
IPD

INTEGRATED PRODUCT DESIGN

UNIVERSITY OF PENNSYLVANIA

Guidelines for Graduate Study

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University of Pennsylvania
School of Engineering and Applied Science
Integrated Product Design, MEAM Department
229 Towne Bldg., 220 S. 33rd Street
Philadelphia, PA 19104-6315
www.me.upenn.edu/ipd
meam-ipd@seas.upenn.edu
Tel. 215-898-2826
Fax 215-573-6334

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****Theses 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 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: <http://www.seas.upenn.edu/graduate/handbook/index.php>

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 of your questions. Advice and answers to questions not covered in these sources may be obtained from the Director¹, Associate Director, or Graduate Program Coordinator², or through one of your advisors.

2. PROGRAM ADVISING

There are two areas of advising within the IPD program, master's program academic progress advising and Final Project specific 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 will be responsible for monitoring the student's academic plan and progress during the IPD Master's program. In addition, during the first or at latest second semester of Final Project work, each team or individual pursuing a Final Project will be responsible for selecting an additional three committee members, one primary, and two secondary to join the Director and Associate Director in overseeing the team or individual's Final Project. Normally, one advisor each will be chosen from the School of Engineering and Applied Science, the School of Design and from the Wharton School. In certain cases, though, one of the secondary advisors may come either from another area of Penn pertinent to the project pursued, or from outside the university. Choices of advisors must be approved by the Director. These five individuals will form the "Final Project advisory committee" on the particular individual or group project.

3. DEGREE REQUIREMENTS

To achieve a Master of Science in Engineering, Integrated Product Design, the MSE requirements consist of a total of ten courses, including three sequential credits of Final Project work, seven of which must be from within the School of Engineering and Applied Science. Since this program is cross-disciplinary, students who do not have the requisite background in the three areas, engineering, design arts, and marketing/finance, may need to enroll in additional background courses in these areas. Background

¹ Dr. Mark Yim, Room 229-A Towne Bldg. (215-898-5269; yim@grasp.cis.upenn.edu)

² Maryeileen B. Griffith, Room 229 Towne Bldg. (215-898-2826; banford@seas.upenn.edu)

courses must be taken for a grade and a grade of “B” or better must be achieved to satisfy the background requirement.

Background Courses (0-3 CUs or proficiency shown)

Engineering Basics:

MEAM 101- Introduction to CAD/CAM,
or comparable approved by the Director

Design Art Basics:

IPD 403 / ARCH 403- Design Fundamentals
or comparable approved by the Director

Marketing/Finance Basics:

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

Core Courses (2 CUs)

IPD 511-Creative Thinking & Functional Iteration in Design (1 CU)
IPD 515 (MEAM 515/OPIM 515)-Product Design (1 CU)

Breadth (1 CU in each in 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 (ARCH 746) - Advanced Mechatronic Reactive (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 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: TRANSWALL (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 - Engineerng Economics (1 CU)
MKTG 728 - Contagious: How Products, Ideas, and Behaviors Catch On (1 CU)
MKTG 756 - Marketing Research (1 CU)
MKTG 776 - Applied Probability Models in Marketing (1 CU)
MKTG 892 – Creativity (1 CU)
OPIM 651- Innovation,Prob Solv&Des (1 CU)
OPIM 662 - Enabling Technologies (1 CU)

OPIM 656 - Operations Strategy and Process Management (1 CU)
or comparable approved by the Director

Depth (1 CU) An additional course in one of the three breadth areas above, designating the field the student chosen to concentrate.

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.

IPD 509- Need Finding (1 CU)

IPD 549 (EAS 449)- Product Development in Entrepreneurial Ventures

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

IPD 799 **Final Project** (3 CUs)

* If a course is cross-listed students must register for the IPD section when available.

** Prior to the fall of 2008 ARCH 727 / MEAM 512 Design Arts Basics was a background course and could not be taken for credit in fulfillment of the degree requirements.

*** Any deviation from the above must be approved by the Director.

4. ATTENDANCE AT SEMINARS AND FINAL PROJECT PRESENTATIONS

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

- The seminar provides an opportunity to learn about the state-of-the-art companies, designs, technologies, ideas, etc.
- The seminar provides 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.
- The seminars are meaningful simply to learn what new and interesting things are going on in the world.
- The seminars 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

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, MSE 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 Final Project and independent studies IPD 599) is considered to be a normal full-time load for all students. Students in the IPD MSE program may take up to five courses in a semester if they are in excellent academic standing (with a G.P.A. of 3.5 or better). Approval from the program Director is necessary if the student wants to take more than four

courses in their first semester. Students must always consult with the 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 complete an advisor's sign-off form. This form may be found in Appendix A and should be submitted to the Director or Associate Director of the IPD program prior to registering for courses.

