About Course Numbers:
Each Carnegie Mellon course number begins with a two-digit prefix that designates the department offering the course (i.e., 76-xxx courses are offered by the Department of English). Although each department maintains its own course numbering practices, typically, the first digit after the prefix indicates the class level: xx-1xx courses are freshmen-level; xx-2xx courses are sophomore level, etc. Depending on the department, xx-6xx courses may be either undergraduate senior-level or graduate-level, and xx-7xx courses and higher are graduate-level. Consult the Schedule of Classes (http://soa.cmu.edu/soaocserv/each sem) for course offerings and for any necessary pre-requisites or co-requisites.

48-025 First Year Seminar: Architecture Edition I
Fall: 3 units
The main objective of this first-year seminar course is on how students learn, develop, and make decisions as they transition into architecture education. The goal of this course is to promote academic success and encourage connections within the SoA and the University at large. Teaching and learning strategies will be introduced to help support the transition into architecture and the development of independent critical thinkers. Students will be introduced to campus resources that support their academic/social/personal integration into the campus community. Topical areas to be covered in the seminar will include teaching and learning strategies in architecture education, academic development, career planning, mentorships, academic and personal support services, and the aspects of professional practice in architecture.

48-026 First Year Seminar: Architecture Edition II
Spring: 3 units
The first-year seminar (part 2) introduces students to opportunities at Carnegie Mellon University and beyond. The goal of this course is to encourage students to pursue their interests inside and outside of the School of Architecture by introducing a range of opportunities, including study abroad experiences, internships, academic minors/additions, majors, and research opportunities. Additional topical areas to be covered in the seminar will include an evaluation of the previous semester, scholarship/academic funding opportunities, ethical decision making, design resume/writing/branding, and engaging with the Career and Professional Development Center.

Course Website: http://soa.cmu.edu

48-095 Spatial Concepts for Non-Architecture Majors
Fall and Spring: 10 units
This course serves as an introduction to the spatial concepts of architecture for students from other disciplines. The course is focused entirely on project design work (this is not an historical survey, technical or lecture course). This course is very hands-on Projects will explore the design and experience of visual and thermal comfort. Students will develop a general understanding of, site analysis, building placement and form as it relates to building comfortable buildings, we explore how tectonics, joinery, materials, as well as site, orientation, context, and human use, can be harnessed to inspire great design. The design process is still carefully controlled, but students are encouraged to begin to speculate and take careful risks. Prerequisite: 48-100 Min. grade C

48-100 Architecture Design Studio: POIESIS STUDIO 1
Fall: 15 units
As the first architectural design studio course, the Poeisis 1 studio establishes a fundamental understanding of representation and abstraction to which more of your own thoughts and ideas about spatial thinking can be added. This will involve, by means of the architectural studio, a reiterative investigation into the relationship of form, site, and meaning through study, invention, testing, and evaluation. During this semester a series of short problems will be given to expose you to the complexities of visual communication and the design act; to develop skills of spatial manipulation; to give you the self-confidence in making valid decisions within set time limits; to develop the skills of graphic presentation necessary for interpreting and communicating your architectural intentions; and above all, to instill the ability to combine insight with the rigorous analytical study in a design process that is efficient, personally effective, and which becomes second nature to you as a working process.

48-104 Shop Skills
Fall
TBD

48-105 Architecture Design Studio: Poiesis Studio 2
Spring: 15 units
The 48-105 studio, called Poiesis Studio 2, is the second studio in CMU's professional B.Arch program. It builds on the lessons from 48-100 about clear architectural communication and abstract spatial definition, but adds a greater emphasis on the material and experiential understanding of how architecture is made and used. We continue to emphasize architectural drawing and models (both analog and digital) as the primary means of architectural communication, but also as a method of creatively exploring and rigorously testing fundamental architectural ideas. We investigate, research, analyze, diagram, and apply lessons from local architecture, and great architecture of the past, in studio, and in the parallel survey of architectural history. We introduce the use of systems, computational thinking, and rules in the design process to create order, deal with a range of parameters, and satisfy specific performance criteria. Beginning with more abstract formal design exercises, and ending with the design of a small building, we explore how tectonics, joinery, materials, as well as site, orientation, context, and human use, can be harnessed to inspire great design. The design process is still carefully controlled, but students are encouraged to begin to speculate and take careful risks. Prerequisite: 48-100 Min. grade C

48-116 Introduction to Building Performance
All Semesters: 3 units
This course will introduce fundamental concepts of building physics. The knowledge and skills obtained from this course can be applied to studio projects and beyond, improving building design and performance through standard methods of evaluation and simulation tools. Course curriculum running concurrent with studio projects will aid students in further developing and guiding design decisions to incorporate fundamental concepts related to climate, energy, light, relationship to site, and occupant visual and thermal comfort. Students will develop a general understanding of, site analysis, building placement and form as it relates to building performance, photometric principles to evaluate lighting conditions, thermodynamic principles, and heat transfer, building energy, renewable and embodied energy. Skills, tools, and knowledge base learned in this course with enable designers and architects to employ sustainable practices at all phases of design, leading to better performing buildings. Prerequisites: 62-122 and 62-123 and 62-125 and 62-126

48-120 Digital Media I
Fall: 6 units
IDM is a required course for all first-year architecture students. The course introduces students to a wide range of digital methods and concepts available to architects for design, representation, and documentation. The coursework is directly coordinated with studio assignments providing the students with the opportunity to master their digital skills in a meaningful manner. Due to the amount of content covered there is no single text for this course, but the course is supported by materials created by the instructor. IDM addresses topics such as digital image editing, vector illustration, HTML coding, and 3D modeling.
48-121 Drawing I
Fall: 6 units
Architects draw and build models for a variety of reasons: to record and reference; to analyze and reveal order, intent, and relationships; to speculate; and to visualize new propositions. The study of architecture requires the connection between the mind, the eye and the hand, so that the nature of ideas and their relationship to physical form can be investigated. The connection of the mind, hand and drawing skills requires considerable time and effort. This course introduces why architects use these forms of representation. Students are introduced to how to do basic academic research as well direct assignments that apply the fundamentals of freehand drawings and drafting techniques as it pertains to plans, sections, elevations and paraline drawing, analytical diagraming and model making.

48-125 Digital Media II
Spring: 6 units
IDM2 is a required course for all first year architecture students. This course is the continuation of IDM. IDM2 introduces students to measured drafting and the process of creating a construction drawing set. The coursework is directly coordinated with Studio assignments providing the students with the opportunity to master their digital skills in a meaningful manner. Due to the amount of content covered there is no single text for this course, but the course is supported by materials created by the instructor. IDM2 addresses topics such as digital drafting, construction drawings, advanced 3D modeling and HTML programming. Prerequisite: 48-120

48-126 Drawing II
Spring: 6 units
Drawing and Appearance? is a traditional course in free-hand architectural drawing. Its central learning objective is building a capacity for visualizing three-dimensional space through the making of hand-made drawings. Two secondary objectives foster visual literacy: the ability to use line, tonal values and color to represent architectural space and the ability to use drawing to represent architectural proposals at various levels of abstraction. Coursework includes free-hand and constructed perspective, shade and shadow projection, chiaroscuro drawing in colored pencil and color drawing in pastel. Work is submitted in three portfolio submissions of two weeks duration each. Coursework is built around exercises in the required course text: Drawing and Perceiving, John Wiley and Sons.

48-175 Descriptive Geometry
Spring: 9 units
Descriptive geometry deals with solving problems in three-dimensional geometry through working with two-dimensional planes using basic mechanical tools. Descriptive geometry deals with physical space, the kind that one is used to since birth. Things one can see around us have geometry and even things that one cannot see, also have geometry. All these things concern geometric objects almost always in relationships that is, next to, above, below, intersecting with, occluding, hidden by and so onto one another that sometimes requires us to make sense of it all in other words, when we try to solve geometric problems albeit in architecture, engineering, or the sciences. In fact, descriptive geometry has proved itself to be practically useful; it has been one of the more important factors in the design of scientific apparatus, engineering systems and architectural structures is the basis of modern geometrical computing. Descriptive geometry is constructivist, one uses conventional mechanical drawing tools: namely, compass, ruler, protractor, divider, triangles, etc., to construct solutions to geometric problems. This course specifically revolves around the historical techniques for manually solving three-dimensional geometry problems.

Course Website: http://soa.cmu.edu

48-200 Architecture Design Studio: POIESIS STUDIO 3
Fall: 18 units
This studio is an introduction to architectural design stressing concept generation and the development of a rich design process to create evocative spatial experiences through architecture. Building on the explorations of form and space in the 1st year, we investigate in greater depth the role that program, context, and the physical “elements of architecture” play in creating meaningful architecture. We seek to understand design principles underlying the buildings of the past and present, from the broadly theoretical and conceptual, to the real implications of tectonics and sustainability, and apply these ideas with intent and significance. We will focus on developing challenging architectural ideas, profound building details, and effective ways of communicating them in order to explore architecture’s potential for creating poetic expressions, appropriate shelter, or exalted experiences, as well as its ability to embody ideas and impart meaning to the world around us. Prerequisites: 48-100 and 48-105 Min. grade C and 62-122 and 62-125 and 62-126 and 62-123 and 62-104 and 48-025

48-205 Architecture Options Studios
Spring: 18 units
Coming Soon.
Prerequisite: 48-200
Course Website: http://soa.cmu.edu

48-215 Materials & Assembly
Spring: 9 units
48-215/ 48-647 introduces and examines the fundamentals between design intent and construction materials, the science of materials (performance) and their assemblies. Learning how materials and techniques inform spatial and form making decisions will be a central theme for the semester. Lectures and discussions will focus on the meaning, aesthetics and techniques related to the use of materials and the process of construction. Prerequisite: 48-100

48-217 Structures
Spring: 9 units
Structures is a required course taught in the second year. It is a successor course to Statics, complementing that previous course by emphasizing structural member design in wood, steel, and reinforced concrete; spatial synthesis of hierarchical one-way systems for gravity load; structural types for lateral load including braced frames, shear walls, and rigid frames; introduction to geometric structures such as cable nets, domes, shells, and air-supported structures.

48-240 History of World Architecture, I
Fall: 9 units
This course cuts a broad swath through time, geography and cultures, surveying critical episodes in the built environment of Europe, the Middle East, Asia, Africa, and the Americas from ancient times through the 19th century. We will examine architecture as a form of cultural expression unique to its time and place, studying the ways that the design, use, meaning, and legacy of a building was conditioned not only by the architect’s will or the patron’s desire, but also by a web of technological, religious, social, cultural, economic, and political factors of the time.

Course Website: http://soa.cmu.edu

48-241 Modern Architecture
Fall: 9 units
This history course surveys modern architecture and theory of the 20th-century from around the world. It is the second of a two-semester global survey that serves both as a historical foundation for disciplinary specialization, and as an intro. to architectural history. We begin the course by defining terms such as history, theory, and criticism, as well as modern, modernity, and modernism in architecture. We look briefly at the bias embedded in most current textbooks and in terms like “evolution” and “Neo-Western.” We problematize canon formation and ideas of progress, we’ll ask who gets left out of histories, and probe the legacy of colonialism, globalization, and social inequity in modern architecture. After briefly identifying architecture’s role in some of the most important challenges facing the world today, this survey works backward in time towards the beginning of the 20th-century. Along the way we will explore major movements of the Euro-American avant-garde and the “heroes” of modernism, but also other responses to modernity, including vernacular, popular, tropical, and even anti-architecture, and their relation to contexts such as the Cold War, the Third World, Global Socialism, Postcolonialism, and Postmodernism. We will highlight the role of experimentation and provocation, but also of tradition and timeless ideals in different cultures, and how they each intersect with the demands of function and technology as well as social and political imperatives. Emphasis throughout the course will be placed on the relationship of buildings to the more general cultural, intellectual, and historical circumstances in which they were created, as well as changing interpretations of the past over time. Work for the course falls into four categories: 1) active listening and note-taking in lectures (some pre-recorded); 2) reading, both original documents from the period, and more recent critical

Course Website: http://soa.cmu.edu

48-250 Urbanism and the Social Production of Space
Fall: 9 units
Formerly titled “Case Studies in Architecture and Cities” (CSE STD ARC C1),
48-300 Architecture Design Studio: Praxis Studio 1
Fall: 18 units
Poeisis Studio 3: Building and Site is a required course taught in the third year. The subjects of the Third Year Fall Semester are the reciprocal orders of buildings and landscapes and the development of the building site. The work builds on knowledge gained in prerequisite and co-requisite courses including 48-312 Site Engineering. This course asks students to continue their investigations into the formal and spatial composition and enquiries of previous semesters with a focus on the following concepts: Occupancy, Social and cultural phenomena, dimension/measurement and cycles of time relating to human and non-human occupancy Site assessment: site inventory at many scales Grading and surface manipulation: compatibility of grading with related technical considerations for water management, ground structures, surfacing, plants, and maintenance Road alignment: design of roads and parking to support construction, service and the anticipated occupancies, design of roads to connect to other roads with appropriate sight lines, stack spaces, and turning requirements, layout and sizing of parking spaces for vehicles Stormwater: volume and direction of runoff water on both the undisturbed and developed areas, storm water surface system, Plants: selection of plants and plant communities with consideration for regional, local, and site-specific factors Prerequisites: 62-275 and 48-205 Min. grade C and 48-116 and 48-215 and 62-221 and 48-324 and 48-200 Min. grade C

48-305 Architecture Design Studio: Praxis Studio 2
Spring: 18 units
This studio introduces integrated architectural design as the synthesis of disparate elements, demands, and desires. It situates architecture as a technological, cultural, and environmental process that is inherently contingent and entangled, yet tethered to a historical project of autonomy. It is within the contested space between these two notions of architecture that the studio operates. The studio sets out alternatives to extractive practices and introduces students to bio-based material practices and computationally facilitated methods of manufacturing and construction. While the studio directs attention to concerns of building, such as context, building systems, program, and regulatory constraints, it challenges students to situate design as a Project that engages contemporary discourse and ecological imperatives to explore emerging aethetics, spatial organizations, and materializations. Prerequisite: 48-300
Course Website: http://soa.cmu.edu

48-313 Kalla Visiting Faculty Elective
All Semesters: 9 units
No course description provided.

