School of Design Courses

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 freshman-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 (https://enr-apps.as.cmu.edu/open/SOC/SOCServlet/) each semester for course offerings and for any necessary pre-requisites or co-requisites.

51-101 Studio: Survey of Design
Fall: 10 units
Students will conduct activities that will help them notice design in the world, investigate how it works, and describe their thinking about design, through photography, video capture, sketching, note-taking and modeling. They will work through projects in various ways as a means of ‘testing out’ and reflecting on command design approaches. This course is for undergraduate design majors only.

51-102 Design Lab
Spring: 10 units
Introduce concepts and methods to familiarize students with a range of analog and digital modes of working across products, communications, and environments. Students will use desktop modeling and comping methods to familiarize them with a range of basic materials to build confidence in using and manipulating material to represent ideas. This course is for freshman Design majors only. Prerequisite: 51-101

51-121 Visualizing
Fall: 10 units
This course introduces basic drawing and sketching techniques including figure-ground translation, 2 pt perspective construction, storyboarding for explanation, diagramming for clarification, field notation for recording through guided exercises, demonstrations, and short projects.

51-122 Collaborative Visualizing
Spring: 10 units
This course introduces frameworks of notational, exploratory and explanatory sketching using collaborative methods and exercises to cooperatively communicate design ideas. This course is for undergraduate design majors only. Prerequisite: 51-121

51-132 Introduction to Photo Design
Spring: 10 units
Using a digital camera, students learn how to extend their ‘seeing’ with the camera, both in the world and in a shooting studio. Through shooting assignments student will understand how to: deconstruct image meaning and aesthetic choices, construction of photographic meaning and aesthetics, an understanding of color and how color delivers meaning, how a photographic studio works, proper digital photographic workflow and contemporary trends in photography. Intended for Design Majors, or permission of the instructor. Prerequisite: 51-101

51-171 Placing
Fall: 10 units
This course will explore the context in which students study design. Using primarily photography, students compare where they are from to the bioregion of the Ohio Valley of Western Pennsylvania and the history of the steel town, Pittsburgh. Students also learn about the modern Western emergence of design as a profession and discipline, and map the edges of current design practice by interacting with local professionals.

51-172 Systems
Spring: 9 units
This course explores how to understand complex phenomena by creating models of interrelations between components. Students learn soft systems diagramming as well as the systems thinking associated with ecologies, integrative science and socio-technical regimes. Students also learn how to see design as a way of making interventions into leverage points in a system in order to transform its functions.

51-173 Design Center: Human Experience in Design
Intermittent: 9 units
Design touches, and can profoundly affect, people’s lives. But why? And how? This course begins with a broad definition of what design is (and can be). We’ll see how design is about the process as much as it is about the final product. We’ll look at how the end user interacts with what is designed. And we’ll discuss how designers need to think beyond the actual artifact to what lies behind it. We’ll touch on design theory, design practice, design responsibility and even some design history. And through a series of guest lectures, explorations of other designers’ work, field trips, viewings, class discussions and projects, we’ll try to determine just what design is and what designers do.

51-175 Design Studies: Place
Fall: 5 units
“Place” introduces you to place-based design thinking. It trains your senses to perceive all that is designed and sustains everyday human lifestyles, especially those infrastructures and services invisible to city dwellers in the built environment. In addition, you will recognize relations between natural and artificial worlds. Coursework covers methods to evaluate individual and collective environmental and social impact at a regional and local level through techniques that develop capacities to reveal dynamic relationships among elements.

51-176 Design Studies: Futures
Spring: 5 units
“Futures” frames design in a temporally-extended, systemic context. It offers essential perspectives, practices, and competencies that are increasingly called for as designers progress in their work and careers, and as the design field evolves to acknowledge its significant powers and responsibilities. You will explore numerous futures methods, which support designers through ideation and storytelling, problem-finding and framing, brief formulation, project coordination, and collaboration. Coursework includes engagement with readings and videos, hands-on creative workshops, and visual prototyping and sketching.

51-177 Design Studies: Histories
Fall: 5 units
“Histories” explores a plurality of design histories extending beyond the dominant, Anglo-European story of Design. Through a series of guest lectures, critical readings, and lively debates, you will expand your understanding of design as a “field,” which evolves and changes over time in the context of broader technological, social, and philosophical developments; a tapestry woven of many threads, some more noticeable than others, but all relevant in their own way. Coursework includes authoring a well-historicized account of an influential designer, practice, or movement, and feature as part of a growing, online archive.

51-178 Design Studies: Experience
Spring: 5 units
Experience explores how design touches peoples lives, and shapes their materials and non-material worlds. Through a series of lectures, viewings, and class discussions, we’ll try to determine just what design is and what designers can do. We will explore contrasting definitions of design, and get to know it as an experientially-rich process. Well examine how users and audiences interact with what is designed, and debate the designers responsibility to consider what lies behind it. Coursework includes individual and team projects exploring design’s role in shaping our experience of the world.

51-208 Research Methods
Spring: 4.5 units
Learn how to select, conduct, and develop appropriate research methods for understanding and discovering contextual information and behaviors of human participants.
51-215 Making Short Films
Interr: 3 units
The objective of this course is to provide students with a practical, technical and theoretical foundation in video work. Students leaving this class will have gained knowledge of developing a moving picture from start to finish. Students will learn storyboard, plan, production, and post-production video. Equally important, students will start to develop their own visual aesthetics in the creation of short moving pictures. The primary software for this course is Adobe Photoshop, with which students will explore construction, combination, manipulation, input, and output of video as a means of narrative creation. This Micro course will run between 5-6 weeks. The instructor will fly into Doha for a short period of face-to-face classes, centered around a Saturday. Enrolled students should expect two 90-minute face-to-face classes during the week before or after this Saturday date, as well as four 90-minute evening (6-7:30 pm) video classes over the duration of the Micro course (typically two before the campus visit, and two after, although instructors can change this). Specific dates will be confirmed in the syllabus closer to fall semester.

51-221 Color for Communications, Products, Environments
Fall: 9 units
This course will explore the fundamentals of color through the implementation of various media as they apply to their use in communication and expression in design. While this course does not deal with color theory per se we will spend time on the causes and effects of color interaction, color contrasts, color harmonies and color strategies for the effective use of color in our visual design work. We will use both nature and man made constructs to discuss how color affects what we see and its effect on our visual world. Short exercises and longer term projects will be the vehicles of our explorations. This course is for Sophomore Design Majors. Prerequisite: 51-122

51-223 Color for Communications & Products
All Semesters: 9 units
Working with pure undamaged Roman letterforms, this course introduces students to the theory and practice of hand-generated letters, employing a variety of mark-making tools. This course provides an in-depth understanding of the basic principles and techniques of the art of formal writing. Rhythm, texture and composition are achieved through routine, elementary exercises using geometric forms, demanding concentration and manual discipline with the development of hand-eye coordination. The function, use, and harmonious sequencing of letterforms is taught through weekly projects. Awareness of rhythm, texture and letterform structure is achieved through routine exercises. Drills, demonstrations, discussions, individual and class critiques are on-going. Additional related topics and activities introduced in class include books: binding and design. A brief introduction to the historical development of our Western alphabet is provided through film, slides, demonstrations, with discussion of twentieth-century type designs. Students also gain exposure to letter vocabulary, paleography, monographs, words and punctuation, classical page design, publication design-past and present, and calligraphy’s role in design today. Thinking with hands and eyes, the manual placement and spacing of letters practiced in this course awakens sensitivity and judgment in the designer.

51-225 Communications Studio I: Understanding Form & Context
Fall: 4.5 units
Giving form to messages and information using type, color, and images will be the focus of this introductory studio in Communication Design. Understanding the connection between content, intent, and form will be the goal of every project and exercise. Principles of hierarchy, chunking, sequence, clarity, and visual voice will guide work for the screen and the printed page, in dynamic and static forms. Prerequisite: 51-122

51-227 Prototyping Lab I: Communications
Fall: 4.5 units
Learn the core methods and tools of visual communication design, with a focus on Adobe CC: particularly InDesign, Illustrator, Photoshop, Prototyping tools, and After Effects. The learning of software ideally will align with the activities conducted in the Communications Studio. This is a requirement for Design sophomores studying Communications.

51-228 Communications Studio II: Designing Communications for Interactions
Fall: 4.5 units
This design studio focuses on designing communications for interactions. Through projects that vary in scale and complexity, students explore ways of inciting interaction and providing feedback in print and digital mediums to recognize the dynamic attributes of communication design. Communication structures both traditional and emergent serve as the backbone of the course, as they provide opportunities for students to seek and discover patterns in communication design and conventions and apply what they learn to their own work in illicit specific types of interaction. Course projects specifically emphasize the importance of narrative structures to communication design. They prompt students to sketch, diagram, and visually weave together layers of information as a means of moving audiences through a sequence of dense content. This process helps students investigate narrative structures as frameworks that shape interactions with communications and impact audience experiences. The course concludes with an introduction to systems design, where students explore designing for interactions across a set of communication pieces. Prerequisite course includes Communications Studio I. Prerequisite: 51-225

51-229 Digital Photographic Imaging
Fall: 9 units
The objective of this course is to provide students with a practical, technical and theoretical foundation in digital imaging. The primary software for this course is Adobe Photoshop, with which students will explore construction, combination, manipulated input and output of image as a means of narrative creation. Through project critique and other discussion, we will also consider the aesthetic and political implications of the emergence of this and other new electronic imaging technologies.

