

**Georgia Institute of Technology
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OPERATIONS MANAGEMENT PhD PROGRAM

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OPERATIONS MANAGEMENT FACULTY

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This document describes the PhD Program in Operations Management. For additional information reflecting College and Institute requirements, please refer to the **PhD Program Processes and Procedures** handbook, which can be obtained from the Graduate Programs Office, College of Management.

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1. OPERATIONS MANAGEMENT: DEFINITION

Operations Management is the functional area of business primarily devoted to the planning, creation, and management of an organization's resources and processes that create products or services. The set of resources includes an organization's work force, equipment, information, distribution system and materials, all of which typically represent a significant portion of an organization's total costs and controllable assets. In both manufacturing and service organizations, the Operations Management function has the responsibility for the evolution of the environment from which the organization's product or service is created. As a result, the operations function is a critical determinant of an organization's success in terms of meeting its strategic goals. Furthermore, the effective management of the operations function can result in a powerful competitive advantage.

Operations Management issues permeate all levels of decision making from the long-term strategic to the tactical and day-to-day activities. For example, a firm must determine its long-term investment in production and distribution technologies such that strategic goals (low cost, high availability, quality, etc.) are achieved. Technology choice decisions are complicated by innovations in process technologies and changes in consumer demand. In addition, designing a manufacturing or service production environment to achieve the target level of quality has long-term implications on the firm's market share. Lastly, the creation and management of a firm's supply chain is a critical long-term decision that impacts the quality, cost, and availability of finished goods.

At the intermediate level, the operations function is responsible for planning the evolution of the production/service creation processes to meet the dynamic long-term strategic goals of the organization. Therefore, by planning for change and improvement in its technology, distribution system, work force, production, quality system, etc., the operations function determines the amount and type of future demand to be met. A key challenge at the intermediate level is developing implementation plans for new technology to minimize disruption to service or production processes. Moreover, decision making at the intermediate level is complicated by changes in the product or service mix, the availability of the work force, and fluctuating or uncertain demand.

In the short-term, the operations function reconciles the daily planned activities with the reality of machine failures, defective parts, materials shortage or unavailable work force, etc. Ultimately, the goal at this decision-making level is to meet targets established at the intermediate planning level. In addition, the operations function is responsible for the day-to-day monitoring of performance of the production and service creation processes including equipment, work force (both knowledge and hourly workers), and suppliers.

Faculty and doctoral students are involved in research cutting across a wide spectrum of operations management issues. The research involves issues at the core of OM as well as multi-disciplinary topics that interface other functional areas in management and engineering. Several current research topics are listed below. In addition, recent PhD dissertation titles are given.

Research Topics

- Strategic acquisition and deployment of new technologies
- Project portfolio management
- Operations and information technology interface
- Implementation of new technology
- Global operations and supply chain strategy
- Managing information and risk in supply chains
- Closed-loop supply chain management
- Measuring the financial impact of operations strategies
- New product development under competition
- Process change: radial and incremental approaches
- Resource flexibility and its impact on operational performance
- Multi criteria production scheduling

PhD Dissertations Titles

- "Strata, Structure, and Strategy for Resource Allocation and New Product Development Portfolio Management," Raul Chao, June 2007 (Advisor: Stelios Kavadias).
- "Revenue Management Performance Drivers: An Empirical Analysis in the Hotel Industry," Carrie Crystal, June 2007, (Advisor: Mark Ferguson).
- "Outsourcing of Supply Chain Processes: Evaluating the Impact of Alignment between Outsourcing Drivers and Competitive Priorities on Performance," James Kroes, June 2007 (Advisor: Soumen Ghosh).
- "Simple Newsvendor Heuristics for Multi-echelon Distribution Networks," Erik Lystad, December 2006 (Advisor: Mark Ferguson).
- "Joint Product Development and Inter-Firm Innovation," Sanjiv Erat, May 2006 (Advisor: Stelios Kavadias)
- "Evaluation of Supply Chain Strategies for Mass Customization," Jack Su, August 2004 (Advisor: Yih-Long Chang)
- "Theoretical Development and Empirical Investigation of Supply Chain Agility", Patty Swafford, August 2003, (Advisor: Soumen Ghosh)
- "A Framework for Integrating Product Platform Development with Global Supply Chain Configuration", Joon Park, July 2002, (Advisor: Soumen Ghosh)
- "Essays on the Globalization of Supply Chains and the Financial Drivers of Logistics Outsourcing", Edmund Prater, February 1999, (Advisor: Soumen Ghosh)
- "The Value of Clean Manufacturing Strategies for Manufacturing Management under the Influence of Environmental Policy", Markus Biehl, August 1998, (Advisor: Cheryl Gaimon)
- "Coordination of Manufacturing, Marketing, and R&D for Strategic Success: Investment in Facility Changeover Flexibility and Product Development Cycle Reduction", Alysse Rosewater, August 1997, (Advisor: Cheryl Gaimon)
- "Strategic Investment in Changeover Flexibility for High Volume Production Facilities: An Interface Between Operations and Marketing", Richard M. Franza, September 1997, (Advisor: Cheryl Gaimon)
- "Improvement in Productivity and Quality from Information Technology – Worker Systems", Karen Napoleon, March 1997, (Advisor: Cheryl Gaimon)

- “Process Improvement Strategies for Manufacturing Excellence”, Janice E. Carrillo, March 1997, (Adviser: Cheryl Gaimon).

