Electrical & Computer Engineering Graduate Handbook

General regulations and procedures for all graduate programs are governed by the University. A description of the common steps required to complete the requirements for a graduate degree in all departments can be found in the Graduate Catalog (https://catalog.mst.edu/graduate/) and all required forms are available at the Graduate Education Office (https://grad.mst.edu/currentstudents/forms/).

The Electrical and Computer Engineering (ECE) department may impose additional requirements. Information contained in this document describes the requirements and procedures specifically applicable to students in the ECE degree programs.

August 2023

Message from the Chairman

On behalf of the Electrical and Computer Engineering (ECE) faculty and staff, I would like to welcome you to our department. While we continue to update this Graduate Handbook to reflect the most recent policies and procedures in our department, it is inevitable that you may have some questions or concerns that are not addressed in this document. I would encourage you to discuss these with the graduate secretary and/or the Graduate Coordinator in the ECE department.

As our department has evolved over the past several years, we have developed research programs in new and exciting areas, and we hope to continue in this direction. If you have questions regarding currently active research areas in the department, you can obtain some general information by consulting the department's website (http://ece.mst.edu/). For more specific questions you may wish to contact the individual faculty members associated with these research areas.

Finally, welcome to Missouri S&T. I hope that your stay with us will be productive as you further your education in your chosen field.

Sincerely,

Jonathan W. Kimball, PhD
Chair, Electrical and Computer Engineering Department
Missouri University of Science and Technology

II. General Information

The ECE department at Missouri S&T offers undergraduate and graduate education in two separate degree programs - Electrical Engineering (EE) and Computer Engineering (CpE). General regulations and procedures for all graduate programs are governed by the University. The individual departments and degree programs may impose additional requirements. Information contained in this document describes the requirements and procedures specifically applicable to students in the Electrical and Computer Engineering (ECE) degree programs. Different sets of rules and regulations may apply to students in other degree programs.

III. Admissions

A) Required Documentation

All of the documentation requested below should be sent to the Director of Admissions, Office of Admissions (admissions@mst.edu; https://futurestudents.mst.edu/admissions/; 1-573-341-6731). When all the required documentation has been received by the Admissions office it will be forwarded to the department. A recommendation will be made by the department. The recommendation will be forwarded to the Graduate Education Office for approval. Official notification of the outcome will be sent to the applicant from the Admissions office.

1. Application Form and Application Fee

All graduate applicants must submit a completed application form and a non-refundable application fee. Graduate online application forms and instructions can be obtained at https://futurestudents.mst.edu/admissions/

2. Graduate Record Exam (GRE) Scores

All graduate applicants must submit a complete set of GRE scores (GRE-V, GRE-Q, and GRE-AW). These reports should be sent directly from ETS to the Director of Admissions. The GRE requirement may be waived for exceptional applicants. See section III.B.3 for details of this waiver.

3. Language Fluency Scores

International applicants must submit TOEFL scores or equivalent to the Director of Admissions. If an applicant has earned a degree from a US institution (or will be earning one before the start of their Missouri S&T program) or from a country exempt from providing the test score, the language proficiency requirement is waived. See section III.B.4 for other options than TOEFL.

4. Letters of Recommendation

All applicants for thesis option master (MS) degree are required to submit at least two letters of recommendation. For all applicants for doctoral degrees, a minimum of three letters of recommendation is required. Letters of recommendation should be directly sent to the Director of Admissions.

5. Transcripts

All applicants must submit official transcripts from all colleges and universities attended. The transcripts should be sent directly from the colleges and universities to the Director of Admissions. Where the colleges and/or universities use a system differing significantly from the 4-point GPA system used at S&T, it is helpful to include a statement of the grading scheme, class rank and any other information that can be provided by the college or university.

6. Financial Statement

All international students must submit a financial statement showing sufficient resources to cover living and educational expenses for one year. This requirement does not apply to domestic applicants.

7. Statement of Purpose

All applicants are strongly encouraged (required for doctoral applicants) to submit a Statement of Purpose indicating their specific area(s) of interest in electrical and/or computer engineering and outlining how the pursuit of an advanced degree will complement their overall career plan.

8. Curriculum Vitae (CV) or Resume

Applicants are strongly encouraged to include a CV or a resume as part of their application package. This material may be useful in documenting significant industrial experience, post graduate training, publications, and other significant professional accomplishments.

9. Summary

Table 1. A Summary of Customarily Required Application Documents

	Master's Degrees (MS)		Doctoral Degrees (PhD or DE)	
	International	Domestic	International	Domestic
Application Form	Required	Required	Required	Required
Application Fee	Required	Required	Required	Required

GRE Scores *	Required	Required	Required	Required
Language Fluency **	Required	Not Required	Required	Not Required
Recommendation Letters	Required***	Required***	Required	Required
Transcripts	Required	Required	Required	Required
Financial Statement	Required	Not Required	Required	Not Required
Statement of Purpose	Encouraged	Encouraged	Required	Required
CV or Resume	Encouraged	Encouraged	Encouraged	Encouraged

* See section III.B.3 for the waiver condition.
** See section III.B.4 for possible options.
*** For thesis option MS only

B) Admission Guidelines

The admission guidelines listed below provide a rough indication of the department's expectations for incoming graduate students. The recommendations are not absolute. They are not necessarily intended to preclude the acceptance of students who may have specialized skills, training, or other accomplishments providing solid evidence of outstanding potential to contribute to the research mission of the department.

