

# ELECTRICAL AND COMPUTER ENGINEERING

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## Discipline Coordinator

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Electrical and Computer Engineering faculty who are members of the doctoral faculty.

Electrical and Computer Engineering is a Ph.D. discipline with the following five Concentration Areas:

1. Computer, VLSI and Embedded Systems Design
2. Nanotechnology
3. Electromagnetics, Radio Frequency (RF) Circuits, and Signal Processing
4. Computer Vision, Multimedia and Machine Learning
5. Power Electronics and Renewable Energy

### Notes:

1. Our Ph.D. Programs are administered by the Interdisciplinary Ph.D. Program of School of Graduate Studies at UMKC.
2. As part of Interdisciplinary Ph.D. Program ([http://web2.umkc.edu/catalog/Interdisciplinary\\_Ph\\_D\\_\\_Program.html](http://web2.umkc.edu/catalog/Interdisciplinary_Ph_D__Program.html)) requirement, ECE Ph.D. students must select a related co-discipline from which they must take 3 or 4 courses to strengthen the knowledge in topics broadly related to their research areas.
3. ECE Ph.D. students **do not need to select the Co-Discipline during the application process**. This has to be done in the first semester after coming to UMKC.
4. The discipline-specific requirements listed here are *in addition* to the requirements listed in the Interdisciplinary Ph.D. Application Procedure and Minimum Criteria for Admission ([http://web2.umkc.edu/catalog/Interdisciplinary\\_Ph\\_D\\_\\_Application\\_Procedure\\_and\\_Minimum\\_Criteria\\_for\\_Admission.html](http://web2.umkc.edu/catalog/Interdisciplinary_Ph_D__Application_Procedure_and_Minimum_Criteria_for_Admission.html)).

## Discipline-Specific Admission Requirements

A student who meets the minimum discipline requirements stated below will be considered for regular admission to the 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 student's interest, the quality of previous work, etc. A student who does not qualify for admission to the Ph.D. program, may be considered for admission to the M.S. in Electrical Engineering program. Requirements for admission are similar, whether the applicant is requesting Electrical and Computer Engineering as the primary or co-discipline.

### Minimum Recommended Ph.D. Admission Requirements:

1. GPA (Bachelor or equivalent Degree): 3.5 in the scale of 4 (or equivalent)
2. GPA (MS or equivalent Degree if any): 3.5 in the scale of 4 (or equivalent)
3. GRE (Quantitative) minimum score = 85%
4. TOEFL iBT minimum Score = 89 or IELTS minimum score = 6.5
5. Prior Projects or Publications (Preferred)\*
6. Internationally Acceptable Accreditation of the Prior Degree Awarding Institutes

- *Prior research project and/or publication record is not required for admission into ECE Ph.D. program. However, doctoral faculty members give very high value to the students with such backgrounds.*

### Direct or Expedited Ph.D. Program

It is not required to have an MS or equivalent degree to apply to ECE Ph.D. program. We accept well-qualified and motivated students with a Bachelor's degree directly into our Ph.D. program. We actively encourage students in the **Direct Ph.D. Program** to try to complete the doctoral study within 4 or 5 years after the Bachelor degree. To complete the Ph.D. degree in an expedited timeline, first, the student has to be dedicated and well qualified. Second, the student must make a comprehensive plan at the beginning of the doctoral study to complete all the relevant steps within a strict timeline, which is challenging but not impossible.

## Clarification of Minimum Requirements and Decision Process

### Academic Preparation

The applicant must have a bachelor and/or a master's degree in electrical and/or computer engineering, electronics, communications engineering or any other field requiring substantial training in at least one of the above fields and in mathematics with a GPA of 3.5 or better, cumulative as well as in the major field; and a GPA of 3.5 or better in all post-baccalaureate or post-master's degree work.

## Aptitude for Advanced Work

The student must demonstrate an aptitude for advanced-level work through national/international standardized examinations such as the GRE. The expected performance level is the 85<sup>th</sup> percentile in the quantitative portion of the GRE examination.

- In rare occasion, ECE Ph.D. Discipline Coordinator exempts GRE requirement for students with outstanding publication or scholarly records in internationally renowned journals, conferences or similar forums.

## Proficiency in English

The student must demonstrate his or her proficiency in oral and written communication in English through national/international standardized English examinations such as TOEFL, verbal portion of the GRE, etc. Because of this test, the student may be required to improve his or her oral and written communication in English before enrollment in the courses of the chosen disciplines.

