ARCH 4960.01 CONSTRUCTION INSTRUCTION; WHATS YOUR FUNCTION?  
**Course Description:** Through the lens of a real project in design by Grimshaw Architects for an orphanage and school in Haiti that is scheduled to be built by August using off-site construction techniques, we will look out how construction documentation is changing with the advent of off-site and modular construction techniques. We will engage in the design process with Grimshaw and the fabricators to help inform the design and documentation of this project. 
Ikea’s construction instructions have no words. Some of BMW’s autoworkers use augmented reality glasses to receive instructions. Floor layouts are done with laser positioning. What does Direct to Fabrication stop and installation start? Ultimately an Architect’s concept must be distilled and disseminated into a set of instructions for fabrication and construction. How is the building industry adapting to changing technology and changing work flows in construction information?  
**Credit Hours:** 2  
**Course Time:** Wednesday 10:00-11:50  
**Instructor:** Eric Churchill

ARCH 4961.01 Programmable Matter and Information Space  
**Course Description:** The Seminar looks at the concept of the SPIME (Bruce Sterling, 2004) as generative unit for the Internet of Things, its implication for the design of architecture space, thought and culture. Evaluates material sciences (nano and meta-materials), robotics, bio-informatics, biotechnology, genetics, information and communication technologies to discuss precedents and extrapolations for future design scenarios.  
**Course Time:** Friday, 12 – 1:50 PM  
**Instructor:** Carla Leitao

ARCH 4962.01 The Influence of Islamic Architecture in Occidental Culture  
**Course Description:** The Alhambra of Granada, one of the major monuments of Islamic architecture and the most splendid of its kind in the Mediterranean World has held for centuries a legendary fascination for travelers, artists and writers through centuries: Victor Hugo, Lord Byron, Washington Irving, M.C. Escher...are just few from the list. Departing from the analysis of this palace and its medieval acropolis, we will walk through other architectural examples in the Iberian Peninsula and Latin America, in which these reminiscences are present.  
**Credit Hours:** 2  
**Course Time:** Thursday, 10 – 11:50 AM  
**Instructor:** Elena Perez Guembe

ARCH 4963.01 Projective Glitch  
**Course Description:** Architectural software reduces projective geometry to an inert spatial simulation, thus eliminating its impact in the design process. However, innovation in architecture often arises by combining the design of objects with original ways of representing
them. Using digital techniques, we will disrupt default projective environments and explore their architectural potential.

**Credit Hours:** 2  
**Course Time:** Thursday, 12 – 1:50PM  
**Instructor:** Stefano Passeri

**ARCH 4965.01 Projective Veils**  
**Course Description:** The seminar “Oblique Veils,” will focus on projective geometry. It will include readings and historic precedents that will relate to the contemporary discipline and discourse. Using oblique projections of image/graphic in conjunction with wrapping/draping, this seminar will explore the ability to visually augment objects to produce visual misconceptions. Compositing projection with draping, our intention will be to redefine corners, seams and other geometric transition creating both unity and/or schisms. We will study in depth the fold, extrusion, projection, wrapping and draping to composite the 2D image with the 3d object.

**Credit Hours:** 2  
**Course Time:** Friday, 12 – 1:50 PM  
**Instructor:** Brian De Luna

**ARCH 4966.01 The Man Next Door: A. Hitchcock + the Arch of Fear**  
**Course Description:** This seminar will explore the cinema of Alfred Hitchcock via the urban condition. The narrative structures of Hitchcock’s films often move the characters from pastoral settings to urban contexts, and vice versa. These allegories track naive or innocent characters as they move into self awareness, a transition always reflected in the costumes, music, lighting, editing and direction. Famously averse to shooting on location, Hitchcock invented and refined techniques for controlling shifts in scale, perspective and space - all part of his reliance on the studio for a kind of ‘world building’. For example, as a way to save on location costs, Hitchcock developed back-lit film transparencies at the scale of architecture. His techniques of sonic and visual abstraction, defamiliarization, continuous takes, color saturation and disorienting perspectives all have analogs in the operations of the modern city. His themes of voyeurism, doubling, mistaken identity and paranoia are hallmarks of the modern human condition. He made the first film to address psychoanalysis as a subject (Spellbound, 1945), shot an entire film on one set (Lifeboat, 1944), and his dark comedy Frenzy (1972) looked at the urban phenomenon of serial murder. From the 39 Steps to Rear Window to Psycho, Hitchcock torqued the city grid as a symbol for both freedom (anonymity) and oppression (chaos). The Master of Suspense has also been seen as a misogynist, sadist, humorist and cultural critic. We will critically engage his works via screenings, writing and our own attempts at storyboarding and set design.

