



DEPARTMENT OF
HIGHER EDUCATION &
WORKFORCE DEVELOPMENT

New Program Report

Date Submitted:

02/12/2024

Institution

University of Missouri-Kansas City

Site Information

Implementation Date:

8/1/2024 12:00:00 AM

Added Site(s):

Selected Site(s):

University of Missouri-Kansas City, 5100 Rockhill Road, Kansas City, MO, 64110

CIP Information

CIP Code:

141901

CIP Description:

A program that prepares individuals to apply mathematical and scientific principles to the design, development and operational evaluation of physical systems used in manufacturing and end-product systems used for specific uses, including machine tools, jigs and other manufacturing equipment; stationary power units and appliances; engines; self-propelled vehicles; housings and containers; hydraulic and electric systems for controlling movement; and the integration of computers and remote control with operating systems.

CIP Program Title:

Mechanical Engineering

Institution Program Title:

Mechanical Engineering

Degree Level/Type

Degree Level:

Doctoral Degree (Research PhD)

Degree Type:

Doctor of Philosophy (PHD)

Options Added:

Collaborative Program:

N

Mode of Delivery

Current Mode of Delivery

Classroom

Student Preparation



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Special Admissions Procedure or Student Qualifications required:
Mechanical Engineering Program Admission Requirements

A student who satisfies the general requirements for admission and meets the minimum requirements stated below will be considered for regular admission to the Mechanical Engineering Ph.D. program. A student who does not meet some of the requirements but shows high potential for advanced-level work may be considered for provisional admission. Admission also depends on factors such as number of seats available, resources available in the area of the student's interest, the quality of previous work, etc. Requirements for admission are the same whether the applicant is requesting Engineering as the primary discipline or the co-discipline.

1. The applicant must have a bachelor's degree or a master's degree in civil or mechanical engineering or related disciplines with a grade-point average of at least 3.0 on a 4.0 scale in the last 60 hours of undergraduate engineering coursework. In addition, a GPA of 3.5 or better in all post-baccalaureate coursework is required. Pre-program requirements may be specified in case the bachelor's degree is in a discipline different than that to which the candidate is applying.
2. The GRE test is preferred but not required. It is beneficial to applicants to take the test and submit scores.
3. TOEFL or IELTS scores are required for international students without prior U.S. degrees. The minimum required score is 80 or 6.5 on TOEFL or IELTS, respectively. TOEFL requirements may be waived for applicants with a baccalaureate from an ABET accredited program.
4. The student must provide at least three recommendation letters from professors at previous institutions or mentors at work. The application can be initially reviewed with just one recommendation letter.
5. The applicant must provide a maximum 300-word statement on their goals and objectives in pursuing the Ph.D. The statement at the least should indicate which of the areas (civil or mechanical) the student is interested in and preferably indicate the sub-discipline the student is interested in as well, such as structures, construction management, biomechanical, HVAC etc.
6. Provisional admission may be granted if the minimum GPA and GRE requirements are not met, but other indicators promise the student's success in the program. To be fully admitted to the Interdisciplinary Ph.D. program, the provisionally admitted student must obtain a grade of B or better in the first nine hours of coursework and submit a satisfactory GRE score within their first year of the program.

Specific Population Characteristics to be served:
n/a

Faculty Characteristics

Special Requirements for Assignment of Teaching for this Degree/Certificate:

All faculty with teaching responsibilities in the PhD, Mechanical Engineering program will have a terminal degree, PhD or professional doctoral degree (MD, DDS, PharmD).



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Estimate Percentage of Credit Hours that will be assigned to full time faculty:
Full time faculty will teach 100% of coursework/credit hours in the program.

Expectations for professional activities, special student contact, teaching/learning innovation:
Faculty teaching in the program will be expected to engage in professional activities and teaching/learning innovation activities including research, and participation and presentations at professional organizations and societies. Faculty will also be expected to mentor and advise students while enrolled in the program and while engaging in independent research.

Student Enrollment Projections Year One-Five

Year 1	Full Time: 7	Part Time: 0	
Year 2	Full Time: 10	Part Time: 0	
Year 3	Full Time: 13	Part Time: 0	Number of Graduates: 3
Year 4	Full Time: 17	Part Time: 0	
Year 5	Full Time: 20	Part Time: 0	Number of Graduates: 3

Percentage Statement:
n/a

Program Accreditation

Institutional Plans for Accreditation:

The proposed Mechanical Engineering PhD program falls under the purview of the university's institutional accreditation. The university is accredited by the Higher Learning Commission, one of the regional accrediting bodies recognized by the US Department of Education. It ensures that the institution and all its programs, including the proposed PhD program, meet the established standards of academic quality.

