

ARCHITECTURE

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UNDERGRADUATE COURSES

Freshman Seminar

SM 111. Architecture in the Anthropocene. (A) Barber.

This course will use architecture and the built environment as a lens to investigate the emerging field of the environmental humanities. Our goal will be to analyze and understand these new intellectual frameworks in order to consider the relationship between global environmental challenges and the process of constructing the built environment. As such, we will oscillate between social and political theory, environmental history, and architectural history and theory. Issues of importance will include: theories of risk, the role of nature in political conflicts; images, design and environmental communication; and the relationship between speculative design and other narratives of the future. These conceptual frameworks will be read alongside examples of related creative projects in art, literature, and architecture, and will be amplified through presentations and discussions with studio faculty and other visitors to the course.

SM 112. Villa Gardens and Villa Life. (B) Giannetto.

This seminar will study the idea of villeggiature (villa life) and the ideology associated with countryside gardens and plantations. In an examination of the circularity of villa ideology across the centuries, other themes will emerge that address the relationship between urban and rural life, between architecture and natural environment and between social, cultural, economic, and political forces and landscape design. These themes will be explored through the study of selected villas and through the reading of sources drawn from villa literature, including architectural and agricultural treatises, epistolary exchanges, and drawings.

Design Studios

L/R 102. Introduction to Design. (B) Faculty.

An exploration of the design process utilizing drawing and model-making techniques. Skills of representation and fabrication are introduced in the context of the development of each student's capacity to observe, interpret, and translate design concepts into physical form. The course includes a weekly lecture and a biweekly studio component.

201. Design Fundamentals I. (A) Faculty. Prerequisite(s): ARCH 102.

This studio course develops drawing and model-making skills with emphasis on digital representation and digital fabrication. The capacity of nature-inspired design is explored as a foundation for the creative production of new forms of expression.

202. Design Fundamentals II. (B) Faculty. Prerequisite(s): ARCH 201.

A studio course exploring the relationship between two-dimensional images and three-dimensional digital and physical models. This studio course develops advanced techniques in digital representation and fabrication through an investigation of the theme of inhabitation in architecture.

ARCHITECTURE

(FA) {ARCH}

301. Design I. (A) Faculty.Prerequisite(s): ARCH 202.

An introduction to the design of architecture in the city. Students explore the relationships between two- dimensional patterns and their corresponding three-dimensional interpretations through the orthographic drawings of plan, section, and elevation and three-dimensional digital and physical models.

302. Design II. (B) Faculty.Prerequisite(s): ARCH 301. Corequisite(s): ARCH 312.

An introduction to the design of architecture in the landscape. Issues of mapping, placement, scale, and construction are explored through studio design projects, site visits, and discussions. Course work focuses on the preparation and presentation of design projects emphasizing analytical skills along with the development of imaginative invention and judgment.

401. Advanced Design. (A) Faculty.Prerequisite(s): ARCH 302. Corequisite(s): ARCH 411.

Content and technique are explored in this studio course through the vehicle of a design project focused on the development of a critical understanding of geometries and mathematics in the representation and fabrication of contemporary architecture.

Theory Courses

L/R 312. Topics in Theory I. (B) Faculty. Corequisite(s): ARCH 302.

This course examines the development of modern architecture in the early-twentieth century. Case studies and selected texts are used to explore how modern architecture responded to the challenges of the Industrial Revolution and social modernization.

L/R 411. Topics in Theory II. (A) Faculty.Prerequisite(s): ARCH 312. Corequisite(s): ARCH 401.

This course examines the development of geometries in modern architecture. Primary and secondary texts are used to explore the origin and evolution of geometrical thinking in architecture.

Technology Courses

431. (ARCH531) Construction I. (A) Faculty.

Course explores basic principles and concepts of architectural technology and describes the interrelated nature of structure, construction and environmental systems. Open to Intensive Majors only.

432. (ARCH532) Construction II. (B) Faculty.Prerequisite(s): ARCH 431.

A continuation of Construction I, focusing on light and heavy steel frame construction, concrete construction, light and heavyweight cladding systems and systems building. Open to Intensive Majors only.

433. (ARCH533) Environmental Systems I. (A) Faculty.

An introduction to the influence of thermal and luminous phenomenon in the history and practice of architecture. Issues of climate, health and environmental sustainability are explored as they relate to architecture in its natural context. The classes include lectures, site visits and field exploration. Open to Intensive Majors only.

ARCHITECTURE

(FA) {ARCH}

434. (ARCH534) Environmental Systems II. (B) Faculty. Prerequisite(s): ARCH 433.

This course examines the environmental technologies of larger buildings, including heating, ventilating, air conditioning, lighting, and acoustics. Modern buildings are characterized by the use of such complex systems that not only have their own characteristics, but interact dynamically with one another and with the building skin and occupants. Questions about building size, shape, and construction become much more complex with the introduction of sophisticated feedback and control systems that radically alter their environmental behavior and resource consumption. Class meetings are divided between slide lectures, demonstrations, and site visits. Course work includes in-class exercises, homework assignments, and a comprehensive environmental assessment of a room in a building on campus. Open to Intensive Majors only.