Michael Oatman  
**Credit Hours:** 2  
**Course Time:** Wednesday, 10 - 11:50AM  
**Instructor:** Michael Oatman
ARCH 4967.01 Emerging Material Systems in Architecture  
**Course Description:** This research seminar looks at the impact of emerging materials, fabrication systems and methods that are upending traditional notions about design, construction, economy and materiality in architecture. Materials such as Cross Laminated Timber, recycled cardboard tubes, plastic composites and composite concrete are just a few of the emerging materials that are already redefining the discipline of architecture and the construction industry in unanticipated ways. By examining a range of new and emerging materials and their impact on architecture, the seminar seeks to catalog the possibilities of construction systems, potential and actual impact, sustainability, and cultural implications of an array of new or reinvigorated materials and material techniques in architecture. The seminar will be organized into a series of research groups with a focus a narrow range of materials. A case-study methodology will be used for documentation and organization of findings and creative speculations collected and disseminated in book form.  
**Credit Hours:** 2  
**Course Time:** Monday, 10 - 11:50AM  
**Instructor:** Lonn Combs

ARCH 4968.01 What an Amazing Time  
**Course Description:** At the beginning of the twentieth century, mankind has discovered digital language. In the forties appeared computers, instruments that enable us to communicate in that language. These devices have changed our lives, ways of communication between us, ways we organize our daily stuff and how we produce things. Almost at the same time in the fifties discoveries in biology, especially genetics, have revealed that all living world speaks the same language, the digital language. "Life is just bytes and bytes and bytes of digital information" (Richard Dawkins)  
We are walking already "in the digital age of biology in which the once distinct domains of computer codes and those that program life are beginning to merge, where new synergies are emerging that will drive evolution in radical directions." (Craig Venter)  
These discoveries are made before our eyes. You and I are their witnesses.  
What an amazing time.  
The Seminar will focus on the consequences of these events. We will study new dependences between nature, culture and technology.  
**Credit Hours:** 2  
**Course Time:** Thursday, 12 – 1:50PM  
**Instructor:** Zbigniew Oksiuta

ARCH 4969.01 The Arch of the Screen: Relationships Between Film/A  
**Course Description:** While architecture is one of the oldest forms of cultural expression, film, by comparison is one of the youngest. Although seemingly at odds with one another, due to the
physicality of architecture, and the image based condition of film, architecture has learned a great deal from the expressive capacities of film. In this seminar we will study the manner in which certain filmmakers have captured the physical environment in dynamic and provocative ways.

**Credit Hours:** 2  
**Course Time:** Thursday, 12 – 1:50PM  
**Instructor:** Anthony Titus

**ASTR 1960 Stars, Galaxies, and the Cosmos**  
This is a 4 credit introductory level astronomy course addressing the nature of the universe from the physics of stars through the nature of space-time. The course will meet in three lecture hours and one studio/workshop hour per week. His course cannot be applied to the Astronomy or Astrophysics minors. There are no prerequisites for this course.  
**Credit Hours:** 4

**ASTR 4960 and 39292 ASTR 6960 Galactic Structure**  
An advanced Astronomy and Astrophysics course for senior and graduate students. This course will build upon student knowledge of theoretical mechanics thermodynamics, and relativity therefore students should consult with the instructor prior to registration. The graduate level course will require extra project work.  
**Credit Hours:** 2

**BIOL 4660/6660 The Biology of Systems**  
This course is designed to be a first course in the study of “systems biology”, to introduce students to the field, the experimental and computational methods that are used within it, and the type of insights that the field can provide to biology. To fully appreciate the complexity of living systems, researchers gather systematic, quantitative measurements of a system’s components using cutting-edge omics techniques. In addition, researchers also leverage computing power to describe, model, and predict dynamic behaviors that could otherwise not be perceived in such large scale omics data. Along with these topics, students will learn to critically read current scientific literature. 4 credit hours. Spring term annual. A student cannot get credit for both BIOL-4660 and BIOL-6660.

