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I Doctor of Philosophy (PhD) in Systems Engineering Program Description

The Doctor of Philosophy (PhD) in Systems Engineering is a trans-disciplinary graduate program offered by The Polytechnic School. The program is aimed at advancing the understanding of complex engineering systems, where these systems are inclusive of technological aspects as well as social, cultural, environmental, and other interacting components that impact the input, output, and interactions within a system. The program will prepare students to identify, model, analyze, interpret, optimize and manage the multidimensional interactions of the ever-increasing complexity of modern societal and technological challenges. A typical incoming student in this program would have a master’s degree in engineering or related discipline. Students will be required to complete a core of five courses of three credits each. The core provides the foundation for systems thinking, systems identification, systems modeling, systems design and analysis, and perspective taking using diverse disciplinary methodological approaches. Students graduating from this PhD degree program will possess the necessary expertise to advance systems integration of key industry and government sectors, and to contribute to the body of knowledge on interdisciplinary methods, techniques, and strategies for designing and managing complex systems over their life cycle.

II Objectives of the PhD in Systems Engineering Student Handbook

This handbook has been developed for students that are enrolled in or considering applying for admission to the PhD in Systems Engineering degree program in the Polytechnic School. The objective is to provide program specific information regarding admissions, curricular requirements and both university and programmatic policies and procedures. As such, this handbook is complimentary to the Polytechnic School Graduate Handbook and to the ASU Graduate College Policies and Procedures Handbook. It is the responsibility of the student to obtain and familiarize themselves with these documents.

All graduate degrees in Engineering that are available in the Polytechnic School are briefly discussed in the next section of this document. However, please note that this handbook is written specifically to provide information and guidance for the PhD in Systems Engineering program. Separate handbooks are available for the MSE and PhD in Engineering Education Systems and Design (EESD) programs referenced below.

III Overview of Graduate Programs in the Polytechnic School

The Polytechnic School, a member of the Ira A Fulton Schools of Engineering, offers three graduate degrees in Engineering: Master of Science in Engineering (MS), PhD in Systems Engineering, and PhD in Engineering Educations Systems and Design. The MS degree requirements include three culminating experience options: Portfolio, Applied Project, or Thesis. Students in the MS Engineering program must choose one of these three options and complete it in order to graduate. The Thesis option requires a formal oral defense of the thesis, the Applied Project requires a written report and presentation of the project, and the coursework option requires a final portfolio covering material from the core courses. The PhD degrees are offered to exceptional applicants that have completed a Master’s degree in engineering or a closely related discipline. Both PhD programs require successful completion of a qualifying exam, a comprehensive exam, and an oral defense of a written dissertation. These requirements are explained in detail in the program specific graduate handbooks.
IV Admission Requirements

Eligibility
Admission to the PhD in Systems Engineering program requires completion of a Bachelor or Master of Science degree in an Engineering discipline or a closely related field from a regionally accredited institution or the equivalent from an international institution that is officially recognized by that country in engineering, physical sciences, mathematics or a similar field. In addition to an applicable Master’s degree, admission requires a minimum of a 3.5 cumulative GPA (scale is 4.0 = A) in the Master’s degree program. The number of students admitted to the program is limited, and admission is, as a consequence, competitive.

In addition, students that have demonstrated exceptionally good performance in their undergraduate programs can, upon completion of their BS in Engineering, be admitted to the direct BS to PhD program. This track requires a cumulative undergraduate GPA of 3.75/4.0 or better coupled with a record of research and/or leadership accomplishments.

Application Process
The admission process begins with the online Graduate Admission application. The application will require that following items must be submitted:

- Official transcripts from each college or university attended.
- A personal statement detailing the applicant’s background, professional goals and research experience.
- A professional CV/resume.
- Letters of recommendation from at least three professional references, at least one of which must be a faculty member at an institution attended by the applicant.
- Official GRE general exam scores.
- For students with a BS applying for PhD program directly, a letter of support from the Engineering faculty interested in supervising/chairing the committee is required.
- Scores from the Test of English as a Foreign Language (TOEFL) or the International English Testing System (IETLS) are required of all international applicants except those from countries whose native language is English.

