

Engineering Education Research Program

Graduate Manual

Effective for students enrolling in
Fall 2021 or later

Last updated July 19, 2021. Updates from the previous version include:

- Changes to reflect that the M.S. degree in engineering is *recommended*, rather than *required* (introduction and section 2.1).
- Clarifications about the process of “Registering for the Qualifying Examination,” including details about research outline page length (Table 2, section 5.1).
- Revisions about the number of courses and credits allowed as candidates (section 5.2).
- Updates about eligible membership for the Dissertation Committee (section 5.3).
- Additions to clarify aspects of the Immersive Learning Experience (section 7.2).
- Updates about requesting approval for other Research Methods Core courses (section 7.4).
- Removal of example “Specialization Electives” to better emphasize that (almost) any course may satisfy this requirement (section 7.5).

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1. INTRODUCTION

The Engineering Education Research (EER) Program at the University of Michigan (U-M) comprises a small core of EER courses and experiential learning requirements, and it builds on research methods courses as well as elective courses from the Schools of Education, Information, and Social Work, the Departments of Psychology, Public Policy, and Sociology, and other units across the university. The program includes a Doctor of Philosophy (Ph.D.) and a Master of Science (M.S.) degree. The program also offers an EER Certificate for U-M students earning a Ph.D. in a traditional engineering discipline.

The **EER Core Faculty*** teach courses in the EER program and work with graduate students to refine students' plans of study, establish research projects, and guide the dissertation research. The intentional combination of course-based and experiential learning is intended to promote interdisciplinary and transdisciplinary research in engineering education and allow students to individualize their learning experience. The program further encourages linkages across U-M and the College of Engineering by fostering an intellectual community of faculty and students committed to the study and improvement of engineering education across the K-16 educational system who will benefit from a regular seminar series and additional activities to promote community.

The market for EER professionals is strong, and EER graduates earning a Ph.D. or M.S. degree have a number of job options including tenure-line faculty in traditional engineering or engineering education departments, instructors or research scientists in universities or national labs, professional staff in centers for teaching and learning, administrators in educational institutions or federal agencies, learning scientists at educational IT companies, and higher-educational liaisons to industry.

This EER program Graduate Manual provides information on the requirements for the **EER Ph.D. degree**, the **EER M.S. degree**, and the **EER Certificate**, and it pertains to students entering the program on or after the date listed on the front cover of the document. The manual is subject to change; however, any changes that affect currently enrolled students will only be enforced if they will be beneficial to the students' academic studies. Such changes will be communicated to all students affected.

The EER Ph.D. and M.S. degrees are part of U-M's Horace H. Rackham School of Graduate Studies (Rackham) which publishes the Graduate School Academic Policies with regulations that apply to all graduate students. Students in the EER program should consult both this EER program Graduate Manual and the Rackham Academic Policies guide (<https://rackham.umich.edu/academic-policies/>).

The **EER Graduate Chair** (eer-grad-chair@umich.edu) oversees graduate admissions, recruiting, Qualifying Examinations, fellowships, and graduate degree requirements. The EER Graduate Chair also serves as academic advisor for EER Ph.D. and M.S. students.

The **EER Graduate Coordinator** (eer-grad-coordinator@umich.edu) helps students navigate the policies and guidelines of both the EER program and Rackham. The coordinator assists with issues related to student admissions, EER Certificate applications, advising, curricula, and degree audits, and will refer students to the other appropriate U-M organizations as needed.

The **EER Financial Administrator** (eer-fin-admin@umich.edu) is responsible for processing fellowships and employment paperwork for EER graduate and undergraduate students.

The **EER Administrative Assistant** (eer-admin@umich.edu) provides support for various EER activities and programs, publicizes and coordinates EER events, and maintains the EER website.

* Through a unique College of Engineering initiative, several tenured/tenure-track faculty whose primary area of scholarship is EER are embedded in traditional engineering departments. These *EER Core Faculty* maintain a thriving EER portfolio, contribute to the EER community, and teach in and support the mission of their home engineering departments.

2. ADMISSION

2.1. APPLICATION TO THE EER PROGRAM

Admission to the EER program is through Rackham (<https://eer.engin.umich.edu/admissions/>). It is the applicant's responsibility to ensure the EER program receives the completed application materials by the specified deadlines.

Effective Fall 2021, students entering the EER program must have earned a B.S. degree (or equivalent) in a traditional engineering discipline, and it is recommended (rather than required) that they also have an M.S. degree (or equivalent) in a traditional engineering discipline. Encouraging students to have an M.S. degree (or equivalent) in engineering ensures that (1) students enter the program with the technical engineering expertise necessary to understand the context critical for developing high quality EER research, and (2) students graduate from the program with marketable skills and ample career opportunities.

Application for both the EER Ph.D. and M.S. degrees can be completed at the Rackham website, and applying to the program requires:

- A completed application form;
- An academic statement of purpose that describes how the EER program will support the student's career and educational goals;
- A personal statement that describes background and life experiences that have influenced the student's decision to pursue an EER degree at U-M;
- Three letters of recommendation;
- Transcripts from B.S. and M.S. degrees and from other previous academic coursework; and
- TOEFL scores (for all non-native English speakers).

For students applying in Fall 2020 for Fall 2021 admission, GRE scores will not be accepted. Competitive applicants must clearly articulate a clear reason for pursuing an EER graduate degree at U-M, describe what other EER programs across the U.S. offer and how the U-M EER program is uniquely aligned with personal goals, demonstrate knowledge of at least one EER faculty's research focus, and reflect on a potential EER advisor and research group. Students admitted to the EER Ph.D. program will be assigned an EER Faculty Advisor.

2.2. DEFERRALS

Admissions deferrals may be available for up to one term under special conditions (<https://rackham.umich.edu/admissions/applying/respond-to-the-offer/#deferring>). Typically, circumstances such as employment, enrollment at another institution, funding, or indecisiveness regarding enrollment are not appropriate justifications for requesting deferred enrollment. It is the policy of the EER program that requests for a one-year deferral will require a new application. To request a deferral, send an email to eer-grad-coordinator@umich.edu.

3. GENERAL ACADEMIC POLICIES

3.1. ENGLISH PROFICIENCY

Based on English language proficiency test scores (such as the TOEFL), some students will be encouraged by Rackham to take specific academic writing or speaking courses offered by the English Language Institute (ELI) to support their studies. The ELI courses are typically 1 to 3 credits, and they help students gain capability and confidence in English. These courses will not count toward the degree requirements or grade point average (GPA).

The quality of a student's written and spoken English is also evaluated when Ph.D. students participate in the oral Qualifying Examination and Dissertation Proposal Examination presentations. Students who are unable to complete degree requirements or make satisfactory progress toward the degree because of significant deficiency in English may be placed on probation. If the EER faculty consider students to be otherwise qualified for the EER program, taking *English as a Second Language* courses may be recommended.

3.2. ENROLLMENT STATUS

To be considered full-time, students who are serving on a Graduate Student Instructor (GSI) or Graduate Student Research Assistant (GSRA) appointment must be enrolled in at least 6 credits in a given term, while students who are not serving on a GSI or GSRA appointment (e.g., students on a fellowship) must be enrolled in at least 8 credits in a given term. Students who enroll in fewer than these credits will be considered to be part-time. There is no upper limit on the number of credits in which a pre-candidate may enroll; however, students who have achieved candidacy are subject to the limits outlined in Section 5.2. Courses in the English Language Institute do not count towards enrollment status, nor does Visit/Audit of a class.

Students who enroll full time are charged a flat tuition rate based on residency and candidacy status, while those who maintain part-time enrollment will accrue a per-credit tuition charge. Michigan residents qualify for in-state tuition, and students who achieve candidacy qualify for a lower tuition rate.

Note that the EER Ph.D. is considered a full-time program. Students are expected to focus full-time effort to their studies and research and to limit any external employment to a maximum of ten hours per week. Any employment during the student's time at U-M must be approved by the student's advisor and program.

3.3. GRADE REQUIREMENTS

Except for research credits (EER 690, EER 990, and EER 995) which are graded as "S" (satisfactory) or "U" (unsatisfactory), all courses must be letter-graded. Grades are assigned according to the following Rackham scale:

A+	4.3	B+	3.3	C+	2.3	D+	1.3
A	4.0	B	3.0	C	2.0	D	1.0
A-	3.7	B-	2.7	C-	1.7	D-	0.7

Graduate students must maintain a GPA of at least 3.0, based on Rackham's 4.0 scale, and only course grades of B- or better will be counted towards the credit hour requirements for the EER Ph.D. or M.S. degree. Students whose cumulative GPA falls below 3.0 on the 4.0 scale may be placed on probation, as described in Section 6.

