



INTEGRATED PRODUCT DESIGN
UNIVERSITY OF PENNSYLVANIA

Guidelines for Graduate Study

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University of Pennsylvania
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****These guidelines are subject to change.***

1. INTRODUCTION

The University of Pennsylvania's Integrated Product Design program is intended to cultivate design professionals that possess both a breadth of knowledge and a depth of expertise in a specialty, in order to effectively bridge the domains of technology, manufacturing, business, aesthetics, and human-product interaction. The guiding philosophy of the program is not only to teach students to create products, but to understand and address the social, environmental and experiential contexts of those products, so that product design can be harnessed as a force for the greater good.

The program builds the skills to investigate, imagine, conceptualize and model a wide range of products and their complementary business models. The program draws on the strengths of three internationally recognized schools within the University: the School of Engineering & Applied Science, the Wharton School, and the School of Design.

The graduate courses that make up the program are intended to create an interdisciplinary point of view and are taught by professors from all three schools. Studio classes accompany classroom studies, providing creative and analytical approaches, and shifting students between rigorous, technical and explorative processes in the development of both experiential and theoretical knowledge. Collaborative team projects and student-driven independent projects complement the core courses to give students both a solid grasp of the fundamentals and a deep understanding of the nuances of these fields.

The information presented in these Guidelines is not exhaustive; students should also obtain information from the Penn Engineering website: www.seas.upenn.edu/graduate/handbook

More information, updated periodically, on the IPD program is also available on the website, www.me.upenn.edu/ipd. Reading all of the rules and procedures is essential in order to be familiar with various degree requirements and the plentiful opportunities that are available.

These guidelines together with the information presented on the above listed websites will answer most questions. Advice and answers to questions not covered in these sources may be obtained from the Director¹, Associate Director² or Graduate Program Coordinator³.

** Students who matriculated before 2013 are subject to the policies that were in effect as of their matriculation date.*

2. PROGRAM ADVISING

There are two areas of advising within the IPD program, master's program academic progress advising and Final Project advising. The first person with whom a new student will have contact will be the Director, Associate Director or Graduate Program Coordinator of the IPD program. These people are responsible for monitoring the student's academic plan and progress during the IPD Master's program. In addition, during the last two semesters of Final Project work, each team or individual pursuing a Final Project is responsible for selecting an additional Final Project Advisor and Final Project committee members to join the Director and Associate Director in overseeing the team or individual's Final Project. Ideally, representation will come from the School of Engineering and Applied Science, the School of Design and from the Wharton School. In certain cases, Final Project committee members may come either from another area of Penn pertinent to the project pursued, or from outside the university. Choices of advisor and committee members must be approved by the Director or Associate Director. These

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³ Maryeileen B. Griffith, Room 229 Towne Bldg. (215-898-2826; mebg@seas.upenn.edu)

individuals will form the “Final Project Advisory Committee” on the particular individual or group project.

3. DEGREE REQUIREMENTS

To achieve a Masters of Integrated Product Design (M:IPD) or a Masters of Science in Engineering Integrated Product Design (MSE:IPD) the requirements consist of a total of ten courses (not including background courses), seven of which must be from within the School of Engineering and Applied Science. Detailed curriculum requirements for each degree track is given below. The degree requirement also includes four sequential credits of Final Project work. Since this program is cross-disciplinary, students who do not have the requisite background in the three areas, engineering, design arts, and marketing, may be required to enroll in additional background courses in these areas. Background courses must be taken in the first year of study and a grade of “B” or better must be earned to satisfy the background requirement. If a student is unsuccessful in earning the grade of “B” or better in a required background course, s/he will be required to take an additional undergraduate course in which the grade of “B” must be earned to graduate. This course will be determined by the student and the Academic Advisor.