- For students with a North American (USA and Canada) B.S. or M.S. degree the English Proficiency requirement is exempt.

## How a Ph.D. Applicant Can Request for the Waiver of any Test Score?

As mentioned above, under special circumstance a Ph.D. applicant can request for the waiver of any test (GRE/TOEFL/IELTS) score. Usually **the GRE waiver request is granted** for students who have already demonstrated outstanding performance in research or other scholarly activities prior to applying to UMKC for graduate admission. Applicants must talk to the respective Ph.D. Discipline Coordinator BEFORE requesting a waiver for the official test score requirements. After talking with the Coordinators, a waiver request can be submitted in writing through the Supplementary Interdisciplinary Ph.D. Application site (iSAP). Choose "Uploads" from the left-hand menu, then "Add files" to upload your waiver request in a PDF format. Choose "Other" for the document type listed in the drop down menu, then click "Start" to add the TOEFL/IELTS/GRE waiver request to your application.

## Recommendation Letters

The student must provide at least three recommendation letters from professors from his or her previous institution(s). If the applicant has been out of school for several years, recommendation letters from his or her supervisors (technical) will be acceptable. However, even in this situation, a recommendation letter from his or her last academic institution is highly recommended. A recommendation from a faculty member in the Computer Science Electrical Engineering (CSEE) Department at UMKC must be provided if the student has taken courses from or worked with the CSEE faculty.

## Statement of Goals and Objectives

The applicant must provide a 250 to 500 words essay on his/her goals and objectives of pursuing the Ph.D. in the chosen fields.

## Prior Research Projects and Publications (Preferred but not Required)

The applicant is encouraged to submit evidence of prior research projects and/or publications (if any).

## Admission at an Advanced Level

An applicant who has already completed significant graduate coursework (15 or more semester hours of post-master's work or 30 or more hours of post-bachelor's work) toward a Ph.D. at another institution must provide reasons for changing institutions. The applicant must also provide a letter of endorsement from a doctoral faculty member in Electrical and Computer Engineering indicating their willingness to be the student's research advisor.

## Ph.D. Admission Decision Process

Ph.D. admission is primarily based on individual doctoral faculty members' needs and preferences. The role of the ECE Ph.D. Discipline Coordinator is to ensure that Ph.D. applicants satisfy the minimum requirements (GPA, GRE, TOEFL/IELTS, reputation of prior degree awarding institutes and other scholarly achievements). If the requirements are satisfied, ECE requires (except in rare cases) a doctoral faculty member to accept advisory duties for a student to be admitted.

## Communication with our Doctoral Faculty Members

In addition to reviewing the academic credentials of a new Ph.D. applicant, many of our faculty members prefer interviewing the student before making any decision. Therefore, ***we strongly advise new Ph.D. applicants to contact our doctoral faculty members in the areas of their research interests before or after starting the application process.*** However, it is not required that every Ph.D. applicant must contact a relevant doctoral faculty member prior to the application. Whenever we receive a new Ph.D. application we share the information with all ECE doctoral faculty members for their consideration.

## Qualifying Requirements for Full Admission

### Prerequisite Knowledge

A Ph.D. student selecting Electrical and Computer Engineering (ECE) as the primary Ph.D. discipline is expected to have the level of preparation represented by a four-year undergraduate degree in electrical/computer engineering. The applicant may have received a bachelor's degree or a master's degree in computer science, computer engineering, electrical engineering or electronics, or any other related field with substantial training in mathematics.

## **Selection of a Co-Discipline and Suggested Compatible Co-Disciplines**

To broaden the knowledge of the Ph.D. students UMKC Interdisciplinary Ph.D. program requires each student to select a co-discipline closely related to the primary discipline.

The following are suggested compatible co-disciplines for ECE students:

Computer Networking and Communication Systems (<https://catalog.umkc.edu/colleges-schools/graduate-studies/telecommunication-computer-networking/>), Computer Science (<https://catalog.umkc.edu/colleges-schools/graduate-studies/computer-science/>), Engineering (<https://catalog.umkc.edu/colleges-schools/graduate-studies/engineering/>), Mathematics (<https://catalog.umkc.edu/colleges-schools/graduate-studies/mathematics/>), Physics (<https://catalog.umkc.edu/colleges-schools/graduate-studies/physics/>)

A co-discipline outside of this list may be considered only in exceptional cases. These co-disciplines require 3 or 4 courses to be taken by the ECE Ph.D. students to fulfill the co-discipline requirements.

