

# OPERATIONS RESEARCH

<b>Graduate Program Head</b>	Jose A. Ventura
<b>Campus(es)</b>	University Park
<b>Degrees Conferred</b>	Dual-Title
<b>The Graduate Faculty</b>	View ( <a href="https://secure.gradsch.psu.edu/gpms/?searchType=fac&amp;prog=OR">https://secure.gradsch.psu.edu/gpms/?searchType=fac&amp;prog=OR</a> )

Students electing this option through participating programs earn a degree with a dual-title at both the Ph.D. and the M.S., M.A., or M.Eng. levels, i.e., Ph.D. in (graduate program name) and Operations Research, or M.S., M.A., or M.Eng. in (graduate program name) and Operations Research.

The following graduate programs offer dual-title degrees in Operations Research:

- Agricultural and Biological Engineering
- Biorenewable Systems
- Business Administration
- Chemical Engineering
- Civil Engineering
- Computer Science and Engineering
- Economics
- Electrical Engineering
- Energy, Environmental, and Food Economics
- Energy and Mineral Engineering
- Entomology
- Forest Resources
- Geography
- Geosciences
- Industrial Engineering
- Mathematics
- Statistics
- Workforce Education and Development

The Operations Research dual-title degree program is administered by an Operations Research committee, which is responsible for management of the program. The committee maintains program definition, identifies faculty and courses appropriate to the option, and recommends policy and procedures for its operation to the dean of the Graduate School. This dual-title degree program is offered by graduate major programs in eight colleges. The dual-title program enables students from diverse graduate programs to attain and be identified with the tools, techniques, and methodology of operations research, while maintaining a close association with areas of application. Operations research is the analysis—usually involving mathematical treatment—of a process, problem, or operation to determine its purpose and effectiveness and to gain maximum efficiency.

## Admission Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Students must apply and be admitted to one of the approved graduate programs and The Graduate School before they can apply for admission to the dual-title degree program.

For the M.S., M.A., M.Eng. dual-title degree in Operations Research, in addition to those prescribed by the graduate major program, prerequisites for acceptance to the program without deficiency include the following or their equivalent:

Code	Title	Credits
MATH 140	Calculus With Analytic Geometry I	4
MATH 141	Calculus with Analytic Geometry II	4
MATH 220	Matrices	2-3
CMPSC 101	Introduction to Programming	3
3 credits of probability and statistics		3

For the Ph.D. dual-title degree in Operations Research, in addition to those prescribed by the graduate major program, prerequisites for acceptance to the program without deficiency include the following or their equivalent:

Code	Title	Credits
MATH 401	Introduction to Analysis I	3
MATH 436	Linear Algebra	3
CMPSC 101	Introduction to Programming	3
3 credits of probability and statistics		3

Doctoral students must apply and be admitted to the Operations Research dual-title program prior to taking the qualifying exam.

## Degree Requirements

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

To qualify for a dual-title degree, students must satisfy the requirements of the graduate major programs in which they are enrolled, in addition to the minimum requirements, or their equivalent, in the Operations Research program. Students must enroll in OR 590 for at least 1 credit in each year enrolled in the program and in residence.

## Master's Degrees

For the M.S. or M.A. dual-title degree in Operations Research, the minimum requirements are:

- 6 credits in stochastic/statistical methods, including a minimum of 3 credits in each of the areas of statistical methods and stochastic processes;
- 6 credits in optimization, including a minimum of 3 credits in linear programming;
- 3 credits in computational methods; and
- 3 credits in applications/specialization. (Application courses are those that involve problem solving through the use of decision methods.)

A minimum of 9 credits must be in the 500 series. Particular courses may satisfy both the graduate major program requirements and those in the Operations Research program. A list of courses that will satisfy these requirements is maintained by the graduate program office.

A thesis may be required by the graduate major program, the supervisor of which must be a member of the Graduate Faculty recommended by the chair of the program granting the degree and approved by the Operations Research committee as qualified to supervise thesis work in operations research. If the graduate major program has an approved non-thesis track for the M.A./M.S. degree, a scholarly paper may be written in lieu of a thesis. All M.Eng. students and M.A./M.S. students who choose to submit a scholarly paper instead of a thesis must take an additional 6 credits in the Operations Research program. It is the prerogative of the graduate major program to assign these credits to one or more of the following categories: stochastic/statistical methods, optimization, computational methods, or applications.

## Doctoral Degrees

The minimum requirements for the Ph.D. dual-title degree in Operations Research are:

- 9 credits in stochastic/statistical methods, including a minimum of 3 credits in each of the areas of statistical methods and stochastic processes;
- 9 credits in optimization, including a minimum of 3 credits in linear programming;
- 6 credits in computational methods, including a minimum of 3 credits in simulation; and
- 12 credits in applications/specialization.

A minimum of 18 credits must be in the 500 series, and particular courses may satisfy both the graduate major program requirements and those in the Operations Research program.

The qualifying examination committee for the dual-title Ph.D. degree must include at least one Graduate Faculty member from the Operations Research program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both the primary graduate degree program and Operations Research. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the chair and at least two members of the Ph.D. committee of an Operations Research dual-title Ph.D. student must be members of the Operations Research Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. The Operations Research representatives on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in both their primary graduate program and Operations Research. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

## Minor Requirements

Requirements listed here are in addition to requirements for minors in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

A Ph.D. minor program in Operations Research is available for doctoral students who find it advantageous to include advanced quantitative methods of systems analysis in their programs of study and have been approved to do so by their dissertation committees. To qualify for a minor in Operations Research, students must satisfy the requirements of their graduate major programs, meet the same admissions prerequisites as the M.S. dual-title degree students, and meet the following minimum degree requirements: 6 credits in stochastic/statistical methods, including a minimum of 3 credits in each of the areas of statistical methods and stochastic processes; 6 credits in optimization; and 3 credits in computational methods. A minimum of 6 credits must be taken at the 500 level.

Official requests to add the minor to a doctoral student's academic record must be submitted to Graduate Enrollment Services prior to establishment of the dissertation committee and prior to scheduling the comprehensive examination. At least one Graduate Faculty member from Operations Research must serve on the candidate's dissertation committee.

## Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

## Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Operations Research (OR) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/or/>)

## Contact

<b>Campus</b>	University Park
<b>Graduate Program Head</b>	Jose A. Ventura
<b>Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)</b>	Jose A. Ventura
<b>Program Contact</b>	Jose A. Ventura 356 Leonhard Building University Park PA 16802 jav1@psu.edu (814) 865-3841
<b>Program Website</b>	View ( <a href="http://sites.psu.edu/ieor/">http://sites.psu.edu/ieor/</a> )