INT 集成产品设计（IPD）

IPD 500 产品工程学基础
该课程面向对理解产品开发方法不感兴趣的专业学生。课程内容包括机械、电气、计算机和材料科学。许多这些话题通常会成为专业课程。课程的目的是引导学生熟悉自己所学的领域。

Prerequisites: MEAM 101, MEAM 150, and MEAM 210, or graduate standing in the School of Engineering, Design, or Wharton with similar experience
Course usually offered in spring term
Activity: Lecture
1 Course Unit

IPD 501 计算机辅助设计、制造和分析
该课程探索了现代分析和模拟工具的深入探讨，以及计算机辅助设计项目。通常用于设计和过程时间。通过一个结合了讲座、实践活动和一个为期一学期的实践活动，课程旨在探索如何将设计和过程带入更广阔的领域。

Prerequisites: MEAM 101, MEAM 150, and MEAM 210, or graduate standing in the School of Engineering, Design, or Wharton with similar experience
Course usually offered in spring term
Activity: Lecture
1 Course Unit

IPD 503 IPD Fundamentals
Activity: Studio
1 Course Unit

IPD 504 康复工程和设计
学生将学习面对残疾人员和医疗康复专家时面临的问题，以及如何通过设计来解决和改进这些问题。课程结合讲座、设计项目和练习，以及临床实习。学生将与学校和患者有实质性互动。课程一学年提供。

Prerequisites: Graduate students or permission of the instructor
Activity: Lecture
1 Course Unit

IPD 509 需求发现
需求发现是将人和他们的需求放在产品开发和商业策略创建中心的方法。90%的新产品在市场失败。这些失败的原因在于对消费者需求的不了解。开发真正成功的新产品，不仅要问人们需要什么，设计师和工程师需要使用工具和技术来超越人们能够明确表达的需求，以了解人们的需求。需求发现是为了解决需要工具和方法来导出设计。在这门课程中，学生们将学习如何进行研究和分析，如何进行设计和过程，并将他们的发现应用于产品设计或设计思维。

Course usually offered in spring term
Activity: Lecture
1 Course Unit

IPD 511 创意思维与设计
这是一门创造性与迭代问题求解课程。课程内容包括一系列机械设计挑战项目，以将学生带入一个无法预测的时间限制问题求解领域。它探索了一种问题定义、探索和解决“工具”，以及围绕“设计思维”话题，如伦理和设计的经验。绘画和原型化在项目中应用。课程通常在秋季学期提供。

Course usually offered in fall term
Activity: Lecture
1 Course Unit

IPD 514 设计可制造性
此课程旨在为当前和未来产品设计/开发工程师、制造工程师和产品开发经理提供理解和设计可制造性的概念和方法。课程内容包括来自多个领域的材料，包括：工程设计、制造、市场营销、金融、项目管理以及质量系统。

Course usually offered in spring term
Prerequisites: MEAM 101 or equivalent, MEAM 210 or equivalent, Senior or Graduate standing in the School of Design, Engineering, or Business with completed product development and/or design engineering core coursework or related experience
Activity: Lecture
1 Course Unit
Integrated Product Design (IPD)

IPD 515 Product Design.
This course provides tools and methods for creating new products. The course is intended for students with a strong career interest in new product development, entrepreneurship, and/or technology development. The course follows an overall product design methodology, including the identification of customer needs, generation of product concepts, prototyping, and design-for-manufacturing. Weekly student assignments are focused on the design of a new product and culminate in the creation of a prototype, which is launched at an end-of-semester public Design Fair. The course project is a physical good - but most of the tools and methods apply to services and software products.
One-term course offered either term
Activity: Lecture
1 Course Unit

IPD 516 Advanced Mechatronic Reactive Systems
This course combines performance art and advanced mechatronics concepts that include the design and implementation of large-scale actuation, advanced sensing, actuation and control. This course pairs design school and engineering students to form interdisciplinary teams that together design and build electro-mechanical reactive spaces and scenic/architectural elements in the context of the performing arts. The two disciplinary groups will be treated separately and receive credit for different courses (ARCH746 will be taught concurrently and in some cases co-located) as they will be learning different things. Engineering students gain design sensibilities and advanced mechatronics in the form of networked embedded processing and protocols for large scale actuation and sensing. Design students learn elementary mechatronics and design reactive architectures and work with engineering students to build them. The class will culminate in a some artistic performance (typically with professional artists) such as a Shakespeare play, robotic ballet, a mechatronic opera.
Course usually offered in spring term
Prerequisite: MEAM 510 (Mechatronics) or equivalent
Activity: Lecture
1 Course Unit

