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I. DEPARTMENTAL REQUIREMENTS FOR THE Ph.D.

A. Timetable
SOE's ideal is for everyone to finish in four years. The Director of the Ph.D. Program (DPP) and the other faculty members will ensure that you are given every opportunity to complete your degree in four years. Students are expected to progress in the program according to the following timetable:

1. First Year
Each student should receive a grade of B or better in every core course. In order to continue in the program beyond the first year, a student will need to pass the preliminary examinations in Microeconomic Theory, Technological Innovation and Econometrics in the summer following the first year. The contents of exams will be the materials covered in the first year core courses. A student who fails an exam in June will have the opportunity to retake the exam in August.

2. Second Year
Students should perform well in the second year, receiving grades of B or better in all courses, including electives. Each student should choose an advisor (mentor) during the fall semester to provide career advice and guidance on research projects. The chosen professor will then decide to accept or not to carry out the mentorship. If the professor becomes the student’s mentor, he or she will guide the student’s research agenda and evaluate the student’s research progress from the second year on. Students may switch mentors if they find other faculty members whose mentoring may be more beneficial. Each student will be encouraged to interact with members of the faculty throughout the year in order to establish contacts and develop a committee for the student’s first oral examination.

A second year paper will be due in mid-May and should follow the structure of a journal article, describing why the topic is important, the relevant literature, the analysis, and a set of results. The paper’s topic will have to be related to globalization and innovation. Students will be able to choose from the lists of topics covered in the innovation core sequence and from the lists of topics covered in each field course offered in the fall. This second year paper will serve as the second written preliminary examination for the program.

3. Third Year
During the fall semester of the third year each student must take the Research Development & Presentation Workshop, register for School Seminar and Dissertation Research. In the spring semester, each student will also be required to enroll in School Seminar and register for Dissertation Research. As described above, every student must present papers in relevant bodies of literature, discuss papers presented by peers, write evaluations of presentations of peers and present his or her first draft of the third year paper in the Research Development & Presentation Workshop.

The third year paper will be due in mid-May and should follow the structure of a journal article, describing why the topic is important, the relevant literature, the analysis, and a set of results. Also in March of the third year each student will file a progress report that describes what the
student has accomplished to date, including papers written, conference presentations, grant applications, courses taught, etc. The report will be read, commented upon, and signed by the student’s mentor. In addition, in consultation with the mentor, the student should select a dissertation committee during this year, if such committee had not yet been formed. Each student will be encouraged to submit the third year paper to a journal, for presentation at conferences and to seek funding for his or her research agenda.

Every student will have to pass an oral examination that covers the breadth of the student’s main field of research by the end of the third year or early in the fourth year. (The third year paper can be used as the instrument for the oral exam, representing in this case, the student's dissertation proposal. The oral exam will involve extensive questioning on the topic of the student’s dissertation proposal and related research by the student's dissertation committee, other faculty and audience.) The presentation will be open to anyone to attend.

4. Fourth Year and Beyond
A student typically completes a Ph.D. with a Major in Economics in four or five years. Students will be required to enroll in School Seminar and register for Dissertation Research in the fall and spring of the fourth year. In the year a student plans to go on the job market, the student will submit a job market packet by October 1 including: (i) an approved draft of a job-market paper; (ii) a vita, and (iii) a dissertation abstract. The student will also contact the members of the student’s dissertation committee to write letters of recommendation and to help in the job search. The final draft of the dissertation should be finished and the dissertation defended sometime during this year. The chair of the dissertation committee shall be responsible for setting up the dates for submission of the final draft to committee members (this date should be at least 14 days prior to the date of defense) and for the dissertation defense. Students should continue to send papers out for publication and for conference presentations.

In March of the fourth and subsequent years, students will file progress reports. Each report should describe the student’s accomplishments since the previous report, including papers written, conference presentations, grants applications, courses taught, etc. The report will be read, commented upon, and signed by the student’s mentor. The fourth year report will be used to evaluate the student’s prospects for funding in the fifth year.