435. (ARCH535) Structures I. (A) Faculty.

Theory applied toward structural form. A review of one-dimensional structural elements; a study of arches, slabs and plates, curved surface structures, lateral and dynamic loads; survey of current and future structural technology. The course comprises both lectures and a weekly laboratory in which various structural elements, systems, materials and technical principles are explored. Open to Intensive Majors only.

436. (ARCH536) Structures II. (B) Faculty. Prerequisite(s): ARCH 435.

A continuation of the equilibrium analysis of structures covered in Structures I. The study of static and hyperstatic systems and design of their elements. Flexural theory, elastic and plastic. Design for combined stresses; prestressing. The study of graphic statics and the design of trusses. The course comprises both lectures and a weekly laboratory in which various structural elements, systems, materials and technical principles are explored. Open to Intensive Design majors only.

Other Courses

303. (IPD 503) Integrated Product Design Fundamentals. (L) Wesley.

The creation of a successful product requires the integration of design, engineering, and marketing. The purpose of this intensive studio course is to introduce basic concepts in the design of three-dimensional products. For purposes of the course, design is understood as a creative act of synthesis expressed through various modes of 2-dimensional and 3-dimensional representation. The course develops basic design skills ranging from hand sketching to the use of digital modeling software and rapid prototyping. Fulfills the requirement for a design background course in the interdisciplinary graduate program in Integrated Product Design (IPD).

SM 311. (ITAL311) Venice: Self-Representation, Performance, and Reception. Finotti and Fabiani Giannetto.

This course focuses on the city of Venice and its elusive identity as represented in written, visual and built form. Structured as a series of topics and case studies (including primary visual and written sources; buildings and gardens) the course aims to introduce students to the material and cultural landscape of Venice and develop their ability to "read" the urban fabric and its unique physical context by identifying its various features and explaining the political, social, economic and cultural agendas that brought them into existence. The course includes visits to Venice, Van Pelt Library Library and the Philadelphia Museum of Art.

490. Independent Study. (C) Faculty. Permission of the Undergraduate Chair.

492. Senior Thesis. (B) Faculty. Prerequisite(s): ARCH 301. Permission of the Undergraduate Chair

ARCHITECTURE

(FA) {ARCH}

498. Senior Honors Thesis. (B) Faculty. Prerequisite(s): ARCH 401. Permission of the Undergraduate Chair

GRADUATE COURSES

Summer Institutes

793. ARCH Summer Institute: History of Architecture. (L) Faculty.

This is a non-credit course for entering Master of Architecture students. The course will cover western architecture from ancient Egypt to the modern age and will satisfy the history pre-requisite condition for matriculation in the fall. Course fee: \$750.00. Course enrollment is by permit only. Please contact Sarah Lam (ARCH Dept.) at sarahlam@design.upenn.edu.

500. Summer Preparatory Design Studio. (L) Mitnick.

The Summer Preparatory Studio offers an intensive drawing and design experience to candidates for admission to the Graduate Program in Architecture who have not completed the necessary design studio prerequisites or who are required to have additional design experience to qualify for matriculation into the Master of Architecture Professional Degree Program in September. Enrollment in this program does not count towards the Master of Architecture degree. The intent of the drawing component of the course is to familiarize the student with primarily black and white mediums (pencil, charcoal, ink, etc). Exercises are designed to sharpen the student's ability to see selectively and to transform image to paper through both line and tonal renditions in freehand sketch form. Exercises will also familiarize the student with basic drafting skills necessary for architectural communication and provide an introduction to computer-aided design through applications of the intensive Rhino and Illustrator tutorials given in the Digital Navigation course. The design part of the course presents a rhythm of basic three-dimensional design studies and simple architectural studio investigations.

These are intended to build fundamental skills and acquaint the student with the architectural issues of form/space, conceptualization, transformation of scale, simple functional and constructional problems and a sensitivity to context. Course enrollment is by permit only. Please contact Sarah Lam (ARCH Dept.) at sarahlam@design.upenn.edu.

791. ARCH Summer Institute: Digiblast I: Fundamentals of 3D Modeling. (L) Blasetti and Willems.

This is a non-credit course for entering Master of Architecture students. The course will cover digital modeling and workflow and will prepare students for techniques used in PennDesign's 500 and 600 level design studios. Course fee: \$550.00. Note: course fees applies only to students who are NOT enrolled in ARCH-500, in addition to ARCH-791. Course enrollment is by permit only. Please contact Sarah Lam (ARCH Dept.) at sarahlam@design.upenn.edu.

792. ARCH Summer Institute: Digiblast II: 3d Modeling and Fabrication. (L) Blasetti and Willems.

This is a non-credit course for entering Master of Architecture students. The course will cover digital modeling and workflow. The course will prepare students for techniques used in PennDesign's 500 and 600 level design studios. Course fee: \$550.00. Course enrollment is by permit only. Please contact Sarah Lam (ARCH Dept.) at sarahlam@design.upenn.edu.

