Welcome!

TO: New Graduate Students
FROM: Alan Erera
      Professor and Associate Chair for Graduate Studies

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 program!

This Graduate Handbook is the definitive guide to all of our Master’s and Ph.D. degree programs, and you should 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 Director of Student Services (Room 203E), and leads the Academic Programs Office. The common goal of everyone on our team is help you through your 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).

The Georgia Tech General Catalog (http://www.catalog.gatech.edu) describes high-level requirements 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 also 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 the floor plans for Groseclose and ISyE Main at http://www.isye.gatech.edu/visitors/buildings/.

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 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. Graduate student mailboxes are located on the first floor of ISyE Main, and can be used for correspondence between classmates and from the Academic Programs Office. This mailbox does not replace the post office box assigned to you at the Student Center Post Office which should be used for all outside correspondence. 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. OIT (http://www.oit.gatech.edu) 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 at http://passport.gatech.edu. 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. For information about our computing resources and instructions about how to apply for an ISyE UNIX account, please visit http://www.isye.gatech.edu/about/schoolcomputing.

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 schedules.

At the end of your graduate program, you must have certain academic and administrative paperwork completed and filed. Degree petitions 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.

**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 now ends after the midway point in the semester (check the Institute Registrar’s calendar at http://registrar.gatech.edu/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 Director of Student Services. 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 at http://www.honor.gatech.edu.
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 (MSSStat)
- 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 [http://www.grad.gatech.edu](http://www.grad.gatech.edu). 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 who might wish to change their Master’s degree program into MSIE, MSOR, MSCSE, MSHS, or MS Statistics can apply for a change of major by submitting a new personal statement, updated CV, and at least one letter of reference from a Georgia Tech faculty member directly to the Associate Chair for Graduate Studies.

Students interested in changing majors into MS Analytics or MS QCF should consult directly with the Faculty Director of the appropriate program about opportunities for transfer. The MS Supply Chain Engineering program does not routinely accept Master’s students seeking to change majors.
Finally, a student pursuing a Master’s degree who wishes to continue studying for the Ph.D. must apply for admission. Georgia Tech Master’s students who do not wish to use the online application system for 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.

**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.

Progress Toward a Degree
Twelve semester hours constitute full-time enrollment status. 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)
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)
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

<table>
<thead>
<tr>
<th>Required Core</th>
<th>(10 courses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISyE 6333</td>
<td>Operations Research for Supply Chain Engineering 1</td>
</tr>
<tr>
<td>ISyE 6334</td>
<td>Operations Research for Supply Chain Engineering 2</td>
</tr>
<tr>
<td>ISyE 6335</td>
<td>Supply Chain Engineering 1</td>
</tr>
<tr>
<td>ISyE 6336</td>
<td>Supply Chain Engineering 2</td>
</tr>
<tr>
<td>ISyE 6337</td>
<td>Supply Chain Engineering 3</td>
</tr>
<tr>
<td>ISyE 6338</td>
<td>Supply Chain Strategy</td>
</tr>
<tr>
<td>ISyE 6339</td>
<td>Supply Chain Information Systems</td>
</tr>
<tr>
<td>ISyE 6340</td>
<td>Supply Chain Engineering Seminar</td>
</tr>
<tr>
<td>ISyE 6341</td>
<td>Capstone Project for Supply Chain Engineering 1</td>
</tr>
<tr>
<td>ISyE 6342</td>
<td>Capstone Project for Supply Chain Engineering 2</td>
</tr>
</tbody>
</table>

**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
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](http://www.isye.gatech.edu/mselectives)

**Free Electives** (1 course)

**Total Required Coursework** 30 credit-hours

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**Master of Science in Analytics (MSANLT)**
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](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](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

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**Master of Science in Quantitative and Computational Finance (MSQCF)**

More information about the MSQCF program can be found at [http://www.qcf.gatech.edu/](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
- ISyE 6763  Stochastic Processes in Finance II
- ISyE 6769  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/csems/program

Core Courses (4 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

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.

