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# Engineering Education Ph.D. Program Handbook

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2020-2021 Academic Year

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## Purpose of the Graduate Handbook

The Graduate Handbook provides a detailed description of the requirements for the PhD in Engineering Education as well as descriptions of the procedures to be followed in completing the requirements of the program. Additional information concerning Graduate School policies can be found at the [Ohio State Graduate School website](#).

This handbook includes the requirements, policies, and procedures adopted by the Department of Engineering Education (EED) at Ohio State for successful completion of the PhD in Engineering Education program. The Ohio State Graduate School has established further and separate requirements, and EED graduate students must meet the requirements of both the Graduate School and the EED for successful degree completion. While Graduate School requirements may be mentioned occasionally in this document, students should consult the [Graduate School's Graduate Handbook](#) for overarching policies and procedures that apply to graduate students across the university.

If there is any doubt regarding the interpretation of any regulation or requirement in this handbook, or if there are questions about the graduate program involving matters not covered in this handbook, please consult with the EED's Graduate Program Coordinator.

This document is a living document that may change each academic year. Particular sections of the handbook are subject to more frequent changes as an artifact of the department's regular degree program revision processes. All updates are made after extensive evaluation by faculty and staff with the student's learning outcomes in mind. Students should follow the *current* handbook for milestone information (e.g., Qualifier Exam guidelines). Regarding more static requirements, such as credit hour or core course requirements, students may choose to follow the Handbook of the year their studies initiated, or they may request the Graduate Studies and Research Infrastructure (GSRI) Committee to consider them under a more recent Handbook if changes made are favorable to the student. Any changes to the Graduate Handbook will be communicated to the graduate students by the beginning of the academic year. This document will reside in the box folder, "EED Graduate Student Resources" as well as on the EED website.

## Graduate Student Code of Conduct

The Department of Engineering Education requires all graduate students to uphold its high standards of scholarship and ethics, and adhere to [Ohio State's professional standards](#). Academic integrity is a central tenet of any scholarly pursuit, and, as such, misconduct will not be tolerated. The department will follow the [university's protocol and policies regarding Academic Dishonesty](#).

**Behavior:** EED Graduate Students are expected to behave professionally. The faculty, staff, and students in the department operate on the basis of mutual trust and respect; student choices and activities should reflect this.

**Advising:** Students and advisors are encouraged to discuss the nature of their working relationship ahead of time. This includes frequency and duration of meetings, work expectations, communication styles and expectations, and more.

**General communications:** Formal requests and communication with GSRI and department leadership should be discussed first with the faculty advisor, then brought to the attention of appropriate department leadership. This is to minimize miscommunication and to clarify the objectives of the messaging. Students are expected to respond to faculty and staff requests in a timely manner. For example, a reply to an email

request for information should be expected within 2 business days, unless extenuating circumstances apply and are communicated in advance.

Email etiquette: Students should maintain professional email etiquette with faculty, staff, and other students. Please use the honorific (e.g., Dr.) and gender pronoun (him/his, she/her, they/them, etc.) of the recipient's choice when writing and speaking with members of the department. Ohio State offers [this guide for email etiquette](#). Additionally, [Purdue's Online Writing Lab](#) is a great resource. When in doubt of a preferred honorific or pronoun, please ask.

Any questions regarding student conduct should be directed to the Graduate Program Coordinator or the student's faculty advisor.

## Admissions Criteria

### The Ohio State University Graduate School Application Minimum Requirements

For a complete application to Ohio State, please submit documentation that demonstrates fulfillment of the following:

- **A baccalaureate or professional degree** (or equivalent foreign credential) from an accredited college or university, earned by the expected date of entry into your graduate program.
- **A minimum of a 3.0 cumulative GPA** (on a 4.0 scale) in all prior undergraduate and graduate work. ([How to calculate your GPA.](#))
- **Prerequisite training that will enable you to pursue your program.** Evidence usually comes in the form of transcripts or other credentials documenting that you have completed prerequisite academic work.
- **Proof of English language proficiency**, for international applicants and those who have held the status of U.S. permanent resident for less than one year from the first day of the first term of enrollment. Minimum required scores:
  - TOEFL: 79 on the Internet-based, 550 on the paper-based
  - MELAB: 82
  - IELTS: 7.0

### Department of Engineering Education Application Requirements

- Three letters of recommendation
- Resume or CV
- Institutional transcript(s), undergraduate and graduate degrees
- Short essay responses
- TOEFL (or other) Test Score, if needed

## Department of Engineering Education Degree Requirements

The specific degree requirements for successfully completing a PhD in Engineering Education are outlined in this section. A minimum of 80 graduate credit hours beyond the baccalaureate degree, including coursework and a dissertation, are required to obtain a doctoral degree in Engineering Education. If a student has obtained a Master's degree at Ohio State or elsewhere, a minimum of 50 graduate credit hours beyond the Master's is required.

## Core Courses

There are 16 credits of required core engineering education coursework:

- ENGREDU 6100: Foundations and the Field of Engineering Education (three credits)
- ENGREDU 6200: Learning Theory, Pedagogy, and Assessment (three credits)
- ENGREDU 7189.01: Teaching Preparation and Support (two credits, must be taken in the same term as the start of a significant two-semester teaching experience)
- ENGREDU 7189.02: Professional Development in College Teaching (one credit, must be taken in the same term as the second semester of a significant two-semester teaching experience)
- ENGREDU 7780: Research Design in Engineering Education (three credits)
- ENGREDU 7881: Seminar in Engineering Education (one credit each semester with a requirement of two total to count toward the degree with expectation that students will participate each semester of enrollment unless there are schedule conflicts)
- ENGREDU 7900: Career Exploration and Professional Development in Engineering Education (3 credits)

## Elective Courses

There are two categories of elective coursework required for the program. Research methods serve to support student's research, whereas the specialization coursework supports the student's research focus and future career goals.

There are 9 credits of required Research Methods coursework:

- Three credits of quantitative research methods that includes an emphasis on statistics, including but not limited to the following existing Ohio State courses:
  - STAT 5510: Statistical Foundations of Survey Research
  - STAT 6410: Design and Analysis of Experiments
  - ESQREM 6641: Introduction to Educational Statistics
  - ESQREM 6661: Introduction to Educational Measurement
- Three credits of qualitative research methods, including but not limited to the following existing Ohio State courses:
  - ESHESA 7256: Qualitative Research in Higher Educational Settings
  - EDUTL 8001: Discourse Analysis and Educational Research I
  - EDUTL 8002: Discourse Analysis and Educational Research II
  - ESQRE 8280: Qualitative Research in Education: Paradigms, Theories, and Exemplars
  - ANTHRO 5650: Research Design and Ethnographic Methods
- Three credits of advanced research methods, including but not limited to the following existing Ohio State courses:
  - ESQREM 7635: Advanced Research Methods
  - EDUTL 7749 Concept Inventories in STEM Education
  - ESQRE 8290: Qualitative Research in Education: Methods and Analysis
  - EDUTL 8751: Survey and Critical Analysis of Research in STEM Education

There are 12 credits of required Specialization coursework:

- Three credits minimum within the Department of Engineering Education
- Three credits minimum outside the Department of Engineering Education