794. ARCH Summer Institute: Physics for Architects. (L) Farley.

This is a non-credit course for entering Master of Architecture students. The course will cover the following: mechanics, heat, light, sound and electricity. The course will satisfy the physics pre-requisite condition for matriculation in the fall. Course fee: \$750.00 Course enrollment is by permit only. Please contact Sarah Lam (ARCH Dept.) at sarahlam@design.upenn.edu.

ARCHITECTURE

(FA) {ARCH}

795. ARCH Summer Institute: Advanced Architectural Design Digital Workshop. (L) Blasetti and Willems.

This is a non-credit course for entering Master of Science in Design: Advanced Architectural Design students. The Digital Methods workshop provides a comprehensive introduction to four elements critical to the workflow of the graduate studios at PennDesign: 3D modeling, scripting, visualization and fabrication. Short daily lectures situating digital technologies in contemporary design practice are followed by hands-on tutorials in Maya and Rhinoceros. The first half of the workshop provides an operative knowledge of the many geometry types, modeling techniques, scripting languages and simulation tools available for studio work. Visualization techniques are also introduced, and students will learn to efficiently produce presentation-quality renderings, animations and technical line drawings from digital models. Students also learn protocols transferring data between various design software packages and how to for create data compatible with PennDesign's digital fabrication equipment. Course fee: \$400.00 Course enrollment is by permit only. Please contact Sarah Lam (ARCH Dept.) at sarahlam@design.upenn.edu.

Design Studios

501. Design Studio I. (A) Saunders and Faculty. Corequisite(s): ARCH 521.

An introductory architectural design studio through which students develop critical, analytical and speculative design abilities in architecture. Students develop representational techniques for the analysis of social and cultural constructs, and formulate propositions for situating built form in the arena of the urban and suburban environment. The studio initiates innovation through a sequence of projects, spatial models and rule sets that introduce each student to rule-based design processes-- in which a reversal of expectations leads to the creation of novel spaces and structures. It introduces computation, geometric techniques, and digital fabrication. Projects explore the formation of space in relation to the body, and the developments of small scale public programs.

502. Design Studio II. (B) Fierro and Faculty. Corequisite(s): ARCH 522.

This studio explores urban architecture as an embodiment of cultural values. Siting, enclosure of space and tectonic definition are stressed in order to challenge students to project relevant and inventive architectural situations.

702. Design Studio VI. (B) Rahim and Faculty.

In the final semester of the program, students select from three options: ARCH 702, an advanced design studio, ARCH 704, a research studio, the exploration of a topic or theme established by an individual faculty member or group of faculty members; or ARCH 706, an independent design thesis, the exploration of a topic or theme under the supervision of a thesis advisor.

ARCHITECTURE

(FA) {ARCH}

601. Design Studio III. (A) Jamelle and Faculty. Corequisite(s): ARCH 621.

In this studio, students engage architecture in its role as a cultural agent and examine the way buildings establish and organize dynamic relationships between site, program and material. The design of a complex building of approximately 50,000 SF provides the pedagogical focus for this research. Students extend skills in geometrical organization, site analysis and building massing/orientation to relate to program organization, circulation and egress, building systems and materials. The conceptual focus centered on the program of dwelling and how this program can be employed to develop and promote dynamic relationships and conditions through time, both within the building and between the building and the context. Through research and experimentation students integrate ecological processes into their design methodology to support design innovations in the building's structure, its construction assemblies, environmental systems, and materials. Students work towards a high level of design resolution and visual representation, including the articulation of the building structure and its material assembly/enclosure.

602. Design Studio IV. (B) Kolatan and Faculty.

This studio enables students to develop and resolve the design of a building in terms of program, organization, construction and the integration of structures, enclosure and environmental systems as well as life safety issues. Students select from a range of individually-directed studios within this overall framework. Each instructor develops a different approach and project for their section of this studio. Studios incorporate the expertise of external consultants in advanced areas of technology, engineering and manufacturing.

701. Design Studio V. (C) Rahim and Faculty.

A set of Advanced Architectural Design studios are offered from which students select through a lottery. Topics and sites vary by instructor.

704. Advanced Design:Research Studio. (B) Faculty.

In the final semester of the program, students select from three options: 1) An elective design studio, selected from among the advanced architectural design studios offered by the Department of Architecture; 2) a research studio, the exploration of a topic or theme established by an individual faculty member or group of faculty members; or 3) an independent thesis, the exploration of a topic or theme under the supervision of a thesis advisor.

Master of Architecture - Core

L/R 511. History and Theory I. (A) Faculty.

The first of three required courses in the history and theory of architecture, this is a lecture course with discussion groups that meet weekly with teaching assistants. The course explores fundamental ideas and models of architecture that have emerged over the past three hundred years.

L/R 512. History and Theory II. (B) Barber.