3.4. COURSE WITHDRAWAL

At the beginning of each term, there is a drop/add period (the first three weeks of classes) during which students are allowed to register for courses through Wolverine Access without penalty. University-wide deadlines are set by the Office of the Registrar (<https://ro.umich.edu/calendars>). After the drop/add deadline, students may continue to drop and add courses through Wolverine Access, but this will be considered a "late-drop" or "late-add." A late-drop will result in students receiving a "W" grade on the transcript (signifying withdraw), which cannot be removed from the transcript.

After the eighth week of a full term (fourth week of a half term), courses may be dropped or changed to Visit/Audit status only under exceptional circumstances and with the approval of the course instructor, the EER Faculty Advisor, and the EER Graduate Chair.

3.5. TRANSFER OF CREDIT

Students who wish to transfer credits must follow the Rackham Transfer of Credit guidelines (<https://rackham.umich.edu/navigating-your-degree/transfer-of-credit-information/>), and they may only apply the transfer credit towards Specialization Electives within the EER program. Specifically, with approval from the EER Graduate Chair, students may be allowed to transfer up to 6 credits from external institutions or 15 credits from within U-M. Transferred credits must be used in whole and cannot be split (e.g. students cannot choose to only use 2 credits earned from a 4-credit course).

To transfer credits, students must have been enrolled at U-M for at least one term, have completed at least 8 credits of letter-graded, graduate-level coursework at U-M, and have a minimum GPA of 3.0. Transfer credits may only be

awarded for courses that are at the 500-level or higher. Students must have earned a “B” grade or higher in the course, and students cannot have used the course to satisfy any undergraduate or graduate degree requirements. To request a transfer of credit for qualifying coursework, students should upload a copy of the college transcript, a catalog course description, relevant course materials, and an official letter from the institution’s registrar at the Rackham website.

3.6. GRADUATION

Graduation for the Ph.D. or M.S. degree is not automatic. Students who have completed the degree requirements must (1) submit a signed, completed final Ph.D. or M.S. Plan of Study to the EER Graduate Coordinator and (2) apply for graduation via Wolverine Access. The last day to apply for graduation for the M.S. for a given term is the last day of classes for that term (not the last day of the final exam period). Ph.D. students must complete all requirements prior to the deadlines stated by Rackham to qualify for graduation.

3.7. ACADEMIC INTEGRITY AND THE HONOR CODE

The EER program at U-M follows the College of Engineering Honor Code which outlines standards of ethical conduct. (<https://elc.engin.umich.edu/policies-and-interpretations/>). Reported violations are investigated by the Honor Council.

3.8. INTERNATIONAL STUDENTS

Curricular Practical Training (CPT) for F-1 Students

The intent of Curricular Practical Training (CPT) is for international students to engage in practical job experience that directly relates to their academic program of study. Students must choose their internships carefully with the understanding that any job that is NOT specifically related to the applicant’s major area of study will likely result in the denial of the CPT request.

International students who wish to enroll in CPT should contact the EER Graduate Coordinator (eer-grad-coordinator@umich.edu) to receive the CPT instruction form and complete all necessary paperwork. Credit for CPT (ENGR 998, previously labeled RACK 998) may not be counted toward any EER degree requirements.

Optional Practical Training (OPT) for F-1 Students

Optional Practical Training (OPT) is defined in the Federal Regulations as temporary employment directly related to a student’s field of study. During OPT, students remain in F-1 status. The end result of the OPT request process is an Employment Authorization Document (EAD) issued by United States Citizenship and Immigrations Services (USCIS). Processing OPT applications typically requires 60 to 90 days. Some STEM students may be eligible for a 17-month extension of OPT.

Reduced Course Load (RCL) for F-1 Students

International students who drop below full-time status or who need fewer than 8 credits to complete their program requirements should contact the EER Graduate Coordinator (eer-grad-coordinator@umich.edu). Such students should also apply for Reduced Course Load (RCL) through the International Center (<http://internationalcenter.umich.edu>).

Please note that students are eligible for RCL only if they have not yet completed their degree requirements. Due to Federal regulations, students must apply for their degree in the term in which they complete their degree requirements. If students wish to remain in the country after completing their requirements, they must apply for OPT. The International Center can provide more information

3.9. PETITION FOR WAIVER OR MODIFICATION OF POLICY OR REQUIREMENT

If there are special circumstances that warrant it, students may petition for a waiver or modification of EER program policies or requirements. Students should first seek the advice of their EER Faculty Advisor, and then should complete the Petition Request Form (available from the EER Graduate Coordinator). The EER Faculty Advisor must approve this request and then submit it to the EER Graduate Coordinator (eer-grad-coordinator@umich.edu) who will submit it to the proper unit for final approval.

4. PH.D. DEGREE

The EER Ph.D. is a typical research-based doctoral degree. It provides essential coursework and other learning experiences that will prepare students to publish in top tier engineering education and education journals, compete for federal grants and contracts, and enter into multiple career paths. Students who are admitted to the EER Ph.D. program will be assigned an **EER Faculty Advisor** (who is a member of the EER Core Faculty) or two EER Faculty Co-Advisors (one of whom must be a member of the EER Core Faculty). The EER Faculty Advisor is intended to serve as the primary academic and research advisor. It is expected that the EER Faculty Advisor will serve in that capacity through the student's successful completion of the Ph.D. This assignment, however, is flexible, and mechanisms are in place to allow students to identify a different EER Faculty Advisor if appropriate or necessary.

4.1. PH.D. DEGREE COURSEWORK

The EER Ph.D. degree requires a minimum of 36 credit hours of graduate-level coursework. The courses that comprise these requirements are described in more detail in Section 7. The credit distribution for the Ph.D. is shown in Table 1.

Table 1. Credit distribution for Ph.D. degree

Category	# courses	# credits
Engineering Education Core (EER 601 and EER 602)	2	6
Research Methods Core	4	12 – 20
Specialization Electives	3 or more	Up to 15
Immersive Learning Experience (EER 610)	1	3
Total	10 or more	36 (minimum)

Typically, students will enroll in 9-10 credits of coursework per term. Up to 6 credits of EER 690: *Graduate Independent/Directed Study* and up to 3 credits of EER 598: *Special Topics in Engineering Education Research* may be counted towards Specialization Electives. Besides EER 690, all courses used for the Ph.D. degree coursework requirements must be letter-graded and may not be marked as satisfactory/ unsatisfactory. Courses that **do not count** toward Ph.D. degree coursework requirements include the following: courses with number 990, 995; course with “doctoral,” “dissertation,” or “preliminary” in the title; ENGR 998 (Curricular Practical Training); courses from the English Language Institute; courses with insufficiently advanced content and level; and courses which substantially duplicate the content and level of courses already completed.

4.2. COGNATE COURSE REQUIREMENT

Rackham requires Ph.D. students to complete at least four credits of coursework outside of their major research/interest area. Only letter-graded, graduate-level courses outside of the EER program may be used to meet this cognate requirement. Students completing an EER graduate degree will automatically fulfill this requirement by satisfying the mandatory number of Specialization Electives.

4.3. PH.D. PLAN OF STUDY

Students will plan their program of study and select the courses for the Ph.D. in consultation with their EER Faculty Advisor and the EER Graduate Chair. Students are required to submit an initial Ph.D. Plan of Study, approved and signed by the EER Graduate Chair, at the beginning of their first term (within a month after the beginning of the first term). Failing to do so will risk the ability to register the following term.

Students are also required to obtain pre-approval and signature from the EER Graduate Chair on a revised Ph.D. Plan of Study each time they wish to make changes to the initial plan, and they must obtain approval for a final Ph.D. Plan of Study in their last term. Failing to do so will risk the ability to graduate. It is highly recommended that students meet with the EER Graduate Chair to discuss the plan at the beginning of each year.

The final Ph.D. Plan of Study must satisfy all Rackham coursework requirements (including GPA, residency, and cognate requirements, see <https://rackham.umich.edu/policy/section4/>).