Application Deadlines
The priority application deadlines are January 15th of the same year for Fall semester admission and August 1st of the preceding year for Spring semester admission.

Evaluation of Applications
There are many factors that will be considered in evaluation of applicants for this program. These include cumulative GPA, institutions the applicant has attended, the personal statement, research experience, letters of recommendation, performance on the GRE and other standardized tests, performance in individual courses, and the number of positions available in the program.

Academic units submit recommendations regarding admission decisions to the Graduate Education; only the Dean of the Graduate Education can make formal offers of admission. Applicants are able to monitor the status of their application through My ASU. If admitted, the formal letter of admission can be downloaded from My ASU. If denied admission, letters are sent via email to the address on record.
V Systems Engineering PhD Degree Requirements

Fundamental Requirement of the PhD Degree
The PhD degree is the highest academic credential conferred by the University. Attainment of a PhD requires that a student demonstrates the capacity to produce and sustain original independent research in the chosen field and that this research be validated through two or more publications in reputable peer reviewed journals or conference proceedings, as approved by the graduate program committee. The process and curriculum described below is designed to lead students through the attainment of a high degree of technical maturity, into candidacy, and finally to the production and oral defense of a written dissertation.

Credit Hour Requirements
The PhD degree requires a minimum of 84 credit hours beyond the bachelor’s degree, not including deficiency courses. A maximum of 30 credits can be transferred from a Master’s degree. Credits transferred from an accelerated Master’s degree may only include those that were not used as part of undergraduate degree requirements.

Outline of the Process for the Obtaining the PhD Degree
The PhD in Systems Engineering will be awarded to candidates that complete the curriculum and demonstrate the capacity to produce independent and relevant research. For full time students this process is nominally about four years long. However, the evolution of a research project is difficult to predict and the time required to finish the degree can vary substantially among individuals. This process involves several milestones, some of which are themselves processes while others are discreet events. Details of these milestones are discussed later in this document, but a short outline of the process is given below:

- Interview faculty and identify research topics of interest in the first semester of attendance.
- Complete the PhD qualifying examination for Systems Engineering within the first two semesters of enrollment.
- Identify a faculty member that agrees to serve as the PhD research advisor, and establish a Program Committee.
- File an Approved Plan of Study
- Complete the 15-credit core curriculum and additional specialized coursework sufficient to meet the degree requirements of 30 credit hours of coursework.
- Pass the Comprehensive exam and obtain approval of the dissertation prospectus, thus advancing to candidacy.
- Write the Dissertation and successfully defend the work.

Master in Passing (MIP)

Students on the direct BS-PhD track may apply for a Masters in Passing (MIP) upon completion of 30 hours of approved graduate coursework. The requirements are:

1. Completion of 30 cr. hrs of graduate coursework including at least 9 cr. of approved mathematics courses.
2. Students can apply for the MIP after successful completion of the comprehensive exam.
3. The MIP for PhD students requires a separate iPoS, and all grades must be entered before the MIP is awarded.
4. Students should work closely with the graduate advisor (Amy Wolsey) to ensure approved
iPOS and graduation application is on file for the MIP.

Faculty Research Advisor
The faculty research advisor plays the central role in the student’s maturation into an independent
scholar, and this relationship is of paramount importance to the success of candidates. Consequently, in the first semester of enrollment students that are not already involved in a research program should begin to interview and identify faculty whose research interests align with their own and with whom they are interested in working. As this process unfolds students may directly ask faculty to serve as their advisor and the faculty member may or may not agree to do so. If the interview process does not result in identification of a research advisor, students must submit a short document detailing their research interests along with a ranked list of four potential faculty advisors to the Graduate Programs committee, who will assign an advisor. As soon as the research advisor is identified, students should begin discussing and investigating potential research topics with their advisor.