Background Courses for both the M:IPD & MSE:IPD (0-3 CUs or proficiency shown)

Engineering Basics:

MEAM 101 - Introduction to Mechanical Engineering Design
or comparable approved by the Director

Design Art Basics:

ARCH 300 - Product Design Fundamentals
or comparable approved by the Director

Marketing Basics:

MKTG 101 - Introduction to Marketing
or comparable approved by the Director

Curriculum for M:IPD Program

Core Courses (6 CU):

IPD 515 - Product Design (1st year) (1 CU)
IPD 551 - Design Process (1st Semester) (1 CU)
IPD 552 - Problem Finding (2nd Semester) (1 CU)
IPD 561 - IPD Theories & Methods 1 (1st Semester) (0.5 CU)
IPD 562 - IPD Theories & Methods 2 (2nd Semester) (0.5 CU)
IPD 799 - Final Project (3rd Semester) (1 CU)
IPD 799 - Final Project (4th Semester) (1 CU)

Breadth (1 CU in each category; engineering, design and business)

Engineering Breadth:

IPD 501 - Integrated Computer-Aided Design, Manufacturing, and Analysis (1 CU)
IPD 514 - Design for Manufacturability (1 CU)
IPD 516 - Advanced Mechatronics in Reactive Spaces (1 CU)
MEAM 510 - Design of Mechatronic Systems (1 CU)
MEAM 535 - Advanced Dynamics (1 CU)
MEAM 625 - Haptic Interfaces (1 CU)
or comparable approved by the Director

Design Arts Breadth:

ARCH 733 - Building Product Design (1 CU)
ARCH 780 - Arch in the Schools (1 CU)
IPD 516 (ARCH 746) - Advanced Mechatronics in Reactive Spaces (1 CU)
IPD 526 (ARCH 726) - Furniture Design (1 CU)
IPD 527 (ARCH 727) - Industrial Design I (1 CU)
IPD 528 (ARCH 728) - Design of Contemporary Products (1 CU)
IPD 530 (ARCH 730) - Building Product Workshop (1 CU)
IPD 532 (ARCH 632) - Surface Effects (1 CU)
IPD 544 (ARCH 744) - Digital Fabrication (in Architecture (1 CU)
or comparable approved by the Director

Business Breadth:

EAS 545 - Engineering Entrepreneurship I (1 CU)
EAS 546 - Eng Entrepreneurship II (1 CU)
ESE 540 - Engineering Economics (1 CU)
MKTG 728 - Contagious: How Products, Ideas, and Behaviors Catch On (1 CU)
MKTG 753 - New Product Management (1CU)
MKTG 756 - Marketing Research (1 CU)
MKTG 776 - Applied Probability Models in Marketing (1 CU)
MKTG 892 - Creativity (1 CU)
OPIM 651- Innovation, Problem Solving and Design (1 CU)
OPIM 662 - Enabling Technologies (1 CU)
OPIM 656 - Operations Strategy and Process Management (1 CU)
or comparable approved by the Director

Elective (1 CU) One additional graduate level course in engineering, design, or business or independent study or another area pertinent to the individual's specific area of interest or study. Electives should be chosen from the breadth lists above or with advisor approval.

IPD 699 Integrated Product Design Seminar (0 CU; 2 semesters)

Curriculum for MSE:IPD (6 CU)

IPD 551 - Design Process (1st Semester) (1 CU)
IPD 552 - Problem Finding (2nd Semester) (1 CU)
IPD 798 - Final Project (3rd Semester) (1 CU)
IPD 798 - Final Project (4th Semester) (1 CU)
MEAM 514 - Design for Manufacturability (1 CU)
MEAM 510 - Design of Mechatronic Systems (1 CU)

MSE:IPD students are required to take an additional two engineering elective courses from the following lists or with advisor approval (2 CUs):

IPD 501 - Integrated CAD manufacturing and Analysis (1 CU)
IPD 516 - Advanced Mechatronics in Reactive Spaces (1 CU)
MEAM 520 - Introduction to Robotics (1 CU)
MEAM 527 - Finite Element Analysis (1 CU)
MEAM 535 - Advanced Dynamics (1 CU)
MEAM 554 - Mechanics of Materials (1 CU)
or comparable approved by the Director (1 CU)

Breadth (1 CU in each category; design and business)

Design Arts Breadth:

ARCH 733 - Building Product Design (1 CU)
ARCH 780 - Arch in the Schools (1 CU)
IPD 516 (ARCH 746) - Advanced Mechatronic Reactive Spaces (1 CU)
IPD 526 (ARCH 726) - Furniture Design (1 CU)
IPD 527 (ARCH 727) - Industrial Design I (1 CU)
IPD 528 (ARCH 728) - Design of Contemporary Products (1 CU)
IPD 530 (ARCH 730) - Building Product Workshop (1 CU)
IPD 532 (ARCH 632) - Surface Effects (1 CU)
IPD 544 (ARCH 744) - Digital Fabrication in Architecture (1 CU)
or comparable approved by the Director

