

SYSTEMS ENGINEERING AND OPERATIONS RESEARCH, PHD

Banner Code: VS-PHD-SEOR

Academic Advising

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This doctoral program offers a unique integration of systems engineering and operations research. This integration gives students a strong analytical and computational capability on the one hand and an overarching systems perspective that is well-grounded in application on the other. No other department in the nation offers a PhD degree program that covers systems engineering and operations research in this integrated manner. The program prepares students for leadership positions in research and development in government, industry, research organization, and academia.

Admissions & Policies

Admissions

All general Mason and specific Volgenau School admissions requirements apply. Candidates for the PhD program typically must hold an MS degree from an accredited institution of higher education in systems engineering, operations research or related areas in engineering, mathematics, and computer science with a minimum graduate GPA of 3.50 and a minimum undergraduate GPA of 3.00. In addition, well-qualified candidates holding a BS degree in these areas may apply directly to the PhD program.

All applicants should have a strong background in engineering mathematics, which includes three semesters of calculus, differential equations, linear algebra, and probability. In addition, students entering the doctoral program must have a sound working knowledge in computing.

The admission process involves submitting the application for admission, undergraduate and graduate transcripts from previous colleges and universities attended, GRE test results, three letters of reference, a résumé and a statement of career goals and aspirations, and a self-assessment of past background. Translations of international credentials must be provided, if they are not in English; in some cases, applicants will be required to have documents evaluated by an external agency. A satisfactory score on the TOEFL examination is required for non-native English speakers. All of an applicant's background is examined before an admission decision is made.

Policies

Program Requirements

The program includes: course requirements; a qualifying exam that tests fundamental concepts in systems engineering and operations research; a comprehensive exam that tests the research competency of the student; dissertation proposal defense; dissertation research; and dissertation

predefense and defense. All general Mason and specific Volgenau School requirements apply to this program.

PhD dissertations are extremely time intensive, and successful completion requires full time focus. It is expected that students who have reached candidacy (that is, successfully presented their dissertation proposal) will spend full time on their research for at least one academic year and will attend the majority of the SEOR departmental seminars throughout that period.

Reduction of Credit

The doctoral program is a 72 credit hour program; however, students entering with a Master's degree in a related discipline will be given a reduction of credit up to 24 hours. Reduction of credit requires the approval of the program director or designee and the dean or designee of the school. They determine whether the credits are eligible for reduction of credit and applicable to the degree program and the number of credits to be reduced.

The 72 hours of required doctoral-level credits typically consist of 48 credits of coursework and 24 credits of dissertation research. Students who receive a reduction of credit will complete a minimum of 48 credits as outlined in Degree Requirements; students entering without an MS will need at least 24 additional credits of coursework.

All decisions concerning the student's course requirements and plan of study must be approved by the dissertation committee chair, as well as by the department's doctoral coordinator.

Requirements

Degree Requirements

Total credits: 72

Doctoral Coursework

A GPA of 3.50 is required, and no grade of C is allowed in these 24 credits. Students lacking prerequisites for their courses or lacking the coursework to complete the qualifying exams or their dissertation may be required to take additional courses.

Code	Title	Credits
OR 568	Applied Predictive Analytics	3
SYST 763	Research Methods in Systems Engineering and Information Technology	3
Select 12 credits of 700-level SEOR approved courses ^{1,2}		12
Select 6 credits in SYST or OR courses numbered 600 or higher ^{2,3}		6
SYST Courses		
OR Courses		
Total Credits		24

¹ A list of approved courses is available from the department

² No more than 3 credits are allowed for a directed reading course. All courses and course substitutions must be approved by the student's dissertation committee chair and the SEOR doctoral coordinator.

³ Excluding SYST 699 Masters Project and OR 699 Masters Project

Additional Coursework Requirements

Students entering without a Master's degree are required to complete an additional 24 credits of Master's level courses, including the following:

Code	Title	Credits
SYST 505	Systems Engineering Principles	3
SYST 520	System Engineering Design	3
OR 541	Operations Research: Deterministic Models	3
OR 542	Operations Research: Stochastic Models	3
Select 12 additional credits from one of two alternatives (systems engineering or operations research) ¹		12
Total Credits		24

¹ Consult the SEOR Department for the list of allowable courses.