B. Academic Requirements for the Ph.D.
The requirements a student must fulfill in order to obtain a doctoral degree are:
1. Pass the written preliminary exams: one exam for each first-year cluster.
4. Pass the final oral examination: dissertation defense
5. Teach two undergraduate courses.

In order to continue in the program beyond the first year, a student must pass the preliminary examinations in Microeconomic Theory, Technological Innovation and Econometrics in the summer following the first year. The contents of exams are the materials covered in the first year core courses. The first round of exams occurs during the first week of June. If a student fails an
exam in June he/she has the opportunity to retake the exam in August. The second round of exams occurs during the first week of August.

Besides the second-year-paper requirement, students must also fulfill the third-year-paper requirement. The third year paper is due in mid-May and should follow the structure of a journal article, describing why the topic is important, the relevant literature, the analysis, and a set of results. The expectation is that the third year paper represents a substantial improvement relative to the second year paper in terms of quality.

Every student must pass two oral examinations. The first is a dissertation proposal defense. This oral examination covers the breadth of the student’s main field of research, involving extensive questioning on the topic of the student’s dissertation proposal and related research. The second is the dissertation defense itself.

Every student must also teach two undergraduate courses. This is an integral component of the education a typical student receives in any leading Ph.D. program in Economics in the US. The teaching experience enhances the chances of students finding academic jobs after they graduate.

C. Curriculum

Our curriculum features 27 credit hours of first year core courses, at least 21 credit hours of fields, electives and workshop, at least 18 credit hours of departmental seminars and at least 33 credit hours of dissertation research. Thus, the minimum number of credit hours to be fulfilled is 99.

1. Core Coursework

Students receive rigorous training in microeconomic theory and quantitative methods during their first year of study. Our first year core coursework also features a two-course sequence in the economics of innovation. This cluster is designed to teach students the key microeconomic and macroeconomic foundations of innovation. In Microeconomics of Innovation, students are taught the microeconomic theoretical concepts, techniques and reasoning that underlie innovation processes. In Macroeconomics of Innovation, students will learn the macroeconomic factors that lead to technological change, the roles played by technological innovation and knowledge spillovers as promoters of economic growth, and the scope for fiscal and monetary policies to foment research and development and hence economic growth.

With the exception of the two-course sequence in the economics of innovation, our core courses are standard. Mathematics for Economists provides students with the necessary quantitative skills to perform well in other core courses and beyond. The course covers matrix algebra, limits and open sets, implicit functions and their derivatives, quadratic forms and definite matrices, unconstrained and constrained static optimization and dynamic optimization.

Microeconomic Theory I and Microeconomic Theory II cover standard topics in microeconomics. In Microeconomic Theory I, the students learn the axiomatic theory of consumer behavior, consumer choice, classical demand theory, aggregate demand, choice under uncertainty, producer theory and partial equilibrium analysis. Microeconomic Theory II covers topics in externalities and public goods, general equilibrium, economics of information and inter-
temporal dynamic analysis. Game Theory complements the knowledge in microeconomics and examines static and dynamic games of complete and incomplete information.

In addition to Mathematics for Economists, students take three courses in quantitative methods, a two-course sequence in statistics and econometrics and a course in empirical research methods. The two-course sequence in statistics and econometrics teaches the students standard concepts and techniques. In Econometrics I, students receive a comprehensive introduction to mathematical statistics principles underlying statistical analyses in economics. Students learn probability theory, expectation, sampling, asymptotic results, the main families of probability distributions studied in economics, estimation and hypothesis testing. In Econometrics II, students learn linear and nonlinear regression analyses, hypothesis testing, ordinary and generalized least squares, instrumental variables estimation, the generalized method of moments, the method of maximum likelihood, methods for stationary time series, unit roots and cointegration, and specification testing. Finally, the course Empirical Research Methods complements the two-course sequence in statistics and econometrics by providing students with up-to-date theory in panel data modeling and analysis. The course also complements the two-course sequence in economics of technological innovation, described in detail below, by featuring up-to-date empirical contributions to this body of literature.