We will continually monitor and evaluate the program's performance in areas like faculty research output, student success, and alignment with industry trends and demands. This continuous assessment will enhance our program's reputation and ensure we deliver a high-quality education to our doctoral students. Lastly, while there is no specific timeline for accreditation given the context of doctoral programs, we commit to maintaining the university's existing institutional accreditation status and upholding the standards expected by our accrediting body, the Higher Learning Commission.

Program Structure

Total Credits:
42

Residency Requirements:

Ph.D. students must satisfy the doctoral residency requirement by satisfactory completion of at least 18 credits in no more than 24 consecutive months. When satisfying the residency requirement, all Ph.D. students are subject to the following restrictions:

- The doctoral residency requirement must be satisfied no later than the end of the semester in which the student completes his or her comprehensive examinations.
- Students must achieve a cumulative graduate grade-point average of at least 3.0 in all courses counted toward satisfying the residency requirement.



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General Education Total Credits:

42

Major Requirements Total Credits:

42

Course(s) Added

COURSE NUMBER	CREDITS	COURSE TITLE
ME 5557	3	Mechatronic Systems Design
ME 5501	3	Vibration Analysis
ME 5554	3	Power Generation Systems
ME 5533	3	Advanced Thermodynamics
ME 5516	3	Biomedical Device design
ME 5529	3	Additive Manufacturing
ME 5559	3	Robotics and Unmanned Systems
ME 5507	3	Advanced Dynamics and Modeling
ME 5558	3	Intermediate Dynamics
ME 5506	3	Introduction to Biomaterials
ME 5501	3	Advanced Topics in Fluid Mechanics
ME 5501	3	Composite Materials
ME 5567	3	Fuel Cells and Renewable Energy Systems
ME 5564	3	Turbomachines
ME 5562	3	Applied Computational Fluid Dynamics
ME 5501	3	Unmanned Aircraft Combat Survivability
ME 5594	3	Robotic System Identification
ME 5512	3	Biomechanics
ME 5570	3	Experimental Design & Analysis
ME 5501	3	Econ/Mgmt Sustainable Energy
ME 5526	3	Introduction to Manufacturing Management
xxxxx	12	Dissertation
ME 5501	3	Flight and Road Test Engineering
ME 5501	3	Advanced Heat Transfer
ME 5513	3	Experimental Biomechanics of Human Motion
ME 5501	3	Industrial Metrology



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ME 5586	3	Applied Finite Element Analysis
ME 5501	3	Advanced Control Theory
ME 5511	3	Introduction to Biomechanics
ME 5501	3	Aircraft Design
ME 5547	3	Contracts and Law for Engineers
ME 5525	3	Failure Analysis
ME 5501	3	Imaging to Modeling

Free Elective Credits:

0

Internship or other Capstone Experience:

12 credit hours of dissertation are required

Assurances

I certify that the program is clearly within the institution's CBHE-approved mission. The proposed new program must be consistent with the institutional mission, as well as the principal planning priorities of the public institution, as set forth in the public institution's approved plan or plan update.

I certify that the program will be offered within the proposing institution's main campus or CBHE-approved off-site location.

I certify that the program will not unnecessarily duplicate an existing program of another Missouri institution in accordance with 6 CSR 10-4.010, subsection (9)(C) Submission of Academic Information, Data and New Programs.

I certify that the program will build upon existing programs and faculty expertise.

I certify that the program can be launched with minimal expense and falls within the institution's current operating budget.

I certify that the institution has conducted research on the feasibility of the proposal and it is likely the program will be successful. Institutions' decision to implement a program shall be based upon demand and/or need for the program in terms of meeting present and future needs of the locale, state, and nation based upon societal needs, and/or student needs.

Contact Information

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Kent

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New Degree Proposal

FULL PROPOSAL

Basic Program Information

Sponsoring University: University of Missouri – Kansas City

College or School: School of Science and Engineering

Department: Mechanical Engineering (EMS)

Proposed Program Title: Mechanical Engineering

Degree Level/Type: Doctoral

Emphasis Areas: None

Program Modality: In-person

If online component: n/a

Program CIP Code¹: 14.1901

Implementation: August 2024

Expected Date of First Graduation: May 2025

Proposal Author(s): Masud Chowdhury, EMS Division Director

Name, phone, and email of person primarily responsible for the proposal:

Professor Masud Chowdhury, EMS Division Director -- masud@umkc.edu (816-235-2432).