Core Curriculum and Mathematics Requirements
All PhD students must complete at least 9 credits of approved mathematics courses after the completion of their Bachelor’s degree. No more than six of these credits may be transferred from a Master’s degree program. Approval of courses that include sufficient mathematical rigor is the responsibility of the Graduate Program Chair.

All students enrolled in the PhD in Systems Engineering must complete the following core courses as early as is reasonable in their program:

- EGR 602: Principles of Independent Research
- EGR 608: Advanced Simulation
- EGR 611: Complex Engineering Systems
- MAE 501: Linear Algebra in Engineering
- MAE 502: Partial Differential Equations in Engineering

If the faculty committee determines that a student needs additional preparation before taking one or more of the core courses, they may be assigned required deficiency courses. The required deficiency courses may not be used as part of the Plan of Study, although the grades received in these courses will be used in computing the overall GPA.

Additional Courses
In addition to the core courses, which total 15 credit hours, students are required to complete, at a minimum, an additional 15 hours of coursework. These courses must be chosen in consultation with the research advisor and should be designed to develop a depth of expertise in the research area of interest.

Qualifying Examination
Within the first two semesters of enrollment, all PhD students in Systems Engineering must pass a Qualifying Examination. The purpose of this examination is to ensure that students have the capacity to conduct independent research before they have invested too much time in the program. In consultation with student’s faculty advisors, members of the graduate programs committee will administer the qualifying examination once each semester, and will also be responsible for advising
students regarding the expectations for the exam. There are three possible outcomes of the first attempt at the qualifying exam:

1. Pass with no restrictions
2. Fail, with an option of one re-examination
3. Fail, dismissal from the program.

Students that fall into the second category will be advised with respect to actions they should take before the second attempt at the qualifying exam. (This advice may include recommendations for deficiency courses, but if such a recommendation is made, these deficiency courses may not be used as part of the PhD iPOS.) Students that are seriously deficient on the first attempt at the exam and those that fail the exam a second time will be dismissed from the program.

Note: As of now, successful completion of “EGR 602: Principles of Independent Research” is considered an option for Qualifying Examination.

PhD Plan of Study (iPOS)
Before the beginning of the third semester in attendance, all PhD students in Systems Engineering are required to file a Plan of Study (iPOS) through MyASU. A minimum of 84 semester credit hours are required for the PhD degree, distributed as follows:

- A maximum of 30 credit hours of coursework from a previous Master’s degree in Engineering or a related field may be applied to the PhD. Credits transferred from an accelerated Master’s degree may only include those that were not used as part of undergraduate degree requirements.
- Five core courses, totaling 15 credit hours
- Additional coursework that is directly in support of the research area. This must total, at a minimum, 15 credit hours
- 12 credit hours of EGR 792 Research
- 12 credit hours of EGR 799 Dissertation

PhD supervisory committee
In the Systems Engineering program, the PhD supervisory committee implies both the program committee and the Dissertation committee. The faculty chair, in consultation with the student, will establish the program committee. The committee shall consist of at least five members, the majority of which are faculty approved to supervise PhD committees in the EGR program. The Graduate Program chair for the EGR program must approve any members that are not in this category, or that are from outside of ASU. Finally, at least one member of the committee must be from outside of the EGR program.

The responsibilities of the Faculty chair and the PhD Supervisory committee are:

- Approve the Plan of Study.
- Provide guidance for the student’s research program.
- Administer the comprehensive exam and evaluation of the dissertation prospectus.
- Administer and evaluate the Dissertation defense.
Comprehensive Examination and Defense of Dissertation Prospectus

No later than one semester after completion of coursework, all students enrolled in the PhD in Systems Engineering program are required to pass a comprehensive examination that will be administered by the supervisory committee. This exam is a rigorous process that, upon successful completion, elevates the student’s status to that of PhD candidacy. The detailed format of the exam is at the discretion of the PhD supervisory committee, but will normally occur over a period of several weeks. It is the responsibility of the student, in consultation with the research advisor, to schedule a period of time that is convenient for the supervisory committee to administer the exam. The comprehensive examination will consist of:

- Submission and defense of a written Dissertation Prospectus.
- A general knowledge exam related to the proposed research area.