**CHEM 1960/01 General Chemistry II for Engineers**  
**Course Description:** Continued examination of the principles of chemistry in more depth, considering thermodynamics, advanced concepts in chemical equilibrium and acid-base chemistry, kinetics of chemical reactions, electrochemistry, nuclear chemistry, basic mechanisms for organic reactions. This course is being offered as a lecture only class with no laboratory requirements. Cannot earn credit for both CHEM 1200 and CHEM 1960

**CHEM 4961/01 37878 Enrichment in Organic Chemistry I**
Course Description: Part One (Six Weeks) Course is offered first half of semester. Students enrolled in this course are required to have successfully completed Freshman Chemistry I (or equivalent course) which covered the fundamentals of the subject matter and Organic Chemistry I, wherein students will have learned about functional groups, acidity and basicity as it applies to organic chemistry, key spectroscopic methods (MS, IR, UV) and how to apply all these concepts. The chemistry of delocalized systems, alkenes, alkynes and aromatic systems and a more advanced approach to synthesis involving a clear understanding of electron flow in the reactions, will be introduced. The course also covers more advanced topics in organometallic chemistry, free radical chemistry and studies of systems in which competing reactions such as substitution and elimination are occurring. Concepts of physical organic chemistry are developed further in this course.

Credit Hours: 1

CHEM 4961.02 Enrichment in Organic Chemistry II

Course Description: Part Two (Six Weeks) Course offered the second half of the semester. Students enrolled in this course are required to have successfully completed Organic Chemistry I (or equivalent course) which covered the fundamentals of the subject matter and the first part of this enrichment program. In Organic Chemistry II, students will have learned additional spectroscopic methods (NMR) and how to apply them in coordination with other methods (IR, MS, UV/Vis) to identify complex molecules. Students will have developed the chemistry of aromatic systems and a rich combination of carbonyl-based chemical reactions and derivatives, especially with respect to directed synthesis. This will now be developed even further towards the targeted synthesis of important biomolecules or molecules with physiological activity, coupled with advanced spectroscopic methods. This course also covers additional selected topics in the biological applications of organic chemistry, including carbohydrates, enzymes, drug-like compounds, “simple” drug synthesis and nucleic acid polymers. Further concepts of physical organic chemistry and an extensive study of pericyclic reactions are also covered. Students will give one or two presentations during the course.

Credit Hours: 2

CIVL 4960/6960 Transportation Data Acquisition and Analysis

Course Description: This course introduces theories and techniques related to the acquisition and analysis of transportation data, with an emphasis on travel behavioral data. Through taking this course, students should:
Be familiar with existing transportation data sources and formats;
Develop and implement data acquisition processes to collect travel behavior information;
Identify and apply appropriate analytical methods for analyzing different types of data.

Prerequisites: ENGR 2600 or equivalent

Credit Hours: 3

Course Time: Monday/Thursday: 2:00-3:50 PM

Instructor: Cara Wang
COGS 2960 Introduction to Linguistics

**Course Description:** This course offers a survey of scientific and applied approaches to the study of human language, highlighting the endlessly surprising, often confounding, nature of this sophisticated mode of communication. Topics include phonology, morphology, syntax, semantics, pragmatics, language acquisition, psycholinguistics, and computational linguistics. Emphasis will be placed on developing the skill sets needed to carry out innovative linguistic investigation. No prerequisites.

COGS 4960/6960 Natural Languages: A Cross-Linguistic Perspective

**Course Description:** This course explores the impressive variety of languages spoken throughout the world, which employ very different strategies to carry out one and the same basic inventory of human communication needs. Topics include: historical linguistics and diachronic language change; language universals; language typology; dialects, creoles and pidgins; translation by humans and machines; and the much-debated question of whether every shade of meaning can, in principle, be expressed in every natural language. Close analyses of select languages will also be undertaken. Class meetings will include lectures, discussions, and group projects.

**Prerequisites:** Undergraduates: Introduction to Linguistics or permission of the instructor. There are no prerequisites for graduate students but they will be required to do background reading if they are new to linguistics.

COGS 6960 Computational Psychology

**Course Description:** This course introduces students to computational psychological models of various kinds. It will present relevant conceptual, theoretical, and implementation aspects of computational modeling of psychological processes and mechanisms. Students in particular will learn about computational cognitive architectures. The course will cover model details, simulation examples, and advanced topics.