Professor John Kevern, NBE Director – kevernj@umkc.edu (816-235-5977).

Individual(s) Responsible for Success of the Program:

Professor Masud Chowdhury, EMS Division Director.

Professor John Kevern, NBE Division Director.

Kevin Truman, SSE Dean.

¹ A selection of CIP codes can be viewed on the National Center for Education Statistics website:
<https://nces.ed.gov/ipeds/cipcode/browse.aspx?y=55>

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Executive Summary

UMKC currently offers a PhD in Interdisciplinary Studies under CIP code 30.0000 (Multi-/Interdisciplinary Studies, Other; Defined as “any instructional program multi/interdisciplinary studies not listed above,” National Center for Education Statistics). As part of a comprehensive strategy to improve academic and research excellence, inclusive of Carnegie R1 classification, UMKC seeks to close the current, catch-all interdisciplinary PhD and create eight (8) discipline-specific and more narrow interdisciplinary PhD programs from the over 20 primary disciplines within it.

This transition will allow for the following: Carnegie credit for degree conferrals across STEM, Social Science, and Humanities disciplines, improved research ranking and reputation as a discovery enterprise, advantage in recruiting high quality students and faculty, and enhanced clarity and validity with students and employers regarding the curricula offered as part of our doctoral degrees.

This proposal focuses on a new **Mechanical Engineering PhD** that can be delivered with existing courses, faculty, staff, student support services, assistantship funding, and other resources currently allocated to the mechanical engineering primary discipline within the Interdisciplinary PhD.

The Mechanical Engineering PhD program’s main goal is to prepare the next generation of scholars for a wide range of research opportunities in academia, industry, and national labs. It will continue to provide students with the background, research skills, and tools to advance the state of the art in Mechanical Engineering, just as the engineering primary discipline does in the current Interdisciplinary PhD program. We currently supervise doctoral dissertations across a diverse mechanical engineering field, including:

1. Robotics and controls
2. Thermal-Fluid sciences
3. Renewable energy
4. Biomechanics
5. Materials
6. Manufacturing
7. Aerospace

Curriculum:

The proposed PhD program in Mechanical Engineering mirrors the existing doctoral program, maintaining academic rigor through a balanced curriculum. This curriculum includes foundational courses, advanced coursework, research seminars, and a comprehensive doctoral dissertation, all drawn from the existing courses and resources of the doctoral program.

As with the current doctoral program, a minimum of 30 classroom credits are required, including fundamental and advanced courses along with seminars. Additionally, a doctoral dissertation necessitates a minimum of 12 research credits.

The PhD in Mechanical Engineering offers courses designed to provide students with advanced knowledge and skills in Mechanical Engineering topics. Students can select their required courses from those offered within the unit. Non-Mechanical Engineering courses can also be selected after discussion and approval by the student's Primary Advisor. After completing coursework, students must complete at least 12 dissertation hours while preparing a dissertation to summarize their research during the PhD program.

1. Introduction

The PhD in Interdisciplinary Studies (30.0000) was launched in 1989. For many years it has provided UMKC students the opportunity to develop as scientists and scholars in their chosen field by combining two or more disciplines of study. The Interdisciplinary PhD at UMKC originally included 26 distinct disciplines, ranging from STEM to social sciences to the humanities. Despite its strength as a highly flexible doctoral degree, it limits our ability to attract highly competitive PhD students who want a narrower disciplinary focus, as well as prospective students who are seeking STEM certified doctoral education. Most recently, we have learned that the current Interdisciplinary PhD program is not recognized by Carnegie in their university classification system—a significant barrier in our progress toward becoming a Carnegie R1 institution.

To address these challenges, we aim to transition the current Interdisciplinary PhD program into eight (8) distinct PhD programs that will be attractive to students (evidenced by historical enrollment data) and that will be recognized by Carnegie. These include **Computer Science, Economics, Education, Engineering (Electrical and Computing; Civil; and Mechanical), Humanities, plus a multidisciplinary PhD in Natural Sciences**. These doctoral research programs were selected after extensive review and discussion with doctoral faculty across the university because they are the strongest historic enrollments, core faculty of active researchers, and greatest potential for ongoing success at UMKC. Together they promise to have a significant impact on our ranking as a research institution, and the workforce in the Kansas City and greater MO area through the research and post-graduate employment outcomes produced by the graduates.