More information on the program can be found at http://www.emil.gatech.edu
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 Queueing Theory and Applications
- ISyE 6662 Optimization II
- ISyE 6663 Optimization III
- ISyE 6664 Stochastic Optimization
- ISyE 6669 Deterministic Optimization
- ISyE 6679 Computational Methods
- 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 7203 Logistics 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 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*

**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 in 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 (https://t-square.gatech.edu) 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 announced. 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: January
- Industrial Engineering, System Informatics and Control: August
- Industrial Engineering, Economic Decision Analysis: February

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. No course listed in the Program Requirements for the primary Ph.D. program may be included.
2. All minor courses must be letter-graded.
3. Not more than one 4000 level course may be included.

4. The GPA for a minor must be 3.0 or higher.

**Ph.D. Students Earning M.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.

**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.

Policies and requirements for Ph.D. dissertations at Georgia Tech are summarized here: [http://www.gradadmiss.gatech.edu/thesis.php](http://www.gradadmiss.gatech.edu/thesis.php)

**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 in 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. Ph.D. in Industrial Engineering students starting Fall 2015 may also need to satisfy this requirement.

**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. This form is available at [http://www.gradadmiss.gatech.edu/thesis/forms.php](http://www.gradadmiss.gatech.edu/thesis/forms.php). 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, available at [http://www.grad.gatech.edu/theses-dissertations-forms](http://www.grad.gatech.edu/theses-dissertations-forms). 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

**Domain Core**  (3 courses)
- ISyE 6202: Warehousing Systems
- ISyE 7201: Production Systems Engineering
- ISyE 7203: Logistics Systems Engineering

**Methods Core**  (5 courses)
- ISyE 6661: Linear Optimization
- ISyE 6662: Discrete Optimization
- ISyE 6761: Stochastic Processes I
- ISyE 6230: Economic Decision Analysis
- ISyE 6414: Statistical Modeling and Regression Analysis

**Computational Elective**  (1 course)
- CSE 6140: Computational Science and Engineering Algorithms
- CS 6550: Design and Analysis of Algorithms
- ISyE 6679: Computational Methods in Operations Research

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

**Domain Core**  
(5 courses)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>ISyE 6412</td>
<td>Theoretical Statistics</td>
</tr>
<tr>
<td>ISyE 6413</td>
<td>Design and Analysis of Experiments</td>
</tr>
<tr>
<td>ISyE 6416</td>
<td>Computational Statistics</td>
</tr>
<tr>
<td>ISyE 7401</td>
<td>Advanced Statistical Modeling</td>
</tr>
</tbody>
</table>
| ISyE 6650   | Probabilistic Models and Their Applications  
  or Math 6241 | Probability I |

**Theory Electives**  
(2 or more courses)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>ISyE 6420</td>
<td>Bayesian Statistics</td>
</tr>
<tr>
<td>ISyE 6761</td>
<td>Stochastic Processes I</td>
</tr>
<tr>
<td>ISyE 6762</td>
<td>Stochastic Processes II</td>
</tr>
<tr>
<td>ISyE 6781</td>
<td>Reliability Theory</td>
</tr>
<tr>
<td>ISyE 7405</td>
<td>Multivariate Data Analysis</td>
</tr>
<tr>
<td>Math 6242</td>
<td>Probability II</td>
</tr>
<tr>
<td>Math 6262</td>
<td>Statistical Estimation</td>
</tr>
<tr>
<td>Math 6263</td>
<td>Testing Statistical Hypotheses</td>
</tr>
</tbody>
</table>