2. Field Coursework
The fields share a common set of core economic concepts and techniques – i.e., microeconomic, game-theoretic, macroeconomic and econometric models taught in the first year of the program – but are typically designed to expose students to specialized bodies of economic literature. We offer three specialization fields, Environmental Economics, Industrial Organization and International Economics. Our fields build on our set of core courses, providing students with opportunities to explore research topics within three distinct but related areas while simultaneously preserving and enhancing our program’s focus on globalization and innovation. Each field shares globalization and innovation as a “common language,” since a substantial share of its content pertains to the importance played by globalization and innovation within the field. Each field provides an equal mix of theory and practice, consisting of two three-hour courses, as described below:

Environmental Economics
ECON 7102 Environmental Economics I 3 hours
ECON 7103 Environmental Economics II 3 hours
Total 6 hours

Industrial Organization
ECON 7111 Industrial Organization I 3 hours
ECON 7112 Industrial Organization II 3 hours
Total 6 hours

International Economics
ECON 7121 International Economics I 3 hours
ECON 7122 International Economics II 3 hours
Total 6 hours
Environmental Economics I is a theoretical course, which provides students with knowledge of three kinds of environmental economics topics: (i) standard; (ii) related to innovation; and (iii) related to the international environment and global economy. Among the standard topics, the course covers negative externalities, property rights, incentive design, emission taxes and tradable emission permits. As for topics related to innovation, the course focuses on innovation incentives originating with environmental regulations and globalization. The third area of the course explores the problems caused by trans-boundary pollutants (e.g., carbon dioxide and sulfur dioxide emissions) within and across nations, international environmental agreements, and the globalization impacts on the environment.

Environmental Economics II is an empirical course, built upon the theoretical topics covered in Environmental Economics I. Students are given an in-depth coverage of key empirical papers in environmental economics, either papers that have tested several hypotheses derived from theoretical models or papers that are advancing knowledge in the field, generating empirical results for which no theory yet exists. The empirical papers studied are divided into the three categories of topics investigated in Environmental Economics I.

Industrial Organization I is a theoretical course. It studies the strategic behavior of firms, market structures and their interactions, technological innovation and diffusion and regulation and procurement. The first part of the course covers issues related to market structures and the strategic behavior of firms: (i) monopoly – pricing behavior, quality choice, price discrimination, vertical control; and (ii) oligopoly – strategic interaction, short run and dynamic pricing competition, product differentiation, entry and exit. The second part of the course examines research and development and the adoption of new technologies. The topics discussed here are the value of innovation, patent races, strategic adoption of new technologies, network externalities, patent licensing and research joint ventures. The third part of the course studies issues related to regulations and procurement. Some of the topics examined in this part are incentive regulations, antitrust law and competition policy.

Industrial Organization II is an empirical course. Students will be trained to examine the theoretical issues arising in Industrial Organization I. Students will be taught about how to use existing data, collect and compile their own datasets and use frontier methods in empirical Industrial Organization to test hypotheses that originate from the theories related to pricing, product and process innovation, among others. Part of this course will also focus on the study of issues arising in specific industries, consistent, for example, with the Sloan Industry Studies Program.

International Economics I is a theoretical course. It covers all basic material in international trade, such as the Ricardian and Hecksher-Ohlin models, extensions to many goods and factors, trade in intermediate inputs and wages, increasing returns, gains from trade and regional agreements, import tariffs and dumping, import quotas and export subsidies, political economy of trade policy and trade and endogenous growth. It also examines the relationship between international trade, foreign direct investment and technological innovation and diffusion.
International Economics II is an empirical extension of International Economics I. It surveys the empirical literature and presents the key empirical results related to the topics discussed in the theoretical course. It also discusses frontier empirical work in the field, empirical studies that go beyond the testable hypotheses originated with theory.