1. Undergraduate Grades

The nominal GPA recommendation for admission to the MS degree program is an undergraduate GPA of 3.3 on a 4.0 GPA system. In evaluating academic performance from universities that may use other grading systems, the department may rely upon statistical data gathered in analyzing academic outcomes for recent graduate students and/or academic qualifications of recently accepted students from comparable institutions to the extent that such statistical data is available. The department will not offer graduate admissions to students who do not have the equivalent of a four-year undergraduate degree in engineering or a closely related field. As an example, we cannot accept students who have only a diploma or an engineering technology degree.

2. Graduate Grades

For doctoral applicants who hold an MS degree, the nominal requirement is a graduate GPA of 3.5/4.0 or higher in their MS degree. An undergraduate GPA of 3.5/4.0 or higher is recommended for the doctoral applicants without an MS degree (directly from undergraduate to doctorate). In addition, applicants seeking admission to the doctoral program should meet or exceed all the guidelines for those seeking admission to the MS program.

3. GRE Scores

The recommended GRE scores by the ECE department are: GRE-Q score of 155, sum of GRE-V and GRE-Q scores of 305, and GRE-AW score of 3.5. This GRE requirement may be waived for applicants with an undergraduate GPA of 3.5 obtained from all courses offered by the ECE program at Missouri S&T (minimum 18 credit hours) or otherwise exceptional applicants nominated by faculty members.

4. Language Fluency

Only international students are required to provide TOEFL scores. The required minimum TOEFL score set by Missouri S&T is 80 on the IBT (Internet-based testing) version. The required minimum scores of other options are: IELTS 6.5, Pearson 58 and Duolingo 115, respectively.

Those applicants who are academically qualified but do not have the required minimum language proficiency score may be admitted with the following condition: Applicants with a score of TOEFL between 60-79, IELTS 5.5-6.0, Pearson 50-57 or Duolingo 105-110 may be admitted to the ECE Department and allowed to take academic courses while improving their language proficiency through the

on-campus language program (Pathway Program) in the Applied Language Institute (ALI: https://ali.mst.edu/) during the first semester. They should submit the required minimum score or equivalent before completing the first semester.

5. Transferring into ECE from Other Fields

Students applying for graduate studies with degrees in closely related fields may have additional conditions placed on their admission. These conditions are generally imposed to make sure that students who do not hold a traditional electrical or computer engineering degree will have sufficient background to have a good chance for academic success in the department's graduate programs. Specifically, students who wish to pursue a graduate degree in electrical engineering but hold only degrees in related subjects (e.g., physics, computer science, other engineering disciplines, etc.) may be required to take courses as listed in the following table:

Table 2. Essential Background Courses for Electrical Engineering (EE)

All subjects below (or equivalent) are required	Two of the five subjects below (or equivalent) are required
• Circuits (EE 2100/2120 or 2800) • Introductory Electronics (EE 2200) • Digital Logic (CpE 2210)	• Control Systems (EE 3320) • Electronics (EE 3100) • Digital Communications (EE 3430) • Electromagnetics or Devices (EE 3600 or 3250) • Power Systems or Machines (EE 3500 or 3540)

The corresponding table for students who wish to pursue a graduate degree in computer engineering but hold degrees in related subjects (e.g., computer science, mathematics, etc.) is:

Table 3. Suggested Background Courses for Computer Engineering (CpE)

All subjects below (or equivalent) are required	Two of the four subjects below (or equivalent) are required
• Digital Logic (CpE 2210) • Data Structures (CS 1575) • Discrete Mathematics (CS 1200)	• Computer Organization (CpE 3110) • Microcontrollers/Embedded Systems (CpE 3150) • Operating Systems (CS 3800) • Digital Signal Processing (EE 3410)

When students are required to take some combination of these background courses as a condition for their admission, they should realize that the required background courses are undergraduate courses. As such, they will not count towards fulfilling the requirements for the MS or doctoral degrees. In exceptional cases, evidence of professional experience in a field directly related to the applicant's chosen graduate program may be accepted in lieu of remedial courses.

6. Other Considerations for Admission

When applicants meet all the guidelines listed above and provide all of the information requested, the department will usually recommend admission. When applicants do not meet these guidelines, the department may consider other factors such as:

1. Recommendations from S&T ECE faculty, particularly when accompanied by offers of a graduate research assistantship (GRA; see section IV.A) or other forms of financial support as appropriate.
2. Specific skills, training, and/or experience relevant to departmental research projects.
3. Publications and/or presentations at conferences.