4.4. EMBEDDED M.S. DEGREE

Students who enter the EER Ph.D. Program are automatically enrolled in the EER M.S. program (described in Section 8.) Students will complete all of the academic requirements for the master's degree as they pursue the EER Ph.D., and they will be eligible to add the M.S. upon successful completion of the 30 credit hours of master's degree coursework. To add the master's degree, students must submit a final M.S. Plan of Study (approved and signed) to the EER Graduate Coordinator at the beginning of the term in which they will complete the master's degree requirements.

4.5. PH.D. DEGREE RESEARCH REQUIREMENTS

Extensive engagement in research is an expectation throughout the EER doctoral experience, and all EER Ph.D. students are required to conduct independent research for their dissertation. The ongoing research apprenticeship ideally begins in the first or second term, as students begin work on directed research with their EER Faculty Advisor (EER 690: *Graduate Independent/Directed Study*). Typically, students should engage in research every term, will enroll in six or more credits of directed research (EER 690) within their first three terms, and will accrue approximately 48 hours of research experience during the course of their graduate career.

Up to 6 credits of EER 690 may be counted towards the Specialization Electives, and EER students are required to conduct advanced dissertation research beyond EER 690. After students have identified a dissertation research area, they should enroll in up to eight credits of EER 990: *Dissertation Research/Pre-Candidate*, under the supervision of their EER Faculty Advisor, every Fall and Winter term until candidacy. Upon achieving candidacy, students must enroll in 8 credits of EER 995: *Dissertation Research/Candidate*, under the supervision of their EER Faculty Advisor, every Fall and Winter term until defending their dissertation. Students should not enroll in EER 990 or EER 995 during the Spring/Summer term except when they are defending their dissertation during the summer months (see Section 5.2 for more details about course enrollment during candidacy).

4.6. OTHER PH.D. DEGREE REQUIREMENTS

Program for Education & Evaluation in Responsible Research & Scholarship (PEERRS)

As researchers in the College of Engineering, all EER graduate students are required to become certified in U-M's Program for Education & Evaluation in Responsible Research & Scholarship (PEERRS) within their first month. EER graduate students must access the MyLinc website (<https://maisline.umich.edu/>) to complete two separate online PEERRS modules –*Responsible Conduct of Research & Scholarship Training (RCRS)* and *Human Subjects Research Protections* (note: effective Fall 2020, the single Responsible Conduct of Research Module was created to replace three previous PEERRS modules). Students should inform their EER Faculty Advisor and the EER Graduate Coordinator when this is complete.

Responsible Conduct of Research and Scholarship

Prior to achieving candidacy, Ph.D. students must complete the College of Engineering's Responsible Conduct of Research and Scholarship (RCRS) program, currently consisting of four distinct workshops. More information and a link to register for the free workshops is available at the RCRS website (<http://rcrs.engin.umich.edu>).

Conference Presentation(s)

At a minimum, all EER Ph.D. students, regardless of their career path, are required to author (or co-author) one conference paper and to present research findings at one international conference before graduation. Most students, and particularly those students preparing for faculty and other research-oriented careers, will author and co-author additional publications related to their research during the course of their program to prepare them for the job market. This requirement will be enforced by the EER Faculty Advisor.

5. PH.D. DEGREE MILESTONES AND TIMELINE

5.1. QUALIFYING EXAMINATION

The purpose of the Qualifying Examination is for the *Qualifying Examination Committee* to determine if a student is adequately prepared to pursue doctoral research under the direction of the EER Faculty Advisor. The Qualifying Examination requires students to synthesize and apply knowledge from their coursework and other relevant experiences as they plan an EER research project. Most students will focus the Qualifying Examination on research in which they are already engaged (e.g., a funded NSF project), and ideally, the Qualifying Examination will serve as preparation for the dissertation research. The Qualifying Examination consists of a **written research proposal** accompanied by an **oral examination**. In order to advance to successfully complete the Qualifying Examination, students must demonstrate the following:

- (a) **A suitable research topic and plan.** Students must present a written research proposal which will be evaluated by the *Qualifying Examination Committee* and defended in an oral examination.
- (b) **Academic preparation.** Students must show that their completed (and planned) coursework provides sufficient breadth and depth of academic preparation to conduct the proposed research.
- (c) **Research ability.** Students must demonstrate that they have acquired skills and abilities required to complete the proposed research through coursework, directed study projects, conference presentations, and/or other research experiences.

Timeline for the Qualifying Examination

The Qualifying Examination will be offered each term, and students are eligible to take the Qualifying Examination no earlier than the term during which they complete the master's degree coursework (typically their fourth term in the program). Thus, by the end of the term in which the Qualifying Examination is taken, students must have completed the following courses (minimum of 30 credit hours):

- The Engineering Education Core (EER 601 and EER 602);
- Three or four courses of the Research Methods Core; and
- Up to five Specialization Electives, which can include up to 6 credits of EER 690.

A timeline for the Qualifying Examination is outlined in Table 2. In the year leading up to the Qualifying Examination, students are expected to have regular conversations with their EER Faculty Advisor to plan and refine ideas for the Qualifying Examination. The deadline for students to pass the exam is the end of the third year.

Table 2. Timeline for the Qualifying Examination

	Winter term	Fall term
Student and EER Faculty Advisor plan and refine ideas	Year leading up to Qualifying Examination	
Student submits research outline and statement of preparation (two separate documents) to EER Faculty Advisor for feedback	January 15	September 15
EER Faculty Advisor approves research outline and statement of preparation	January 30	September 30
Student registers their intent to take the Qualifying Examination through the online portal	January 30	September 30
EER Graduate Chair forms Qualifying Examination Committee	February 28	October 31
Student schedules 2-hour oral examination	Mar 15–30	Nov 1–15
Student submits written research proposal and statement of preparation to Qualifying Examination Committee	Two weeks prior to oral examination	
Qualifying Examination Committee conducts oral examination	April 10–30	December 1–20
EER Graduate Program Office informs student of Qualifying Examination outcome	Three weeks after the oral examination	

Registering for the Qualifying Examination

By the date listed in Table 2, students must submit two PDF documents to their EER Faculty Advisor : (1) a *research outline* describing the tentative project (two-page maximum, single-spaced, including references) and (2) a *statement of preparation* (one-page maximum). The research outline is similar to a white paper (e.g., the Project Summary page of a full proposal for National Science Foundation) that a researcher might send to a program manager at National Science Foundation prior to developing a full proposal. It should include a title for the proposed project, the date, and the student’s name, and it should describe a research need in the field of EER and provide an overview of a research project proposed to address the need. The statement of preparation should demonstrate that the student has both the appropriate background (e.g., related coursework, research experiences, and publications) and resources (e.g., access to faculty advisors and lab and computational facilities) to accomplish the proposed research. It should include details similar to those in National Science Foundation “Biographical Sketch” and “Facilities, Equipment, and Other Resources” documents.

The EER Faculty Advisor shall review the research outline and statement of preparation, provide feedback, and approve a final draft of the documents by the date listed in Table 2. Then, students register their intent to take the Qualifying Examination by submitting the research outline and statement of preparation (that have been approved by their EER Faculty Advisor) through the online portal. At the same time, the student may propose and justify members for the Qualifying Examination Committee (note that not all requests can be accommodated). The deadline to register to take the Qualifying Examination is the date listed in Table 2.

Upon obtaining approval of the research outline and registering their intent to take the Qualifying Examination, students should prepare a complete research proposal in preparation for the Qualifying Examination at the end of the term.

Qualifying Examination Committee

The *Qualifying Examination Committee*, formed by the EER Graduate Chair, will consist of two EER faculty members (neither of whom may be the student’s EER Faculty Advisor or Co-Advisor). The student may recommend a committee to the EER Graduate Chair. The committee will be formed by the EER Graduate Program Chair by the date listed in Table 2.

Written Research Proposal

Following approval of the research outline, students should develop a comprehensive, written research proposal, limited to 30 pages, double-spaced, 12-point font (including references), with 1-inch margins and with citations and references that adhere to the American Psychological Association's Publication Manual. The written research proposal should identify a research need and fully describe a proposed research project to address the need. It is recommended, but not required, that the project be related to the student's dissertation research. The written research proposal is similar to a National Science Foundation "Project Description," and it should include the following elements:

- A brief, descriptive title, the student's name, and the date of submission;
- A justification for the study, with citations to current and relevant literature, demonstrating that the research questions are important, they have not yet been answered sufficiently, and the expected answers are reasonable;
- A short set of clear research questions that can be answered with qualitative or quantitative data and (if applicable) a related set of propositions outlining the expected answers to the questions (e.g., hypotheses);
- Theoretical and/or conceptual frameworks that inform the proposed research study; and
- A detailed description of the research methods, with an articulation (supported by citations) of how the methods are guided by best practices, including:
 - A mapping to demonstrate alignment of research questions, data collection approaches, and analysis methods;
 - Information about data collection, including plans for recruitment, expected participant sample, approaches for data collection, existing or to-be-developed research instruments (including example items) to be used, and plans for piloting (if applicable);
 - Summary of data already collected;
 - Plans for analysis, including an overview of steps to synthesize, analyze, and interpret data collected; and
 - A two- to three-year timeline showing how this study might be completed.

