

# GRADUATE STUDENT HANDBOOK

2024-2025



COLLEGE OF ENGINEERING

Systems & Industrial  
Engineering

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# 1 Introduction

Welcome to the Department of Systems and Industrial Engineering (SIE) at the University of Arizona! Founded in 1961 as the nation's first systems engineering academic program, the SIE department is committed to providing a welcoming learning and research environment and a comprehensive graduate curriculum leading to Master of Science (MS) and Doctor of Philosophy (PhD) degrees (see <https://sie.engineering.arizona.edu/grad-programs/campus-degrees>). The department offers three MS degrees: Systems Engineering, Industrial Engineering, and Engineering Management, and two Graduate Certificates: Systems Engineering, and Engineering Management. At the doctoral level, the department offers a research-intensive PhD in Systems and Industrial Engineering.

Also, the SIE department hosts MS and PhD degrees in Software Engineering, more information can be found here: <https://sfwe.engineering.arizona.edu/>. For the joint MS Cybersecurity with the Department of Management Information Systems, Eller College of Management, please see here: <https://cybersecurity.arizona.edu/>.

The **purpose** of this handbook is to serve as a guide for current graduate students on requirements for completing SIE graduate programs (MS Systems Engineering, MS Industrial Engineering, MS Engineering Management, and PhD in Systems and Industrial Engineering). Additional information is also provided for prospective students to help them assess opportunities for graduate studies in SIE.

## 1.1 SIE Graduate Studies Administration

The following are key contacts of individuals who will support students in their SIE graduate studies.

### **Graduate Program Coordinator**

The Graduate Program Coordinator provides administrative and operational support for SIE Graduate programs, in addition to advising and assisting students with general procedures related to obtaining a SIE graduate degree.

### **Director of Graduate Studies**

The Director of Graduate studies, also the chair of the SIE Graduate Studies Committee, appointed by the Department Head, oversees graduate programs in SIE. The duties of the Director of Graduate Studies include the following, but are not limited to:

- Provide support and necessary resources to ensure professional well-being and success of SIE graduate students from admission through graduation.
- Lead recruitment, admission, and assessment processes for SIE graduate programs.
- Manage day-to-day operations of SIE graduate programs including review and oversight of plans of study, transfer credits, and other graduate student petitions.

The SIE Graduate Studies Committee, comprised of the Director of Graduate Studies and faculty members appointed by the SIE Department Head, provides overall leadership in administering SIE graduate programs, in collaboration with the Graduate College at the university level: <https://grad.arizona.edu/>.

### **Faculty Advisor**

Upon arriving at the University of Arizona, students are assigned a tentative faculty advisor based on their interests. MS and PhD students interested in pursuing research are required to identify a research advisor before the end of their first year in the program. Students are encouraged to identify and contact faculty members in their area of interest. A list of current SIE faculty, their research areas, and contact information can be found here: <https://sie.engineering.arizona.edu/faculty-staff/faculty>. Once a student and a faculty member agree to work together on research, the student should inform the Graduate Program Coordinator of this change.

### **SIE Graduate Studies Contact Information**

Cindy Nguyen, Graduate Program Coordinator	1127 E. James E. Rogers Way, Room 111
Neng Fan, Director of SIE Graduate Studies	The University of Arizona
E-mail: <a href="mailto:graduateadvisor@sie.arizona.edu">graduateadvisor@sie.arizona.edu</a>	Tucson, AZ 85721-0020

## **2 Master of Science Degrees**

SIE Master of Science (MS) programs are designed to prepare individuals for high-level professional work in systems engineering, industrial engineering, and engineering management.

### **2.1 MS Degree Requirements**

The following general degree requirement applies to all three MS programs: MS in Systems Engineering, MS in Industrial Engineering, MS in Engineering Management.

- Students must earn at least 30 units of graduate credit (courses numbered 5xx, 6xx, 9xx). Credit for SIE 695A, SIE 900, SIE 920, and SIE 930 may not be counted toward the MS degree. No course may be counted toward the requirements for more than two degrees (earned at any institution). For example, an SIE 5xx course can be counted toward the MS in Systems Engineering as well as PhD in SIE, but it cannot be counted toward a third degree (e.g., MS in another program).
- The majority of course work must be taken within the SIE Department. With the faculty advisor's approval, two courses may be taken outside of SIE.
- Students enrolled in an MS degree program are expected to gain in-depth knowledge within specific methodological and/or application areas in SIE. To meet this expectation, students are encouraged to identify two areas of concentration, each consisting of courses related to a common theme. In general, SIE courses that share a common middle digit are related to a common theme.
- All MS students must choose one of the options described below.

MS Degree Options		
Option	Requirements	Min. Units
Project Option	<ul style="list-style-type: none"> <li>27 units of graduate coursework</li> <li>At least 3 units of SIE 909 (MS Report)</li> </ul>	30
Thesis Option*	<ul style="list-style-type: none"> <li>24 units of graduate coursework</li> <li>6 units of SIE 910 (Thesis)</li> </ul>	30
Coursework Option	33 units of graduate coursework	33

\*Thesis option is not available for MS in Engineering Management.