Business Breadth:

EAS 545 - Engineering Entrepreneurship I (1 CU)
EAS 546 - Engineering Entrepreneurship II (1 CU)
ESE 540 - Engineering Economics (1 CU)
MKTG 728 - Contagious: How Products, Ideas, and Behaviors Catch On (1 CU)
MKTG 753 - New Product Management (1CU)
MKTG 756 - Marketing Research (1 CU)
MKTG 776 - Applied Probability Models in Marketing (1 CU)
MKTG 892 - Creativity (1 CU)
OPIM 651- Innovation, Problem Solving and Design (1 CU)
OPIM 662 - Enabling Technologies (1 CU)
OPIM 656 - Operations Strategy and Process Management (1 CU)
or comparable approved by the Director

IPD 699 **Integrated Product Design Seminar** (0 CU; 2 semesters)

Notes

- * If a course is cross-listed, students must register for the IPD section when available.
- ** Any deviation from the above must be approved by the Director.

4. ATTENDANCE AT SEMINARS AND PROJECT PRESENTATIONS

The attendance of all full-time graduate students at IPD seminars and final presentations is mandatory. There are many good reasons why students should attend departmental seminars and presentations even when the seminars are not directly linked to their areas of research. For example:

- They provide an opportunity to learn about the state-of-the-art companies, designs, technologies, ideas, etc.
- They provide an opportunity for the student to get acquainted with people from other institutions and companies and get an inside view of their culture and ideas. On more than one occasion, during job interviews, interviewers have been known to mention a visit to Penn and delivering a seminar.
- They are meaningful simply to learn what new and interesting things are going on in the world.
- They are an excellent opportunity to get together as a department. It is hoped that a full attendance at these seminars will help create departmental spirit and cohesiveness.

Seminar Course IPD 699

The seminar course has been established so that students are recognized for their seminar attendance as well as to encourage students to attend. There are no quizzes, tests, or homeworks. The course is graded S/U. In order to obtain a satisfactory (S) grade, the student must attend the IPD seminars. In order to obtain their degree, IPD students are required to accumulate 2 seminar course credits (IPD 699). Under special circumstances, e.g., in a case of a conflict with a course offering, the student may waive the seminar requirement for the particular semester by petitioning to the Director. Part-time students are exempted from the mandatory overall seminar attendance requirement although they are strongly encouraged to attend all possible seminars.

5. GENERAL INFORMATION

Registration:

All students enrolled in a degree program are required to be continuously registered. Three courses per semester (including studio project research, such as IPD 799 or IPD 798 Final Project and Independent Studies IPD 599) are considered to be a normal full-time load for all students. The seminar course, IPD 699, does NOT count towards full-time status. Students must always consult with the Director or Associate Director if a deviation from the normal load is desired or being contemplated. Part-time students usually take one or, at most, two courses per semester.

Students must meet with their advisor to discuss course selection and obtain advisor's sign-off prior to registration.

Leaves of Absence:

Continuous registration as a graduate student is required unless a formal leave of absence is granted by the Dean of the student's school. A Leave of Absence (LOA) may be requested by submitting a Petition for Action (www.seas.upenn.edu/graduate/pdf/g-petition.pdf). More detailed information regarding LOA is available on the following website: www.seas.upenn.edu/graduate/handbook/g-academic.php

Obsolescence:

The maximum time allowed for the completion of all masters degree requirements is seven years. Course units that are older than seven years may not be counted toward the degree requirements.

Changes in Course Program:

Students may add or drop courses without penalty during a semester if it is done by the deadline listed in the current graduate bulletin. The Director or Associate Director must be informed of the student's decision beforehand and must receive his/her approval. International students must consult with the office of International and Student Scholar Services before dropping a course.