The student should meet with the EER Faculty Advisor to discuss overarching research ideas, to develop the written research proposal, and to ensure that the proposed research fits within the scope of a typical two- to three-year Ph.D. project. The EER Faculty Advisor may provide feedback to shape the document, but the written research proposal is expected to be original writing by the student.

Oral Examination

The oral examination should allow a student to demonstrate expertise and knowledge through an oral presentation and defense of the proposed research. The student should coordinate with their *Qualifying Examination Committee* to schedule a two-hour oral examination to occur between the dates listed in Table 2. Two calendar weeks prior to the oral examination, the student must submit a PDF of both the written research proposal and the statement of preparation to the online portal. The *Qualifying Examination Committee* will review these materials and will conduct the oral examination to evaluate the student's research ability and potential.

During the two-hour oral examination, the *Qualifying Examination Committee* will first meet privately to review the student's file, and then the student will make a brief, 20- to 30-minute presentation of the proposed research. Following the presentation, the committee may ask questions about the proposed research and about specific knowledge and skills gained through relevant academic coursework or research experiences. Then, the student will be dismissed while the *Qualifying Examination Committee* discusses the student's written research proposal and oral presentation and deliberates in private on the outcome of the Qualifying Examination. The committee will recommend one of the following three outcomes:

- **Pass:** The student is prepared to design a formal proposal in partnership with her/his advisor.
- **Fail with option to re-take:** The student has not demonstrated satisfactory potential to perform doctoral research. However, the student may retake the Qualifying Examination at the next available opportunity (e.g., the following April for a student who attempts it in the fall term). If the student does not successfully

retake the Qualifying Examination during the next academic term, the grade becomes a Fail. A student may not earn a grade of **Fail with option to re-take** on the second attempt.

- **Fail:** The student has not demonstrated satisfactory potential to perform doctoral research and is not permitted to register for additional terms as a Pre-Candidate. As any student taking the Qualifying Examination is expected to have completed the master's degree coursework during the same term, a student who fails the exam is eligible to receive an EER M.S. A student who fails the Qualifying Exam is dismissed without probation at the end of the term in which the Qualifying Examination is taken. In this case, the level of funding will continue through the term in which the Qualifying Examination is failed.

The *Qualifying Examination Committee* will communicate the recommended outcome to the EER Graduate Chair and will provide the student with notes about the exam within 48 hours of the oral examination, and the EER Graduate Program Office will inform the student of the outcome within three weeks of the oral examination.

5.2. CANDIDACY

Advancing to candidacy is a prestigious milestone towards the Ph.D. As stipulated by Rackham, students are expected to do so within three years of enrolling in the Ph.D. program. Deadlines for completing the requirements to advance to candidacy are found at the Rackham website (<https://rackham.umich.edu/navigating-your-degree/candidacy-deadlines>).

To advance to candidacy, a student must:

- 1) Complete all 30 credit hours of master's degree coursework for EER (note that credits elected for Visit/Audit status do not meet this requirement, nor do any EER 990 credits) and be in satisfactory academic standing;
- 2) Pass the EER Qualifying Examination;
- 3) Satisfy all Rackham candidacy requirements (including GPA, residency, etc. see <https://rackham.umich.edu/navigating-your-degree/candidacy-requirements/>); and
- 4) Complete the College of Engineering's Responsible Conduct of Research and Scholarship (RCRS) program.

A student who completes the 30 credits of master's degree coursework but does not pass the Qualifying Examination within the three-year time frame will be released from the program with an EER M.S. degree, unless Rackham has granted a petition request for additional time because of extenuating circumstances.

Candidacy is not automatic. Once all EER and Rackham requirements are satisfied, a student must apply for candidacy by submitting the appropriate forms to the EER Graduate Coordinator (cer-grad-coordinator@umich.edu). These forms include the Ph.D. Plan of Study approved by the EER Graduate Chair and the EER Faculty Advisor.

Course Enrollment During Candidacy

Upon achieving candidacy, students must maintain full-time enrollment by registering for 8 credits of EER 995: *Dissertation Research/Candidate* under the supervision of their EER Faculty Advisor every Fall and Winter term until defending their dissertation (students who are defending in the Spring or Summer may register for 4 credit hours in a Spring or Summer half term). No part-time enrollment is allowed.

In addition to EER 995: *Dissertation Research/Candidate*, candidates may elect one course (with any number of credit hours) or up to four credits of coursework per term without paying additional tuition. This coursework may be taken for credit or for Visit/Audit status. Students who do not elect coursework during one term of EER 995 enrollment may elect up to eight credits in the next term of EER 995 enrollment; however, no more than four credits can be deferred in this manner (an additional course may not be taken in anticipation of taking none in a future term of EER 995 enrollment).

Thus, as doctoral students may have up to 6 remaining credits of coursework to complete after achieving candidacy, they may complete the coursework in two consecutive terms.

Candidates who choose to take more courses than those for which they are eligible with the candidacy tuition rate will be assessed additional tuition per credit hour. Students are responsible for covering the additional tuition costs accrued, even if they are being funded through a fellowship, GSI, or GSRA position.

5.3. DISSERTATION PROPOSAL EXAMINATION (DPE)

The DPE requires students to propose their dissertation research. This examination includes a **written research proposal** for the planned dissertation research and an **oral defense**. The dissertation proposal should identify a significant research need in the EER literature, articulate a series of relevant research questions, provide a detailed review of the literature, outline an original, advanced research project to address that question, and possibly include initial research results. The oral defense should allow students to demonstrate their expertise and knowledge about the proposed research area.

Dissertation Committee

The *Dissertation Committee* is responsible for reviewing the written research proposal, conducting the oral examination, and deliberating on the outcome of the DPE. The committee should be formed by the student, in consultation with the EER Faculty Advisor. It should be chaired by the EER Faculty Advisor (or co-chaired by the EER Faculty Co-Advisors if applicable), and it should comprise three or more additional members, including at least two EER Core Faculty members and at least one cognate member who is not part of the EER Core Faculty. The EER Graduate Chair must approve the student's *Dissertation Committee*.

All members of the *Dissertation Committee* should bring important content and/or methodological expertise to the committee and should be willing to guide students as they progress through the dissertation process. Cognate members will typically be selected from a field that is substantially related to the research topic chosen by students (e.g., education, psychology, organizational theory and behavior)

The committee must satisfy Rackham's Guidelines for Dissertation Committees (<http://www.rackham.umich.edu/current-students/dissertation/committees>). The *Dissertation Committee* must have at least four members, three of whom should have graduate faculty status.

Timing for the DPE

Students should typically complete the DPE by the end of the third year in the program, and the EER program's deadline for students to complete the DPE is the end of the fourth year in the program. Students who fail the DPE will be permitted to petition for a second opportunity to pass the exam within six months.

Once students have successfully passed the DPE, they should meet informally (or formally at the discretion of the committee chair) with the *Dissertation Committee* at least once per year.

5.4. ORAL DEFENSE

Each Ph.D. candidate must prepare a written dissertation, giving evidence of their abilities to (1) conduct original, advanced research, (2) present the results of that research in well-written form, and (3) defend the work orally in an open examination. The dissertation is the most important aspect of the Ph.D. program experience. Students should prepare a rough draft of the dissertation and provide it to all members of the *Dissertation Committee*, collecting their comments, before preparing a final draft.

A final and complete copy of the written dissertation must be submitted as a PDF to all members of the *Dissertation Committee* at least 14 business days before the scheduled date of the Oral Defense to allow sufficient time for a written evaluation. The committee members will then review the written dissertation and, if all members deem it acceptable, the Oral Defense will be held. The Oral Defense will be a public seminar presented by the candidate, with an open question period, followed by a question period with just the *Dissertation Committee* on the candidate's research.