COGS 6968.01 Research Problems in Cognitive Sciences

**Course Description:** The research problems in cognitive sciences seminar is aimed to provide graduate students with in-depth information concerning a broad range of research problems and domains in cognitive sciences. It includes talks by invited speakers, as well as research progress reports by graduate students and faculty. Its goal is to establish some broad understanding of current, ongoing cognitive sciences research and to stimulate further research.

CSCI 2963.01 Introduction to Open Source

**Course Description:** An introduction to open source software, open source communities and group dynamics, and open source tools. Students learn about the structure of groups, how communities form, and how group behavior impacts project success in communities, all in the
context of open source software. Students also learn hands-on open source tools, including git and svn, and contribute to existing open source projects by modifying source code. Topics also include: challenges of global communication via blogs, wikis, IRCs, bug trackers; debugging and fixing code; communicating code changes and documentation; group formation; and the value of sharing and building one's software portfolio. This course is highly recommended as a prerequisite to working with RCOS.

**Prerequisites:** CSCI 1100  
**Corequisites:** CSCI 1200  
**Credit Hours:** 4  
**Instructor:** Krishnamoorthy

**CSCI 4961.01 Cognitive Modeling I**  
**Course Description:** See COGS 4210  
**Prerequisites:** See COGS 4210  
**Credit Hours:** 4  
**Instructor:** Schoelles

**CSCI 4963.01 RCOS**  
**Course Description:** This 0-credit non-graded course offering is an administrative means to obtaining a full roster of students participating in RCOS. RCOS (Rensselaer Center for Open Source) is an eclectic group of undergraduate students that embark on individual and team-based open source projects, primarily software, but also open hardware projects. Many new projects are introduced each semester, though many ongoing and higher-profile projects are undertaken, as well. Students are required to work on and contribute to open source projects, maintain a blog, and present to the group during the semester. Students may earn independent study credit hours, a limited stipend, or do RCOS for the experience only.  
**Prerequisites:** CSCI 1200 and a 2000-level course in CSCI, ECSE, or ITWS  
**Credit Hours:** 0  
**Instructor:** Krishnamoorthy, Turner, Goldschmidt

**CSCI 4964.01/6964.01 Knowledge Discovery and Extraction**  
**Course Description:** This is an advanced research-centric course to go over the most up-to-date techniques in Information Extraction and Knowledge Discovery. We pick up ten trending topics, and give a comprehensive overview for each topic. We will review where we have been (the most successful methods in literature), and where we are going (the remaining challenges, and novel methods to tackle these challenges). These topics are selected to match the thesis topics and research interests for the students attending this course. We also expect to invite several top researchers in this field to give guest lectures. The goal is for each student to have at least one solid paper submission ready at the end of this course. We also aim to strengthen everyone's presentation and writing skills, so we will do peer review on the presentations and paper submissions.  
**Prerequisites:** CSCI 2300 or permission of instructor  
**Credit Hours:** 4
Instructor: Ji

CSCI 4965.01/6966.01 Learning and Advanced Game AI
Course Description: See COGS 4962/6963
Prerequisites: See COGS 4962/6963
Credit Hours: 4
Instructor: Si

CSCI 4968.01/6967.01 Ontologies
Course Description: This class will provide an introduction to ontologies and their uses, along with semantic technologies that leverage ontologies. Ontologies encode term meanings thus enabling computer programs to function more effectively. Ontologies have become increasingly common on the web, and class participants will not only learn about what ontologies are and how they can be used, but they will also learn how to find relevant ontologies as well as learning how to evaluate ontologies. Participants in the class will read relevant papers, learn how to critically review papers as well as ontologies, and will participate in at least one group project designing, using, and evaluating ontologies.
Prerequisites: CSCI 2300 or permission of instructor
Credit Hours: 4
Instructor: McGuinness