51-231 Calligraphy I
All Semesters: 9 units
Working with pure undamaged Roman letterforms, this course introduces students to the theory and practice of hand-generated letters, employing a variety of mark-making tools. This course provides an in-depth understanding of the basic principles and techniques of the art of formal writing. Rhythm, texture and composition are achieved through routine, elementary exercises using geometric forms, demanding concentration and manual discipline with the development of hand-eye coordination. The function, use, and harmonious sequencing of letterforms is taught through weekly projects. Awareness of rhythm, texture and letterform structure is achieved through routine exercises. Drills, demonstrations, discussions, individual and class critiques are on-going. Additional related topics and activities introduced in class include books: binding and design. A brief introduction to the historical development of our Western alphabet is provided through film, slides, demonstrations, with discussion of twentieth-century type designs. Students also gain exposure to letter vocabulary, paleography, monographs, words and punctuation, classical page design, publication design-past and present, and calligraphy’s role in design today. Thinking with hands and eyes, the manual placement and spacing of letters practiced in this course awakens sensitivity and judgment in the designer.

51-232 Calligraphy II
All Semesters: 9 units
This course serves as a continuation and deeper investigation of topics explored in Calligraphy I, where students tackle advanced problems in calligraphy and lettering. The introduction of new hands is to be decided by the student and instructor. Prerequisites: 51-231
Prerequisite: 51-231

51-236 Information Design
Fall and Spring: 9 units
This studio course focuses on teaching a basic visual design process from ethnographic research through ideation to finished artifact. Students will work individually and in teams to gain proficiency in applying specific design techniques to information design challenges. Students will attend lectures to gain new perspectives, engage in projects to learn through making, conduct readings to balance theory and practice, participate in critiques to verbalize their views and consider alternate perspectives, join in discussions to develop shared understanding, give presentations to communicate their thinking, and complete tutorials and learn software for additional insight.

51-239 Prototyping Lab II: Communications
Spring: 9 units
Program simple websites as a means of learning basic HTML 5.0 and CSS; prepare documents for digital and print production using Adobe InDesign, Illustrator, Acrobat; learn basics of UX prototyping
Prerequisite: 51-227
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51-240 Design, Brands, & Futures: Service Design Approaches and Pivots
Intermittent: 3 units
Design, Brands, and Futures: Service Design Approaches and Pivots

51-241 How People Work
Fall: 9 units
51241 How People Work: Human Factors (ID/CD Lab I) This course is a general introduction to the field of human-centered design and applied human factors. It centers on the understanding of physical, cognitive, and emotional human needs and desires, including methods employed to acquire this information and translate it into useful criteria for the design and evaluation of products. Lecture, discussion, lab exercises, and projects are employed. Required of all sophomore design students. Others admitted by permission of instructor only.

51-242 How Things Work: Mechanics and Electronics
Intermittent: 9 units
This course investigates the basic principles of mechanics and electronics. Through the combination of lectures, investigations, and lab experiments, students develop simplified representations of complex systems. The skills of freehand drawing, mechanical drawing and three-dimensional models are employed and developed during the project sequence. Instructor permission required for non-Design majors.

51-245 Products Studio I: Understanding Form & Context
Fall: 4.5 units
This mini-semester course takes students through a progression of exercises and projects that investigate how object forms can relate to people through reasons of looks, feel, function, make, and preference. The understanding of context plays a role as the system of internal and external factors and conditions that cause people to interact a particular way. Through how they recognize, handle, move, and perform activity with the form and material of an object. Drawing and physical modeling become essential tools for the planning, development, and communication of these ideas. Prerequisite: 51-102

51-247 Prototyping Lab I: Products
Fall: 4.5 units
The course will consist of introductions, demonstrations and solutions to introductory aspects of SolidWorks. Forming foundation skills in CAD-based communication and problem solving will be emphasized.

51-248 Products Studio II: Designing Products for Interactions
Spring: 9 units
Introduce student to 3D semantics, how form communicates meaning, and how to make meaningful objects through appropriate material choices and mechanical manipulation; utilize a range and combination of analog and digital tools for higher fidelity output. Prerequisite: 51-245

51-249 Prototyping Lab II: Products
Spring: 9 units
Introduce students to high fidelity modeling techniques through a series of machines, processes, and or methods to simulate desired form, scale, and proportions. Prerequisite: 51-247

51-251 Digital Prototyping
Fall: 4.5 units
A half-semester laboratory mini-course introducing 3D modeling software. Each class meeting consists of an introduction to and demonstration of specific aspects and functions of SolidWorks software. At the end of each class session, work related to the covered topic(s) will be assigned for completion by the next class meeting. This course is a requirement for all ID majors. Instructor permission required for non-ID majors.

51-252 Design, Brands, and Futures: Design Thinking for Sustainable Change
Intermittent: 3 units
Design, Brands, and Futures: Design Thinking for Sustainable Change

51-256 Design, Brands, and Futures: Designing Product and Service Identities
Intermittent: 3 units
Design, Brands, and Futures: Designing Product and Service Identities

51-257 Introduction to Computing for Creative Practices
Intermittent: 10 units
This course is an introduction to Java programming for designers, architects, artists and other visual thinkers, using the popular "Processing" Java toolkit for interactive graphics. Intended for students with little or no prior programming experience, the course uses interaction and visualization as a gateway for learning the traditional programming constructs and the fundamental algorithms typically found in a first course in programming. Students will become familiar with essential programming concepts (types, variables, control, user input, arrays, files, and objects) through the development of interactive games, information visualizations, and computationally-generated forms. Because of limited space, only Design majors may take this course. Students following an IDEATE concentration or minor should register for 15-104.

51-261 Design Center: Communication Design Fundamentals: IxD for Communications
Fall: 9 units
A one-semester course that introduces non-majors to the field of communication design. Through studio projects, lectures, and demonstrations, students become familiar with the visual and verbal language of communication designers, the design process, and the communicative value of word and image. Macintosh proficiency required. This course (or 51262) is required for Design minors. Section W - Qatar campus only

51-262 Design Center: CD Fundamentals: Design for Interactions for Communications
Spring: 9 units
A one-semester course that introduces non-majors to the field of communication design. Through studio projects, lectures, and demonstrations, students become familiar with the visual and verbal language of communication designers, the design process, and the communicative value of word and image. Macintosh proficiency required.

51-264 Design Center: Product Design Fundamentals: Design for Interactions
Spring: 9 units
This one-semester studio-like course non-majors are introduced to product design from the product designer’s point of view. Through studio projects, lectures, and discussions, students will learn approaches to defining and visualizing product concepts for mass production. Case histories and the analysis of existing products will supplement hands-on experience in developing product concepts. This course is required for all Design minors.

51-265 Environments Studio I: Understanding Form & Context
Fall: 4.5 units
Learn the basic design processes for experience-driven multi-modal environments, making meaningful physical and virtual experiences through planning, structuring, and explaining/visualizing; utilize a range and combination of analog and digital tools for high fidelity output. Prerequisite: 51-102

51-266 Environments Studio II: Designing Environments for Interaction
Spring: 9 units
Introduce students to the concept of resonant environments that provide meaningful physical and virtual experiences; utilize a range and combination of analog and digital tools for high fidelity output. Prerequisite: 51-265

51-267 Prototyping Lab II: Environments
Fall: 4.5 units
Learn methods for designing interactions in environments through experiencing the space, low-fi prototyping, rapid making, 3D CAD software and video sketching. Express multi-modal aspects of integrated physical-digital-hybrid environments.

51-268 Environments Studio II: Designing Environments for Interaction
Spring: 9 units
This course is an introduction to human-centered principles of design, including physical, cognitive, and emotional human factors. Capacities and limitations of people affected by design are learned through the study of known principles and user research. The knowledge is delivered through a series of combined lectures, readings, hands-on lab activities, and a team project applying human-centered field research methods and design.

51-271 How People Work
Fall: 9 units
Introduction to human-centered designs, including physical, cognitive, and emotional human factors. Capacities and limitations of people affected by design are learned through the study of known principles and user research. The knowledge is delivered through a series of combined lectures, readings, hands-on lab activities, and a team project applying human-centered field research methods and design.
51-272 Cultures
Spring: 4.5 units
Explore the sociotechnical aspects of the many identity based differences between people. These differences may be not only cultural, but also related to gender, age, class, race etc. The course will survey critical theories that are useful for understanding how difference both constructs, and is constructed, by systems, practices and things. Students will also explore different frameworks and strategies for exploring questions of difference, and to think critically around the ethical and political implications for design interventions.

51-277 Design Studies: Systems
Fall: 5 units
“Systems” prepares you to design for, and within, complex systems. You will make use of systems theory and experiment with systems-thinking techniques to interpret and illustrate how ecological, social, and cultural systems operate at different levels of scale. You will also learn to identify leverage points within a system, and design ways to intervene that creates openings for norms, behaviors, attitudes, and habits. Coursework includes exposure to theoretical frameworks, analysis of case studies, and complexity mapping projects to analyze and represent the world from scalar and systemic perspectives.