Following the Oral Defense, the *Dissertation Committee* may require minor edits to the dissertation, and after the committee approves the final draft of the dissertation, it must be formatted to meet Rackham's standards. Students are also required to set up a pre-defense meeting and a post-defense meeting with Rackham to complete the doctoral degree requirements (<https://rackham.umich.edu/navigating-your-degree/completing-doctoral-degree-requirements/>).

Rackham requires students to enroll in 8 hours of EER 995: *Dissertation Research/Candidate* during the term of the Oral Defense, and students must defend and complete all Rackham degree requirements before the final doctoral degree deadline for the term.

Rackham allows a grace period of several additional weeks beyond the end of each term for Ph.D. students to complete all of the doctoral degree requirements (<https://rackham.umich.edu/policy/section4/>). The grace period enables students to complete their work without needing to register for the new term. However, the degree is still awarded at the end of the new term.

Timing for the Oral Defense

Students should typically defend their dissertation by the end of the fifth year in the program, and the Rackham deadline for doing so is by the end of year seven.

5.5. TIMELINE FOR THE EER PH.D.

The Ph.D. coursework and research activities are unique to each student. Therefore, the Ph.D. degree timeline is subject to flexibility in timing. A representative timeline for the EER Ph.D. is shown in Table 3, and three sample curricula (one for an EER M.S. student, one for an EER Ph.D. student interested in a faculty career, and one for an EER Ph.D. student interested in a career in national policy) are included in the appendix. Note that students are also expected to participate in EER community activities every term, and they are encouraged to complete the *Rackham Professional Development Diversity, Equity, and Inclusion Certificate* (<https://rackham.umich.edu/professional-development/dei-certificate/>).

The deadline for achieving key milestones is as follows:

- Students typically pass the Qualifying Examination and advance to Candidacy by the end of Year 2 – the deadline for this is the end of Year 3.
- Students typically pass the DPE by the end of Year 3 – the deadline for this is the end of Year 4.
- Students typically complete the Ph.D. degree by the end of the Year 5 – the deadline for this is the end of Year 7 (students who take longer than five years may lose departmental financial support).

Students may be granted four additional months (one term) to complete each milestone with approval from both the EER Graduate Chair and the EER Faculty Advisor. Students who take more than seven years to earn the Ph.D. degree must submit a petition to Rackham requesting an extension.

Table 3. Representative Timeline for EER Ph.D.

Year: Term	Coursework	Research Activities	Milestones
Year 1: Fall	Enroll in 2 or 3 courses	Begin research with EER Faculty Advisor	
Year 1: Winter	Enroll in 2 or 3 courses	Continue research with EER Faculty Advisor	
Year 1: Sp/Su		Continue research with EER Faculty Advisor	
Year 2: Fall	Enroll in 2 or 3 courses	Continue research with EER Faculty Advisor	Complete RCRS program
Year 2: Winter	Enroll in 2 or 3 courses	Conduct research for Qualifying Exam	Pass Qualifying Exam Earn M.S. degree
Year 2: Sp/Su		Begin research for DPE	Advance to Candidacy
Year 3: Fall	Enroll in up to 1 course	Continue research for DPE	Form Dissertation Committee
Year 3: Winter	Complete Immersive Learning Experience	Continue research for DPE	Pass DPE
Year 3: Sp/Su		Begin dissertation research	Present research at conference
Year 4: Fall	Enroll in up to 1 course	Continue dissertation research	Update <i>Dissertation Committee</i>
Year 4: Winter	Enroll in up to 1 course	Continue dissertation research	Update <i>Dissertation Committee</i>
Year 4: Sp/Su		Continue dissertation research	Publish journal paper
Year 5: Fall	Enroll in up to 1 course	Continue dissertation research	Update <i>Dissertation Committee</i>
Year 5: Winter	Enroll in up to 1 course	Continue dissertation research	Pass Oral Defense Make required dissertation revisions Graduate with Ph.D.

6. ACADEMIC PROBATION AND DISMISSAL

6.1. SATISFACTORY ACADEMIC PROGRESS

Guaranteed financial support and continued enrollment are contingent upon students maintaining satisfactory progress in the following ways:

- Maintain a cumulative GPA of 3.0 or higher on a 4.0 scale,
- Pass the Qualifying Examination by the end of Year 3,
- Complete the DPE by the end of Year 4,
- Maintain adequate progress toward completion of the dissertation, and
- Follow university standards of professional conduct.

6.2. PROGRESS REPORTS

To document progress towards the Ph.D., all students are required to submit a Progress Report online (deptapps.engin.umich.edu/progeval/student/index?dept=216004) by February 1 each year. The EER Faculty Advisors will review their students' reports and submit their evaluations online by February 15, and the students will be required to review the evaluation and confirm that the report has been read and understood by February 28. Failure to submit the Progress Report may result in the student being placed on probation (as determined by the *Academic Probation Committee*, Section 6.4).

Progress Reports will indicate one of three possible outcomes: (1) satisfactory progress, (2) progress that is of concern, or (3) unsatisfactory progress. If progress is of concern, students will be required to submit a follow up Progress Report within two months.

The student, EER Graduate Chair, or EER Faculty Advisor may also initiate an evaluation at any time by submitting a Progress Report.

6.3. UNSATISFACTORY PROGRESS

If students are making unsatisfactory progress, either in one or more of the ways outlined in Section 6.1 or as revealed on the Progress Report as described in Section 6.2, the EER Graduate Coordinator will notify Rackham, which will place the notation of “Unsatisfactory Academic Standing” on the student’s academic record (i.e., the unofficial transcript). Making unsatisfactory progress may lead to students being placed on probation (as determined by the *Academic Probation Committee*, Section 6.4), the termination of the guarantee of financial support, and dismissal from the Ph.D. program. Students with unsatisfactory academic standing may not advance to candidacy, may not be granted a degree or certificate, and may only change programs or transfer credits with permission of the admitting program.

6.4. ACADEMIC PROBATION

When students are found to have made unsatisfactory progress, an *Academic Probation Committee* consisting of two EER faculty members (excluding the EER Faculty Advisor) will be formed by the EER Graduate Chair, and this committee will determine whether students are to be placed on probation. The terms of probation will be individually-designed based on the situation and as agreed upon by the EER Graduate Chair, the EER Faculty Advisor, and the student. The agreed-upon terms will be outlined in the Letter of Probation. The EER Graduate Chair will notify the students and Rackham in writing before the probationary period begins, explaining the reasons and conditions of probation; the start and end dates of the probationary period (note, the duration of the probationary period may be no less than two months); terms of funding support; conditions, if any, for returning to satisfactory standing; and options for appeal. “Academic Probation” will be noted on the transcript. The EER Graduate Chair will enforce the terms of probation.

Students who have been placed on probation may withdraw or may request a leave of absence (due to medical or personal reasons independent of the probation) from Rackham, during which time students will be separated from the university. The withdrawal or leave will stop the clock on the probationary period, which resumes when students return to active status or are reinstated. Probation will remain in effect until the conditions are remedied or students are dismissed.

Length of the Probationary Period

The probationary period may be no shorter than two months of the fall or winter term, and it will normally conclude at the end of that term. For students placed on probation within two months of the end of the fall term, the probationary period will extend into the winter term for a total of at least two months. For students placed on probation within two months of the end of the winter term, the probationary period may include the spring or summer half-terms or the following fall term, for a total of at least two months. Students may be placed on probation starting in the spring or summer half term for a minimum of two months, and students do not need to be enrolled during these half terms.

Funding Students on Probation

The level of funding prior to probation should be continued through the probationary period. Thus, students with guaranteed financial support will continue to be funded while on probation (i.e., students will continue to receive tuition and fees, stipend, and insurance benefits). Funding for the probationary period shall be arranged by the EER Faculty Advisor in discussion with the EER Graduate Chair.

6.5. DISMISSAL

At the end of the probationary period, and upon the recommendation of the EER Graduate Chair and the consent of Rackham, students may either be returned to satisfactory academic standing or be dismissed from the program. Dismissal will occur by decision of the *Academic Probation Committee*. The EER Graduate Chair will notify students and Rackham in writing of the dismissal decision. Students with guaranteed financial support will continue to be funded until the end of the term in which dismissal occurs.

Students may choose to change their EER Faculty Advisor, for example, due to a mismatch in research interests. Students must have an EER Faculty Advisor at all times in order to remain in satisfactory academic standing. If a student secures external funding (e.g., as a Graduate Student Instructor), the student may have a gap between advisors for up to a single term. If a student is without an EER Faculty Advisor at the start of a second term, the student can be declared to be in “Unsatisfactory Academic Standing” by the EER Graduate Chair and placed on probation.