2. PURPOSE OF THIS DOCUMENT

This document was designed to provide background on the OM PhD program for prospective applicants and to aid currently enrolled doctoral students achieve success in their academic program. It reflects the efforts of the OM faculty, feedback from graduates of our doctoral program, and input from current doctoral students. We describe specific course requirements, the examination process, and expectations regarding research. We offer guidance to achieve job placement success upon completing the PhD degree. However, this document is not intended as a substitute for interaction with the faculty. In fact, a theme expressed throughout the document is recognition of the mentoring relationship each student must develop with at least one member of the faculty. Lastly, this document is not comprehensive in the sense that it does not re-state the institute or college guidelines and requirements for a PhD degree.

3. PROGRAM REQUIREMENTS

According to the requirements of the College of Management, a PhD student is admitted to candidacy once he/she has (A) demonstrates that he/she has sufficient background in basic mathematics, economics and management, (B) demonstrates that he/she has sufficient communication skills (both verbal and written) as well as reasonable teaching skills, (C) completes all course requirements in the major, minor and research tools areas, (D) writes and presents two research papers, and (E) passes a written comprehensive examination in the major area. Admission to candidacy indicates that the student is ready to undertake research that will constitute the PhD dissertation. The final stage in the PhD program is completion of the dissertation proposal and defense, as described in (F).

Next, we elaborate on categories, (A)-(F). *Please note that substitutions, changes, or other exceptions to the requirements stated below are possible subject to approval by an OM faculty.*

A. Background: Math, Management and Economics

PhD students in Operations Management must demonstrate a basic knowledge of mathematics, management, and economics. This requirement can be fulfilled from the student's prior course work (for example, a completed MBA or an undergraduate degree in Business or Economics). Students should obtain waivers from OM PhD Coordinator for those portions of the background requirements fulfilled prior to entering the doctoral program. Alternatively, the background requirement may be met by completing courses during the student's PhD program of study.

Mathematics. First, the student is required to demonstrate knowledge of calculus, linear algebra, probability, and statistics. The basic knowledge in mathematics serves as a prerequisite for most of the required research tool courses. Any mathematics deficiency must be remedied during the first two semesters in the doctoral program. Note that the credits hours taken in this category may not be used to meet the PhD credit hour requirement since they represent prerequisites to the program.

Economics. Second, the student is required to demonstrate knowledge on fundamentals of Micro and/or Macroeconomics. A PhD student who has already completed an MBA has met this requirement. Otherwise, the student must complete the core economics course offered to MSM students during the first semester in the doctoral program.

Management Breadth. Third, the PhD student must demonstrate a breadth of knowledge in two areas of management outside of OM. A PhD student who has already completed an MBA has met this requirement. Otherwise, the student must complete two graduate level courses in the College of Management offered outside of OM. A student should take courses to satisfy the breath of knowledge requirement during the second or third year of study after developing a better understanding of those areas of management that best support particular research interests.

B. Communication and Teaching Skills

Teaching and Oral Communication Skills. PhD students are required to obtain training to prepare them to be effective classroom teachers. The training also reinforces oral communication skills that are necessary to communicate research results in seminars and conference presentations.

First, upon entering the doctoral program, students are required to attend CETL's introductory course on teaching and classroom management. This three-hour seminar is offered early in fall (and perhaps in spring) semester and covers general teaching issues as well as specific teaching tools. As necessary, the faculty may require additional oral communication training.

Second, prior to their first undergraduate teaching experience (which typically occurs in the second year of the program), a PhD student must develop a comprehensive understanding of the material and the teaching approach used for that course. During the first year in the PhD program, the student will be assigned a faculty-teaching mentor. The student should attend the course regularly to observe teaching methods. While not a full teaching assistant (TA) for the course, the PhD student may be asked to help the faculty with classroom teaching, preparation, grading, or writing of exams. To obtain actual experience, the doctoral student must prepare and deliver at least one lecture under the guidance of the faculty mentor.

Third, prior to their first undergraduate teaching experience, all doctoral students must demonstrate a reasonable level of teaching competence. This requirement can be met in several ways; such as successfully delivering a guest lecture in an undergraduate class (see above) or giving a lecture that is videotaped and critiqued by CETL.

Fourth, during the first two years in the doctoral program, students should attend a brownbag series offered by the College of Management on teaching effectiveness. The series provides a forum for faculty and senior doctoral students to discuss teaching experiences. After their second year, assuming the OM faculty is satisfied with the doctoral student's teaching effectiveness, attendance at the brownbag series is optional.

Written Communication Skills. A student must complete *at least one* course in technical writing. The first (and possibly only course) should be completed (or a waiver obtained) during the student's first year of study. The purpose is to provide a student with the foundation necessary to write research papers.

(Often, problems associated with technical writing add a full year to the length of a student's PhD program.) A student may fulfill this requirement by completing a regular (for credit) course on technical writing from the School of Literature, Communications and Culture (LCC), or by taking a noncredit course entitled "The Little Red Schoolhouse" offered by Dr. Jeffrey Donnell (404-894-8568, jeffrey.donnell@me.gatech.edu). To take Dr. Donnell's course, which meets once a week for 10 weeks, a student must contact Dr. Donnell directly (there is no formal registration).

C. Major, Minor and Other Selected Courses

A PhD student in Operations Management must complete a minimum of 60 credit hours in the following areas: (i) Operations Management masters level courses, (ii) Operations Management PhD seminars, (iii) Research Tools courses fulfilling the requirement for a minor, and (iv) independent study or other selected courses. Below, each course area is described in detail.

(i) Operations Management Masters Courses (12 credits)

A portion of this requirement will be waived for a student who has completed an MBA (see the PhD OM coordinator). Otherwise, students must complete four out of the following courses for letter grade (earning a B or better). Students must complete a minimum of two courses prior to taking the written comprehensive exam. The courses should be selected to provide managerial background that is consistent with a student's research interests (the student should solicit input from his/her research advisor to select electives). The remaining two courses can be taken after the student completes the written comprehensive exam. A student may be advised by their research faculty advisor to take additional OM electives (beyond the 12 credits) for a letter grade or on a pass/fail basis.