This proposal focuses on the **PhD in Mechanical Engineering**.

Impact:

The impact of this broad degree transition, including the **PhD in Mechanical Engineering**, will be the following: Carnegie credit for degree conferrals across STEM, Social Science, and Humanities disciplines, improved research ranking and reputation as a discovery enterprise, advantage in recruiting high quality students and faculty, and enhanced clarity and validity with students and employers regarding the curricula offered as part of our doctoral degrees.

2. University Mission & Program Analysis

2.A. Alignment with University Mission & Goals

The needs of the Greater Kansas City region are of the utmost importance and drive what UMKC is doing. The university is a change agent and plays a vital role in economic development and workforce development for the region. The new proposed PhD degree in Mechanical Engineering will support our mission of economic development of the region and the nation by educating specialized graduate-level engineers who contribute to both workforce development and industry research and development. Therefore, the proposed Engineering PhD programs align seamlessly with the broader goals of the campus, college, and department as detailed in <https://www.umkc.edu/about/strategic-plan.html>.

Successful PhD programs are necessary for the department and the college to show a comprehensive program that attracts future students to maintain the increase in enrollment at the BS, MS, and PhD levels. In addition, PhD students are the key components of maintaining and expanding our research excellence at the department and college levels. Finally, the PhD program in Mechanical Engineering will expand the number and quality of our STEM graduates, which will help advance the research classification of UMKC in general.

2.B. Duplication & Collaboration within Campus, Across System

The proposed Mechanical Engineering PhD program already exists in the form of the engineering primary discipline within the Interdisciplinary PhD program and there is no threat of duplication with programs across the UM System. The proposed title and code changes reflect the correct Engineering CIP codes as per the current course requirements: this will attract students who might have been deterred by the esoteric Interdisciplinary PhD title. This change will make our existing doctoral program more attractive.

The Mechanical Engineering PhD program is diverse and wide enough to allow for multiple successful programs across the UM System. Moreover, we have established several niche areas in this area of Engineering with several years of demonstrated success.

3. Business-Related Criteria & Justification

3.A. Market Analysis

3.A.1. Rationale & Workforce Demand for the Program

The demand for doctoral graduates in Mechanical Engineering is on the rise, both nationally and within the dynamic job market of Missouri. According to the Bureau of Labor Statistics, the field of Mechanical Engineering is projected to experience a 5% increase in employment opportunities from 2020 to 2030, in line with the average for all occupations. Missouri, renowned for its thriving industries, presents exceptional prospects for Mechanical Engineering doctoral graduates. Companies such as Boeing, General Motors, and Emerson Electric, which have a significant presence in the state, actively seek candidates with advanced research capabilities and specialized knowledge. These corporations rely on doctoral graduates to spearhead innovation in product design, enhance manufacturing processes, and drive sustainable engineering solutions. With its strategic location as a transportation hub and a commitment to research and development initiatives, Missouri offers an attractive environment for doctoral graduates to excel and contribute significantly to the growth and advancement of these renowned companies, as well as emerging startups in the region.

A PhD in Mechanical Engineering from the University of Missouri-Kansas City (UMKC) represents a transformative educational journey that equips students with the knowledge and skills to drive innovation and address pressing challenges in the field. At UMKC, we recognize the paramount importance of conducting cutting-edge research across diverse domains, including materials and manufacturing, robotics, and thermal-fluid systems. This emphasis on advanced research empowers our students to become pioneers in their respective areas of specialization, contributing to the ever-evolving landscape of mechanical engineering and is particularly prudent given the recent increase in externally funded research grants/contracts. Through rigorous academic pursuits and hands-on experiences, our PhD candidates are poised to make meaningful contributions to society by developing novel materials, designing cutting-edge robotics solutions, and optimizing thermal-fluid systems for enhanced efficiency. In a world that increasingly relies on technological advancements, a PhD in Mechanical Engineering from UMKC positions students for success while empowering them to be at the forefront of regional, national, and international innovation and progress in these critical fields.