6.6. OPTION TO APPEAL

Students may appeal the probation or dismissal decision. In this case, the EER Graduate Chair will establish a new *Academic Probation Committee*, none of whom are members of the original committee. This committee will either confirm or overturn the probation or dismissal decision. Students may use Rackham’s Academic Dispute Resolution process only for procedural issues of fair and equal treatment under the policy of the program, and not to appeal the academic reasons for the decision.

6.7. PROFESSIONAL CONDUCT

Students who fail to meet standards of academic or professional integrity or who have been found responsible for violations of other University standards of conduct may be placed on probation or dismissed in accordance with separate procedures described in Rackham Academic and Professional Integrity Policy.

7. EER COURSE INFORMATION

To complete a graduate degree in EER, students must complete courses from the Engineering Education Core and the Research Methods Core, as well as Specialization Electives and, for the Ph.D., the Immersive Learning Experience. Information about these courses is included here.

7.1. ENGINEERING EDUCATION CORE

The purpose of the Engineering Education Core is to provide a bridge into this interdisciplinary program by integrating engineering and education concepts, providing breadth and depth of knowledge, and providing the foundation for an area of specialization. The Engineering Education Core comprises the following two courses (6 credit hours):

- EER 601: *Foundations of Engineering Education Research* (3 credits, graded A – E, to be offered each year)
Introduction to the field of EER, the conduct of educational research and its application to engineering education; current literature in EER; the use of theoretical and conceptual frameworks to guide EER; and professional development opportunities in EER.
- EER 602: *Theoretical and Conceptual Frameworks in Engineering Education Research* (3 credits, graded A – E, to be offered each year)
In-depth examination of relevant theories from education, psychology, and other disciplines; focus on how the theories apply to EER and can guide research and advance knowledge and practice.

7.2. IMMERSIVE LEARNING EXPERIENCE (EER 610)

A key element of the EER Ph.D. degree is a required 3-credit Immersive Learning Experience (EER 610: *Practicum – Immersive Learning Experience*). There are two basic types of Immersive Learning Experience (ILE): teaching apprenticeships and internships. Students preparing for faculty positions or other professional staff positions in academia will typically pursue the teaching apprenticeship, while those seeking post-graduate positions in administrative, policy, or outreach settings will typically complete an internship for their ILE. The ILE will enable students to develop a robust skill set in applying knowledge acquired from coursework to practical needs or real-world problems in engineering education, and it will connect students to academic and non-academic role models who serve as mentors during this practicum experience.

Regardless of the type of ILE a student elects, the student must identify an *EER Experience Advisor* – a member of the core EER faculty[†] who agrees to help oversee the ILE. The *EER Experience Advisor* may or may not be the same person as the EER Faculty Advisor.

Teaching apprenticeships will provide a more complete teaching experience than what is typically afforded through a GSI appointment, as students who complete a teaching apprenticeship will collaborate with an engineering faculty member to plan and facilitate a substantive portion of an engineering course. The engineering faculty member who is the course instructor must agree to serve as a teaching mentor, ensuring that the student assumes significant responsibility for some curriculum design, lesson planning, instruction, assessment, and grading. If the course instructor is a core EER faculty member, that person will also serve as the *EER Experience Advisor*. Otherwise, the student must identify an *EER Experience Advisor* who will co-advise the ILE with the course instructor.

Internships will provide on-the-job professional experience, and they will be offered in on-campus or off-campus settings. For example, students who are engaged in research related to outreach programming might work in the College of Engineering's Center for Educational Diversity and Outreach (CEDO) or at the Museum of Science and Industry in Chicago to develop or evaluate educational programming; students interested in educational evaluation and assessment might work in the School of Education's Center for Educational Design, Evaluation, and Research (CEDER) to gain hands-on experience in evaluating STEM education programs; and students who endeavor to have a career in a public policy setting might pursue a summer internship at the National Science Foundation or the White House Office of Science and Technology Policy (OSTP). The EER faculty will work to cultivate a network of professionals who could supervise internships for EER doctoral students, but students are ultimately responsible for securing the internship. For this type of ILE, the student should identify an *EER Experience Advisor* who has related expertise and/or experience and who will partner with the internship supervisor to co-advise the ILE experience.

The ILE should entail a minimum of 320 hours (e.g., full time for 8 weeks or 20 hours/week over 16 weeks). At least six weeks prior to the start of the ILE, the student must acquire approval for the ILE by submitting three items to the *EER Practicum Lead*:

- (1) A **letter of confirmation** from the *EER Experience Advisor*, describing the faculty member's willingness to meet virtually with the student at least twice during the ILE to ensure that the student is having a successful experience.
- (2) A **letter of support** from the course instructor or internship supervisor (the *EER Practicum Lead* will provide templates for the letter of support):
 - For a teaching apprenticeship, the letter of support should describe the course instructor's willingness to (1) mentor the student by meeting with the student at least twice before the student's portion of the course to review plans, observing the student in action during their portion of the course, and meeting with the student after their portion of the course to provide feedback, (2) partner with the *EER Experience Advisor* (if the course instructor is not a core EER faculty member) to co-advise the student, and (3) complete a short, one-page survey to evaluate the student at the conclusion of the course.

[†] If there is sufficient justification, the student may petition the EER Program to request that a non-core EER faculty member serve as the *EER Experience Advisor* by following the steps outlined in Section 3.9.

- For an internship, the letter of support should highlight the importance of the proposed project to the organization and describe the internship supervisor's willingness to (1) mentor the student by seeking opportunities for the student to meet stakeholders, reviewing the student's work, and providing feedback during the internship, (2) partner with the *EER Experience Advisor* to co-advise the student, and (3) complete a short, one-page survey to evaluate the student at the conclusion of the internship.

(3) A **one-page ILE proposal**:

- For a teaching apprenticeship, the one-page proposal should describe:
 - The course name and number, the semester, and the expected number of enrolled students;
 - The parts of the curriculum for which the student will be responsible;
 - The approximate number of lectures the student will design and deliver and the assignments the student will develop for the course;
 - A plan for assessing success of the activity; e.g., a question on the midterm or final exam, or grade on the assignment(s).
- For an internship, the one-page proposal should describe:
 - Where the internship will take place;
 - The name, title, and contact of the internship supervisor;
 - The student's role during the internship;
 - The aspects of EER the student will emphasize during the internship (e.g., developing and evaluating an educational intervention, working in educational evaluation and assessment, or exploring public policy issues in higher education);
 - The main goals and deliverables for the project.

While students are engaged in the ILE, the *EER Practicum Lead* will facilitate student reflections on the experience.

Students will typically complete the ILE during the third year in the program, and they will enroll in EER 610: *Practicum – Immersive Learning Experience* one or two semesters after completing the ILE. As part of EER 610, students will prepare a brief formal report and provide an oral presentation to the EER community at an annual program for faculty and EER graduate students. The *EER Practicum Lead* will conduct the course, review the report and presentation, and assign course grades for the students.

7.3. OTHER EER COURSES

- EER 598: *Special Topics in Engineering Education Research* (1-4 credits, graded A – E)
Topics of current interest in engineering education research. Lectures, seminar or laboratory. Can be taken more than once for credit, and up to 3 credits of ENGR 598 may count towards Specialization Electives.
- EER 690: *Graduate Independent/Directed Study* (1-4 credits, Satisfactory/Unsatisfactory)
Opportunity for graduate students to work on research projects under the supervision of an engineering education research faculty member. Project report submitted at end of term; may be elected for 1-4 credits (approximately 4 hours/week for each credit). Up to 6 credits of EER 690 may count towards Specialization Electives.
Note: the topic of the research is flexible, to be agreed upon by the EER faculty instructor.
- EER 990: *Dissertation Research/Pre-Candidate* (1-8 credits, Satisfactory/Unsatisfactory)
Election for dissertation work by doctoral student not yet admitted to status as candidate, typically after all coursework is complete. The defense of the dissertation, that is, the final oral examination, must be held under a full-term candidacy enrollment.
- EER 995: *Dissertation Research/Candidate* (4-8 credits, Satisfactory/Unsatisfactory)
Election for dissertation work by a doctoral student who has been admitted to candidate status. The defense of the dissertation, that is, the final oral examination, must be held under a full-term candidacy enrollment.

