Welcome!

<table>
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<th>TO:</th>
<th>New Graduate Students</th>
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<tr>
<td>FROM:</td>
<td>Alan Erera</td>
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<td></td>
<td>Professor and Associate Chair for Graduate Studies</td>
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On behalf of the faculty and staff, let me welcome you to the H. Milton Stewart School of Industrial and Systems Engineering (ISyE). We are glad that you have decided to pursue graduate studies here, and we wish you success. We encourage you to take full advantage of the many resources offered by our top-ranked programs!

This Graduate Handbook is the definitive guide to all of our Master’s and Ph.D. degree programs, and you must refer to it as you plan your studies here in our School. As you probably know, we offer a large number of graduate degree programs, each with its own unique set of requirements and rules. Additionally, we have a number of policies and procedures that apply to all graduate students in the School. Please study the requirements of your program carefully, and understand that while we will advise you along the way as needed, the ultimate responsibility to ensure that you meet requirements and adhere to policies is yours alone.

If you have questions about the contents of the Graduate Handbook, please come to the Academic Programs Office and someone here will try to clarify matters and/or address your concerns. Our Graduate Programs Manager is Amanda Ford (room 203C). Dr. Dima Nazzal is our Executive Director of Academic Administration and Services Experience (Room 210), directs the Academic Programs Office. The common goal of everyone on our team is help you throughout your time as a student in our graduate program.

Again, welcome to Georgia Tech and good luck!
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Introduction
This handbook has been designed to help you plan and implement your graduate program of study, and to inform you of the various policies and regulations of the H. Milton Stewart School of Industrial and Systems Engineering (ISyE).

Several resources are available to you to help you plan and execute your graduate study here at Georgia Tech. A good source of information is the Georgia Tech Grad Guide, published by Graduate Studies, which provides a high-level overview of graduate programs and contains useful links to various online resources. The Georgia Tech General Catalog describes common requirements and policies for all graduate programs, as well as procedures and course grading. Graduate students should study and refer to the Catalog sections that cover relevant topics, including specific degree requirements. It is important for you to note that this Handbook does not replace the Catalog. However, this Handbook does describe policies and procedures specific to ISyE graduate students; in general, your academic program is guided by the Handbook version for the semester of your matriculation at Georgia Tech. In addition to this guide, your faculty advisor, the Associate Chair for Graduate Studies, and the Academic Programs Office staff are available to help you with questions pertaining to your program.

ISyE Building Complex
The ISyE complex is located on the west side of campus, directly across the street from the Campus Recreational Center (CRC). Three buildings, connected by glass-enclosed walkways, comprise the complex: the Instructional Center (IC) houses classrooms for many ISyE classes; the Groseclose Building is where the majority of faculty have their offices, and also houses some conference and seminar rooms; the ISyE Main Building houses the School Chair’s Office, some administrative and support staff and the majority of offices for Ph.D. students. The Office of Academic Programs is located in the Groseclose Building. You can view online floor plans for Groseclose and ISyE Main.

Several common-use study areas are available for you within the complex. The first floor of Groseclose and the first floor of ISyE Main have study areas open to all ISyE students. A special study hall for MS Supply Chain Engineering students is located in room 213 Groseclose. Ph.D. students can also use the Ph.D. Study Room and Material Handling Library in ISyE Main 340. Each Ph.D. student will also receive separate office space. You will receive separate information regarding the location of your Student Center mailbox, as well as how to have mail addressed to this mailbox.

The primary mechanism by which ISyE faculty and staff and Georgia Tech staff communicate with students is via your official Georgia Tech email address. The Institute Office of Information Technology (OIT) provides every student and every employee with a Georgia Tech (GT) account. Your GT account username and password identify you to the GT campus network and enable you to use a variety of web-based resources and services outside of ISyE. Your official campus e-mail address is initially your GT account username, but can be modified using the Passport website. This e-mail address is the official means of communication between you and the Institute. In addition to your GT account, graduate students can also apply for an ISyE UNIX account. An ISyE UNIX account provides a centralized home directory within our common-use computing.
infrastructure, and access to the appropriate UNIX and Linux resources within ISyE. The ISyE website includes information about our computing resources and instructions about how to apply for an ISyE UNIX account.

There are two general-use computer labs within the ISyE complex, both of which are unattended but may be accessed 24 hours a day, seven days a week using your BuzzCard. One lab facility is in ISyE Main 126 and the other is in Groseclose 118. To print or make photocopies in these facilities requires charges to your BuzzCard account.

There is also a general use high performance computing facility. This is a large Linux cluster that shares network mounted home directories and is managed using the Condor workload management system. This facility is accessible from anywhere in the world via secure shell for those with an ISyE UNIX account. We have a central helpdesk system where you can submit any questions you may have about computing resources. Email helpdesk@isye.gatech.edu for computing questions, or facilities@isye.gatech.edu for questions regarding building or room access.

Soon after your first term registration, your BuzzCard will be activated to allow you access to the ISyE buildings and computer labs. Please be sure to immediately report a lost or stolen card to the BuzzCard Center in order to prevent a security problem (as soon as the BuzzCard Center has issued a replacement card, facilities@isye.gatech.edu should also be notified so that you can regain access to buildings and labs).

Student File Maintenance Responsibilities

Each student is responsible for the various requirements specified in the General Catalog, the Master’s and Ph.D. policy statements, and other information in this Handbook. In short, ISyE adopts the viewpoint that the student is responsible for seeing that his/her records are complete and accurate, and that all program requirements are met and recorded. It is the student’s responsibility to meet any deadlines specified in this document, the General Catalog, or any other School or Institute policy.

Registration; Starting and Stopping

In order to register, you will need to refer to the schedule of classes bulletin within the On-line Student Computer Assisted Registration (OSCAR) system. The information published on OSCAR is prepared by the Office of the Registrar and contains all of the information necessary for registration, including the official school calendar, course catalog links and the final exam schedule.

At the end of your graduate program, you must have certain academic and administrative paperwork completed and filed. Degree petitions for Master’s degrees must be submitted in the term prior to graduation, and are necessary for the award of any degree. Be sure to carefully read emails and follow instructions from the ISyE Academic Office staff during your final semester of enrollment to ensure that you are cleared for graduation.

DegreeWorks is a Georgia Tech degree audit system that enables you and your advisor to review coursework and evaluate which degree requirements are complete and which are remaining. Be sure to check your DegreeWorks account once a semester and communicate with the ISyE Academic Office if you see any discrepancies.
**Enrollment**

The Georgia Tech catalog includes policies on graduate student enrollment and workloads. Full-time enrollment during a semester is for at least 12 credit hours on a letter grade or pass-fail basis. Audit basis courses are not counted toward full-time enrollment. Maximum enrollment is 21 hours in Fall or Spring semester, and 16 hours in Summer semester.

International students on student visas must be enrolled full-time for at least 12 credit hours during each Fall and Spring semester. Students with graduate research or teaching assistantships, traineeships, or who are receiving a fellowship payment during any semester (Fall, Spring, or Summer) must also be enrolled full-time.

**Special Problems and Research Courses**

Graduate students may sometimes work with faculty members on research study, or may study specialized material not available in classroom courses. ISyE graduate students have a few registration options when this is the case.

Ph.D. students performing research should generally register for pass/fail ISyE 9000 credit-hours. Each ISyE faculty member has an ISyE 9000 section, and students should seek permission from the faculty member before enrolling.

Master’s students performing research should register for pass/fail ISyE 8900 or ISyE 8901 credit-hours, again choosing the section associated with the faculty advisor. Pass/fail ISyE 8900 or ISyE 8901 credit-hours do not count toward any Master’s degree requirements. Graduate students studying a special topic course with a faculty member should register for letter-graded ISyE 8900 or 8901 credit-hours.

Registration for ISyE 8900 and 8901 is by permit only. Students must submit a permit request no later than Wednesday of the final week of course registration. Permit requests are approved first by the faculty advisor/instructor, and second by the Associate Chair for Graduate Studies. Letter-graded course requests are limited to 3 credit-hours, and must include a course syllabus and a document describing the course grading procedure.

**Course Grading Policies**

Final course grades are issued at the end of each semester following the Final Examination week. No interim grades appear on a transcript. Letter graded courses at Georgia Tech result in A, B, C, D, or F grades. Pass/fail graded courses result in S (satisfactory) or U (unsatisfactory) grades.