3.A.2. Student Demand for the Program

Student demand is evidenced by our previous five-year enrollment trends in the catch-all engineering primary discipline within the current UMKC interdisciplinary PhD program. The engineering primary discipline has ranged from 17-21 students/year with an average of 19.6 students/year. The proposed Mechanical Engineering PhD is estimated to represent approximately ½ of those students. We anticipate the new program will start with 8-10 students and grow to a steady state of approximately 20 students/year as faculty research, and consequently grant-funded research assistantships, grows in the next 3-5 years. Pending approval, we will encourage current interdisciplinary PhD students to switch to the new degree program in Fall 24; those who want to complete their degree within the existing interdisciplinary PhD program will be allowed to do so. Admission to the existing interdisciplinary PhD program will be suspended in Fall 24 and program teach out will begin. This period of transition is reflected in the enrollment projections below.

Table 1a. Student Enrollment Projections (anticipated total number of students enrolled in the program during the first five fall semesters following implementation.)

Year:	1	2	3	4	5
Full-time	7	10	13	17	20
Part-time	0	0	0	0	0
Total	7	10	13	17	20

Table 1b. Projected Number of Degrees Awarded

Year:	1	2	3	4	5	6	7	8	9	10
# of Degrees Awarded	3	3	3	3	3	3	3	3	3	3

3.B. Financial Projections

Research-based doctoral education (i.e., PhD) differs in key ways from professional doctoral education (e.g., JD, MD, PharmD, DDS, etc.). These differences can be found in the curricular and academic experiences, size of the student cohorts, and relationship of the program to the University mission. As such, there are significant differences in the financial models between research-based and professional doctoral programs. Research-based doctoral programs (e.g., PhD), in contrast to professional doctoral programs (e.g., JD, MD, PharmD, etc.), generally accept a smaller cohort of new students each year and often offer full or partial financial support in the form of tuition waivers and graduate assistantships. PhD students, in turn, make significant contributions to faculty research through their work on research studies (e.g., data collection), dissemination of research findings (e.g., manuscript/monograph writing), and grant writing. PhD students also provide critical support to the educational mission of the University through mentorship and instruction of undergraduate students. In most instances, PhD programs are revenue neutral or have a financial cost that is offset by positive impact on University research productivity and support of undergraduate education.

In the sections that follow, we have estimated the costs and revenues associated with the PhD in Mechanical Engineering. ***Notably, because we are using the same resources, the net revenue and financial impact of the PhD in Mechanical Engineering is the same as the engineering primary discipline within the existing interdisciplinary PhD program.*** We anticipate adding grant funded assistantships in years 3-5 in order to grow the cohort size to maintain academic viability.

3.B.1. Additional Resources Needed

No new instructional, marketing, or other university overhead resources are needed. In order to grow the program size to 20 total students/year, research-funded assistantships are expected by year 3. These are included in expenditure estimates.

3.B.2. Revenue

Revenues are generated from tuition (net scholarship) and remain the same as the existing interdisciplinary PhD program.

3.B.3. Net Revenue

No new one-time expenses are needed because all resources exist within the current interdisciplinary PhD program. Recurring expenses are estimated based on the current interdisciplinary PhD program. Because we are growing the program size beyond the current engineering primary discipline within the interdisciplinary PhD, assistantship funding beginning in year 3 will be supported by externally-funded faculty research grants. The other existing recurring expenses and revenues will shift from the interdisciplinary PhD to the new PhD, with the majority of that shift happening in year 1, as most current students transfer to the new degree program.

Faculty salaries are estimated at .10 FTE (representing 25% of their overall teaching workload) for the current faculty who participate in teaching and mentorship within the interdisciplinary PhD. Notably, most courses are co-taught with advanced undergraduate and/or master's level students, thereby inflating the FTE specific to PhD students; this inflation is offset by the variable amount of time spent mentoring dissertations. Staff estimates represent staff support time within the academic unit. Institutional overhead includes library and all central campus enrollment management and student support staff. Other includes assistantship stipends and associated tuition remission.

Table 2. Financial Projections for Proposed Program for Years 1 Through 5.

	Year 1	Year 2	Year 3	Year 4	Year 5
1. Expenses per year					
A. One-time					
<i>New/Renovated Space</i>	0	0	0	0	0
<i>Equipment</i>	0	0	0	0	0
<i>Library</i>	0	0	0	0	0
<i>Consultants</i>	0	0	0	0	0
<i>Other</i>	0	0	0	0	0
Total one-time	0	0	0	0	0
B. Recurring					
<i>Faculty</i>	79164	79164	79164	79164	79164
<i>Staff</i>	5000	5000	5000	5000	5000
<i>Benefits</i>	30299	30299	30299	30299	30299
<i>Equipment</i>	0	0	0	0	0
<i>Library</i>	0	0	0	0	0
<i>Institutional Overhead</i>	2352	3360	4368	5712	6720
<i>Other</i>	81568	122352	183528	224704	305880