CSCI 4969.01/6961.01 Digital Manufacturing
Course Description: In the next ten years traditional manufacturing will be transformed by intelligent machines. In this course we will study what types of information are necessary to control digital manufacturing. Using aircraft and trucks as examples, we will look at how a manufacturing process operates and the types of information necessary to control digital manufacturing. We will examine the information in a product and how it is related to the mathematics of surfaces, the kinematics of manufacturing machines and the definitions of quality. We will examine how all this data can be shared over the supply chain between many different types of users, applications and programmers. The course will be delivered as two lectures per week with graded hands-on examples, and follow-up homework’s. Teams will be formed for final presentations at the end of the class. Opportunities for sponsored research will be available for successful students.
Prerequisites: CSCI 2300 or permission of instructor
Credit Hours: 4
Instructor: Hardwick

CSCI 4971.01/6971.01 Large-Scale Computation and Machine Learning
Course Description: Modern machine learning routinely deals with millions of points in high-dimensional spaces. Classical numerical linear algebra algorithms can be prohibitively costly in such applications, as they aim at machine precision and scale super-linearly in the size of the input data. Fortunately, machine precision is seldom necessary, and recent developments have established that randomization can be used to bring the costs of matrix algorithms closer to
linear in the size of the input data; this is done by sacrificing, in a principled manner, computational accuracy for increased speed. This seminar course surveys modern randomized numerical linear algebra and its applications to machine learning, with the goal of providing a solid foundation for the development of new methods. Topics will include fast linear regression, fast approximate low-rank decompositions, fast k-means and spectral clustering, fast approximate kernel methods, and promising research directions in the field.

**Prerequisites:** CSCI 4100 or permission of instructor

**Credit Hours:** 4

**Instructor:** Gittens

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**CSCI 4976.01 Web Science Systems Development**

**Course Description:** See ITWS 4500

**Prerequisites:** See ITWS 4500

**Credit Hours:** 4

**Instructor:** Adali

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**CSCI 6963.01 Computational and Social Trust**

**Course Description:** Will you trust that information you find online is true? Will you trust an online source/seller is reliable, not compromised, not a troll or not a bot? Trust is underlying many decisions we make online, often manipulated and distorted by many hidden algorithms that filter and present that information. We need to understand both our perception of trust and how computation impacts it before we can develop better algorithms. Trust is an often used term in many disciplines including Computer Science, but not all definitions of trust really define the same phenomenon.

In this graduate class, we will review trust literature in social and cognitive psychology and link them to computational methods developed in Computer Science in many disparate fields. We will especially concentrate on social trust and its effect on how individuals consume information in networks where mistrust and misinformation are present. As a graduate level class, the class will assume a level of academic maturity ideally demonstrated by multiple upper level Computer Science courses completed (4xxx or higher). Students must also have the ability and desire to read research papers critically.

**Prerequisites:** Multiple CSCI 4XXX courses

**Credit Hours:** 4

**Instructor:** Adali

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**ECSE 4961 Introduction to Optoelectronics**

**Course Description:** An introduction and survey to optical physics with an emphasis on the practical aspects of optoelectronic devices and systems. Topics include the nature of light, optical waveguides and fibers, light emitting diodes, laser diodes, photodetectors and solar cells, modulators, optical filters, and birefringence materials for display technology.

**Prerequisites:** ECSE-2210 Microelectronics Technology and ECSE-2100 Fields & Waves I or equivalent.
ECSE 4963/6963 Wireless Data Communications

Course Description: This course is an introduction to the notion of multi-antenna communication systems. The hallmark of a multi-antenna system is to explore a new physical dimension (space) which in conjunction with the traditional communication dimension (time) constitute a new paradigm of communication, known as multi-antenna communication or space-time communication, over the unreliable communication medium. Multiple-input multiple-output (MIMO) technology constitutes a breakthrough in the design of wireless communication systems, and is already at the core of several wireless standards. Exploiting multi-path scattering, MIMO techniques deliver significant performance enhancements in terms of data transmission rate and interference reduction.

The course is broadly split into three parts reflecting the conceptual development of multi-antenna systems. The first part focuses on exploring the gains of deploying multi-antenna transmitters and receivers in a simple point-to-point communication channel. Next part discusses the merits and challenges of multi-antenna systems in one-to-many (broadcast) and many-to-one (multiple access) communication channels. The last part focuses on large wireless networks (specifically, contemporary cellular networks such as those based on the 3GPP LTE or IEEE 802.16e standards) that consist of many broadcast or multiple-access channels and investigates the co-existence of these building blocks and their mutual interplay and impacts.

The course will also discuss broadband communications systems, and the technologies that enable efficient broadband communication, such as OFDM and CDMA.