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 student who has reached dissertation tuition status will not be granted a leave of absence, except for military duty, medical reasons, or when a student receives a grant for dissertation research abroad and the grant does not include funds to pay home institution fees. A student not on dissertation status who desires a leave of absence must submit a request to the Director and to the Graduate Division Office.

Obsolescence:

The maximum time allowed for the completion of all MSE 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.

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.*

MSE 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.

6. INDEPENDENT STUDY

Independent study courses (IPD 599) are important vehicles to accommodate special interests of the students which are not served through the regular courses. They create opportunities for miniprojects 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

MSE students may obtain credit for up to two courses taken at another institution. 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 graduate program in the Department of Mechanical Engineering and Applied Mechanics. 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 (<http://www.seas.upenn.edu/forms/documents/gtransfer-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 three 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 document is intended to help set the expectations of work on the part of the advisors and students.

Team projects

Interdisciplinary group work is encouraged, but not mandatory. Ideal 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 so should have recognized expertise in those three areas. The student and project advisor should communicate regularly (typically once a week) 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.

Timeline:

The final project follows a three semester course where the 1st semester focuses on developing design sensibilities and methodologies without direct development of the final project. The 2nd and 3rd project semesters are structured with deliverables as follows:

- Preliminary project proposal (due before second week of 2nd project semester)
- Final Project Description (due at mid-semester crits of 2nd project semester)
- Project Concept Presentation (End of second project semester)
- Final Project Presentation and Report Submission (end of 3rd project semester)

Preliminary Project Proposal (due before second week of 2nd project semester)

The preliminary 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 first week of the 2nd 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 writeup:

Title of project

Student info (name, email address)

Potential advisors (name, affiliation, email address)

Proposal text.
Proposal images.
Supporting data.

Final Project Description (due at mid-semester crits of 2nd project semester)

Within the first seven weeks of the 2nd semester, the student or student team will have found their advisors. During this semester the students in consultation with their advisors and IPD staff will work on their final project description.

During this semester it is expected that the research towards fulfilling needs, initial market research, criteria identification and analysis, and preliminary models/ prototypes of the final project will inform the creation of the final project description which will likely have many elements that carry over to the final project presentation.

Besides a narrative of the project, the final project description should at a minimum include a description of the projected impact of the product, who will be affected, plan for the final semester, business plan (or market analysis), project budget and plan, and elements of the project broken down into the three components: engineering, business, and design arts.

Project Concept Presentation (End of 2nd 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;

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

Final Semester Development Plan

By the end of the third week of the 3rd semester, each student or project team will create and submit for review, a 3rd semester project plan describing:

- The semester's project goals
- 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 gates), deadlines and estimated hours of effort

Final Project Presentation and Report Submission (end of 3rd 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

- 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 submatriculate in the MSE degree program and take graduate-level courses as electives during their senior year. After fulfilling the requirements of both programs, the student will receive a B.S.E. and a MSE 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 MSE degree may be completed in two 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 B.S.E. degree) during the undergraduate program.

Applications to the program must be completed by the March 1 deadline and before the end 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 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 17 courses (not including background courses) and satisfaction of the MSE 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 in the Academic Programs Office in 111 Towne Building.

A dual degree is also offered with the School of Design (Architecture). Please contact the School of Design about the requirements for this dual degree.

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 or IPD 799) 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 Penn InTouch at <https://sentry.isc.upenn.edu/intouch>. Graduate students are encouraged to periodically check the accuracy of their records and to bring any discrepancies to the attention of the Director.

APPENDIX A

Program Advisor Sign-Off Form
INTEGRATED PRODUCT DESIGN
Mechanical Engineering and Applied Mechanics
School of Engineering and applied Science
University of Pennsylvania

To the Student: This form **must** be filled out by ALL IPD graduate students in order to register for courses for next semester. Please complete and return this signed form to the MEAM main office.

Today's Date: _____ For the Term: _____

Student Name: _____

Email address: _____ / Tel Num: _____

Academic Advisor: _____

Final Project Committee Members

Primary Secondary Secondary

Comments (Background Course Requirements)

Business Design Arts Engineering

PROGRAM ADVISOR SIGN-OFF:

____ I have met with the above student; please clear this student to register for next semester.

Student's Signature Date

Director or Associate Director's Signature Date