IV. Financial Assistantships

There are three major mechanisms of funding for graduate students in the ECE department: Graduate Research Assistantship (GRA), Graduate Teaching Assistantship (GTA), and Fellowship. There are also Grader positions compensated on an hourly basis. Students can be appointed as GRA or GTA at a rate of 25% or 50% FTE (Full-Time Equivalent). The 50% FTE is the maximum part-time employment rate for students (100% represents the full-time job). The monthly stipend for 50% FTE is approximately $2,200. The stipend is proportionally adjusted for lower % FTE (e.g., $1,100 for 25% FTE). A student's out-of-state tuition is waived if the student is funded as a GRA or GTA (or a combination of the two) at a rate of 25% FTE or higher. General information about financial assistantship is available at: https://futurestudents.mst.edu/admissions/graduate/ (for domestic students) and https://futurestudents.mst.edu/admissions/international/graduate/ (for international students).

A) Graduate Research Assistantship (GRA)

This assistantship is to support students who contribute to faculty members' research. If a GRA is offered, the out-of-state tuition is waived (if higher than 25% FTE) and the monthly stipend is provided according to % FTE. Students may contact individual faculty members with materials (CVs, publication, etc.) preferably before application to demonstrate their qualification and competency in the interested research areas. The faculty member may offer a GRA position with admission if the student is qualified and funding is available. Or it may be offered anytime with continued interactions with faculty members during study in the ECE program.

B) Graduate Teaching Assistantship (GTA)

GTAs are normally required to teach undergraduate-level laboratory courses. If a GTA is offered, the out-of-state tuition is waived (if higher than 25% FTE) and the monthly stipend is provided according to % FTE. The department appoints GTAs every semester. Students apply for the GTA positions several months before the start of the semester they are to teach and are selected by the department. Non-native speakers must pass a verbal exam that measures proficiency in spoken English and complete a workshop before teaching as a GTA. The workshop is held once per fall and spring semester (https://gta-workshop.mst.edu/). Therefore, new incoming non-native speaker students are typically not eligible for a GTA position during the first semester.

C) Grader

This mechanism provides students with biweekly stipends based on hourly rates (no tuition waived). Graders are normally required to grade assignments from undergraduate-level courses. Students may contact individual faculty members who teach the course to be appointed as Grader several months before the start of the semester when they are to grade. Therefore, typically new incoming students are not eligible for the Grader position during the first semester.

V. Graduate Degrees

The ECE department offers master's (MS; thesis and non-thesis options) and doctoral degrees (Doctor of Philosophy, PhD, and Doctor of Engineering, DE) in electrical and computer engineering, respectively (https://ece.mst.edu). Students who meet the normal graduate admissions criteria, but only wish to take an advanced 6xxx-level course can be admitted as non-degree graduate students. To earn a degree, a cumulative GPA of 3.0 or higher in all graduate-level courses listed on Form 1 or Form 5 (see section VI.A) must be obtained.

If the semester graduate GPA falls below 3.0, the student will be placed on probation for the following semester. If the graduate GPA is not 3.0 or above in the following semester that coursework is taken, the student shall no longer be a candidate for a graduate degree or certificate from Missouri S&T. Also, the university requires that all the graduate credits including transferred credits must have been obtained in prior ten years with no possible extension, preceding the degree's conferral.

A description of the common specific steps required to complete the requirements for a graduate degree in all departments can be found in the Graduate Catalog (https://catalog.mst.edu/graduate/) and all required forms are available at the Graduate Education Office (https://grad.mst.edu/currentstudents/forms/). The following describes how these procedures are followed in the ECE department.

A) Master's (MS) Degrees (thesis and non-thesis)

The thesis option MS degree is based on a combination of coursework and research. This option requires the student to find a faculty member willing to serve as advisor. This should be done as soon as possible so that the student and advisor will be able to formulate both a plan of coursework (Form I/I-A) and a research project. Thesis option MS students must have their advisory committee chaired by the student's advisor. The committee must consist of a minimum of three members. The advisor may be from other departments at S&T if a co-advisor from ECE is a member of the student's advisory committee. Up to one member from outside the ECE department is allowed including the advisor. The advisor and at least one of the other members must be members of Missouri S&T graduate faculty. If a committee member is not a member of the Missouri S&T graduate faculty, a vita verifying equivalent level (or higher) of education must be provided with the Form I/I-A. The advisor can remain as the chair of the committee should he or she choose to leave Missouri S&T. However, the student will need to add an on-campus co-advisor to the committee.

The non-thesis option MS degree is based entirely on coursework. Non-thesis students are assigned an initial advisor by the department, typically the Graduate Coordinator. In this case the advisor's role is to assist the students in selecting courses consistent with their interests and abilities. The advisor is also responsible for ensuring the student's program of study meets the department's degree requirements and allows the student the opportunity to complete all degree requirements within a reasonable and customary time limit.

MS degree students, both thesis and non-thesis option, may change this degree option and/or their advisor at any time with the consent of their current advisor, their new advisor (in cases of advisor change), and in the case of thesis option students with the consent of their advisory committee. Once admitted to the MS program, a student will be given six years to complete the program. A student may take a leave of absence, up to one year only, which will not count toward the six-year time limit.