## 2.2 MS Plan of Study

The Plan of Study is the student's contract with the university regarding specific course requirements that the student must satisfy before becoming eligible for the MS degree. Students should consult with their advisor, Graduate Program Coordinator, and/or the Director of Graduate Studies to identify courses to include in the plan of the study. Students are encouraged to submit a completed plan of study through GradPath before the end of the first year in the program.

**Performance Requirements:** A cumulative GPA of 3.0 or higher must be maintained on all coursework taken for graduate credit. A grade of C or higher is required for a course to be used to satisfy the degree requirements (A or B for transfer credits).

## 2.3 MS Report vs Thesis Option

**MS Thesis Option:** Thesis work is designed for students who wish to work with a faculty member on a specific research topic. The thesis is prepared under the guidance of the faculty advisor and is reviewed by an examining committee prior to an oral presentation. As a part of graduation requirements, the thesis must be submitted to the Graduate College for formatting review and publishing in the campus repository. Students wishing to pursue a Doctoral degree are encouraged to choose the thesis option.

**MS Project Option:** The MS project report option is designed for those who wish to work on an applied project. The topic should have practical significance and require application of graduate course material. The project typically involves application of new or existing methodologies to an industrial or community-oriented problem. Occasionally, if the faculty advisor agrees and the project scope is appropriate, up to three students may work together on the same project and produce a joint report.

**MS Committee for Thesis or Project Option:** Students who pursue either the MS thesis or MS project option are required to have a committee of at least three faculty members, including the faculty advisor who will serve as the chair of the committee. At least two members must be current Graduate Faculty (i.e., tenured, tenure-track, or approved tenure-equivalent faculty member). If the third member is not a Graduate Faculty, they must be approved by the Graduate College as a special member.

- For a list of eligible committee members, please see the SIE Graduate Faculty Database: <https://bit.ly/siegradfaculty>.
- Once the committee is formed, the student should submit a *Committee Appointment form* through GradPath.

- A complete draft of the MS Report or Thesis should be shared with all committee members at least two weeks prior to the anticipated defense date.
- How to identify committee members? The committee for the MS thesis or report option will ideally include faculty in the student’s area of interest. The faculty advisor may have suggestions on potential committee members.
- The specific format of thesis or report is defined by the faculty advisor. General formatting guidelines are provided by the Graduate College: <https://grad.arizona.edu/gsas/dissertations-theses/dissertation-and-thesis-formatting-guides>, <https://arizona.app.box.com/v/grad-dissthesis-checklist>.
- All theses and project reports should include a *Statement of External Resources and Support* (pg. 14) that summarizes any assistance sought in writing the document. This may include, but not limited to, funding sources, professional editing services, writing center services, reference management tools, digital writing assistants, and artificial intelligence-supported writing assistants/generators. The format and placement of this statement is up to the student and faculty advisor (For example, this information may be included in the introductory chapter or in the Appendix).

## 2.4 MS in Systems Engineering

The MS in Systems Engineering program is focused on providing design, modeling, and analytical methods for sociotechnical systems in various application domains such as aerospace, communication, defense, healthcare, transportation, and manufacturing. This department was the first Systems Engineering department in the country. It was founded on the premise that if complex systems are to do what is intended, without unwanted side effects, they must be designed not only with imagination and technical skill, but with rigorous attention to the design process itself and to the interactions among the system components and with other systems and society. Consequently, the curriculum provides students with design viewpoints, methods, and tools for modeling and analysis that are especially appropriate for large complex systems.

Required Courses for MS in Systems Engineering		(12 units)
Course Name		Typical Term
SIE 554A Systems Engineering Process		Fall & Spring
SIE 558 Model-based Systems Engineering		Spring
SIE 550 Theory of Linear Systems <b>or</b>		Spring
SIE 531 Simulation Modeling and Analysis		Fall & Spring
SIE 522 Engineering Decision Making Under Uncertainty <b>or</b>		Fall
SIE 530 Engineering Statistics		Fall

## 2.5 MS in Industrial Engineering

The MS in Industrial Engineering program is focused on providing technical knowledge and skill from the physical, engineering, and social sciences to design, integrate, and evaluate systems, while also monitoring and optimizing the system performance.

Required Courses for MS in Industrial Engineering	(9 units)
Course Name	Typical Term
SIE 530 Engineering Statistics	Fall
SIE 540 Survey of Optimization methods <b>or</b> SIE 545 Fundamentals of Optimization	Spring Fall
One course from SIE 56X or 58X series	--

## 2.6 MS in Engineering Management

The MS in Engineering Management is designed for graduate engineers and scientists aspiring to advance into management careers within technological organizations.