**Notes:**

- **ECE Ph.D. students do not need to apply to a co-discipline at the time of admission.**
- ECE Ph.D. students have to select a co-discipline in the first semester after coming to UMKC.
- ECE Ph.D. students are advised to consult their primary (ECE) adviser to select an appropriate co-discipline.
- ECE Ph.D. students can change their co-discipline any time before the comprehensive exam.

## **Transfer of Course Credit**

New Ph.D. students with some prior graduate level course works from another university can apply to transfer up to 6 credit hours in each discipline (primary and co-discipline).

## **Alternate Admission Criteria**

An applicant not meeting the minimum admission requirements, or not having sufficient academic preparation (stated above under prerequisite knowledge) for advanced work in the chosen discipline (s), may be considered for provisional admission by the CSEE Departmental Ph.D. committee if the committee sees high potential for advanced work from the rest of the applicant's credentials. Evidence of high potential might be pertinent work experience, published papers or extremely high achievements in related areas. A student not having an undergraduate degree in electrical and/or computer engineering may be admitted provisionally if the admission committee determines that the student has a strong aptitude for research and is willing to take prerequisite courses as determined by the admission committee based on the student's academic record.

## **Application for an MS Degree while Enrolled in ECE Ph.D. Program**

ECE Ph.D. students may apply to receive an MS degree upon passing the qualifying and comprehensive exams provided that the coursework required for MS degree under course only option is completed. This is a very good option for students in ECE Direct Ph.D. Program. However, this is subject to primary Ph.D. supervisor's approval.

**Note:**

- If an ECE Ph.D. student fails to pass the Qualifying Exam in two attempts or cannot successfully complete the Comprehensive Exam, the student will not be allowed to apply for transfer to the MS program or apply to receive an MS degree even if the coursework required for MS degree under course-only option is completed. Please consult your ECE Ph.D. supervisor and/or ECE Ph.D. Discipline Coordinator for details.

## **Core Program Requirements**

The amount of work required for the Ph.D. depends on the student's level of preparation. For example, a student entering the Ph.D. program after earning a bachelor's degree may expect to do significantly more work compared to a student who enters after earning a master's degree.

## **Electrical and Computer Engineering as a Co-Discipline**

- Students who choose ECE as a co-discipline need to take 3 ECE graduate courses (9 credit hours).
- Students who choose ECE as a co-discipline do not need to take the ECE Ph.D. Qualifying Exam.
- **CNS, CS, Engineering and Physics Ph.D. students are automatically eligible for ECE as a co-discipline.**

## **Full-time Status and Doctoral Residency Requirement**

US Domestic students can enroll into any number of credit hours per semester during the regular academic year (Fall and Spring). International students are usually required to enroll in 9 credit hours per semester during the regular academic year (Fall and Spring) to maintain full-time (visa) status. However, for international graduate (Ph.D. and MS) students with 50% FTE (20 hours per week) appointments as Graduate Research/Teaching Assistants the requirement is 6 credit hours of enrollment per semester for full time equivalence. Enrollment is not required in Summer.

Interdisciplinary Ph.D. students must satisfy the doctoral residency requirement by satisfactory completion of at least 18 credits within 24 consecutive months. When satisfying the residency requirement, all Interdisciplinary Ph.D. students are subject to the following restrictions:

1. 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.
2. Students must achieve a cumulative graduate grade-point average of at least 3.0 in all courses counted toward satisfying the residency requirement.
3. Dissertation research credits (696 to 699) may not be counted toward satisfying the doctoral residency requirement

## **Financial Aid**

Various forms of financial aid (such as graduate research assistantships, graduate teaching assistantships, graduate fellowships) are available through the Computer Science and Electrical Engineering Department and the School of Graduate Studies. Contact the discipline coordinator for more information.