B) Doctoral Degrees (PhD and DE)

The two types of doctoral degrees are the Doctor of Philosophy (PhD) and the Doctor of Engineering (DE), both of which place a strong emphasis on research with an advisor. The research portion of the PhD degree is generally conducted on campus. It is strongly recommended for PhD students to have at least three IEEE journal-class articles accepted or under review at the time of the Defense from their PhD work as major contributor. The primary difference of the research portion of the DE degree from that of the PhD is that DE research is conducted as an internship with an industrial concern or government laboratory and is jointly supervised by an internship advisor employed by the cooperating organization and a faculty advisor employed by S&T. Once admitted to a doctoral program, a student will be given eight years to

complete the program. A student may take a leave of absence, up to one year only, which will not count toward the eight-year time limit.

All ECE doctoral programs require the completion of a dissertation. Oversight for the dissertation is the responsibility of the student's advisor together with an advisory committee. Doctoral students must have their advisory committee chaired by the student's advisor. The committee must consist of a minimum of five members. The advisor may be from other departments at S&T if a co-advisor from ECE is a member of the student's advisory committee. At least one member from outside the ECE department, but no more than half, is required. The advisor and at least three of the other members must be members of Missouri S&T graduate faculty. If a committee member is not a member of the Missouri S&T graduate faculty, a vita verifying equivalent level (or higher) of education must be provided with the Form 5/5A. The advisor can remain as the chair of the committee should he or she choose to leave Missouri S&T. However, the student will need to add an on-campus co-advisor to the committee.

VI. Graduate Degree Procedures

A description of the common specific steps required to complete the requirements for a graduate degree in all departments can be found in the Graduate Catalog (https://catalog.mst.edu/graduate/) and all required forms are available at the Graduate Education Office (https://grad.mst.edu/currentstudents/forms/. The following describes how these procedures are followed in the ECE department.

A) Plan of Study (Form 1 and Form 5)

Graduate degrees are often highly individualized to accommodate each student's research and academic interests. Therefore, graduate degree seekers are required to submit a formal Plan of Study showing the courses they plan to take and when they plan to take the courses (see chapter VII for requirements). This is met by completing a Plan of Study, Form 1 for MS students and Form 5 for doctoral students, respectively (see chapter VII for details of the degree requirements to complete the forms).

The MS student must plan their graduate program (Plan of Study) and submit a Form 1 (https://grad.mst.edu/currentstudents/forms/) for approval during the semester the student will have completed nine hours of graduate credit: typically, during the first semester of study. The thesis MS students must select an advisory committee; while, there is no advisory committee required for the non-thesis MS option.

After passing the PhD Qualifying Exam, the doctoral student must select an advisory committee that will assist the student in immediately preparing an acceptable Plan of Study and submit a Form 5 (https://grad.mst.edu/currentstudents/forms/) to obtain the approval from the department, advisors, committee members and the Graduate Education Office.

The Plan of Study requirement must be fulfilled after the required form receives approval from the Graduate Education Office. Failure to comply with this requirement may cause the Graduate Education Office to place a hold (encumbrance) on the student's registration. Once a hold has been placed, the student will not be allowed to register for courses until a Plan of Study has been submitted and approved. In addition to Form 1 and Form 5, thesis option MS and doctoral students are required to pass major exams including: Qualifying Exam, Comprehensive Exam, and/ or Defense, to fulfill the degree requirements (see chapter VIII for details of the major exams).

B) Modifications to Plan of Study (Form 1A and Form 5A)

Once the Form 1 or Form 5 has been approved, students can modify their Plan of Study by submitting a revised Form 1 -- Form 1A, or a revised Form 5 -- Form 5A. It is strongly recommended that these forms be updated as soon as any changes (i.e., course change, committee member change, not required/accepted change, etc.) have been made. Forms will be reviewed by the Graduate Education Office and needs to be current before the final Defense (for thesis MS students), before graduation (for non-thesis MS), and before the Comprehensive Exam and final Defense (for doctorate). Also, these forms will be reviewed when the students apply for Curricular Practical Training (CPT), Optional Practical Training (OPT), Reduced Enrollment, or I-20 Extension.

Students should use Form 1A or Form 5A to change their advisor and/or to replace members of their advisory committee. Changing advisors requires the approval of both the old and new advisors. Replacing committee members requires the approval of current advisor and both former and proposed committee members. A student who changes advisors should realize that their new advisor has the right to request the addition or deletion of specific courses from the previously approved form.

Any course that has received a grade of 'C' or lower cannot be removed from an approved Plan of Study. If a student receives an 'F' grade and has not removed the course from their Plan of Study before the grade has been issued, they'll be required to retake the course until a passing grade has been earned. However, if a MS student has extra hours with grade 'A' or 'B' listed on their Form 1 and decides to continue to a PhD program at S&T before they graduate, a Form 1A may be submitted with those extra courses removed. These extra hours with grade 'A' or 'B' can count towards PhD credit.

Responsibility for assuring that the Plan of Study, as modified, still meets the requirements enumerated above, rests with the student and the advisor. MS degree students (both thesis and non-thesis option) may change this degree option at any time with the consent of their current advisor, their new advisor, and in the case of thesis option students, the consent of their advisory committee. On Form 1A or Form 5A, the revision of the course list only, without change of advisor/and or committee members, requires the approval of only the advisor.