Prerequisites: ECSE-2500 Engineering Probability and ECSE-4520 Communication Systems

ECSE 4964/6964 Internetworking of Things

Course Description: This is an advanced course on communication networks meant for graduate and senior-level undergraduate students interested in understanding state-of-the-art technologies and emerging developments in networking. The course provides an in-depth study of the technologies and protocols involved in building the Internet-of-Things (IoT), with specific focus on networking at the edge of the Internet. This includes understanding of wireless communication and link layer technologies, multi-access and scheduling mechanisms, mobility models, routing in ad-hoc networks, energy-efficient edge networking, loss tolerant transport protocols, and their applications to emerging areas such as vehicular networks/robotics, RFID systems and smart buildings. This course will also have a strong emphasis on hands-on experience utilizing Raspberry Pi and/or Arduino, and a significant part of the course assessment will be based on a final project focused on building a wireless based indoor localization application for IoT devices.

Prerequisites: Basic understanding of computer organization, operating systems and networks (as in ECSE-2660). Ability to write computer programs in a high level language (such C, C++, Python etc.)

ECSE 4965/6965 Introduction to Deep Learning

Course Description: Deep learning involves learning hierarchical representations of input data in increasing levels of abstraction. Deep Learning is rapidly emerging as one of the most
successful machine learning techniques. It has revolutionized several fields, including computer vision, natural language processing, and speech recognition. This course introduces fundamentals in deep learning and demonstrates its applications in computer vision. It covers both probabilistic deep models such as Restricted Boltzmann Machines (RBM), Deep Boltzmann Machines, Deep Belief Networks, and Deep Bayesian Networks as well as deterministic deep models including Convolutional Neural Networks and Autoencoders. In addition, the course will also cover the latest deep learning topics including Recurrent Neural Networks and Deep Reinforcement Learning. The course is self-contained. It starts with an introduction of the background needed for learning deep models, including probability, linear algebra, standard classification and optimization techniques. To demonstrate various deep models, we will apply them to various computer vision tasks, including object recognition, human action recognition, and facial expression recognition.

Prerequisites: Knowledge in linear algebra and basic probability and strong programming skills in a high level language such as C++, Matlab, Python. Prior courses in machine learning/pattern recognition and computer vision/image processing are preferred but not required.

ERTH 6961/01 Advanced Metamorphic Petrology II:
Course Description: The course will cover current topics in metamorphic petrology as gleaned from recent literature.

ISYE 6960/01 Big data Analytics
Many organizations have invested heavily in information technology to help them manage their businesses more effectively and gain a competitive edge. Over the last three decades, increasingly large amounts of critical business data have been stored electronically and this volume is expected to continue to grow considerably in the near future. Yet despite this wealth of data, many organizations have been unable to fully capitalize on its value.

Big Data Analytics is intelligent automated extraction of potentially useful information from large amounts of data. It is the process of automated presentation of patterns, rules and functions from large data bases to make crucial decisions (e.g., in science or business). This course takes a multi-disciplinary approach to big data analytics and knowledge discovery involving statistics, support vector machines, decision trees, Bayesian classification, neural networks, deep belief learning and clustering. This course requires a project and will put a special emphasis on deep belief neural networks and computational intelligence in general. Also, recent developments in and text mining will be highlighted in this course.

ITWS 6960/ITWS 4960 Data and Society
Course Description: The ubiquitous availability of digital information has transformed the world as we know it. This has created a paradigm shift from information-poor to information-rich, and impacts virtually every part of society. This course is a data topics course that provides an overview of the ways in which society is leveraging and responding to social, organizational, policy, and technical opportunities and challenges of a digitally-enabled world. Course topics and readings will sample a broad spectrum of areas of a data-enabled society and are described below. Cross listed with CSCI 6370/CSCI 44370
Prerequisite: Data Science (CSCI/ERTH/ITWS 4350/6350) or permission from the instructor.
Credit Hours: 3/4 credits
Instructor: Berman