48-314 Thomas Visiting Faculty Elective
All Semesters: 9 units
Coming Soon.

48-315 Environment I: Climate & Energy in Architecture
Fall: 9 units
This course introduces architectural design responses for energy conservation, human comfort, and the site-specific dynamics of climate. Students will be expected to combine an understanding of the basic laws of comfort and heat flow with the variables of local climate to create energy design guidelines for their own work. The state of the art in building energy conservation and passive heating and cooling technologies will be presented, with take-home readings and assignments. To stress the significance of architectural design decision-making on energy consumption and comfort, full design specifications and calculations will be completed for a residential-scale building. Students will compile a professional energy consultant’s report, designing the most viable energy conservation retrofit measures for their client from siting, massing, organization, enclosure detailing, opening control, to passive system integration and management. An overview of world energy consumption in buildings and energy design standards will be challenged by lectures on building energy conservation successes, and emerging demands for a broader definition of sustainability. The course will end with a focus on the design integration of natural conditioning systems and the potentially dynamic interface of mechanical systems in small- and large-scale buildings.

48-324 Structures/Statics
Fall: 9 units
We examine structural types, structural behavior, material behavior, and construction constraints that underlie our design of buildings, emphasizing the need for a designer to envision a complete 3-D structure. We mostly build “orthogonal structure” constructed in horizontal and vertical planes, requiring high-strength modern materials such as steel or reinforced concrete, comprising roughly 75-80% of the course. This is complemented by “geometric structure” where the three-dimensional shape dictates function; prominent examples include membranes, cable nets, historic masonry domes, and shells. Geometric structure is characterized by “form-finding.” Statics underlies all topics, and our treatment is consistent with NCARB expectations.
Course Website: http://soa.cmu.edu

48-328 Detailing Architecture
Spring: 9 units
This course examines the role of the architectural detail in the formation/ thematic development of a work of architecture and how the detail reinforces the theoretical position of the architect. Architectural detailing is often considered only a technical task, but, in fact the detail holds the key to inspire, integrate and reinforce the architectural idea as well as the architect’s intellectual/ societal position. Many scholars, historians and academics have avoided the detail as a snapshot into the design methodology of architecture. This class is an attempt to do the opposite. The course will consist of a series of weekly lectures, readings, field trips and student developed graphic and physical representations that reveal how the role of detail has played an essential role in the history, evolution and development of the built environment. Prerequisite: 48-205
Course Website: http://soa.cmu.edu

48-332 Teaching and Learning
Intermittent: 6 units
In this course, students will learn about effective strategies for teaching architecture and the built environment. Topics include the cognitive differences between novices and experts, instructional techniques, and goal alignment. As part of the coursework, each student will implement these teaching strategies to design and teach a lesson. Elements of developmental psychology, learning theories, and classroom practices will inform the architectural education lesson. Teaching and learning techniques can be generalized for communication with clients, practice, and the community.

48-336 Architecture and Agency
All Semesters: 9 units
If buildings consume vast resources and are often embedded in extractive systems of material and labor, how can the agency of architecture be deployed to consider other forms of thinking and praxis? What tactics, strategies, manifestos, and actions can architects deploy to resist, upend or reinvent normative mechanisms of architectural production? How do such practices seek new modes of conceiving the architectural project and its concomitant processes; radically reinvent the brief, site, program, material or tectonic capabilities? This course will consider agency simultaneously through historical and contemporary forms of praxis as well as theories that inform them.
Course Website: http://soa.cmu.edu
48-338 European Cities in the XIX Century: Planning, Architecture, Preservation
All Semesters: 9 units
The history of the main cities of Europe during the XIX century is a history of change and transformation. The physical environment and the political, financial, and administrative structures adapt to the needs of new masses of population and to the challenges of metropolitan life. In some cases, cities even acquire new representative functions, as they become a national capital. This course traditionally offers an overview of the urban culture of XIX century Europe, reconstructing aspects of the broader historical context and then focusing on reading the effects of the XIX century transformations on the physical appearance, structures and image of present-day European cities, such as Paris, London, Berlin, Barcelona, Vienna and Rome. This semester we will add to this analysis, acquired by learning and applying a set of essential questions about XIX century urban transformations, a second look at the image of the city - the issue of how the city is represented and described in the various moments of its Nineteenth century transformation (from historical maps, to paintings, from postcards to literary descriptions). We will try to consider its changing visual representation and the different perception of its character and peculiarities over time, finally discussing how the Nineteenth century image of each city still affects how it is viewed today. We will rely, along with the usual reading materials (articles, book excerpts) also on visual documentation, such as photography and film. The course is based on lectures and discussions and requires personal elaboration, as well as a fair amount of reading and writing.
Prerequisite: 48-240

48-339 IDEAte: Making Things Interactive
Spring: 12 units
In this hands-on design-build class you will learn the skills to embed sensors and actuators (light, sound, touch, motion, etc.) into everyday things (and places etc.) and to program their interactive behavior using a microcontroller. You’ll also dive into the fields of VR/AR/MR and experiment with combining these disciplines with physical computing. Through weekly exercises and a term project the class will introduce basic analog electronics, microcontroller programming, projection mapping and virtual reality; as well as exploration into using kinetics and materials to make the things you design perform. Emphasis will be on creating innovative experiences. The graduate edition of this course will require additional work including a paper that can be submitted to a peer-reviewed interaction design conference such as CHI, UIST, or TEI. Students from all disciplines are welcome: but please note that the class demands that you master technical material. Experience in at least one of: programming, electronics, or physical fabrication is strongly recommended. Participants will provide their own supplies and materials.
Prerequisites: 60-223 or 16-223
Course Website: http://soa.cmu.edu

48-340 Modern Architecture and Theory 1900-1945
Intermittent: 9 units
This architectural history lecture course surveys the modern buildings and literature of the first half of the twentieth century, focusing primarily on Europe but extending also to non-western countries. We begin with a look at the “crisis of modernity” that plagued most of western civilization in the late 19th-century, and then focus on the major movements of both the avant-garde and other responses to modernity from 1900-1945. The course includes lectures, readings, and discussions about a broad range of issues, including 1) Formal tendencies; 2) Theoretical issues; 3) National traditions; 4) Biographical sketches; 5) Significant technologies and materials; 6) Political motivations; 7) Social and cultural influences. Emphasis will be placed on the relationship of buildings to the more general cultural, intellectual, and historical circumstances in which they were created, especially the important manifestoes, theoretical and critical writings that so determined the project of modern architecture. Work for the course involves extensive reading and a major research paper.
Prerequisite: 48-240

48-341 Expression in Architecture
Intermittent: 9 units
This architectural history seminar will explore expression in architecture in its many forms, particularly in written works of architectural theory through the ages. We start with the premise that architecture is not merely pragmatic, technical, or functional: it can express or communicate like a language, it can represent and inspire like many of the arts, it can shape behavior and emote, it can trigger memories, emotions, or meanings. As Isozaki put it: “Architecture is a machine for the production of meaning.” We’ll investigate many ways that architects have theorized the design process, as well as the forms, materials, and contexts of architecture, to express a myriad of ideas and sensibilities. We’ll also look at the ways that buildings can communicate and have meaning, often beyond the intent of the architect, and usually changing over time. Some of the topics to be explored include the classical orders, gothic geometry and mystical light, the theatrical space of the Baroque, architecture parlante, character, and style in the Enlightenment, tectonics as structural expression, political architecture and morality, the aesthetics of functionalism, Expressionism, key terms such as ornament, representation, linguistics, and semiotics, as well as more recent theoretical constructs such as embodiment, materiality, atmosphere, and affect. The work of the seminar will include intensive weekly readings, especially of primary sources by the architects seeking to express ideas, weekly presentations and discussions about the sources, and a term paper on an important theory of expression in architecture of your choice.
Prerequisite: 48-240

48-348 Architectural History of Mexico & Guatemala
Intermittent: 9 units
Despite the leveling forces of mass culture and globalization, the geographic and social diversity of the U.S. has created distinctive regional mosaics of landscape and architecture. Say New England and images of English Pilgrims, town greens with white framed churches, and industrial mill villages may come to mind. The Southwest conjures different images, perhaps of adobe pueblos, Spanish friars, arid ranches, and the color turquoise. The built environment of the Midwest, the California coast, the Mississippi Delta, and many places in between reflect particular regional identities that have been both unconsciously and consciously created over time. This course examines the historical development of regional patterns in the American built environment. It investigates how and why a regions architectural identity evolved in the ways that it did. To what degree is place something to respond to, to interact with, and to what degree is place something that is created? Our focus will be primarily pre-20th century when the forces of vernacular traditions were stronger, we will also examine more recent trends of regionalism as an aesthetic choice and a theoretical stance.
Prerequisite: 48-240

48-350 Postwar Modern Architecture and Theory
Intermittent: 9 units
This architectural history lecture course surveys the modern buildings and architectural theory of the post-World War II period. It begins with the cataclysm of WWII and the fundamental shifts it caused on the conception of modernism, technology, cities, and geo-politics. It proceeds to investigate themes such as rebuilding and reconstruction, grand modern masters such as Mies, Kahn, and Le Corbusier, the fascination with technology, megastructures and utopian thought, the need for monumentality, meaning and regional identity, and the dissemination of modernism from corporate America to the third world. It ends with the rupture in modernism associated with the social revolutions and the rise of a post-modern architecture in the late 1960s and early 1970s. The course includes lectures, readings, and discussions to define the unique character of the postwar period, as modernism both reigned supreme, and began to be questioned. Emphasis will be placed on the relationship of buildings to the more general cultural, intellectual, and historical circumstances in which they were created.
Special attention will be devoted throughout the course to the important manifestoes, theoretical and critical writings that so determined the project of modern architecture. Work for the course involves extensive reading, preparing for class discussions, and a major research paper.
Prerequisites: 48-240 or 48-241
with patina, marked from their past use. The presence of history as a layer of complexity embedded in the material of the choices we make as designers. Finally, we will critically engage with reuse had an impact on the built environment in the past, just as they do lifecycles and the networks of extraction, production, transportation, and manipulation, or added to those meanings through their own work. Materials’ craft required to work them. We will reflect on how architects interpreted, intertwined with the social, political and ecological context. In this seminar the course concludes with a final project built around the student’s interest. Prerequisite: 62-126 or permission of the instructor.

Prerequisite: 48-105

48-356 Color Drawing
Intermittent: 9 units
48-356 Color Drawing provides practice in the use of color to depict architectural surroundings. Following preliminary exercises using pastels, watercolor is used for most of the course. A central objective is that by the end of the course, students will have good judgement in evaluating color hue, value, and temperature and gained confidence in use of watercolor. Coursework assumes some knowledge of linear perspective. Work consists of in-class exercises and weekend assignments built on these. Students can expect to spend up to 6 hours of work per weekend.

Prerequisites: (48-126 and 48-121) or (48-130 and 48-135) or (62-125 and 62-126) or (48-125 and 48-120)

48-359 Special Topics: Design Build / Building Systems
All Semesters: 9 units
In this studio we will consider Thoreau’s essay meaning of this about his own design/build experience in today’s context. Collectively, we will design a cabin to meet the high standards of sustainability set by Eden Hall. After a round of prototyping, testing, and design development, the studio will create a set of construction documents and shop drawings. Covid and funding allowing, we will begin building the cabin at mid-term, with construction continuing into the summer or fall as required. This studio has a nine credit co-requisite, 48-358 Cabin Building Systems, which is also open to CEE students. Its focus will be on the building systems for the cabin that is being developed in the parallel studio. Topics include energy performance (e.g. production, renewable energy systems, passive and active ways to achieve efficiency, and modeling); integrated structural and engineering systems (e.g. building envelope, water treatment and management, heating and cooling systems, and electrical and lighting systems); and sensing for monitoring and control. The class will have a team-based format that is hands-on and lab-oriented rather than a seminar structure, and it will contribute directly to the build part of the studio.

48-367 Material Histories
All Semesters: 9 units
Materials affect the way we engage with a building and carry cultural meanings connected with complex histories, deep and at times messily intertwined with the social, political and ecological context. In this seminar we will look at the history of the architecture of the last two centuries by following the thread of the history of materials. We will discuss the ways in which buildings of the past and the practice of architecture were affected by which materials were available, how they were produced, and the craft required to work them. We will reflect on how architects interpreted, manipulated, or added to those meanings through their own work. Materials’ lifecycles and the networks of extraction, production, transportation, and reuse had an impact on the built environment in the past, just as they do today. We will learn from historical examples to assess the consequences of the choices we make as designers. Finally, we will critically engage with the presence of history as a layer of complexity embedded in the material itself - an effect that is compounded in the practice of reuse of materials with patina, marked from their past use.

48-368 Rediscovering Antiquity: Travelers, Archeologists & Architects in Mediterranean
Spring: 9 units
The course proposes a journey in the Mediterranean, with special focus on Greece and Turkey, but also travel through time. In fact ancient cities and archeological sites, from the hills of Troy to the archeological sites of Pergamon and Ephesus, to the cities of Athens and Costantinople/Istanbul, will be studied not so much as signs of the important Greek and Roman past of the region, but as the object of late Eighteenth and Nineteenth century rediscovery. The rich vestiges of the mythical past of this region were then brought to the light, in the frame of complex and adventurous missions. The eyes of scholars, travelers and artists filtered and transformed the reality of the ancient objects and places, adding to their fascination and vitality and changing the way we perceive this legacy today. At the same time though, a new political agenda, new biases and new aims were connected with the rediscovery. These in turn influenced not only the way the past of the region was explored and the way the finds were studied and exposed, but also the cultural debate in the rest of Europe, with important effects on the architecture of the main European cities.