Total recurring	198,401	240,175	302,359	344,879	427,063
Total expenses (A+B)	198,383	240,175	302,359	344,879	427,063
2. Revenue per year					
<i>Tuition/Fees</i>	35221	50316	65410	85537	100632
<i>Institutional Resources</i>	0	0	0	0	0
<i>State Aid -- CBHE</i>	0	0	0	0	0
<i>State Aid -- Other</i>	0	0	0	0	0
Total revenue	35221	50316	65410	85537	100632
3. Net revenue (loss) per year					
	(163,162)	(189,859)	(236,949)	(259,342)	(326,431)

3.B.4. Academic and Financial Viability

There is no net difference in academic and financial viability between the existing engineering primary discipline within the interdisciplinary PhD and the new PhD in Mechanical Engineering. The enrollment projections described above will ensure we achieve a degree conferral threshold consistent with MDHE expectations, as well as advance our Carnegie ranking. There is a financial cost, consistent with doctoral education in general. In addition to new assistantship funds generated through faculty research grants, funds will be reallocated from the existing PhD program to the new PhD program so that we remain financially net neutral.

3.C. Business Plan: Marketing, Student Success, Transition & Exit Strategies

3.C.1. Marketing Plan

The marketing plan for UMKC's newly coded and titled PhD programs in Engineering will continue to use the following strategies, which we have used successfully for the interdisciplinary PhD:

- 1- Offer new research areas with many exciting employment opportunities.
- 2- Advertise the success of previous doctoral students in terms of local, national, and international awards. We will encourage our doctoral students to participate more in these competitions.
- 3- Use our alums as ambassadors to recruit new students.
- 4- Focus heavily on online platforms and social media, considering their extensive reach and the tech-oriented nature of our target audience. Platforms such as LinkedIn, Facebook, and academic forums can facilitate reaching prospective students locally, nationally, and internationally.

The target population will continue to be highly qualified graduates of other state schools and domestic students across the nation, including local UMKC undergraduates and the international population of students through our extensive global network in countries like India, Pakistan, Bangladesh, Saudi Arabia, and Egypt. Employees of local industry interested in pursuing a PhD degree as part of their existing duties or in a part-time format will also continue to be a primary target.

3.C.2. Student Success Plan

No additional student support services will be needed to support or retain students in the PhD in Mechanical Engineering program. Current enrollment, retention and graduation trends for this program are on track with institution and national averages, and the program will continue to provide current levels of faculty and staff resources to support students through graduation.

3.C.3. Transition Plan

The people primarily responsible for the success of the PhD in Mechanical Engineering program are: Professor Masud Chowdhury, EMS Division Director, Professor John Kevern, NBE Division Director, and Kevin Truman, SSE Dean. Program leadership is supported by program faculty and the School of Graduate Studies staff.

3.C.4. Exit Strategy

If full-time enrollment in the PhD in Mechanical Engineering drops below 10 students, the School of Science and Engineering will evaluate a temporary hiatus or program closure, depending on the reason for the low enrollment (e.g., temporary funding challenge, market demand, etc.).

4. Institutional Capacity

The proposed PhD in Mechanical Engineering is designed to utilize existing infrastructure, faculty, and resources, thereby negating the necessity for any additional expenses. The program will repurpose the existing faculty resources, student support services, laboratories, equipment, and technology from the current doctoral program.

5. Program Characteristics

5.A. Program Outcomes

Program Goals

Students in the Ph.D. Program will acquire:

- grounding in the discipline
- the ability to integrate the principles and theories of the disciplines
- the ability to effectively communicate findings and approaches to solving research problems;
- research skills, such as approaches, methods, ethical principles, and tools to pursue a research line of inquiry;
- the ability to form effective teams to solve novel research questions

5.B. Program Design & Content

The course requirements for the Mechanical Engineering Ph.D. will remain largely consistent with those of the previous engineering primary discipline within the Interdisciplinary PhD program. No new resources will be required. The coursework requirements include:

- A total of 30 credit hours of total coursework beyond an MS degree in Engineering;
- At least 12 dissertation hours in the primary area;