C) Transition from MS to Doctorate

A MS student may change their degree program from MS to doctorate before completing the MS study. The student is then subject to the case of the doctoral student without MS (directly from BS to Doctorate) and must meet all requirements accordingly (see section VII. C for BS to Doctorate). All lecture and research course credits obtained during MS study may be then counted toward the doctoral study.

All doctoral students with a completed MS degree by the beginning of doctoral study are subject to the requirements of a doctoral student with MS (see section VII. D for MS to Doctorate). For those doctoral students with a completed MS degree from Missouri S&T, any extra credit hours during MS (earned beyond the minimum requirement and listed on the Form 1) may not be used to fulfill course requirements for any other degree. The basic premise for counting courses is that one course can count towards only one degree. Accordingly, all the courses shown on the Form 1 or Form 1A are the requirements for MS. However, if the MS study has not been finished, the student may want to consider submitting a Form 1A to remove extra courses from the Form 1. These courses then may no longer be considered part of the MS degree and may be counted towards fulfilling the doctorate. However, it is important to note that this process requires the approval of the advisor, Graduate Coordinator, and the Graduate Education Office.

International students who wish to remove courses from one degree to apply towards another degree should discuss the implications of this change with the International Affairs Office (https://international.mst.edu/). This change could conceivably affect the I-20 status of an international student. Therefore, the International Affairs Office has two additional requirements for international students who wish to remove courses from their Plan of Study. The policy of the International Affairs Office is:

1. An international student may remove courses from their Plan of Study only when they are in the last semester of the MS program. For unavoidable circumstances, for instance family/medical emergency, the student will have to provide documentation to the International Affairs Office to remove the course during the Plan of Study.
2. The courses being removed from the Plan of Study can include only courses being taken during the current semester. Courses cannot be removed retroactively.

D) Transfer of Lecture Course Credits

To transfer lecture course credits from a student's previous institution, a document describing the course (including title, credit hours, summary of contents, academic level) is required to prove the equivalency of the course to be transferred to a course at Missouri S&T. Examples include: course catalog description in the previous institution's homepage, course syllabus used, or letter from the instructor who taught the course. Also, the student's transcript listing the course title and its score must be provided. The Graduate Coordinator may approve the transfer based on the information provided after consulting with the instructors of equivalent courses at Missouri S&T and/or ECE Graduate Studies Committee members.

A maximum of nine hours of lecture course credits for an MS degree may be transferred from a student's previous institution. For doctoral credits, a student who does not hold an MS degree may transfer a maximum of 18 hours, while a student with an MS degree may transfer a maximum of nine hours. Students must have earned at least a B grade for any course to be transferred to our programs. The student must also provide documentation showing the proposed transfer courses were not used toward a previously earned degree. Courses can be transferred if earned within the previous ten years, while the courses taken earlier than the ten-year time limit at the time of graduation cannot be counted toward degree.

E) Application for Graduation

Within the first four weeks of the final semester, the student should ensure that all degree requirements will be fulfilled by the end of the semester. At this time the student should fill out an application for graduation through Joe'SS. Complying with this requirement will allow adequate time for the faculty to approve the granting of the degree and will also enable the student to participate in the next graduation ceremony. Failure to comply with this requirement may delay granting the degree. Graduation ceremonies are held at the end of the Fall and Spring semesters. Students who complete their degrees during the summer session and meet these requirements will be invited to participate in the graduation ceremony held at the end of the next Fall semester.

Occasionally, students fill out their application for graduation and, due to unforeseen circumstances, are unable to complete their degree requirements by the end of the semester. In these cases, the student will need to notify their advisor and fill out a new application for graduation for the subsequent semester. International students who determine that they will not be able to fulfill their degree requirements after applying for graduation should contact the International Affairs Office as soon as possible to avoid any adverse consequences regarding their immigration status.

If a student is planning on finishing program requirements during intercession, he or she will have to submit all final forms and documentation by the Friday before the next semester begins and apply for graduation the following semester. If needing to defend during intercession, a student will have to enroll for the defense by filling out an Oral Defense Registration form.

VII. Graduate Degree Requirements

Requirements for graduate degrees may originate at different levels. Requirements applying to all graduate degrees granted by S&T are set by the graduate faculty. Requirements applying to all graduate degrees granted in the ECE department are determined by the faculty of the department. It is important to realize that a candidate for a graduate degree from this department must meet both requirements set at the campus (S&T) level and the department (ECE) level.

A) Master's (MS) Degree

On the Form 1, there must be at least one single subset of courses that satisfies all the following requirements simultaneously:

1. The total number of credit hours in the subset for thesis/non-thesis option students must be greater than or equal to 30. Credits earned by Curricular Practical Training (CPT) 5085 will not count towards fulfilling the requirements for the degrees.
2. All lecture courses must be courses in engineering, math, or science, specifically excluding humanities/social sciences except for a course taken to fulfill the graduate communications requirement (see section VII. F for more details on how to satisfy the communications requirement).
3. If a student wishes to pursue courses in an area where they lack background, they may be required to take suitable remedial courses at the undergraduate and/or graduate levels prior to enrolling in graduate courses in that area. These remedial courses are likely to be prerequisites to the graduate courses in which the student wishes to enroll and cannot be counted towards the degree requirements.
4. Thesis option: There must be at least 21 credit hours of lecture courses (specifically excluding 5099) and at least 6 hours of thesis research credit (5099). The remaining 3 hours (out of total 30 hours) may be either lecture or research credit hours. Under rare circumstances (e.g., no course is available toward the degree to keep the full-time student status), with approval from the Graduate Coordinator, up to 1 credit hour of Special Problems (5000) and/or seminar courses may be accepted. There must be at least 6 credit hours of 6xxx-level lecture courses. At least 15 hours of lecture credits, at least 3 hours of 6xxx-level credits and at least 3 hours of thesis research (5099) credits should be in the ECE program.
5. Non-thesis option: There must be at least 30 credit hours of lecture courses. The number of research credit hours (5099) accepted towards a non-thesis MS degree is zero. Under rare circumstances (e.g. no course is available toward the degree to keep the full-time student status), with approval from the Graduate Coordinator, up to 4 credit hours of Special Problems (5000) and/or seminar courses may be accepted. There must be at least 9 credit hours of 6xxx-level lecture courses. At least 6 hours of 6xxx-level credits and at least half of the Special Problems (5000) and/or seminar courses should be in the ECE program.
6. Non-thesis option: Students are required to declare their primary emphasis area from the list of emphasis areas in the ECE graduate program after consulting with the Graduate Coordinator. A student should take a minimum of 12 lecture credit hours from their primary area. The remaining lecture credit hours (out of a total of 30 hours) can be taken from other areas, while up to 6 hours can be taken from non-ECE programs. Courses co-listed in the ECE program are considered as ECE courses. Under rare circumstances (e.g. a sufficient number of courses are not available from the primary area), then courses from close areas and close programs may be permitted with the approval of the Graduate Coordinator.

7. Non-thesis option: A student can change the primary area after approval from the Graduate Coordinator. However, the aforementioned requirement for the course selection (minimum 12 hours from the new primary area) must be satisfied.

B) Second Master's (MS) Degree in ECE

The second MS degree in ECE is intended for students who already hold an MS degree in a field closely related to ECE. The minimum number of credit hours required for a second MS degree is 24. As in the case of a first MS degree, the second MS degree can include research and coursework (thesis option) or coursework only (non-thesis option). Students who wish to obtain a second MS degree based on having a MS degree in a closely related field must apply specifically for admission as a second MS degree student. The following requirements apply once the student has been accepted as a second MS degree student:

On Form 1, there must be at least one single subset of courses that satisfies all the following requirements simultaneously:

1. The total number of credit hours in the subset must be greater than or equal to 24 (6 hours less than the regular MS degree in section VII.A). All lecture credit hours and all thesis research (5099) credit hours should be taken from the ECE program with the exception of a course taken to fulfill the graduate communications requirement (see section VII.F). .
2. Thesis option: There must be at least 18 hours of lecture credit (specifically excluding 5099) and at least 6 hours of thesis research credit (5099). .
3. Non-thesis option: A student should take a minimum of 12 lecture credit hours from their primary area in the ECE program. The remaining lecture credit hours (out of total 24 hours) should be taken from the other areas of the ECE program.
4. All other requirements as listed for the first MS degree in ECE must be met.

C) Doctor of Philosophy (PhD) Degree (BS → Doctorate)

Occasionally students who are exceptionally well qualified by virtue of outstanding academic accomplishments, research potential, and/or relevant experience will request and be granted direct admission to the doctoral program with only a BS degree. Programs of study for doctoral students without a relevant MS degree are subject to the following requirements:

On Form 5, there must be at least one single subset of courses taken for graduate credit that satisfies <u>all</u> the following requirements simultaneously:

1. The total number of credit hours in the subset must be greater than or equal to 90. Credits earned by Curricular Practical Training (CPT) 6085 will not count towards fulfilling the requirements for the degrees.
2. Excluding all credit hours attributable to dissertation research (6099), the number of remaining credit hours of lecture courses must equal or exceed 48 and at least 30 of these credit hours should be taken in the ECE program.
3. Students are required to take at least 18 credit hours of 6xxx-level lecture courses. Under rare circumstances (e.g., no course is available toward the degree to keep the full-time student status), with approval from the Graduate Coordinator, up to 1 credit hour of Special Problems (6000) and/or seminar courses may be accepted.
4. All lecture courses must be courses in engineering, math, or science, specifically excluding humanities/social sciences, with the exception of a course taken to fulfill the graduate communications requirement (see section VII.E.).
5. The total number of credit hours taken as doctoral dissertation research (6099) must equal or exceed 42, and at least half of these credit hours should be taken in the student's degree program.

6. A minimum of three years of residency (equivalent to at least six academic semesters while enrolled as an on-campus student at Missouri S&T) must be documented on the student's plan of study (Form 5/5A). ECE program considers the residency requirements are fulfilled for a PhD student outside the campus with advisor approval when: regular meetings take place between the student and PhD advisor by remote conference; the qualifying exam, comprehensive, and defense are taken on campus; and the student remotely participate in campus seminars and research group meetings where appropriate and feasible. Further details of campus-level residency requirements, off-campus research and alternative routes are available from the Graduate Education Office.