51-279 Design Studies: Cultures
Fall: 5 units
“Cultures” immerses you in ways in which societies shape design, and how design shapes societies in return, rooted in historical and philosophical origins of identities and cultures. We will explore various aspects of human difference and relate them to the designed, material worlds we inhabit. Coursework involves reflective practices to connect theoretical, personal, and contextual understandings of the themes exposed, to explore meaning, purpose, and values that represent you as a person and as a designer.

51-282 Design Studies: Persuasion
Spring: 5 units
“Persuasion” develops your capacity to put across your message, to get other people to understand you, to value your work, and to want to work with you. Skills that will be central to your career, both inside and outside of design. Understanding what persuades you and othershow we are influenced by other people, by media, by technology, by our environment, by designs a critical skill to develop in better understanding yourself, your design practice, those around you, and society more widely. Coursework includes a series of persuasive, exploratory exercises including filmmaking and exhibition of speculative work.

51-284 Design Studies: Power
Spring: 5 units
“Power” explores the concepts of politics, the political, and the powers that intertwine with design. You will delve into the mesh formed by plural forms of knowledge, wisdom, power, and designs. A deepening into matters of ideology allows us to think critically about how design artifacts are the embodiment of ideology, having the power to influence what people think, and shape their aspirations, desires, and values. You will be exposed to emerging design practices and theories that harness the power of design for social change with sociocultural and ecological mindsets. Coursework includes facilitation of activities for the collective analysis of topics at the intersection of design and power.

51-317 Publication
Intermittent: 9 units
This course will ask you to individually discover a specific story that is important to you. A story that you want to tell. It can be your own personal story, a campus story or a story from the outside world. You will then develop, produce and publish this storyputting it out into the world in a compelling, memorable and “designed” way. Your publication can take the form of a substantial book, a series of smaller booklets, a film, an animation, an interactive experience or a combination of these. It will include a plan for how you want to disseminate your publication beyond just the classroom and campus. This course is geared towards Communications students as it involves important advanced skills: typography, color, scale, grid, hierarchy, juxtaposition, pacing, layout, bookmaking (binding, materials, etc.) and, most importantly, storytelling. But this course opens to Products and Environments students as well as they may also find it pertinent to their practice.

51-319 Digital Photography in the Real World
Intermittent: 4.5 units
DIGITAL PHOTOGRAPHY IN THE REAL WORLD Photographers are active observers. They look until they see what they want others to see -then they compose and click the shutter. In this course students will walk streets with their cameras. They will learn how to use their cameras to better understand what they believe is important, beautiful, and/or intriguing in the world. They will also learn how to communicate their imagery to others through screen-based and print output. Assignments range from accurately describing reality, to showing aspects of life that should be improved, to making images for purely aesthetic reasons. There are two main goals to this course: learning the fundamentals of operating a digital camera and producing digital output; and, learning to become better ‘seers’ in the world. Students must own a camera but no prior photographic experience is necessary.

51-321 Design Center: Photographic Narrative
Intermittent: 9 units
Most photographs tell stories. We see photographs in newspapers, magazines, snapshot albums, on the web, in books, and in posters. In these contexts photographs often work with words to convey meaning, whether they are shown with captions, news stories, or just with titles. Photographs can work without words, too, to create purely visual narratives. In this course, students will make a photo narrative and determine how it will be seen. Students may make photo books, for example, or decide that their images will be seen digitally on screen. While students are making photographs, we will explore the rich traditions of photographic story-telling that range from the world-oriented work of photo-journalist W. Eugene Smith to the documentarians such as Walker Evans, Nicholas Nixon, and Alec Soth. We will look at photographers, too, who construct fictional worlds, such as Duane Michals, Cindy Sherman, and Gregory Crewdson. As students make their own narratives, we will look at the interplay between words and photographic images; how images are paced and scaled to create rhythm; how photographs are sequenced to tell stories; and other formal elements involved in creating visual narratives. 12-15 students. Prerequisite: college level photography course.

51-322 Advanced Digital Imaging
Intermittent: 4.5 units
Building on the technical skills and methods of communicating narrative learned in Digital Imaging Advanced Digital Imaging takes communication to the next level of resolution with particular concern in art creation. Students explore historical and groundbreaking means of content delivery.

51-323 Communications Studio III: Designing for Complex Communication Systems
Fall
Gain a greater understanding of how to craft communications that resonate with specific people by researching topics/audiences/contexts, by developing/iterating/testing concepts, and by investigating deeply the nuances of typographic form/image/sequencing of interactions; learn how to craft graphic form to express ideas that are not dependent on the reading of words themselves; continue to develop communication systems Prerequisites: 51-228 and 51-225

51-324 Basic 3D Prototyping
Spring: 4.5 units
A half-semester laboratory mini-course introducing a range of materials, methods, and workshop techniques by which designers prototype designs in three dimensions. Basic competence in shop techniques is established by bringing to realization a series of simple artifacts. Studio and model shop tools are required; lab fee. Instructor permission required for non-Design majors.
51-326 Communication Systems Design for Social Equity  
Intermittent: 9 units  
This course will take a systems approach to understanding issues related to social equity and justice and will explore the creation of effective communication strategies for specific audiences across a range of analog and digital platforms. In this class students will explore and discuss the meaning of “social equity and justice” and explore its many facets through 1) assigned readings and discussions; 2) research on the problem and the stakeholders affected by it; 3) the design of a communication system. A review of communication design from historic social equity movements will introduce the course. Students will work in teams to select a social justice issue, and map both the problem and the stakeholder groups affected by it in order to identify target audiences for the communication system. Over the course of the semester, students will formulate content and messaging for use in a range of communications that work together as a system such as brief tweets and messages + images for online platforms, concepts for apps, brief videos as well as print applications such as posters, brochures etc. The final result will be a multi-pronged campaign to raise awareness and motivate action with respect to a social justice/equity problem. Class will meet once a week for 2 hours and 50 minutes. Students will be asked to work in Miro and other online collaborative platforms. This course will be offered remotely.

51-327 Design Center: Introduction to Web Design  
Fall: 9 units  
This class will introduce the basics of designing and building websites, the fundamentals of HTML5 and CSS3, and responsive design approaches to assist students in creating semantically sound web pages that can be viewed across a variety of platforms, devices and browsers. The class will help students understand the constraints and advantages of working with the web, with this course focused on technically pragmatic solutions for making websites. Students will also be exposed to content management systems and topics such as responsive web design, research, and information architecture. Upon completion, students will be capable of designing, creating, launching and managing their own web sites. Your own laptop is required, with the following software installed: Adobe CS6 or later, as well as other open-sourced software. This course is for Design Majors only, or by special permission of the instructor.

51-328 Design Center: Design for Digital Systems  
Intermittent: 9 units  
Through tools and methods of user experience research and ideation, Design for Digital Systems uses web-based technologies to create functional prototypes for digital systems. Through demos, exercises, and a team-based trans-disciplinary project, students will use design thinking, industry-standard UX software, and code to identify, propose, and generate novel ideas for user problems. Students will learn advanced HTML and CSS, along with basic database-driven web platforms using server-side technologies such as PHP and databases. The course is focused on screen-based interactions, but not exclusively so; it considers what technologies are viable today while leaning into the future to solve problems. Experience with HTML, CSS, and JavaScript is recommended but not required. This course replaces 51328 and 51828 Advanced Web Design. There may be a lab fee for non-design students.

51-330 Communications Studio IV: Designing Communications for Social Systems  
Spring: 9 units  
As the final course in a sequence of studio courses for Communication Design majors, this one builds on everything learned previously. Apply skills/knowledge learned in researching, developing, evaluating, refining communications to multi-faceted communication challenges that warrant the design of multiple communication pieces that span diverse mediums (in print and digital platforms) and function as a system; learn how to design for the future (parts of the system yet to be determined) and for co-design where parts of the system are made for growth through contributions from audiences. This course is required of Communication Design majors in the School of Design.

51-331 Advanced Calligraphy I  
All Semesters: 9 units  
This course serves a continuation of study in the discipline of calligraphy. (It meets at the same time as Calligraphy II.) Students are encouraged to tackle advanced problems or work with the instructor to determine new directions of study. Prerequisites: 51332  
Prerequisite: 51-323

51-332 Advanced Calligraphy II  
All Semesters: 9 units  
This course serves a continuation of study in the discipline of calligraphy. (It meets at the same time as Calligraphy II.) Students are encouraged to tackle advanced problems or work with the instructor to determine new directions of study. Prerequisites: 51332  
Prerequisite: 51-331

51-333 Design Center: Designing to Collaborate  
Intermittent: 9 units  
In Designing to Collaborate, we’ll be working on new and better ways to work cooperatively. The class will be a combination seminar and project-based studio in which we will work together to generate, vet, and test ideas to improve collaboration within and across disciplines. We’ll be exploring how issues such as values and goals, intimacy and independence, team dynamics, constructive criticism, and others affect the way we work together. Students can expect reading assignments, class discussion, informal (low stakes) writing projects and presentations, and team-based exercises and projects in which we apply our learning.