With respect to the Dissertation prospectus, students will submit a detailed research proposal to the supervisory committee at least one week before the exam is scheduled to begin. This prospectus should be a formal document that, at a minimum, includes:

- Discussion of the research area
- Statement of the proposed research
- Discussion of the significance of the research
- Comprehensive review of the relevant literature.
- Discussion of the research methodology that will be followed in course of research
- Discussion of the resources that will be required to complete the research
- Schedule for completion of the research
- Discussion of forums in which the proposed research may be published/presented.

Within one week of submission of the prospectus, each member of the supervisory committee will return a list of questions about the research to the student. The student will then have three weeks to prepare written responses to the submitted questions and send them to the committee as a single document that includes a Table of Contents that links each question to the student’s response.

The Dissertation prospectus is considered the written portion of the comprehensive exam. Within two weeks of submission of this document, the oral portion of the comprehensive examination will be administered. The detailed format of this examination is at the discretion of the supervisory committee. However, at a minimum, the process will include:

- Examination of the student’s responses to questions submitted by the supervisory committee.
- Additional questions regarding the both technical aspects of the research prospectus and the student’s plans for completing the research.
- An oral exam that covers general knowledge relevant to the research area.

Passing this examination elevates the student to the status of candidacy for the PhD degree. This process is documented with Report of Doctoral Examination and the Approval of Dissertation Prospectus forms available on the EGR program website. When completed, these forms are submitted to the Polytechnic School graduate advising office for processing.
If a student does not pass the examination, the supervisory committee will decide whether or not a re-examination is warranted. If a second attempt at the examination is offered, that attempt must take place within two semesters. Only one retake is possible.

Research and Dissertation Defense
The completion of a PhD coincides with entry into the community of scholars, and publication of the research conducted in preparing the dissertation in peer-reviewed forums is considered a strong indication of the quality of the work and the capacity of the candidate to contribute to this community as their career unfolds. Students are encouraged to attend and submit their work to conference proceedings during the course of their program and, in consultation with their research advisor, students are required to submit at least one paper based on the dissertation research to a relevant and impactful journal.

The oral defense of the dissertation is a public examination that is administered by the supervisory committee. Students are responsible for working with their research advisor and supervisory committee to schedule the defense such that all necessary deadlines and requirements established by the Graduate College are met, including submission of the completed dissertation to the Office of Graduate Education for format review at least 10 days before the oral defense. (Please see the 10-Day Working Calendar to identify permissible defense dates.) Students are also responsible for reserving a room for the defense, and ensuring all necessary equipment is available. In addition, the dissertation must be delivered to all members of the supervisory committee at least 10 working days before the oral defense. The format of the oral defense will be established by the supervisory committee subject to the constraint that the defense includes both a public forum followed by a closed session limited to the supervisory committee.

The dissertation defense is an opportunity for the candidate to present and explain the relevance of the results of their research to the academy and to offer the community the opportunity to evaluate and comment on both the quality of the research and the qualifications of the candidate. At the completion of the exam, the supervisory committee will meet in closed session to further discuss the performance and qualifications of the candidate and cast their vote on whether or not the candidate has passed the exam. Passing the exam requires that the major advisor and a majority of the supervisory committee vote in the affirmative. The possible outcomes of the defense are Pass, Pass with minor revisions, Pass with major revisions, or Fail. The committee will discuss the results of their decision with the candidate, including all subsequent steps that are necessary.

After the defense, the student must deliver a copy of the Doctoral Defense Report to the graduate advising office of the Polytechnic School, and, when all revisions are complete, upload the final version of the dissertation through the My ASU and ProQuest.