Prerequisite: 48-205

48-369 TERRA COTTA ASSEMBLIES: Cultural Expression and Climate Change
All Semesters: 9 units
This seminar speculative cultures, environment performance, a material like terra cotta can be instrumental in returning cultural expression to the building skin (Picon 2013). The ornamental nature of architectural terra cotta facades can not only move us towards a more sustainable future, but also express our milieu: we created problematic climate futures but as designers we also can envision and propose diverse and alternative relationships to our environment. An exploration of the topics that define the ecological turn and how to manifest them through form, technique, and material will be the focus of the seminar which will culminate in a collective project. The group’s issues of concern that will be manifested in the design of an architectural ceramic assembly may range from the expression of conditions of scarcity, to patterns for biodiversity, or performances of energy flows, to an indexing of climate change, to mention a few. Following the methods of interaction with fabricators and manufacturers often found in practice, we will be working hands on (but remotely) with the techniques and technologies used in contemporary architectural terra cotta design and fabrication. The seminar will engage the Architectural Ceramic Assemblies Workshop -2021 (https://archceramicworkshop.com/), sponsored by regional industry partner Boston Valley Terra Cotta, to expose students to contemporary architectural terra cotta workflows from design concept to production. Through regular engagement with the projects and process of participating architectural firms the seminar will provide students exposure to architecture professionals, facade engineers, ceramics engineers and artists, and glaze experts. In consultation with these the group will develop a prototype to be presented in the upcoming Architectural Ceramics Workshop along with the professional teams.

48-371 City & Suburb: Housing in America after 1850
Intermittent: 9 units
This architectural history course examines the development of American house and housing choices during the period 1850-1975. A recurring picture of the “American Dream” has typically included the image of a single-family, detached dwelling set within its own green yard in the suburbs. However powerful and durable that image is, the history of house and home in America is actually a far more complex story with many different twists and turns. In the course we will look at both urban and suburban housing choices and cultures, ranging from single family detached dwellings to multi-unit housing, and across a social spectrum income, class, race, and gender. Through the use of occasional field trips, we will use Pittsburgh as a touchstone for understanding broader national trends in the history of American urban and suburban housing. The course is organized as a lecture course supplemented with field trips and discussions based on field trips and primary source readings. The additional time slot on Thursday afternoons will be used only when field trips are scheduled. Student work will include a research paper and several shorter written assignments throughout the semester.

Prerequisite: 48-240
48-374 History of Architecture in the Islamic World—A Primer
Fall: 9 units
This course introduces the architectural lands where Islam spread over the centuries. This course aims to provide a basic understanding of major epochs and regional variations. The students will learn the function and meaning of the most important building types, examine how these types changed over time to adapt to the needs of changing societies and consider influences and exchanges with other traditions. They will examine the historical context within which art and architecture developed and explore critically the lingering signs of those traditions on contemporary society.
Course Website: http://soa.cmu.edu

48-380 Real Estate for Architects
Spring: 6 units
This course investigates the real estate development process, both from the point of view of the architect and the point of view of the developer. The primary objective of the course is for students to understand how financial, economic, and political issues may affect their design practices. The course introduces real estate development team members, processes, and phases. Students study the societal context for real estate development including housing issues related to racial segregation and social class. Specific topics include market research, site constraints, and zoning; the course also includes a financial component to introduce students to the basic project budgeting, pro forma analysis, and financial feasibility analysis. Current trends and issues are also addressed.
Course Website: http://soa.cmu.edu

48-381 Issues of Practice
Spring: 6 units
Issues of Practice introduces students to the realm of architectural professional practice, focusing on the overlay of design within the context of the client’s role and the architect’s responsibilities in competent architectural project and practice management. The course will introduce the student to fundamental principles of business planning, risk management and regulatory constraints and legal responsibilities. The class will also explore the expanding professional horizons beyond traditional practice in which the architect’s collaborative, design and critical thinking skills are valuable.
Course Website: http://soa.cmu.edu

48-383 Ethics and Decision Making in Architecture
Intersession: 6 units
This course investigates ethics for architecture and the built environment. Students will learn about ethics as a discipline, how to identify an ethical issue, and how one might work through an ethical problem. Frameworks will be presented with case studies for practice and discussion. On a large scale, we will consider the entanglement of architecture with capital as well as sustainability and climate change. We will also touch upon day-to-day concerns regarding safety, zoning, contracts, material selection, internet of things and workplace discrimination. Reading responses and class discussions are the primary format for learning. Each student will also conduct an ethical assessment of one of their studio projects. Non-architects are welcome.
Course Website: http://soa.cmu.edu

48-386 PORTFOLIO & RESUME PREPARATION (UG)
All Semesters: 3 units
No course description provided.

48-390 Physical Computing Studio
Spring: 10 units
This collaborative studio course will allow interdisciplinary teams to develop wearables with a focus on assistive technology. The ubiquitous nature of mobile devices coupled with low-cost and easily integrated sensors and actuators make this a good time to approach real problems for a range of users from the physically disabled to athletes. Teams will learn skills in hardware, software, fabrication, and design communication in order to effectively develop and share their ideas.
Prerequisites: 60-223 Min. grade C or 16-223 Min. grade C
Course Website: http://ideate.cmu.edu/

48-400 Architecture Design Studio: Praxis Studio 3
Fall: 18 units
Having proven competency in the spectrum of skills determined necessary for tomorrow’s architect during the first three years of the program, students in their fourth and fifth year are permitted to select from a variety of studio options, each providing the opportunity to build upon or augment some of those skills with new or more nuanced perspectives. All advanced synthesis studios are open to both years, the vertical integration offering enhanced learning opportunities. The content and focus of each studio is governed by faculty interests, which run the spectrum of architectural pursuits, ranging in scale from the design of a piece of furniture to a city and in approach from a comprehensive and complex building program to a critically-driven speculation. They may also be interdisciplinary in nature, taking advantage of the unique juxtapositions made possible at Carnegie Mellon.
Prerequisite: 48-305 Min. grade C

48-405 Advanced Synthesis Options Studio II
Spring: 18 units
Having proven competency in the spectrum of skills determined necessary for tomorrow’s architect during the first three years of the program, students in their fourth and fifth year are permitted to select from a variety of studio options, each providing the opportunity to build upon or augment some of those skills with new or more nuanced perspectives. All advanced synthesis studios are open to both years, the vertical integration offering enhanced learning opportunities. The content and focus of each studio is governed by faculty interests, which run the spectrum of architectural pursuits, ranging in scale from the design of a piece of furniture to a city and in approach from a comprehensive and complex building program to a critically-driven speculation. They may also be interdisciplinary in nature, taking advantage of the unique juxtapositions made possible at Carnegie Mellon.
Prerequisites: 48-412 and 48-400

48-409 History and Future of Interaction Design
All Semesters: 9 units
The history of Interaction Design is far richer than what is commonly known among students and teachers, practicing designers and entrepreneurs. Understanding IxD’s origins and evolution helps us realize the promises and possibly avoid some of the pitfalls of IxD’s future. This course blends readings, lectures, discussions, and prototyping as a means for students to experience this history as if first-hand. Students become immersed in pragmatic yet mind-expanding examples of person-machine interaction such as MEMEX, Musicolour, Hypertext, Dynabook, Fun Palace, Collogy of Mobiles, Architecture Machine, THOUGHTSTICKER, Architrainer, and Hypercard. Through period articles and subsequent perspectives, students research a handful of historical innovations and then prototype key concepts from that history, forewarning what has been lost in modern commercial implementations. This offers students a hands-on experience of the history of IxD. To explore IxD’s future, students are invited to invent its prototype their individual future vision of interactive experiences. The course is especially suitable for students with interest or background in interaction design, computational design, responsive architecture, and interactive media.

48-410 Advanced Synthesis Options Studio II
Spring: 18 units
Course Description coming soon.
Prerequisite: 48-305 Min. grade C

48-432 Environment II: Design Integration of Active Building Systems
Fall: 9 units
High-performance buildings are achieved with designs that effectively integrate passive and active systems. Having been introduced to passive systems in prior semesters, students in 48432/48655 will focus on the active systems typically included in commercial buildings and strategies for their successful integration with passive components. The goal of the Design Integration of Active Building Systems course is to familiarize students with active building systems and integrative design strategies that should result in high levels of occupant comfort in commercial buildings that, in the US, are moving toward net zero energy and net zero carbon emissions. Active systems introduced in this class include: Electric lighting, Mechanical ventilation, Active heating and cooling, Water systems for interior and exterior use, and Water heating, including solar Onsite electricity generation with renewable energy. Building transportation systems, Active fire protection and smoke control. Because of the breadth of this subject area, the course will be future-focused, concentrating on design approaches and technologies that appear to be well-suited to a net zero energy and net zero carbon future.
48-435 Modern Mexico & Guatemala: 19th-21st Century Architecture
All Semesters: 9 units
This course examines the architectural history of modern Mexico and Guatemala, with an emphasis on the 20th century, but drawing on the 19th and 21st centuries as well. We will use architecture as a lens through which we study how both the high-style design vanguards and the vernacular built environment were responses to forces such as industrial modernization, urban growth, economic fluctuation, international relationships, political and social revolution, indigenous discrimination, genocide, and cultural regeneration. Throughout the course we will look at the countries' urban and rural architectural evolution as explicit and implicit expressions of identity (Mexicanidad or Guatemalanidad).
Course Website: http://soa.cmu.edu

48-448 History of Sustainable Architecture
Intermittent: 9 units
The History of Sustainable Architecture investigates themes of nature, ecology, pollution and conservation in the built environment and visual arts. The term "sustainable architecture" is a comparatively recent concept, arising in reaction to the destructive and toxic nature of the industrial era and its strident ambassador, Modern architecture. Yet, an esthetic and philosophical view of harmony with nature accompanies many forms of historical human activity in the built environment. Similarly, issues of waste removal, mechanical systems and natural materials that characterize current concerns have illustrative historical roots in numerous civilizations going back centuries and even millennia in pre-industrial or non-industrial cultures. This course will engage texts and examples related to architecture, landscape and urban history, but also art, philosophy and popular culture as a means to understand the many precedents for today's interest in sustainable architecture and planning. The course will examine texts and works by figures including Vitruvius, Pirny, Leon Battista Alberti, Thomas Cole, Frederic Law Olmsted, Buckminster Fuller, Reyner Banham, Ebenezer Howard, Hassan Fathy, Bernard Rudofsky, Norman Foster, Robert Smithson, Andy Goldsworthy and more. Students will be encouraged to apply principles from the class to understanding and execution of work in their own discipline.

48-454 Futures of the City/Cities of the Future
Intermittent: 9 units
All Semesters: 9 units
This course will introduce the Real Estate development process and explore the interdependence of development drivers and the design process. Classroom learning, exercises and guest-lectures will introduce students to the concepts of market and financial analysis, as well as the basic techniques of budgeting, proforma development, and valuation. Parallel to this investigation, students will evaluate real world developments and interface with the development professionals that executed them to learn how development drivers shaped the development process and decision making. Students will study how market demand, tenant requirements, site constraints, and available capital affect feasibility, and through this the ultimate design solution. The semester's effort culminates in the execution of a mini-development project. Students will work in teams to complete a basic market analysis, program evaluation, schematic design, construction and development cost estimate, proforma analysis, and a determination of financial feasibility. Development practitioners will interface with student teams during this mini-project to offer "real world" guidance on student schematic designs and feasibility analysis.
Prerequisite: 48-305

48-453 Urban Design Methods
Fall: 6 units
This undergraduate lecture course introduces urban design history, theory and methods. It is a required supporting course for the Urban Laboratory design studio, and similarly examines urban design at multiple scales: city form and networks, neighborhoods and block structures, streets, public spaces, and urban building typologies. Key issues introduced include the emergence and evolution of urban design as a discipline, economic, social and political factors affecting the contemporary city, and environmental sustainability at the urban scale. A wide variety of cities, projects, proposals and methodologies are examined. Assignments include readings from seminal texts, quizzes, and a final examination.
Prerequisite: 48-305

48-454 Futures of the City/Cities of the Future
Intermittent: 9 units
All Semesters: 9 units
If all design can be read as attempts to predict and to shape the future, then no one looks further into the future than the urban designer and the urban planner. The work in which they are involved often does not materialize in their lifetimes; in fact, the duration of the projects are so long twenty, thirty, fifty and hundred year timeframes, it is more than likely that he or she will pass on before the project reaches fruition. The trouble with predicting the future is that it is so uncertain, so undecided, so unknowable. A brief look backwards reveals that we are not the first generation to consider the future. History is replete with predictions, some of which were actualized, the vast majority of which were not. Today's forecasts for tomorrow vary wildly. A handful of optimists view the future through rose colored glasses, whereas humanity is delivered to salvation via technological wonders and the widespread adoption of common social values. A larger group predicts the end of the world as we now know it, but even they cannot agree on the cause of our demise, with those arguing that climate change will kill us comparing those who believe that we will destroy ourselves via robots and achieve technological singularity. Shy of total extinction, however, any vision of the future requires designers, and will likely occur in urban (or formerly urban) locations. As of this decade, for the first time in history, more than half of the world's population, almost three and a half billion people, live in towns and cities. Estimates suggest that by 2030 this number will swell to almost five billion.
Prerequisite: 48-205
48-459 Material Simulacra
All Semesters: 9 units
This fabrication-based course interprets Jean Baudrillard’s ideas of “panic-stricken production of the real and the referential, above and parallel to the panic of material production.” Serial mold-generated surface studies activated by material properties, behavior, intuition, and expression ask how our perceptions of the real is mediated by language of the made artifact. Structured as the tripartite investigation: Theory/Research/Craft, this seminar’s pedagogy is centered on the cultural, historical, ethical, aesthetic and tectonic values of architectural materialism to arrive at an awareness of what a material conveys. Analog and digital techniques and simulations engage the technological and intellectual roles of the crafts-person.
Course Website: http://soa.cmu.edu

48-467 Design Build Elective
Spring: 9 units
In this course, students will work on an interdisciplinary, design-build project to improve the quality of life through design interventions on campus. The semester will begin with a review of design proposals developed during the Fall semester, and through a collaborative process the class will determine what can be built given budgetary and workforce constraints. Students will complete construction documents, develop project management plans, build full scale prototypes, procure materials, and construct the designs.
Course Website: http://soa.cmu.edu

48-470 The Depth of Surface
Fall: 9 units
Lamination is the process of gluing wood together along the edge or face of a plank. There is unlimited variety in the ways to do this and to generate pattern in the process. This course will prescribe a few basic ways to laminate following standard rules of wood working and then introduce the possibilities of pattern generation. Generally lamination is unidirectional, however, in this class we will introduce ways to achieve cross directional patterning and the use of inlay to elaborate on the idea of patterning. Projects will be visual and sculptural statements. Their function will be limited and will not be furniture. Each exercise will present a series of basic wood working operations, which, when repeated and recombined will become products of compelling visual character. As visual idea statements you will be asked to experiment, invent and explore and take these standard operations in new directions. As visual idea statements the greatest clarity of vision will be achieved through careful construction.