- A coherent course of study in the student's chosen area of specialization. Each faculty advisor will work with their students to together define the specialization focus for each student's coursework, based on student needs and faculty interests. Further categorization will be developed among the emergent individual specializations. It is not intended that any specializations will appear on the student transcript unless the student specifically chooses to draw upon existing OSU programs that are already noted on transcripts. Some examples (many of which are transcriptable) include:
  - Adult education / Business human resource development
  - African American and African studies (transcriptable OSU graduate minor)
  - Applied developmental science in education (transcriptable OSU interdisciplinary specialization)
  - Cognitive and brain sciences (transcriptable OSU interdisciplinary specialization)
  - College and university teaching (transcriptable OSU interdisciplinary specialization)
  - Disability studies (transcriptable OSU interdisciplinary specialization)
  - Engineering technical communications
  - Humanitarian engineering
  - Inter-professional studies (transcriptable OSU interdisciplinary specialization)
  - Latino/a studies (transcriptable OSU interdisciplinary specialization)
  - Neuroscience (transcriptable OSU graduate minor)
  - Nonprofit studies (transcriptable OSU graduate minor)
  - Public policy and management (transcriptable OSU graduate minor)
  - Quantitative research methods (transcriptable OSU interdisciplinary specialization)
  - Sexuality studies (transcriptable OSU interdisciplinary specialization)
  - Statistics and statistical data analysis (transcriptable OSU graduate minor)
  - Survey research (transcriptable OSU interdisciplinary specialization)
  - Women's, gender, and sexuality studies (transcriptable OSU graduate minor)

If there are interests in other specializations, please contact the Graduate Program Coordinator.

At least 30 hours of research toward the dissertation is required for each PhD student, as well. This course is ENGREDU 8999 and you must contact the Graduate Program Coordinator to enroll you in the number of hours you and your advisor have determined are necessary each semester. No instructor permission is needed if the student is enrolling in Dissertation Research hours with their permanent faculty advisor.

## Disciplinary Requirements

In addition to the core and elective coursework, 12 credits in traditional engineering coursework are required. Traditional engineering coursework must be a 5000 level course or higher.\*

*\*Ph.D. candidates with an undergraduate degree in non-engineering STEM fields (e.g., math, physics or chemistry) are generally required to take two to five undergraduate courses in a selected traditional engineering discipline, including a significant engineering design experience, to adequately prepare them for graduate level engineering courses at the 5000 or higher level. Students must receive approval for these courses from a potential faculty advisor. Not all of this course work can count toward the PhD degree, and this constraint will be made transparent to students who are in this situation.*

*Alternatively, students may demonstrate their engineering proficiency, and thus their eligibility to enroll in graduate-level engineering coursework, through successful completion of the Fundamentals of Engineering (FE) examination (NCEES, 2020) and demonstrated completion of a significant engineering design experience. In the United States, engineers are licensed at the state level by professional licensing*

boards. Professional Engineering (P.E.) licensure candidates must meet a combination of requirements in education, experience, and exams. The first of the two major national exams, usually taken within six months of graduation from an accredited undergraduate engineering program, is the Fundamentals of Engineering (FE) examination (NCEES, 2020). A few states will allow candidates with undergraduate degrees in non-engineering STEM fields to sit for these exams, if they can demonstrate appropriate on-the-job engineering experience.

## Department of Engineering Education Milestones

(Also located on the EED website)

EED milestones and the timing of each milestone is listed in Table 1. Details about each milestone are listed below.

Milestone	Timeline
Advisor Selection	End of student's first year
Plan of Study	End of student's first year
Transfer Credits Approved	End of student's first year
Annual Review	Every year
Qualifier Exam	End of student's first year, or when the student completes these three EED core courses: ENGREDU 6100, 6200, 7780
Candidacy Exam	After completion of coursework
Dissertation Defense (Final Oral Exam)	End of program

**Table 1- Milestone Overview**

### Advisor Selection

Academic advisors must be selected by the end of the student's first year in the Ph.D. program. For example, if a student begins the program in August, an advisor must be selected by the end of Spring semester. The advisor must be a member of the EED Graduate Faculty and should have particular expertise in the area of research the student intends to pursue. Advisor selection involves conversations with faculty surrounding, but not limited to, the following:

- Both the student's and advisor's work styles
- Faculty advising style and expectations
- Student timeline for graduation
- Student and faculty research interests
- Student career interests
- Faculty funding availability

To allow EED PhD students sufficient time to develop their research interests, the department encourages prospective and new students to meet with as many of the EED faculty as possible before selecting an advisor. The student will then fill out the Advisor Request Form and submit it to the Graduate Program Coordinator. In the event that a student wishes to switch advisors, the student must complete the Change of Advisor Form and submit it to the Graduate Program Coordinator. In all cases, the faculty member

must give his/her consent to serve in the capacity of graduate advisor. A student may also select two faculty as co-advisors. At least one of the co-advisors must have Category P status at the university; the other may hold M status. For more information on Category P and M faculty, please see [the Graduate School's Graduate Handbook](#), section 12.4, page 80.

### **Interim Advisors**

Before a formal faculty advisor is selected, an interim advisor with “P” status (a tenure-track, tenured, or research professor) is assigned randomly to each student upon admission. Interim advisors help students make connections within and outside of the department, assist with fellowship or other applications, and discuss research and career interests. Advisors will remain interim advisors until an official advisor is selected and an Advisor Request Form is completed.

### **Plan of Study**

A plan of study outlines the general curriculum, transfer courses, and semester timelines for course completion. Students must submit their plans of study by the end of their first year in the Ph.D. program. For example, if a student begins the program in August, the plan of study must be complete, submitted, and approved by the end of Spring semester. The Plan of Study Form outlines the student's semester-by-semester plan for completing program and university requirements and lists the courses taken and those the student is planning to take. It also includes courses previously taken at other institutions that the student has transferred in, or wishes to transfer in, for OSU/EED credit. The student and faculty advisor will work together to prepare the plan of study for approval by the Graduate Studies and Research Infrastructure (GSRI) Committee. The GSRI will review and discuss the plan of study, make suggestions for changes if needed, and vote to approve the plan. If changes are recommended, the student will submit the changes to their faculty advisor for approval, and no further GSRI action is needed.

### **Transfer Credit**

Students may transfer up to 30 credits beyond the bachelor's degree of course work at the 5000 level or higher (graduate credit) earned at another accredited university. The following conditions must be satisfied in order to transfer graduate credit:

- that the graduate credit was earned as a graduate student at an accredited university
- that the student earned at least a grade of “B” for which credit is to be transferred (grades of satisfactory (“S”) or pass (“P”) may be evaluated but not accepted as transfer credits)
- that the GSRI Committee approves the transfer

Additionally, the Graduate School lists other considerations:

- Doctoral students can only transfer in one Master's degree
- If doctoral students have additional credit hours beyond 30 to transfer, those credit hours must be at the doctoral level and the student must demonstrate that they attended a Ph. D. program at that institution.
- Ph.D. students must complete (at least) 24 credit hours at Ohio State.

Credits should be transferred within the student's first year. Transfer credits count in the student's total earned hours but do not count in the student's graduate cumulative point-hour ratio. The credit hours and the mark “K” appear on the student's official permanent record.