Grades, Credits, and Academic Standing:

The grading system is as follows: A (4.0), Excellent; B (3.0), Good; C (2.0), Fair; D (1.0), Poor; F (0.0), Failure. A course in which an F was obtained must be taken again; however, the F will remain on the student's transcript. Courses for which a passing grade was obtained cannot be retaken for credit. An incomplete (I) or a no report (NR) are temporary notations and students are allowed a period of one semester to clear them from their transcripts. Failure to clear an "incomplete" or "no report" within the allotted time will result in an automatic grade of F. *No students will be permitted to graduate if there are any Incomplete, Unsatisfactory, or No Report notations on their records.*

M:IPD and MSE:IPD Students in the School of Engineering are expected to maintain at least a B- average (2.7) in their work. A student whose record falls below a B- average will be put on academic probation and may be required to withdraw; graduation requires a minimum of a B- average.

Academic Integrity

Each student is expected to abide by Penn's Code of Academic Integrity (http://www.upenn.edu/provost/PennBook/academic_integrity_code_of). Students should not knowingly use any dishonest method to gain an unfair advantage over other students in academic pursuits, especially through, but not limited to:

- Giving or receiving any unauthorized aid on an assignment or exam, including working in groups on any assignment that has been designated as individual by the professor;
- Misrepresenting the originality of one's work (plagiarism), particularly through direct copying of work and also through failing to note the contributions of others, except as permitted by the instructor;
- Submitting substantially the same work for credit in more than one class, except with prior approval of the instructor.

If there is any doubt as to what is permissible, it is the student's responsibility to ask the instructor. Students caught cheating will be subject to disciplinary action, which may include referral to the Office of Student Conduct. For more information, please see the Student Guide on Academic Integrity: www.upenn.edu/academicintegrity/

6. INDEPENDENT STUDY

Independent Study courses (IPD 599) are vehicles to accommodate special interests of the students which are not served through the regular courses. They create opportunities for mini-projects and a mentoring relationship between the student and the faculty. IPD 599 can only be counted towards the elective requirement and must be a topic independent of your final project work.

Since independent studies are less structured than regular courses and typically do not come with strict deadlines, occasionally students tend to fall behind in their work. There is also the possibility of miscommunication between the student and the faculty on the objectives, extent, scope, and the grading method for the independent study. The purpose of this policy is to set the rules for an independent study with the objectives of maintaining academic rigor and minimizing any potential for miscommunication.

An independent study course should require effort comparable to that of a regular course, about 9 hours a week or a total of 126 hours per semester. The student should meet the faculty member administering the independent study (the advisor) on a regular basis, at least once a week. It is the student's responsibility to schedule these weekly meetings. Past experience indicates that failure to maintain regular contact with the student's advisor can lead to a less than satisfactory performance in the independent study course. In the absence of regular contact, the student stands the risk of not being focused leading to an impression of dereliction. The key to a successful independent study is a steady effort throughout the semester. The student should not expect to be able to cram a semester's work into a few days of intensive work at the end of the semester.

Prior to the beginning of the semester in which the student contemplates taking the independent study, the student and his/her advisor should develop a brief document. The first paragraph of the document should describe the objectives, scope, and content of the independent study. The second paragraph should state how the independent study will be evaluated and how the student will be graded. The document should be signed by both the student and his/her advisor, and it should be submitted to the program Director for approval before the beginning of the semester.

At the conclusion of the independent study, the student should prepare a brief report specifying what material was covered during the independent study, those objectives that were met and those that were not. In the event that objectives were not met, a clear explanation should be provided as to why such objectives were not met. This document should also be signed by the student and his/her advisor, and it will be included in the student's file.

It is the student's responsibility to make sure that these guidelines are followed. Failure to follow these guidelines may result in the student not receiving credit for the independent study.

7. POLICY ON TRANSFER OF CREDIT UNITS EARNED IN OTHER INSTITUTIONS

IPD students may obtain credit for up to two approved courses taken at another institution. Dual Degree and Submatriculant students who are double counting courses towards both degrees will not be permitted to transfer courses in addition to double counting courses. These courses are referred to as transfer courses. Transfer courses must be graduate level courses in which at least a B grade has been earned. Transfer credit will only be considered for courses taken prior to matriculation in the IPD graduate program. To obtain credit for courses taken at other institutions, the following procedure must be followed:

For each transfer course, obtain information about the, e.g. course description, syllabus, homeworks and/or exams and the title of the textbook prescribed for the course.