Students are required to have a major and at least one minor in fields offered by SOE. Occasionally, SOE offers elective courses that complement our field courses. Students may also take independent study courses. These courses are to be supervised by tenure-track or tenured faculty members who agree to provide guidance to students in specific research topics. Students who take independent study courses must fulfill all expectations regarding coursework and deliverables set by their supervisors in order to pass. Supervisors will not accept research projects which they have not previously agreed to supervise as substitutes for research projects that supervisors and students have agreed upon in their discussions pertaining the expectations for the coursework and deliverables.

Table 3 below outlines the current curriculum.

Table 3: Curriculum and Sample Schedule for the Ph.D. Program – All courses 3 credit hours

<table>
<thead>
<tr>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First Year</strong></td>
<td></td>
</tr>
<tr>
<td>Mathematics for Economists</td>
<td>Microeconomic Theory II</td>
</tr>
<tr>
<td>Microeconomic Theory I</td>
<td>Econometrics II</td>
</tr>
<tr>
<td>Econometrics I</td>
<td>Microeconomics of Innovation</td>
</tr>
<tr>
<td>Macroeconomics of Innovation</td>
<td>Game Theory</td>
</tr>
<tr>
<td><strong>Second Year</strong></td>
<td></td>
</tr>
<tr>
<td>Major Economics Field, Course I</td>
<td>Major Economics Field, Course II</td>
</tr>
<tr>
<td>Minor Economics Field, Course I</td>
<td>Minor Economics Field, Course II</td>
</tr>
<tr>
<td>Empirical Research Methods</td>
<td>Elective II</td>
</tr>
<tr>
<td>Elective I</td>
<td>Seminar I</td>
</tr>
<tr>
<td><strong>Third Year</strong></td>
<td></td>
</tr>
<tr>
<td>Research Dev. &amp; Presentation Workshop</td>
<td>Dissertation Research</td>
</tr>
<tr>
<td>Dissertation Research</td>
<td>Seminar III</td>
</tr>
<tr>
<td>Seminar II</td>
<td></td>
</tr>
<tr>
<td><strong>Fourth Year</strong></td>
<td></td>
</tr>
<tr>
<td>Dissertation Research</td>
<td>Dissertation Research</td>
</tr>
<tr>
<td>Seminar IV</td>
<td>Seminar V</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Minor Concentrations outside SOE
In addition, students are allowed to take elective courses outside of Economics subject to the approval of the DPP. A set of elective courses taken in another discipline constitutes a minor in that particular discipline if at least nine credits are taken from this discipline.

4. Research Development Workshop and School Seminars
The goals of the Research Development & Presentation Workshop are threefold. First, the workshop provides an extra incentive for students to start working early on the topic of their third year paper, since students present papers closely related to their third year papers to peers
and the instructor. Second, the workshop provides each student with regular feedback from the instructor and peers on the student’s ability to deliver lectures. Third, the workshop serves the purpose of enhancing the student’s ability of writing a research paper. Students not only present papers closely related to their own, but also discuss papers presented by peers, evaluate their peers regarding presentation skills and present the first drafts of their third year papers at the end of the term.

School Seminars provide students with an opportunity to get involved in the research life of the Department. They also enable students to start acquiring key presentation skills. Each student is required to attend all School seminars each semester, starting in the fall semester of the second year. The DPP keeps an attendance list, and students have to submit weekly reports summarizing the papers presented. Absences have to be justified in writing – copies of such documents are kept in the student’s file together with other student records. Absences may affect the student’s eligibility for funding or the amount of funding in the subsequent semester. At the end of each semester, the DPP evaluates the students’ performances and issue “pass” or “no pass” grades. Those who receive pass grades earn three credits. Each student must earn a minimum of 18 Seminar credit hours to graduate.

In addition to the School Seminar, students must also register each semester for Dissertation Research, starting in the fall semester of the third year. In such a semester, students must register for at least six hours of Dissertation Research. In every subsequent semester, students must register for at least nine hours of Dissertation Research. Students must complete a minimum of 33 Dissertation Research credit hours to graduate.