Note

With appropriate selection of courses, students may obtain the MS degree in systems engineering or operations research by completing 6 additional credits, including 3 approved credits from the advanced emphasis courses (which may also apply towards the PhD degree advanced emphasis requirements) and 3 credits of either SYST 699 Masters Project or OR 699 Masters Project. Consult the SEOR Department for further detail. Credits taken in the courses SYST 699 Masters Project or OR 699 Masters Project may not be applied towards the PhD degree program requirements.

Qualifying Exams

The exams are primarily for testing the students' familiarity with fundamental concepts. Each student must take the following four exams within two years of enrolling in the program:

- Systems Engineering Principles
- Systems Engineering Design
- Deterministic Models
- Stochastic Models

A student who passes three of the four exams in the first attempt must retake and pass the failed exam within one year. A student who passes fewer than three exams in the first attempt must retake and pass an entire set of four exams within one year. After two unsuccessful attempts, a student is dismissed from the PhD program.

Dissertation Research

Choose 24 credits from the following:

Code	Title	Credits
Select 24 credits from the following:		24
SEOR 998	Doctoral Dissertation Proposal	
SEOR 999	Doctoral Dissertation (must complete a minimum of 12 credits)	
Total Credits		24

Doctoral Supervisory Committee

Students should select a dissertation director and a doctoral supervisory committee as soon as possible. It is recommended that the committee be formed by the end of the second or third semester of study. The dissertation director must be a member of the SEOR graduate faculty or a member of the Mason graduate faculty with approval from the SEOR department chair. The doctoral supervisory committee must include

at least three members from the SEOR department-approved graduate faculty, and at least one non-SEOR member from the Mason graduate faculty. The composition of the doctoral supervisory committee is to be approved by the doctoral coordinator. At least four members of the committee must be members of the Mason graduate faculty.

Comprehensive Exam

The comprehensive exam is taken after the student has satisfactorily completed all the advanced emphasis course work requirements in the approved plan of study filed by the student. The examiners will include the supervisory committee plus any outside examiners considered appropriate. However, the supervisory committee determines whether the student passes or not. The comprehensive exam consists of a written examination of 8 hours in length and an oral examination. The committee will determine if the student has a mastery of the advanced emphasis coursework. If a student fails the comprehensive exam, the student may request a re-examination within 60 days of receiving notice of the exam result. The request should be made in writing to the doctoral coordinator. If the student fails the re-examination or does not request a re-examination within 60 days, the student will be dismissed from the PhD program. In such a case, with recommendation of the supervisory committee and approval of the SEOR Chair, the student may apply his/her coursework towards a Master's degree.

Dissertation Proposal

After passing the comprehensive exam, each doctoral student prepares a written dissertation proposal, which is presented to the doctoral supervisory committee. After successfully completing this requirement, the student is formally admitted as a candidate for the PhD degree.

Dissertation Defense

When the central portions of the research have been completed to the point where the student is able to describe the original contributions of the dissertation effort, a candidate submits the written dissertation to the supervisory committee and schedules an oral predefense with the committee. The predefense is attended by the supervisory committee. The supervisory committee must approve the work or the student must schedule a second predefense.

Once the committee believes the student is ready, a final public oral defense may be scheduled no sooner than one month after the conclusion of the predefense, with an announcement posted for at least two weeks. The defense must be attended by the supervisory committee and the department's doctoral coordinator, unless an exception has been approved in advance by the doctoral coordinator. Following a satisfactory evaluation of the oral defense of the dissertation by the supervisory committee, the student must prepare, with supervision from the dissertation director, a final publishable dissertation that represents a definitive contribution to knowledge in systems engineering and operations research. This document must meet format guidelines specified by the Guide for Preparing Graduate Theses, Dissertations, and Projects. If the student fails to successfully defend the dissertation, the student may request a second defense, following the same procedures as for the initial defense. There is no time limit for this request, other than the general time limits for the doctoral degree. An additional predefense is not required, but the student is strongly advised to consult with the committee before scheduling a second defense. If the student fails on the second attempt to defend the dissertation, the student will be dismissed from the PhD program.