Operations Strategy	Operations Resource Planning
Global Operations and Supply Chain Mgt.	Service Operations Management
Managing Resources of the Technological Firm	Collaborative Product Development
Supply Chain Modeling and Revenue Management	

(ii) Operations Management PhD Seminars (12 credits)

Four PhD level Operations Management seminars are required for letter grade, earning a B or better. The course titles and numbers for PhD OM seminars are given below (each course is 3 credits). Only two such courses will be offered during each academic year (typically one in the fall and one in the spring semesters). Please note that this is the *minimum* requirement and that many students will complete more than the four required, as described below. Typically, two PhD seminar courses are offered each academic year. A first year PhD student may wish to audit the courses if he/she does not have sufficient background to take the course for letter grade. By the end of the third year of study, the minimum four-course PhD seminar requirement must be complete.

Grades of A are *not* guaranteed in PhD courses. Faculty will provide students with feedback during the course so that performance expectations are well understood. Also, students should request performance feedback from the faculty during the semester. Each PhD seminar will require some form of a *research exercise*. Examples of research exercises include a project, a literature review, suggestion of extensions to a set of papers, or student development of a topic suggested by the faculty. The research exercise is not the equivalent of a summer research paper in terms of length, depth, or quality. However, the exercise can be part of a portfolio from which to start and/or continue the student's research program.

The faculty has developed the following policy regarding the doctoral seminars. The key driver of the policy is recognition that an academic career reflects a commitment to continuous investment in knowledge creation. First, while in residence and prior to successfully completing the comprehensive exam, a student should take any newly offered PhD seminar for letter grade. Second, while in residence and prior to successfully completing the comprehensive exam, a student may take any repeated PhD

seminar topic for letter grade or on a pass/fail basis. We believe that knowledge is both reinforced and further developed when PhD seminars are repeated. Once a student completes the written comprehensive exam, newly offered PhD seminars may be taken pass/fail or for letter grade; repeated seminars may be audited, taken pass/fail, or for letter grade. Lastly, if taking a PhD seminar pass/fail, a student is not typically expected to complete the research exercise (project).

Mgt 7350 – Operations Strategy I	Covers strategic issues in OM.
Mgt 7351 – Operations Strategy II	Continuation of Mgt 7350 with more advanced topics.
Mgt 7352 – Operations Planning & Control I	Covers tactical, planning and control issues in OM.
Mgt 7353 – Operations Planning & Control II	Continuation of 7352 with more advanced topics.
Mgt 7354 – Research Methods in OM	Intro. and development of research methods for OM.
Mgt 8803 – Special Topics in Mgt	Topics of current interest in OM.
Mgt 8855 – Research Topics in OM	Special research topics of interest in OM.

(iii) Research Tools Courses (21 credits)

To successfully undertake independent research, PhD students in OM must demonstrate rigorous understanding of research tools. Research tools in the field of Operations Management are both descriptive (empirically driven techniques related to the collection and analysis of data using methods such as statistics) and normative (modeling driven related to optimization).

First, the following courses must be completed (12 credits), earning an average grade of B or better.

Statistical Modeling & Regression Analysis (ISyE 6414) to replace Linear Models (ISyE 6411)
 Probabilistic Models (ISyE 6650)
 Deterministic Optimization (ISyE 6669)
 Multivariate Data Analysis (ISyE 7405) or Introduction to Multivariate Statistics (PSYC 7301)

Second, each student must select three additional research tools courses from the following list (9 credits), earning an average grade of B or better. At least one of the courses should be at the PhD level. These courses should be selected to support particular research interests (such as whether the student intends to complete a normative or empirical dissertation). Students should seek input from their research faculty advisor to identify the appropriate courses to support their research program. Moreover, for planning purposes, students should refer to the ISyE Graduate Handbook (updated each academic year) for the tentative schedule of courses that appears at the *end of the document*. Lastly, a student may take a course that does not appear in this list subject to faculty approval of the substitution.

Nonparametric Data Analysis (ISyE 6404)
 Simulation (ISyE 6644)
 Queuing Theory (ISyE 6656)
 Optimization I (ISyE 6661) (PhD level; student should consider first taking Math 4317- Analysis I)
 Optimization II (ISyE 6662) (PhD level)
 Stochastic Processes I (ISyE 6761) (PhD level; student should consider first taking Math 4317- Analysis I)
 Stochastic Processes II (ISyE 6762) (PhD level)
 Advanced Simulation (ISyE 6831)
 Advanced Design of Experiments (ISyE 7400)
 Theory of Linear Models (ISyE 7441)

Statistical Analysis of Psychological Data I (PSYC 6019) (PhD level)
 Statistical Analysis of Psychological Data II (PSYC 6020) (PhD level)
 Structural Equation Modeling (PSYC 7302) (PhD level)

*The 21 credits constitute a minor field of study in Operations Research or Management Science.

(iv) Other Selected Courses and Independent Study (15 credits)

To fulfill this 15-credit category, a student should select courses that support his/her career objectives. The PhD student should meet with the research advisor to jointly select these courses. In particular, the OM faculty urges PhD students to seriously consider taking a graduate-level course that provides exposure to economic modeling. For example, students should consider taking ISyE 6229 or ISyE 6230 or a PhD-level course on microeconomics offered from the College of Management. In addition, ISyE applications-oriented (as opposed to methodology driven) courses that relate to OM may be particularly appropriate for this 15-credit category.