Transfer requests will be reviewed by the GSRI Committee after being approved by the student's advisor or interim advisor. Students should prepare a packet for review by the GSRI Committee that includes the following:

- A Course Transfer Request Form for each course
- Syllabi for all courses (courses taken at other institutions as well as the Ohio State course the student is requesting it count toward)
- Justification statements (one paragraph each) explaining why the course should transfer
- Table or Excel spreadsheet summarizing the requests (see Appendix).

On receipt and evaluation of a transcript listing courses completed, the student initiates the request for transfer of graduate credit via OSU GRADFORMS. Once approved by the program, the request will be reviewed by the Graduate School for the final decision and if approved, the Graduate School will notify the student.

## Annual Review

The annual review serves as a formal checkpoint between the faculty advisor and the student and is to be completed once per year beginning at the end of the student's first year. The review meeting allows the advisor and student to discuss strengths, successes, and areas for growth and improvement and is not intended to be punitive in nature. The annual review form that the advisor and student complete together can be found in the Appendix of this document.

The timeline for the annual review process is as follows:

On the first Monday in April, the Graduate Program Coordinator will send the annual review form to students and faculty advisors, along with an availability request for a faculty meeting to discuss student progress.

The students have 2 weeks to fill out the form, and by the third Monday in April, students will send the completed form to their advisors. Faculty advisors then meet as a group the first week in May to discuss student progress. Students can expect communication from their faculty advisors regarding their progress in the weeks following the faculty review meeting.

## Exams

### Qualifier Exam

Students in the EED PhD Program are eligible to take the Qualifier Exam after successful completion of the following courses: ENGREDU 6100: Foundations and the Field of Engineering Education, ENGREDU 6200 Learning Theory, Pedagogy, and Assessment, and ENGREDU 7780: Research Design in Engineering Education. This is usually after the first year but can be postponed as determined by the student and their faculty advisor.

The EED Qualifier Exam is composed of two parts. The first part involves individual written analyses of (1) a national call for research proposals, (2) a recently published engineering education research paper, and (3) materials for an undergraduate engineering course. The second part of the qualifier is a team oral panel review of research proposals.

The Qualifier is designed to test knowledge of core course material and provide experience in professionally relevant skills. In this exam, students will be asked to apply methods learned in courses and other activities in their first year as graduate students.

The Qualifier will be offered once a year in late Summer/early Autumn (only). Those who did not pass or withdrew their attempt in one year are eligible to take it again the following year. Students are required to retake only the questions/parts for which they were not successful.

Three questions will be emailed to students on the day that the exam is scheduled to start, and students will have 2 weeks to write their answers. Please note that students are NOT expected to only work on the Qualifier during this time. They should still participate in their classes, attend meetings, and continue to work on their other responsibilities.

On or before the day after written answers are submitted, students will receive example NSF proposals, which they are to read and critique in preparation for the team Oral Panel. The Graduate Program Coordinator will email participating students for their availability. The Oral Panel will be a discussion among participating students concerning proposals prepared for the NSF solicitation, overseen by faculty members, and is modeled after the NSF panel process. Each student will receive 1-3 proposals to review and rate on a scale of poor to excellent. Each student will serve in the “lead” panelist role for at least one proposal during the discussion. Serving as the lead panelist involves giving a brief summary of the proposal prior to the group discussion of that proposal. Much like a real NSF panel, students will work together give the “program officer” (a faculty member) advice about funding each proposal (“highly recommend”, “recommend” or “do not recommend”) and decide the rank order in which your team recommends funding for all of the proposals. Though the Oral Panel is a team-based exercise, each student will be scored individually.

Students may use notes, books, or other resources with the exception of peer collaboration. Any instances of peer collaboration will be considered Academic Dishonesty and will result in university action through Ohio State’s Committee on Academic Misconduct (COAM).

Guidelines for Asking Questions: If students have questions during the Written Exam, they should email them to the Graduate Program Coordinator. The questions will be answered by the faculty, and the Graduate Program Coordinator will send out the response to all students taking the Qualifier.

Guidelines for Submission: Answers will be typed in 11-point Arial font, single-spaced, and submitted to the Graduate Program Coordinator in three separate PDFs (one PDF per question) by the exam’s due date. The Graduate Program Coordinator will upload the questions to a box folder where faculty will access the exams for evaluation. APA Citation style is expected throughout the written portion of the exam. Though there is no minimum or maximum required page length for the written portion of the exam, but in the past successful responses were in the range of seven to ten pages including literature cited for each of the three questions.

A grading rubric will be provided to students before the exam begins. Students will receive their scores via email for all questions, along with comments (but not suggested revisions) for both portions of the Qualifier. If a student fails to answer one or more questions satisfactorily, the failed question may be rewritten during a future Qualifier.

Withdrawal Policy: Students who have begun the Qualifier Exam may withdraw their attempt up until the submission deadline. The withdrawal does not count against the student as one of their attempts at the Qualifier, but a student may only employ the withdrawal option once and must wait until the following year to take the exam again

The first non- or partial pass on the Qualifier Exam counts only internally to EED. The second non- or partial pass counts internally and prompts communication with the Graduate School. This means the Graduate Program Coordinator must notify the Graduate School that a student is not progressing as expected; the Graduate School will send a warning letter to the student regarding the student's potential dismissal from the Graduate School. Dismissal is not formalized until the Graduate School issues two warnings.

Any testing accommodations should be brought to the Graduate Program Coordinator's attention as soon as the student decides to take the exam. We will accommodate any student registered with Ohio State Student Life Disability Services appropriately.

**Preparation:** Students are expected to prepare for the Qualifier Exam for a period of time deemed appropriate by the student's faculty advisor. This period of time should take into account other research, teaching, or coursework responsibilities, as students are expected to continue their other commitments. Preparation involves more work than simply having completed required coursework. Preparation could include working with peers and faculty to think about how to approach sample responses, practicing writing sample responses, and preparing materials and references prior to the exam. This preparation time can also be used for the student to get additional feedback on their writing. As soon as the student knows they will be taking the qualifying exam, the student should consult with their faculty advisor to devise a plan for adequate preparation.

### **Candidacy Exam**

The candidacy examination is a requirement of Ohio State's Graduate School which requires a "...*single examination consisting of two portions, written and oral, administered under the auspices of the Graduate Studies Committee in conjunction with the student's candidacy examination committee and the Graduate School*" (*Graduate School Graduate Handbook, Section 7.3*). The purpose of the candidacy examination is to test a student's knowledge and comprehension of engineering education, capacity to undertake independent research, and ability to think and express ideas clearly. It is usually taken once the student completes all required and elective coursework so that the student can focus on the dissertation following successful completion of the Candidacy Exam.

The candidacy examination consists of a written and oral portion, the structure of which is at the discretion of the department. Doctoral students achieve candidacy once both portions are successfully completed.

Candidacy should be reached after doctoral students have taken enough course work to become proficient in the field of study, which is generally two years after starting the doctoral program or one year after successfully completing the qualifying exam.