Required Courses for MS in Engineering Management	(15 units)
Course Name	Typical Term
SIE 567 Financial Modeling for Innovation	Fall
SIE 557 Project Management	Fall & Spring
SIE 522 Engineering Decision Making Under Uncertainty	Fall
SIE 515 Technical Sales and Marketing	Fall & Spring
SIE 514 Law for Engineers & Scientists	Spring

## 2.7 Accelerated MS Programs

The SIE Accelerated Master's Program (AMP) is designed to allow exceptional undergraduate seniors at the University of Arizona to work concurrently toward an MS degree. Up to 12 units of approved graduate coursework taken in their undergraduate career may count towards both BS and MS degrees, allowing students to earn their MS degree quicker.

**When can undergraduate students apply to the AMP program?** Students interested in the program may apply after completion of a minimum of 75 eligible undergraduate credits. The minimum cumulative GPA of 3.3 is required at the time of application as per the Graduate College.

### AMP Admission Requirements

- Cumulative GPA at the time of admission is 3.3
- A minimum of 90 undergraduate credit hours is required at the time of **entry** into the AMP
- Completion of at least 12 earned undergraduate credits in their major at the University of Arizona. Units still graded Incomplete, units graded Pass/Fail or units taken as audit will **not** count toward the requirement of the 12 undergraduate units
- **Applicant Background:** SIE students should complete the following pre-requisite courses prior to applying. Courses equivalent to these prerequisites taken at other departments or institutions will be allowed. Applicants from a non-SIE background will also be reviewed on a holistic basis.
  - SIE 305: Introduction to Probability and Statistics
  - SIE 321: Probabilistic Models in Operations Research (optional for MS in EMG students)
  - SIE 340: Deterministic Operations Research
- **Application Materials:** Eligible candidates should submit the following materials: Three letters of recommendation, a statement of purpose, and a CV/Resume. GRE is not required for AMP admission.

### Academic Policies related to the AMP

- Once students are admitted to the AMP, they are strongly encouraged to see the Graduate Program Coordinator and the SIE Undergraduate Advisor to discuss their plan of study. Students pursuing MS thesis or report plan must select a faculty advisor and submit a preliminary thesis/report proposal and plan of study before the end of the first semester after being admitted to the AMP.
- SIE 500 level courses that are convened with 400 level courses and their 400 level courses are required for a BS degree cannot be counted toward an MS degree. For example, if a student is enrolled in the BS in Industrial Engineering (INE) program, SIE 531 cannot be counted toward the student's MS INE degree as SIE 431 is required for the BS INE program. However, if a student is enrolled in the BS in Systems Engineering (SYE) program, SIE 530 can be counted toward both the BS SYE and MS SYE as SIE 430 is not required for the BS SYE.

AMP academic policies and tuition policies are defined by the Graduate College and are described in the General Catalog at <https://catalog.arizona.edu/policy/accelerated-masters-program-amp#policies>.

## 3 Graduate Certificate Programs in SIE

### 3.1 Graduate Certificate in Engineering Management

The Professional Graduate Certificate in Engineering Management is intended for professionals who desire the knowledge and skills to effectively manage resources in technology-based organizations. Students develop an understanding of decision-making theory and methodology, financial modeling and analysis, and project management strategies. They will learn to utilize modern software packages to manage human and material resources efficiently and effectively. All coursework for this certificate is available via on campus or online. Requirements for this program include four courses (12 units of study), of which three are required and one is an elective:

Required Courses for Certificate in Engineering Management
SIE 567 Financial Modeling for Innovation
SIE 557 Project Management
SIE 522 Engineering Decision Making Under Uncertainty
<b>Elective:</b> Choose <b>one</b> of the following
SIE 506 Quality Engineering
SIE 515 Technical Sales and Marketing
SIE 531 Simulation Modeling and Analysis
SIE 540 Survey of Optimization Methods

### 3.2 Graduate Certificate in Systems Engineering

The Professional Graduate Certificate in Systems Engineering offers valuable resources for any engineer responsible for the oversight, creation, or operation of a complex system. It provides essential education for systems engineers, design engineers, lead engineers, total-life-cycle engineers, senior software systems engineers, and project managers seeking to increase their professional knowledge and advance their careers.



All coursework for this certificate can be earned online as well as on-campus. Requirements for this program include four courses (12 units of study), of which three are required and one is an elective:

Required Courses for Certificate in Systems Engineering
SIE 554A Systems Engineering Process
SIE 531 Simulation Modeling and Analysis
SIE 558 Model-based Systems Engineering <b>or</b> SIE 654 Advanced Concepts in Systems Engineering
<b>Elective:</b> Choose <b>one</b> of following SIE 530 Engineering Statistics SIE 540 Survey of Optimization Methods SIE 654 Advanced Concepts in Systems Engineering SIE 550 Theory of Linear Systems SIE 522 Engineering Decision Making Under Uncertainty

## 4 SIE Doctor of Philosophy

The Systems and Industrial Engineering Doctor of Philosophy Program (PhD) is designed for individuals wishing to pursue advanced research and scholarly work.