Lastly, a student should register for an independent study course with an OM faculty while undertaking research that involves direct and substantial guidance from that faculty. In addition, a student may take an independent study course in support of his/her research interests. The 15 credit hours in this category are NOT part of the PhD Comprehensive Exam content.

D. First and Second Research Papers and Presentations

Prior to embarking on the PhD dissertation, faculty will help students to develop the capability to create original research of publishable quality. Immediately upon entry into the program, students should begin working on research under the direct supervision of one or more OM faculty. Initially, the faculty largely directs the research. Over time, however, the balance shifts until ultimately the student drives the research activity with faculty supervision and input. In this section, we describe the research activities students undertake prior to the doctoral dissertation.

First Year Research Activity. Throughout the first year of the program, each PhD student works with a faculty on research. The purpose of the first year research activity is to afford students a concrete research experience. The faculty member will design a research activity that best integrates his/her research program with the student's interests and background.

Prior to arriving on campus, newly admitted students should seek information on faculty research interests. If possible, incoming students can provide input to the OM PhD. Coordinator indicating areas of overlapping interest with the faculty. Based on student input and availability of the faculty, the OM. Coordinator will make an initial assignment of each incoming student to a faculty for the purpose of first year research activities. The initial faculty-student assignment will hold for at least one semester; however, the assignments may be shifted as better fits are identified.

First Summer Project. The first summer research project is a continuation of the first-year research activity. Under the direction of at least one OM faculty, a student devotes extensive effort to a selected research problem. *The purpose of the first summer research project is to develop the student's research skills (including creativity, rigor, written and oral communication).* **BY THE END OF OCTOBER OF THE SECOND YEAR,** students must make presentations of their research efforts. In addition,

COLLEGE POLICY requires the following. (i) A written document describing the work must be available at least two weeks prior to the presentation. (ii) The seminar must be announced two weeks in advance to the entire management faculty. (iii) The presentation must be scheduled during an academic session (e.g., between the first day of class and the last day of exams of fall, spring, or summer terms).

Second Year Research Activity. In the fall of their second year, students should obtain faculty approval of a research problem they wish to pursue as their second year research activity. The research problem may be initiated by the student or selected from a list suggested by faculty. It is the student's responsibility to interact with faculty to obtain approval of the research problem and a commitment from the faculty to supervise the research activity.

Second Summer Project. The second summer research project may be a continuation of the second year research activity or may develop from a project in a PhD seminar. Under faculty supervision, students will devote extensive effort to a research problem. *The purpose of the second summer research project is to further strengthen the student's research skills (including creativity, rigor, written and oral communication).* The student should demonstrate that she/he is developing the necessary skills to define and analyze a research concept, and to write-up the research content in a clear, organized and concise manner, representative of papers published in major OM journals such as those covered in PhD seminars. Relative to the first summer research project, more limited faculty participation will occur. By the END OF OCTOBER of the third year, students must make presentations of their research efforts. Lastly, the COLLEGE POLICY described for the first summer project presentation applies here, as well.

E. Written Comprehensive Exam

Students are encouraged to take the written comprehensive exam during the spring of their third year of study. Students should take the comprehensive exam after completing their second year research paper. The faculty must approve any deviation from this target timetable. Prior to taking the written comprehensive exam, students must complete 6 credits from C-i and all courses from C-ii and C-iii.

The exam provides students with an opportunity to synthesize various research topics to develop a holistic view of OM. The exam reflects the broad content of the PhD program in OM with particular emphasis on *four* PhD OM seminars. The exam also reflects research tools as presented either within OM PhD seminars or in separate research tools courses. Lastly, additional OM readings may be assigned to complete the breadth of coverage of the OM domain.

F. The PhD Dissertation Proposal and Defense

Upon successfully completing the Comprehensive Exam, a student is admitted to PhD Candidacy. At this time, a PhD student is formerly permitted to begin the PhD dissertation. Typically, a student has already begun work that will become a part of the PhD dissertation prior to candidacy, e.g., the summer research papers may ultimately become part of the PhD dissertation.

Third Year and Third Summer Research Activity. During the third year and third summer, students should continue to build their research expertise. Over time, additional emphasis is placed on the student's initiative in identifying and solving research problems. Similarly, written and presentation skills are further developed. Although students may be working somewhat independently, we urge students to continue to seek input and direction from faculty on a regular basis. Since students should

have already completed their research tools courses and should have sufficient teaching experience, they are expected to undertake research activities even while they are teaching. The clear goal of the third year and third summer research activity is the dissertation proposal, as described below.

Proposal for the PhD Dissertation. With guidance from the faculty, students will develop a Proposal for the PhD Dissertation. The Proposal should demonstrate that a student has the ability to (i) think independently, (ii) take initiative developing and structuring the research problem, rigorous solution, and analysis, (iii) write-up the research in a clear, organized and concise manner representative of papers published in major OM journals, and (iv) offer a research seminar presentation close to the quality necessary for successful job interviews. The oral presentation should be made EARLY IN THE FOURTH YEAR. Lastly, the COLLEGE POLICY described for the first summer project presentation applies here, as well.

Fourth Year Research Activity and Dissertation Defense. During the fourth or fifth year, students should complete their PhD Dissertation. During the preparation of dissertation, students are urged to have timely and consistent communication with their dissertation committee. The research is presented at an *oral defense* open to the entire faculty in the College of Management. Lastly, the COLLEGE POLICY described for the first summer project presentation applies here, as well.