7.4. RESEARCH METHODS CORE

The application of educational research methods to the engineering context requires students to adopt a new learning paradigm, and the purpose of the Research Methods Core is to provide deep knowledge of EER approaches and guide students in the development of their research theses. As such, in consultation with the EER Faculty Advisor, EER Ph.D. students must select and complete four research methods courses (two approved courses in quantitative methods and two approved courses in qualitative methods) that align with the area of research interest. Students completing the EER M.S. degree must complete three courses from the Research Methods Core. Multiple courses exist across the university to fulfill this requirement.

The quantitative and qualitative research methods courses in the School of Education (several of which are 5-credit courses) are recommended, both because they regularly enroll engineering graduate students and because they address the engineering context; however, some students may benefit from other research methods courses offered by different disciplines. Courses that have been approved to satisfy the requirements are listed below. Students are encouraged to be creative about identifying courses to satisfy the Research Methods Core requirement (e.g., if appropriate, students might request approval for EDUC 896: *Writing Educational Research* or SI 724: *Qualitative Methods*). Approval for courses not on this list should be requested before assuming the courses will satisfy the requirements.

Courses that satisfy the two-course **quantitative research methods** requirement include:

- EDUC 707/PSYCH 707: *Psychometric Theory*
- EDUC 712/PUBPOL 712: *Causal Inference in Education Policy Research – Preschool, Elementary, and Secondary*
- EDUC 714/PUBPOL 713: *Causal Inference in Education Research and Policy - Postsecondary*
- EDUC 793: *Introduction to Quantitative Methods in Educational Research*
- EDUC 795: *Quantitative Methods for Non-Experimental Research Methods*
- EDUC 803/PSYCH 804: *Structural Equation Modeling*
- PSYCH 613: *Advanced Statistical Methods I*
- PSYCH 614: *Advanced Statistical Methods II*
- PSYCH 711: *Questionnaire Design and Evaluation*
- SOC 610: *Statistical Methods*
- SOC 612: *Applied Sampling*

Courses that satisfy the two-course **qualitative research methods** requirement include:

- EDUC 603: *Design-Based Research*
- EDUC 732: *Critical Race Methodologies*
- EDUC 737: *Introduction to Discourse Analysis*
- EDUC 792: *Methods in Educational Research: Qualitative*
- EDUC 891: *Qualitative Methods Workshop*
- PSYCH 692: *Qualitative Research Methods*
- SI 724: *Qualitative Methods*
- SOC 522: *Qualitative Research Methods I*
- SOC 523: *Qualitative Research Methods II*
- SOC 532: *Comparative & Historical Methods I*
- SOC 533: *Comparative & Historical Methods II*
- SOC 595: *Advanced Interviewing*

7.5. SPECIALIZATION ELECTIVES

The purpose of the Specialization Electives requirement is to allow students to develop depth of knowledge in one area of EER. Thus, students should propose a coherent set of Specialization Elective courses to support their dissertation research. At least two of these courses should be from outside the EER program to satisfy the cognate requirement.

The Specialization Elective courses include, but are not limited to, existing courses offered in the College of Engineering, the School of Education, and across the university. Students may elect to use up to 3 credits of EER 598: *Special Topics in EER* and up to 6 credits of EER 690: *Graduate Independent/Directed Study* towards their Specialization Electives.

8. M.S. DEGREE

The goal of the EER M.S. Program is to provide foundational knowledge of EER topics, theories, and research methods as well as a specialization appropriate to students' intended career path. Students may earn the M.S. degree in one of two ways. First, it is an embedded master's degree attained during the EER doctoral program. Students admitted to the Ph.D. program will be eligible to add the master's degree after successful completion of the 30 credit hours of master's degree coursework (typically within two years). Doctoral students who successfully attain the M.S. degree and who also pass the Qualifying Examination will achieve Candidacy and continue for the Ph.D. Second, students may apply for and be admitted to the EER program to earn a stand-alone EER M.S. degree. In either case, students must satisfy the EER Graduate requirements outlined in this manual, as well as those outlined in the Rackham Academic Policies.

8.1. M.S. COURSEWORK

The EER M.S. degree requires a minimum of 30 credit hours of graduate-level coursework. The courses that comprise these requirements are described in more detail in Section 7. The credit distribution for the M.S. is shown in Table 4.

Table 4. Credit distribution for EER M.S. degree

Category	# courses	# credits
Engineering Education Core (EER 601 and EER 602)	2	6
Courses from the Research Methods Core	3	9 – 15
Specialization Electives	3 or more	Up to 15
Total	8 or more	30 (minimum)

Typically, students will enroll in 9-10 credits of coursework per term. Up to 6 credits of EER 690: *Graduate Independent/Directed Study* and up to 3 credits of EER 598: *Special Topics in Engineering Education Research* may be counted towards Specialization Electives. Besides EER 690, all courses used for the master's degree coursework requirements must be letter-graded and may not be marked as satisfactory/ unsatisfactory. Courses that **do not count** toward master's degree coursework requirements include the following: courses with number 990, 995; course with "doctoral," "dissertation," or "preliminary" in the title; ENGR 998 (Curricular Practical Training); courses from the English Language Institute; courses with insufficiently advanced content and level; and courses which substantially duplicate the content and level of courses already completed.

8.2. M.S. PLAN OF STUDY

The M.S. Plan of Study outlines which courses students propose to satisfy the specific master's degree requirements. Students are required to submit an initial M.S. Plan of Study, approved and signed by the EER Graduate Chair, at the beginning of their first term (within a month after the beginning of the first term). Failing to do so will risk the ability to register the following term.

Students are also required to obtain pre-approval and signature from the EER Graduate Chair on a revised M.S. Plan of Study each time they wish to make changes to it, and they must obtain approval for a final M.S. Plan of Study in their last term. Failing to do so will risk the ability to graduate. It is highly recommended that students meet with the EER Graduate Chair to discuss the plan at the beginning of each term.

Note: Students are responsible for submitting to the EER Graduate Coordinator an updated, signed final M.S. Plan of Study when applying for graduation. Failure to submit the final M.S. Plan of Study could delay graduation.

9. EER CERTIFICATE

Students earning a Ph.D. in a traditional engineering discipline at U-M may apply to earn the Rackham Certificate in EER to learn and practice the skills needed to be proficient in the field of EER. The certificate requires at least 9

credit hours of coursework (with a B average) and a related engineering education research project. Students are responsible for ensuring that the coursework also complies with Rackham’s policies (<https://rackham.umich.edu/policy/section7/>).

9.1. APPLICATION TO THE EER CERTIFICATE

U-M engineering graduate students who have completed at least one term in a Rackham program and who are in satisfactory academic standing are invited to apply online (<https://eer.engin.umich.edu/graduate-certificate/>) at any time. The following materials must be submitted at the time of applying:

- Statement of interest describing the reasons for pursuing the certificate;
- “Certificate Plan of Study” listing the courses expected for the certificate, the timeline for enrolling in them, and a title and summary of the proposed project;
- Letter of advisor’s support (not required for students whose research advisor is one of the EER Core Faculty); and
- Current transcript.

The student’s application will be reviewed by the EER Graduate Chair, and if acceptable, the Certificate Plan of Study will be approved. Deviations to the plan of study must be approved by the Graduate Chair. Students should apply for the Rackham Certificate in EER **prior** to completing the requirements to ensure the plan of study is approved.

9.2. CERTIFICATE REQUIREMENTS

Effective Fall 2019, the EER Certificate requires students to complete both courses of the Engineering Education Core (EER 601 and EER 602), at least one course from the Research Methods Core aligned with the required project, and an EER project. The EER project comprises either (1) an approved EER project equivalent to a 3-credit class (a paid or unpaid research experience); or (2) an additional 3-credit course that has, as part of its requirements, a substantial EER project (this could be an independent study). Students pursuing the certificate are encouraged to consult relevant resources about EER and to meet with EER faculty as they plan and conduct their research.

The set of courses comprising the Certificate Plan of Study must be approved prior to completing them. The credit distribution for the EER Certificate is shown in Table 5.

Table 5. Credit distribution for EER Certificate

Category	# courses	# credits
Engineering Education Core (EER 601 and EER 602)	2	6
Courses from the Research Methods Core	1	3-5
Total	3	9 (minimum)
Approved EER project	n/a	3 (approximately)

Upon completing the approved requirements and before the last day of classes in the term they expect to graduate, students should submit their final EER project to the EER Graduate Coordinator. The coordinator will then confirm that the required coursework has been completed, will seek approval for the EER project from the EER Graduate Chair, and will submit the required paperwork to Rackham.