*"Doctoral students who have achieved candidacy are deemed to have:*

- 1. acquired the necessary advanced knowledge of the subject (normally by meeting all of the course requirements for the particular PhD program)*
- 2. developed the needed technical skills (e.g., language, laboratory, computational, etc.) for work in the subject*
- 3. demonstrated the ability to do the research or scholarship necessary to begin work on a dissertation (Graduate School Graduate Handbook, Section 7.7)"*

EED goals for the students taking the Candidacy Exam are:

- To familiarize themselves with the literature in the field
- To practice formulating a research problem
- To practice synthesizing information in clear, cohesive arguments
- To develop a research question and corresponding plan

#### Members of the Candidacy Exam Committee

Committee members are chosen by the student and the advisor. The committee should be composed of the student's advisor and at least three other relevant graduate faculty members chosen by the student and the advisor together. Only tenure-track, tenured, research, and clinical faculty can serve on candidacy exam committees. The Candidacy Exam Committee can be formed at any time deemed appropriate by the student and the faculty advisor.

The Candidacy Exam consists of both a written and oral portion. The process for scheduling and taking the Candidacy Exam is as follows:

- 1) Student forms a candidacy exam committee made up of four faculty members, providing ample time for faculty to respond to the request and discuss the student's research interests with them.
- 2) Student schedules the candidacy timeframe, wherein the research proposal will be developed, submitted, and defended (example: August – November 2020). In addition, at this time, the student should schedule their candidacy exam oral defense with the Graduate School. The Graduate School specifies:

*“The oral portion of the candidacy examination lasts no more than two hours, with at least one hour devoted to questioning of the student. Oral presentation of any proposal or other prepared materials must be made prior to or after the oral examination. Questioning of the student should occupy the entire period of the examination. All committee members are expected to participate fully in the questioning during the course of the examination and in the discussion of and decision on the result of the candidacy examination.” (Graduate School Graduate Handbook, Section 7.5.2)*

- 3) Student develops a 15-page NSF-style research proposal in consultation with their advisor and submits it to their committee
  - a. The committee may approve a different yet equivalent style based on the student's career interest; however, the focus must still be a research proposal.
- 4) The committee has 2 weeks to read the proposal and develop questions. Each committee members will write one question based on the proposal that aids the student in the development of their dissertation research.
  - a. If the committee finds the proposal to be inadequate, the committee may decide to restart the process.
- 5) After the two-week proposal review period, the student will be given the four questions and will have four weeks to write a response to each question.
  - a. At this time, the student should also schedule their candidacy exam oral defense with the graduate school.
- 6) After the four-week response period, all of the questions and student's responses will be emailed to the entire committee. The committee has 2 weeks to read all the materials and prepare for the candidacy exam oral defense.
- 7) After the two-week response review period, the committee and the student will meet for a two-hour candidacy exam oral defense that has been previously approved by the Graduate School. The only people in attendance at the oral defense are the student and the Candidacy Exam Committee members.

- a. During this meeting the student may clarify any of their written items, answer additional questions for the committee, and provide additional insights about their proposal dissertation research.
  - b. This time will also be used to negotiate any ill-defined requirements of the dissertation research so the student and committee are all in agreement about the scope of work needed to complete the research.
- 8) Following the candidacy exam oral defense, if the exam is deemed satisfactory, the committee members will submit the required paperwork to the Graduate School for processing.

### Candidacy Expiration

Students should complete all doctoral program requirements within five years of taking the candidacy exam or the exam will expire, resulting in cancellation of the student's candidacy. The student can petition the Graduate Studies and Research Infrastructure Committee to take a supplemental candidacy exam, which will differ from the original exam given. If the student passes this supplemental candidacy examination, the student is readmitted to candidacy and must then complete a dissertation document within two years. Note that EED students are not guaranteed a supplemental exam.

For more Graduate School policies regarding the Candidacy Exam, please visit <https://gradsch.osu.edu/handbook/all#7-3> (Section 7.7).

## Dissertation Defense (Final Oral Examination)

### **Dissertation Committee**

The student must form a dissertation committee made up of at least three authorized Graduate Faculty members. The Chair of the dissertation committee is the student's advisor who must be a Category "P" status Graduate Faculty member in EED. The dissertation committee is established at a time thought appropriate by the student and the advisor. It is the student's responsibility to make certain that committee members are on duty in the semester of the defense.

### **Final Oral Examination**

Regarding the dissertation defense, the Ohio State Graduate School Handbook states:

*"The final oral examination committee is composed of the student's dissertation committee, plus the Graduate Faculty Representative. Other Graduate Faculty members may be added to the committee, subject to the rules of the Graduate Studies Committee. The advisor serves as chair of the final oral examination committee. The advisor of a doctoral student must be a Category P member of the student's graduate program. Responsibility for conducting and evaluating the final oral examination rests with the student's final oral examination committee.*

**Draft Approval.** *Before a defense can be held, the student must submit a complete, word-processed dissertation draft to the dissertation committee for review and approval or disapproval. All dissertations submitted for format review and approval must be of a caliber similar to that expected of an article submitted to a journal for review. Draft documents that are missing tables, graphs, citations, chapters or sections, etc., are incomplete. Incomplete drafts cannot be submitted for draft approval or defended.*

**Scheduling.** *A dissertation committee member's approval of the dissertation draft means that the committee member judges it to be of sufficient merit to warrant holding the final oral examination. To schedule the final exam, the student must submit an Application for Final Examination on GRADFORMS and have this approved by each dissertation committee member*

at least two weeks before the proposed defense date. After the final oral examination committee has been approved by the Dean of the Graduate School and the Graduate Faculty Representative has been assigned, the Report on Final Examination and Report on Final Document are made available to the examination committee. The final oral examination must take place during announced university business hours, Monday through Friday.

**Graduate Faculty Representative.** Once the final oral examination is scheduled, the Graduate School appoints the Graduate Faculty Representative (GFR). The GFR is a Category P graduate faculty member who is neither a graduate faculty member in the doctoral candidate's graduate program nor a member of the dissertation committee. No less than one week before the final oral examination, a complete dissertation or DMA document draft must be presented to the GFR for reference. The presence of the GFR is required at the oral examination for its entire duration. The GFR is a full voting member of the final oral examination committee and is invited by the advisor to ask questions. The GFR has the right to ask at least one question and renders an opinion by observation of the student's answers to all questions. The purpose of the GFR on the final oral examination committee is to assess:

- the rigor of the examination process
- the fairness, professionalism and integrity of the examination process
- conformity to rules of the Graduate School (e.g., duration of the exam, adequate time for questions by the committee members) The GFR reports a judgment of the above to the Graduate School once the final oral examination is completed through an evaluation form on GRADFORMS, preferably within 48 hours after the examination.

**Attendance and Format.** Except when video conferencing is approved by the Graduate School, all members of the final oral examination committee must be present during the entire examination. All committee members are expected to participate fully in questioning during the course of the examination and in the discussion of and decision on the result. Other faculty members and graduate students may attend the examination, subject to the rules of the Graduate Studies Committee. The final oral examination lasts approximately two hours. A presentation of the dissertation research by the student is allowable. At least one hour of the two-hour examination period, however, must be allotted to discussion of the research and to questions of and answers by the student. Local programs may develop additional local protocols and procedures." (Graduate School Graduate Handbook, Section 7.9)

In EED, the advisor will set expectations for what constitutes a successful defense. The final exam will include a two-hour, private oral defense following a one-hour public presentation of the dissertation research. The Graduate Program Coordinator will help students advertise their public presentations to the department and external parties.