4. PERFORMANCE MILESTONES AND FEEDBACK

To help guide students and ensure the successful and timely completion of the PhD program, several opportunities have been identified for formal feedback from the faculty. *The outcomes of the milestone reviews, as indicated below, are critical to determine the status and continuity of the student in the PhD program.* Please note that the OM faculty are also interested in input from the doctoral students aimed at improving the quality of the PhD program.

- Program Approval. *Each semester prior to registration*, a PhD student must have his/her course schedule approved. First year students should seek approval from the OM PhD Coordinator. Thereafter, students should obtain approval from their faculty research advisor. *Students must submit an updated course plan and transcript to the OM PhD coordinator each semester.*
- Semester Grade Report. At the end of each semester, students must share their grades with the OM PhD Coordinator and their faculty advisor. The faculty will assess the level and quality of progress being made in course work as well as the balance between course work and research and provide any needed guidance.
- Milestone First-Year Student Review (beginning Summer semester). This *milestone review* reflects course work, research activities, and any teaching experiences. The assessment reflects the input of all OM faculty. The student's research advisor and at least one other OM faculty member will meet with the student to convey the milestone feedback. In addition, a written assessment will be placed in the student's file.
- Milestone Review of First Research Paper Presentation (October, second year). This assessment is a *milestone review* that takes place in a meeting following the student's first research paper presentation. The assessment reflects the views of all OM faculty.

- Milestone Second-Year Student Review (beginning of Summer semester). This *milestone review* reflects course work (including PhD seminars), research activities, and any teaching experiences. The assessment reflects the input of all OM faculty. The student's research advisor and at least one other OM faculty member will meet with the student to convey the milestone feedback. In addition, a written assessment will be placed in the student's file.
- Milestone Review of Second Research Paper Presentation - (October of the third year) – This assessment is a *milestone review* that takes place in a meeting following the student's second research paper presentation. The assessment reflects the views of all OM faculty.
- Milestone PhD Comprehensive Exam and Candidacy – (Students should make every effort to complete the written exam no later than the end of the summer following the third year of study.) Three outcomes are possible. (i) A student may pass the written exam. (ii) A student may be asked to complete a follow-up exam or take additional course work focused on specific topics where the original written response was deficient. If the outcome of this follow-up activity is satisfactory, the student continues in good standing in the PhD program. (iii) A student may be asked to leave the doctoral program. Since the faculty is committed to provide feedback and works closely with doctoral students throughout their program of study, it is highly unusual for a student to reach this stage in the program and be terminated unless they are or have been on probation (see below).
- Milestone Third-Year and Subsequent Annual Student Reviews - The milestone review of students at the end of the third year reflects performance on the Comprehensive Exam (assuming this has been completed), course work, research activities, and any teaching experiences. The assessment reflects the input of all OM faculty. The student's research advisor and at least one other OM faculty member will meet with the student to convey the milestone feedback. In addition, a written assessment will be placed in the student's file.
- Milestones Dissertation Proposal and Defense - Described above.

Students will be provided with a clear message regarding their progress and development in the doctoral program following each milestone review. The aim of this feedback is to keep students on track to successfully complete the program within a four-year timetable. The faculty will assess a student's status from the following categories.

- (i) A student may be deemed in good standing (pass).
- (ii) A student may be given a "conditional pass" (such as on a first year research paper). If this occurs, the student will work with her/his research advisor (and possibly one additional OM faculty) to remedy the deficiency and remove the "conditional" status. The PhD coordinator must be informed in writing by the set of faculty involved when the status changes to "pass". If the "conditional" status is not resolved in a reasonable amount of time, the student may be placed on probation (see (iii), below).
- (iii) A student may be placed on probation. If this occurs, a clear understanding of how the probation may be removed (including a timetable) will be given. An additional review is required as indicated in the terms of the probation.

- (iv) A student may be terminated from the program. It is highly unlikely that termination will occur unless a student is already on probation. Two consecutive terms of probation are likely to result in termination.

5. DOCTORAL PROGRAM PROCEDURE

A typical path for completion of a PhD in Operations Management is described below.

Admission: Admission criteria and procedures conform to Institute and College admission criteria and procedures. The OM faculty, the PhD Committee, and the Graduate Office of the College of Management work together to make timely recommendations for admission.

Financial Support: In conforming to the College of Management's procedure, students admitted to the PhD program will be considered for Graduate Research Assistantships (GRA), Graduate Teaching Assistantships (GTA), and/or Presidential Fellowships. Although there is no guarantee of financial support, the College makes every effort to support a PhD student for four years subject to the reasonable progress of the student. Moreover, reflecting the fact that the PhD program is full-time and to ensure students make reasonable progress, the following policy has been established. *PhD students may not work as GRAs for more than 50% time (20 hours per week). Graduate assistants shall not accept additional employment within or outside Georgia Tech without prior approval of both their primary advisor in Operations Management and the Director of the PhD Program in the College of Management.*

Course Numbers and Credit Hours: Each semester (including summer), students should register 21 credits. Typically, 12 of the credits will be regular coursework. For the remaining credits, you should register for either MGT 8903 (Special Problems) which is an independent study course with a particular faculty or MGT 9000 (Doctoral Thesis) which you can register for only after you have entered PhD candidacy. Of course, a combination of MGT 8903 and 9000 is fine, too. Lastly, to maintain your Graduate Research Assistantship you must take a minimum of 12 credit hours.

Advisor: Upon entering the program, the OM PhD Coordinator will advise the student on course related matters, approve the student's plan for course registration, and monitor progress. Also during the first year, each student will be assigned a faculty-teaching mentor. Once the student has begun working on a research activity with a particular OM faculty (at the latest, this happens during spring semester in the first year of study), that faculty assumes the primary responsibility for approving the student's course plan and for monitoring overall progress. Naturally, the advisor assignment may change as better matches of research interests between the student and faculty are apparent. Ultimately, the assessment of student performance is the responsibility of all OM faculty including but not limited to the research advisor, the teaching mentor, and the faculty who have taught courses that completed by the student.