48-473 Hand and Machine Joinery, New Directions
Fall: 9 units
In the Fall 2017 and Spring 2018 there will be some changes to the shop electives offered. First the Spring Furniture Design and Construction course #48564 will no longer be offered because that content is incorporated within the Furniture Studio in the fall. Next, the two shop mini courses previously offered in the fall will each be expanded to become full electives, one in the fall and one in the spring. The prerequisite for both of these classes is documentable experience with the band saw, table saw (ripping and crosscut), drill press and the belt and disk sander. The Hand and Machine Joinery, New Directions, is scheduled Tuesday and Thursday mornings 10:30 am to 11:50 in the spring 2018, and will be a 9 unit elective running the entire semester. The elective will focus on building a free standing (or hung) cabinet with doors. If enrolled students have taken the Exploring Pattern course in the fall the doors made in that class will be mounted on the cabinet. If students have not taken that course then a pair of simple doors will be made instead. The primary goal of this course will be to learn the steps of making a simple cabinet using hand and machine joinery. Quality of craft will be of great importance. Uniqueness of design will not be emphasized, however individuation of the cabinet will still be possible throughout the construction, starting with choices between a wall mounted or free standing (with legs) cabinet, the selection of hardwoods, the specific size of parts, and the selection of particular detail options. The construction process will be carefully staged with demonstrations continuing throughout the semester. The cabinet will be perpendicular and rectangular. Students will use standard mortise and tenons of various sizes, bridled joints, floating tenons, tongue and groove, spline and dovetail joints.

48-478 Digital Tooling
All Semesters: 6 units
This course serves as an immersive analysis of the available technologies located in the Digital Fabrication Lab at Carnegie Mellon and beyond. Students begin to understand equipment limits/boundaries, purposes and concepts; and the possibilities that arise from thoroughly comprehending how these tools work. During your Digital Experience, students begin to understand more systematically how to use these tools to their advantage. A better understanding of the equipment proves very useful towards a SoArch Student’s 3rd, 4th and 5th years at Carnegie Mellon; but more importantly provides a fundamental understanding of a leading edge technology that will certainly prove itself as an integral tool for any Designer throughout their professional career. It is based on the idea that pushing the limits of design fabrication; comes from knowing the limits of your tools. The course operates by discovering tooling extremes; thus indicating limits, and then incorporating these boundaries (and/or breaking them) with Digital Fabrication methods and tooling; ultimately providing a platform in which students begin to understand and incorporate project efficiency. Prerequisites: Imagination, Laser Cutting, Milling and 3D-Modeling Experience required. Prerequisite: 48-205

48-493 Representing Activism
Intermittent: 9 units
Efforts to promote social, political, economic and environmental change range in form from written word to direct action. Sources of injustice that those efforts address are multi-dimensional and complex. Effective forms of activism are fueled by creativity that synthesize and distill complex constellations of information and foster understanding. REPRESENTING ACTIVISM explores the role of multi-media graphic representation as a lens through which change and social justice can be fostered. Exploration of efficacy in application will span four dimensions, 1) Social Media, 2) Film, 3) Poster/Graphic Design, and 4) Publication - all aspiring to achieve the status of art. Art and Activism are predicated on exposing the truth. Art has the unique power to convey messages across linguistic and cultural barriers that often divide. Part of the Activist’s challenge is to grip and inspire people to action. With the avalanche of information and media modern society absorbs every day, this is increasingly hard to do. Sometimes it is too much to ask people to stop and think: sometimes it’s too much just to ask them to stop. Successful art compels this, penetrating apathy and imploring the viewer to look deeper and explore the narrative that is embedded in what elicited a visceral response. This seminar aspires to compel action in the public interest through artful representation.

48-494 Beyond Patronage
Intermittent: 9 units
TBD

48-497 Pre-Thesis
Spring: 3 units
This 3 unit course is designed for B.Arch and M.Arch students a year before their final Spring semester. The course develops an understanding of research methods, and explores the formation of ideas for architecture thesis projects. Many directions of architectural thinking (spatial, material, ideological and procedural), will be discussed and in framing a theoretical position you will see how an architecture thesis can use a creative process to discover and express findings in relation to large questions and disciplinary discussions. This is a required course for Fall Thesis Seminar in F22 (9units) and Spring Thesis ASOS (18units).
Course Website: http://soa.cmu.edu

48-500 Advanced Synthesis Options Studio
Fall
Having proven competency in the spectrum of skills determined necessary for tomorrow’s architect during the first three years of the program, students in their fourth and fifth year are permitted to select from a variety of studio options, each providing the opportunity to build upon or augment some of those skills with new or more nuanced perspectives. All advanced synthesis studios are open to both years, the vertical integration offering enhanced learning opportunities. The content and focus of each studio is governed by faculty interests, which run the spectrum of architectural pursuits, ranging in scale from the design of a piece of furniture to a city and in approach from a comprehensive and complex building program to a critically driven speculation. They may also be interdisciplinary in nature, taking advantage of the unique juxtapositions made possible at Carnegie Mellon.
Prerequisite: 48-410

Course Website: http://soa.cmu.edu
48-505 Advanced Synthesis Options Studio III
Spring: 18 units
Having proven competency in the spectrum of skills determined necessary for tomorrow's architect during the first three years of the program, students in their fourth and fifth year are permitted to select from a variety of studio options, each providing the opportunity to build upon or augment some of those skills with new or more nuanced perspectives. All advanced synthesis studios are open to both years, the vertical integration offering enhanced learning opportunities. The content and focus of each studio is governed by faculty interests, which run the spectrum of architectural pursuits, ranging in scale from the design of a piece of furniture to a city and in approach from a comprehensive and complex building program to a critically-driven speculation. They may also be interdisciplinary in nature, taking advantage of the unique juxtapositions made possible at Carnegie Mellon.
Prerequisite: 48-105

48-509 Architecture Design Studio: Thesis I/ Independent Project
Spring: 18 units
This is a year-long, independently defined research and design project that takes the place of upper level option studios. Thesis is an opportunity to develop skills, thoughts, and habits essential for future success, including mental discipline; independence of mind and judgment; working with advisors; the capacity to focus and pursue a subject in depth and over an extended time; the ability to design and execute a complex project; the skills of analysis, synthesis, and clear writing; and the self-confidence that grows from mastering a difficult challenge. Thesis topics and research agendas are generated by the student, but must be determined in collaboration with an advising team, and approved by a Thesis Coordinator. The School seeks to encourage an expansive range of rigorous and provocative inquiry as a culminating experience for the B.Arch education, including work that speculates, invents, or improves on existing ideas, practices, or systems through research and design; work that challenges the boundaries of the discipline and the profession, and moves beyond mere practice or solution-based work; work that engages with open-ended and generalizable ideas, as much as with specific situations; work that projects or imagines a better future and an improved world; work that leads to generalizable ideas, as much as with specific situations; work that takes the place of upper level option studios. Thesis is an opportunity to develop skills, thoughts, and habits essential for future success, including mental discipline; independence of mind and judgment; working with advisors; the capacity to focus and pursue a subject in depth and over an extended time; the ability to design and execute a complex project; the skills of analysis, synthesis, and clear writing; and the self-confidence that grows from mastering a difficult challenge. Thesis topics and research agendas are generated by the student, but must be determined in collaboration with an advising team, and approved by a Thesis Coordinator. The School seeks to encourage an expansive range of rigorous and provocative inquiry as a culminating experience for the B.Arch education, including work that speculates, invents, or improves on existing ideas, practices, or systems through research and design; work that challenges the boundaries of the discipline and the profession, and moves beyond mere practice or solution-based work; work that engages with open-ended and generalizable ideas, as much as with specific situations; work that projects or imagines a better future and an improved world; work that leads to the new knowledge, ideas, understanding, or paradigms. Acceptance into Thesis is dependent on passing the 48-497 Thesis Prep course or its pre-approved equivalent, and submitting a rigorous thesis proposal to the Thesis Coordinator in late August, before the begin of classes. Approval for the 2nd semester is contingent upon successful completion of the 1st.

48-510 Advanced Synthesis Options Studio IV
Spring: 18 units
Course description coming soon.
Prerequisites: 48-400 Min. grade C or 48-410 Min. grade C

48-516 NOMAS
All Semesters: 3 units
TBD
Prerequisite: 48-105

48-519 Architecture Design Studio: Thesis II/ Independent Project
Spring
This is a year-long, independently defined research and design project that takes the place of upper level option studios. Thesis is an opportunity to develop skills, thoughts, and habits essential for future success, including mental discipline; independence of mind and judgment; working with advisors; the capacity to focus and pursue a subject in depth and over an extended time; the ability to design and execute a complex project; the skills of analysis, synthesis, and clear writing; and the self-confidence that grows from mastering a difficult challenge. Thesis topics and research agendas are generated by the student, but must be determined in collaboration with an advising team, and approved by a Thesis Coordinator. The School seeks to encourage an expansive range of rigorous and provocative inquiry as a culminating experience for the B.Arch education, including work that speculates, invents, or improves on existing ideas, practices, or systems through research and design; work that challenges the boundaries of the discipline and the profession, and moves beyond mere practice or solution-based work; work that engages with open-ended and generalizable ideas, as much as with specific situations; work that projects or imagines a better future and an improved world; work that leads to the new knowledge, ideas, understanding, or paradigms. Acceptance into Thesis is dependent on passing the 48-497 Thesis Prep course or its pre-approved equivalent, and submitting a rigorous thesis proposal to the Thesis Coordinator in late August, before the begin of classes.
Course Website: http://soa.cmu.edu

48-524 Building Performance Modeling
Fall: 9 units
The BPM course focuses on conceptual foundations and practical applications of advanced and integrated whole-building energy simulation programs with emphasis on architectural building envelope systems, mechanical electrical building systems and their controls (electric lighting and HVAC systems) and building integrated solar photovoltaic power systems. Students are engaged in project-based collaborative studies with emphasis on analytical methods of simulation-aided high-performance building design. Theoretical lectures and software demonstrations are supported with discussions of relevant building case studies and particular design solutions which exhibit an innovative character with the application of whole-building energy simulations in the evaluation and improvement of the total building performance starting from early stages of design development.
Prerequisite: 48-305 Min. grade C
Course Website: https://omerkaraguzelphd.wixsite.com/praxismodeling

48-525 Thesis Seminar
All Semesters: 9 units
This seminar is designed to prepare students planning to work on a thesis project in the B.Arch and M.Arch programs. Thesis work is highly self-directed and requires a level of metacognitive thinking, which includes identifying a valid area of concern, understanding the disciplinary discourse around a chosen topic, situating it within its cultural and social context, identifying the means and methods to implement the project, and establishing the criteria by which to evaluate the work. This course is structured around the individual effort required to advance these aims. You will enter this course with an initial thesis statement, a body of background research related to your topic, and a set of questions that can be interrogated by engaging in research and discussion. The seminar will help you refine the scope of the thesis argument, define appropriate research methods, sharpen communication about thesis work in all of its phases. In addition, it will facilitate group conversation and exchange of ideas, providing dialogue, feedback, and continued motivation. The collective engagement of all seminar participants, in addition to individual conversations and targeted feedback from the instructor, will support your sustained progress.

48-527 5th-Year/Senior Seminar
Intermittent: 3 units
Seminar for students graduating from the Bachelor of Architecture and Bachelor of Arts in Architecture programs.
Course Website: http://soa.cmu.edu

48-528 IDeATe: Responsive Mobile Environments
Intermittent: 9 units
As part of this project-based course, we'll get hands-on with emerging technologies, concepts and applications in the Internet of Things through a critical lens. We'll prototype everyday intelligences and design smart and connected devices that examine and speculate on the strange, supernatural, and mystic qualities of the smart home. The first half of the semester will introduce students to building connected devices and intelligent spaces through technical development workshops, readings, applied explorations, and guest lectures. The second half of the semester will be organized as an applied collaborative project.
Course Website: http://daraghbyrne.me/teaching/responsive-mobile-environments/

48-530 Human-Machine Virtuosity
Spring: 12 units
Human dexterity embodies a wealth of physical understanding which complements computer-based design and machine fabrication. This project-oriented course explores the duality between hand and machine through the practical development of innovative design and fabrication systems. These systems fluidly combine the expressivity and intuition of physical tools with the scalability and precision of the digital realm. Students will develop novel hybrid design and production workflows combining analog and digital processes to support the design and fabrication of their chosen projects. Specific skills covered include 3D modeling (CAD), 3D scanning, algorithmic geometric modeling, digital and robotic fabrication (additive and subtractive manufacturing), motion capture and computer based sensing, and human-robot interaction design. Areas of interest include architecture, art, and product design.
School of Architecture Courses

48-531 Fabricating Customization: Prototype
Intermittent: 9 units
While architects continue to develop their work principally through mediated environments of viewing and modeling, computational design and fabrication methods afford opportunities to bolster design processes through the infusion of physical and virtual prototypes. More than a large model or mere three-dimensional rendering of form, the prototype is a testbed and instrument of design projection. The prototype brings with it the physical instantiation of design ideas at larger scale and in actual materials to provide the designer with the feedback of material qualities and performance. The prototyping process is a potential vehicle for discovery in which affordances of fabrication processes and unanticipated results expand the realm of possibilities and challenge assumptions of linear design to fabrication processes. The course places great emphasis upon the reciprocity of design and prototyping, challenging students to leverage physical artifacts as tools for thinking. Prototyping is a means of exploration, not merely a method of production or fabrication. Selecting an architectural condition from a previous design project, students utilize modeling, prototyping, and simulating to develop a detailed architectural element. Students produce a series of versions of their architectural element culminating in a final prototype and collection of digital representations. The course is structured as two modules. Module 1 provides a historical and theoretical background of digital fabrication in architecture, while asking students to identify significant references related to their architectural element, its potential material makeup, construction system, and fabrication process(es). Module 2 operates as a laboratory/workshop in which students produce a comprehensive collection of models, material tests, simulations and prototypes using both digital and analog methods of fabrication.