In some cases, you may receive a course grade of Incomplete (I) when course requirements are not completed by the grading deadline in a semester. Please be informed that an incomplete (I) course grade must be removed during the first semester of enrollment after the semester in which it was given. If this is not done, the incomplete grade becomes an F grade.

If you wish to withdraw from a class, please be advised that the dropped class does not disappear from your transcript but rather appears with a W grade. The drop period at Georgia Tech ends after the midway point in the semester (check the [Institute Registrar’s](#)
calendar for the specific dates for each semester, including the Summer semester). Courses can be dropped on-line using the student online registration system accessible via Buzzport. It is always a good idea to keep a record of your drop action until the W appears on your transcript. If you are eligible for a refund, you must complete a separate request for this and submit it in accordance to the dates stipulated by the Office of the Bursar.

**Student Grievances**
If a student has an academic complaint about an instructor in an ISyE course, the first step is for the student to discuss the concern directly with the instructor to seek a resolution. If the student is not satisfied with the instructor response, the student should then file the complaint in writing with ISyE’s Executive Director of Academic Administration and Student Experience. If the student is not satisfied with the proposed plan of action jointly determined between the Director and the instructor, the student may file the complaint with the ISyE School Chair who will consider the case and then advise the student on next steps.

**Honor Code**
Georgia Tech has an honor code, and ISyE vigorously enforces all of its tenets. At its core, the Georgia Tech Honor Code establishes principles of personal and academic integrity that all members of the Georgia Tech community—staff, faculty, and students—must use to guide their conduct. Students that are not interested in participating in such a community should reconsider their decision to enroll at Georgia Tech. You are advised to familiarize yourself with the Honor Code.
Master’s Degree Programs

ISyE offers four degree options at the Master’s level:

Master of Science in Industrial Engineering (MSIE)  
Master of Science in Operations Research (MSOR)  
Master of Science in Supply Chain Engineering (MSSCE)  
Master of Science in Health Systems (MSHS)

and jointly offers four additional interdisciplinary degrees with other Georgia Tech academic units:

Master of Science in Analytics (MSANLT)  
Master of Science in Statistics (MSStat)  
Master of Science in Quantitative and Computational Finance (MSQCF)  
Master of Science in Computational Science and Engineering (MSCSE)

The School also offers a Master’s degree in an executive format:

Master of Science in International Logistics (MSIL)

Admission

A student seeking admission to a Master’s program should complete the application process described at the Institute Graduate Studies [website]. Applicants to all programs except MS Analytics must complete the Graduate Record Examination (GRE) General Test, and provide official scores to Georgia Tech. MS Analytics applicants may substitute Graduate Management Admission Test (GMAT) scores as a substitute, although the GRE is preferred. Georgia Tech also requires all international students from countries in which English is not the primary native language to take the Test of English as a Foreign Language (TOEFL), except international students who have attended a college or university in the United States for at least one academic year (two semesters or three quarters). No other language test may be substituted.

Changing Degree Program

Students may not change degree programs until they have completed a full semester at Georgia Tech. Students seeking to change primary or secondary degree programs must do so at least 4 weeks prior to the semester for which the change is sought.

Current Georgia Tech students pursuing a Master’s degree may apply to change their primary major degree program into MSIE, MSOR, MSCSE-ISYE, MSHS, or MS Statistics-ISYE by submitting a new personal statement, updated CV, and at least one letter of reference from a Georgia Tech faculty member directly to the ISyE Graduate Programs Manager for approval by the Associate Chair for Graduate Studies. Master’s of Science students at Georgia Tech will not be permitted to add a secondary major in any ISyE degree program. Furthermore, students who have completed a Master’s of Science degree at Georgia Tech will not be typically admitted into an ISyE Master’s degree program subsequently.
Georgia Tech graduate students pursuing the Ph.D. degree in other schools across campus can seek a secondary major within our MSIE, MSOR, MSCSE-ISYE, MSHS, or MS Statistics-ISYE programs in order to earn a Master’s of Science degree in addition to the Ph.D. Such students should again apply to the ISyE Graduate Programs Manager using the same process as above, except that a reference letter must be provided by the dissertation research advisor recommending the admission.

Current Georgia Tech Master’s students interested in changing majors into MS Analytics, MS Supply Chain Engineering, or MS QCF should consult directly with the Faculty Director of the appropriate program about opportunities for transfer.

**Follow-on MBA Study**

Students pursuing Master’s of Science degrees from Georgia Tech are eligible to apply to the [MBA Dual Degree program](https://www.isye.gatech.edu/graduate/masters/ms-resolution), offered by Georgia Tech’s Scheller College of Business. Students admitted to the dual degree program can earn a follow-on Master’s of Business Administration (MBA) by double counting 15 hours of core and technical elective MS coursework as electives for the MBA program. Doing so allows the student to earn an MBA degree by completing 39 additional credit-hours of coursework in the MBA program, including the traditional MBA core. The follow-on MBA can be completed in the full-time or evening program.

Students interested in this option must apply before graduating from the MS program, and should generally do so no later than their first semester on campus. Application instructions are available at the Scheller MBA Dual Degree website.

**Follow-on Ph.D. Study**

A student pursuing a Master’s degree in an ISyE program who seeks admission for a follow-on Ph.D. degree from an ISyE program must apply for admission. Students who do not wish to use the online application system to apply for Ph.D. study can submit a simplified application directly to the Associate Chair for Graduate Studies consisting of an updated CV, a statement of purpose, and at least two new letters of recommendation from Georgia Tech faculty. It is best if one of these letters is written by the student’s prospective thesis research advisor and expresses very strong support. Such requests will be evaluated in the same fashion as for new Ph.D. applicants and typically will not be considered until the final term of the applicant’s Master’s program. It is best if such applications are received by the usual Ph.D. application deadline, which is December 15 each year for the following Fall semester.

**Student Advising**

Each Master’s student is assigned an advisor prior to enrollment, as noted on the admission letter. The advisor is your first point of contact for questions about your degree program, and to help you create a program of study that conforms to our requirements while satisfying your interests. It is a good idea to obtain a copy of the *Instructions and Worksheet for Master’s Program of Study* form from the ISyE website, and to use it to prepare a preliminary program of study for discussion with your advisor.
Subsequent changes in this program should be made in consultation with your advisor and if needed, the Associate Chair for Graduate Studies.

**Preliminary Preparation**
A student seeking a Master’s degree must have a bachelor’s degree and typically one earned in engineering, science, mathematics, or some other field that provides an adequate background for the successful completion of an ISyE program. For students who arrive without an engineering or mathematics degree, adequate preparation minimally includes a mathematics background equivalent to that provided during the first two years of an accredited engineering degree. Exposure to linear algebra and calculus-based probability and statistics will be assumed. Students that have significant gaps in background preparation will be advised to complete preliminary undergraduate coursework upon arrival to Georgia Tech, or to attain background through additional self-study.

Many graduate level courses list prerequisite courses. We do not rigidly enforce prerequisites by preventing enrollment. However, students should be advised that the listed prerequisite course content understanding will be assumed by the instructor. Please consult with individual instructors if you have any concerns.

**General Requirements**
Most Master’s degrees in ISyE require 30 semester hours of course credit; MS QCF and MS Analytics both require 36 hours. In very rare cases, prior graduate coursework completed at another institution that was not used toward another degree (graduate or undergraduate) may be transferred for credit. A syllabus for a transfer course must be provided and must demonstrate equivalence to an ISyE course. No more than 6 hours of credit may be transferred, and all transfer credit must be approved prior to the end of the student’s first enrolled semester by the Associate Chair for Graduate Studies.

Students wishing to pursue a thesis can do so, and a thesis will count for six (6) hours of free or unrestricted elective credit. It is very rare for a student to pursue a thesis, and you should consult with the Associate Chair for Graduate Studies prior to beginning.

**Undergraduate Courses**
Credit earned for undergraduate courses taken as remedial work in order to satisfy a program’s prerequisites cannot apply toward a Master’s degree. In general, undergraduate courses, with the exception of those specified in certain Master’s programs described below, cannot be used to satisfy degree requirements. In some cases, a student may take a 4000-level course for degree credit, subject to approval by the Associate Chair for Graduate Studies; required courses in our BS in Industrial Engineering curriculum will not be approved. Do not register for any unspecified undergraduate courses expecting degree program credit until written approval has been granted. Courses at the 3000-level and below are not permitted.