Every semester, the PhD student is required to submit an updated course plan to the OM PhD Coordinator that includes those courses for which the student is registered as well as a recent transcript indicating the grades earned in the previous semester. Once the PhD student begins teaching her/his own class, the PhD coordinator must be given a copy of the course syllabus and teaching evaluations.

Study Plan: The student must submit a Study Plan to his/her adviser prior to each Milestone Review. The Study Plan will serve as guidance for the student's timely completion of the program. The Study Plan should include a complete description of the student's course related fields of study (major, minor, and research tools, and other selected courses), and a projected timetable for the student to complete the PhD degree requirements (including research papers). The Study Plan should be updated over time with any changes approved by the adviser and new copies filed with the faculty adviser.

Examination Committee: An Examination Committee consisting of most of the OM area faculty will write and grade the Comprehensive Exam. Typically, the exam is written and graded by at least the set of OM faculty who have taught doctoral seminars taken by the student for a letter grade. The results are reported to the College of Management's PhD Program Coordinator.

Dissertation Committee: Upon passing the PhD Comprehensive Examination, the student should consult with the OM faculty to form a Dissertation Committee. This committee consists of at least three Operations Management Faculty from the College of Management. At least one of the Dissertation Committee members will serve as the student's final advisor. The Dissertation Committee is responsible for approval of (i) the dissertation topic and approach, (ii) the dissertation proposal defense, and (iii) the final oral defense of the completed dissertation.

Recommended Time Table: The precise length of time required to complete all requirements for a PhD in OM depends on many factors including the student's background and efforts. Typically, students should be able to complete the program within five years.

Consider the following timetable for course work. We recommend that students complete two of the four Operations Management masters' elective courses during their first two years of study. Courses to strengthen a student's communication skills (written and oral) should be taken during the first year in the program. We recommend that students complete all research tools courses in their first two years of study. No later than the end of the third year of study, students should complete all PhD seminars required for letter grade. (We recognize that it may be difficult for a student to take some PhD seminars for letter grade in their first year of the PhD program and prior to completing a portion of the research tools courses. If that is the case, the student must at take the doctoral seminar pass/fail or on an audit basis.) Courses outside the OM area that are needed to support research interests or to meet the minor field requirement should be completed during the student's second or third year of study.

6. SUGGESTIONS FOR SUCCESSFUL JOB SEARCH

The faculty has a variety of suggestions to help OM doctoral students attain successful job placement in the academic job market. Additional information should be sought from individual faculty if industry positions are desired.

Preparing for the job market takes years so start early! Strong job candidates will have already made several conference presentations, have completed a couple of working papers, have a couple of proceedings publications, and at least one paper under journal review.

Students are strongly urged to attend and participate in research conference as soon as possible. At the latest, we suggest a student attend conferences and present his/her research during the third year of study.

Students should solicit input from their faculty advisor to ascertain whether their ongoing research activities can be developed into material for journal or conference submission. Regardless of whether a student makes a research presentation, they should attend conferences whenever possible. INFORMS, POMS and DSI are three key conferences where leading research ideas are exchanged and contacts are made.

The following timetable should help students plan for conference participation. In the fall, students should submit an abstract in order to present a paper at the POMS Conference that takes place later that spring. (Typically, POMS accepts all abstracts for presentation.) In the spring, students should submit an abstract to be able to present a paper at the INFORMS Conference the following fall. (Informs accepts all abstracts for presentations.) Typically in early March, students should submit a short paper to be able to make a presentation in the DSI Conference the following fall. Following an informal review process, papers are scheduled for regular presentations or discussion in table-topic sessions at DSI.

INFORMS (fall), POMS (spring), and DSI (fall) offer doctoral student workshops and consortiums (by application only) to aid students who plan to enter the academic community. Applications must be submitted early relative to the conference date. Workshop participation is highly recommended.

The serious job placement activity occurs during the fall in the fifth-year of study at the INFORMS and DSI Conferences. Vitas must be polished (students are urged to get help from faculty to write their vita during the prior summer). During early fall, students should work closely with their advisor and dissertation committee members on a target list of schools for possible job placement. The dissertation chair will write letters introducing the student to colleagues at other universities. Along with the letter of recommendation, the faculty will include a copy of the student's vita, all research papers the student has written (and hopefully under journal review), and a sample of the student's teaching evaluations. Students will be invited for preliminary interviews at the INFORMS and DSI conferences (about 30-40 minutes). Follow-up campus interviews occur in winter.

Both INFORMS and DSI have formal job placement activities for academic and industry positions. The focus is on academic placement. Faculty experience indicates that industry job placement opportunities are stronger at INFORMS. That is not necessarily the case for the academic job market, which is more variable among the different professional societies. POMS also offers job placement activities (though they do not have a fall conference). All societies have two types of job placement databases set up on-line. First, the employer database contains most (not all) position announcements. Second, the employee database contains bios of persons looking for jobs. We urge students to get input from faculty on how to fill out the job placement forms.

To prepare for face-to-face interviews, we urge students to familiarize themselves with the research interests (and workplace environments) of the persons they are scheduled to meet. Typically, information on faculty research interests as well as program descriptions are available on the web. In addition, feel free to get help from your advisor and other OM faculty.