48-541 The Cut, The Beach and Beyond
All Semesters
The Cut, The Beach and Beyond will be a FALL design elective with a SPRING build option studio working with Campus Design and Facility Development, the Department of Civil and Environmental Engineering and campus constituents to improve the quality of life through design intervention(s) on campus.

48-543 Landscapes of the Anthropocene
All Semesters: 9 units
This seminar will question how we perceive, define, represent, construct, and reconstruct our world in relation to evolving concepts of “nature” and their manifestation in art, architecture, and landscape architecture. Focused on the intellectual trajectories that address ecology and environment to arrive at an understanding of the paradigm shift that theoretician Donna Haraway has termed natureculture, the class will familiarize itself with historical ways of seeing and consider the formulation of the landscapes of the Anthropocene. We will address the role of creative agents and environmental critics, notions of care and stewardship, and traditional and emergent cultural constructs that can define an eco-centric practice and shape building futures.

48-545 Design Fabrication
Spring: 9 units
Digital Fabrication is a project based seminar exploring the application of Computer Aided Manufacturing (CAM) in architecture. The course meets in the School of Architecture’s Design Fabrication Lab (dFab), which serves as a context to better understand the interconnected affordances of building materials, machine processes, and modeling software for design thinking. The course focuses on Transdimensional Fabrication, a manufacturing framework that foregrounds design thinking across space and time. A growing array of approaches in contemporary architecture are motivated by this focus (e.g. flat pack, 4D printing, metamaterials, kinetic architecture, robotic origami, design for disassembly). We will investigate Transdimensional Fabrication concepts through three projects that explore translations between 2D, 3D, Space Time, Assembly Reconfiguration Disassembly.

48-550 Issues of Practice
Fall: 9 units
Issues of Practice is a required course taught in the fifth year. It consists of three modules: Personal Promotion, Emerging Professional’s Companion, and Excursions. The Personal Promotion module provides the students with a framework to create a resume, cover letter, and portfolio. The EPC (Emerging Professional’s Companion) provides concentrated study in different aspects of professional practice. The Excursions require students to see how architecture relates to the wider world with architecturally related events that can include volunteer opportunities, lectures, mentorship, or teaching.
Prerequisite: 48-305

48-551 Ethics and Decision Making in Architecture
Spring: 9 units
Ethical Decision Making in Architecture is a required course in the fifth year of the Bachelor of Architecture Degree. It is part of a sequence dealing with professional aspects of the field of architecture, alongside courses like Human Factors, Real Estate Design and Development, and Issues of Practice. It builds on an understanding of the issues of occupancy, economics and practice in design decision making. The course covers basic frameworks of decision making and ethical adjudication through several case studies including Fallingwater, Sydney Opera House, Citicorp Tower, Pruitt-Igoe housing development, Crystal Palace and Kansas City Hyatt. The text for the course is a manuscript by the instructor entitled "Ethical Decision Making in Architecture".
Prerequisite: 48-205

48-554 Entangled: Remaking Nature from the Picturesque to the Hypernatural
All Semesters: 9 units
This seminar questions how we perceive, represent, and reconstruct our world in relation to evolving concepts of “nature” and their manifestation in architecture, art, and landscape. It is focused on the intellectual trajectories that define ecology and environment to arrive at the paradigm shift theoretician Donna Haraway has termed natureculture. We will first familiarize ourselves with historical ways of seeing “nature” and how this has formed the landscapes of the Anthropocene. This will help us put a critical lens on land, environmental and ecological art, ecoscenics, architectural living systems, biomimicry, biophilia, and projective ecologies while we consider the influence of gardens, responsive landscapes, hypernatures, and artificial ecologies in changing the way we design and build. We look for not only relevance but joy and beauty in practices that highlight the relation between desire, responsibility, more-than-human wellbeing, and ecological justice. This may help us build notions of care and stewardship and an understanding traditional and emergent cultural constructs that can define an eco-centric practice which shapes building futures. The course surveys texts from a range of topics including ecological aesthetics, architecture, art, landscape urbanism, and ecologically focused philosophy and theory. It includes weekly readings, discussions, presentations, and visual or written deliverables. Open to graduate and undergraduate students in Architecture and allied fields.

48-555 Introduction to Architectural Robotics
Spring: 9 units
This course provides an introduction to industrial robotics and automated fabrication within the field of Architecture. A series of lectures will cover the basic components, as well as their work flows, needed to design flexible automation - while work sessions will develop skills in hands-on programming, RAPID, work flow simulation, fixtures, and sensors. We will also issue competency-building projects within the lab environment in order to provide students with hands-on experience using the equipment. Upon covering the fundamental software and hardware content, an end-of-semester project will challenge you to apply your newfound knowledge to solve a final prompt. This is a portal course to all sanctioned coursework using the School of Architecture’s Robotic Fabrication Lab. Upon successful completion, students will be eligible and prepared to enroll in advanced robotic fabrication courses.

48-557 Formless as an Operation
All Semesters: 9 units
This seminar focuses on the formless as an operation relative to social constructs, parametrics and aesthetics. Geometry is often thought of as a rational or a structure that secures and grounds things, however the structures of the built environment is an unfolding and indeterminate product. Social constructs can be defined as formless or the informal, as coined by George Bataille; an operational existence. Within social and political space, traditions become spatial operators. How can we spatialize and draw traditions, rituals, and narratives? We will investigate the means and methods of representation relative to the formless and the built environment.

48-558 Reality Computing
Fall: 12 units
Reality computing encompasses a constellation of technologies focused around capturing reality (laser scanning, photogrammetry), working with spatial data (CAD, physical modeling, simulation), and using data to interact with and influence the physical world (augmented reality / virtual reality, 3d printing, robotics). This semester the studio will focus on utilizing these technologies to capture places and objects to digitally recreate them as archives, artifacts, and interactive experiences. We will explore and analyze how to optimize these creations for real-time rendering and analyze how these platforms bridge the divide between “virtual” and “real."
48-560 Histories of Urban Design  
**Fall: 9 units**  
Cities are manmade artifacts, created for a purpose. In this course we will examine various histories of the design and redesign of cities and the reasons for these interventions. The scale of urban interventions varies greatly, from the macro-scale of designing totally new cities to the micro-scale of altering individual nodes within a city. We will explore the relationship between form and culture by considering the theoretical, social, political, economic, and aesthetic forces that have shaped urban spaces (streets, squares, public realm, housing). Our focus will be on recognizing and understanding the rationale behind the design and use of culturally important urban spaces during their own time, with periodic forays into the issues that influence those spaces today.

48-564 Furniture Design & Construction  
**Spring: 9 units**  
This course is for students who already have a basic knowledge of hand tools and machines, and standard fabrication methods. Wood is the primary material, although other supplemental materials are permitted. One functional project will be built during the semester. Because all the equipment in the shop is traditional analog, the fabrication will remain analog. All operations will be done with hand tools or machines operated and controlled by hand. The emphasis of the design phases will also be non-digital. However recognizing the versatility of CAD, students will be permitted to advance and refine their ideas using their computer. One full scale orthographic drawing by hand will still be required, including plan, elevations, sections, and dimensions on 1/8” ply or mdf.  
Prerequisites: 48-105 and (48-470 or 48-473)

48-568 Advanced CAD, BIM, and 3D Visualization  
**Fall: 9 units**  
This course is designed to introduce a student to 3D software tools, including AutoCAD 3D, Revit Architecture, and 3D Studio MAX. Building information and parametric modeling, materials, lighting, rendering, and animation concepts allow students to create integrated CAD/BIM projects, 3D video animations, and realistic renderings. At the conclusion of this course, students will have projects and animations created and architectural CAD/BIM standards outlined. Students should have some familiarity with basic AutoCAD 2D commands. Those who don’t have AutoCAD 2D knowledge can contact the professor to arrange for on-line tutorials that need to be completed before classes begin.  
Prerequisite: 48-305

48-569 GIS/CAFM  
**Spring: 9 units**  
A geographic information system (GIS) provides storage, retrieval, visualization, and analysis of geographically referenced data. GIS provides unique analytical tools to investigate spatial relationships, patterns, and processes of cultural, biological, demographic, economic, social, environmental, health, and other phenomena. GIS creates digital twins (virtual representations) of natural and built environments and uniquely integrates many types of digital models including CAD, BIM, and CAFM. Computer Aided Facilities Management (CAFM) and Integrated Work Management (IWMS) technologies streamline facility operations, boost productivity, and develop strategic planning goals for an organization. Facility and infrastructure management technologies improve the integration of the physical workplace with the people and work of an organization. The course includes in-person and asynchronous video lectures to learn important GIS concepts. Software tutorials and in-person/remote technical sessions cover leading GIS software from Esri Inc. Applications include ArcGIS Pro, ArcGIS Online, ArcGIS Map Viewer, ArcGIS Story Maps, and Dashboards. CAFM/IWMS software will be reviewed.  
Prerequisite: 48-205  
Course Website: http://soa.cmu.edu

48-576 Mapping Urbanism  
**Intermittent: 9 units**  
This seminar provides the critical tools necessary to examine the city as both a representation and a reality in flux. Through an interdisciplinary framework, students study urban history, theory, visual thinking and spatial mapping. Contemporary urban issues are introduced through weekly lectures, readings, and class discussions. Parallel to these urban explorations, students learn to employ a diverse set of representational techniques to create inventive mappings. Upper-level (300 and 400 level) undergraduate students and graduate students are encouraged to register.

48-587 Architecture Lighting Design  
**Intermittent: 9 units**  
Through hands-on exploration of light, lecture, and discussion, students will develop a design process for lighting people and architecture. Topics will include the role of the architectural lighting designer in the collaboration process, establishing design goals and a lighting point of view, communicating design ideas, analyzing successful lighting design in case studies for interior and exterior applications, and becoming familiar with the technical tools of lighting design. The final design project will include lighting mock-ups of a building site.  
Prerequisite: 48-105  
Course Website: http://soa.cmu.edu

48-596 LEED Buildings and Green Design  
**Spring: 6 units**  
Green building and sustainable design have been rapidly gaining acceptance in all sectors of the building market. Global issues of energy use, emissions, resource depletion, and land use are forcing building professionals to re-evaluate standard design and construction processes, and look to more environmentally friendly practices. The U.S. Green Building Council (USGBC) developed green building rating systems entitled Leadership in Energy and Environmental Design (LEED) in order to define “green building” by establishing a common standard of measurement. LEED considers green building methods and technologies in several categories including site, water, energy, materials, and indoor air quality, and awards points towards an overall green building rating of certified, silver, gold or platinum. Currently, LEED registered projects make up 3% of the current U.S. commercial building market, and Pennsylvania is the third leading state with LEED registered projects. There is now a demand for design professionals with knowledge and experience not only in sustainable design but specifically with the LEED rating system as well. This course will provide students with background knowledge of the USGBC, the LEED system, as well as referenced standards related to specific topics. The course will benefit greatly from the large number of LEED projects in the Pittsburgh region, which will serve as case studies. Upon completion of the course, students will be prepared to take the LEED Professional Accreditation Exam, which is quickly becoming the standard of recognition for green building professionals.  
Prerequisite: 48-315

48-613 Kala Visiting Faculty Elective  
**All Semesters: 9 units**  
Coming Soon.

48-614 Thomas Visiting Faculty Elective  
**All Semesters: 9 units**  
Coming Soon.

48-621 Beyond the Building's Footprint  
**All Semesters: 9 units**  
This project-based seminar explores the use of machine learning and other software to create a speculative future for Braddock, Pennsylvania, a town just nine miles outside of Pittsburgh. To be mindful of the areas history and our engagement with it, we will study the work of LaToya Ruby Frazier to understand the social and ecological effects of steel extraction, emission, and construction. Frazier builds a visual archive of the intersection of the steel industry, the environment, and the human body, describing her work as excavations of hidden histories, from the micro to macro level. Students are encouraged to collect data using photography, film, record sounds, 3D scanning, and taking drone footage of the site. The workflow will deploy generative adversarial neural networks, various 3D modeling, and rendering software. Students will produce a short animation for the final deliverable. The seminar welcomes students with little or no experience with computation and those with more experience.
48-625 Thesis Seminar
Fall: 9 units
This seminar is designed for students planning to work on a thesis project in the M.Arch program and is intended to prepare students for a semester long, studio-based thesis project in the following Spring. You will enter this course with a written thesis statement, a body of background research related to your topic(s), and an initial set of questions that can be interrogated by engaging in research and discussion. Your continued progress is supported by the collective engagement of the seminar participants and the structure provided by course assignments and deadlines, in addition to individual conversations and targeted feedback from the instructor. The seminar focuses on refining the scope of the thesis argument, defining the methods to make the topic(s) of inquiry actionable through design-based methods, and sharpening the communication about thesis work in all of its phases. Thesis work is highly self-directed and requires a level of metacognitive thinking, which includes identifying a valid area of concern motivating the work, understanding the disciplinary and societal context for the project, identifying the means and methods for acting, and establishing the criteria by which to evaluate the work. The course is structured around the individual effort required to advance these aims. In addition, it facilitates group conversation and the regular exchange of ideas, providing dialogue, feedback, and continued motivation.