51-336 The Non-Selfie  
Intermittent: 9 units  
The Non-Selfie: using the camera to record, probe, and understand one’s own and another’s behavior This course is the opposite of the selfie, but it uses the camera to record human behavior, both your own and another’s. Designers need to be good human observers in order to design for human needs. Designers also need empathy. This course aims to deepen sensitivity to others by first better understanding ourselves. Informed by Manfred Max-Neef’s classification of fundamental needs and other relevant materials, we will create two in-depth photo-essays, the first being a study of ourselves, the second being a study of someone who is unfamiliar to us. In the first half of this course, while looking at the tradition of self-portraiture in photography and other media, we will be making in-depth photographic stories of ourselves. In addition to photographs, we may make scans of objects, include personal artifacts and anything else that may contribute to building an in-depth self-portrait. In the second part of the semester, we will apply what we learned to a person who we do not know, in hopes of bringing new insights and methods to understanding for another. In addition, we will look at the rich literature that exists in documentary photography about representing "the other." By the end of the semester, each student’s work will be made into a hand-made Japanese stab book of two volumes: a volume on oneself, and one on another. The skills learned in this course are immediately relevant to becoming a good designer. Digital camera is necessary, and knowledge of camera operation, Photoshop and InDesign is helpful.

51-338 Documentary Photography  
Intermittent: 4.5 units  
Documentary Photography: the Social and Built Landscape Documentary photography explores issues, often social, humanistic and/or political, in man-made culture. This course examines the work of nineteenth, twentieth, and twenty-first century documentary photographers. Informed by Manfred Max-Neef’s classification of fundamental needs and other relevant materials, we will create two in-depth photo-essays, the first being a study of ourselves, the second being a study of someone who is unfamiliar to us. In the first half of this course, while looking at the tradition of self-portraiture in photography and other media, we will be making in-depth photographic stories of ourselves. In addition to photographs, we may make scans of objects, include personal artifacts and anything else that may contribute to building an in-depth self-portrait. In the second part of the semester, we will apply what we learned to a person who we do not know, in hopes of bringing new insights and methods to understanding for another. In addition, we will look at the rich literature that exists in documentary photography about representing "the other." By the end of the semester, each student’s work will be made into a hand-made Japanese stab book of two volumes: a volume on oneself, and one on another. The skills learned in this course are immediately relevant to becoming a good designer. Digital camera is necessary, and knowledge of camera operation, Photoshop and InDesign is helpful.

51-341 How Things are Made  
Fall: 9 units  
This course will provide a breadth of knowledge for current manufacturing, materials, and processes encountered in the industrial design field. There will be an emphasis on actual production/manufacturing methods and not rapid prototyping methods. The class will consist of various lectures, media, electronic tools, and on-site visits to enable an understanding of how mass production affects design and design decisions. Industrial Design Juniors and Seniors or permission of the instructor.

51-343 Products Studio III: Designing for Complex Products Systems  
Fall and Spring: 9 units  
Provide a framework for understanding core practices of the product design profession by placing it in relation to other disciplines and their influences on mass manufacture of goods; students will use a design process to identify problems, map them into a clear set of tangible artifacts, are made to learn more about the interaction between object, person, space, and context  
Prerequisites: 51-245 and 51-248
51-344 Advanced Digital Prototyping
Spring: 6 units
This course is an advanced course using SolidWorks computer modeling. It is a prerequisite for Production Prototyping. This course is intended for undergraduate Design majors.

51-346 Production Prototyping
Spring: 6 units
This course is the second half of Advanced Digital Prototyping, using your work in SolidWorks to produce hard models. This course is for undergraduate Design majors.

51-347 Drawing from Nature
Intermittent: 9 units
Drawing From Nature This course is about observing and making images of things growing, crawling, flying, swimming etc. Observations will be made firsthand in the field, supported with relevant research in topic areas with the aim of deepening personal understanding of all things biological. Issue surrounding natural forms such as behavior, locomotion, adaptation, the environment and systems will also be investigated. We will work in tandem on refining our abilities in communicating what we discover through the process of drawing. A variety of visualization methods will be covered i.e. analytical drawing, visual notes, and diagramming to name a few. We will be using a variety of basic drawing and digital media to develop our work as we uncover aspects of form, structure, and surface. Guest speakers will present work they have done in areas such as botany, biology, and environmental studies to name a few. A majority of the work will be done in the field and will then be developed in the studio. A final project will be assigned that will challenge you to develop a concept along with a compelling form(s) that communicates what you have uncovered about nature to a variety of audiences. This course builds on your experiences from First Year Drawing and introduces several more advanced visualization methods. This course is intended for Junior and Senior Design Majors.

51-349 Visual Notation/Journaling
Intermittent: 9 units
Visual notation is the graphic equivalent of taking written notes. While the camera is a valuable and at times indispensable tool for recording what we see, the camera cannot make visible mental concepts. Nor can it discover and display underlying structures, create hierarchies, explain organizational schema or concepts that are not easily seen or understood. This course is about making visual notes in order to become fluent in your abilities to observe, record and interpret. Through daily entries in a journal you will work in several content areas i.e. mapping, natural and built environments and systems to name a few. A good portion of the work in this class will be conducted in the field using the resources available to us such as the museum, zoo and architectural sites. You will also be challenged to incorporate your notes as tools for communicating design concepts, implementing project development and presentations. The course will rely on the use of a variety of simple drawing tools and electronic media. Several visualization methods will be introduced and the work will build on the drawing experiences from First Year drawing. This course is intended for Junior and Senior Design Majors.

51-350 Products Studio IV: Designing Products for Social Systems
Spring: 9 units
Challenge students to build their own design and research process to identify and frame the scale and scope of a problem/opportunity, and place it in relation to the wider system (social, cultural contexts); projects will require synthesizing a range of inputs to develop proposals for future working and living.

51-352 Cardboard Modeling II: Exploring expressive product behavior
Intermittent: 6 units
State-of-the-art interactive products express themselves through their screens. This behavior is mostly figural in nature. In the human-computer interaction community there are many examples of interaction-styles that offer a more physical/tangible experience. In order to design products that offer such experiences new skills and tools are necessary: not only do we need to explore aspects of expressive form and interaction; we also need to explore expressive (physical) product behavior with an emphasis on sensing and actuating. While there are tools such as arduino, phidgets or gadgeteer available to do this there is little integration with the simultaneous exploration of form. This course aims to offer this integration. This course is open to Industrial Design Juniors, seniors and grad's others by permission of the instructor. Cardboard Modeling I is a prerequisite, unless approved by the instructor. Materials and tools need to be acquired in advance, a list will be provided; LAB FEE

51-355 Experimental Sketching
Intermittent: 4.5 units
Experimental Forms of Sketching fall 2011 Advancing design drawing philosophy and application This 7 week mini course seeks to expand our experiences with interpreting forms of drawing quality within the process of sketching. This approach will explore semantics of rendering with mixed media, sensitivity of representational perspective, form building, and sequence evolution, within drawing developments that stimulate emotional connections with a viewer. Through exploring and testing variables, we will use the nature of drawing behavior processes to expand the interpretive significance of abstract idea forms. These “drawing idea forms” will be represented throughout a range of abstract levels from literal to highly figurative. Interpretations will derive from a variety of themes involving design, life, and nature and expressed on paper as objects, scenes, and story persuasions.

51-357 Stuff That’s Optional: People at Play
Intermittent: 9 units
Stuff that’s optional: People at play Unlike our necessary work that provides sustenance for self and dependents, our recreation is optional and chosen. Products that support recreation are, likewise, an option. Soccer balls, kayaks, daypacks, fly reels, chess sets, running shoes; for that matter, the entire recreational industry is based on election. Our lives are better off for it; play is good for us. In this studio/project course we will investigate play as an aspect of human endeavor. There are readings, discussions, and sessions aimed at gaining an understanding of the field. We will then respond by searching out and framing design opportunities, ideate and propose, refine and test. We will make stuff as teams and individuals that help us further define what it means to be humans at play. This course is intended for Junior and Senior Design Majors.

51-359 Tools for UX Design
Intermittent: 9 units
The course intent is to develop appropriate user experience of tools and technology for a projected time frame or context of use. The need to understand people’s stories, their lives, and how they want to live determines what interfaces, products, and systems should be developed. Student teams will work together to create appropriate user interactions and experiences which are supported by the design of tools and/or technology. This integrated course will utilize rapid prototyping as the basis for the creation of these proposed tools and products. This course is intended for junior, senior, graduate level students, Non-Disclosure Agreement and other legal agreements may be part of the requirements. Proficiency in one or more of these visualization methods: freehand sketching, computer visualization in 2D graphics, motion graphics and/or 3D solid or surface modeling. By Instructor Approval if NOT in Design. Please forward statement of intent to Instructor.

51-360 Environments Studio IV: Designing Environments for Social Systems
Spring: 9 units
Develop high fidelity proposals and demonstrations of multi-modal hybridized physical-digital environments based on rich information content and principles of user experience design.