7. BIOS OF THE OPERATIONS MANAGEMENT FACULTY

Atalay Atasu is an Assistant Professor of Operations Management in the College of Management at Georgia Tech. He received his PhD in Management, with a concentration in Technology and Operations Management, from INSEAD in 2007. He holds a BS in Textile Engineering from Istanbul Technical University, an MS in Industrial Engineering from Bogazici University and an MS in Management from INSEAD.

Dr. Atasu's research focus is on sustainable operations management. His research interests include design of closed-loop supply chains, strategic pricing and positioning of remanufactured/refurbished products, design of environmental directives and inventory control. His research appeared in scientific Journals such as *Management Science* and *Production and Operations Management*. Dr. Atasu has won the Wickham Skinner Award for best unpublished paper at the 2007 Production and Operations Management Meeting for "Efficient Take-Back Legislation." He is a member of INFORMS and POMS.

Yih-Long Chang is a Professor of Operations Management in the College of Management at the Georgia Institute of Technology. He received his PhD degree from the University of Texas at Austin in 1985. His research and teaching interests include the interface between Operations Management issues and Management Information System methodologies. He has published articles in journals including *Annals of Operations Research*, *Decision Sciences*, *Decision Support Systems*, *International Journal of Production Research*, *Management Science*, *Naval Research Logistics Quarterly*, *OR Letters*, *Production Planning and Control*, and *Simulation*. Professor Chang is a member of INFORMS and has reviewed numerous papers for many academic journals. Professor Chang is the author of the software packages *QSB+*, *QSOM*, *QS*, *MacQSB*, *MacQOM*, *MacQS*, and *WinQSB*.

Mark Ferguson is an Associate Professor of Operations Management and the Gregory J. Owens Term Professor in the College of Management at Georgia Tech. He received his PhD in Business Administration, with a concentration in Operations Management from Duke University in 2001. He holds a BS in Mechanical Engineering from Virginia Tech and an MS in Industrial Engineering from Georgia Tech.

Dr. Ferguson's research interests involve many areas of supply chain management including supply chain design for sustainable operations, contracts that improve overall supply chain efficiency, pricing and revenue management, and the management of perishable products. He is the coordinator for the focused research area on dynamic pricing and revenue management. Two of his papers have won best paper awards from the Production and Operations Management Society and several of his research projects have been funded by the National Science Foundation. Prior to joining Georgia Tech, he had five years of experience as a manufacturing engineer and inventory manager with IBM.

Cheryl Gaimon is a Regents' Professor and the Richard and Carol Kalikow Term Professor specializing in the area of Operations Management in the College of Management at the Georgia Institute of Technology. She received her Masters and PhD Degrees from Carnegie Mellon University. Professor Gaimon initiated establishment of the Operations Management Program in the College of Management at Georgia Tech and served as the Area Coordinator for seven years. She was a core participant in the development of an interdisciplinary certificate program in the Management of Technology (MOT) and currently serves as that program's director. She has taught courses at the undergraduate, masters, executive, and PhD levels.

Professor Gaimon's *research and teaching interests* are primarily in the area of the management of technology. Her work focuses on knowledge management, process improvement (with manufacturing and information technology), new product development, technology acquisition and implementation, and technology flexibility. Her research articles have appeared in refereed journals including *Management Science*, *Operations Research*, *Production & Operations Management*, *Institute of Industrial Engineers (IIE) Transactions*, *Naval Research Logistics*, *IEEE Transactions on Engineering Management*, *European Journal of Operational Research*, *International Journal of Flexible Manufacturing Systems*, and *Decision Sciences*. She has received special distinctions including "The 1999 Georgia Tech Research Award" for doctoral student development and two "Best Paper Awards" from the *Decision Sciences Institute*. She has received grants from the *National Science Foundation* to study the impact of new technology on a firm's competitive positive.

Professor Gaimon is currently the President-Elect of the Production and Operations Management Society (POMS). She is Department Editor for the "Management of Technology" area of *Production and Operations Management (POM)*. Formerly, she was Associate Editor for *Management Science*, Departmental Editor for *IIE Transactions* and *IEEE Transactions on Engineering Management*, and Senior Editor for *Manufacturing and Service Operations*. Formerly she was a Board Member and VP-Membership for POMS.

Soumen Ghosh is a Professor of Operations Management and the Alan J. and Caron A. Lacy Term Professor in the College of Management. He received his PhD in Business Administration with specialization in Operations Management (1987) and M.S. in Industrial Engineering (1982) from The Ohio State University. He holds a B.S. in Mechanical Engineering from Birla Institute of Technology (India). His research and teaching interests are in the areas of global operations and supply chain strategy, supply chain flexibility, product development and supply chain interface, quality management, and manufacturing planning and control. He has received funding from organizations such as the National Science Foundation, Dept. of Education, American Society for Quality, European Union Information Directorate and the Lorraine (France) Development Corporation, and from companies such as Hewlett-Packard, IBM, and SAP America.

His research has been published in several scholarly journals such as *Journal of Operations Management*, *Decision Sciences*, *IIE Transactions*, *International Journal of Production Research*, *European Journal of Operational Research*, *Quality Management Journal*, etc. He is a recipient (co-author) of two *Best Paper* awards from the Decision Sciences Institute, and Advisor of a *Best Dissertation* award. He has worked as a production engineer with Tata Industries, and has consulted with several manufacturing companies on productivity, quality, and supply chain improvement. He has served on the Board of Examiners of the Georgia Oglethorpe Quality Award. Professor Ghosh is a member of the Decision Sciences Institute (currently serving a second term as Vice President), the Institute for Operations Research and Management Sciences, and the Production and Operations Management Society. He is an Associate Editor for *Decision Sciences* and the *Journal of Operations Management*, and also serves on the Editorial Review Boards of *Production and Operations Management*, *IEEE Transactions on Engineering Management*, and the *Quality Management Journal*.