## Funding

Funding for graduate students is never guaranteed, unless expressly stated in a contract or admission letter. Students with a one-year contract for funding should not expect that the contract will automatically be renewed. Funding decisions are made at the discretion of the advisor and are based on a variety of factors, including budget constraints, graduate positions available, student standing, progress in the program, and more. As such, students should expect to hold a variety of roles during their time in the EED. Different types of funding opportunities are explained in detail below.

## Fellowships & Scholarships

Fellowships are prestigious awards that enhance a student's CV and guarantee one or more years of funding for their graduate work. Students are expected to apply for fellowships for which they are eligible. With the exception of University Fellowships and College of Engineering Fellowships, the onus falls upon the student to complete the application requirements for any fellowship. Examples of fellowships are described below.

**University Fellowships** are awarded by the Graduate School on an annual basis. To be considered for University Fellowships, students must submit application materials to the EED by December 1 for admission the following Autumn semester. The Graduate Program Coordinator and the Graduate Studies Chair will nominate eligible applicants for University Fellowships. Benefits and requirements for all Graduate School Fellows can be found [here](#).

College of Engineering Fellowships are awarded by the College on an annual basis. The Graduate Program Coordinator and the Graduate Studies Chair will nominate eligible applicants for College Fellowships upon receipt of application materials.

GRE scores are not required for any fellowship nominations.

### **Graduate Research Fellowship Program**

NSF awards fellowships annually to eligible graduate students as part of their Graduate Research Fellowship Program (GRFP). *All eligible EED graduate students are highly encouraged to apply for the GRFP.* Eligibility requirements and more information about the GRFP can be found [here](#). Every Autumn semester, the Graduate Program Coordinator, along with some faculty, will host a roundtable information session about the GRFP. Students are expected to attend the roundtable session and bring drafts of their GRFP applications. Students will work with faculty advisors or, in the event that an advisor has not yet been selected, a faculty member willing to serve as interim advisor, on their applications.

## Graduate Teaching Associate (GTA) Positions

One of the requirements of the PhD Program in Engineering Education is to engage in a significant teaching experience over the course of two semesters. While a significant teaching experience may occur any number of ways, many PhD students will serve the Department of Engineering Education as Graduate Teaching Associates (GTAs). GTAs in Engineering Education who are assigned a 50% appointment are expected to work 20 hours per week toward the duties outlined in the GTA Handbook. GTAs who are assigned a 25% appointment are expected to work 10 hours per week. These appointment numbers are the same across all departments and Colleges at Ohio State.

## Graduate Research Associate (GRA) Positions

Students should also pursue a Graduate Research Associate (GRA) position for funding. If there is a faculty member doing research in a field of interest, you may reach out to them to inquire if they are looking for GRAs. The funding acquired from these positions comes directly from the faculty and may vary depending on the project. Similar to the GTA role, GRAs who are assigned a 50% appointment are expected to work 20 hours per week towards the duties that are assigned to them by the researchers of the project. GRAs may also be assigned 25% appointments and are expected to work 10 hours per week. These appointment numbers are the same across all departments and Colleges at Ohio State. It should be noted that both GTAs and GRAs require the same amount of work outside of coursework and dissertation

work based on their appointment percentage. Receiving a GRA position does not mean the student will be working fewer hours than if they are assigned as a GTA. The EED values both of these roles equally, and students should expect similar work expectations.

## External Funding

Other funding opportunities exist around the university. Graduate students are encouraged to reach out to departments and centers of interest if no other funding opportunities are evident. Examples of funding opportunities include Graduate Associate positions at the [Center for the Study and Teaching of Writing](#), the [University Institute for Teaching and Learning](#), the [Office of Diversity and Inclusion](#), and the [Multicultural Center](#). For more information on external funding opportunities, see the Graduate Program Coordinator or contact faculty directly about available research opportunities.

For more information about policies that apply to Graduate Associates, visit the Graduate School's [website on Graduate Associates](#).

## Parental Leave

Per the Graduate School Handbook, graduate students on a 50% (or higher) appointment are granted paid leave for the birth or adoption of a child. Graduate student employees are eligible for three weeks of paid leave at the time of birth or adoption. The parent who has given birth is eligible for an additional three weeks of leave, totaling 6 weeks. There will be no expectation of work pertaining to the graduate appointment or degree progression while a student is on parental leave. In addition, the student on leave is not responsible for email communication until the return date. Parental leave should be discussed and planned with the faculty advisor and communicated to the Graduate Program Coordinator well in advance.

## Important Dates & Academic Calendar

### The Graduate School Event and Graduation Calendar

Find dissertation defenses, special events, and graduate school events here:

<https://gradsch.osu.edu/calendar>

Find the graduate calendar here: <https://gradsch.osu.edu/calendar/graduation>

### The Ohio State University Academic Calendar

Find important dates including University holidays and finals week here:

<https://registrar.osu.edu/staff/bigcal.asp>

## Points of Contact

### Graduate Studies Committee

The Graduate Studies and Research Infrastructure (GSRI) Committee leads recruitment and monitors progress of EED graduate students, oversees graduate-level curriculum matters related to the graduate courses offered by the department, and implements Graduate School policies in the EED. The director of the Graduate Program is the chair of the GSRI Committee. The Graduate Program is led by faculty in the department with graduate faculty status in conjunction with the Graduate Program Coordinator.

## Graduate Studies Committee Chair

The Graduate Studies Committee Chair oversees the GSRI Committee in its operations and decision-making. The Chair also serves as a liaison between graduate faculty and the Graduate School, nominates faculty for P and M status, and approves processes.

## Associate Department Chair for Graduate Studies and Research Infrastructure

The Associate Department Chair for Graduate Studies and Research Infrastructure is a faculty member who devotes a portion of their time to administrative duties concerning graduate students and the research operations of the department (currently Dr. Julie Martin).

## Graduate Program Coordinator

The EED's Graduate Program Coordinator assists with the daily administrative responsibilities of the Graduate Program (currently Dr. Ana Casado). Other roles include the following:

- Recruits graduate students
- Provides information about the graduate program to prospective students, faculty at Ohio State and other institutions, industry partners, and others
- Advises on required and elective coursework, specialization area, program and university policies and procedures
- Develops professional development for graduate students
- Serves as a voting member of the EED Graduate Studies and Research Infrastructure Committee
- Advocates on behalf of graduate students and their interests
- Processes applications and admissions into the department
- Liaises between the graduate students and the following offices and groups:
  - The Graduate School
  - Graduate & Professional Admissions
  - Graduate faculty in the EED

## Goals for Graduate Student Learning & Development

The PhD program in Engineering Education has been very consciously and rigorously designed using the Backward Design method discussed in Wiggins and McTighe (1998) and elsewhere. Guided by the experts in curriculum design at Ohio State's University Center for the Advancement of Teaching, the Graduate Studies and Research Infrastructure (GSRI) Committee proposed several learning goals for graduate students who complete the PhD in this department. These goals include:

1. Identify, discuss, and address critical issues facing engineering education in alignment with stakeholder needs.
2. Design, conduct, and critique research in engineering education
3. Create, teach, and assess courses and curricula
4. Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits

In addition, the GSRI Committee wrote program outcomes and levels of proficiency graduate students should attain by their graduation from the program. These can be accessed in the Appendix of this document.