D) Doctor of Philosophy (PhD) Degree (MS → Doctorate)

Many graduate students accepted into the doctoral program already hold a relevant MS degree, either from S&T or elsewhere. Typically, this MS degree will be in electrical engineering, computer engineering, or a closely related field. Plan of study for doctoral students with a relevant MS degree are subject to the following requirements:

On Form 5, there must be at least one single subset of courses taken for graduate credit that satisfies all the following requirements simultaneously:

1. The total number of credit hours in the subset must be greater than or equal to 60. Credits earned by Curricular Practical Training (6085) will not count towards fulfilling the requirements for the degrees.
2. Excluding all credit hours attributable to dissertation research (6099), the number of remaining credit hours of lecture courses must equal or exceed 24 and at least 15 of these credit hours should be taken in the ECE program.
3. Students are required to take at least 12 credit hours of 6xxx-level lecture courses. Under rare circumstances (e.g. no course is available toward the degree to keep the full-time student status), with approval from the Graduate Coordinator, up to 1 credit hours of Special Problems (6000) and/or seminar courses may be accepted.
4. All lecture courses must be courses in engineering, math, or science, specifically excluding humanities/social sciences with the exception of a course taken to fulfill the graduate communications requirement (see section VII.E).
5. The total number of credit hours taken as doctoral dissertation research (6099) must equal or exceed 36, and at least half of these credit hours should be taken in the student's degree program.
6. A minimum of two years of residency (equivalent to at least four academic semesters while enrolled as an on-campus student at Missouri S&T) must be documented on the student's Plan of Study (Form 5/5A). ECE program considers the residency requirements are fulfilled for a PhD student outside the campus with advisor approval when: regular meetings take place between the student and PhD advisor by remote conference; the qualifying exam, comprehensive, and defense are taken on campus; and the student remotely participate in campus seminars and research group meetings where appropriate and feasible. Further details of campus-level residency requirements, off-campus research and alternative routes are available from the Graduate Education Office.

E) Doctor of Engineering (DE) Degree

Details of DE requirements are available at the catalog information from the Office of the Registrar (http://catalog.mst.edu/graduate/admissionsandacademicprogramprocedures/doctoratedegrees/).

F) Technical Communications Requirement

An ECE graduate student is required to fulfill a zero-credit hour communications requirement to demonstrate that they possess sufficient technical communications capabilities to be successful in their profession. Fulfillment of this requirement is determined by the student's graduate advisor in consultation with the Graduate Coordinator. A Communications Requirement Form, approved by the advisor, should

be submitted with the first submission of the Graduate Form 1 or Form 5. Resubmission of this form is required if the activity elected for fulfillment changes. This form will be referenced by the graduate secretary each time a student submits a revised Form 1 or Form 5 and is tracked on the graduate degree audit before graduation.

Typical examples of experiences that might demonstrate completion of this requirement include:
1. Major contribution to authoring a conference or journal paper
2. Completing an approved communications-intensive graduate-level course (English 5571 Advanced Writing for Science and Engineering, Tech Com 5510 Technical Editing, Tech Com 5550 Advanced Proposal Writing, BioSci 6223 Science Proposal Writing or equivalent)
3. Substantial communications-related experience in industry
4. Substantial communications coursework at the undergraduate level.

VIII. Major Exams

There are several major exams required for students pursuing advanced degrees in the ECE department. A description of the common specific steps required to complete the requirements for a graduate degree in all departments can be found in the Graduate Catalog (https://catalog.mst.edu/graduate/) and all required forms are available at the Graduate Education Office (https://grad.mst.edu/currentstudents/forms/). The following describes how these procedures are followed in the ECE department.

A) Master (MS) Thesis Defense

All thesis option MS degree candidates must defend their thesis in an oral thesis Defense examination conducted by their advisory committee. It is strongly recommended for MS students to have at least one IEEE-journal-class articles from research work as major contributor (typically first author) accepted or under review at the time of the Defense. Committee members should be provided with a written copy of the thesis and oral presentation material (typically PowerPoint slides) at least one week in advance of the exam. After the Defense, the chair of the advisory committee will submit the evaluation rubric (available at https://ece.mst.edu/resources/current-students/graduate-advising/) to the graduate secretary for approval, and the student will submit a Form 2 (Report on Final Examination and Thesis Approval).

The student is responsible for checking the eligibility for the exam in advance and scheduling the oral thesis Defense. The student's Form 1 (Plan of Study) must be up to date before the exam can be authorized. Students should contact the graduate secretary at least two weeks in advance of the exam to submit an ECE Graduate Defense Request Form (available at https://ece.mst.edu/resources/current-students/graduate-advising/) to provide details of the Defense: to create an announcement to publicize the Final Defense and to reserve a room for the Defense. *Very important: One week prior to the defense, the student must contact the Graduate Education Office to notify them of intent to defend; failure to do so will delay the Defense.

B) Doctoral Qualifying Exam

The Qualifying Exam is administered in two parts: a written exam and an oral exam. The objective of the written exam is to determine the students' understanding of the fundamentals of EE/CpE subjects and ensure solid theoretical background to begin research. The objective of the oral exam is to evaluate the students' ability for critical thinking, problem-solving and communication required to independently conduct research. The oral exam will be administered only for students who have passed the written exam.