Identify a professor who teaches a similar course at Penn. If a similar course is not offered at Penn, identify a professor whose areas of expertise are in the general area of the course to be transferred. The professor should certify that the course is of similar level to a graduate course offered at Penn or, if a similar course is not offered at Penn, that the course qualifies for Penn students to take at the graduate level if it were offered here.

Submit a petition on a standard form (www.seas.upenn.edu/graduate/pdf/g-transfer-credit.pdf) to the program Director. Attach to the petition a copy of the transcript, the professor's certification, and documents and information noted on the standard form.

8. FINAL PROJECT

The IPD Final Project is the output of two semesters of interdisciplinary master's study combining engineering, design arts and business. In keeping with the nature of this unique major, every student aims to have a committee of advisors that include three different disciplines. This section is intended to help set the expectations of work on the part of the advisors and students.

Final Project Expectations

A viable IPD Project should include the following elements or qualities:

- Be a holistic offering, explicitly addressing design, engineering and business elements
- Solve a real problem in the world
- Be both commercially viable and socially valuable
- Be innovative: either entirely new to the world, a fundamental improvement on something that exists, or something that is translated from one domain to another in a new way
- Be user-centered
- Be prototyped for the purposes of evaluation and iteration
- Include a tangible object
- Be developed and prototyped to the fullest extent possible
- Contribute to the discourse on product design

In addition to the aforementioned requirements, students who pursue the MSE:IPD degree track (Masters of Science in Engineering) of the IPD program will be expected to complete final projects that demonstrate engineering knowledge and expertise, including the ability to implement the technology of the product, innovation in the technology of the products, the ability to fabricate the product, analysis of engineering performances, iteration and improvements of the product based on that analysis.

Team projects

Interdisciplinary group work is encouraged, but not mandatory. Ideally teams will be formed by two or three students from different backgrounds. In these cases, the work and contributions from each member needs to be clearly delineated.

Students will work together on one project, however they will submit separate project proposal (with shared text) but with emphasis on the work of their respective parts.

Project Committee Interactions

The project committee is comprised of one project advisor and two or more supporting project committee members. This committee needs to advise in engineering, design arts and business areas and therefore should have recognized expertise in those three areas. The student and project advisor should communicate regularly (typically once every few weeks) and may consider including the IPD Final Project instructor on major milestone communications. The other committee members communicate during the semester as needed with the whole committee meeting at least once per semester (just before or after mid-term is recommended). In addition to committee meetings, it is expected that committee members will attend major student project presentations. The Project Leader (student) must secure the permission of the Advisors to include their names in the final presentations. Advisor and Committee Members will jointly determine the Final Project semester grades along with the Final Project class Professor.

Timeline:

The final project follows a four semester sequence where the first two semesters are preparatory classes and the final two semesters focus on execution. The first semester focuses on integration of disparate themes delving deeply into design of products and developing design sensibilities and methodologies without direct development of the final project. The 2nd, 3rd and 4th project semesters are structured with deliverables as follows:

- Project Proposal (due at the middle of the 1st semester)
- Project Concept Presentation and Final Semester Development Plan (End of 1st project semester)
- Final Project Presentation and Report Submission (End of 2nd project semester)

Project Proposal (due at the end of the 1st project semester)

The project proposal is a brief document roughly 500-750 words long containing a basic description of what the student wants to do and would be looking for in an advisor. Include a basic outline of the project that should preliminarily identify:

- The inspiration / source of the problem
- Preliminary research done to indentify the problem conflicts
- Preliminary criteria for the problem solution
- Anticipated scope of the project
- The potential impact of the project on the project member(s), the community and/or the world.

If the project includes a team, students need to present an argument for why they are a good group to work together and what elements each member brings to the table. Team formation proposals should be cleared with Final Project faculty within the second half of the 1st project semester.

After evaluation by IPD Final Project teaching staff, this preliminary proposal will be used to help find and acquire the project committee. Note that the project proposal is not expected to clearly define the project solution, nor what the student plans to accomplish in detail, but it should clearly define the larger parameters of the project area, and a few possibilities the student could envision exploring within that project area.

The following are some suggested guidelines for the write-up:

Title of project

Student info (name, email address)

Potential advisors (name, affiliation, email address)

Proposal text

Proposal images

Supporting data

Project Concept Presentation and Final Semester Development Plan (End of 1st project semester)

At the conclusion of the second project semester the student or student team will present the final project concept design that has been generated from the semester's efforts.