5.C. Program Structure

5.C.1. Program Structure Form

1. **Total Credits Required for Graduation: 42**
2. **Residence requirements, if any:** Ph.D. students must satisfy the doctoral residency requirement by satisfactory completion of at least 18 credits in no more than 24 consecutive months. When satisfying the residency requirement, all Ph.D. students are subject to the following restrictions:
 - The doctoral residency requirement must be satisfied no later than the end of the semester in which the student completes his or her comprehensive examinations.
 - Students must achieve a cumulative graduate grade-point average of at least 3.0 in all courses counted toward satisfying the residency requirement.
3. **General education**
 - a. Total general education credits: *n/a*

Courses (specific course or distribution area and credit hours):

The PhD in Mechanical Engineering offers courses designed to provide students with advanced knowledge and skills in mechanical engineering topics. Students can select their required courses from those offered within the unit. Non-Mechanical Engineering courses can also be selected after discussion and approval by the student's Primary Advisor. After completing coursework, students entering the program with an MS must complete at least 30 credit hours, inclusive of the 12 dissertation hours. The table below shows existing courses that will be offered under this program.

ME 5506	Introduction to Biomaterials	3
ME 5507	Advanced Dynamics and Modeling	3
ME 5511	Introduction to Biomechanics	3
ME 5512	Biomechanics	3
ME 5513	Experimental Biomechanics of Human Motion	3
ME 5516	Biomedical Device design	3
ME 5525	Failure Analysis	3
ME 5526	Introduction to Manufacturing Management	3
ME 5529	Additive Manufacturing	3
ME 5533	Advanced Thermodynamics	3
ME 5547	Contracts and Law for Engineers	3
ME 5554	Power Generation Systems	3
ME 5557	Mechatronic Systems Design	3
ME 5558	Intermediate Dynamics	3
ME 5559	Robotics and Unmanned Systems	3
ME 5562	Applied Computational Fluid Dynamics	3
ME 5564	Turbomachines	3
ME 5570	Experimental Design & Analysis	3
ME 5586	Applied Finite Element Analysis	3
ME 5594	Robotic System Identification	3
ME 5501	Unmanned Aircraft Combat Survivability	3
ME 5501	Flight and Road Test Engineering	3
ME 5501	Aircraft Design	3
ME 5501	Advanced Heat Transfer	3
ME 5501	Econ/Mgmt Sustainable Energy	3

ME 5501	Advanced Control Theory	3
ME 5501	Composite Materials	3
ME 5567	Fuel Cells and Renewable Energy Systems	3
ME 5501	Vibration Analysis	3
ME 5501	Advanced Topics in Fluid Mechanics	3
ME 5501	Industrial Metrology	3
ME 5501	Imaging to Modeling	3

4. Free elective credits

a. Total free elective credits: n/a

5. Requirement for thesis, internship or other capstone experience:

12 credit hours of dissertation are required

6. Any unique features such as interdepartmental cooperation:

n/a

5.D. Program Goals and Assessment

All UMKC programs are required to submit an annual summary of program assessment efforts (assessment plans, findings & discussions, and recommendations). The Mechanical Engineering Ph.D. program will maintain the established assessment protocol currently in place for all Interdisciplinary Ph.D. disciplines. The following outcomes have been identified:

1. Students will demonstrate a thorough degree of knowledge in the discipline.
2. Students will demonstrate an ability to use proper investigation techniques for the discipline.
3. Students will effectively use oral and written forms of communication to convey their ideas.

Applicable student learning outcomes will be assessed at the following program, academic milestones: 1) Comprehensive Exams; 2) Dissertation/Research Proposal; and 3) Dissertation Defense.

At the milestone of Dissertation Defense, program targets for student performance across all Student Learning Outcomes have been set to meet or exceed average ratings of 3.5 for all (100% of) students assessed. For example, one component of students' ability to use proper investigation techniques will be evaluated by the following rubric and rating scale:

Superior (4)	Good (3)	Acceptable (2)	Unacceptable (1)	Cannot Judge
Cutting edge methodology or novel application of existing method	Incremental advance in application of methodology and careful plan for execution of research	Conventional use of methodology and adequate plan for execution of research	Inappropriate use of method; use of method that cannot adequately address research question	Outside area of expertise

5.E. Student Preparation

The minimum criteria for admission to the UMKC graduate school can be found via the [UMKC catalog](#).

Mechanical Engineering Program Admission Requirements

A student who satisfies the general requirements for admission and meets the minimum requirements stated below will be considered for regular admission to the Mechanical Engineering Ph.D. program. A student who does not meet some of the requirements but shows high potential for advanced-level work may be considered for provisional admission. Admission also depends on factors such as number of seats available, resources available in the area of the student's interest, the quality of previous work, etc. Requirements for admission are the same whether the applicant is requesting Engineering as the primary discipline or the co-discipline.