### 4.1 Doctoral Coursework and Plan of Study

The Plan of Study is the student's contract with the university regarding specific course requirements that the student must satisfy before becoming eligible for the PhD degree. This includes a minimum of 48 units of non-dissertation course work (of which 12 units will be applied to the minor), at least 36 of which must be SIE-type domain courses approved by the faculty advisor and the Director of Graduate Studies, plus at least 18 units of dissertation research. The overall coursework should include at least 21 units taken from the SIE Department.

SIE Doctoral Plan of Study		Min. Units
Coursework (48 units)		
Required Core Courses	<p><b>Three</b> core courses, one from each core area:</p> <p>Probability &amp; Statistics</p> <ul style="list-style-type: none"> <li>• SIE 520 Stochastic Modeling I <b>or</b></li> <li>• SIE 530 Engineering Statistics</li> </ul> <p>Optimization</p> <ul style="list-style-type: none"> <li>• SIE 540 Survey of Optimization <b>or</b></li> <li>• SIE 545 Fundamentals of Optimization</li> </ul> <p>Systems Engineering</p> <ul style="list-style-type: none"> <li>• SIE 554A: The Systems Engineering Process <b>or</b></li> <li>• SIE 550 Theory of Linear Systems</li> </ul>	<b>9 units</b>
Elective Courses	<p>27 units of SIE-related coursework</p> <ul style="list-style-type: none"> <li>• At least 12 units must be taken from SIE.</li> </ul>	<b>27 units</b>

	<ul style="list-style-type: none"> <li>The remaining 15 units may be taken from SIE or a SIE-related domain with approval from the faculty advisor &amp; the Director of Graduate Studies.</li> </ul>	
Minor Courses	12 units of minor coursework <ul style="list-style-type: none"> <li>All minor coursework (12 units) can come from a single discipline or split between two disciplines (6 units from each discipline).</li> </ul>	<b>12 units</b>
<b>Colloquium &amp; Dissertation Research</b>		
Colloquium	SIE 695A Graduate Seminar: Minimum 2 units required	2 units
Dissertation Research	SIE 920 Dissertation: Minimum 18 units required	18 units

**Performance Requirements:** A cumulative GPA of 3.0 or higher must be maintained on all coursework taken for graduate credit. A grade of C or higher is required for a course to be used to satisfy the degree requirements (A or B for transfer credits). Doctoral students are also required to actively participate in and contribute to research activities with mentorship from their faculty advisor. An annual progress report is due on May 31<sup>st</sup> of every year.

**Can graduate coursework from a master's degree be applied toward the PhD degree?** With approval from the student's faculty advisor, graduate coursework applied toward a master's degree may be applied toward the PhD. Non-coursework credits (e.g., thesis or research credits) from a master's degree cannot be applied toward the PhD degree. Transfer credits are subject to the following restrictions:

- A maximum of **30 units** of relevant coursework from another graduate degree may be transferred and applied toward the PhD requirements.
- The credits must first be reviewed and approved by the student's faculty advisor.
- The minimum grade for transferred credits must be an A, B, or the equivalent at the institution where courses were taken.

**Participation in SIE Graduate Seminar/Colloquium:** Students must take at least two and no more than three units of SIE 695A Graduate Seminar. This class will be graded as Pass/Fail. To fulfill this requirement, students must attend the department seminars during each semester where they are enrolled in SIE 695A. Prior to completing the seminar requirement, the student must also give a research presentation to the class. After completing the seminar requirement, students are highly encouraged to continue attending graduate seminars of interest to their research area.

**Are independent study credits (e.g., SIE 699) applicable to PhD coursework?** Three units of independent investigation may be included in the plan of study, provided the independent study covers a topic not available through regular courses and a detailed course plan is submitted to and approved by the Graduate Studies Committee

**Are SIE 900 credits applicable to PhD coursework or dissertation research?** SIE 900 research credits may not be counted toward the PhD Degree.

**Minimum registration requirement for funded students:** Students funded by the SIE Department are required to be enrolled in at least nine graduate units per semester to maintain their appointment.

Year 1	<ul style="list-style-type: none"> <li>• Complete core SIE courses</li> <li>• Identify your research and professional interests</li> <li>• Get acquainted with peers in your cohort as well as faculty/staff in the department</li> <li>• Identify a faculty advisor by the end of the second semester</li> <li>• Register and prepare for the Doctoral Qualifying Exam (DQE) during summer</li> </ul>
Year 2	<ul style="list-style-type: none"> <li>• Take the DQE at the start of the second year</li> <li>• Develop and submit a Doctoral Plan of Study</li> <li>• Continue taking elective coursework and begin minor coursework</li> <li>• Develop a research plan with mentorship from your faculty advisor</li> </ul>
Year 3	<ul style="list-style-type: none"> <li>• Refine and implement your research plan</li> <li>• Begin developing a dissertation research proposal</li> <li>• Complete any remaining coursework</li> </ul>
Years 4 – 5 or later	<ul style="list-style-type: none"> <li>• Continue refining and implementing your research plan</li> <li>• Complete written comprehensive exam &amp; then schedule oral comprehensive exam</li> <li>• Begin identifying career opportunities**</li> <li>• Begin disseminating your research ideas and findings**</li> </ul> <p><i>Final Semester</i></p> <ul style="list-style-type: none"> <li>• Complete doctoral research, including writing the dissertation</li> <li>• Schedule a final oral defense when the research is complete, and the written dissertation is ready for sharing with committee members</li> <li>• Defend your dissertation and submit an approved, electronic copy of the dissertation to the Graduate College</li> <li>• Complete the exit survey</li> </ul>