Every doctoral student is required to pass the Qualifying Exam, both written and oral portions, by the end of the second semester (for those with MS degree) or by the end of the fifth semester (for those without MS degree). These exams are offered only once in the fall semester and once in the spring semester. The graduate secretary will notify students to register seven weeks before the exam. Details, including the exam procedures, written exam study guides, and the oral exam evaluation rubric are available in a separate document (see General Information for EE/CpE Qualifying Exam, available at https://ece.mst.edu/resources/current-students/graduate-advising/). After the oral exam, the student's advisor and committee members will submit an oral report to the graduate secretary. After the successful completion of the Qualifying Exam, both written and oral portions, the student will submit a Form 4 to the Graduate Education Office (https://grad.mst.edu/currentstudents/forms/). A Form 5 is also submitted to the Graduate Education Office.

Students who fail the Qualifying Exam on their first attempt will be given a second opportunity to pass the exam when it is given in the following semester. Students who passed the written exam but failed the oral exam may again attempt only the oral exam in the following semester. Students who fail the exam once and do not take the exam at the subsequent opportunity will no longer be considered doctoral degree candidates in the ECE department. Under rare circumstances (e.g., family emergency) a student who fails the Qualifying Exam on two consecutive semesters may file a written petition with the ECE Graduate Studies Committee for a third attempt. The petition must include at least three faculty recommendations, documentation of academic and research progress, and documentation of extenuating circumstances. The committee will vote, by simple majority, to approve or deny the petition. If the petition is approved, it will be forwarded to the Office of Graduate Studies as a request to administer the last attempt.

Upon request of the advisor, the Qualifying Exam may be waived for those who transferred to our doctoral programs after they had passed the Qualifying Exam, or equivalent, in the same program (e.g., electrical or computer engineering) at other institutions. The advisor should provide the Graduate Coordinator with the necessary information related to the exam taken, including the subjects list and the method of administration. The Graduate Coordinator may then waive the exam based on the information provided and input from the Graduate Studies Committee.

C) Doctoral Comprehensive Exam

The purpose of the Comprehensive Exam is to evaluate a student's overall research progress and plan for completion of the doctoral dissertation. It should be taken after preliminary work has been carried out to demonstrate the promise of the proposed topics and the student's preparation to conduct research. The exam serves as an opportunity for the advisory committee to recommend revisions to the topic or approach, and as such, the exam should be taken well before the final Defense. The Comprehensive Exam can be taken any time after completion of at least half of their required doctoral lecture credit hours (12 hours for doctoral students with MS degree and 24 hours for doctoral students without MS degree, respectively). A period of at least six months must elapse between the Comprehensive Exam and the Defense.

In the course of this exam, the student is expected to demonstrate their ability to formulate research questions, identify objectives, conduct a literature survey, design research methods, illustrate the approach with preliminary data, and articulate plans for completion of the dissertation in a timely fashion. The exam will be an oral session (approximately 45 minutes) to present the research questions, objectives, literature survey, proposed methods, preliminary work and plans for completion of the dissertation, followed by questions from the advisory committee. A separate written dissertation proposal must be provided. The student is responsible for obtaining guidance from the full committee regarding the contents and format of the written proposal. The oral presentation material (typically PowerPoint slides) and a

written dissertation proposal should be distributed to the committee members no later than two weeks prior to the date of the exam.

The student is responsible for checking the eligibility for the exam in advance and scheduling the exam. The student's Form 5 (Plan of Study) must be up to date before the exam can be authorized. Students should contact the graduate secretary at least two weeks in advance of the exam to arrange a location. After the exam, the chair of the advisory committee will submit the evaluation rubric (available at https://ece.mst.edu/resources/current-students/graduate-advising/) to the graduate secretary for approval and the student will submit the Form 6 (Report on Comprehensive Examination).

D) Doctoral Dissertation Defense

All doctoral degree candidates must defend their dissertation in an oral dissertation Defense examination conducted by their advisory committee. It is strongly recommended for doctoral students to have at least three IEEE-journal-class articles from doctoral work as major contributor (typically as first author) accepted or under review at the time of the Defense. The oral presentation material (typically PowerPoint slides) and the written dissertation should be distributed to the committee members no later than two weeks prior to the date of the exam. After the Defense, the chair of the advisory committee will submit the evaluation rubric (available at https://ece.mst.edu/resources/current-students/graduate-advising/) to the graduate secretary for approval, and the student will submit a Form 7 (Report on Final Examination and Thesis Approval).

The student is responsible for checking the eligibility for the exam in advance and scheduling the oral dissertation Defense. Form 5 (Plan of Study) must be up to date before the exam can be authorized. Students should contact the graduate secretary at least two weeks in advance of the exam to submit an ECE Graduate Defense Request Form (available at https://ece.mst.edu/resources/current-students/graduate-advising/) to provide details of the Defense: to create an announcement to publicize the Final Defense and to reserve a room for the Defense. *Very important: One week prior to the defense, the student must contact the Graduate Education Office to notify them of intent to defend; failure to do so will delay the Defense.

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