**Core Courses**
Each ISyE Master’s degree program includes a set of required core courses. In general, no substitutions will be allowed for core courses except when a student successfully
completes a Ph.D. level course covering the same material. A Ph.D. course substitution table is provided in this handbook, and is available on the ISyE website.

**Elective Courses**

Some degree programs also allow electives to be included in the Program of Study.

*Technical or Track Electives* must be at the 6000-level or higher and need not be confined to ISyE, but may include courses from other fields such as mathematics and computer science as well as other engineering disciplines. Above all, the intent is that these courses have demonstrable technical content. Most programs have a restricted list of courses that can be used as technical or track electives. Students must seek approval of courses not on the approved list from the Associate Chair for Graduate Studies, and such approvals are very rarely granted. Do not enroll in a class you expect to use as a technical elective prior to approval.

*Free Electives* need not be selected from approved technical elective lists, although many students will select additional such courses. A free elective course can be chosen among any of Georgia Tech’s colleges, and should be chosen to complement your graduate study program. If a chosen free elective does not clearly align with your degree program, then you may be asked to provide a written explanation identifying how the course complements your study. The Associate Chair for Graduate Studies reserves the right to deny a request for free elective credit for any course not on a technical elective list that appears unrelated to your degree interest. Special Problems courses (ISyE 8900/8901) taken for a letter grade can only be used for free electives, and a maximum of 3 credit-hours of such coursework is allowed to count toward your degree.

If a degree program allows four or more courses as either technical or free electives, at least two must carry ISyE course numbers. Cross-listed courses such as ISyE 67xx (see below) will not count as satisfying this 2-course minimum.

**Cross-Listed Classes**

Classes in the 67xx series are cross-listed with one or more schools in College of Engineering or other colleges at Georgia Tech. Frequently they will be taught by faculty who are not from ISyE, but when signing up for the class on OSCAR, you should always have the option of taking the course as ISYE 67xx.

**Petition for a Degree**

A student is responsible for seeing that his/her graduate file in ISyE is up-to-date and that all requirements and deadlines are met. Some important requirements that apply to all Master’s students include:

1. No course listed on a degree petition was counted toward requirements of another Master’s or Ph.D. program.
2. Not more than two undergraduate 4000-level courses may be listed on a degree petition.
3. All courses on the degree petition must be letter graded.
A petition for a degree must be submitted by the end of the term prior to the term in which graduation is anticipated; ISyE staff will notify students about degree petition deadlines each term.

**Grades Required**
Only courses with letter grades of $A$, $B$, or $C$ may be used to satisfy degree requirements and the Georgia Tech final Institute graduate GPA requirement of 2.7 must also be satisfied. All required courses in a Master’s program of study must be taken for a letter grade. Courses taken with a pass/fail grading option cannot be counted toward a degree. If you receive a $D$ or $F$ in a program course, it may be repeated. Please note that since courses are generally offered at most once per year, this can delay graduation significantly. When courses are repeated, the original course and grade remains on the transcript and is still counted toward your Institute GPA.

**Academic Standing**
Students should familiarize themselves with the [Registrar’s Academic Standing](#) system. A student in a Master’s program will be placed on **Warning** standing if the GPA at the end of any semester falls below the 2.7 graduation threshold. If a student fails to improve performance, or if performance in a single semester is extremely unsatisfactory, **Probation** standing may result. **Drop/Dismissal** standing results from academic deficiency; once dropped, a student must be absent for a complete semester before a readmission application will be considered.

Students who do not maintain **Good** standing may be subject to registration restrictions.

**Progress Toward a Degree**
As a full-time student, you are encouraged to schedule coursework that provides clear evidence that you are making progress toward your degree requirements. Delaying progress by scheduling courses with the apparent intent of delaying graduation is not allowed. Students who appear to be violating the spirit of this guideline will receive a registration hold for the subsequent semester; particularly serious cases will be forwarded to the Office of the Dean of Students.

Please be advised that most courses in ISyE are taught at most once per year, and very few offerings are available during the summer semester. During orientation, we will discuss ISyE’s plan to offer specific courses for the following three semesters (Fall, Spring, Summer). Please study this information carefully. Degree requirement exceptions will not be granted due to poor planning by a student.
Master’s Degree Requirements By Program

Master of Science in Industrial Engineering (MSIE)
Faculty Advisor: Dr. Dima Nazzal

Required Core (6 courses)
ISyE 6201 Manufacturing Systems
ISyE 6202 Warehousing Systems
ISyE 6203 Transportation and Supply Chain Systems

and select (3) courses from the following list:
ISyE 6225 Engineering Economy
ISyE 6414 Statistical Modeling and Regression Analysis
ISyE 6644 Simulation
ISyE 6650 Probabilistic Models and Their Applications
ISyE 6669 Deterministic Optimization

MSIE Technical Electives (2 courses)
Approved technical electives are provided in a subsequent list in this handbook, and on the ISyE website: http://www.isye.gatech.edu/mselectives

Free Electives (2 courses)

Total Required Coursework 30 credit-hours

Master of Science in Operations Research (MSOR)
Faculty Advisor: Dr. Dima Nazzal

Required Core (4 courses)
ISyE 6669 Deterministic Optimization
ISyE 6650 Probabilistic Models and Their Applications
ISyE 6644 Simulation
Math 4261 Mathematical Statistics I

Computing Elective (1 course)
CS 6520 Computational Complexity Theory
CS 6550 Design and Analysis of Algorithms
ISyE 6679 Computational Methods in Operations Research
CSE 6140 Computational Science and Engineering Algorithms

MSOR Technical Electives (5 courses)
Approved technical electives are provided in a subsequent list in this handbook, and on the ISyE website: http://www.isye.gatech.edu/mselectives

Total Required Coursework 30 credit-hours
Master of Science in Supply Chain Engineering (MSSCE)
Faculty Director: Dr. Alan Erera

Required Core (10 courses)
- ISyE 6333 Operations Research for Supply Chain Engineering 1
- ISyE 6334 Operations Research for Supply Chain Engineering 2
- ISyE 6335 Supply Chain Engineering 1
- ISyE 6336 Supply Chain Engineering 2
- ISyE 6337 Supply Chain Engineering 3
- ISyE 6338 Supply Chain Strategy
- ISyE 6339 Supply Chain Information Systems
- ISyE 6340 Supply Chain Engineering Seminar
- ISyE 6341 Capstone Project for Supply Chain Engineering 1
- ISyE 6342 Capstone Project for Supply Chain Engineering 2

Total Required Coursework 30 credit-hours

ISyE 6333-42 courses are restricted to enrollment only by MSSCE students. MS Analytics students with appropriate preparation may request permits to enroll in 6333-37 if space permits.

Master of Science in Health Systems (MSHS)
Faculty Advisor: Dr. Pinar Keskinocak

The MSHS degree can be earned by completing one of two track options, the General Track or the Predictive Health Track:
**MSHS General Track**

**Required Core** (6 courses)
- HS 6000 Introduction to Healthcare Delivery

and select (1) course from the following list:
- HS 6400 Healthcare Systems Practice
- ISyE 6320 Public Impact Applications of OR

and select (3) courses from the following list:
- ISyE 6669 Deterministic Optimization
- ISyE 6650 Probabilistic Models and Their Applications
- ISyE 6644 Simulation
- ISyE 6414 Statistical Modeling and Regression Analysis

and select (1) course from the following list:
- MGT 6000 Financial and Managerial Accounting
- MGT 6060 Financial Management I
- ISyE 6225 Engineering Economy
- ISyE 6227 Introduction to Financial Engineering
- HS 6200 Healthcare Financial Management

**MSHS Technical Electives** (3 courses)
Approved technical electives are provided in a subsequent list in this handbook, and on the ISyE website: [http://www.isye.gatech.edu/mselectives](http://www.isye.gatech.edu/mselectives)

**Free Electives** (1 course)

**Total Required Coursework** 30 credit-hours

**MSHS Predictive Health Track**

**Required Core** (8 courses)
- HS 6000 Introduction to Healthcare Delivery
- ISyE 6669 Deterministic Optimization
- ISyE 6650 Probabilistic Models and Their Applications
- ISyE 6644 Simulation
- ISyE 6414 Statistical Modeling and Regression Analysis
- ISyE 7406 Data Mining and Statistical Learning

and select (1) course from the following list:
- HS 6400 Healthcare Systems Practice
- ISyE 6320: Public Impact Applications of OR

and select (1) course from the following list:
- MGT 6000 Financial and Managerial Accounting
- MGT 6060 Financial Management I
- ISyE 6225 Engineering Economy
- ISyE 6227 Introduction to Financial Engineering
- HS 6200 Healthcare Financial Management
MSHS Technical Electives (1 course)
Approved technical electives are provided in a subsequent list in this handbook, and on the ISyE website: http://www.isye.gatech.edu/mselectives

Free Electives (1 course)

Total Required Coursework 30 credit-hours

Master of Science in Analytics (MSANLT)
Faculty Director: Dr. Joel Sokol

The MS Analytics degree can be earned by completing one of three track options: Analytical Tools, Business Analytics, or Computational Data Analytics. Please note that MS Analytics students select one of these tracks as a major, and that switching tracks requires approval of the Director of the MS in Analytics program. With approval of the Director, courses marked below with asterisks (*) may be replaced with MS Analytics Electives by students with appropriate backgrounds. The two practicum courses marked with (**) can be replaced with an approved internship and MS Analytics Electives with approval from the Director.