This course traces the emergence of contemporary issues in the field by exploring the architecture of the twentieth century. Buildings, projects, and texts are situated within the historical constellations of ideas, values, and technologies that inform them through a series of close readings. Rather than presenting a parade of movements or individuals, the class introduces topics as overlaying strata, with each new issue adding greater complexity even as previous layers retain their significance. Of particular interest for the course is the relationship between architecture and the organizational regimes of modernity.

ARCHITECTURE

(FA) {ARCH}

521. Visual Studies I. (A) Willems. Corequisite(s): Arch 501.

The study of analysis and projection through drawing and computer visualization

522. Visual Studies II. (B) Willems. Corequisite(s): ARCH 502.

A continuation of the study of analysis and projection through drawing and computer visualization.

531. (ARCH431) Construction I. (A) Trubiano.

Lecture course exploring the basic principles of architectural technology and building construction. The course is focused on building material, methods of on-site and off-site preparation, material assemblies, and the performance of materials. Topics discussed include load bearing masonry structures of small to medium size (typical row house construction), heavy and light wood frame construction, sustainable construction practices, emerging + engineered materials, and integrated building practices. The course also introduces students to Building Information Modeling (BIM) via the production of construction documents.

532. (ARCH432) Construction II. (B) Ryan.

A continuation of Construction I, focusing on light and heavy steel frame construction, concrete construction, light and heavyweight cladding systems and systems building.

533. (ARCH433) Environmental Systems I. (A) Diemer.

An introduction to the influence of thermal and luminous phenomenon in the history and practice of architecture. Issues of climate, health and environmental sustainability are explored as they relate to architecture in its natural context. The classes include lectures, site visits and field exploration.

L/R 611. History and Theory III. (A) Barber.

This is the third and final required course in the history and theory of architecture. It is a lecture course that examines selected topics, figures, projects, and theories from the history of architecture and related design fields during the 20th century. The course also draws on related and parallel historical material from other disciplines and arts, placing architecture into a broader socio-cultural-political-technological context. Seminars with teaching assistants complement the lectures.

534. (ARCH434) Environmental Systems II. (B) Braham.

This course examines the environmental technologies of larger buildings, including heating, ventilating, air conditioning, lighting, and acoustics. Modern buildings are characterized by the use of such complex systems that not only have their own characteristics, but interact dynamically with one another and with the building skin and occupants. Questions about building size, shape, and construction become much more complex with the introduction of sophisticated feedback and control systems that radically alter their environmental behavior and resource consumption. Class meetings are divided between slide lectures, demonstrations, and site visits. Course work includes in-class exercises, homework assignments, and a comprehensive environmental assessment of a room in a building on campus.

535. (ARCH435) Structures I. (A) Farley. Corequisite(s): Arch 535.

Theory applied toward structural form. A review of one-dimensional structural elements; a study of arches, slabs and plates, curved surface structures, lateral and dynamic loads; survey of current and future structural technology. The course comprises both lectures and a weekly laboratory in which various structural elements, systems, materials and technical principles are explored.

ARCHITECTURE

(FA) {ARCH}

536. (ARCH436) Structures II. (B) Farley. Corequisite(s): Arch 536.

A continuation of the equilibrium analysis of structures covered in Structures I. The study of static and hyperstatic systems and design of their elements. Flexural theory, elastic and plastic. Design for combined stresses; prestressing. The study of graphic statics and the design of trusses. The course comprises both lectures and a weekly laboratory in which various structural elements, systems, materials and technical principles are explored.

621. Visual Studies III. (A) Hume. Corequisite(s): Arch 601.

The final of the Visual Studies half-credit courses. Drawings are explored as visual repositories of data from which information can be gleaned, geometries tested, designs refined and transmitted. Salient strengths of various digital media programs are identified and developed through assignments that address the specific intentions and challenges of the design studio project.

631. Technology Case Studies I. (A) Ryan.

A study of the active integration of various building systems in exemplary architectural projects. To deepen students' understanding of the process of building, the course compares the process of design and construction in buildings of similar type. The course brings forward the nature of the relationship between architectural design and engineering systems, and highlights the crucial communication skills required by both the architect and the engineer.

SM 632. Technology Designated Elective. (B) Faculty.

Several sections are offered from which students make a selection. This year's selections include: Deployable Structures, Performance and Design, Detailed Design Studies, Daylighting, Principles of Digi/Fab, Matter and Energy, Material and Structural Intelligence.

SM 638. Technology Special Topics. (B) Faculty.

Several sections are offered from which students make a selection such as: Building Acoustics; Building Envelopes; Building Systems; Lighting and Component Design.

671. Professional Practice I. (A) Ryan.

The course consists of a series of workshops that introduce students to a diverse range of practices. The course goal is to gain an understanding of the profession by using the project process as a framework. The course comprises a survey of the architectural profession - its licensing and legal requirements; its evolving types of practice, fees and compensation; its adherence to the constraints of codes and regulatory agencies, client desires and budgets; and its place among competing and allied professions and financial interests. The workshops are a critical forum for discussion to understand the forces which at times both impede and encourage innovation and leadership. Students learn how architects develop the skills necessary to effectively communicate to clients, colleagues, and user groups. Trends such as globalization, ethics, entrepreneurship, sustainability issues and technology shifts are analyzed in their capacity to affect the practice of an architect.

