

DOCTOR OF PHILOSOPHY WITH A MAJOR IN OPERATIONS RESEARCH

The Doctor of Philosophy in Operations Research has the following principal objectives:

- 1.) To train students who are able to advance the state of knowledge and practice in operations research through innovative research contributions.
- 2.) To train students who are able to integrate and apply principles from optimization, stochastic processes, simulations, and machine learning to innovate, and create operations research models and apply them to solve important real-world problems.
- 3.) To train students who are able to participate in multidisciplinary teams that include individuals whose primary background is in statistics, optimization, engineering, mathematics and science.
- 4.) To provide a high quality education that prepares individuals for careers in industry, government (e.g., national laboratories), and academia, both in terms of knowledge, computational (e.g., software development) skills, and mathematical modeling skills.

Students in the Ph.D. in Operations Research program choose a single track from Optimization, Stochastics, or Applications that guides the program of study as given below.

Code	Title	Credit Hours
Domain Core (6 courses)		
ISYE 6661	Linear Optimization	3
ISYE 6662	Discrete Optimization	3
ISYE 6663	Nonlinear Optimization	3
ISYE 6761	Stochastic Processes I	3
ISYE 6762	Stochastic Processes II	3
ISYE 6832	Simulation Theory and Methods	3
Depth Electives (3 or more courses)		
Students choose courses below only in their chosen track:		
Optimization		
ISYE 6664	Stochastic Optimization	3
ISYE 6679	Computational Methods in Optimization	3
ISYE 7510	Graph Algorithms	3
ISYE 7661	Theory of Linear Inequalities	3
ISYE 7682	Convexity	3
ISYE 7683	Advanced Nonlinear Programming	3
ISYE 7686	Advanced Combinatorial Optimization	3
ISYE 7687	Advanced Integer Programming	3
ISYE 7688	Computational Mathematical Programming	3
Stochastics		
ISYE 6664	Stochastic Optimization	3
MATH 6241	Probability I	3
MATH 6242	Probability II	3
MATH 7244	Stochastic Processes and Stochastic Calculus I	3

Applications		
ISYE 6229	Productivity Measurement and Analysis	3
ISYE 6230	Economic Decision Analysis	3
ISYE 6664	Stochastic Optimization	3
ISYE 6759	Stochastic Processes in Finance	3
ISYE 7201	Production and Service Systems Engineering	3
ISYE 7203	Logistics Systems Engineering	3
MATH 7244	Stochastic Processes and Stochastic Calculus I	3
Breadth Electives (2 or more courses)		
Students choose courses below only in their chose track		
Optimization		
ISYE 6230	Economic Decision Analysis	3
ISYE 6412	Theoretical Statistics	3
ISYE 6656	Queuing Theory	3
ISYE 7201	Production and Service Systems Engineering	3
ISYE 7203	Logistics Systems Engineering	3
ISYE 7400	Advanced Design of Experiments	3
ISYE 7401	Advanced Statistical Modeling	3
ISYE 7405	Multivariate Data Analysis	3
MATH 6014	Graph Theory and Combinatorial Structures	3
MATH 6241	Probability I	3
MATH 6242	Probability II	3
MATH 6643	Numerical Linear Algebra	3
MATH 6644	Iterative Methods for Systems of Equations	3
CS 6550	Design and Analysis of Algorithms	3
CS 7520	Approximation Algorithms	3
CS 7530	Randomized Algorithms	3
Stochastics		
BIOL 7023	Bioinformatics	3
ISYE 6412	Theoretical Statistics	3
ISYE 6645	Monte Carlo Methods	3
ISYE 6679	Computational Methods in Optimization	3
ISYE 6759	Stochastic Processes in Finance	3
ISYE 7201	Production and Service Systems Engineering	3
ISYE 7203	Logistics Systems Engineering	3
ISYE 6400	Design Of Experiments I	3
ISYE 7401	Advanced Statistical Modeling	3
ISYE 7405	Multivariate Data Analysis	3
Applications		
ISYE 6402	Time Series Analysis	3
ISYE 6412		
ISYE 6673	Financial Optimization Models	3
ISYE 6679	Computational Methods in Optimization	3
MATH 6014	Graph Theory and Combinatorial Structures	3
MATH 6241	Probability I	3
MATH 6242	Probability II	3
ISYE 6656	Queuing Theory	3
ISYE 7400	Advanced Design of Experiments	3
ISYE 7401	Advanced Statistical Modeling	3
ISYE 7405	Multivariate Data Analysis	3
ISYE 7682	Convexity	3