**Methods Electives**  
(3 or more courses)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>ISyE 6402</td>
<td>Time Series</td>
</tr>
<tr>
<td>ISyE 6404</td>
<td>Nonparametric Statistics</td>
</tr>
<tr>
<td>ISyE 6405</td>
<td>Statistical Methods for Manufacturing Design and Improvement</td>
</tr>
<tr>
<td>ISyE 6414</td>
<td>Statistical Modeling and Regression Analysis</td>
</tr>
<tr>
<td>ISyE 6805</td>
<td>Reliability Engineering</td>
</tr>
<tr>
<td>ISyE 7400</td>
<td>Advanced Design of Experiments</td>
</tr>
<tr>
<td>ISyE 7406</td>
<td>Data Mining and Statistical Learning</td>
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</table>

**Other Electives**  
(1 or more courses)

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

<table>
<thead>
<tr>
<th><strong>EDA Core</strong></th>
<th>(5 courses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISyE 6225</td>
<td>Engineering Economy</td>
</tr>
<tr>
<td>ISyE 6230</td>
<td>Economic Decision Analysis</td>
</tr>
<tr>
<td>ISyE 8813</td>
<td>Game Theory</td>
</tr>
<tr>
<td>ECON 7012</td>
<td>Microeconomic Theory I</td>
</tr>
<tr>
<td>ECON 7013</td>
<td>Microeconomic Theory II</td>
</tr>
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<table>
<thead>
<tr>
<th><strong>Operations Research Core</strong></th>
<th>(3 courses)</th>
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<tbody>
<tr>
<td>ISyE 6661</td>
<td>Optimization I</td>
</tr>
<tr>
<td>ISyE 6663</td>
<td>Optimization III</td>
</tr>
<tr>
<td>ISyE 6761</td>
<td>Stochastic Processes I</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Statistics Elective</strong></th>
<th>(1 course)</th>
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</thead>
<tbody>
<tr>
<td>Select one course from ISyE 6402 to ISyE 6421</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Breadth Elective</strong></th>
<th>(1 course)</th>
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<tbody>
<tr>
<td>ISyE 6227</td>
<td>Introduction to Financial Engineering</td>
</tr>
<tr>
<td>ISyE 6673</td>
<td>Financial Optimization</td>
</tr>
<tr>
<td>ISyE 6785</td>
<td>The Practice of Quantitative &amp; Computational Finance</td>
</tr>
<tr>
<td>ISyE 7201</td>
<td>Production Systems Engineering</td>
</tr>
<tr>
<td>ISyE 7203</td>
<td>Logistics Systems Engineering</td>
</tr>
<tr>
<td>HS 6000</td>
<td>Introduction to Health Care Delivery</td>
</tr>
<tr>
<td>CS 8803</td>
<td>Algorithmic Game Theory</td>
</tr>
</tbody>
</table>

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

#### Domain Core (3 courses)
- ISyE 6810 System Monitoring and Prognostics
- ISyE 7201 Production Systems Engineering
- ISyE 7204 Informatics in Production and Service Systems

#### Methods Core (3 courses)
- ISyE 6661 Linear Optimization
- ISyE 6761 Stochastics I
- ISyE 7406 Data Mining

#### Methods Breadth (4 or more courses)
Select courses from two or more of the six focus areas:

#### 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
- ISyE 6662 Discrete Optimization
- ISyE 6663 Nonlinear Optimization
Applications
ISyE 6201 Manufacturing Systems
ISyE 6202 Warehousing Systems
ISyE 6203 Transportation and Supply Chain Systems
ECE 6557 Manufacturing Systems Design
ME 6222 Manufacturing Processes and Systems
ME 6223 Automated Manufacturing Process Planning
ME 6225 Metrology and Measurement Systems
ME 6754 Engineering Database Management Systems

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>
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</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>
<tr>
<td>Math 6242</td>
<td>Probability II</td>
</tr>
<tr>
<td>Math 7244</td>
<td>Stochastic Processes and Stochastic Calculus</td>
</tr>
</tbody>
</table>
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
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 curriculum area of the ISyE website:

https://www.isye.gatech.edu/academics/masters/ms-industrial-engineering/curriculum

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.