ARCHITECTURE

(FA) {ARCH}

672. Professional Practice II. (B) Capaldi.

A continuation of ARCH 671. Further study of the organizational structures of architectural practices today, especially those beyond the architect's office. The course is designed as a series of lectures, workshops and discussions that allows students and future practitioners the opportunity to consider and develop the analytical skills required to create buildings in the world of practice.

Master of Environmental Building Design - Core

708. Environmental Design Studio. (L) Faculty. Prerequisite(s): ARCH-751, ARCH-752, ARCH-753, and ARCH-754.

An advanced design studio for the MEBD program that synthesizes the concepts and techniques of environmental building design. Topics and materials for the studio are developed in Arch 752: MEBD Research Seminar, and summarized in a research report at the end of studio.

SM 754. Performance Design Workshop. (B) Yi.

The workshop applies simulation and diagramming techniques to a series of discrete design projects at different scales. The emphasis is on refinement and optimization of performance based building design. Performance analysis techniques can provide enormous amounts of information to support the design process, acting as feedback mechanisms for improved performance, but careful interpretation and implementation are required to achieve better buildings.

Energy, lighting, and air flow are the three main domains covered in the workshop. Students will learn how to utilize domain tools at an advanced level, and utilize them as applications to examine the environmental performance of existing buildings. Using the results of analytical techniques, the students will develop high-performance design strategies in all three domains.

Lectures will be given on specific topics each week. A series of analytical class exercises will be assigned to provide students with hands-on experience in using the computer models. A case-study building will be provided at the beginning of the course and students will model different components each week throughout the semester. Every week students present the progress of their work, which will be used to correct methodological and technical issues.

Master of Science in Design: Advanced Architectural Design - Core

751. Ecology, Technology, and Design. (A) Braham.

This course will examine the ecological nature of design at a range of scales, from the most intimate aspects of product design to the largest infrastructures, from the use of water in bathroom to the flow of traffic on the highway. It is a first principle of ecological design that everything is connected, and that activities at one scale can have quite different effects at other scales, so the immediate goal of the course will be to identify useful and characteristic modes of analyzing the systematic, ecological nature of design work, from the concept of the ecological footprint to market share.

The course will also draw on the history and philosophy of technology to understand the particular intensity of contemporary society, which is now characterized by the powerful concept of the complex, self-regulating system. The system has become both the dominant mode of explanation and the first principle of design and organization.

ARCHITECTURE

(FA) {ARCH}

SM 752. MEBD Research Seminar. (A) Braham.

Directed student research of selected topics in environmental building design. These topics will be further explored in ARCH 708: MEBD Studio and will provide the basis for the research documents developed with each student's design project. Course work will include lectures, discussions, weekly readings, and in-class exercises. Each student will be required to make a presentation and submit a research report.

753. Building Performance Simulation. (A) Yi.

The course provides students with an understanding of building design simulation methods, hands-on experience in using computer simulation models, and exploration of the technologies, underlying principles, and potential applications of simulation tools in architecture. Classroom lecturers are given each week, with a series of analysis projects to provide students with hands-on experience using computer models. This course is required and reserved for MEBD students.

703. Advanced Architectural Design Studio. (A) Rahim and Faculty.

An Advanced Architectural Design Studio specifically tailored to post-professional students. Through this studio, students engage in the challenges and opportunities presented by changes in society, technology, and urban experience. Through design projects, they explore alternative modes and markets for practice, along with new directions and new tools for design.

717. Philosophy of Urban History. (A) Delanda.

The seminar is based on the thesis that "the Architecture of the City" is not only the work of an individual architect or a company but also the product of the city itself. The intention of the seminar is to demonstrate the creative architectural production of the city of New York and particular of Manhattan. The seminar is a build up by the progressive transformation of the architecture of the city within the 20th century until today. This process of transformation of the architecture of New York starts with the moment architecture was formed by the underlying subdivision of the cities grid, continues with the transformation of architecture becoming the city itself and ends with today's architectural production of the city as the production of a new ground for the city. There will be eight sessions in Philadelphia and five sessions in New York City which will provoke a discussion with New York City Leaders, Inter-disciplinary thinkers, cultural leaders and financiers.

SM 743. Form and Algorithm. (A) Balmond/Blasetti.

The critical parameter will be to develop the potential beyond finite forms of explicit and parametric modeling towards non-linear algorithmic processes. We will seek novel patterns of organization, structure, and articulation as architectural expressions within the emergent properties of feedback loops and rule based systems. This seminar will accommodate both introductory and advanced levels. No previous scripting experience is necessary. It will consist of a series of introductory sessions, obligatory intensive workshops, lectures followed by suggested readings, and will gradually focus on individual projects. Students will be encouraged to investigate the limits of algorithmic design both theoretically and in practice through a scripting environment.

Master of Science in Architecture and PhD in Architecture - Core

ARCHITECTURE

(FA) {ARCH}

SM 811. (ARCH711) Architectural Research. (A) Leatherbarrow and Faculty.