Concept presentation deliverables include:

- The initial areas of study as defined above and a brief review of functional user needs and interaction research
- Initial criteria generated and if the design process caused them to be changed and why.
- Final problem definition
- Initial concept functionality, usability, visual communication
- An initial proposed business model that this concept should support
- A point of view on the social, ethical, and sustainability impact of the project on the project member(s), the community and/or the world.
- Scope and goals of the final semester development

Development plan deliverables include:

- The project goals for the final semester
- The process steps to achieve those goals
- The anticipated scope of effort and roles of participants
- Planned project deliverables
- Identification of the outside expertise that will be required to support the project
- A planned semester timeline including milestones (review dates), deadlines and estimated hours of effort

Final Project Presentation and Report Submission (end of 2nd project semester)

The last semester will focus on specific execution and refinement of the final project solution including user feedback and detail iteration. The semester will culminate in a public presentation of the final project. This presentation should include;

- A detailed description of the project
- Need finding, user, background area and marketing research
- Business plan/model
- In depth engineering and design explorations, alternative concepts and development
- A brief video about the project
- Data, preferably including video/audio of progressive user feedback during development
- A discussion of the ethical questions raised during and by the execution of this project
- Iterative and final functional prototypes
- Demonstrations are encouraged

9. SUBMATRICULATION

Outstanding undergraduate students at the University may apply to submatriculate into either of the IPD masters degree programs and take graduate-level courses as electives during their senior year. After fulfilling the requirements of both programs, the student will receive a BSE and a MSE or a BSE and a M:IPD degree. Undergraduates at the University of Pennsylvania may double-count up to three graduate level courses taken while enrolled as a submatriculant towards both the undergraduate and the graduate degree. If final project work is begun before the end of the senior year, the degree may be completed in three extra semesters of study. In order to complete both degrees in only five years, students can consider:

- Taking the background courses during the undergraduate program.
- Take two extra graduate-level courses (cannot be counted towards the BSE degree) during the undergraduate program.
- Take two of the four final project sequences (IPD 551 and IPD 552) in the 4th (senior undergraduate) year.

Students enrolled as a submatriculant can only count graduate courses taken at Penn towards the master's degree. No transfer credit, study abroad, or study away courses will be accepted.

Applications to the program must be completed by the February 1st deadline of the junior year. Submatriculation applications are available via the Penn Engineering website.

10. DUAL DEGREE PROGRAMS

Students may enroll in a dual degree program and receive an MIPD or MSE degree in Integrated Product Design and any of the other disciplines in the Engineering School such as Electrical and Systems Engineering, Bioengineering, Computer Science, Chemical and Biomolecular Engineering, and Materials Science Engineering. The dual degree program requires the completion of at least 16 courses (not including background courses) and satisfaction of the degree requirements of each department in which the student wishes to major. This program typically requires four semesters to complete. To enroll in this program, the student must complete an application form, list the course plan for both programs and obtain the approval from the Director/Graduate Group Chairman of each department. Applications for this program are available at www.seas.upenn.edu/prospective-students/graduate/admissions.php

A dual degree is also offered with the School of Design (Architecture) and the Wharton School. Students must satisfy independent admission requirements for the School of Engineering, The Wharton School of Business and the School of Design (Architecture). This means that the appropriate standardized tests, such as the GRE, GMAT or MCAT, a completed application form and fee, transcript, and recommendations, must be sent to each school independently. Dual degree students can double count up to three courses towards both programs. However, seven course units taken only for the IPD degree must be within Engineering.

Please contact the appropriate School for more information about specific application and degree requirements.

11. SUMMER STUDIES

There are several possibilities for scholarly activities by graduate students at the University during the summer, including:

- Independent study or Final Project (IPD 599) with an instructor willing to act as a supervisor during the summer.
- Course work outside SEAS, as well as a limited number of regular courses occasionally offered by some SEAS departments. The Director must approve summer school courses.

12. RECORDS

The official graduate student records are kept in 111 Towne Building; transcripts can be viewed on PennInTouch at https://medley.isc-seo.upenn.edu/penn_portal/intouch/splash.html. Graduate students are encouraged to periodically check the accuracy of their records and to bring any discrepancies to the attention of the Director.