10. ADDITIONAL RESOURCES

The Rackham Graduate School Student Handbook and the Engineering College Bulletin are among the numerous U-M publications available online. The Rackham Handbook gives details about the graduate degree requirements imposed by the Graduate School, and should be consulted by all graduate students. Some important topics include the continuous enrollment policy and fees. A list of website includes:

- Rackham Graduate School: <http://www.rackham.umich.edu>

- College of Engineering: <http://www.engin.umich.edu/college/>
- U-M Wolverine Access: <https://wolverineaccess.umich.edu/>
- U-M Registrar: <http://ro.umich.edu>
- Student Financial Services: <http://www.finance.umich.edu/finops/student>
- U-M International Center: internationalcenter.umich.edu
- EER Department: <https://eer.engin.umich.edu>
- College of Engineering Honor Code: <https://elc.engin.umich.edu/about/>
- Student Rights and Responsibilities: <https://oscr.umich.edu/article/statement-student-rights-and-responsibilities>

APPENDIX

SAMPLE CURRICULA

Student #1: EER MS student

	Term	Coursework
Year 1	Fall 11 credits	EDUC 760: <i>Access and Equity</i> (3 cr) EDUC 793: <i>Quantitative Methods 1</i> (5 cr) EER 601: <i>Foundations of EER</i> (3 cr)
	Winter 11 credits	EDUC 791: <i>Foundations of Teaching & Learning</i> (3 cr) EDUC 795: <i>Quantitative Methods 2</i> (5 cr) EER 602: <i>Introduction to Theoretical Frameworks</i> (3 cr)
	Sp/Su	
Year 2	Fall 9 credits*	EDUC 792: <i>Qualitative Methods 1</i> (5 cr) EDUC 709: <i>Motivation in the Classroom</i> (3 cr) EER 598: <i>Special Topics in EER</i> (1 cr)

Student #2: EER Ph.D. student interested in faculty career

	Term	Coursework	Other Suggested Activities
Year 1	Fall 10 credits*	EDUC 793: <i>Quantitative Methods 1 (5 cr)</i> EER 598: <i>Special Topics in EER (1 cr)</i> EER 602: <i>Introduction to Theoretical Frameworks (3 cr)</i> EER 690: <i>Graduate Independent/Directed Study (1 cr)</i>	Begin research with EER Faculty Advisor Meet with core EER faculty
	Winter 10 credits*	EDUC 795: <i>Quantitative Methods 2 (5 cr)</i> EER 598: <i>Special Topics in EER (1 cr)</i> EER 601: <i>Foundations of EER (3 cr)</i> EER 690: <i>Graduate Independent/Directed Study (1 cr)</i>	Continue research with EER Faculty Advisor
	Sp/Su		Continue research with EER Faculty Advisor
Year 2	Fall 8 credits*	EDUC 792: <i>Qualitative Methods 1 (5 cr)</i> EDUC 709: <i>Motivation in the Classroom (3 cr)</i>	Continue research with EER Faculty Advisor Begin formulating independent research ideas Serve as GSI for ENGR 100
	Winter 4 credits*	EER 598: <i>Special Topics in EER (1 cr)</i> EER 990: <i>Dissertation Research/Pre-Candidate (5 cr)</i> PSYC 708: <i>Cognition & Instruction in the Classroom (3 cr)</i>	Prepare written report for Qualifying Exam Earn M.S. degree Pass Qualifying Exam
	Sp/Su		Begin research for DPE Advance to Candidacy Present at ASEE conference
Year 3	Fall 3 credits*	EDUC 760: <i>Access and Equity (3 cr)</i> EER 995: <i>Dissertation Research/Candidate (8 cr)</i>	Continue research for DPE Prepare to present dissertation proposal Complete teaching apprenticeship
	Winter 3 credits*	EER 610: <i>Immersive Learning Experience (3 cr)</i> EER 995: <i>Dissertation Research/Candidate (8 cr)</i>	Complete Rackham's DEI Certificate Continue research for DPE Defend dissertation proposal
	Sp/Su		Begin Ph.D. research Present at ASEE conference
Year 4	Fall 3 credits*	ENGR 580: <i>Teaching Engineering (3 cr)</i> EER 995: <i>Dissertation Research/Candidate (8 cr)</i>	Continue Ph.D. research Update dissertation committee
	Winter 3 credits*	EDUC 737: <i>Introduction to Discourse Analysis (3 cr)</i> EER 995: <i>Dissertation Research/Candidate (8 cr)</i>	Continue Ph.D. research Update dissertation committee
	Sp/Su		Continue Ph.D. research Publish journal paper
Year 5	Fall 3 credits*	EDUC 791: <i>Foundations of Teaching & Learning (3 cr)</i> EER 995: <i>Dissertation Research/Candidate (8 cr)</i>	Continue Ph.D. research Update dissertation committee
	Winter 3 credits*	EDUC 561: <i>Intro to Higher Education (3 cr)</i> EER 995: <i>Dissertation Research/Candidate (8 cr)</i>	Pass Oral Defense

* Only credits towards Ph.D. coursework requirements are counted here (e.g., EER 690 in excess of 6 credits, EER 990, and EER 995 are not counted).

Student #3: EER Ph.D. student interested in career in public policy

	Term	Coursework	Other Suggested Activities
Year 1	Fall 10 credits*	EER 598: <i>Special Topics in EER (1 cr)</i> EER 601: <i>Foundations of EER (3 cr)</i> EER 690: <i>Graduate Independent/Directed Study (3 cr)</i> SOC 522: <i>Qualitative Research Methods I (3 cr)</i>	Begin research with EER Faculty Advisor Meet with core EER faculty
	Winter 10 credits*	EER 598: <i>Special Topics in EER (1 cr)</i> EER 602: <i>Introduction to Theoretical Frameworks (3 cr)</i> EER 690: <i>Graduate Independent/Directed Study (3 cr)</i> SOC 523: <i>Qualitative Research Methods II (3 cr)</i>	Continue research with EER Faculty Advisor Engage in advocacy work (e.g., write to local leaders to address educational disparities)
	Sp/Su		Continue research with EER Faculty Advisor
Year 2	Fall 10 credits*	EDUC 793: <i>Quantitative Research Methods 1 (5 cr)</i> EDUC 760: <i>Access and Equity (3 cr)</i> EER 690: <i>Graduate Independent/Directed Study (2 cr)</i>	Continue research with EER Faculty Advisor Begin formulating independent research ideas
	Winter 4 credits*	PUBPOL 713: <i>Causal Inference in Education Research (3 cr)</i> EER 598: <i>Special Topics in EER (1 cr)</i> EER 990: <i>Dissertation Research/Pre-Candidate (5 cr)</i>	Prepare written report for Qualifying Exam Earn M.S. degree Pass Qualifying Exam
	Sp/Su		Advance to Candidacy Complete summer internship at NSF
Year 3	Fall 3 credits*	EER 610: <i>Immersive Learning Experience (3 cr)</i> EER 995: <i>Dissertation Research/Candidate (8 cr)</i>	Begin research for DPE Complete Rackham's DEI Certificate
	Winter 3 credits*	EDUC 661: <i>History of Postsecondary Education (3 cr)</i> EER 995: <i>Dissertation Research/Candidate (8 cr)</i>	Continue research for DPE Prepare to present dissertation proposal
	Sp/Su		Defend dissertation proposal Present at AERA meeting
Year 4	Fall 3 credits*	PubPol 510: <i>Political Environment of Policymaking (3 cr)</i> EER 995: <i>Dissertation Research/Candidate (8 cr)</i>	Begin Ph.D. research
	Winter 3 credits*	PubPol 650: <i>Intro to Science & Technology Policy (3 cr)</i> EER 995: <i>Dissertation Research/Candidate (8 cr)</i>	Continue Ph.D. research Update dissertation committee
	Sp/Su		Continue Ph.D. research Publish journal paper
Year 5	Fall 3 credits*	EER 995: <i>Dissertation Research/Candidate (8 cr)</i> SI 549: <i>Transformative Learning & Teaching Technology (3 cr)</i>	Complete Ford School's STPP Certificate
	Fall 0 credits*	EER 995: <i>Dissertation Research/Candidate (8 cr)</i>	Pass Oral Defense

* Only credits towards Ph.D. coursework requirements are counted here (e.g., EER 690 in excess of 6 credits, EER 990, and EER 995 are not counted).