51-361 HyperSENSE: Augmenting Human Experience in Environments
Intermittent: 9 units
We make sense of the world using our bodies, and just as we shape environments around us, they also shape our experiences and senses. In this course, we will look at how we can create physical and digital interactions that bridge the gap between humans and built environments to augment our senses. To support our hands-on projects, we will look at both the phenomenology and temporality of human experience and interactions. We will also explore and introduce new roles of computational design and making in embodied sense-making, including human perception and cognition. We will study how we perceive human presence within our space and time. Students in this class will be working in groups to create installations in space controlled by human actions or wearable pieces that augment the body. We will apply methods and practices that form the basis for embodied interaction design. Using research-through-design and iterative design methods, we will create prototypes that materialize these interactions. Students choose the themes for their final projects. Some possible themes for these projects could be: An installation that materializes a human presence in a remote space; a remote collaboration work tool or a wearable piece that enhances a certain human sense, and/or alters the perception of a specific space. Students also submit a publishable semester paper documenting the theoretical approach, creative process and results. The instructors will help students publish their paper or pictorial in upcoming design conferences if students ask for help.
51-362 Environmental Typography: Experiments in Space, Place & Identity
Intermittent: 9 units
This course explores the creative opportunities for typography in the physical environment. Through both individual and team projects, we experiment with dimensionality, material, color, and form. Design experiences that consider scale, interaction, and experimental type. Learn theories, concepts, and strategies related to wayfinding. And lastly, give form to identities through color, material, form, and typographic systems.

51-363 Environments Studio III: Designing for Complex Environment Systems
Fall
Provide a framework and tools for designing for environments using experience design methods as a means to address the plurality of digital/physical hybrid environments.
Prerequisites: 51-265 and 51-268

51-364 Drawing Spaces
Intermittent: 9 units
The natural and built environment will comprise the subjects of inquiry in this course. We will investigate systems of spatial and physical organization as found in the landscape in various forms and structures from forest to farm and from tent to tenement as examples. The intersection of these systems found in accessible locals will be investigated in the field through on site drawings using simple media and sketchbooks. These studies will then form the basis for the iteration of more developed images depicting environments both existing and imagined. Some time will be spent on observing people and various life forms as they populate and interact within these spaces to various ends.

51-365 Information & Space
Intermittent: 9 units
In this course, we will take computational approaches to explore information design in space. Students will consider the interactivity and readability of information when creating data-driven systems. They will learn Javascript programming and use P5.js for their interactive systems. There will be three projects: 1) Speech-responsive Kiosk; 2) Immersive Space using Projection; and 3) Data Visualization using Holo Lens. There is no prerequisite for this course, but basic understanding of typography and information design is expected.

51-367 Design Center: Computational Design Thinking
Intermittent: 9 units
In this course, we will explore creative coding in the context of communication and interaction design and use it as a primary medium to consider form, content and context for designing systems. Specifically, we will use computation as process and material for perceiving and generating forms through crafting the relationships between input and output. In other words, we will create artifacts computationally by designing formations through constructing algorithms and manipulating parameters for recognizing, deconstructing and generalizing patterns across solutions. There will be three group projects to explore the following concepts: 1) Rhythms and Patterns, 2) Structures and Relationships, and 3) Conditionals and Events. There is no prerequisite for this course, but strong understanding of typography, grid, and visual system is expected. In addition, since coding is an integral part of this course, it is assumed that you already have prior experience with programming or will spend time outside of class to learn and understand the basics on your own (links to online tutorial videos will be provided).

51-368 Moving Pictures
Intermittent: 9 units
The objective of this course is to provide students with a practical, technical and theoretical foundation in video work. Students leaving this class will have gained knowledge of developing a moving picture from start to finish. Students will learn how to storyboard/scamp, plan/scout, produce, and post-produce. Equally importantly students will develop their own visual esthetics through the creation of 4 short videos.

51-369 You Are Here: Identity & Place
Intermittent: 9 units
Placemaking is a practice that strengthens the connection between people and the public spaces they share. In this course well explore the identity of spaces, the theories of how we navigate environments, and the ways that designers can define, craft, and/or express the identity of the places we go. This will take the form of projects that ask you to design and prototype permanent and temporary identity systems, custom typography, and full scale physical interventions.

51-371 Futures I
Fall: 4.5 units
The Futures 1 course focuses on aligning near term design action with longer time horizons aimed at sustainable futures. We introduce the students to Design Futures. Design is defined as “an experimental type of design that integrates Futures Thinking with Design Thinking.” A distinguishing feature of design in our usage is the focus on aligning current action with long-term sustainability goals. The course covers different approaches to interpreting the future: from the extrapolations of trend forecasting, through the risk assessments of scenario planning, to attempts to steering the present through backcasting. Students explore the future through utopian and dystopian fictions that are created by authors, filmmakers and themselves. Students also attempt to evaluate futures in terms of their longer-term consequences.

51-372 Persuasion
Spring: 9 units
Examine written argumentation, oral presentations, artifact exhibitions, but also branding and social media. Students learn how to position their design ideas and connect them to the people and organizations that will increase their perceived value to target audiences. A focus of the course is on argument by precedent, where students build the significance of their innovations by situating them historically.

51-373 Futures II
Intermittent: 4.5 units
This course, paired with Futures I (51371), is the second half of a semester-long deep dive into forecasting futures for emerging designers. It represents a turn from learning basic concepts and methods in the futures field, toward more advanced, applied approaches at the cutting edge of strategy, co-design, worldbuilding, and transmedia storytelling.

51-374 Preparing for Design Practice
Intermittent: 9 units
This course helps design students formulate individual plans for their professional practice. In a ramp-up to Confluence, the first third of the course is devoted to self-evaluation, developing/organizing portfolios, writing/designing resumes and cover letters, practicing interviewing skills and creating leave-behinds. After Confluence through a series of lectures, guest lectures, workshops, projects and field trips we explore various aspects of a professional design career as well as other post-graduate opportunities. The course is geared towards Seniors but Sophomores and Juniors applying for internships are also welcome.

51-375 Meaning in Images
Intermittent: 4.5 units
Images abound in our culture. This course takes a critical look at many different kinds of photographic images to understand how they operate in our culture to inform, persuade, and entertain various audiences. The content for this course will be generated from looking at, thinking about and discussing issues discovered while studying well-known to lesser-known images that range from photographs used in ad campaigns, to photographs that are used in scientific representation, to snapshots in family photo albums, to photographs that are used to show social injustices, to photographs that exist in museum collections. Readings will be assigned and short writing exercises will be required throughout the semester. In addition, photography assignments will be given. Design majors will have preference. Requirement: A digital camera. 15 students, junior and senior Design Majors.

51-376 Semantics & Aesthetics
Intermittent: 4.5 units
The course will explore the principles of visual composition, proportioning systems and the rules of order as it relates to art, architecture and design. The class will involve extensive reading and discussion of these topics in class. Some project work will also be required but minimal to the reading. A reading list will be provided. Instructor permission required for non-Design majors.

51-377 Design Center: Sensing Environments
Intermittent: 9 units
Whereas UX Design is typically described as shaping the immediate environment between a user and an object/interface, this course will instruct you in techniques, methods, and vocabularies to expand the scale of your design. Course content will give students experience integrating and shaping their current work into 2-3 other levels of scale, such as a single room, building, campus, and neighborhood. Students will walk away with an understanding of environments that will expand their range of capability, fitting for interdisciplinary application within fields such as social innovation, community development, public policy, architecture, and urban design.
As a society, we're inundated with enormous amounts of dense information on a daily basis. In fact, many of us have grown so accustomed to the abundance of information in our lives that we expect and need it to be accessible virtually anywhere and anytime. Technological advancements, which seem to develop at lightning speed, continually provide us with tools that make it easy for us to access information quickly. However, little is being done to aid people's understanding of information that is increasing in complexity. Why? Our addiction to accessible and thorough information has caused many of us to turn a blind eye to the perceptual problems associated with its speedy delivery. In this course we will investigate contemporary visualizations of information and the bearing of their forms on the quality of communication. We will also study how peoples' perception of content, interaction with others, belief systems, and mental and physical well being can be affected by the visual communication of information. Thus, although we CAN represent information various ways we will ask how SHOULD it be designed to aid people's understanding of it. Your explorations will take the form of analyses of existing artifacts; class discussions and exercises; short, relevant readings that originate in various disciplines such as cognitive science, architecture, learning science, and design; and corresponding projects that enable you to illustrate what you’re learning.

### 51-378 Developing Form with Sketches & Models
**Intermittent:** 4.5 units
**Development of Form with Models and Sketches**

### 51-379 Information + Interaction + Perception
**Intermittent:** 9 units
As a society, we're inundated with enormous amounts of dense information on a daily basis. In fact, many of us have grown so accustomed to the abundance of information in our lives that we expect and need it to be accessible virtually anywhere and anytime. Technological advancements, which seem to develop at lightning speed, continually provide us with tools that make it easy for us to access information quickly. However, little is being done to aid people's understanding of information that is increasing in complexity. Why? Our addiction to accessible and thorough information has caused many of us to turn a blind eye to the perceptual problems associated with its speedy delivery. In this course we will investigate contemporary visualizations of information and the bearing of their forms on the quality of communication. We will also study how peoples' perception of content, interaction with others, belief systems, and mental and physical well being can be affected by the visual communication of information. Thus, although we CAN represent information various ways we will ask how SHOULD it be designed to aid people's understanding of it. Your explorations will take the form of analyses of existing artifacts; class discussions and exercises; short, relevant readings that originate in various disciplines such as cognitive science, architecture, learning science, and design; and corresponding projects that enable you to illustrate what you’re learning.