This course has three parts. All incoming students in the M.S. and Ph.D. programs should attend the first, and register for either the second or the third sections. The first part consists of a series of presentations by members of the Graduate Group in Architecture. The several presentations will address the topics the faculty are currently examining and will demonstrate different methods or styles of research. The other two sections of this course address basic concepts, texts, and methods in 1: history and theory, and 2) technology and simulation.

851. Dissertation Bibliography. (D) Faculty.

This course is essentially an independent study, undertaken by doctoral students in preparation for the Candidacy Examination. This course should be taken in conjunction with ARCH 852 after all other courses have been completed. Normally a member of the student's Dissertation Committee supervises this course.

812. Field Research. (B) Faculty.

First year Ph.D. and M.S. students will use this course to register for a research elective in their field of study. Courses to be taken will be selected from a list of electives offered by members of the Graduate Group of Architecture, typically the seminars offered by those faculty at the Masters level. At the outset of the course Ph.D. and M.S. students will discuss and decide with the professor the readings, research, and writings that will be appropriate for the course, given the student's field of study.

813. Qualifying Research. (B) Faculty.

This is an independent study course for first year Ph.D. and M.S. students, supervised by a member of the Graduate Group in Architecture. A course of readings and advisors sessions throughout the semester will result in an independent study paper, which will also be used as the student's qualifying paper for the Qualifying Examination. This research paper will be prepared as if for scholarly publication.

815. Research Report. (A) Faculty.

The candidate for the M.S. in Architecture degree shall prepare a research report in his or her subject of study. The topic of this report must be approved by an advisor. This report will be developed in the independent study courses, undertaken after the eight units of course work has been completed, normally in the summer semester. The purpose of these courses is to give the student an opportunity to synthesize their previous coursework at Penn. Course enrollment is by permit only. Please contact Leigh Anne Scarborough (ARCH Dept.) at lascarbo@sas.upenn.edu.

852. Dissertation Proposal. (D) Faculty.

This course is essentially an independent study, undertaken by doctoral students in order to write the Proposal for the Dissertation. The Proposal is prepared before and defended during the Candidacy Examination. This course should be taken in conjunction with ARCH 852 after all other courses have been completed. Normally a member of the student's Dissertation Committee supervises this course.

Study Abroad

ARCHITECTURE

(FA) {ARCH}

698. Architectural Association (AA), London. (A) Farjadi.

An advanced Architectural Design Studio taught by Homa Farjadi in London at the Architectural Association's School of Architecture. Topics engage aspects of urban life and urban form in London, and vary from year to year. During the fifth term of the Master of Architecture program, up to fifteen students a year may enroll for the semester abroad program in London, England. This is coordinated by Prof. Homa Farjadi and is housed at the Architectural Association (AA), located on Bedford Square in the heart of Bloomsbury. Students enroll in a special design studio, ARCH 702, taught by Prof. Farjadi, and in two elective courses offered by the faculty at the AA.

782. Architecture Study Abroad Program. (L) Fierro and Faculty. Last day to drop course without penalty: April 22, 2016. Students who withdraw from the program after April 22, 2016 will forfeit 100% of the tuition and general fee.

A four to six week program of study in locations that vary, such as Paris, Greece and Colombia. Summer 2016: ARCH-782-901 Paris, France: May 25 to June 01 2016. ARCH-782-902 Greece: May 17 to June 16, 2016. ARCH-782-903 Colombia: May 17 to June 23 2016. For additional information please contact the Architecture Department directly: arch@design.upenn.edu.

Electives

706. Independent Thesis. (B) Faculty.

In the final semester of the program, students select from three options; 1) An elective design studio; selected from among the advanced architectural design studios offered by the Department of Architecture; 2) a research studio, the exploration of a topic or theme established by an individual faculty member or group of faculty members; or 3) an independent thesis, the exploration of a topic or theme under the supervision of a thesis advisor.

SM 721. (IPD 521) Designing Smart Objects for Play and Learning. (A) Diana.

Today's children enjoy a wide array of play experiences, with stories, learning, characters and games that exist as physical stand-alone objects or toys enhanced with electronics or software. In this course, students will explore the domain of play and learning in order to develop original proposals for new product experiences that are at once tangible, immersive and dynamic. They will conduct research into education and psychology while also gaining hands-on exposure to new product manifestations in a variety of forms, both physical and digital. Students will be challenged to work in teams to explore concepts, share research and build prototypes of their experiences in the form of static objects that may have accompanying electronic devices or software. Final design proposals will consider future distribution models for product experiences such as 3D printing, virtual reality and software- hardware integration. Instruction will be part seminar and part workshop, providing research guidance and encouraging connections with subject matter experts throughout the Penn campus.

ARCHITECTURE

(FA) {ARCH}

SM 728. (IPD 528) Design of Contemporary Products. (B) Diana.