VI Grades, Academic Performance Standards and Enrollment Constraints
Students enrolled in the Systems Engineering PhD program at the Polytechnic School must meet all university requirements in addition to the specific program requirements described in this document. The ASU Graduate College satisfactory progress policies apply to all graduate students at ASU. Meeting both the University and the Polytechnic School academic performance requirements requires that all PhD students must achieve a 3.0 GPA for each semester for which they are enrolled and achieve a cumulative grade point average of 3.0 or better in three different grade point average calculations:
1. The grade point average in all courses numbered 500 or higher that appear on the transcript, except those that were listed as deficiencies in the original letter of admission.
2. The grade point average in all coursework that appears on the approved program of study, and
3. The grade point average in all post-Master’s coursework taken at ASU.

Courses with grades of “D” (1.00) and “E” (0.00) cannot appear on the iPOS but will be included when calculating the Graduate GPA. Courses with a “W” or an “I” grade cannot appear on the iPOS and may be considered lack of satisfactory progress if more than one occurrence during the students’ graduate program of study.

**Evaluation of Student Progress**
After each semester, the academic unit reviews students’ files for satisfactory progress towards completion of the degree. All students are placed under one of the three categories:

1. *Satisfactory progress* - the student does not have any academic and/or progress probationary issues.
2. *Academic Probation* - the student has failed to meet all of the semester or cumulative GPA requirements outlined above or failed to make satisfactory progress in their research efforts.
3. *Withdrawal* - from the program due to lack of satisfactory progress toward the degree.

**Probationary Status and Conditions for Dismissal**
Students will be placed on probation if they fail to meet all of the GPA requirements, fail to make satisfactory progress toward completion of their dissertation, academic dishonesty as outlined in ACD Manual, or receive a grade of “D” or “E” in any course. Students placed on academic probation will receive a letter explaining the reasons for the probationary status, the required actions to return to normal status and the consequences if those conditions are not met.

A student will be recommended for withdrawal from the program if the student fails to meet the probationary standards outlined in their probationary letter. The student will receive a letter from the Polytechnic School explaining reasons for recommendation for withdrawal. The student will have ten (10) calendar days from the date of the letter to appeal the decision to the EGR Graduate program committee. The Graduate Program Committee will review the appeal and the Graduate Program Chair, on behalf of the committee, will provide a written explanation of the outcome. If the outcome is favorable, the student will be required to sign an agreement acknowledging the recommendations of the Committee and the consequences if the agreements are not met.

If the appeal is not granted in favor of the student, the GAC Chair, on behalf of the GAC, will recommend the Polytechnic School Director’s Office withdraw the student from the program. The student will then have the opportunity to appeal to the Polytechnic School Academic Standards Committee, which reviews the student’s case and makes the final recommendation to the competent authority.

**Policy on Maximum Course Load**
Registration in nine credits is considered a full-time load for graduate students at ASU, and graduate students in the Ira A. Fulton Schools for Engineering are restricted to a maximum of 12 credits per
Continuous Enrollment Requirement
Once admitted to the PhD program in Systems Engineering, students must be continuously enrolled for at least one credit hour during each fall and spring semester. Summer registration is required for students taking examinations, completing culminating experiences, conducting a doctoral prospectus, defending theses or dissertations, or graduating from the degree program in that semester. This credit must appear on the iPOS or must be an appropriate graduate-level course (e.g. 595, Continuing Registration). Courses with grades of “W” and “X” are not considered valid registration for continuous enrollment purposes.

Students planning to discontinue enrollment for a semester or longer must request approval for a leave of absence (Request to Maintain Continuous Enrollment) through the Plan of Study (iPOS) petition. The ASU Graduate College allows for a leave of absence for a maximum of two semesters during a student’s entire program. Students who wish to take advantage of this policy must submit a Request to Maintain Continuous Enrollment to the Polytechnic School graduate advising office for review. This petition (Request to Maintain Continuous Enrollment), is reviewed by the Graduate Program Chair. The Graduate Program Chair makes the recommendation to the Graduate College. The petition must be submitted in a timely fashion and approved before the start of the semester of the anticipated absence.