### 51-380 Experiential Media Design
**Intermittent:** 9 units
Experiential Media Design focuses on the theory, methodology and history behind the design, development and interpretation of experiential media systems. The class incorporates a multidisciplinary approach to the study of complex media systems as technological, political, economic, socio-cultural and personal experiences. Topics covered include media and communications theory, cultural studies, qualitative and quantitative methodology, design principles, human-computer-interaction, information visualization and representation, user studies and evaluation. Students will create and critique a variety of integrated media systems demonstrating technical competence, aesthetic knowledge, analytic rigor and theoretical relevance. This class is open to Junior and Senior Design Majors, and others by permission of the instructor.

### 51-382 Design Center: Design for Social Innovation
**Spring:** 9 units
Design for social innovation is a seminar that traces the history and application of design methods to solving social problems. The course will weave together themes from readings in design, business, public policy, technology, social service, international relations and current events. The course will review examples of successful and failed social innovations from local, regional, national and international contexts. Students will learn the role of governments, technology, funding, infrastructure, mindset, emotion, and cultural factors in addressing problems in the social sector. The course will include a real-world problem-solving component where students (in teams or individually) will write a paper, design an artifact or intervention, propose a project or conduct a short design research study that addresses a real-world problem that impacts a local community.

### 51-384 Design Center: Co-Designing for Social Innovation
**Intermittent:** 4.5 units
This course is for students considering how their work can contribute to a positive societal shift. Through a mix of lecture, readings, classroom activities and short field assignments, the course covers models of change, and methods, approaches, and skills that support the emergence of new social patterns. Such work necessarily involves diverse stakeholders, the complexity of human relationships and beliefs, and the challenges of power, conflict, exclusion and inequity. For that reason, this course helps students make first steps in preparing to facilitate creative change among diverse stakeholders attuning to the conditions for generative dialogue, listening to all voices, and hosting the long process of co-creation.

### 51-385 Design for Service
**Intermittent:** 9 units
We all have an idea of what a good service is -- when everything clicks into place, when you feel a little surprised and delighted because of the thoughtfulness and smoothness. And we know what it’s like when a service goes wrong -- missed flight connections leading to sleeping on an airport floor, sitting for too long in a doctor's waiting room, a website or app acting tone deaf in a sensitive situation. So what does it take to get a service right? And how can our services best communicate and reflect their interactions with us when they’re integrating different streams of data? We will explore the fundamentals of service design in this lecture/studio class. In the first part of the class, we’ll begin with a set of modules on tools and practices of service design. Then, you’ll put them to use in a group project, in which you design and prototype a service. Our goals (and the objectives of this class) will be to learn service design fundamentals by hypothesizing, experimenting, building, testing our assumptions, sometimes failing, tweaking, and improving. Some great visitors will join us too, in person and virtually, to provide real-world insights about service design.

### 51-387 Introduction to DeXign Futures
**Intermittent:** 9 units
As corporations, governmental organizations, and civil associations face accelerating change in uncertain times, increasingly they are looking to designers for new ways of thinking and acting. Designers today are engaged as thought leaders, strategists, activists, and agents of change in complex socio-technical problems throughout private, public, civil and philanthropic sectors worldwide. For designers trained to shape futures defined by uncertainty and change, these exponential times represent unprecedented creative opportunities for innovation. In this course, students learn the basic design skills necessary explore the forces that drive change in the future and learn to align innovation strategically with the trajectories of those forces.

### 51-390 Social Interaction Design in Community
**Intermittent:** 9 units
The course looks at Design for Social Innovation principles and practices, Documentary Photography, and Design Research while walking the streets, talking to residents, and working with organizations in a Pittsburgh neighborhood to understand its challenges. Students will examine Social Design case studies, with a focus on Problem Reframing processes (Dorst), and Solution Amplification (Manzini), and various design-enabled Theories of Change. They will also explore histories and theories of Documentary Photography. For the project/ethnographic portion of the class, students will work in teams of two within a neighborhood, and partner with residents and organizations. These collaborations will help students see the challenges of the community from an insiders point of view, in order for them to design appropriate responses to some of those challenges.

### 51-392 Images and Communication
**Intermittent:** 4.5 units
No doubt the values of photography as a means of recording life. Even if we don't think of ourselves as photographers, digital cameras make it easy to photograph our families, our trips, and aspects of our life that we want to remember. But beyond snapshots, can photography also teach us how to see? And how do they teach us about the world? And, what are the qualities inherent in photographs that make them effective as artifacts of communication? Does looking through the camera's viewfinder sensitize us to world and help us see more? Or, as some writers suggest, does the camera interfere with experiencing the world fully? This course explores seeing with the camera and the many issues that arise when one snaps the shutter. We will be looking at a range of different kinds of photographic images, understanding their contexts, and how to read them. Designers and other visual people use photographs extensively in their work. This course endeavors to make students more aware of their decisions and actions when making photographs as well as how to judge a photograph's effectiveness. The issues that we discuss using photographs, relate to other kinds of visual images, as well. We will be making photographs as we are discussing critical issues in photography that come out of readings. Students must own a digital camera but no prior photographic experience is necessary.

### 51-393 Object Lessons: Design History at the Museum
**Intermittent:** 4.5 units
This course will use Carnegie Museum of Art's collection to explore the history of three-dimensional design from ca. 1850 to the present (with an emphasis on major designs and designers of the 20th century). In small workshops and gallery sessions with the museum's curator of decorative arts and design, students will engage in close looking, formal analysis, and interpretation of iconic objects. Students will also learn about curatorial practice including cataloguing and acquiring objects and exhibition planning.
51-396 Design Center: Design for Climate Change
Intermittent: 9 units
Nobel Laureate Herbert Simon said in Sciences of the Artificial (1969), “Designers devise courses of action aimed at changing existing situations into preferred ones.” Fast forward to today, we are in the middle of a climate emergency. The United Nations Intergovernmental Panel on Climate Change (IPCC) issued a dire warning in October 2018 with the 1.5C report conservatively estimated that to avoid the catastrophic effects of climate change, rapid decarbonization by at least 40-50% by year 2050 and 100% by year 2050 are needed. Global mass movements are pressuring governments towards meaningful change: global student-led strikes fashioned on Greta Thunberg, Extinction Rebellion in the United Kingdom, and so forth. In 2019, employee solidarity walkouts from major corporations coincided with the student-led strikes (e.g., Amazon, Microsoft, Google, Ben and Jerry’s). In January 2020, BlackRock Inc. the world's largest asset manager announced that it would begin divestment from thermal coal and take other measures to make its assets more sustainable. In the Design for Climate Change course, students explore pathways to sustainable futures. What role might designers take on during our defining existential challenge for the future of humanity and life on this planet? Students explore how to become the agents of change around the challenges of the climate emergency focused on rapid decarbonization by the years 2030 and 2050. Projects focus on four levels: individual, university campus, community, and design practice. This course is open to all kinds of designers interested in shifting to sustainable futures ranging from architecture, art, business, computer science, HCI, engineering, psychology, and so forth.

51-399 Junior Independent Study
All Semesters
Proposal forms are available on the Design Intranet. Proposals must be approved by faculty before registration.

51-400 Transition Design
All Semesters: 9 units
Transition Design: Designing for Systems-Level Change. This course will provide an overview of the emerging field of Transition Design, which proposes societal transitions toward more sustainable futures. The idea of intentional (designed) societal transitions has become a global meme and involves an understanding of the complex dynamics of socio-technical-ecological systems which form the context for many of today’s wicked problems (climate change, loss of biodiversity, pollution, growing gap between rich/poor, etc.). Through a mix of lecture, readings, classroom activities and projects, students will be introduced to the emerging Transition Design process which focuses on framing problems in large, spatio-temporal contexts, resolving conflict among stakeholder groups and facilitating the co-creation, and transition towards, desirable, long-term futures. This course will prepare students for work in transdisciplinary teams to address large, societal problems that require a deep understanding of the anatomy and dynamics of complex systems.

51-418 Diversity, Equity, Inclusion and Design
Intermittent: 9 units
In this course, students will explore Diversity, Equity, and Inclusion (DEI) issues as they relate to the School of Design to propose and possibly implement and initiate efforts to begin to address some of these issues. We will learn about the systems, structures, and tools for, by, and with Design at the intersection of DEI. Foundational lectures, discussions, and hands-on workshops combined with a review and consolidation of precedent research and work supporting the definition and scope of DEI. Through a variety of group exercises, directed working sessions, guest lectures by subject matter experts, readings, case studies, and more, students will be guided through an intensive learning process. Students will work individually and collaboratively, including working with the full course cohort. We will ask questions such as: What do we mean by DEI? What are the opportunities and challenges within the design discipline and its pipelines? Within design pedagogy and practice? With designers and designing? What happens if we put DEI at the center of our work? How do we develop new postures and mindsets that place DEI at the forefront of the School of Design at Carnegie Mellon University?

51-420 Sensing Place through Color
Intermittent: 9 units
The world is enhanced by color in every facet of our environment, but we often overlook unimaginable color interactions. The application of color depends mainly upon a trial and error process of selection, comparison, inspection, and evaluation. This course is about learning to look at the world with color filters and exploring ways to utilize color in new and meaningful ways. Through a series of prompts, journaling exercises, and personal experiences, we will reimagine our sense of place through color.