## **Appendix A&B Contents**

### **Appendix A: Graduate Student Forms**

Appendix A.1: Transfer Petition

Appendix A.2: Petition for Course Substitution

Appendix A.3: Advisor Request

Appendix A.4: Change of Advisor

Appendix A.5: Request to Change Plan of Study

Appendix A.6: Annual Review

Appendix A.7: Candidacy Exam Committee Request

Appendix A.8: Dissertation Committee Request

Plan of Study Spreadsheet: <https://app.box.com/file/317444636883>

### **Appendix B: PhD Program Goals and Outcome**



## EED Petition for Transfer Course Credit

Name: \_\_\_\_\_

Date: \_\_\_\_\_

University where credit was attained: \_\_\_\_\_

Course department: \_\_\_\_\_ Course number: \_\_\_\_\_

Course title: \_\_\_\_\_

Official course description from course syllabus:

OSU equivalent course (Department & Number): \_\_\_\_\_

\_\_\_\_\_  
Student Signature

For action by the EED Graduate Studies Committee

Approved  Disapproved

Comments: \_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
Graduate Studies Chair Signature

\*Please attach the syllabi for both courses in question to this document along with a justification (one paragraph) for why this course should qualify for a course substitution



## Petition for Course Substitution

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Course department: \_\_\_\_\_ Course number: \_\_\_\_\_ Credit Hours: \_\_\_\_\_

Course title: \_\_\_\_\_

Official course description from course syllabus:

Which Ohio State course should this course replace?

Course title: \_\_\_\_\_ Course Number: \_\_\_\_\_ Credit Hours: \_\_\_\_\_

\_\_\_\_\_  
Student Signature

For action by the EED Graduate Studies Committee

Approved  Disapproved

Comments: \_\_\_\_\_

\_\_\_\_\_  
Graduate Studies Chair Signature

\*Please attach the syllabi for both courses in question to this document along with a justification (one paragraph) for why this course should qualify for a course substitution



THE OHIO STATE UNIVERSITY

## Advisor Request Form

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Semester Enrolled: \_\_\_\_\_

Research Interests/Areas: \_\_\_\_\_

Faculty member you are requesting to advise your doctoral work:

Professor: \_\_\_\_\_

This advisor assignment  is: Temporary

Permanent

\_\_\_\_\_  
Signature of Graduate Student

\_\_\_\_\_  
Signature of Requested Advisor



## Change of Advisor Form

Date: \_\_\_\_\_

This is to certify that the advisor of: \_\_\_\_\_

Semester Enrolled: \_\_\_\_\_

Research Interests: \_\_\_\_\_

Has been changed from:

Professor: \_\_\_\_\_

To:

Professor: \_\_\_\_\_

This advisor assignment is: Temporary

Permanent

\_\_\_\_\_  
Signature of Graduate Student

\_\_\_\_\_  
Signature of Current Advisor

\_\_\_\_\_  
Signature of New Advisor



## Request to Change Plan of Study

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Change requested:

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Reason for change request:

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\_\_\_\_\_  
Advisor Signature

\_\_\_\_\_  
Student Signature

For action by the EED Graduate Studies Committee

Approved       Disapproved

Comments: \_\_\_\_\_

\_\_\_\_\_  
Graduate Studies Chair Signature

\*Please attach the original plan of study to this document

**EED PhD Student Annual Review  
Student Form 2020****Student Name:****Faculty Advisor:****First Semester of Enrollment in EED PhD:****Current Semester:****Expected Graduation:****Current GPA:**

**This form is to be filled out annually by each EED Ph.D. student to gauge the student's progress toward completion of the EED Ph.D. program. This form is due to the student's advisor (interim or formally established) no later than the third Monday in April. Responses are not required to be lengthy (a couple sentences/thoughts per question) and will be used to guide a "check-in" conversation with the student's Ph.D. advisor. The advisor will archive this document after the meeting along with the Annual Review Faculty Form to track student progress.**

Along with this form, please submit a current copy of your CV.

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**Milestone 1: Completion of Coursework (*all* academic credits in Plan of Study)**

Has Your Plan of study been approved? If not, when?

List any changes from your current Plan of Study:

List what coursework on your plan of study remains for you to complete and your plan to complete:

**Milestone 2: Qualifier Exam**

Indicate your status (e.g., passed on XX/XX/XX) for each task/question of the qualifier exam:

1. Review and evaluate an NSF RFP (written)
2. Review and evaluate an article published in JEE (written)
3. Review and evaluate design of an undergraduate engineering course (written)
4. Evaluate proposals submitted to NSF (oral)

What is your plan to pass the tasks/questions that remain to be completed (if any)?

## Milestone 3: Significant Teaching Experience

1. Have you completed your significant teaching experience? If not, when?
2. Describe your significant teaching experience.
3. How did/will your significant teaching experience contribute to your professional development and career expectations?
4. (If applicable) Reflecting on your teaching experience (and your SEIs), what are your strengths and areas for improvement? How will you implement them in your next teaching experience?

## Milestone 4: Dissertation Proposal (Candidacy Exam)

What is the status of your dissertation proposal? What have you accomplished on your dissertation this academic year (e.g., research questions, literature review, methodology, writing, feedback, revising, forming committee etc.)? What is your plan for next academic year?

## Milestone 5: Dissertation Defense and Submission

What is the status of your dissertation? What have you accomplished on your dissertation study this academic year (e.g., data collection, writing, feedback, analysis, updating committee, scheduling, etc.)? What is your plan for next academic year?

## General PhD Student Professional Development

What additional opportunity(ies) have you participated in as a part of the EED? What is (are) your role(s)? Reflect on your growth over the course of the year (for example, ways that you have continued to develop your CV or other professional documents). This may include, but is not limited to the following areas listed below.

1. Research/Scholarly Production (e.g., proposal writing, research design, data collection, data analysis, publications/presentations, mentoring researchers, etc.)
2. Education (e.g., curriculum development, teaching, mentoring, evaluating others, etc.)
3. Community (e.g., engagement in professional organizations, contributions to EED, outreach activity, reviews for conferences or journals, etc.)
4. Leadership (e.g., service roles in professional organizations, service roles in EED, etc.)

**Other: Optional Feedback**

If, after completing this form, you have any constructive feedback on possible revisions to this form to make it more effective at fostering reflection on your own progress and facilitating discussion with your faculty advisor about your progress, please include actionable recommendations here.



## EED Request for Approval of Candidacy Examination Committee

Name: \_\_\_\_\_

Date: \_\_\_\_\_

- ❖ As faculty advisor, I am requesting approval for the Candidacy Examination Committee and acceptance of dissertation research for the above-named student.
- ❖ I have reviewed this student's EED PhD plan of study and confirmed that it is up to date and the student is scheduled to complete the course requirements for the EED PhD degree.

\_\_\_\_\_  
Signature of Faculty Advisor

**Faculty Examiners**

**Signature**

**Research Area**

\_\_\_\_\_  
Advisor

\_\_\_\_\_  
Major Examiner

\_\_\_\_\_  
Minor Examiner

\_\_\_\_\_  
4<sup>th</sup> Examiner

\_\_\_\_\_  
Signature of EED Graduate Studies Chair



## EED Request for Approval of Doctoral Dissertation Committee

Name: \_\_\_\_\_

Date: \_\_\_\_\_

❖ As faculty advisor, I am requesting approval for the Doctoral Dissertation Committee.