Smart objects are information-based products that are in ongoing dialogs with people, the cloud and each other. By crafting rich interactions, designers can create expressive behaviors for these objects based on sophisticated programmed responses. At the same time, sensor technologies have enabled us to introduce natural gestures as a means of interacting with a product. (Not only can we push, pull and twist a data value, but we can wave at, caress, tilt and shake it as well.) With an explosion of new possibilities for object interaction and human control, it is the designer's role to envision new solutions that are both meaningful and responsible.

This course will explore product design solutions through a combination of physical and digital design methods. Beginning with an examination of case studies, students will gain a sense of the breadth of product and interaction design practice as it applies to smart objects. Through a series of lectures and hands-on studio exercises, students will explore all aspects of smart object design including expressive behaviors (light, sound and movement), interaction systems, ergonomics, data networks and contexts of use. The course will culminate in a final project that considers all aspects of smart object design within the context of a larger theme.

SM 724. Technology in Design. (B) Kim, Simon.

The aim of this course is to understand the new medium of architecture within the format of a research seminar. The subject matter of new media is to be examined and placed in a disciplinary trajectory of building designed and construction technology that adapts to material and digital discoveries. We will also build prototype with the new media, and establish a disciplinary knowledge for ourselves. The seminar is interested in testing the architecture-machine relationship, moving away from architecture that looks like machines into architecture that behaves like machines: An intelligence (based on the conceptual premise of a project and in the design of a system), as part of a process (related to the generative real of architecture) and as the object itself and its embedded intelligence.

SM 726. (IPD 526) Contemporary Furniture Design. (B) Mueller-Russo.

This course provides a platform, in the form of furniture, to execute and deploy architectural & engineering principles. It will be conducted as a seminar and workshop, and will introduce students to a variety of design methodologies that are unique to product design. The course will engage in many of the considerations that are affiliated with CAD/CAM production, the appropriate and innovative use of materials, and human factors. Students conduct case studies and research into industrial design processes, and will adapt these processes into techniques for designing a chair. Throughout the semester, students will experience first hand structural and material behavior, and understand ergonomic constraints by testing their design at different scales. The process will include: the production of a final design, its detailing, prototype development, Color/Material/Finishes (CMF), design for Computer Aided Manufacturing (CAM), the possibility of mass customization, research of materials and fabrication methods, optimization studies, Computer Aided Design (CAD), model making, furniture case studies, and a site visit to a major furniture manufacturer.

ARCHITECTURE

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727. (IPD 527) Industrial Design. (C) Bressler.

Industrial design (ID) is the professional service of creating and developing concepts and specifications that optimize the function, value and appearance of products and systems for the mutual benefit of both user and manufacturer. Industrial designers develop these concepts and specifications through collection, analysis and synthesis of user needs data guided by the special requirements of the client or manufacturer. They are trained to prepare clear and concise recommendations through drawings, models and verbal descriptions. The profession has evolved to take its appropriate place alongside Engineering and Marketing as one of the cornerstones of Integrated Product Design teams. The core of Industrial Design's knowledge base is a mixture of fine arts, commercial arts and applied sciences utilized with a set of priorities that are firstly on the needs of the end user and functionality, then the market and manufacturing criteria.

This course will provide an overview and understanding of the theories, thought processes and methodologies employed in the daily practice of Industrial Design. This includes understanding of ethnographic research and methodologies, product problem solving, creative visual communication, human factors / ergonomics application and formal and surface development in product scale. This course will not enable one to become an industrial designer but will enable one to understand and appreciate what industrial design does, what it can contribute to society and why it is so much fun.

730. Techniques, Morphology, and Detailing of a Pavilion. (B) Al Khayer, Mohamad.

The course will focus on the design, morphology detailing, and the construction of "PennDesign Pavilion inspired by Russel Write Designs" which is set to be constructed in Spring 2016 on a site located at the University of Pennsylvania Campus. The course will develop through hands-on workshops and will focus on acquiring knowledge through making (Techne), understanding the morphological transformation of a given geometric packing, and building using readily available materials. The process consists of building and testing physical models that simulates the actual pavilion. In addition to digital simulation sessions to realize the desired design, which answers to the program developed by PennDesign faculty. The second half of the semester will focus on using lightweight construction materials to fabricate the pavilion's actual components, including structural elements, molded components, and joints, which are required for pavilion's final assembly. Additionally students will learn to organize design and fabrication teams, control design and production schedules, and work with set budget, which requires keeping track of construction cost and forecast for required procurements, including material quantities takeoff, ordering and schedule deliveries and receiving.

SM 738. The Modern House: Technology Then and Now. (B) Fierro.

In the current age of new fabrication methodologies, methods are emerging for the conception and design of the contemporary house which have radical potential for enclosure, habitation and practices of daily life. This course begins by examining the canonical houses of the original avant-garde--Adolf Loos, Frank Lloyd Wright, Le Corbusier, Mies van der Rohe and Alvar Aalto -on the premise that their houses were working manifestos for rethinking space, form and indeed ideas of life itself -all of which were prompted by new concepts of construction. From this spectrum of issues, contemporary houses and contemporary methods and materials will be studied extensively to develop equally new ideas between matter and quotidian life. As the primary task of the course, students will work in teams to develop highly detailed constructional proposals for a portion of a speculative home.