\* Annual progress report is due by May 31<sup>st</sup> of every year. \*\* Exploring career opportunities and writing and disseminating research ideas and findings through presentations and peer-reviewed publications are ongoing activities and may start early in the program.

## 4.2 Doctoral Minor

**For SIE PhD Students:** Doctoral students in SIE are required to choose a minor and minor advisor outside of SIE and complete 12 units of graduate coursework in the minor department/program. Common minor programs for SIE students are computer science, information science, statistics, and other engineering programs (e.g., biomedical, computer, or mechanical engineering). Students can also choose to do a split minor between two programs (6 units in each minor program) or a multidisciplinary minor. The minor advisor typically serves on the student’s comprehensive exam committee. Their participation in the final dissertation committee is at the discretion of the student’s major advisor.

**For non-SIE PhD Students:** Doctoral students in any department/program outside of SIE may choose to minor in SIE. Students intending to minor in SIE should first identify a SIE faculty as their minor advisor. The PhD minor in SIE consists of 12 units of graduate coursework. A minor that is split between SIE and another academic department/program requires 6 units of graduate coursework in SIE and 6 units of coursework in the other program. Participation of the SIE minor advisor in written and oral comprehensive exam and final defense is at discretion of the minor and major advisors.

### 4.3 Doctoral Qualifying Exam

**Purpose:** The purpose of the Doctoral Qualifying Examination (DQE) is to assess students' fundamental knowledge in specific SIE domains and whether students have an integrated understanding in those domains as well as their readiness of a student to undertake advanced graduate work.

**Topics:** This exam encompasses five fundamental domains listed below. In consultation with their faculty advisor, students should select **three** of the following areas.

- Probabilistic Models (covered in SIE 520)
- Engineering Statistics (covered in SIE 530)
- Optimization (covered in SIE 545 or SIE 540)
- Systems Theory (covered in SIE 550)
- Systems Engineering Processes (covered in SIE 554A)

**Format and Timing:** This exam is administered at the start of every academic year. Students are required to take the exam at the start of their second year in the program. To register for the exam, students must have a cumulative GPA of 3.5 or higher in courses selected for their DQE.

**Evaluation:** Students are evaluated holistically considering their performance in all three selected DQE areas, their grades in SIE core courses, and recommendations from faculty. Each DQE area faculty recommend whether a student receives a grade of "high pass," "pass," or "fail" in their corresponding DQE area, for faculty approval at the DQE evaluation meeting. Based on these recommendations and their performance in SIE courses, students are evaluated as: (1) pass, (2) conditional pass with additional course requirements, or (3) fail either the entire or parts of the DQE. Students failing the DQE can retake the exam for the second time. Students failing the DQE twice are required to withdraw from the PhD program.

### 4.4 Doctoral Comprehensive Exam

**Purpose:** The purpose of the comprehensive examination is to determine whether the student has developed sufficient background and expertise for research in the field of their planned dissertation. Successful completion of the examination leads to formal admission to PhD candidacy.

**Format:** This exam includes written and oral portions covering the major and minor areas of the student. Shortly after successful completion of the written portion, an oral exam is conducted by a committee appointed by the Dean of the Graduate College in consultation with the department.

- **Written Comprehensive Exam:** The student will send a summary of the dissertation proposal to the committee when they are ready for taking the comprehensive exam. Each committee member will then develop a set of questions related to the student's area of specialization and, when appropriate, on any aspect of the student's proposed dissertation. The nature and type of questions as well as the timeline for the student to respond to the questions (e.g., few weeks to a month) are up to each committee member.
- **Oral Comprehensive Exam:** After completing all written portions, the student can schedule an oral exam with the committee. The oral exam typically includes a presentation based on the proposed dissertation research.

**Timing:** The comprehensive exam is typically taken at least a semester to a year before the final dissertation defense. It is recommended that the comprehensive exam is taken at least nine months before the final defense.

**Evaluation:** Students are evaluated on their ability to formulate and analyze research problems using theory and methods from their major and minor areas of specialization as well as their written and oral communication.

- For the written comprehensive exam, each committee member will assess the outcome as pass or fail. A committee member may ask for clarifications or revisions to the written exam once. Satisfactory response to *all* questions from each committee member constitutes a pass in the written exam.
- For oral comprehensive exam, each committee member will assess three areas (extent of pertinent literature review and analyses; depth and originality of research problem and methods; communication) on a scale of 1 to 5. A score of 3 or above on all three areas from all committee members is considered as pass. When the student passes the oral comprehensive exam, they are recommended to the Graduate College for acceptance as a PhD candidate. At the discretion of the committee, the student may repeat the oral comprehensive exam once within four months, incorporating specific recommendations from committee members.