II. INSTITUTE's REQUIREMENTS FOR THE Ph.D.

Georgia Tech's requirements for the Ph.D. are outlined below. For detailed information, see the following website: http://www.catalog.gatech.edu/students/grad/doctoral/graduationrequire.php

A. Registration and Residence Requirements
The matriculation requirements are similar to those outlined for the master's degree with the addition of the residency requirement: doctoral students must spend at least two full-time semesters in residence at the Georgia Institute of Technology and ordinarily must complete research for the dissertation while in residence. Under special circumstances, candidates who have met the residency requirement may receive permission to pursue their research in absentia, provided the chair of the appropriate school approves and a faculty member directs the project. Although doctoral students working full-time on thesis research should normally be registered for a full course load of 9000 level dissertation hours each semester, this requirement is at the discretion of the advisor and the department: no minimum number of 9000 level dissertation hours is required for the doctoral degree. Doctoral students must be registered in the semester of graduation.

While no fixed course requirements apply for the doctoral degree, the student's thesis advisory committee may recommend graduate coursework in both a major and a minor field of study. Doctoral students must be registered in the semester of graduation. See Additional Graduation Requirements for more information. If a student has completed all degree requirements and will
no longer require any of the Institute's facilities or faculty time, the student may request an enrollment waiver.

**B. Additional Graduation Requirements**

In addition to requirements listed elsewhere, the candidate must:

1. Submit a petition for the degree to the Registrar's Office during the term preceding the anticipated final term of work. Petition forms are available from the Registrar's Office.
2. Have an overall grade point average of at least 3.0 in order to graduate.
3. Register for a minimum of one hour of dissertation in the term of graduation. This reduction from the normal minimum course load of 3 hours may be used only once. If all requirements for graduation, including submission of the final approved dissertation, have been completed prior to the last day of registration, and the student was registered for the preceding term, the student may apply for a waiver of the enrollment requirement.
4. Pay the Institute a fee for archiving and distributing the dissertation through UMI Dissertations Publishing prior to the final submission of the completed dissertation to Graduate Studies via the Electronic Thesis and Dissertation website.

If both the dissertation and the examination are satisfactory and the candidate has completed the requirements of residence, minor field, and any additional school requirements, the Graduate Studies Office will certify the candidate as qualified to receive the degree of Doctor of Philosophy.

**C. Advancement to Candidacy**

Admission to candidacy is a very important step in meeting both departmental and university requirements. To advance to candidacy, you must have passed all three core preliminary examinations, passed the field preliminary examination (second-year paper), complete all the required coursework and successfully defended your thesis' proposal. Note that financial support may be held up if you do not advance to candidacy by the end of the spring semester of the third year. Students who do not advance to candidacy on time will be required to meet with the DPP to discuss their status in the program.

**D. Minor**

In addition to an adequate knowledge of the major field of intended research, the student must demonstrate mastery of some other, smaller body of knowledge—the minor field—preferably outside the student's school. The purpose of the minor is to encourage a wider interest on the part of the student and to provide a broader basis for the evaluation of the student's capabilities. The minor will normally consist of at least nine semester hours of work in related courses, chosen by the student in consultation with a guidance committee and approved by the Graduate Studies Office on behalf of the graduate dean. These courses should be at the 6000 level or above, but the use of certain 4000 level courses may also be approved. Courses taken at other institutions may be included in the minor. Once the student has satisfactorily completed the minor, the school chair sends a confirmation, accompanied by course grades, to the Graduate Studies Office for final approval and recording.
Although the student need not complete the minor as a prerequisite for admission to candidacy, the minor must be completed and approved in order to be cleared for graduation.
E. Orals
There are two oral examinations. The first oral is your thesis' proposal defense. The second oral is your thesis' defense.

F. Conferral of Degree
Please check the following website for information regarding all the necessary steps for the conferral of the Ph.D. degree: http://www.gradadmiss.gatech.edu/thesis.php

G. Commencement
Commencement ceremonies are held in the fall, spring and summer. In order to participate in the ceremony, you must meet various deadlines, the most important of which is the thesis completion deadline. See http://www.gradadmiss.gatech.edu/thesis/thesisdeadlines.php.