\_\_\_\_\_  
Signature of Faculty Advisor

**Faculty Examiners**

**Signature**

**Research Area**

\_\_\_\_\_  
Faculty Advisor

\_\_\_\_\_  
Dissertation Committee Member 2

\_\_\_\_\_  
Dissertation Committee Member 3

\_\_\_\_\_  
If applicable: Dissertation  
Committee Member 4

\_\_\_\_\_  
Signature of EED Graduate Studies Chair

## APPENDIX B: PhD Program Goals, Learning Outcomes, and Levels of Proficiency

**Table 1.** Goal #1 with Program Outcomes and Levels of Proficiency

Program Goals	Program Outcomes	Levels of Proficiency (B= Basic, I = Intermediate, A= Advanced)
1. Identify, discuss, and address critical issues facing engineering education in alignment with stakeholder needs	1.A. Engage critical issues in the field with attention to inclusion of multiple perspectives and demographics	1.A.(B) Identify several of the contemporary educational issues with attention to inclusion of multiple perspectives and demographics
		1.A.(I) Discuss the main perspectives of contemporary educational issues and describe impact on stakeholders with attention to inclusion of multiple perspectives and demographics.
		1.A.(A) Develop and execute a plan to address educational issues with attention to inclusion of multiple perspectives and demographics
	1.B. Analyze the history and foundations of the education of engineers and the discipline of engineering education in US and international contexts	1.B.(B) Identify broad historical and foundational aspects of engineering education in US and international contexts.
		1.B.(I) Discuss key historical and foundational aspects of engineering education related to contemporary issues in US and international contexts.
		1.B.(A) Synthesize relevant educational history and foundations of critical contemporary issues in US and international contexts.
	1.C. Characterize potential stakeholders and design appropriate engagement strategies	1.C.(B) Identify primary stakeholders of engineering education.
		1.C.(I) Explain relationships among stakeholders and contemporary educational issues.
		1.C.(A) Define appropriate engagement strategies with stakeholders.
	1.D. Identify and interpret stakeholder needs to develop action plans	1.D.(B) Describe several relevant stakeholder needs.
		1.D.(I) Interpret stakeholder needs in relationship to engineering education.
		1.D.(A) Create an action plan to address one or more stakeholder needs.
	1.E. Contribute to high-impact efforts to use and/or transform engineering education to best meet stakeholder	1.E.(B) Actively participate in an effort that leads to specific application or transformation of engineering education to meet stakeholder needs.
		1.E.(I) Lead an effort grounded in theory of change to transform engineering education to best meet stakeholder needs.

	needs	1.E.(A) Translate high-impact effort into scholarship.
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**Table 2.** Goal #2 with Program Outcomes and Levels of Proficiency

<b>Program Goals</b>	<b>Program Outcomes</b>	<b>Levels of Proficiency (B= Basic, I = Intermediate, A= Advanced)</b>
2. Design, conduct, and critique research in engineering education	2.A. Research with attention to inclusion of multiple perspectives and demographics so that research outcomes are more universally relevant	2.A.(B) Identify ways that diverse populations may be impacted negatively and positively by research.
		2.A.(I) Reflect critically on research across various fields that targets diverse audiences.
		2.A.(A) Expand the body of knowledge in engineering education with attention to inclusion of multiple perspectives and demographics.
	2.B. Demonstrate awareness of broadly applicable research opportunities, funding, resources, and communications (internal and external to the field)	2.B.(B) Identify current research opportunities and communications within and outside of engineering education.
		2.B.(I) Distinguish between types of resources and funding available and the corresponding reporting expectations.
		2.B.(A) Select appropriate research opportunities, funding, resources, and communications that aligns with one's research interests and expertise.
	2.C. Construct appropriate research questions in engineering education that address stakeholder needs and advance the field	2.C.(B) Identify appropriate, researchable questions considering relevant literature that address stakeholder needs and advance the field.
		2.C.(I) Appraise whether research questions appropriately align with an overall research study design, address stakeholder needs, and advance the field and contributes to larger body of knowledge in engineering education.
		2.C.(A) Develop sound engineering education research questions that address stakeholder needs and advance the field.
	2.D. Design research that uses appropriate and evidence-based methods	2.D.(B) Define qualitative, quantitative, and mixed methods commonly used within and outside of engineering education research.
		2.D.(I) Select appropriate methods to research questions.
		2.D.(A) Propose a comprehensive research project that uses a sound methodological design.

	2.E. Collect, analyze, and interpret data using appropriate techniques	2.E.(B) Collect, analyze, and interpret data within a given set of research parameters
		2.E.(I) Collect, analyze, and interpret data for a comprehensive research project
		2.E.(A) Defend the collection, analysis, and interpretation of data from a comprehensive research project

Program Goals	Program Outcomes	Levels of Proficiency (B= Basic, I = Intermediate, A= Advanced)
2. Design, conduct, and critique research in engineering education <i>(continued)</i>	2.F. Communicate results of research efforts in traditional and non-traditional forms	2.F.(B) Differentiate among and select types of dissemination venues for research.
		2.F.(I) Assess when research is appropriate for submission to identified venues.
		2.F.(A) Publish in a peer-reviewed dissemination outlet.
	2.G. Critique the quality of engineering education research studies of various types presented in different forms	2.G.(B) Identify quality indicators of research.
		2.G.(I) Evaluate the quality of a selected scholarly effort.
		2.G.(A) Serve as a peer reviewer of research studies for an appropriate dissemination venue.
	2.H. Analyze how a broad array of research projects integrate into the field.	2.H.(B) Recognize prior research conducted in an area of interest.
		2..H.(I) Determine how to make connections across research themes to identify gaps in literature.
		2.H.(A) Propose a research agenda informed from a synthesis of existing literature and research across multiple fields.
	2.I Structure, manage, and implement research projects.	2.I.(B) Define the aspects of research project management.
		2.I.(I) Develop a structured plan to manage a research study for implementation.

2.I.(A) Execute a research project and reflect on the execution of that project.

**Table 3.** Goal #3 with Program Outcomes and Levels of Proficiency

Program Goals	Program Outcomes	Levels of Proficiency (B= Basic, I = Intermediate, A= Advanced)
3. Demonstrate, value, and apply engineering expertise	3.A. Apply an engineering mindset to devise solutions to complex problems with attention to inclusion of multiple perspectives and demographics.	3.A.(B) Discuss solutions to complex problems with attention to inclusion of multiple perspectives and demographics.
		3.A.(I) Discern the impact of engineering solutions with attention to inclusion of multiple perspectives and demographics.
		3.A.(A) Develop an engineering solution to a complex problem with attention to inclusion of multiple perspectives and demographics.
	3.B. Demonstrate engineering competence in at least one specific domain.	3.B.(B) Define an engineering problem and discuss multiple solutions within selected domain
		3.B.(I) Assess integrity of an engineering solution using design criteria within a selected domain
		3.B.(A) Create and validate an engineering solution within selected domain
	3.C. Formulate applications of engineering education to engineering practice and vice versa.	3.C.(B) Discuss a novel solution and translate language to and from engineering and engineering education settings
		3.C.(I) Design and propose a novel solution to and from engineering and engineering education settings
		3.C.(A) Synthesize outcomes from an engineering solution into an engineering education setting and vice versa
	3.D. Identify pathways for lifelong learning in engineering.	3.D.(B) Discuss opportunities for continued learning in engineering.
		3.D.(I) Propose a professional development agenda illustrating pathways for lifelong learning in engineering.
		3.D.(A) Demonstrate engagement within opportunities for lifelong learning in engineering.