**MSANLT Analytical Tools Track**

Introductory Core (3 courses)
- CSE 6040 Computing for Data Analytics*
- ISyE 8803 Introduction to Analytical Methods*
- MGT 8803 Introduction to Business for Analytics*

Required Core (7 courses)
- CSE 6242 Data and Visual Analytics
- MGT 8803 Big Data Analytics in Business
- ISyE 8803 Applied Analytics Practicum I**
- ISyE 8803 Applied Analytics Practicum II**
(2) approved Statistics courses and (1) approved Operations Research course, as listed on the MS Analytics website: http://www.analytics.gatech.edu/curriculum/electives

Track Electives (2 courses)
(1) approved Operations Research course, and (1) approved course in either Statistics or Operations Research, as listed on the MS Analytics website: http://www.analytics.gatech.edu/curriculum/electives

Total Required Coursework 36 credit-hours

**MSANLT Business Analytics Track**

Introductory Core (3 courses)
- CSE 6040 Computing for Data Analytics*
- ISyE 8803 Introduction to Analytical Methods*
- MGT 8803 Introduction to Business for Analytics*
### Required Core (7 courses)
- **CSE 6242** Data and Visual Analytics
- **MGT 8803** Big Data Analytics in Business
- **MGT 8803** Applied Analytics Practicum I**
- **MGT 8803** Applied Analytics Practicum II**

(2) approved Statistics courses and (1) approved Operations Research course, as listed on the MS Analytics website: [http://www.analytics.gatech.edu/curriculum/electives](http://www.analytics.gatech.edu/curriculum/electives)

### Track Electives (2 courses)
Two approved Business electives, as listed on the MS Analytics website: [http://www.analytics.gatech.edu/curriculum/electives](http://www.analytics.gatech.edu/curriculum/electives)

### Total Required Coursework 36 credit-hours

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**MSANLT Computational Data Analytics Track**

### Introductory Core (3 courses)
- **CSE 6040** Computing for Data Analytics*
- **ISyE 8803** Introduction to Analytical Methods*
- **MGT 8803** Introduction to Business for Analytics*

### Required Core (7 courses)
- **CSE 6242** Data and Visual Analytics
- **CSE 6740** Computational Data Analysis
- **MGT 8803** Big Data Analytics in Business
- **ISyE 8803** Applied Analytics Practicum I**
- **ISyE 8803** Applied Analytics Practicum II**

(1) approved Statistics course and (1) approved Operations Research course, as listed on the MS Analytics website: [http://www.analytics.gatech.edu/curriculum/electives](http://www.analytics.gatech.edu/curriculum/electives)

### Track Electives (2 courses)
Two approved Computing electives, as listed on the MS Analytics website: [http://www.analytics.gatech.edu/curriculum/electives](http://www.analytics.gatech.edu/curriculum/electives)

### Total Required Coursework 36 credit-hours

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**Master of Science in Statistics (MS Stat)**

Faculty Advisor: Dr. Brani Vidakovic

### Required Core (4 courses)
- **Math 4261** Mathematical Statistics I
- **Math 4262** Mathematical Statistics II
- **ISyE 6413** Design and Analysis of Experiments
- **ISyE 6414** Statistical Modeling and Regression Analysis

### Technical Electives (5 courses)
- **Math 4317** Real Analysis
- **Math 6262** Statistical Estimation
- **Math 6263** Testing Statistical Hypotheses
- **Math 6266** Linear Statistical Models
- **Math 6267** Multivariate Statistical Analysis
ISyE 6402  Time-Series Analysis
ISyE 6404  Nonparametric Data Analysis
ISyE 6405  Statistical Methods for Manuf. Design & Improvement
ISyE 6412  Theoretical Statistics
ISyE 6416  Computational Statistics
ISyE 6420  Bayesian Statistics
ISyE 6421  Biostatistics
ISyE 6761  Stochastic Processes I
ISyE 6762  Stochastic Processes II
ISyE 6781  Reliability Theory
ISyE 6783  Financial Data Analysis
ISyE 7400  Advanced Design of Experiments
ISyE 7401  Advanced Statistical Modeling
ISyE 7405  Multivariate Data Analysis
ISyE 7406  Data Mining

Free Elective (1 course)

Total Required Coursework 30 credit-hours

Master of Science in Quantitative and Computational Finance (MSQCF)
More information about the MSQCF program can be found at http://www.qcf.gatech.edu/

Required Core (6 courses)
MGT 6078  Finance and Investments
MGT 6081  Derivative Securities
Math 6635  Numerical Methods in Finance
ISyE 6759  Stochastic Processes in Finance I
ISyE 6767  Design and Implementation of Systems to Support Computational Finance
ISyE 6769  Fixed Income Securities

Technical Electives (3 courses)
ISyE 6673  Financial Optimization
Math 6235  Stochastic Processes in Finance II
MGT 6090  Management of Financial Institutions
ISyE 6783  Statistical Techniques of Financial Data
ISyE 6785  The Practice of Quantitative and Computational Finance
MGT 7061  Empirical Finance

Free Electives (3 courses)

Total Required Coursework 36 credit-hours

Master of Science in Computational Science and Engineering (MSCSE)
ISyE Unit Coordinator: Dr. Christos Alexopoulos
Details regarding this interdisciplinary Master’s degree option can be found at: http://www.cseprograms.gatech.edu/cseems/program
### Core Courses  
**CSE 6643**  
Numerical Linear Algebra  

**CSE 6140**  
Computational Science and Engineering Algorithms  

**CSE 6730**  
Modeling and Simulation  

**ISyE 6740**  
Computational Data Analysis  

**CSE 6220**  
High Performance Computing  

### Computational and Technical Specialization  
**4 courses**  
The 12 credit-hours of coursework here must be relevant to CSE, include one application area, and include 6 credit-hours of coursework in non-CS/CSE courses. The specialization must be approved by your ISyE advisor.

### Technical Electives  
**2 courses**  
Technical electives must be approved by your ISyE advisor, and are typically drawn from the MSIE and MSOR technical elective lists in this handbook, and on the ISyE website:  
[http://www.isye.gatech.edu/mselectives](http://www.isye.gatech.edu/mselectives)

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**Master of Science in International Logistics (MSIL)**  
Students complete the MSIL degree in the Executive Master’s in International Logistics and Supply Chain Strategy program (EMIL-SCS). The program delivers 30 credit-hours of coursework spread over 5 intensive two-week sessions, with required intersession distance-learning work. Students in Georgia Tech’s traditional on-campus and distance learning programs are not eligible to take EMIL-SCS courses, numbered IL 6000-8000 in the Georgia Tech course catalog.
Master’s Degree Technical Electives and Substitutions

Technical Electives for MS in Industrial Engineering

- ISyE 6225 Engineering Economy
- ISyE 6230 Economic Decision Analysis
- ISyE 6307 Scheduling Theory
- ISyE 6402 Time-Series Analysis
- ISyE 6404 Nonparametric Data Analysis
- ISyE 6405 Statistical Methods for Manufacturing Design/Improvement
- ISyE 6413 Design and Analysis of Experiments
- ISyE 6414 Statistical Modeling and Regression Analysis
- ISyE 6416 Computational Statistics
- ISyE 6420 Bayesian Statistics
- ISyE 6421 Biostatistics
- ISyE 6644 Simulation
- ISyE 6650 Probabilistic Models and Their Applications
- ISyE 6656 Queuing Theory and Applications
- ISyE 6662 Optimization II
- ISyE 6663 Optimization III
- ISyE 6664 Stochastic Optimization
- ISyE 6669 Deterministic Optimization
- ISyE 6679 Computational Methods
- ISyE 6701 Energy Policy and Technology
- ISyE 6740 Computational Data Analysis
- ISyE 6781 Reliability Theory
- ISyE 6805 Reliability Engineering
- ISyE 6810 Systems Monitoring & Prognostics
- ISyE 7201 Production and Service Systems Engineering
- ISyE 7204 Informatics in Production and Service Systems
- ISyE 7210 Real-Time Interactive Simulation
- ISyE 7406 Data Mining and Statistical Learning
- ISyE 7653 Case Studies in Logistics/Manufacturing

Other courses may be acceptable, including advanced versions of courses listed above, but must be approved by the Associate Chair for Graduate Studies. Submit all approval requests via email to your advisor.