ARCHITECTURE

(FA) {ARCH}

SM 731. Experiments in Structures. (A) Al Khayer.

This course studies the relationships between geometric space and those structural systems that amplify tension. Experiments using the hand (touch and force) in coordination with the eye (sight and geometry) will be done during the construction and observation of physical models. Verbal, mathematical and computer models are secondary to the reality of the physical model. However these models will be used to give dimension and document the experiments. Team reports will serve as interim and final examinations. In typology, masonry structures in compression (e.g., vault and dome) correlate with "Classical" space, and steel or reinforced concrete structures in flexure (e.g., frame, slab and column) with "Modernist" space. We seek the spatial correlates to tensile systems of both textiles (woven or braided fabrics where both warp and weft are tensile), and baskets (where the warp is tensile and the weft is compressive). In addition to the experiments, we will examine Le Ricolais' structural models held by the Architectural Archives.

733. (IPD 530) Building Product Design. (A) Faculty. Prerequisite(s): ARCH 403/IPD 503 or ARCH major.

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, one 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 and prototype development 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 construction 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 context that creates the unique need for a new product and have an opportunity to conceptualize their ideas through sketches, digital modeling and prototype development.

SM 734. Ecological Architecture - Contemporary Practices. (B) Woodward.

Architecture is an inherently exploitive act - we take resources from the earth and produce waste and pollution when we construct and operate buildings. As global citizens, we have an ethical responsibility to minimize these negative impacts. As creative professionals, however, we have a unique ability to go farther than simply being "less bad." We are learning to design in ways that can help heal the damage and regenerate our environment. This course explores these evolving approaches to design - from neo-indigenous to eco-tech to LEED to biomimicry to living buildings. Taught by a practicing architect with many years of experience designing green buildings, the course also features guest lecturers from complementary fields - landscape architects, hydrologists, recycling contractors and materials specialists. Coursework includes in-class discussion, short essays and longer research projects.

741. Architecture Design Innovation. (A) Rahim.

The mastery of techniques, whether in design, production or both, does not necessarily yield great architecture. As we all know, the most advanced techniques can still yield average designs. Architects are becoming increasingly adept producing complexity & integrating digital design and fabrication techniques into their design process - yet there are few truly elegant projects. Only certain projects that are sophisticated at the level of technique achieve elegance. This seminar explores some of the instances in which designers are able to move beyond technique, by commanding them to such a degree so as to achieve elegant aesthetics within the formal development of projects.

ARCHITECTURE

(FA) {ARCH}

SM 744. (IPD 544) Postdigital Craft. (B) Kolatan.

As we have entered a postdigital era, the dominance of a purely technological approach as a vehicle for design innovation has waned. Questions of substance and disciplinary autonomy have found their way back into the contemporary cultural discourse, enriching the way we examine and deploy advanced technologies towards novel expressions in architecture. This seminar will investigate, through the production of estranged objects, opportunities for design that are being generated at the intersection of machinic and human minds, and speculate on possible futures in which concepts of nature and technology have been inseparably intertwined.

SM 750. Parafictional Objects. (B) Ayata, Ahemt Kutan.

This representation/design seminar explores the aesthetics of estrangement in realism through various mediums. The reality of the discipline is that architecture is a post-medium effort. Drawings, Renderings, Models, Prototypes, Computations, Simulations, Texts, and Buildings are all put forward by architects as a speculative proposal for the reality of the future. Students will explore the reconfiguration of a "found object" in multiple mediums and represent parafictional scenarios in various techniques of realism. At a time when rendering engines enable the production of hyper-realistic images within the discipline without any critical representational agenda, it has become ever more imperative to rigorously speculate on realism.

999. Independent Study. (C) Faculty.

This course enables student to undertake a self-directed study on a topic in Architecture, under the supervision of a faculty member. Students are required to make a proposal for the study to the Department Chair, outlining the subject and method of investigation, and confirming the course supervisor at least two weeks prior to the beginning of the semester.

762. (CPLN643) Design and Development. (B) Sehnert.

This course provides an introduction to the relationship between architectural design and real estate development. Following a discussion of fundamentals, examples focus on commercial building types, and illustrate how architectural design can contribute to real estate development. Topics include housing design commercial buildings, adaptive reuse, downtown development, mixed-use projects, and planned communities. The course consists of lectures, reading assignments, short essays, a group project, and an mid-term test. Invited lecturers include architects and real estate developers. Readings consist of a Bulkpack available from Wharton Reprographics. There is one course text: Witold Rybczynski, "Last Harvest."

SM 765. Project Management. (B) Capaldi.

This course is an introduction to techniques and tools of managing the design and construction of large, and small, construction projects. Topics include project delivery systems, management tools, cost-control and budgeting systems, professional roles. Case studies serve to illustrate applications. Cost and schedule control systems are described. Case studies illustrate the application of techniques in the field.