51-421 Design Center: Data Visualization
Intermittent: 9 units
This is a comprehensive data visualization primer. In Data Visualization course students will learn how to parse and visualize data. Starting with multiple introductory exercises on the foundations of data viz, we will then investigate tools, principles and best practice by which computational design driven data visualizations are operating today. Then, students will decide on a data set of their choice (necessary complexity given), to either create a data visualization with an emphasis on telling a story, or to generate a meaningful data art piece with an emphasis on engagement and experience. Project outcomes can be expressed through a variety of forms of the students choosing, from print posters, websites to mind-bending interactive experiences. These can be documented and presented on the final crit. This course assumes that students are already familiar with elementary programming (in any language), such as for() loops, if() statements, array[] and functions(). Participants will use Javascript and very likely popular creative coding toolkits like p5.js, Basil.js, Snap.svg, GSAP, D3.js etc. for their projects.


51-423 Pieces 2.0: Social Innovation: Desis Lab
Intermittent: 4.5 units
In this class, students will identify a social problem and take a holistic design approach to solving it. They will design a product/product line anything from a set of tools to help older adults lead a more active lifestyle, to re-envisioned collateral for the Lupus Foundation Pennsylvania. After or in tandem with the creation of this product, the student will construct an image, which will entail print media, a Web presence, packaging, and photography. By creating the product and its “marketing” effort from top to bottom, the student will gain a diverse set of skills in design as well as a richer understanding of the product. In the end, all the pieces will come together to create a well-refined image.

51-424 Web Portfolio
Intermittent: 4.5 units
This course will provide an opportunity for students to design and code their online portfolio. The course covers basic elements of Web design along with the foundations of HTML, CSS, Javascript and Flash as components of the design process. Prior experience with HTML is encouraged but tutorials will be provided if necessary. This is not an Actionscript programming course.

51-425 Design Center: Beginning Book Arts Lab
Fall and Spring: 6 units
Beginning Book Arts Lab Class. 6 units. (This class is a prerequisite for the Advanced Book Arts Workshop Lab Class). This is a class of basic issues regarding hand bookbinding and letterpress printing. It's purpose is to develop a basic structural sense of book forms, of flat format work and of three dimensional forms. Learning hand craft techniques, developing hand skills and the sensitivity to materials are also a goal. Binding projects assigned will target the unique nature of papers, fabrics and archival cardboards. Structural procedures and techniques will be identified with each assigned binding project. The binding projects will be: A hardcover for a paper back book, a single signature book, a multi-signature book with flat spine, and a box construction. The box project is designed and crafted to contain a small letterpress printed class edition, either in book form, or as a set of un-bound pages. The letterpress component teaches the standard issues, unique to the relief process, in press work, handset procedure of cast metal type, page form spacing, lock-up of pages in press, proofing, and production printing. Each semester a small class edition project of text content and image, in two-color registration, is designed, hand set and printed. Image generation can be by hand cut block, assembled type-high forms, or digital process to polymer plate. This class is not to be repeated.
51-426 Beginning Book Arts Lab
Spring: 6 units
Beginning Book Arts Lab Class. 6 units. (This class is a prerequisite for the Advanced Book Arts Workshop Lab Class). This is a class of basic issues regarding hand bookbinding and letterpress printing. It's purpose is to develop a basic structural sense of book forms, of flat format work and of three dimensional forms. Learning hand craft techniques, developing hand skills and the sensitivity to materials are also a goal. Binding projects assigned will target the unique nature of papers, fabrics and archival cards. Structural procedures and techniques will be identified with each assigned binding project. The binding projects will be: A hardcover for a paper back book, a single signature book, a multi-signature book with flat spine, and a box construction. The box project is designed and crafted to contain a small letterpress printed class edition, either in book form, or as a set of un-bound pages. The letterpress component teaches the standard issues, unique to the relief process, in press work, handset procedure of cast metal type, page form spacing, lock-up of pages in press, proofing, and production printing. Each semester a small class edition project of text content and image, in two-color registration, is designed, hand set and printed. Image generation can be by hand cut block, assembled type-high forms, or digital process to polymer plates. This class is not to be repeated.

51-427 Advanced Book Arts Workshop
Intermittent: 9 units
Students will be required to plan and design projects that relate to binding, or digital printing, or letterpress printing, or hand-setting of cast metal type. Projects utilizing a combination of all processes can be planned as well. Experimental work, or Artists’ Books are also encouraged. In this class structure students will be able to plan and design projects that are complete books, with printed content, or with out content. Other flat structures, and three dimensional containers are examples of general forms that will be categorized as binding work. Students who wish to enroll in this course must have already taken Beginning Book Arts, and must also speak to the instructor directly about project ideas. Emphasis for binding is working independently with a greater level of hand craft and a sensitivity to materials. Emphasis for letterpress printing is to learn in depth, and master, the general mechanical process for doing press work. Emphasis for hand typesetting is on gaining an understanding of the system of cast metal type, and to develop a sensitivity to typographic principles. Instruction will be given on an individual basis through consultation at strategic times throughout the semester. Project evaluation will be based on the success of the project work compared to each student’s written project proposal at the start of the semester. The Advanced Workshop in Book Arts can be repeated. For more complex project work this class can be continued for the following semester.

51-428 Time, Motion and Communication
Intermittent: 9 units
This course focuses on designing and presenting time-based messages on screen. The differences between paper-based and screen-based communication are discussed and become departure points for projects. Working with word, image, sound, and motion — in Adobe AfterEffects — students develop responses to a variety of project briefs. Brief histories of animation, experimental films, and title sequences, as well as experimental music provide conceptual models to our discussions. An attitude of exploration is stressed with emphasis on visual, perceptual, typographic, and communication. Content will include personal messages and timely information. Proficiency with AfterEffects is a firm requirement. Preference will be given to junior and senior Design students.

51-434 Experimental Form
Intermittent: 9 units
The Experimental Form Studio looks broadly at the discipline of industrial design with an emphasis on creating new paradigms for interactive objects. This course encourages an exploratory study of physical objects and artifacts and provides a creative and intellectual forum to re-imagine our relationship with objects. Each independently-themed project presents opportunities to consider embedded mechanics and technology, objects as interactive media, and experience-driven design. Experimental Form, at its most basic, is a process that blends play and inquiry in an open-ended way finding the unexpected through tinkering and trying something you don’t quite know how to do, guided by imagination and curiosity. In this sense, Experimental Form complements the core ID Studio sequence by providing a playground for intellectual discourse, experimental trial and error, and refining individual processes for designing. This is your sandbox. Prerequisites: Junior standing in industrial design, Junior level communication design with instructor permission. Prerequisites: 51-343 or 51-311 or 51-248

51-441 Foundation of BME Design
Fall: 6 units
This course focuses on the Product Development scope and framing of a new medical device. Students will work together in an interdisciplinary team with Biomedical Engineering students to identify medical professional or patient needs through behavioral research and participatory research methods. This course deliverable requires the team to propose the problem space and develop a design brief and plan for the following Spring semester to implement. Prerequisite: Junior level design or higher with studio training. Solid modeling or surface modeling recommended.

51-442 BME Design Project
Spring: 9 units
This course is the second in sequence of prototyping and testing a proposed medical device product. The course consists of modules for the development of a project plan, background research, hazard analysis, setting product specifications based on user requirements, detailed design and analysis, prototype development and final documentation and presentation. All products developed will respond to the needs of appropriate market segments; resulting products will be deemed safe, effective, useful, usable and desirable by those segments. Students will produce a form model, functional prototype, marketing plan, and manufacturing plan of their product. Prerequisite: 51-441 (3 units, Fall) Foundations of Biomedical Engineering Design (or permission of the instructor), Junior level design or higher with studio training. Solid modeling or surface modeling recommended.

51-451 Fundamentals of Joinery & Furniture Design
Fall: 9 units
Intensive introduction to traditional joinery techniques and the properties of wood through the use of textbook studies and lab experiments. Emphasis placed on how these techniques and properties influence design decisions. Students will learn how to set up, sharpen and use traditional hand powered tools. This acquired knowledge will be applied in the design and realization of a piece of wooden furniture. Limited enrollment. Lab fee and material purchases required.