Technical Electives for MS in Operations Research

- ISyE 6225 Engineering Economy
- ISyE 6230 Economic Decision Analysis
- ISyE 6307 Scheduling Theory
- ISyE 6402 Time-Series Analysis
- ISyE 6404 Nonparametric Data Analysis
- ISyE 6413 Design and Analysis of Experiments
- ISyE 6414 Statistical Modeling and Regression Analysis
- ISyE 6416 Computational Statistics
- ISyE 6420 Bayesian Statistics
- ISyE 6421 Biostatistics
- ISyE 6679 Computational Methods
- ISyE 6701 Energy Policy and Technology
- ISyE 6781 Reliability Theory
- ISyE 7201 Production and Service Systems Engineering
• ISyE 7203 Logistics Systems Engineering  
• ISyE 7210 Real-Time Interactive Simulation  
• ISyE 7400 Advanced Design of Experiments  
• ISyE 7401 Advanced Statistical Modeling  
• ISyE 7405 Multivariate Data Analysis  
• ISyE 7406 Data Mining and Statistical Learning  
• ISyE 7653 Case Studies in Logistics/Manufacturing  
• Math 4022 Introduction to Graph Theory  
• Math 4032 Combinatorial Analysis  
• Math 4305 Topics in Linear Algebra  
• Math 4317 Analysis I or  
  Math 4318 Analysis II  
• Math 4640 Numerical Analysis I or  
  Math 4641 Numerical Analysis II  
• CS 4510 Automata and Complexity  
• CS 6236 Parallel and Distributed Simulation  
• CS 6505 Computability and Algorithms  
• CS 6520 Computational Complexity  
• CS 6550 Design and Analysis of Algorithms  

Various 6000-level math courses that are graduate versions of courses above may be suitable, but should be approved in advance by the Associate Chair for Graduate Studies. Certain advanced topics courses (ISyE 88xx) may also be allowed, subject to approval. Submit all approval requests via email to your advisor.

**Technical Electives for MS in Health Systems**

• ARCH 6243 Evidence-Based Design  
• ARCH 6271 Healthcare Des Of Future  
• BIOL 6150 Genomics and Applied Bioinformatics  
• BIOL 7023 Bioinformatics  
• BMED 6507 Fundamentals of Medical Device Regulatory Process  
• ISyE 6421 Biostatistics or  
  BMED 6700 Biostatistics  
• BMED 6789 Technology Ventures  
• BMED 7411 Mathematical Models in Biology and Medicine  
• CS 6150 Computing For Good  
• CS 6440 Intro Health Informatics  
• ECON 6510 Health Economics  
• HP 6601 Industrial Hygiene  
• HTS 6122 History of Medicine  
• HTS 6123 Social & Cultural BIOMED  
• MGT 6357 Service Operations Management  
• MGT 8803 Management of the Healthcare Enterprise

**Ph.D. Course Substitutes**

Any course in a Master’s degree program of study can be substituted for higher-level Ph.D. courses covering the same material. Please note that Ph.D. courses can be very challenging without appropriate preparation:

• ISyE 6412 Theoretical Statistics substitutes for Math 4261  
• ISyE 6661 Optimization I or ISyE 6662 Optimization II substitutes for ISyE 6669
- ISyE 6761 Stochastic Processes I substitutes for ISyE 6650
- ISyE 6832 Simulation Theory substitutes for ISyE 6644
- ISyE 7201 Production and Service Systems Engineering substitutes for ISyE 6201
- ISyE 7203 Logistics Systems Engineering substitutes for ISyE 6203
- ISyE 7400 Advanced Design of Experiments substitutes for ISyE 6413
- ISyE 7401 Advanced Statistical Modeling substitutes for ISyE 6414

Ph.D. Degree Programs
The degree Doctor of Philosophy (Ph.D.) earned via an ISyE doctoral program recognizes students with demonstrated proficiency and high achievement in research within the disciplines represented in the School faculty. After adequate preparation, the successful Ph.D. candidate must complete a searching and authoritative investigation of a special area in their chosen field, culminating in a written dissertation describing the unique contributions created by that investigation.

Admission Requirements
Each applicant is required to submit a written statement describing motivation for pursuing the Ph.D. in ISyE, including a description of current research interests. Transcripts of prior academic work are required as are scores on the general portion of the Graduate Record Examination (GRE). In addition to the required GRE test scores, applicants are encouraged to submit scores from the Mathematics Subject Test. All applicants must request that credible letters of reference be submitted on their behalf and which attest to their ability to perform rigorous Ph.D. level course and research work. In order to be considered for admission into the Ph.D. program, an applicant need not possess a Master’s degree.

Students who are presently enrolled in an ISyE Master’s programs can apply for admission into the Ph.D. program without reapplying to Georgia Tech. Applicants can submit a simplified application directly to the Associate Chair for Graduate Studies consisting of an updated CV, a statement of purpose, and at least two new letters of recommendation from Georgia Tech faculty. Such requests will be evaluated in the same fashion as for new Ph.D. applicants and typically will not be considered until the final term of the applicant’s Master’s program.

Program Structure
Doctoral students in ISyE can pursue 5 different Ph.D. degrees, including the three interdisciplinary degrees marked with an asterisk (*) below. The Ph.D. in Industrial Engineering degree offers four different specializations, and each student must select one prior to the Comprehensive Examination. Students wishing to switch between the IE, OR, or CSE degree must seek permission from the Associate Chair for Graduate Studies. Switching into the Ph.D. degrees in ACO and Bioinformatics is only possible after permission is granted from the heads of those programs.

Doctor of Philosophy in Industrial Engineering
- Specialization in Supply Chain Engineering
- Specialization in Statistics
- Specialization in Economic Decision Analysis
Specialization in System Informatics and Control

Doctor of Philosophy in Operations Research
Doctor of Philosophy in Algorithms, Combinatorics, and Optimization (ACO)*
Doctor of Philosophy in Computational Science and Engineering (CSE)*
Doctor of Philosophy in Bioinformatics*

Enrollment
Every Ph.D. student in an ISyE program is supported by an assistantship or a fellowship during Fall and Spring semesters during the first four program years. During any semester in which a student is supported, full-time enrollment is required.

Since Ph.D. students usually do not take a full-time load of classroom coursework, enrollment is supplemented by registering for research credit hours. During each semester of full-time enrollment, we expect Ph.D. students to enroll for maximum credit hours (classroom plus research); 21 credit-hours for Fall or Spring semesters, and 16 credit-hours for Summer semesters.

Ph.D. students should register for ISyE 9000 research credit-hours in the course section offered by the Ph.D. research advisor. In the first year of the program, students may not have settled yet on a research advisor, but we still expect enrollment in the ISyE 9000 section associated with the prospective research advisor. In rare cases, a faculty member may ask instead that you enroll in special problems courses ISyE 8900 or ISyE 8901, but these requests will not be typically approved.

Responsible Conduct of Research (RCR) Training
Each Ph.D. student who enrolled for graduate study at Georgia Tech during or after Fall 2011 must complete Responsible Conduct of Research (RCR) training. The training consists of two required components:

1. Online CITI RCR training course
2. In-person PHIL 6000: Responsible Conduct of Research course

Each student needs to complete the CITI RCR online course within 90 days of enrolling at Georgia Tech. A registration hold will be placed after 90 days, and not removed until this requirement is met.

PHIL 6000 can be taken during the first Summer semester, or during any Fall or Spring semester. This course requirement should be completed as early as possible, and no later than the 3rd enrolled semester. Students in the CSE program can also take CSE 6001 as an alternative to PHIL 6000.