**Comprehensive Exam Committee:** The committee must consist of a minimum of four members, of which one member must be a minor representative. Three members, including their major and minor advisors, must be current tenured, or tenure track faculty members or approved tenure equivalent. The fourth member may be an approved special member. The minor faculty advisor may choose to waive the written portion of the exam but is required to participate in the oral comprehensive exam.

#### 4.5 Doctoral Final Exam: Written Dissertation and Final Oral Defense Exam

**Purpose:** The purpose the doctoral final exam is to assess the merit and contributions of the candidate's doctoral research. This doctoral final exam is a culmination of the candidate's original research conducted during their PhD program.

**Format:** There are two components to the doctoral final exam: a written dissertation and a final oral defense of their dissertation.

- **Written Dissertation:** The candidate should develop a written document that demonstrates all aspects of their research including significance of the work, a detailed review of relevant literature, methodologies employed and/or developed, significant findings from the work, a critical discussion of the findings, limitations, and the impact, and potential for future research.
  - The specific format of written dissertation is defined by the faculty advisor. General formatting guidelines are provided by the Graduate College:  
<https://grad.arizona.edu/gsas/dissertations-theses/dissertation-and-thesis-formatting-guides>
  - The dissertation should include a *Statement of External Resources and Support* that summarizes any assistance sought in writing the dissertation. This may include, but not limited to, funding sources, professional editing services, writing center services, reference management

tools, digital writing assistants, and artificial intelligence-supported writing assistants/generators. The format and placement of this statement is up to the student and faculty advisor. (For example, this information may be included in the introductory chapter or in the Appendix).

- Guidelines for the SIE Statement of External Resource and Support can be found here: <https://bit.ly/SIExtResourcesGuide>.
- **Final Oral Defense:** When the doctoral candidate has met the rigor and standards of scholarship and has documented the research in a dissertation, the candidate will publicly defend the dissertation and answer any general questions related to their work. The exact time and place of the oral defense must be announced publicly at least two weeks in advance of the oral defense. The oral defense is facilitated by a faculty committee appointed by the Dean of the Graduate College in consultation with the major department and chaired by the faculty advisor. The presentation portion of the oral defense is open to the public. Following the public presentation and discussion, the candidate will participate in a closed meeting with the committee for further evaluation.

**Timing:** The oral defense can be scheduled when both the candidate and faculty advisor agree that the proposed dissertation research is complete, rigorous, and of high quality. The written dissertation should be complete at the time of scheduling the oral defense. An electronic version of the dissertation should be shared with all committee members at least two weeks prior to the oral defense date. Additionally, an *Announcement of Oral Examination Form* should be completed and submitted via GradPath at least two weeks (i.e., 10 business days) prior to the oral defense date. This announcement should include a copy of the dissertation abstract as well as the *Statement of External Resources and Support*.

**Evaluation:** The dissertation committee will assess the originality, merit, and contributions of the candidate's research. This includes their ability to (a) identify and critically evaluate relevant literature, (b) formulate and solve original problems using SIE theory and methods, and (c) interpret and communicate research ideas and findings. Further guidelines for the oral defense are provided by the Graduate College: <https://arizona.app.box.com/v/grad-gsas-finaldefnsinstr>.

**Dissertation Committee:** The committee must consist of a minimum of three faculty members, all of whom must be current University of Arizona faculty members that are either tenured, tenure-track, or approved as tenure equivalent. Fourth and any additional committee members can be tenured or tenure-track or approved special members. All dissertation committee members are expected to attend the entire final defense.

## 5 Resources and Academic Policies for SIE Graduate Students

### 5.1 Grievance Procedures

A graduate student with any type of grievance should first communicate with their faculty advisor or Director of SIE Graduate Studies, depending on who is more appropriate from the student's view. Should the issue not be properly addressed by either faculty members, the student may bring the matter to the attention of the Graduate Program Coordinator and the SIE Department head.

- When issues cannot be resolved at the department-level, the student is encouraged to review the Graduate College grievance policy; <https://grad.arizona.edu/policies/academic-policies/grievance-policy>.
- Summary of Grievance Types and Responsibilities is here: <https://grad.arizona.edu/policies/academic-policies/summary-grievance-types-and-responsible-parties>.
- If a student believes they have been subject to discrimination or harassment based on race, religion, color, sex, age, national origin, disability, veteran status, sexual orientation, gender identity or genetic information, they can report such issues to the Office of Institutional Equity: <https://equity.arizona.edu/>.

## 5.2 Satisfactory Academic Progress

Graduate students are required to maintain a minimum 3.00 cumulative GPA. Students should consult with both their faculty advisor and Graduate Program Coordinator to discuss issues pertaining to unsatisfactory progress that may result in academic probation: <https://grad.arizona.edu/policies/academic-policies/academic-probation>.

