This doctoral program offers a unique integration of systems engineering and operations research. This integration gives students a strong analytical and computational capability combined with an overarching systems perspective that is well-grounded in application. 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, and academia.

Admissions & Policies

Admissions

All general Mason and specific College of Engineering and Computing 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

For policies governing all graduate programs, see AP.6 Graduate Policies (http://catalog.gmu.edu/policies/academic/graduate-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 pre-defense and defense. All general Mason and specific College of Engineering and Computing 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 may 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.

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 doctoral coursework. Students lacking prerequisites for their courses or lacking the coursework to complete the qualifying exams or their dissertation may need to take additional courses.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR 568</td>
<td>Applied Predictive Analytics</td>
<td>3</td>
</tr>
<tr>
<td>or SYST 568</td>
<td>Applied Predictive Analytics</td>
<td></td>
</tr>
<tr>
<td>SYST 763</td>
<td>Research Methods in Systems Engineering and Information Technology</td>
<td>3</td>
</tr>
<tr>
<td>or OR 763</td>
<td>Research Methods in Systems Engineering and Information Technology</td>
<td></td>
</tr>
<tr>
<td>Select 12 credits of 700-level SEOR approved courses; students in the ME concentration may include credits from 700-level ME approved courses (<a href="http://catalog.gmu.edu/courses/seor/">http://catalog.gmu.edu/courses/seor/</a>)</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Select 6 credits in SYST or OR courses numbered 600 or higher; students in the ME concentration may include credits from 600-level ME approved courses (<a href="http://catalog.gmu.edu/courses/seor/">http://catalog.gmu.edu/courses/seor/</a>)</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>SYST Courses (<a href="http://catalog.gmu.edu/courses/syst/">http://catalog.gmu.edu/courses/syst/</a>)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OR Courses (<a href="http://catalog.gmu.edu/courses/or/">http://catalog.gmu.edu/courses/or/</a>)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For more information, visit the SEOR website: https://seor.gmu.edu/
SEOR 800 Systems Engineering and Operations Research Colloquium I  
or ME 500 Special Topics

Total Credits 24

A list of approved courses is available from the SEOR department. Approved courses for the concentration in Mechanical Engineering are available from the ME department.

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.

Excluding SYST 699 and OR 699.

Students must register for the 0-credit SEOR 800 three times before being able to take SEOR 997. Students in the Mechanical Engineering concentration may take ME 500 in place of SEOR 800.

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:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYST 505</td>
<td>Systems Engineering Principles</td>
<td>3</td>
</tr>
<tr>
<td>SYST 520</td>
<td>System Engineering Design</td>
<td>3</td>
</tr>
<tr>
<td>OR 541</td>
<td>Operations Research: Deterministic Models</td>
<td>3</td>
</tr>
<tr>
<td>OR 542</td>
<td>Operations Research: Stochastic Models</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Select 12 additional credits from one of two alternatives (systems engineering or operations research)</td>
<td>12</td>
</tr>
</tbody>
</table>

Total Credits 24

Consult the SEOR Department for the list of allowable courses.

Students in the Mechanical Engineering concentration who enter without a masters are required to complete an additional 24 credits of Master’s level courses, including the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three courses from the following list:</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>SYST 505</td>
<td>Systems Engineering Principles</td>
<td></td>
</tr>
<tr>
<td>SYST 520</td>
<td>System Engineering Design</td>
<td></td>
</tr>
<tr>
<td>OR 541</td>
<td>Operations Research: Deterministic Models</td>
<td></td>
</tr>
<tr>
<td>OR 542</td>
<td>Operations Research: Stochastic Models</td>
<td></td>
</tr>
<tr>
<td>One course from the Mechanical Engineering (ME) Specialized Coursework list</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Select 12 additional credits from systems engineering, operations research, and mechanical engineering</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits 24

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 or OR 699 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

Students in the Mechanical Engineering concentration must take three of the four exams (systems engineering principles, systems engineering design, deterministic models, and stochastic models) plus one ME qualifying exam corresponding to a Fundamental Knowledge course.

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 terminated from the PhD program.

Systems Engineering and Operations Research Colloquium II

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEOR 997</td>
<td>Systems Engineering and Operations Research Colloquium II</td>
<td>3</td>
</tr>
</tbody>
</table>

SEOR 997 must be taken after coursework is completed, after three semesters of SEOR 800 are completed, and along with SEOR 998. Students should also have a dissertation advisor and a dissertation topic prior to registering. The colloquium presentation in SEOR 997 must be given at least one month prior to the proposal defense.

Dissertation Research

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select 21 credits from the following:</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>SEOR 998</td>
<td>Doctoral Dissertation Proposal</td>
<td></td>
</tr>
</tbody>
</table>
when 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 terminated
from the PhD program.

Concentration in Mechanical Engineering (ME)
(Optional)
This concentration is suitable for students who wish to pursue doctoral
research in areas related to mechanical engineering with a foundation
in systems engineering and operations research. The concentration has
modified requirements for coursework, qualifying exams, and the doctoral
supervisory committee, as described in the relevant sections.

Students whose primary research interests are in systems engineering
and operations research should follow the standard program
requirements for the PhD/SEOR without enrolling in this concentration.