**Table 4.** Goal #4 with Program Outcomes and Levels of Proficiency

Program Goals	Program Outcomes	Levels of Proficiency (B= Basic, I = Intermediate, A= Advanced)
4. Create, teach, and assess courses and curricula	4.A. Educate with attention to inclusion of multiple perspectives and demographics so that every student has the opportunity to learn	4.A.(B) Discuss student and teacher similarities and differences across multiple perspectives and demographics
		4.A.(I) Experiment with different teaching techniques to engage multiple perspectives and demographics so that every student has the opportunity to learn
		4.A.(A) Engage all students in a given educational experience so that every student has the opportunity to learn.
	4.B. Design a course or other significant educational experience founded in learning theory explicitly addressing stakeholder needs	4.B.(B) Build a lesson plan addressing stakeholder needs.
		4.B.(I) Critique an existing course syllabus using learning theory.
		4.B.(A) Develop a course syllabus and discuss the choices made founded in learning theory explicitly addressing stakeholder needs.
	4.C. Analyze how multiple courses integrate into a curriculum	4.C.(B) Evaluate a course's significance and effectiveness in the context of other courses in a curriculum.
		4.C.(I) Synthesize a set of courses' impact on students' learning across a curriculum.
		4.C.(A) Propose curricular adjustments to address gaps in achieving learning outcomes.
	4.D. Instruct a course or other significant educational experience using appropriate and evidence-based pedagogical techniques	4.D.(B) Observe a course or other significant educational experience, highlighting the various techniques used and their appropriateness to the context.
		4.D.(I) Teach effectively a course or other significant educational experience.
		4.D.(A) Use appropriate and evidence-based pedagogical techniques while teaching a course.

Program Goals	Program Outcomes	Levels of Proficiency (B= Basic, I = Intermediate, A= Advanced)
4. Create, teach, and assess courses and curricula <i>(continued)</i>	4.E. Assess and improve their own teaching through informed, inquiry-based practice	4.E.(B) Reflect on one's teaching experiences highlighting strengths and areas for improvement
		4.E.(I) Critique different examples of teaching, highlighting the various techniques used and their appropriateness to the context.
		4.E.(A) Gather and apply teaching feedback.
	4.F. Develop effective tools to evaluate learning	4.F.(B) Create appropriate learning outcomes.
		4.F.(I) Develop tools that measure learning outcomes at various levels.
		4.F.(A) Revise tools and learning outcomes based on experiences and student feedback.
	4.G. Evaluate and improve student learning responsibly, equitably, and in alignment with learning outcomes	4.G.(B) Identify students' level of knowledge, skills, and abilities responsibly, equitably, and in alignment with learning outcomes.
		4.G.(I) Determine students' difficulties in alignment with various learning outcomes.
		4.G.(A) Develop responsible and equitable strategies to assist students in their learning that align with learning outcomes
	4.H. Design and implement evaluations/assessments of a variety of educational programming	4.H.(B) Describe the differences and similarities between assessment and evaluation.
		4.H.(I) Critique an educational program using appropriate assessment and evaluation tools.
		4.H.(A) Develop a tool to assess and evaluate the effectiveness of an educational program.

**Table 5.** Goal #5 with Program Outcomes and Levels of Proficiency

Program Goals	Program Outcomes	Levels of Proficiency (B= Basic, I = Intermediate, A= Advanced)
5. Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits	5.A. Engage in professional activities with attention to inclusion of multiple perspectives and demographics in order to create synergy in the midst of differences.	5.A.(B) Reflect with curiosity about what can be learned from communities and cultures with attention to inclusion of multiple perspectives and demographics in order to create synergy in the midst of differences.
		5.A.(I) Demonstrate evidence of adjustment in attitudes and beliefs through working within and learning from diverse communities and cultures.
		5.A.(A) Promote others' engagement with diversity.
	5.B. Demonstrate a mindset that values curiosity and questioning, finds and leverages connections across a wide range of ideas, and creates positive societal value	5.B.(B) Discuss the diverse and rapidly changing world from more than one field of study or perspective with curiosity about potential positive societal values.
		5.B.(I) Connect examples, facts, or theories from more than one field of study or perspective and describe how positive societal value is created.
		5.B.(A) Synthesize conclusions by combining examples, facts, or theories from more than one field of study or perspective which create positive societal value .
	5.C. Function effectively on diverse, multidisciplinary teams	5.C.(B) Discuss the elements of effective teamwork and importance of diverse, multidisciplinary teams.
		5.C.(I) Participate effectively on a diverse, multidisciplinary team.
		5.C.(A) Manage a diverse, multidisciplinary team.
	5.D. Communicate effectively with a range of audiences using multiple modes and media	5.D.(B) Explain the appropriate communication strategies to use with a range of audiences using multiple modes and media.
		5.D.(I) Critique specific communications considering a range of potential audiences.
		5.D.(A) Disseminate/publish appropriate to target audience(s) using multiple modes and media.
	5.E. Recognize, analyze, and equitably engage with professional	5.E.(B) Recognize complex, multi-layered professional ethical dilemmas.
		5.E.(I) Critique appropriate perspectives and theories used to analyze professional ethical dilemmas, considering full implications.

	ethical dilemmas	5.E.(A) Apply appropriate perspectives and theories to engage professional ethical dilemmas including assumptions and implications, equitably defending trade-offs.
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Program Goals	Program Outcomes	Levels of Proficiency (B= Basic, I = Intermediate, A= Advanced)
5. Identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits <i>(continued)</i>	5.F. Demonstrate effective leadership skills	5.F.(B) Discuss the elements of effective leadership skills, including self-awareness, resource management, and motivating others.
		5.F.(I) Critique leadership skills of select individuals, considering visioning, conflict and resource management, and mentoring.
		5.F.(A) Apply effective leadership skills.
	5.G. Apply appropriate principles to manage teams and projects	5.G.(B) Describe the project management process and primary constraints including scope, schedule, budget, and quality.
		5.G.(I) Critique project management from a variety of sectors including education, development, and industry.
		5.G.(A) Implement the project management process for a comprehensive project
	5.H. Demonstrate empathy and cultural competence across professional interactions	5.H.(B) Identify components of multiple cultural perspectives.
		5.H.(I) Demonstrate empathetic connection to the complexity of elements important to multiple cultures.
		5.H.(A) Promote empathy and cultural competence across professional interactions.
	5.I. Prepare professional documents and demonstrate effective communication skills appropriate to a variety of job search and career advancement processes	5.I.(B) Describe documents prepared regularly in professional career contexts and identify quality indicators of each.
		5.I.(I) Prepare documents and demonstrate effective communication skills appropriate to a variety of job search and career advancement processes .
		5.I.(A) Solicit feedback from multiple sources and revise professional documents appropriate to career goals.

	5.J. Value and demonstrate commitment to continuing education and lifelong learning	5.J.(I) Develop and pursue plans for lifelong learning to support career goals.
		5.J.(A) Promote and contribute to knowledge and experiences of peers which provide foundation for expanded knowledge, growth, and maturity over time.