Most of our Ph.D. students are funded through a **Graduate Research Assistantship (GRA)** and/or a **Graduate Teaching Assistantship (GTA)**. GRA support is provided by individual doctoral faculty members from their research grants. GTA support comes from Department Chair's instructional fund. However, the GTA support is also provided based on the recommendation of the Ph.D. advisor. The Department Chair normally honors the requests for GTA support if there are available GTA slots. Therefore, every Ph.D. student must have a faculty advisor to get funding in the form of a GRA or GTA. Once a Ph.D. student is admitted we (the Department Chair and the doctoral faculty members) will try our best to provide funding to the student throughout the Ph.D. study. However, the applicants must keep in mind that the number of funding slots (GRA and GTA) for the Ph.D. students are not unlimited. The supports are provided based on respective faculty advisor's recommendations and Department Chair's needs. The awarding of GRA and GTA funding is a competitive process. The students are required to maintain high academic standing and demonstrate strong research performance to get continuous support throughout the Ph.D. study. Our Department's policy is to provide support to as many Ph.D. students as possible.

Additionally, the UMKC School of Graduate Studies provides many different types of fellowships, awards and scholarships to qualified graduate students through a competitive selection process. Please visit the website of the School of Graduate Studies for further details.

### **Note:**

- **If a student receives financial aid in the form of GTA/GRA from the CSEE Department or its doctoral faculty members after the full admission and enrollment into ECE Ph.D. program, the student must complete the doctoral study. If a funded Ph.D. student decides to leave the program at any stage before the completion, no terminal MS or equivalent degree will be awarded.**

## **Monthly Stipend for Ph.D. Students with GRA/GTA Appointments**

Ph.D. students with 50% FTE (20 hours per week) appointments as GRA/GTA will receive a stipend of around \$6000 (subject to availability of funds) per semester during the Fall and Spring semesters. This stipend will be paid in 4 or 5 monthly installments. All GRA/GTA appointments (if awarded) are for one regular academic year (Fall and Spring) for the new students. Beyond the first year, the GRA/GTA supports are subject to availability and performance. **There is no guaranteed financial support for the Summer semester.**

### **Other Fees and Health Insurance**

Students are responsible for some additional fees, health insurance, books and supplies, and living costs.

## **Timeline and Steps Toward the Completion of ECE Ph.D. Degree**

New Ph.D. students are strongly advised to make a clear plan in consultation with the ECE Ph.D. advisor as soon as they start their doctoral study to complete the following steps within the required time line:

1. **Annual Evaluation:** Every Ph.D. student is required to complete an annual evaluation in two parts - one in spring and one in fall. These are online surveys to evaluate last year's achievements and next year's goals, then the primary and co-discipline advisors provide feedback for the students.
2. **Ph.D. Qualifying Examination:** Students taking an ECE Ph.D. Discipline as the primary unit should make the first attempt to pass the qualifying exam during the first three (3) regular semesters after fully admitted to the doctoral study at UMKC. The student must pass both parts of the qualifying exam within four (4) regular semesters. Summer term is not counted.
3. **Plan of Study:** The Ph.D. Plan of Study form, signed by the student, members of the student's proposed Supervisory Committee, and the Academic Administrators in the student's disciplines, must be filed with the School of Graduate Studies no later than the end of the second year (24 months) after the student has been fully admitted. The Interdisciplinary Ph.D. Plan of Study may be filed prior to that time.
4. **Formation of Ph.D. Supervisory Committee:** The Supervisory Committee shall consist of at least five members composed of one doctoral faculty from each of the primary and co-disciplines, with a maximum of three from any one discipline. Regarding the formation of the committee the student should consult the primary (ECE) Ph.D. supervisor, who will be the Chair of the Committee. Names and signatures of the committee members have to be submitted with the **Plan of Study**.
5. **Fulfilling Ph.D. Residency Requirement:** Ph.D. students must satisfy the doctoral residency requirement.
6. **Comprehensive Examination:** The format and general requirements for the Comprehensive Exam vary according to the Ph.D. discipline. The Comprehensive Exam is administered by the candidate's doctoral committee. A student can either take a written test or opt for an oral

presentation covering both primary and co-discipline areas. Discussion with and agreement from the student's doctoral committee is required before choosing the best option. Candidates should contact the CSEE Department's office and the chair of their doctoral committee for more information.

The ECE discipline usually requires the students to make a formal presentation on the background study, current progresses and future plans regarding the selected research problems for doctoral study. ECE students can take the **Comprehensive Exam any time after passing ECE Ph.D. Qualifying Exam and the approval of the Plan of Study** by the School of Graduate Studies.