Stylianos Kavadias is an Assistant Professor of Operations Management in the College of Management at Georgia Tech. He received his PhD in Management with a specialization in Operations Management from INSEAD (France) in 2001. He holds an MSc in Management from INSEAD and a Diploma (MSc

Equiv.) in Electrical Engineering from NTUA (Greece). His PhD dissertation was awarded the second place in the 2001 Dantzig Best Dissertation Competition of INFORMS. His research interests are in the area of technology management and new product development (NPD), and include resource allocation and project portfolio selection, performance measurement, learning and testing strategies in NPD, as well as technology introduction and adoption strategies. While undertaking his PhD thesis, he worked closely with the R&D subsidiaries of diamond companies. He has published his work in *Management Science*, *Production and Operations Management*, and *IIE Transactions*, and he is the primary author of the book *Project Selection Under Uncertainty* (invited publication by Kluwer's International Series in OR/MS). He has presented his research at national meetings of INFORMS, MSOM and POMS. He is a member of INFORMS, MSOM, POMS and serves in the editorial review board of *Production and Operations Management*. He is teaching the *Technology Management* Ph.D. seminar, and the *Collaborative Product Development* and *Managing the Resources of the Technological Firm* courses at the MBA level. He has also authored several business case studies, and recently (2003) was awarded the first prize in the OM case studies category of ECCH-Babson (European Case Clearing House) for his case entitled *Dragonfly: Developing an Uninhabited Aerial Vehicle*.

Vinod Singhal is a Professor of Operations Management, the Dr. Alfred F. and Patricia L. Knoll Term Professor and Area Coordinator of the Operations Management Group at the College of Management at Georgia Tech. He received his PhD from the University of Rochester in 1988. Prior to joining Georgia Tech, he worked for three years as a Senior Research Scientist at GM Research Labs. His teaching interests include operations strategy, supply chain management, activity-based costing. His research interests include justification of new technologies, measuring the financial impact of operations strategies, estimating the impact of manufacturing decisions on the financial performance of firms, supply chain management, and design of activity-based cost systems. His research has been supported through grants from the US Department of Labor, National Science Foundation, American Society of Quality, and the Center for Paper Business and Industry Studies. He has published a number of articles in academic journals including *Management Science*, *Journal of Manufacturing and Operations Management*, *Journal of Operations Management*, *European Journal of Operational Research*, *Journal of Cost Management for Manufacturing Industries*, *OMEGA*, *Quality Progress*, *Center for Quality of Management Journal*, and the *International Journal of Flexible Manufacturing Systems*.

He has been involved in the curriculum and program development of Operations Management in the College of Management. He has participated in executive education programs at the College of Management. He has served on the editorial boards of *IIE Transactions*, *Manufacturing and Service Operations Management*, *Production and Operations Management*, *Quality Management Journal*, and *Technology and Operations Review*. He has served on the Board of Examiners of the Georgia Oglethorpe Award, and Bell South's President Quality Award, and the Baldrige Board of Examiners.

Ravi Subramanian is an Assistant Professor of Operations Management in the College of Management at the Georgia Institute of Technology (starting August 2005). He is currently a doctoral candidate in Operations and Management Science at the Stephen M. Ross School of Business, University of Michigan, Ann Arbor. He holds a bachelor's degree in Mechanical Engineering from the Birla Institute of Technology and Science, Pilani (India), an MBA from the Indian Institute of Technology Bombay, and an MS in Industrial and Operations Engineering from the University of Michigan, Ann Arbor. He has business experience in manufacturing planning, operations strategy, and ERP implementation.

Ravi Subramanian's research focuses on the interface between operations and the environment with an emphasis on strategic managerial responses to recent market-based and goal-oriented environmental policies. His work has been published (or is forthcoming) in *Manufacturing and Service Operations Management* and *Production and Operations Management*. A paper based on his dissertation research won the second prize at the INFORMS MSOM 2004 paper competition. He has presented his work in invited and sponsored sessions at INFORMS, MSOM, and POMS meetings.

L. Beril Toktay is an Associate Professor of Operations Management and the Nancy J. and Lawrence P. Huang Term Professor in the College of Management at the Georgia Institute of Technology. She received her PhD in Operations Research from Massachusetts Institute of Technology in 1998. She holds BS degrees in Industrial Engineering and Mathematics from Boğaziçi University, and an MS degree in Industrial Engineering from Purdue University. She was formerly Associate Professor of Technology and Operations Management at INSEAD.

Professor Toktay's research focuses on two topics within supply chain management. The first is the *management of closed-loop supply chains*, which are supply chains in which value is recovered from used products via recycling, remanufacturing or repair operations. The second is the *management of information and risk in supply chains*. The complex nature of supply chains brings particular challenges in information and risk management, which are aspects addressed in this research. Professor Toktay's research has received distinctions such as first prize in the *MSOM* student paper competition, finalist in the *EURO 2003* paper competition and best unpublished paper award at the 2005 *POMS* conference. She has published in *Management Science* and *Operations Research*. Her work in remanufacturing is currently funded by the *National Science Foundation*. Professor Toktay is the coordinator of the Georgia Tech Focused Research Program on *Closed-Loop Production Systems*. Professor Toktay has taught Supply Chain Management courses at the PhD, MBA and Executive Education levels, as well as Operations Management and Operations Research courses at the PhD level. She has developed cases and pedagogical material for MBA and Executive Education audiences. Professor Toktay serves on the Editorial Board of *Manufacturing and Service Operations Management* and *Production and Operations Management*.