First-Year Review
The performance for each Ph.D. student will be reviewed after the first two non-Summer semesters of study. This assessment will be based on course performance, a report from the thesis advisor, and feedback from instructors on graduate teaching assistants (if
applicable). The review will be conducted by the Associate Chair for Graduate Studies and the ISyE Faculty Graduate Committee.

If the review is satisfactory, the student will be informed that they have passed. If the review reveals some concerns, the student may pass, but with these concerns clearly described including possibly some suggested remediation. Finally, if the review reveals that performance in the first year is unsatisfactory, the student will be informed that they are not permitted to continue in the program.

Students in the ACO program are also subject to a separate review that is performed by the ACO Coordinating Committee.

**Comprehensive Examination**

The Comprehensive Examination is an Institute requirement for Ph.D. students, and must be completed prior to advancing to Ph.D. degree candidacy. Comprehensive exams are designed to assess both general and specialized knowledge in the student’s area of study, and to assess student readiness for research. Students in ISyE are expected to complete a comprehensive examination no later than their second full year of Ph.D. study.

Students are admitted to a comprehensive examination by the Associate Chair for Graduate Studies via a sign-up process managed by the Academic Programs Office. A t-square site titled *Comprehensive Exams* is used to manage sign-ups and announcements regarding the exams, and serves as a repository for previous exams.

Each academic year, faculty examining committees for Operations Research and each of the specializations within Industrial Engineering are formed. Examination schedules and formats are also announced, and may differ by committee. At the completion of the examination, the faculty examining committee recommends one of the following outcomes for each examinee: (i) pass, (ii) pass with some stated condition(s), (iii) failed, or for exceptional cases, (iv) failed but with an opportunity to re-take the examination. An exam outcome must be agreed upon by 2/3rd of the members of the faculty examining committee.

Comprehensive Examinations are organized separately for Ph.D. students seeking the ACO, CSE, and Bioinformatics degrees. Students in these programs should consult with the program heads for more information.

Currently, the schedule for exams is:

- Operations Research: August
- Industrial Engineering, Statistics: August
- Industrial Engineering, Supply Chain Engineering: December
- Industrial Engineering, System Informatics and Control: December
- Industrial Engineering, Economic Decision Analysis: December

A student who has not passed a comprehensive examination by the end of the 6th enrolled semester in the Ph.D. program may not continue in the program. Any student failing two comprehensive exams may not continue in the program, regardless of the number of semesters completed.
Minor
Each Georgia Tech Ph.D. candidate must complete a minor consisting of 9 hours (3 courses) in a field of study distinct from the student’s primary concentration. The spirit of the minor is to provide breadth to the student’s program. Students should design a minor in consultation with the faculty advisor immediately after successful completion of the Comprehensive Examination. Each minor must be approved by the Associate Chair for Graduate Studies, in consultation when necessary with the Faculty Graduate Committee.

While our goal is to give students flexibility in designing minors, it must be noted that it is critical that the minor be coherent (representing a single defined field of study) and distinct from the primary concentration. Minor courses should be at the 6000 level or higher, although certain 4000 courses may be approved. Typical minors for ISyE Ph.D. students are computer science, mathematics, economics, finance, operations management, and statistics, or subfields within those fields.

When designing a minor, please adhere to the following rules:

1. A minor must be different from the major, and cannot be simply a subfield of the major
2. No course listed in the Program Requirements for the primary Ph.D. program may be included.
3. All minor courses must be letter-graded.
4. Not more than one 4000 level course may be included.
5. The GPA for a minor must be 3.0 or higher.

Ph.D. Students Earning Master’s Degrees at Georgia Tech
It is common for Ph.D. students to earn a Master’s degree as they progress through their Ph.D. program of study. That is, appropriate courses taken as part of their Ph.D. program are often applied to satisfy relevant degree requirements for a single Master’s degree. Any course completed within a Ph.D. program of study that is an advanced version of a corresponding Master’s degree requirement can be used as a substitute. Some such substitutions are listed in this handbook, and all must be approved by the Associate Chair for Graduate Studies.

Ph.D. students will not be granted multiple Master’s degrees from ISyE. Ph.D. students are also eligible to apply for follow-on MBA study through the MBA Dual Degree program, offered by Georgia Tech’s Scheller College of Business.

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

Faculty Research Advisor
Ph.D. students are encouraged to select a research advisor to guide their dissertation research as soon as appropriate. If a student beginning the first year has not yet settled on an area of concentration, it is recommended that the student select an initial research advisor in an area of interest.

The research advisor will work with the student during all phases of Ph.D. dissertation research. If a student requires financial assistance to complete doctoral study, it is expected that the research advisor will provide a Graduate Research Assistantship (GRA). Limited funding opportunities in the form of Graduate Teaching Assistantships (GTA) or Graduate Student Instructors (GSI) are available from the School, but should not be relied upon.

A student who does not have a willing faculty research advisor after the completion of three Ph.D. semesters (not including summers) will generally not be eligible for GTA or GSI funding from ISyE.

Thesis Advisory and Final Doctoral Exam Committee Membership
There are two committees that function to advise, approve, and conduct the final doctoral oral examination of the dissertation and the student’s knowledge of the field in which it lies.

The first committee is called the Thesis Advisory Committee or the Thesis Reading Committee and consists of at least three Georgia Tech academic faculty members, one of whom is the Thesis Advisor. The majority of the Thesis Advisory Committee shall be tenure-track or tenured members of the Academic Faculty. It is expected that the Thesis Advisor is a tenure-track or tenured member of the Academic Faculty, preferably from the home unit of the student. Approval of the Faculty Graduate Committee is required prior to the Dissertation Research Proposal if a student seeks to appoint a Thesis Advisor who is not a tenure-track or tenured member of the Academic Faculty.

The Thesis Advisory Committee approves the research topic, provides advice and guidance during the research, and is charged with approving the thesis when the research is completed and ready to be presented as the doctoral thesis (i.e., dissertation). When the committee considers the dissertation to be satisfactory, a recommendation is made to the Vice-Provost for Graduate Studies and Faculty Affairs for the appointment of the second committee, which is called the Final Doctoral Examination Committee. This committee consists of five individuals.

The Final Doctoral Examination Committee always contains the Thesis Advisory Committee members and other members of the tenure-track and tenured Academic Faculty, as appropriate, who are recommended by the School or College to the Vice-Provost for approval. At least one member of the Final Doctoral Examination Committee must be from a unit distinct from the unit in which the student is enrolled. It is most common for a student to select a Thesis Advisory Committee with five members that will also serve as the Final Doctoral Examination Committee.
Occasionally, a request is made to have a non-Georgia Tech individual included as a member of the Final Doctoral Examination Committee. The proposed member must have a Ph.D. in a related research area and should be research active. The credentials of such an individual must be submitted to the Associate Chair for Graduate Studies and will be scrutinized to verify that the individual has a background that approximates that of a member of the Academic Faculty.

**Second Year Paper**

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. Paper requirements are described elsewhere.

**Dissertation Research Proposal**

The first step toward completing a 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 Thesis Advisory Committee. The content expected in the written research proposal should be discussed with the research advisor and Thesis Advisory Committee members.

If judged to be satisfactory, the Thesis Advisory Committee signs the appropriate section of the Request for Admission to Ph.D. Candidacy form approving the thesis topic. Each member of the Thesis Advisor 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. Advisors may expect a longer period between proposal and 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.

**Candidacy**

To qualify for candidacy students must have completed any formal course work requirements as stated in their Program concentration, achieve a satisfactory scholastic record, pass the Comprehensive Examination, and have a thesis topic approved by their Thesis Advisory Committee and the Associate Chair for Graduate Studies via the
Dissertation Research Proposal process. Students must also have completed all Georgia Tech Responsible Conduct of Research (RCR) training requirements.

The minor need not be completed prior to candidacy.

**Final Doctoral Examination**

The Final Doctoral Examination, often referred to as the “dissertation defense”, will be an oral examination on the student’s research and the results obtained. A final draft version of the dissertation should be presented to the Final Doctoral Examination Committee membership at least two weeks prior to the defense date, though some advisors and/or committee members may require a longer lead time (typically not more than one month). It is expected that the final draft will be a complete document conforming to the requirements for submission to the Georgia Tech Graduate Thesis Office.

A student will pass the examination if not more than one dissenting vote is cast by the committee. A vote may be favorable subject to minor revisions to the dissertation; these would be coordinated through the advisor. Upon successful completion of the examination and any conditions, the Final Doctoral Examination Committee signs the *Certificate of Thesis Approval* form. The student is responsible for delivering this completed form to the Academic Programs Office.