1. **Interdisciplinary Ph.D. Research Proposal:** After the completion of the Comprehensive Exam each Ph.D. student must submit a written Research Proposal to the School of Graduate Studies.
2. **Doctoral Dissertation:** The format and general requirements for the Doctoral Dissertation exam vary according to the discipline. The ECE discipline requires the students to make a formal presentation on the outcomes of the doctoral research in front of the committee members. *ECE Comprehensive Exam and dissertation defense presentations are open to all students and faculty members.* In addition, it is recommended that students submit a draft copy of the dissertation to the committee members prior to the presentation. The defense of the dissertation is approved when a majority of the supervisory committee members recommend approval and sign the Report of Results of Final Dissertation Examination form. Students can schedule **Dissertation Defense six months after the Comprehensive Exam.**
3. **Final Thesis Submission:** After the successful completion of the Dissertation Defense, Ph.D. students must formally submit their Ph.D. dissertations according to the format and instructions of the School of Graduate Studies.

#### **Notes:**

- Ph.D. students are allowed to apply for extensions/exceptions/changes under exceptional circumstances.
- Part-time Ph.D. students may apply for flexibility of the timeline regarding the above-mentioned steps.
- Students are advised to regularly check the updates and modifications by the Schools of Graduate Studies.

#### **Qualifying Examination Guidelines**

The Qualifying Exam is a written test administered by the ECE Ph.D. committee. The test questions are from a set of fundamental courses in electrical and computer engineering. The ECE Ph.D. discipline offers the qualifying exam twice a year, once in the spring semester and once in the fall semester. Students taking an ECE Ph.D. Discipline as the primary (coordinating) unit should take the qualifying exam during the first 18 months after fully admitted. In case a student failed in his/her first attempt, and then he/she should take the failed part of exam again in the next consecutive term. Students who fail both attempts will be disqualified for the Ph.D. admission in ECE. *The ECE Qualifying Exam is only for students whose primary Ph.D. discipline in ECE. Students from other primary disciplines who select ECE as a co-discipline will not be required to take the ECE Qualifying Exam.*

#### **Qualifying Exam has two parts:**

- 1) Compulsory Part (Part-I)
- 2) Concentration Area Based Part (Part-II)

#### **Part-I: Compulsory Part of Ph.D. Qualifying Exam (Math and Circuit Theory): (Open Notes)**

1. Part I of the exam will be held twice every year on the third Friday of April and November
2. It is compulsory for every student taking the qualifying exam to pass Part I, which will be based on E&C-ENG 276 (Circuit Theory I) and E&C-ENG 341R (Applied Engineering Analysis II).
3. Students are required to attempt only six questions out of ten.
4. Students are required to attempt at least two questions from each E&C-ENGR 276 and E&C-ENGR 341R. Total Time = 3 hours

#### **Part-II: Concentration Area Based Part of the Ph.D. Qualifying Exam: (Open Notes)**

1. Part II of the exam will be held twice every year on the Monday following the Part-I of the exam.
2. Students will be tested out from one of the concentration areas selected by the student.
3. Faculty in charge of the courses belonging to that particular concentration area will be asked to submit three questions per course and submit them to the ECE Ph.D. coordinator.
4. From the selected concentration area the students will be required to select three courses.
5. The students will be required to attempt only six questions out of nine questions from the selected 3 courses.
6. Students are required to attempt at least one question from each of the three courses selected for that concentration area. Total Time = 3 hours

#### **ECE Ph.D. Concentration Areas for Qualifying Exam (Part II):**

1. Computer, VLSI and Embedded Systems Design
2. Nanotechnology
3. Electromagnetics, Radio Frequency (RF) Circuits, and Signal Processing

4. Computer Vision, Multimedia and Machine Learning
5. Power Electronics and Renewable Energy

**ECE Ph.D. Qualifying Exam Dates:**

1. Spring Semester Exam: **Part I:** Third Friday of April and **Part II:** Monday following the Part I Exam
2. Fall Semester Exam: **Part I:** Third Friday of November and **Part II:** Monday following the Part I Exam

**A Snapshot of Qualifying Exam Guidelines:**

1. Please consult your Ph.D. Adviser about area selection and timing of your Ph.D. Qualifying Exam.
2. **Clarification of Open Notes Policy:** Students are allowed to bring 2-page doubled-sided written notes per subject during the exam. Students are not allowed to bring any textbook and other printed materials. Electronic copies of the notes are not allowed.

**Restrictions on Electronic Devices:** Scientific Calculators are allowed during the both parts of the examination. However laptop, smartphone, tablet, PDA or any other internet connected device will be absolutely prohibited during the both parts of the qualifying examination.