Students who fail to meet the GPA requirement will be placed on academic probation for one semester. Students on academic probation, under the advisement of their faculty advisor, will meet to develop a mentoring plan to raise the cumulative GPA. If after one semester the cumulative GPA has not been raised, the graduate studies committee will decide whether to: (1) academically disqualify the student from the program; or (2) with approval from the Graduate College, allow the student to continue probation upon approval of a justification waiver. The student is expected to continue working with their faculty advisor and Graduate Program Coordinator to improve their academic standing. Students who fail to make satisfactory progress for two consecutive semesters will be dismissed from their program.

## 5.3 Incomplete Grades

Students earning a grade of Incomplete, “I” are encouraged to submit a completed Report of Incomplete form to the Graduate Student Coordinator: <https://registrar.arizona.edu/faculty-staff-resources/grading/grading-policies/incomplete>.

- Incomplete grades should be completed in a timely manner and are submitted at the discretion of the course instructor. Per the Graduate College, any incomplete grade must be completed no later than one year from the last day of the term for the course for which the student received the incomplete: <https://catalog.arizona.edu/policy/grades-and-grading-system#incomplete>.
- If an additional extension is needed, the student may submit a Graduate Course Extension Petition to be reviewed by the Graduate College prior to the one-year deadline.

## 5.4 Graduate Student Academic Services

The graduate student academic services (GSAS) within the graduate college help students, staff, and faculty advisors keep track of academic progress and the steps needed to complete a graduate degree: <https://grad.arizona.edu/gsas>.

Links to Graduate College Resources	
GradPath is the Graduate College’s degree audit system that facilitates tracking and monitoring of academic progress. GradPath allows the graduate student, our SIE program, and	<a href="https://grad.arizona.edu/gsas/gradpath">https://grad.arizona.edu/gsas/gradpath</a>

Graduate College to see where a student is in their academic journey at a glance.	
Overview of Degree Requirements: In addition to SIE degree requirements, graduate students must meet requirements of the Graduate College as described in the link on the right.	<a href="https://grad.arizona.edu/gsas/degree-requirements">https://grad.arizona.edu/gsas/degree-requirements</a> .
Important dates and deadlines related to graduate degree	<a href="https://grad.arizona.edu/gsas/degree-requirements/important-degree-dates-and-deadlines">https://grad.arizona.edu/gsas/degree-requirements/important-degree-dates-and-deadlines</a>
Commencement Information	<a href="https://grad.arizona.edu/gsas/commencement">https://grad.arizona.edu/gsas/commencement</a>
Graduate College Forms	<a href="https://grad.arizona.edu/forms/gsas">https://grad.arizona.edu/forms/gsas</a>
The current Degree Counselor for all SIE graduate programs is Kristi Davenport; kdavenport@arizona.edu	<a href="https://grad.arizona.edu/directories/degreecounselors/">https://grad.arizona.edu/directories/degreecounselors/</a>

## 5.5 Resources for Healthy and Productive Graduate Student Life

The following are curated set of resources\* for healthy, happy, and productive graduate student life at the University of Arizona.

- Professional Development resources including writing resources, teaching workshops and seminars, and resources for expanding language abilities: <https://gradcenter.arizona.edu/resources>
- Graduate Assistant/Associate Benefits including parental leave, family and medical leave, bookstore discount, and health insurance: <https://grad.arizona.edu/funding/ga/benefits-appointment>
- Health and well-being: List of comprehensive services and support for physical, mental, emotional well-being for graduate students: <https://www.arizona.edu/health-wellness-students>
- Child and Elder Care: <https://lifework.arizona.edu/>
- Safety: Link to sign-up for campus emergency alerts - <https://cirt.arizona.edu/ualert>
- **Student Support Groups and Organizations:**
  - Graduate Student Professional Council: <https://gpsc.arizona.edu/>
  - Office of Fellowships and Community Engagement: <https://gradcenter.arizona.edu/gcof/>
  - SIE-specific organizations: <https://sie.engineering.arizona.edu/undergrad-programs/student-clubs>

\*The primary source for all the above information comes from the Graduate College: <https://grad.arizona.edu/new-and-current-students>

## 5.6 Financial Assistance

### Graduate Teaching and Research Assistantships

Financial assistance is available through the SIE Department in limited amounts, in the form of Graduate Teaching Assistantships (GTA) and Graduate Research Assistantships (GRA). Online students are generally not eligible for these assistantships.

- *Teaching Assistantships:* GTAs are allocated on a competitive basis, with priority given to incoming students who exhibit outstanding potential and to continuing students who are making satisfactory progress toward their graduate degree. GTAs are normally provided for a maximum of three semesters for a student in an MS degree program, or for a total of six semesters for a student pursuing a PhD.



- *Research Assistantships:* A limited number of GRAs are available for students who are exceptionally well-prepared to aid faculty research activities. Funding decisions on GRAs rest directly with those faculty members with grant funding. Interested students should discuss the availability and requirements for GRA funding with their faculty advisor.