Once the Associate Chair for Graduate Studies signs a *Certificate of Thesis Approval* and the Ph.D. candidate files the dissertation with Georgia Tech, the Ph.D. degree is conferred!
Ph.D. Program Requirements By Program

Each Ph.D. degree program and specialization has specific course requirements. Students are expected to complete the course programs described below prior to candidacy, and many of the courses are recommended to be completed prior to the comprehensive examination. Students seeking to waive a program course requirement must receive permission from the Associate Chair for Graduate Studies.

Ph.D. in Industrial Engineering: Specialization in Supply Chain Engineering

<table>
<thead>
<tr>
<th>Domain Core</th>
<th>(3 courses)</th>
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</thead>
<tbody>
<tr>
<td>ISyE 6202</td>
<td>Warehousing Systems</td>
</tr>
<tr>
<td>ISyE 7201</td>
<td>Production Systems Engineering</td>
</tr>
<tr>
<td>ISyE 7203</td>
<td>Logistics Systems Engineering</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Methods Core</th>
<th>(5 courses)</th>
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</thead>
<tbody>
<tr>
<td>ISyE 6661</td>
<td>Linear Optimization</td>
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<tr>
<td>ISyE 6662</td>
<td>Discrete Optimization</td>
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<tr>
<td>ISyE 6761</td>
<td>Stochastic Processes I</td>
</tr>
<tr>
<td>ISyE 6230</td>
<td>Economic Decision Analysis</td>
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<tr>
<td>ISyE 6414</td>
<td>Statistical Modeling and Regression Analysis</td>
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<table>
<thead>
<tr>
<th>Computational Elective</th>
<th>(1 course)</th>
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<tbody>
<tr>
<td>CSE 6140</td>
<td>Computational Science and Engineering Algorithms</td>
</tr>
<tr>
<td>CS 6550</td>
<td>Design and Analysis of Algorithms</td>
</tr>
<tr>
<td>ISyE 6679</td>
<td>Computational Methods in Operations Research</td>
</tr>
</tbody>
</table>

By completion of the Ph.D., students must have taken a minimum of two additional courses related to their major area chosen in consultation with their advisor.

It is recommended that students complete the domain courses as well as ISyE 6661, 6662 and 6761 before they sit for the comprehensive examination. A student is not admitted to candidacy until all of the stated course requirements in the Program of Study have been completed.
**Ph.D. in Industrial Engineering: Specialization in Statistics**

<table>
<thead>
<tr>
<th>Domain Core</th>
<th>(5 courses)</th>
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<tbody>
<tr>
<td>ISyE 6412 Theoretical Statistics</td>
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<tr>
<td>ISyE 6413 Design and Analysis of Experiments</td>
<td></td>
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<tr>
<td>ISyE 6416 Computational Statistics</td>
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<tr>
<td>ISyE 7401 Advanced Statistical Modeling</td>
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<tr>
<td>ISyE 6650 Probabilistic Models and Their Applications</td>
<td>or Math 6241 Probability I</td>
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</tbody>
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<thead>
<tr>
<th>Theory Electives</th>
<th>(2 or more courses)</th>
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</thead>
<tbody>
<tr>
<td>ISyE 6420 Bayesian Statistics</td>
<td></td>
</tr>
<tr>
<td>ISyE 6781 Stochastic Processes I</td>
<td></td>
</tr>
<tr>
<td>ISyE 6762 Stochastic Processes II</td>
<td></td>
</tr>
<tr>
<td>ISyE 6781 Reliability Theory</td>
<td></td>
</tr>
<tr>
<td>ISyE 7405 Multivariate Data Analysis</td>
<td></td>
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<tr>
<td>Math 6242 Probability II</td>
<td></td>
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<tr>
<td>Math 6262 Statistical Estimation</td>
<td></td>
</tr>
<tr>
<td>Math 6263 Testing Statistical Hypotheses</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Methods Electives</th>
<th>(3 or more courses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISyE 6402 Time Series</td>
<td></td>
</tr>
<tr>
<td>ISyE 6404 Nonparametric Statistics</td>
<td></td>
</tr>
<tr>
<td>ISyE 6405 Statistical Methods for Manufacturing Design and Improvement</td>
<td></td>
</tr>
<tr>
<td>ISyE 6414 Statistical Modeling and Regression Analysis</td>
<td></td>
</tr>
<tr>
<td>ISyE 6805 Reliability Engineering</td>
<td></td>
</tr>
<tr>
<td>ISyE 7400 Advanced Design of Experiments</td>
<td></td>
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<tr>
<td>ISyE 7406 Data Mining and Statistical Learning</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other Electives</th>
<th>(1 or more courses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 7023 Bioinformatics</td>
<td></td>
</tr>
<tr>
<td>CS 7645 Numerical Machine Learning</td>
<td></td>
</tr>
<tr>
<td>ECE 6254 Statistical Digital Signal Processing</td>
<td></td>
</tr>
<tr>
<td>ISyE 6201 Manufacturing Systems</td>
<td></td>
</tr>
<tr>
<td>ISyE 6202 Warehousing Systems</td>
<td></td>
</tr>
<tr>
<td>ISyE 6203 Transportation and Supply Chain Systems</td>
<td></td>
</tr>
<tr>
<td>ISyE 6230 Economic Decision Analysis</td>
<td></td>
</tr>
<tr>
<td>ISyE 6644 Simulation</td>
<td></td>
</tr>
<tr>
<td>ISyE 6664 Stochastic Optimization</td>
<td></td>
</tr>
<tr>
<td>ISyE 6669 Deterministic Optimization</td>
<td></td>
</tr>
<tr>
<td>or ISyE 6661 Linear Optimization</td>
<td></td>
</tr>
<tr>
<td>ISyE 6783 Statistical Techniques of Financial Data Analysis</td>
<td></td>
</tr>
<tr>
<td>ISyE 6832 Simulation Theory and Methods</td>
<td></td>
</tr>
</tbody>
</table>

All 11 courses satisfying the above requirements in the Program of Study must be completed in order to obtain doctoral candidacy.
Ph.D. in Industrial Engineering: Specialization in Economic Decision Analysis

**EDA Core**  
(5 courses)  
- ISyE 6225 Engineering Economy  
- ISyE 6230 Economic Decision Analysis  
- ISyE 8813 Game Theory  
- ECON 7012 Microeconomic Theory I  
- ECON 7013 Microeconomic Theory II

**Operations Research Core**  
(3 courses)  
- ISyE 6661 Optimization I  
- ISyE 6663 Optimization III  
- ISyE 6761 Stochastic Processes I

**Statistics Elective**  
(1 course)  
Select one course from ISyE 6402 to ISyE 6421

**Breadth Elective**  
(1 course)  
- ISyE 6227 Introduction to Financial Engineering  
- ISyE 6673 Financial Optimization  
- ISyE 6785 The Practice of Quantitative & Computational Finance  
- ISyE 7201 Production Systems Engineering  
- ISyE 7203 Logistics Systems Engineering  
- HS 6000 Introduction to Health Care Delivery  
- CS 8803 Algorithmic Game Theory

For new students who have not taken Real Analysis, it is recommended you take Math 4317 in your first year. The following courses compose the comprehensive examination: ISyE 6230, ISyE 8813 Game Theory, Econ 7012, ISyE 6661. All ten courses in the Program of Study must be completed in order to obtain doctoral candidacy.
Ph.D. in Industrial Engineering: Specialization in System Informatics and Control

<table>
<thead>
<tr>
<th>Domain Core (3 courses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISyE 6810 System Monitoring and Prognostics</td>
</tr>
<tr>
<td>ISyE 7201 Production Systems Engineering</td>
</tr>
<tr>
<td>ISyE 7204 Informatics in Production and Service Systems</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Methods Core (3 courses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISyE 6661 Linear Optimization</td>
</tr>
<tr>
<td>ISyE 6761 Stochastics I</td>
</tr>
<tr>
<td>ISyE 7406 Data Mining</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Methods Breadth (4 or more courses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select courses from two or more of the six focus areas:</td>
</tr>
</tbody>
</table>

### Stochastics and Simulation

| ISyE 6644 Simulation                      |
| ISyE 6832 Simulation Theory and Methods   |
| ISyE 6656 Queuing Theory                  |
| ISyE 6762 Stochastics II                  |