48-630 M.Arch Studio: Praxis 1
Fall: 18 units
TBA
Course Website: https://soa.cmu.edu/march

48-631 Fabricating Customization
Fall: 9 units
To be created by the department
Prerequisite: 48-205

48-634 Architectural Theory & Contemporary Issues
Fall
This graduate history and theory seminar starts with the conviction that Architecture is not only space, materials, technology, structure, form, program, site... but also culturally constructed discourse, meaning, communication, concept, and debate: or theory. Architects must draw from other disciplines, distinguish multiple positions on any issue, take a stance, act on, and be able to discuss, debate, and defend their ideas. The course will begin with the fundamental questions: What is theory in architecture? How has our understanding of architecture and theory evolved historically to get to this point? How will it continue to transform into the 21st century? Where is architecture going? Students will discover how architectural ideas and theories evolve and reoccur, and even the oldest theories have contemporary relevance. The topics covered will vary from year to year to acknowledge the dynamic nature of the program, profession, environment, and global context. The work of the seminar will focus on readings, weekly presentations and discussions about the sources, and a research paper on a theoretical aspect of architecture that might lead to a thesis or grant proposal.

Course Website: https://soa.cmu.edu/march

48-635 Environment I: Climate & Energy
Fall: 9 units
This course introduces architectural design responses for energy conservation, human comfort, and the site-specific dynamics of climate. Students will be expected to combine an understanding of the basic laws of comfort and heat flow with the variables of local climate to create energy design guidelines for their own work. The state of the art in building energy conservation and passive heating and cooling technologies will be presented, with take-home readings and assignments. To stress the significance of architectural design decision-making for energy consumption and comfort, full design specifications and calculations will be completed for a residential-scale building. Students will compile a professional energy consultant's report, designing the most viable energy conservation retrofit measures for their client from siting, massing, organization, enclosure detailing, opening control, to passive system integration and management. An overview of world energy consumption in buildings and energy design standards will be challenged by lectures on building energy conservation successes, and emerging demands for a broader definition of sustainability. The course will end with a focus on the design integration of natural conditioning systems and the potentially dynamic interface of mechanical systems in small- and large-scale buildings.

Course Website: https://soa.cmu.edu/march

48-636 Architecture & Agency
Spring: 9 units
Coming Soon

48-637 Structures/Statics
Spring: 9 units
We examine structural types, structural behavior, material behavior, and construction constraints that underlie our design of buildings, emphasizing the need for a designer to envision a complete 3-D structure. We mostly build "orthogonal structures" constructed in horizontal and vertical planes, requiring high-strength modern materials such as steel or reinforced concrete, comprising roughly 75-80% of the course. This is complemented by "geometric structure" where the three-dimensional shape dictates function; prominent examples include membranes, cable nets, historic masonry domes, and shells. Geometric structure is characterized by "form-finding." Statics underlies all topics, and our treatment is consistent with NCARB expectations.

Course Website: http://soa.cmu.edu

48-640 M.Arch Studio: Praxis II
Spring: 18 units
Architecture transforms and shapes relations between individuals, communities, objects and environments. Praxis II will continue to understand architecture as a modulator of complex cultural and historical flows, but will aim to do so by intensively exploring, evaluating, and expanding the role that tectonic cultures and their associated modes of architectural expression play in shaping our world. Through a non-linear/ multi-scalar, iterative design process, students will develop and refine detailed architectural assemblies attuned to methods of construction, craft, and labor practices; to the role of structural configurations in organizing the spatial distribution of occupancies and human experiences; to how envelopes regulate and respond to thermal and visual performance while also participating in aesthetic discourse; to ecological synergies and impacts; to modes of participation in carbon culture; and ultimately to the disciplinary imperative to integrate and orchestrate these multiple forces and systems.

Course Website: http://soa.cmu.edu

48-641 Modern Architecture
Spring
This history course surveys modern architecture and theory of the 20th-century from around the world. It is the second of a two-semester global survey that serves both as a historical foundation for disciplinary specialization, and as an intro. to architectural history. We begin the course by defining terms such as history, theory, and criticism, as well as modern, modernity, and modernism in architecture. We look briefly at the bias embedded in most current textbooks and in terms like "evolution" and "Non-Western." We problematize canon formation and ideas of progress, we’ll ask who gets left out of histories, and probe the legacy of colonialism, globalization, and social inequity in modern architecture. After briefly identifying architecture's role in some of the most important challenges facing the world today, this survey works backward in time towards the beginning of the 20th-century. Along the way we will explore major movements of the Euro-American avant-garde and the “heroes” of modernism, but also other responses to modernity, including vernacular, popular, tropical, and even anti-architecture, and their relation to contexts such as the Cold War, the Third World, Global Socialism, Postcolonialism, and Postmodernism. We will highlight the role of experimentation and provocation, but also of tradition and timeless ideas in different cultures, and how they each intersect with the demands of function and technology as well as social and political imperatives. Emphasis throughout the course will be placed on the relationship of buildings to the more general cultural, intellectual, and historical circumstances in which they were created, as well as changing interpretations of the past over time. Work for the course falls into four categories: 1) active listening and note-taking in lectures (some pre-recorded); 2) reading, both original documents from the period, and more recent critical

Course Website: http://soa.cmu.edu

48-644 M.Arch Pre-Thesis
Spring: 3 units
This 3 unit course is designed for B.Arch and M.Arch students a year before their final Spring semester. The course develops an understanding of research methods, and explores the formation of ideas for architecture thesis projects. Many directions of architectural thinking (spatial, material, ideological and procedural), will be discussed and in framing a theoretical position we will see how an architecture thesis can use a creative process to discover and express findings in relation to large questions and disciplinary discussions. This is a required course for Fall Thesis Seminar in F22 (18units) and Spring Thesis ASOS (18units)

Course Website: http://soa.cmu.edu

48-650 ASO Masters Studio
Fall: 18 units
TBA
48-676 Connected Communities: Technology, Publics, Politics, and Participation
Intermittent: 6 units
This seminar examines how smart and connected technologies can be designed for neighborhoods, what considerations are involved, and what effects such technologies create for communities. We will introduce and critically examine the relationships between smart systems with the places, infrastructures, histories, politics, publics and problems that surround them. To do this, we will survey topics across research and practice across different domains. These will reveal approaches, methods and design factors to designing systems for communities, as well as the challenges created when computing becomes a non-human participant in communities and publics. The first five weeks of this mini-course will introduce a series of topical readings, cases, guest lectures, case studies, and design exercises. The rest of the course will invite students to investigate topics and contexts of interest to them. By the end of the course, students will be familiar with the socio-technical considerations for designing systems for places and publics.

Course Website: http://soa.cmu.edu

48-699 Environmental Racism, Injustice, & Unfreedom: Lessons for Architecture
All Semesters: 3 units
Environmental racism refers to the disproportionate concentration of environmental toxicities and harms in low-income communities of color (particularly Black and indigenous communities) through the structural and systematic workings of white privilege and white supremacy. More broadly, environmental injustices also include restrictions to environmental resources and infrastructures and the unjust placements and displacements of communities of color resulting from uneven development. In this seminar, we will examine the histories and definitions of environmental racism, environmental injustice/justice, and environmental unfreedoms. We will read and discuss literature from a range of fields including Environmental Justice, urban political ecology, critical race studies, Black geography, indigenous studies, and more; explore case studies in the US and beyond through the EPA's EJ data and the EJAtlas project; and have conversations with activists, architects, and scholars invested in spatial justice. Through these we will critically assess architecture's role as a mechanism of environmental inequities and injustices, and learn from social movements for radical and hopeful change.

Course Website: http://soa.cmu.edu

48-701 Entangled: Remaking Nature from the Picturesque to the Hypernatural
All Semesters: 9 units
This seminar questions how we perceive, represent, and reconstruct our world in relation to evolving concepts of "nature" and their manifestation in architecture, art, and landscape. It is focused on the intellectual trajectories that define ecology and environment to arrive at the paradigm shift theoretician Donna Haraway has termed natureculture. We will first familiarize ourselves with historical ways of seeing "nature" and how this has formed the landscapes. This will help us bring a critical lens on land, environmental and ecological art, ecoventions, architectural living systems, biomimicry, biophilia, and projective ecologies while we consider the influence of gardens, responsive landscapes, hypernatures, and artificial ecologies in changing the way we design and build. We look for not only relevance but joy and beauty in practices that highlight the relation between desire, responsibility, more-than-human wellbeing, and ecological justice. This may help us build notions of care and stewardship and an understanding traditional and emergent cultural constructs that can define an eco-centric practice which shapes building futures. The course surveys texts from a range of topics including ecological aesthetics, architecture, art, landscape urbanism, and ecologically focused philosophy and theory. It includes weekly readings, discussions, presentations, and visual or written deliverables. Open to graduate and undergraduate students in Architecture and allied fields.

48-706 Urban Design Studio II: Urban Systems
All Semesters: 18 units
Optimistic assessments about Pittsburgh's livability mask a complicated reality where actual prospects for health and well-being are starkly differentiated along lines of race, class, and gender. Environmental harms, underpinned by the ongoing legacies of industrial production, extraction, and segregative planning, create a toxic combination adversely impacting human health, ecology, and community futures. These challenges are significant and wickedly multi-scalar and defy conventional design frameworks. They necessitate multidisciplinary, collaborative, and emancipatory approaches to knowing and engaging the built environment, and particularly community-centered methods in urban design that attend to the local histories, embedded knowledges, and political ecologies of life in toxic systems. This studio will expand on MUD students' understanding of neighborhood-scaled urban design gained in their first semester, and introduce urban systems and systemic processes. The studio will focus on the infrastructures and ecologies of toxic systems, and the impacts of local action and stewardship to fight them. It will be anchored through an ongoing collaboration with North Braddock Residents For Our Future, a grassroots organization which has led the opposition to unconventional gas drilling and other forms of environmental injustice in Braddock and North Braddock and surrounding communities. Paying attention to how the toxic systems and their material effects on frontline communities are inseparable from racialized abandonment, dispossession, and accumulation in the urban realm, the studio asks how urban design might engage with the complex histories, power struggles, ecological effects, material residues, social relationships, and desired futures within landscapes of toxicity.

Course Website: http://soa.cmu.edu

48-709 History and Future of Interaction Design
All Semesters: 12 units
The history of Interaction Design is far richer than what is commonly known among students and teachers, practicing designers and entrepreneurs. Understanding IxD’s origins and evolution helps us realize the promises and possibly avoid some of the pitfalls of IxD’s future. This course blends readings, lectures, discussions, and prototyping as a means for students to experience this history as if first-hand. Students become immersed in pragmatic yet mind-expanding examples of person-machine interactionssuch as MEMEX, Musicolour, Hypertext, Dynabook, Fun Palace, Colloquy of Mobiles, Architecture Machine, THOUGHTSTICKER, Architrainer, and Hypercard. Through period articles and subsequent perspectives, students research a handful of historical innovations and then prototype key concepts from that history, foregrounding what has been lost in modern commercial implementations. This offers students a hands-on experience of the history of IxD. To explore IxD’s future, students are invited to invent ito prototype their individual future vision of interactive experiences. The course is especially suitable for students with interest or background in interaction design, computational design, responsive architecture, and interactive media.

48-711 Paradigms of Research in Architecture
Spring
Paradigms of Research in Architecture challenges the false dichotomy between research and design and provides an introduction to a wide range of research strategies including Experimental, Simulation, Qualitative, Correlational, Interpretive-historical, Logical Argumentation, Case Study, and Mixed Methods as feedstock for understanding robust published research and for developing an independent architectural research proposal. Throughout the semester there will be guest lectures from faculty who will share their expertise, successful research strategies and methods, results of their current and past research, and innovative ideas for future research.