ISYE 7683	Advanced Nonlinear Programming	3
ISYE 7686	Advanced Combinatorial Optimization	3
ISYE 7687	Advanced Integer Programming	3
CS 6550	Design and Analysis of Algorithms	3
CS 7520	Approximation Algorithms	3
CS 7530	Randomized Algorithms	3

Comprehensive exam

The comprehensive examination for the Ph.D. in Operations Research is based on content of the courses in the Domain Core. Students must complete exams in ISYE 6661 and 6761, and one other Domain Core course.

Second year paper requirement

Students in the Ph.D. in Operations Research program are required to submit a second year paper no later than the end of Spring semester of their second full program year. This paper at a minimum:

- defines a research problem;
- provides a literature review;
- describes progress towards solving the research problem;
- identifies additional research questions to be answered and steps to be taken.

The advisor needs to certify that the document meets the above requirements, that it was written primarily by the student, and that the student is making good progress on research and should stay in the OR program. Should a student fail to complete the paper on time, they will be asked to leave the program.

Dissertation Research Proposal

The first step toward completing a final dissertation is to receive formal approval of a dissertation research topic. This is accomplished via the Dissertation Research Proposal. Students must present their dissertation research proposal to the Thesis Advisory Committee no later than the end of Spring semester of the student's third full year in the program.

Each Ph.D. student must prepare a cogent, self-contained written research proposal that should describe the research to be addressed, demonstrate an understanding of existing work, describe intended research approaches, and present initial and anticipated results. The student must deliver this proposal, along with an oral presentation, to his/her committee. The content expected in the written research proposal should be discussed with the research advisor and committee members.

If judged to be satisfactory, the Thesis Advisory Committee members must sign the appropriate section of the Request for Admission to Ph.D. Candidacy form approving the thesis topic. Each member of the committee must also complete the Dissertation Proposal

Assessment Form, available on the ISyE website. The student should bring copies of all forms to the proposal presentation and is responsible for returning all forms to the Academic Programs Office. A student must present the thesis proposal at least one semester prior to the Final Doctoral Examination.

A student who fails to obtain approval of his/her thesis proposal must modify the existing proposal, and if required by the Thesis Advisory Committee, must defend the modified proposal in a subsequent oral presentation. If this second thesis proposal is not successful, the student will have not more than 6 months to identify a new research topic and if necessary a new research advisor, and to report this information to

the Associate Chair for Graduate Studies. Failing to do so will prevent a student from continuing in the program.

Dissertation

The primary requirement of a Ph.D. program is the completion of a dissertation, a written work documenting the research findings of a searching and authoritative investigation of a topic in the chosen primary field of study. The dissertation must either extend the boundaries of fundamental knowledge in a field or provide a new and better understanding or interpretation of facts already known. It should demonstrate that the candidate possesses powers of original thought, a talent for scholarship and research, and an ability to organize and present his/her findings.

Georgia Tech Graduate Studies maintains a website that discusses policies and requirements for Ph.D. dissertations at Georgia Tech.

Minor

The minor will follow the standard Georgia Tech requirement: 9 hours outside the student's home unit, with a GPA in those courses of at least 3.0. The courses for the minor should form a cohesive program of study that is approved by the ACGS. Courses selected from the breadth requirements can be used to count toward the Minor.