### Statistics

| ISyE 6402 Time Series                    |
| ISyE 6405 Statistical Meth. for Manuf. Systems Design/Improvement |
| ISyE 6412 Theoretical Statistics         |
| ISyE 6413 Design and Analysis of Experiments |
| ISyE 6420 Bayesian Statistics            |
| ISyE 7401 Advanced Statistical Modeling  |
| ISyE 7405 Multivariate Data Analysis     |
| ECE 6555 Optimal Estimation              |

### Computing and Algorithms

| ISyE 6679 Computational Methods in Operations Research |
| ISyE 6416 Computational Statistics                |
| CS 6550 Design and Analysis of Algorithms          |

### Dynamics and Control

| ECE 6120 Automata Theory                      |
| ECE 6550 Linear Systems and Control          |
| ECE 6551 Digital Control                     |
| ECE 6552 Nonlinear Systems                   |
| ECE 6553 Optimal Control                     |
| ECE 6554 Adaptive Control                    |
| ECE 6556 Intelligent Control                 |
| ECE 6559 Advanced Linear Systems             |
| ME 6401 Linear Systems Control               |
| ME 6402 Nonlinear Control Systems            |
| ME 6403 Digital Control Systems              |
| ME 6404 Advanced Control Systems Design and Implementation |
| ME 6443 Variational Methods                  |

### Optimization

| ISyE 6664 Stochastic Optimization            |

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Along with the regular course requirements, students are required to sign up one time for the seminar class ISyE 8014 (Contemporary Topics in System Informatics and Control).

It is recommended that students complete the domain and methods course requirements before they sit for the comprehensive examination. A student is not admitted to candidacy until all of the stated course requirements in the Program of Study have been completed.

### Ph.D. in Operations Research

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

#### Domain Core (6 courses)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISyE 6661</td>
<td>Linear Optimization</td>
</tr>
<tr>
<td>ISyE 6662</td>
<td>Discrete Optimization</td>
</tr>
<tr>
<td>ISyE 6663</td>
<td>Nonlinear Optimization</td>
</tr>
<tr>
<td>ISyE 6761</td>
<td>Stochastics I</td>
</tr>
<tr>
<td>ISyE 6762</td>
<td>Stochastics II</td>
</tr>
<tr>
<td>ISyE 6832</td>
<td>Simulation Theory and Methods</td>
</tr>
</tbody>
</table>

#### Depth Electives (3 or more courses)

Students choose courses below only in their chosen track:

**Optimization:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISyE 6664</td>
<td>Stochastic Optimization</td>
</tr>
<tr>
<td>ISyE 6679</td>
<td>Computational Methods in OR</td>
</tr>
<tr>
<td>ISyE 7510</td>
<td>Graph Algorithms</td>
</tr>
<tr>
<td>ISyE 7661</td>
<td>Theory of Linear Inequalities</td>
</tr>
<tr>
<td>ISyE 7682</td>
<td>Convexity</td>
</tr>
<tr>
<td>ISyE 7683</td>
<td>Advanced Nonlinear Programming</td>
</tr>
<tr>
<td>ISyE 7686</td>
<td>Advanced Combinatorial Optimization</td>
</tr>
<tr>
<td>ISyE 7687</td>
<td>Advanced Integer Programming</td>
</tr>
<tr>
<td>ISyE 7688</td>
<td>Computational Mathematical Programming</td>
</tr>
</tbody>
</table>

**Stochastics:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISyE 6664</td>
<td>Stochastic Optimization</td>
</tr>
<tr>
<td>ISyE 7xxx</td>
<td>Stochastic Process Limits</td>
</tr>
<tr>
<td>ISyE 7xxx</td>
<td>Stochastic Networks</td>
</tr>
<tr>
<td>ISyE 7xxx</td>
<td>Rare Event Systems</td>
</tr>
<tr>
<td>Math 6241</td>
<td>Probability I</td>
</tr>
</tbody>
</table>
Math 6242 Probability II
Math 7244 Stochastic Processes and Stochastic Calculus

Applications:
ISyE 6229 Productivity Measurement and Analysis
ISyE 6230 Economic Decision Analysis
ISyE 6664 Stochastic Optimization
ISyE 6759 Stochastic Processes in Finance I
ISyE 7201 Production and Service Systems Engineering
ISyE 7203 Logistics Systems Engineering
Math 7244 Stochastic Processes and Stochastic Calculus

Breadth Electives (2 or more courses)
Students choose courses below only in their chosen track (same as above):

Optimization:
ISyE 6230 Economic Decision Analysis
ISyE 6412 Theoretical Statistics
ISyE 6656 Queueing Theory
ISyE 7201 Production and Service Systems Engineering
ISyE 7203 Logistics Systems Engineering
ISyE 7400 Advanced Design of Experiments
ISyE 7401 Advanced Statistical Modeling
ISyE 7405 Multivariate Data Analysis
Math 6014 Graph Theory
Math 6241 Probability I
Math 6242 Probability II
Math 6643 Numerical Linear Algebra
Math 6644 Iterative Methods for Systems of Equations
CS 6650 Design of Algorithms
CS 7520 Approximation Algorithms
CS 7530 Randomized Algorithms

Stochastics:
BIOL 7023 Bioinformatics
ISyE 6412 Theoretical Statistics
ISyE 6645 Monte Carlo Methods
ISyE 6679 Computational Methods in OR
ISyE 6759 Stochastic Processes in Finance I
ISyE 7201 Production and Service Systems Engineering
ISyE 7203 Logistics Systems Engineering
ISyE 7400 Advanced Design of Experiments
ISyE 7401 Advanced Statistical Modeling
ISyE 7405 Multivariate Data Analysis

Applications:
ISyE 6402 Time-Series Analysis
ISyE 6412 Theoretical Statistics
ISyE 6673 Financial Optimization
ISyE 6679 Computational Methods in OR
Math 6014 Graph Theory
Math 6241 Probability I
Math 6242 Probability II
ISyE 6656 Queueing Theory
ISyE 7xxx Stochastic Process Limits
ISyE 7xxx Stochastic Networks
ISyE 7xxx  Rare Event Systems  
ISyE 7400  Advanced Design of Experiments  
ISyE 7401  Advanced Statistical Modeling  
ISyE 7405  Multivariate Data Analysis  
ISyE 7682  Convexity  
ISyE 7683  Advanced Nonlinear Programming  
ISyE 7686  Advanced Combinatorial Optimization  
ISyE 7687  Advanced Integer Programming  
CS 6650  Design of Algorithms  
CS 7520  Approximation Algorithms  
CS 7530  Randomized Algorithms  

The comprehensive examination for the Ph.D. in Operations Research is based on content of the courses in the Domain Core except for ISyE 6832 as indicated above. The student may use courses selected from their breadth requirements to form the basis of a Minor.

Ph.D. in Algorithms, Combinatorics, and Optimization (ACO)
The ACO Program is a multidisciplinary venture sponsored by ISyE, the School of Mathematics, and the College of Computing. ACO Program faculty members are drawn from these three academic units. Qualified students are admitted to the ACO Program by an admissions committee consisting of ACO faculty with representatives from the three participating units. Each student in the ACO Program has a home academic unit chosen from among the three sponsoring units. Details regarding this interdisciplinary program can be found at:

http://www.aco.gatech.edu/descript.html

Ph.D. in Computational Science and Engineering
The CSE Ph.D. degree is a joint program between the Colleges of Computing, Sciences, and Engineering. The Ph.D. degree in CSE requires a minimum of 31 semester hours of coursework. The program of study is designed to give the student breadth of knowledge in computational science and engineering, depth in specific computational methods and techniques, and knowledge to apply these techniques to problems within the context of a specific application domain. Details regarding this interdisciplinary program can be found at:

http://www.cseprograms.gatech.edu/csephd

Ph.D. in Bioinformatics
Bioinformatics is a multidisciplinary field in which physical sciences, life sciences, computer science, and engineering are merged to solve both fundamental and applied problems in biology and medicine. The Bioinformatics Ph.D. degree is a joint program among School of Biology, School of Chemistry and Biochemistry, School of Mathematics, College of Computing, School of Industrial and Systems Engineering, School of Biomedical Engineering. Details regarding this interdisciplinary program can be found at:

http://www.biology.gatech.edu/graduate-programs/bioinformatics/
Tentative Graduate Course Projection

To determine which ISyE graduate courses will be offered during which semester, please refer to the registration and curriculum area of the ISyE website. Courses that are taught regularly in a semester are marked, and those that are taught sporadically may be marked with a specific year or not at all.