IPD 519 Real Time Embedded Systems
One-term course offered either term
Also Offered As: ESE 519
Activity: Lecture
1 Course Unit

IPD 520 Designing Smart Objects
One-term course offered either term
Activity: Seminar
1 Course Unit

IPD 521 Design of Contemporary Products
One-term course offered either term
Activity: Seminar
1 Course Unit

IPD 522 Ergonomics/Human Factors Based Product Design
Human Factors and Ergonomics knowledge is a critical component of a product designer or design engineer's toolbox. This course teaches the direct application of existing human factors/ergonomic data to the creation of new product designs. Applying human factors knowledge to problem solving for product design happens throughout the design process. It is a useful input as initial ideas begin to ut and as a way to verify completed concepts through directly documented user testing and design iteration. The course would be a mini-lecture/studio style course in which the students will work in class on assigned projects, finding, analyzing, extrapolating and applying data to design solutions and creating mockups, modeland prototypes for user testing of their designs.
One-term course offered either term
Activity: Lecture
1 Course Unit

IPD 522 Contemporary Furniture Design
Course usually offered in spring term
Activity: Seminar
1 Course Unit

IPD 527 Industrial Design I.
This course provides an introduction to the ideas and techniques of Industrial Design, which operates between Engineering and Marketing as the design component of Integrated Product Development. The course is intended for students from engineering, design, or business with an interest in multi-disciplinary, needs-based product design methods. It will follow a workshop model, combining weekly lectures on design manufacturing, with a progressive set of design exercises.
Course usually offered in fall term
Activity: Lecture
1 Course Unit

IPD 528 Design of Contemporary Products
This course was designed to explore intersections of functionality and performance using an experimental platform to uncover opportunities within the built environment to create domestic products. Provides practical insights into the material manipulation and aesthetic experimentation that are essential for the design and fabrication of products. Lectures and case studies help students to learn from examples and develop their own designs. Through a series of exercises, students design and fabricate a prototype using actual materials. The course addresses problems unique to product design, such as scale, weight, cost and production.
Course usually offered in spring term
Activity: Lecture
1 Course Unit

IPD 529 Designing Connected Objects and Experiences
The objective of this course is to introduce students to a more conceptual, creative, and meaningful approach to creating interactive functional objects utilizing analog, digital, and electronic skillsets acquired through the core engineering curriculum. This course will cover basics of design as an art form, wearables design, electronic sensors, and creating connected devices. Students will be challenged to create 3 pieces of work both individually and in teams culminating in a gallery show of the students' work.
Activity: Lecture
1 Course Unit

IPD 530 Building Product Workshop: Transwall
As Craig Vogel notes in The Design of Things to Come, "we are in a new economic age that is in need of a new renaissance in product development, on that leverages multiple minds working in concert." With this mindset, this interdisciplinary workshop guides students through the product design process from design brief to concept generation in one semester, working firsthand with Transwall, a leading manufacturer of demountable wall systems, to focus on a specific product need. The design opportunity looks for the next generation of pre-manufactured wall systems; getting away from field constructed walls and looking at critical issues of mass-produced wall systems; flexibility, mobility, structural stability, acoustics, transparency/opacity, and operability. During the workshop, students will explore the challenge that creates the unique need for a new product and have an opportunity to conceptualize their design ideas through sketches, scale model studies and partial prototypes.
One-term course offered either term
Activity: Lecture
1 Course Unit
IPD 544 Digital Fabrication
A seminar and design workshop that explores associative and parametric CAD-CAM strategies, to enable an interactive continuity between conception and fabrication. Through parametric 3D constructions, students will explore how to link different aspects of the architectural projects, such as: (1) design intention; (2) control of variation and adaptation; (3) construction constraints; (4) digital fabrication processes. The course emphasizes the cross-fertilization of formal, technical and performative aspects of the design activity. Course usually offered in spring term
Activity: Seminar
1 Course Unit

IPD 545 Eng Entrepreneurship I
One-term course offered either term
Also Offered As: EAS 545
Activity: Lecture
1 Course Unit