H. Grades and Exams
Always identify your exam books completely with the following information: (i) your name (or secret code in the prelims); (ii) course number; (iii) course title; (iv) date of exam. Preliminary examination grades will be sent by email. Course grades are available in Oscar shortly after the end of each semester.

III. FINANCIAL SUPPORT
SOE offers financial support to incoming and continuing students. Typically, the initial teaching assistantship (or, if available, research assistantship) offer is for the first two years, contingent on the student being in good academic standing (maintaining a GPA of at least 3.0). Contingent on the availability of funds, TAs in good academic standing by the end of the second year, should be offered teaching assistantship appointments for years three and four. There is no guarantee of funding beyond the fourth year.

A. Being a TA
Being a TA is also an important learning experience. Teaching skill is highly valued in the academic job market, and teaching experience should help you in presenting seminars. Students must attend the following two TA orientation sessions offered by the Center for the Enhancement of Teaching and Learning (CETL) in the beginning of their second year:

1. Graduate Teaching Assistant Orientation
   (http://www.cetl.gatech.edu/students/tas/orientation.htm)

2. New Undergraduate Teaching Assistant Orientation
   (http://www.cetl.gatech.edu/students/tas/uta_orientation.htm)

   In addition, international students must also attend the following orientation session:

3. New International Teaching Assistant Orientation
   (http://www.cetl.gatech.edu/students/tas/ita_orientation.htm).

B. Finding an RA Position
Faculty may hire RAs with their own grant money, not with SOE funds. Faculty grants may come from NSF or other granting agencies and foundations. Please let the DPP know as soon as possible if a faculty member agrees to hire you, and the details of the appointment. Prior to the beginning of each semester, please verify your continued appointment with the faculty member and notify the DPP.

C. Stipends and Taxes
TAs and RAs may earn different salaries. Your initial salary will be based on the offer you received from SOE during the admission process. Stipends are typically taxed by the federal and state governments. Foreign students may wish to consult with an advisor in Payroll regarding possible tax exemptions based on a treaty between the US and their home countries.

D. Incentives for TAs
All students must be a TA for at least one semester (not counting any summer session) before the end of the fourth year. Outstanding TAs are eligible for the Distinguished Teaching Award, which can be listed on your CV and provides a monetary award. This award is based on student evaluations and on the faculty evaluations of TAs.

E. Summer Support
Students may seek summer jobs outside SOE. There may be summer school TA positions available; see the DPP in early spring if you are interested.

IV. STUDENT RESOURCES

A. Libraries
The University Library collections are very comprehensive. The main library carries many journals in economics, a large collection of books and other materials. Most journals in economics are available online at

http://gtsearch.library.gatech.edu/search/?base=databases&action=subject&subject=economics

B. Computers
There is a student computing lab located in the ground floor of the Old CE Building. Students have daytime and after-hours access to this lab.

V. STUDENT-FACULTY COMMUNICATION

A. Advising
The DPP is the official advisor to all Ph.D. students. The DPP is available to consult with students about progress and help them to select courses. The DPP also monitors the progress of students during their first three years. In addition to the DPP, students select an advisor in the second year. The second-year advisor (who may become the thesis advisor) is helpful in the second year and beyond. Once students start work on their dissertation, the thesis advisor becomes the main advisor. A formal thesis advisor agreement form must be filed prior to the first oral examination (the thesis proposal defense).
B. Graduate Student Meetings
The DPP schedules periodic meetings with Ph.D. students during each academic year. These meetings provide an opportunity to ask questions and discuss current issues of concern, which may include computers, office space, financial support and the core curriculum.

C. Mailboxes
Most information is sent to students via email. However, important information may also be placed in the graduate student mailboxes (e.g., TA assignments, office assignments, announcements of RA positions). **It is your responsibility to check your mailbox regularly.**

VI. THE DEPARTMENTAL JOB MARKET
If you wish to go on the job market, you need first to secure your thesis advisor's support. You must also submit a draft of a job-market paper to SOE's placement officer by October 1 of that year. The paper must be approved by your thesis advisor.