*Minimum registration requirement for funded students:* Students funded by the SIE Department are required to be enrolled in at least nine graduate units every semester to maintain their appointment.

### **Tuition Scholarships**

Each semester the SIE Department awards a limited number of tuition scholarships, which provides partial tuition waivers for graduate students. To be eligible, a student must be enrolled for nine or more graduate units, be in good academic standing, and have a GPA of 3.50.

### **Graduate Fellowships**

SIE graduate students are actively considered for fellowships at the department, college, and University levels, as well as external fellowship opportunities.

- *SIE PhD Scholarship Initiative:* The Department of Systems & Industrial Engineering offers a comprehensive, merit-based, four-year scholarship to selected PhD students. The SIE PhD Scholarship Initiative recruits the most distinguished domestic and international doctoral students and offers a competitive financial package, dedicated mentoring, and professional development opportunities through engagement in world-class research, teaching and outreach. Each recipient is offered a full-time graduate assistantship that includes stipend, health insurance premiums, travel support for professional conferences, and access to mentored research rotations.
- *College Fellowships:* The College of Engineering offers a range of graduate fellowships to highly qualified MS and PhD students. The SIE Graduate Studies Committee nominates current and incoming graduate students for college fellowships on a regular basis as opportunities arise.
- *University Fellowship Program:* As the flagship initiative of the Graduate College, the University Fellows program is offered to highest-ranked incoming doctoral students. Every year, the SIE Graduate Studies Committee nominates two incoming doctoral students. More information on this program can be found here: <https://gradcenter.arizona.edu/university-fellows-program>.
- *Funding and Financial Information from the Graduate College:* <https://grad.arizona.edu/funding>

### **Travel Funding**

SIE Graduate Students engaged in research and scholarly work are highly encouraged to disseminate their work through professional conferences and journal publications. The following are funding sources to support conference travel. The award amount depends on the department's budget and funding availability.

- *2024-2025 Academic Year Departmental Travel Funding:* The SIE Department will provide up to \$400 (based on actual reimbursement), and it is expected that the remaining travel costs will be covered by the faculty advisor's research funding or other sources. Instructions for the SIE Travel Funding can be found here: <https://bit.ly/siegradtravel>.

- *Graduate and Professional Student Council (GPSC) Travel Grant:* <https://gpsc.arizona.edu/travel-grants>.

## 6 Information for Prospective Graduate Students

### 6.1 Graduate Admissions

For regular admissions, applicants should have a bachelor's degree in engineering, mathematics, physical sciences, or a related field. Application for admission is made by applying through GradApp: <https://apply.grad.arizona.edu/users/login>. All applications require academic transcripts, a statement of purpose describing their intent and motivation to pursue a graduate degree in SIE, three letters of recommendation, and a resume or curriculum vitae. Application deadlines and other admission details are available at <https://sie.engineering.arizona.edu/grad-programs/admissions>.

### 6.2 Minimum Admission Requirements

Applicants interested in pursuing any SIE graduate degree or certificate must meet the following minimum requirements:

- A minimum 3.0 cumulative GPA in their overall undergraduate degree or in the last 60 units of their undergraduate degree.
- Hold a BS degree in math, physics, chemistry, or engineering or related field.

#### **Students with BS Degree outside of Systems and Industrial Engineering**

Students with BS degrees in disciplines not directly related to Systems and Industrial Engineering may be admitted into the MS or PhD program. However, those students may be required to complete a certain number of undergraduate deficiency courses prior to enrolling in graduate courses for SIE. Furthermore, PhD students who do not have a BS in System and Industrial engineering must demonstrate competency in at least three courses selected from the 3xx-level SIE courses, in consultation with a faculty advisor, that are needed for the Systems or Industrial Engineering BS degree.

Any required deficiencies for a PhD student are determined by the student's faculty advisor and must be submitted to the SIE Graduate Studies Committee during the first semester. Students are encouraged to take pre-requisite and co-requisite courses for audit or credit, even though they are not required. Otherwise, students may need to learn the material from these courses on their own time to successfully pass the required deficiency courses. The following are suggestions for PhD students to satisfy any undergraduate deficiencies:

1. Provide proof (transcript and a description of the course) of satisfactorily completing equivalent coursework at an institution recognized by the University of Arizona.
2. Complete the needed deficiency courses at the University of Arizona with a grade of B or better for undergraduate credit.
3. Receive course credit by examination (consult with the SIE Graduate Studies Committee) if allowed.

**Is an MS degree required for applying to the SIE PhD program?** The SIE doctoral program does not require applicants to have an MS degree to be admitted. Admitted PhD students have the option to earn a SIE MS degree enroute to their PhD. Students interested in this option should contact the Graduate Program Coordinator during their second year in the program.

For all other questions, please visit <https://sie.engineering.arizona.edu/grad-programs/admissions> or e-mail [grad@sie.arizona.edu](mailto:grad@sie.arizona.edu).

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