Course Website: http://soa.cmu.edu
48-712 Graduate Seminar 2: Issue of Global Urbanization
Intermittent
By 2050 the number of urban dweller across the world will double. The seminar is an investigation into the future of cities focusing on three existential challenges: the escalating environmental crisis, growing social inequity and technological dislocation. In the face of these wicked problems, we will address the role and agency of designers and planners, decision makers and citizens in tackling what Jeremy Rifkin describes as the Third Industrial Revolution and how to lay the foundational infrastructure for an emerging collaborative age. These issues are explored through contemporary writings and case studies that situate urban transformations in the US within a broader global context, with a specific focus on the political as articulated through the negotiation of topdown planning and bottom-up behavior of cities. The seminar course will revolves around reading reflections, in-class presentations and discussions on theories and case studies of global urbanization. This is a 3- or 6-unit course that requires attendance at one 1.5-hours class per week. The extra credits involve a more extensive final paper.
Course Website: http://soa.cmu.edu

48-713 MUD Urban Ecology
Fall: 9 units
Urban ecology describes the complex relationships between humans and our environment and is bound by an understanding of system dynamics. This class will examine the shifting regimes of urban ecology and equip students with skills and core concepts that enable them to lead or contribute to transition through design. The study of urban ecology is inherently interdisciplinary, and this course will approach the subject from the field of design and planning as well as from other disciplinary perspectives. We will examine contributions from landscape, planning, engineering, economics, biology, sociology, political science, climatology, and even public health. We will learn the fundamentals of systems dynamics as it applies to the design of historical and contemporary landscapes, and spatial practices and we will look through both a positivist lens of evidence as well as a normative lens of belief. Students will learn design tools and methods to query ecological systems and will also gain specific skills and knowledge from other fields, including causal loop diagrams, agent-based models, and scenario planning. Lastly, students will reflect on their own work and investigate case studies to understand how these tools can augment design practice. Students from other disciplines are encouraged to join this class.
Course Website: http://soa.cmu.edu

48-715 MSCD Pre-Thesis 1
All Semesters: 6 units
This seminar introduces graduate students in Computational Design to the rudiments of graduate level academic research, and offers a space to discuss inchoate research methods, questions, and projects in the field. Assignments require students to gain familiarity with past and current research in the field in order to distinguish different research traditions, practices, opportunities and pitfalls. An emphasis is placed on the materialities and socio-technical infrastructures of computing.
Course Website: http://soa.cmu.edu

48-720 Planning by Design: Campuses, Waterfronts, Districts, and Cities
Spring
In responding unprecedented challenges of density, information, equity, and climate change, cities continue to define and design "districts." Waterfront, historic, arts, innovation and ecodistricts draw on models including on university/corporate campuses, neighborhoods, main streets, and downtowns. How can cities remake districts in that are viable in terms of engagement and opportunity? How can they be meaningful and inclusive in a society that appears to be increasingly less place-based? Through presentations, case studies, and the semester project, students will develop strategies to respond to these challenges.
Course Website: http://soa.cmu.edu

48-721 Building Controls and Diagnostics
Intermittent: 12 units
Students' theoretical knowledge on energy and environmental performance assessment methods are leveraged with the hands-on approach of the BCD course which addresses research-grade concepts of building controls and diagnostics through actual building case studies and the application of field measurement techniques. Special emphasis is given to empirical evaluation of the performance of buildings and systems by considering interactions with occupants about thermal-visual-acoustics criteria. Students will acquire necessary skills to develop interactive dashboards to demonstrate building energy systems and their dynamic performance, conduct Post-Occupancy Evaluation and Measurement studies, develop advanced building control logic and algorithms, create virtual prototypes of these controls systems, and test them on actual building cases.
Course Website: http://soa.cmu.edu

48-722 Building Performance Modeling
Fall: 12 units
The BPM course focuses on conceptual foundations and practical applications of advanced and integrated whole-building energy simulation programs with emphasis on architectural building envelope systems, mechanical electrical building systems and their controls (electric lighting and HVAC systems) and building integrated solar photovoltaic power systems. Students are engaged in project-based collaborative studies with emphasis on analytical methods of simulation-aided high-performance building design. Theoretical lectures and software demonstrations are supported with discussions of relevant building case studies and particular design solutions which exhibit an innovative character with the application of whole-building energy simulations in the evaluation and improvement of the total building performance starting from early stages of design development
Prerequisite: 48-754
Course Website: https://omerkaraguzelphd.wixsite.com/praxismodeling/

48-723 Performance of Advanced Building Systems
Spring
Advanced Building Systems Integration This is a graduate level course that focuses on commercial building performance achieved through systems integration. In lectures, class discussion, and student projects, we will explore the topic of building performance, the design and technical strategies that support sustainable high performance; the design, construction and operation processes that are likely to produce sustainable high(er) performance buildings; and the current state of theory versus practice. The course assumes a basic understanding of buildings’ impact on the environment, of building design and materials performance, and the calculation of building heating and cooling loads. On that foundation, we will examine the concept of systems integration and how this approach can sustain the occupants and the environment far better than conventional design, construction and operation. Although US climate, building conventions and codes will be our reference point, we will broaden our discussion by using examples and data from many other countries. An essential aspect of our exploration will be identifying successful built projects and examining the factors that may have allowed those projects to succeed. If this course meets its objectives, students who successfully complete the material will understand and be able to discuss sustainable building performance characteristics, will understand the systems integration approach and how it differs from conventional approaches to building design, and will know how to positively affect architectural and engineering decisions to support the design, construction and operation of sustainable high performance buildings.

Course Website: http://soa.cmu.edu
48-724 Scripting and Parametric Design
Intermittent: 10 units
This course prepares students for modeling geometry through scripted development of parametric schemes primarily for design applications that is, to introduce students to basic scripting in geometrical modeling environment with a focus on algorithms relating to form making and to reinforce and extend basic concepts of parametric modeling. Contemporary approaches to modeling geometry are computational reflected in designers wanting much more control over the generative process by varying parameters, in turn, enhancing the efficiency with which they navigate design variations, analyze design artifacts and explore design manifestations. This course has two parts: firstly, to supply the basics of object-oriented programming and algorithmic thinking using Python language constructs, and secondly, to supply the basics of scripting generative form making specifically, by customizing procedures for generative design via scripts in Grasshopper in conjunction with Rhino/ Grasshopper objects. A number of different form-making algorithms are explored, e.g., fractals, rule-based models, cellular models, agent- based models, and optimization- based models. The course consists of lectures, computer instruction and weekly assignments. Prior exposure to Rhino/ Grashopper is required.

48-725 Graduate Real Estate Development
Fall
This course will provide an overview of the real estate development process and explore the interdependence of real estate development and design. The primary objective of this course is for you, the student, to understand how real estate development, public policy, and finance will affect your professional life when you enter the workforce. The course will introduce real estate development context, team members, processes, and phases. Students will study how market demand, tenant requirements, site constraints, zoning restrictions, and available capital affect development projects. The course will include a financial component that will introduce students to the basics of property valuation, project budgeting, pro forma analysis, sourcing of financing, and investment analysis. We will also touch on societal issues including social equity and international real estate topics. The semester's effort will culminate in the execution of a team development project. The project client will be a nonprofit or government entity. The project will be a real project/site in the city of Pittsburgh. The project components may include a basic market analysis, program evaluation, schematic design, project cost estimates, pro forma analysis, and evaluation of financial feasibility. You will make a final presentation to the class and the client.

48-729 Sustainability, Health and Productivity to Accelerate a Quality Built Environment
Intermittent
Given the growing demand for green buildings by federal and private sector clients, professional practices are looking for a tool to use in all over the world to deliver high performance, environmentally responsive, quality buildings and communities. However, investments in green, high performance building solutions and technologies are still limited by first cost decision-making, and life cycle costs are still largely inaccessible to professionals. A building investment decision support tool - BIDS? continues to be developed by the Center for Building Performance and Diagnostics at Carnegie Mellon University, with the support of the Advanced Building Systems Integration Consortium. This cost-benefit decision support tool presents the substantial cost-benefits of a range of advanced and innovative building systems designed to deliver ? privacy and interaction, air quality, ergonomics, lighting control, thermal control, network flexibility, and performance to the natural environment - field case studies, laboratory studies, simulation studies, and other research efforts. This course will explore the relationship of quality buildings, building systems, and land-use to productivity, health, well-being and the environment. The course will engage students in the literature that relates building design decisions to ten cost/performance impacts: energy, facilities management, organizational change, technological change, attraction/retention (quality of life) of employees, individual productivity, organizational productivity, salvage/waste, tax/insurance/litigation, and health.

48-733 Environmental Performance Simulation
Intermittent
*Design of a boat is optimized for sail-driven locomotion. Buildings should be able to sail using free energy if wind, air, sun and internal heat sources to temper indoor environment*. Brendon Lewitt. Based on this viewpoint, this course introduces fundamental knowledge in building physics in relation to a range of environmentally responsive building design principles and computational approaches for increased resiliency for human habitability with minimal reliance on mechanical systems. EPS course refreshes some of the fundamental building physics topics such as building thermodynamics (heat and mass transfer mechanisms), photometric quantification of light and luminous environment, human visual and thermal comfort, thermal modeling and the principles of generating electricity from sunlight (photoelectric effect). EPS course outlines a series of environmental design principles with emphasis on evidence-based design approaches and reviews of building case studies are evaluated against actual buildings in operation. Focus is also given to integration of multi-valent environmental design strategies into the early stages of performative architectures. EPS also introduces state-of-the-art architectural design and research oriented environmental performance simulation and visualization tools, methods and techniques (based on the algorithmic/parametric modeling ecosystem of RHINO-Grasshopper-DIVA-ArchiSIM -Ladybug-Honeybee programs). Computational introductions will be accompanied with pre-established/ seed workflows which are ready for future adaptation and extension by the students.

48-737 Detailing Architecture
All Semesters: 9 units
This course examines the role of the architectural detail in the formation/ thematic development of a work of architecture and how the detail reinforces the theoretical position of the architect. Architectural detailing is often considered only a technical task, but, in fact the detail holds the key to inspire, integrate and reinforce the architectural idea as well as the architect's intellectual/ societal position. Many scholars, historians and academics have avoided the detail as a snapshot into the design methodology of architecture. This class is an attempt to do the opposite. The course will consist of a series of weekly lectures, readings, field trips and student developed graphic and physical representations that reveal how the role of detail has played an essential role in the history, evolution and development of the built environment.

Course Website: http://soa.cmu.edu

48-738 Special Topics: Ecological Footprints
Fall: 6 units
The Ecological Footprint is a measure of the demand that human activity puts on the biosphere. More precisely, it measures the amount of biologically productive land and water area required to produce all the resources an individual, population, or activity consumes, and to absorb the waste they generate, given prevailing technology and resource management practices (Global Footprint Network 2010). This course will engage students in the metrics and impacts of our collective consumption and waste of - Energy - Materials (Cradle to Cradle) - Food - Water - Transportation - The Integration of Systems towards Quality of Life Starting at the global context, this course will address challenges/opportunities to advance regenerative practices, improving our relationship to nature. Learning from international best practices, we will continue to explore ecological footprints at the global, national, regional, city, neighborhood, building and individual scale. The course will be based on lectures and readings, with assignments and student presentations to fully explore each of the footprint characteristics. Experts on water, energy, materials, food and other resources have been invited to lecture. By mid semester, an application project will be selected for ecological footprint analysis and the development of design, engineering, and operational guidelines towards reducing that footprint. The potential application projects include: the CMU campus footprint and Donner House retrofit; the Energy Innovation Center and education of the trades in reducing our regions footprint; or a new Net Zero building for Carnegie Mellon University. This will be a collaborative effort.
Prerequisite: 48-305
48-739 Making Things Interactive (Graduate)
Fall: 12 units
In this hands-on design-build class you will learn the skills to embed sensors and actuators (light, sound, touch, motion, etc.) into everyday things (and places etc.) and to program their interactive behavior using a microcontroller. You’ll also dive into the fields of VR/AR/MR and experiment with combining these disciplines with physical computing. Through weekly exercises and a term project the class will introduce basic analog electronics, microcontroller programming, projection mapping and virtual reality; as well as exploration into using kinetics and materials to make the things you design perform. Emphasis will be on creating innovative experiences. The graduate edition of this course will require additional work including a paper that can be submitted to a peer-reviewed interaction design conference such as CHI, UIST, or TEI. Students from all disciplines are welcome; but please note that the class demands that you master technical material. Experience in at least one of: programming, electronics, or physical fabrication is strongly recommended. (Participants will provide their own supplies and materials.)

48-743 Introduction to Ecological Design and Thinking
Intermittent
This seminar offers an overview of scholarly, design-based and research-based approaches to issues of ecology and sustainability in architecture and urban design. The seminar intends to question contemporary paradigms of sustainability within the built environment and includes inquiries from different disciplinary perspectives ranging from history, theory, technology, engineering, art and design. The goal of this seminar is to offer a platform for critical thinking, in-depth discussion and analysis of actionable methodologies related to sustainability, and procedures relevant to the shaping of our physical environment and social systems. Composed of a series of lectures, readings and short assignments, this seminar will lead students through a diverse collection of interdisciplinary views and positions towards defining what is our understanding of sustainability today, and what is a role of large scale ecology within the constructed environments. Students will be introduced to a wide overview of technical, analytical, practical, theoretical and intellectual inquiries that will help them to navigate varied fields of expertise and enable their future investigation of innovative sustainable strategies for the built environment. This seminar will consist of majority of lecture sessions and 2 project review sessions, spread across the fall semester. Each session will introduce set of readings and/or a small exercises related to the lecture theme. The invited lecturers come from both: academia and practice. Invited speakers’ areas of research and design work feature diverse approaches to issues of sustainability and technology. This seminar serves as a platform for development of a cross-disciplinary theoretical foundation to investigate varied methodologies towards sustainable design practice.

48-745 Design Fabrication
Fall and Spring: 9 units
Digital Fabrication is a project based seminar exploring the application of Computer Aided Manufacturing (CAM) in architecture. The course meets in the School of Architecture’s Design Fabrication Lab (dFAB), which serves as a context to better understand the interconnected affordances of building materials, machine processes, and modeling software for design thinking. The course focuses on Transdimensional Fabrication, a manufacturing framework that foregrounds design thinking across space and time. A growing array of approaches in contemporary architecture are motivated by this focus (e.g. flat pack, 4D printing, metamaterials, kinetic architecture, robotic origami, design for disassembly). We will investigate Transdimensional Fabrication concepts through three projects that explore translations between 2D 3D, Space Time, Assembly Reconfiguration Disassembly. Course Website: http://soa.cmu.edu

48-746 Shape Machine
Fall: 9 units
A shape machine is any computational technology that fundamentally expresses the way shapes are represented, indexed, queried and manipulated. In this course the shape machine is based on visual rules (shape rules) grounded in symbolic rules (programming language instructions) to provide a robust technology to individuals who use drawings and visual models to develop and communicate their ideas. A shape machine is intended to be a computational, visual and disruptive technology for shape cognition and computing, which intersects with such fields as design, artificial intelligence, computer science, and mathematics. We consider a particular kind of shape machine - spatial grammars - which have their origin in formal grammars for spatial composition. Grammatical approaches to designing offer an alternative to traditional approaches. The goal of grammars is not to produce a single design as the final outcome, but, rather, to provide an understanding of the underlying spatial relations that come into play in an eventual design. For nearly three decades, grammars have been studied extensively to understand style in architecture, engineering, design, fine art and ornament. Recently, there has been an increasing application of grammatical ideas to other disciplines. Specifically, there is resurgent interest in implementing shape grammars for application. This is the focus of this course. Prerequisite: 48-724

48-749 Special Topics in Computational Design
Intermittent
This project-based course interrogates the confluence of robotics and artificial intelligence methods and its potential applications to design, manufacturing, and construction domains. In combination with a group of computational design and robotics faculty and PhD students, course participants will advance visions for the future of design that do not aspire to full automation, but instead at culturally-situated, algorithmically and robotically-supported cooperative processes. Course participants will be able to take advantage of new laboratory space and state-of-the-art equipment at CMU’s new Mill 19 facility, and help envision, develop, and evaluate functional prototypes for robotically-supported design and construction.