1. The applicant must have a bachelor's degree or a master's degree in civil or mechanical engineering or related disciplines with a grade-point average of at least 3.0 on a 4.0 scale in the last 60 hours of undergraduate engineering coursework. In addition, a GPA of 3.5 or better in all post-baccalaureate coursework is required. Pre-program requirements may be specified in case the bachelor's degree is in a discipline different than that to which the candidate is applying.
2. The GRE test is preferred but not required. It is beneficial to applicants to take the test and submit scores.
3. TOEFL or IELTS scores are required for international students without prior U.S. degrees. The minimum required score is 80 or 6.5 on TOEFL or IELTS, respectively. TOEFL requirements may be waived for applicants with a baccalaureate from an ABET accredited program.
4. The student must provide at least three recommendation letters from professors at previous institutions or mentors at work. The application can be initially reviewed with just one recommendation letter.
5. The applicant must provide a maximum 300-word statement on their goals and objectives in pursuing the Ph.D. The statement at the least should indicate which of the areas (civil or mechanical) the student is interested in and preferably indicate the sub-discipline the student is interested in as well, such as structures, construction management, biomechanical, HVAC etc.

6. Provisional admission may be granted if the minimum GPA and GRE requirements are not met, but other indicators promise the student's success in the program. To be fully admitted to the Interdisciplinary Ph.D. program, the provisionally admitted student must obtain a grade of B or better in the first nine hours of coursework and submit a satisfactory GRE score within their first year of the program.

5.F. Faculty and Administration

The people primarily responsible for the success of the PhD in Mechanical Engineering program are: Professor Masud Chowdhury, EMS Division Director, Professor John Kevern, NBE Division Director, and Kevin Truman, SSE Dean

All faculty with teaching responsibilities in the PhD, Mechanical Engineering program will have a terminal degree, PhD or professional doctoral degree (MD, DDS, PharmD). Full time faculty will teach 100% of coursework/credit hours in the program. Faculty teaching in the program will be expected to engage in professional activities and teaching/learning innovation activities including research, and participation and presentations at professional organizations and societies. Faculty will also be expected to mentor and advise students while enrolled in the program and while engaging in independent research.

5.G. Alumni and Employer Survey

The UMKC Alumni Affairs Office, and External Relations team engage with UMKC alumni and the community through several opportunities designed to maintain connections, gather feedback, provide engagement opportunities, and create an environment of continuous improvement.

Graduating students are surveyed through an exit survey at the point of graduation and followed up with at 6-months post degree conferral if the student was still seeking employment at graduation or did not respond to the initial survey request. Alumni affairs and external relations provides opportunities for alumni to participate in student research competitions such as the Three Minute Thesis. Alumni are also engaged through on campus events, opportunities to serve on boards, volunteer, and nominate and receive alumni awards.

5.H. Program Accreditation

The proposed Mechanical Engineering PhD program falls under the purview of the university's institutional accreditation. The university is accredited by the Higher Learning Commission, one of the regional accrediting bodies recognized by the US Department of Education. It ensures that the institution and all its programs, including the proposed PhD program, meet the established standards of academic quality.

We will continually monitor and evaluate the program's performance in areas like faculty research output, student success, and alignment with industry trends and demands. This continuous assessment will enhance our program's reputation and ensure we deliver a high-

quality education to our doctoral students. Lastly, while there is no specific timeline for accreditation given the context of doctoral programs, we commit to maintaining the university's existing institutional accreditation status and upholding the standards expected by our accrediting body, the Higher Learning Commission.

6. Appendices

- Letters of support
 - Ian M. Colrain; President and CEO, MRIGlobal
 - Chris Isaacson; EVP & COO, Cboe Global Markets
 - Kevin Truman; Dean, School of Science and Engineering- UMKC
 - Praveen Edara; Interim Dean, College of Engineering- MU
 - Robin Stubenhofer; National Security Campus, Kansas City
 - David Borrok; Vice-Provost and Dean, College of Engineering and Computing- Missouri S&T
 - Jennifer Lundgren; Provost and Executive Vice Chancellor- UMKC
 - Stephen John Dilkes; Associate Dean, School of Graduate Studies- UMKC

Please contact the Missouri Department of Higher Education and Workforce Development to view the letters of support for this program.