51-452 Furniture Design II
Spring: 9 units
A continuation of 51-451, this course explores a much broader range of issues related to furniture design. Students will identify and define in a proposal the area of furniture design they intend to investigate and then produce one or more furniture pieces developed from their findings. Materials and processes applied to the project are limited only by the resources the student can bring to bear. Assigned readings and a series of in-class discussions will focus on the influence of workmanship in design, and on how the behavior of the user is influenced by the form or esthetic language of the artifact. Lab fee and material purchases required. Prerequisite: 51-451

51-455 DeXign the Future: Human Centered Innovation for Exponential Times
Intermittent: 9 units
DEXIGN THE FUTURE: Human Centered Innovation for Exponential Times As corporations, governmental organizations, and civil associations face accelerating change in uncertain times, increasingly they are looking to designers as thought leaders, strategists, activists, and agents of change to work on socio-technical problems throughout private, public, civil and philanthropic sectors worldwide. For designers trained to shape futures defined by uncertainty and change, these exponential times represent unprecedented creative opportunities for innovation. In this course, students explore methods and tools for design in exponential times to shape uncertain futures. Students will explore the forces that drive change in the future (i.e., social, economic, political, environmental, technological), and learn to align innovation strategically with the trajectories of those forces. The design project that drives everything else is the future of mega-metropolitan regions, the hubs of innovation where 70% of people in the world and 75% of Americans will live in 2050. In the semester long project, students create scenarios for Life 2050 in Metro 3.0, using Pittsburgh as a locus and focusing on a project within urban systems such as Sustainable Production and Consumption, Lifelong Learning, Human Development and Resilient Community.
51-471 Design Center: Imaginaries Lab: Research through Design
Fall: 9 units
The Imaginaries Lab is a research studio developing design methods to explore and support people's imagining both new ways to understand, and new ways to live, in an increasingly complex world. This course, running over three weekends, immerses you in a creative 'research through design' project, including prototyping and using experimental design methods 'in the wild', and in depth. You will learn and develop a variety of tools for conducting innovative forms of research through design, including exploring how people think, understand and imagine complex social and technological concepts, and envision futures, and depending on your expertise or interest, will be able to concentrate on applying particular skills as part of multidisciplinary teams. For example, a project might include speculative design, ethnographic inquiry, physical computing, and novel creative methods. We will aim to turn your work into a published output for a conference or journal, so there is additionally the opportunity to gain experience in this aspect of academic research.

Course Website: http://imaginari.es

51-478 Speculative Critical Design
Intermittent: 9 units
This praxis-based course will actively engage futures research through the integration of findings from critical readings, ethnographic research, mediated storytelling and hybrid prototyping. Using techniques of inversion, defamiliarization, uncertainty scenarios, everyday practice and good old-fashioned humor, we will create objects, systems and experiences that stimulate conversation, debate and understanding. The course seeks to produce a diversity of 'what will?' and 'what if?' cultural provocations that deeply examine possible, unwanted and seductive futures. This course is open to Junior and Senior Design majors, or by permission of the instructor.

51-480 Design Capstone Project: Service Design & Social Innovation
Spring: 12 units
Learn how to work independently, applying skills/knowledge in Products, Communications, Environments to the research/definition/development/ testing of a project that focuses on the design of a service or social innovation that warrants investigation; deepen understanding of service and social innovation design principles and how they are put into practice.

51-481 Senior Design Studio
Fall: 12 units
As contributors to the built world, the School of Design recognizes that designers can greatly impact society and embrace the responsibility to propose new ways of seeing and exploring the numerous dimensions of any given problem space. In this studio, we will continue to evolve our disciplinary practices, ways of working, and purview to develop proposals that can positively impact local communities around us. This will require you to explore research through design, prototype, make, and present compelling, well-reasoned design solutions to the challenge given, leveraging your discipilinary orientations to design products, communications, environments (P.C.E.).

51-483 Debating the Roles & Responsibilities of the Designer
Intermittent: 9 units
Designers are expected to play a role in creating aspirational lifestyles through products and services, and informing and influencing human behavior on small and large scales. However what impact does or should the designer have on our lives, our society, and culture? Through readings, discussions, and team activity, students will construct pro and con arguments and debate the role and responsibility of the designer in a critical and fun way.

51-485 Design Center: Imaginaries Lab: New Ways to Think
Intermittent: 4.5 units
In this course, we’ll carry out 'research through design' projects using experimental investigative methods in the wild, focusing on new ways to think and understand in an increasingly complex world. Learn and develop a variety of tools for conducting innovative forms of research through design, focused on exploring how people think, understand and imagine complex social and technological concepts, and envision futures. By the end of the course students will have worked on an interdisciplinary research project, including with an external partner, drawing on a number of disciplinary domains, and have experience with different kinds of design research and practice, from speculative and critical design to participatory design, as well as developing the skills and experience necessary to innovate with, and deploy, those methods. This course is a complement to 51-487 Design Center: Imaginaries Lab: New Ways To Live, but is independent of it, and either both courses can be taken without overlap (we will be doing different projects, with a different focus).

Course Website: http://imaginari.es/newways

51-486 Designing Experiences for Learning
Intermittent: 4.5 units
This course focuses on designing experiences that engage people in educational activities that enhance their learning through meaningful, memorable, and enjoyable interactions with information. Throughout the course, students investigate the intersection of design thinking, UI/UX design, cognitive studies, social sciences, instructional design, and educational pedagogy as a way of developing knowledge and skills in designing experiences for learners. Students study topics that are often difficult to grasp and collaboratively build a taxonomy of content types based on common and differentiating characteristics to identify design opportunities. Through readings, projects, and class exercises, students explore how people perceive and process information, what motivates them to learn, and what constitutes an experience. The course introduces students to traditional and emergent learning tools and methods as a means of defining affordances and limitations of various learning approaches and mediums. It also provides students the opportunity to apply what they learn through the design, testing, and assessment of learning experiences that they create.

51-487 Design Center: Imaginaries Lab: New Ways to Live
Intermittent: 4.5 units
Focusing on new ways to live and experience the world, now and in the future, we’ll do practical investigative ‘research through design’ projects using experimental methods in the wild. Learn and develop a variety of tools for conducting innovative forms of research through design, focused on exploring how people think, understand and imagine complex social and technological concepts, and envision futures. By the end of the course, students will have worked on an interdisciplinary research project, including with an external partner, drawing on a number of disciplinary domains, and have experience with different kinds of design research and practice, from speculative and critical design to participatory design, as well as developing the skills and experience necessary to innovate with, and deploy, those methods. This course is a complement to 51-485 Design Center: Imaginaries Lab: New Ways To Think, but is independent of it, and either both courses can be taken without overlap (we will be doing different projects, with a different focus).

Course Website: http://imaginari.es/newways

51-489 Design Center: Designing Narratives Across Media
Intermittent: 4.5 units
This studio mini will deal with designing at the intersection of three things: developing rich worlds, i.e. experiences and narratives, understanding how different mediums work and what they do, and understanding how genres work in terms of conventions around content and form. Students will thus be exposed to thought from various disciplines like media, genre, literary and cultural theory in order to create rich, interactive worlds as part of a single design studio project. Specifically, we will be analyzing and reflecting on the phenomenon of interactivity by studying how mediums like interactive print, film and cinema, tangible board/tabletop games, and installation art can be employed using the frame of "Other" futurisms (sinofuturism, Afrofuturism, indofuturism etc.) that are part of the general practice of speculative and science fiction throughout the world. We will engage with popular and cultural texts and artifacts, so students should be prepared to spend time watching movies, playing games, reading books etc. in an analytic, reflexive manner in order to better understand the different strategies that authors have developed in order to evoke specific responses in their audiences. In this class, you will bring the technical skills required - the object will be to collaborate with others with complementary skill-sets in order to create one lavish, intricate transmedial project that will draw people into the depth of its world. This is not an art class - we will discuss the designerly applications of this type of work, particularly with reference to design studies, speculative/critical design, ontological design, and decolonial design. The object of the course will be to make "other" ways of designing in the world visible and experiment with the boundaries of design as a practice of cultural production.

51-493 Design Center: Decoloniality: Past, Present & Future
All Semesters: 4.5 units
The relevance of decoloniality in design. The role of media and technology in shaping and advancing particular ways of understanding the world. The future of decoloniality: where do we go from here?
51-494 Design that Lasts
Intermittent: 6 units
Never have we wanted, owned, and wasted so much "stuff." Our consumptive path through modern life leaves a wake of social and ecological destruction -- sneakers worn only once, forgotten smartphones languishing in drawers, and abandoned IoT devices promising solutions to problems that don't exist. By what perverse alchemy do our newest, coolest things so readily transform into meaningless junk? This design elective investigates why we throw away things that still work, and shows how we can design products and services that last. This is a studio class, with a substantial theoretical thread woven through it. We will therefore spend about half our time on lectures, readings, and debates, and the other half on studio practice, project coaching tutorials, and group critique. The result, a seven-week journey toward an "experience heavy, material light" design sensibility. A vital and timely new design philosophy that reveals how meaning emerges from designed encounters between people and things, explores ways to increase the quality and longevity of our relationships with objects, and the systems behind them, and ultimately, demonstrates why design can -- and must -- lead the transition to a sustainable future.

51-499 Senior Independent Study
All Semesters
Guidelines for independent study are on the Design Intranet. Proposals must be approved by faculty before pre-registration.

51-818 Diversity, Equity, Inclusion and Design
Intermittent: 12 units
In this course, students will explore Diversity, Equity, and Inclusion (DEI) issues as they relate to the School of Design to propose and possibly implement and initiate efforts to begin to address some of these issues. We will learn about the systems, structures, and tools for, by, and with Design at the intersection of DEI. Foundational lectures, discussions, and hands-on workshops combined with a review and consolidation of precedent research and work supporting the definition and scope of DEI. Through a variety of group exercises, directed working sessions, guest lectures by subject matter experts, readings, case studies, and more, students will be guided through an intensive learning process. Students will work individually and collaboratively, including working with the full course cohort. We will ask questions such as: What do we mean by DEI? What are the opportunities and challenges within the design discipline and its pipelines? Within design pedagogy and practice? With designers and designing? What happens if we put DEI at the center of our work? How do we develop new postures and mindsets that place DEI at the forefront of the School of Design at Carnegie Mellon University?