Milwaukee in the same way through a high-quality program as well as research collaborations with local industry.

³ <https://uwm.edu/mission/>

At present there is a college-wide Ph.D. program in Engineering and Applied Science. The mechanical engineering department had, in the fall of 2021, a total of 54 graduate students, divided between 21 students of Master of Science (M.S.) program, and 33 students of Doctor of Philosophy (Ph.D.) program. The proposed program is simply to split off the mechanical engineering portion of the existing college-wide Ph.D. program, to become a Ph.D. in Mechanical Engineering. Department faculty feel that this is an appropriate move for several reasons. First, there is some student reluctance to have a Ph.D. degree that is, officially, in Engineering, rather than in Mechanical Engineering. Having a more specific degree name would aid in attracting top Ph.D. student candidates to the program. Second, department faculty would like more autonomy in administering the program, including scheduling and evaluation of the Ph.D. Qualifying Exam.

In addition, having a combined college-wide program makes it difficult to collect data on Mechanical Engineering students and graduates, as all Ph.D. students in the college are, officially, in either Engineering or Electrical Engineering rather than Mechanical Engineering. Related to data collection and for purposes, the presence of a college-wide Ph.D. program adversely affects UW-Milwaukee in rankings, such as US News and World Reports and similar venues. UW-Milwaukee does not appear in these rankings of mechanical engineering Ph.D. programs because it does not have a Ph.D. in Mechanical Engineering, even though the university does have a track within the Ph.D. in Engineering program that is of longstanding nature.

Institutional Program Array

CEAS currently offers the Ph.D. in Engineering in six engineering tracks including Biomedical, Civil, Computer Science, Materials, Industrial, and Mechanical (aside from its first stand-alone Ph.D. in Electrical Engineering). The proposed program will replace the existing Mechanical Engineering track of the Engineering Ph.D., and thus create a new stand-alone Ph.D. in the college. There will be no other impact on the program array of the institution.

Other Programs in the University of Wisconsin System

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

Need as Suggested by Current Student Demand

Student demand is clearly demonstrated by sustained enrollments in the current Mechanical Engineering track of the Ph.D. in Engineering program. An average of 36 Ph.D.

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students have been enrolled in the Mechanical Engineering portion of the program in recent years and this number has been relatively stable for a considerable time.

Need as Suggested by Market Demand

The occupational categories included in job vacancy projections reported by the U.S. Bureau of Labor Statistics and Wisconsin Department of Workforce Development have limited utility when evaluating specific market demand for positions require doctoral preparation in the area of mechanical engineering. Many of the established categories combine disciplines, as is the case for the occupation categories of postsecondary teachers, scientists, or managers. According to U.S. Bureau of Labor Statistics, long-term occupational projections in the U.S. for vacancies in the occupational area of Post-secondary Engineering Teachers is anticipated to grow by 12.7%, and in Wisconsin by 8% for the period 2020 to 2030; although, the projection data do not disaggregate by discipline within Engineering. Further, while vacancies in the occupational area of Mechanical Engineers are anticipated to grow by 11.7% in Wisconsin during this period, the projections include positions requiring both undergraduate and graduate degrees⁴. When viewed in combination, however, these data suggest that as market demand for mechanical engineers increases, so will the demand for qualified post-secondary instructors who can train and prepare students to enter the workforce as mechanical engineers.

A more focused indicator of sustained market demand for the proposed program are placement data collected through the tracking of graduates of the Mechanical Engineering track of the Ph.D. program. There is a local and national need for Ph.Ds. 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 Ph.Ds. 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 Ph.D. 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.

UW-Milwaukee future graduates who will hold a Ph.D. in Mechanical Engineering will be even more competitive in the marketplace than those graduating from track in the umbrella Ph.D. in Engineering. CEAS faculty and staff repeatedly noted position advertisements that specify an earned Ph.D. in Mechanical Engineering is required. This is especially so in academic postings. As well, doctoral programs enroll international students, many of whom return to their home country for their careers. In many foreign countries, the name of the degree in the diploma is critical and can impact hiring decision.

⁴ Occupational projection data retrieved from
<https://www.projectionscentral.com/Projections/LongTerm>, August 2022