48-750 Histories of Urban Design
Fall: 9 units
Cities are manmade artifacts, created for a purpose. In this course we will examine various histories of the design and redesign of cities and the reasons for those interventions. The scale of urban interventions varies greatly, from the macro-scale of designing totally new cities to the micro-scale of altering individual nodes within a city. We will explore the relationship between form and culture by considering the theoretical, social, political, economic, and aesthetic forces that have shaped urban spaces (streets, squares, public realm, housing). Our focus will be on recognizing and understanding the rationale behind the design and use of culturally important urban spaces during their own time, with periodic forays into the issues that influence those spaces today.

48-752 Zero Energy Housing
Fall: 9 units
Are you interested in designing or renovating the high-performance housing of the future? Net zero or carbon neutral buildings are become code requirements in some cities and countries and at the very least, we aspire to those standards. Yet despite numerous single-family successes, far fewer multistory, multifamily examples exist even though multifamily housing is considered an essential typology to address rapid development and urbanization. 48-752 is a graduate level course that explores the requirements and strategies for achieving successful net zero multifamily housing. Through lectures, research, discussion, and a final applied project, we consider the design approaches, codes, policy, technology, and energy infrastructure that support net zero or carbon neutral performance.

Course Website: http://soa.cmu.edu

48-753 Intro to Urban Design Media
Fall: 6 units
This course introduces urban design history, theory and methods of analysis and representation. Urban design is examined at multiple scales: city form and networks, neighborhood and block structures, streets, public spaces, and urban building typologies. A wide variety of cities, projects, proposals and methodologies are examined with a special focus on urban sustainability in the contemporary city. Assignments include readings from seminal texts, presentations and discussions, graphic assignments and a final project. A required course for Master of Urban Design students, it is also open to fourth and fifth-year architecture undergraduates as well as graduate students in related programs.

Course Website: http://soa.cmu.edu
48-755 Introduction to Architectural Robotics  
Fall and Spring: 9 units  
This course provides an introduction to industrial robotics and automated fabrication within the field of Architecture. A series of lectures will cover the basic components, as well as their work flows, needed to design a flexible automation - while work sessions will develop skills in hands-on programming, rapid work flow simulation, fixtures, and sensors. We will also discuss competency-building projects within the lab environment in order to provide students with hands-on experience using the equipment. Upon covering the fundamental software and hardware content, an end-of-semester project will challenge you to apply your newfound knowledge to solve a final project. This is a portfolio course to all sanctioned coursework using the School of Architecture’s Robotic Fabrication Lab. Upon successful completion, students will be eligible and prepared to enroll in advanced robotic fabrication courses.

48-756 Project Planning and Reporting  
Fall  
The aim of this course is to teach advanced project scheduling and familiarize the students with the reporting nuances as practiced in the industry such as change management, resource charts, and project status reports. In this pursuit the objectives of this course are: 1) outline and discuss the established theoretical constructs of the subject; 2) demonstrate the dynamic nature of construction projects stemming from inherent uncertainties; and 3) hone student's adaptability to the dynamism while conducting construction projects. This course will include both discussions on assigned readings and a studio based group project. The assigned readings would include chapters from recommended books and peer-reviewed journal and conference papers. It will be expected that students critique and deliberate on these readings on an online forum created by the instructor. In order to provide a real world experience to the students the second half of the semester will focus on development of a construction project with varying scenarios such as changes in resources and scope creep.

Course Website: http://soa.cmu.edu

48-758 Responsive Mobile Environments (Grad)  
Intermittent: 12 units  
As part of this project-based course, we’ll get hands-on with emerging technologies, concepts and applications in the Internet of Things through a critical lens. We’ll prototype everyday intelligences and design smart and connected devices that examine and speculate on the strange, supernatural, and mystic qualities of the smart home. The first half of the semester will introduce students to building connected devices and intelligent spaces through technical workshops, readings, applied explorations, and guest lectures. The second half of the semester will be organized as an applied collaborative project.

Course Website: http://rme2021.daraghbyrne.me

48-759 Value Based Design Introduction  
All Semesters  
This course will explore the fundamentals of project values, incentives and motivations as they relate to the diverse, sometimes conflicting perspectives of a project's stakeholders. It will hone the student's understanding of multifaceted issues required in problem seeking and stakeholder collaboration to make a design project successful in the business world and or society. Students will learn proven methodologies in documenting and incorporating value into the ethos of the project delivery team's thinking from design concept to construction completion. The class will rely on case studies and interviews with clients, architects and contractors to advance the idea of balancing the principles of Return on Investment (ROI) with Return on Design (ROD).

Course Website: https://soa.cmu.edu/

48-763 Protein Systems: Sustainable Solutions for Uncertain Futures  
Intermittent  
Uncertainty perpetually plagues the built environment. The inability of our buildings and cities to adapt to shifting circumstances has led to an enormous amount of waste. We will explore the various types and scales of change and review various concepts (Metabolism, Shearing Layers of Change, C2C, DfD, Open Building, Lifetime Homes, Resiliency, etc.), and a wide array of precedents, products, and dynamic materials that have attempted (with varying degrees of success) to respond to these challenges over time. Students will produce sketches, animations, working physical models, short histories, and longitudinal effectiveness reviews of these exemplars. From this deep review students will begin designing their own Protein Systems by utilizing a scenario planning tool and day/year/decade(s)-in-the-life diagrams that will help address the often-overlooked social aspects of their technical solutions.

48-770 Inquiry into Machine Learning and Design  
Spring  
Formerly titled "Learning Matters, Exploring Artificial Intelligence in Architecture and Design". With the recent blooming of artificial intelligence (AI) and machine learning, there has been a renewed interest in how these technologies may impact architecture and other creative practices. Learning Matters introduces students to this emerging field, giving them the tools to make their own machine-learning based design tools by adapting state-of-the-art models to design new models and to understand how data shapes machine learning processes. The course places a particular emphasis on machine learning interfaces. Similar to other rule-based computational design approaches, users can interact with machine learning models through scripting. However, machine learning demands new approaches to interacting with data. By collecting, selecting, and generating data points, we will explore how bespoke interfaces can elicit new kinds of designing and making processes. Throughout this course, we explore these new field by curating data sets and training models on them. Four fields of machine learning and their potentials in design and making problems will be explored: 1) unsupervised generative models, 2) reinforcement learning, 3) multimodal machine learning, and 4) machine learning for robotics. Students will be introduced to the fundamental concepts of each field and hands-on experience with state-of-the-art research and tools to implement them.

Course Website: http://soa.cmu.edu

48-779 Processes of Digital Design Fabrication  
Intermittent: 3 units  
Digital Fabrication techniques are well established and widely used across all stages of design to production. Contemporary pre-occupations with materiality, ornament, digital craft, and surface topology are tethered to the affordances of these workflows and their direct connection to digital design methods. The impact of these processes reverberates across scales and around the globe, its presence undeniable. Off-site, prefabrication techniques are increasingly reliant upon computational methods to achieve greater control and precision, while reusing traditional design to production workflows. The architects traditional conveyer of design intent, the working drawing, and its conventions of plan and section are increasingly supplemented with machine and robot code. Meanwhile the job site and field construction of buildings is an unwieldy endeavor, reliant upon the skill of local labor to assemble the many components that constitute a building to produce the one-off piece of architecture. This tension between the promise of the factory floor and the messy reality of the job site reflects the evolving nature of construction and its regimes of labor. Building construction is an industry in flux rooted in traditions that pre-date the emergence of computation, yet also in the midst of digital disruption as seen in advancements in onsite architectural robotic fabrication. Lest they succumb to greater marginalization, architects must engage these transformations and leverage their design affordances. Practitioners should be versed in the basic principles of digital fabrication and understand its affordances and potential influence upon the design process. Translations from drawing and models to building increasingly rely upon these modes of production. Emerging practitioners must be capable of engaging these modes of communication and leveraging these techniques in the realization of their design intent.

48-780 MAAD Design Research Project Prep  
Spring: 3 units  
TBD

48-781 Spatial Analysis in Infrastructure Planning  
Spring: 3 units  
A geographic information system (GIS) provides storage, retrieval, visualization, and analysis of geographically referenced data. GIS provides unique analytical tools to investigate spatial relationships, patterns, and processes of cultural, biological, demographic, economic, social, environmental, health, and other phenomena. GIS creates digital twins (virtual representations) of natural and built environments and uniquely integrates many types of digital models including CAD, BIM, and CAFM. Computer Aided Facilities Management (CAFM) and Integrated Work Management (IWMS) technologies streamline facility operations, boost productivity, and develop strategic planning goals for an organization. Facility and infrastructure management technologies improve the integration of the physical workplace with the people and work of an organization. The course includes in-person and asynchronous video lectures to learn important GIS concepts. Software tutorials and in-person/remote technical sessions cover leading GIS software from Esri Inc. Applications include ArcGIS Pro, ArcGIS Online, ArcGIS Map Viewer, ArcGIS Story Maps, and Dashboards. CAFM/IWMS software will be reviewed.

Course Website: http://soa.cmu.edu
48-783 Generative Modeling (GRAD)
Fall and Spring: 9 units
This course introduces students to the fundamentals of generative modeling using computer aided design as practiced in the field of architecture. Core competencies will be developed through modeling projects and software intensive labs, while a broader critical framework for conceiving of contemporary and historical parametric practices will be encouraged through periodic lectures. Emphasis will be placed on careful consideration of digital mediums and developing a sense of craft related to digital modeling in the hope that students will become conscientious makers and consumers of digital content. Students will be encouraged to understand and apply algorithmic problem solving to the many design constraints encountered in architecture. The course will explore the relationship of parametric workflows to design thinking and will situate contemporary trends in a broader framework of computational design. The course will also confront complex form-making as a response to bio-mimicry, systems thinking, and mass-customization. Rather than positioning parametric modeling as a disruption of historical architectural design process, the course will encourage students to consider how new tools might augment the discipline’s historical commitments to orthographic projection, perspectival drawing, and physical modeling.

48-786 PORTFOLIO & RESUME PREPARATION (G)
Fall and Spring: 3 units
No course description provided.

48-795 LEED
Spring: 6 units
Are you interested in how urban infrastructure and community design may be approached differently around the world? Do countries that high population density approach urban design and green infrastructure the same way as the US and other more sparsely populated countries? 48795 A4, LEED. Green Infrastructure and Community Rating in Global Context, is a graduate level mini-course that uses global community and infrastructure rating systems to gain perspective about sustainability in context. The course is organized within the framework of the US Green Building Council’s Leadership in Energy and Environmental Design (LEED) Cities and Communities Rating System and the Institute for Sustainable Infrastructure (ISI) Envision Rating System. Within those frameworks, we explore the strategies and credit structure, and compare these with the community characteristics, strategies and credit structure in community and infrastructure rating systems from other countries. We also discuss emerging issues that may be omitted from rating systems, and the design of the rating system itself, its implementation, and the national context in which the system was created.
Prerequisite: 48-315
Course Website: http://soa.cmu.edu

48-801 Office Visits
Fall: 6 units
Each candidate will arrange with their home office a virtual ‘visit’ for members of the degree program and organize presentations of the projects, methodological challenges, recurring problems, best and worst practices within the context of their office experience. Asynchronous Course Delivery (Fall 2014) -> September 18, through December 7, 2014 Online Synchronous Course Conclusion (Fall 2014) - December 8-11, 2014

48-802 Principles of Research I
Fall: 6 units
Candidate’s current knowledge of problems, methods and outcomes based on their professional work. Overview of the eight knowledge areas as existing disciplines and their potential place in them. Asynchronous Course Delivery (Fall 2014) -> September 18, through December 7, 2014 Online Synchronous Course Conclusion (Fall 2014) - December 8-11, 2014

48-803 Areas of Practice
Fall: 6 units
Candidate presentations of area(s) of expertise summarizing the methods and problems that are prevalent; using case studies to establish a situated approach to research. Asynchronous Course Delivery (Fall 2014) -> September 18, through December 7, 2014 Online Synchronous Course Conclusion (Fall 2014) - December 8-11, 2014

48-804 International Exchange I
Fall: 12 units
Conduct workshops for collaborative research and information exchange meetings with EU cohorts visiting from the Université Toulouse III - Paul Sabatier, Doctoral Programs in Architecture. Asynchronous Course Delivery (Fall 2014) -> September 18, through December 7, 2014 Online Synchronous Course Conclusion (Fall 2014) - December 8-11, 2014

48-805 Directed Study I
Fall: 6 units
Prepare the first publishable article under the supervision of the advisor, based on the current professional practice record of the candidate. Submitted to a committee of faculty for approval. Asynchronous Course Delivery (Fall 2014) -> September 18, through December 7, 2014 Online Synchronous Course Conclusion (Fall 2014) - December 8-11, 2014

48-809 International Exchange II
Spring: 12 units
Visit Université Toulouse III - Paul Sabatier, Doctoral Programs in Architecture and participate in collaborative research and information exchange meetings with EU cohorts, based on the cohorts current knowledge base culled from their practice experience. Asynchronous Course Delivery (Spring 2015) - January 18, through May 13, 2015 – Online Synchronous Course Conclusion (Spring 2015) - May 14 through 17, 2015

48-810 Comparative Analysis of US and EU Practices
Spring: 6 units
Practices in the building sector vary considerably in the US versus the EU. The instructor will provide a rich collection of national and international initiatives in the AEC domains and include a stimulating series of site visits to important installations in the area. Asynchronous Course Delivery (Spring 2015) - January 18, through May 13, 2015 – Online Synchronous Course Conclusion (Spring 2015) - May 14 through 17, 2015