An approved leave of absence will enable students to re-enter their program without reapplying to the university and the graduate program. Students who do not enroll for a fall or spring semester without an approved Request to Maintain Continuous Enrollment are considered withdrawn from the university under the assumption that they have decided to discontinue their program. A student removed for this reason may reapply for admission to resume their degree program; the application will be considered along with all other new applications to the degree program. A student with a Graduate Education approved Request to Maintain Continuous Enrollment is not required to pay tuition and/or fees, but in turn is not permitted to place any demands on university faculty or use any university resources. See the ASU Graduate College Policies and Procedures for more information.

Time Limit for Degree Completion
Doctoral students at ASU must complete all work within a ten-year period, which begins with the semester and year of admission. Graduate courses taken prior to admission that are included on the Plan of Study must have been completed within three years of the semester and year of admission to the program (previously awarded master's degrees used on the Plan of Study are exempt). The supervisory committee and the Dean of the Graduate College must approve any exceptions. See the ASU Graduate College Policies and Procedures for more information.

VII Advising
The Polytechnic School Graduate Advising Office is responsible for advising all graduate students with respect to progress towards the degree as well as program, school, college and university-wide ASU Policies and Procedures. Questions involving details of academic content in courses, professional practice, and research can be discussed with faculty advisors and/or the Graduate Program Chair.
VIII Professionalism and Honor Code

The highest standards of academic integrity and compliance with the university’s Student Code of Conduct are expected of all graduate students in academic coursework and research activities. Students are expected to obtain, read and follow the University’s Student Code of Conduct requirements (ABOR 5-308) which can be obtained at https://eoss.asu.edu/dos/srr/codeofconduct, as well as the Fulton Engineering Honor Code, which may be found at: http://engineering.asu.edu/integrity/. The failure of any graduate student to uphold these standards will result in serious consequences, including suspension or expulsion from the university and/or other sanctions as specified in the academic integrity policies of the Polytechnic School, as well as the University.

Violations of academic integrity include, but are not limited to: cheating, fabrication of data, tampering, plagiarism, or aiding and/or facilitating such activities. At the graduate level, it is expected that students are familiar with these issues and take personal responsibility in their work. It is the student’s responsibility to become familiar with the academic integrity policies at the program, college and university levels.
Plan of Study (iPOS) Outline
Systems Engineering PhD
Previous Master’s Degree Earned

A minimum of 84 semester credit hours are required for the Systems Engineering PhD degree, distributed as follows:

- A maximum of **30 credit hours** of coursework from a previous Master’s degree in Engineering or related field may be applied to the PhD.
- Five core courses, totaling **15 credit hours**:

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<tr>
<th>Course</th>
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- Additional coursework that is directly in support of the research area. This must total, at a minimum, **15 credit hours**:

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- **12 credit hours** of EGR 792 Research:

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12 credit hours of EGR 799 Dissertation:

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Systems Engineering PhD students must also select 3 committee members by their last year in the program. Please use this section to list faculty members you are considering:

Committee Chair: _____________________________________________________

Committee Member #1: ________________________________________________

Committee Member #2: ________________________________________________
A minimum of 84 semester credit hours are required for the Systems Engineering PhD degree, distributed as follows:

- **Five core courses, totaling 15 credit hours:**

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- **30 credit hours** of coursework chosen in conference with your faculty/committee chair:

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☐ **12 credit hours** of EGR 792 Research:

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☐ **12 credit hours** of EGR 799 Dissertation:

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**Systems Engineering PhD students must also select 3 committee members by their last year in the program. Please use this section to list faculty members you are considering:**

Committee Chair: __________________________________________________________

Committee Member #1: ______________________________________________________

Committee Member #2: ______________________________________________________

Committee Member #3: ______________________________________________________