IPD 549 Product Development in Entrepreneurial Ventures
A product is any artifact, service or experience for which a buyer is willing to pay. Product Design and Development is at the core of entrepreneurship. Though in the modern mythology it is a solitary effort by a passionate individual, entrepreneurship is frequently more successful when pursued in an interdisciplinary environment. Though it rarely requires the greatest time investment, concentration of personnel, the majority of the funding or even the greatest depth of expertise to accomplish, excellent product design can be the difference between a successful or failed venture. A poorly designed “product” can prevent a venture from being successful. An excellently designed product can make a competent business plan much more successful. A well defined and designed product solution will create differentiation, and cannot only meet customer expectation, but can create desirability. Through the review and discussion of case studies, lecture subjects, guest lecturers, field trips, and a semester long interdisciplinary team project, this class will provide insight into the problem identification and product design processes, user needs research, intellectual property research, experience design, Industrial Design, Interface Design, brand development and product centric fundraising processes. Course usually offered in spring term
Also Offered As: EAS 449
Prerequisites: Seniors and Graduate students from the School of Design, Engineering or Business that have an interest in product design and/or integrated product development in an entrepreneurial environment.
Activity: Lecture
1 Course Unit

IPD 551 Design Processes
This studio is structured for IPD students as an intensive, interdisciplinary exploration of Design as purposeful for Integrated Product Design. The goal of the studio is to give students a firsthand experience of various processes involved in creating successful integrated product designs. This first semester of the four-semester studio sequence focuses on giving students experience developing designs based on a range of starting points: form, function, materiality and manufacturing process. Students will practice design through rigorous, consistent processes for thinking through the evolution of their ideas. In this course, they will go through an entire design process from conceptualization to design to producing prototypes. They will be taught to focus on the specifics of their designs, causing them to be conscious of what drives their choices as designers and providing them with a wider range of tools to design from in successive projects. Course work will involve readings, assignments, class participation, in-class exercises, a mid-term presentation and a final submission.
One-term course offered either term
Activity: Lecture
1 Course Unit

IPD 552 Problem Framing
In the second semester of the four-semester studio sequence, we ask students to take a step back from what and how they are designing and ask the question of why they are designing it. We will teach them a rigorous process for understanding stakeholder needs and for translating those needs into implications for product design. They will begin to develop greater awareness of the personal, social, competitive and technological contexts that their products fit into, and to learn how to design for those contexts. They will develop the ability to dive into a topic and frame a design problem, and to understand the implications of how they frame the problem on what they design. Ideally, they will use this process to identify a problem or opportunity to work on for their final project. Course work will involve readings, assignments, class participation, in-class exercises, and a final submission. Course usually offered in spring term
Activity: Lecture
1 Course Unit

IPD 561 IPD Theories/Methods I
Activity: Seminar
0.5 Course Units

IPD 562 IPD Theories/Methods II
Course usually offered in spring term
Activity: Seminar
0.5 Course Units

IPD 568 Integration Design Studio: Biological Design
This course is a research-based design studio that introduces new materials, fabrication, and prototyping techniques to develop a series of design proposals in response to the theme: Biological Design. The studio introduces life sciences and biotechnologies to designers, artists, and non-specialists to develop creative and critical propositions that address the social, cultural, and environmental needs of the 21st century. The course will be a pilot study of the first biodesign challenge organized by CUT/PASTE/GROW. The final projects will be submitted to a competition and the winning entry will be featured at Biofabricate in Summer 2017.
One-term course offered either term
Activity: Studio
1 Course Unit
Integrated Product Design (IPD)

IPD 572 Design Thinking and Making
Creating new product concepts was once a specialized pursuit exclusively performed by design professionals in isolation from the rest of an organization. Today's products are developed in a holistic process involving a collaboration among many disciplines. Design thinking - incorporating processes, approaches, and working methods from traditional designers' toolkits - has become a way of generating innovative ideas to challenging problems and refining those ideas. Rapid prototyping techniques, affordable and accessible prototyping platforms, and an iterative mindset have enabled people to more reliably translate those ideas into implementable solutions. In this course, students will be exposed to these techniques and learn how to engage in a human-centered design process.
One-term course offered either term
Activity: Seminar
1 Course Unit

IPD 599 Master's Independent Study
One-term course offered either term
Activity: Independent Study
1 Course Unit

IPD 699 IPD Seminar.
One-term course offered either term
Activity: Seminar
1 Course Unit

IPD 799 Studio Project Thesis.
One-term course offered either term
Activity: Lecture
1 Course Unit