MANE 2961 Inventor’s Studio I: Ideation Innovation – with Professional Development I
Course Description: Inventor’s Studio 1/PD 1 is being offered in Spring 2017 as an alternative to ENGR-2050 Introduction to Engineering Design / PD1. While the course is open to all students, at this time only MANE students may take this course in lieu of IED/PD1. Students from other programs should consult with their degree clearance officer to see if IED credit may be granted. Students will learn how to: 1) Build on your personal values, purpose, and mission, to prepare and build confidence for a career as a leader of technological innovation; 2) Learn critical thinking, problem solving, and interpersonal skills required for success in the world as an innovator; 3) Regain your creativity, and develop the mindset of an innovator. Specifically, you will learn a) to select “tools” for innovation, and how to choose the appropriate tool for an idea or problem; b) a systematic “process” for innovation to develop an innovative idea from concept to a minimum workable prototype; c) to iterate on fine tuning innovative ideas, learning from each "iteration" using an ideate-build-learn cycle; d) a quick overview of "Additive Manufacturing" or 3-D printing methods.
At the end of the course, students will be given preference to enroll in Inventor’s Studio 2 (Alternative Capstone class to MDL Capstone), which is to develop their prototype into a full-fledged product or offering to have discussions with industry or investors. Students/mentors/RPI would own the Intellectual Property of the ideas.
Credit Hours: 3

MANE 4962 Digital Control Systems
Course Description: This is a new MANE cross-listing of ECSE-4510 Digital Control Systems, taught by an Electrical, Computer, and Systems Engineering instructor. It is expected to be of special interest to Mechanical Engineers concentrating in Dynamics and Control.
Prerequisites: ECSE-2410 Signals and Systems is specified as a prerequisite, but MANE-4050 Modeling and Control of Dynamic Systems will be sufficient for students concentrating in Dynamics and Control.
Credit Hours: 3

MANE 4963 Introduction to Computational Fluid Dynamics
Course Description: This course will provide an understanding of the computational methods and analysis techniques used to solve problems in Fluid Dynamics. It will also provide real-world, hands-on experience in solving complex flow problems in Aerospace and Aeronautical Engineering. The course will progress along two parallel tracks. In one track, students will learn about computational methods, in particular, the finite volume method, used to solve fluid dynamics problems. They will write a finite volume code in a simple programming language (Python/Matlab), use it solve benchmark problems, and learn to analyze the stability and convergence their algorithms. In the second track, they will use an established computational fluid dynamics package to solve problems that are motivated by complex Aerospace and Aeronautical problems. Here they will learn the importance of representing geometry, meshing fluid volumes, and selecting important problem parameters like appropriate models for turbulence.

This course will satisfy the new Class of 2020 Computation Intensive Elective requirement for mechanical and aerospace engineering students.

Prerequisites: MATH-2010 Multivariate Calculus & Matrix Algebra, either MANE-4010 Thermal and Fluids Engineering II or MANE-4070 Aerodynamics I, and a programming course.

Credit Hours: 3

MANE 6961.01 Physics of Micro- and Nano-Fluidics

Course Description: This course introduces fundamentals of fluid transport in micro and nanoscale channels at low Reynolds numbers. Topics of electrokinetics, capillary and multiphase phase flows, and electrowetting will be covered. The course will also cover how these flow physics can be utilized for various biomedical applications and combined with other modalities for new functionalities. Course includes a design project of the microscale flow using a FEM computational fluid dynamics package.

Prerequisites: MANE-4010 Thermal and Fluids Engineering II, or MANE-4070 Aerodynamics I, or equivalent.

Credit Hours: 3

MANE 6962.01 Helicopter Design

Course Description: This is a cross-listing of MANE-4860 Introduction to Helicopter Design. The 4000-level course is an approved Communication Intensive Capstone Design course for aeronautical engineering seniors. This 6000 level course is for graduate students who have not taken MANE-4860.

Prerequisites: MANE-4200 Rotorcraft Performance, Stability, and Control, or permission of the instructor.

Credit Hours: 3

MATH 6590 Introduction to Mathematical Physics

Course Description: Introduction to Mathematical Physics will provide an introduction, for mathematics students, to some of the mathematical and physical theories needed to understand mathematical physics and cosmology. The course will provide an introduction to classical mechanics, electromagnetic theory, differential geometry, group representations,
variational principles, and the special and general theories of relativity. No knowledge of physics will be required.

**Prerequisites:** Some knowledge of ordinary and practical differential equations, multivariable calculus and linear algebra, and a curiosity about the fundamental laws of Nature.

**Credit Hours:** 4

**Course Time:** Spring 2017, TF 10:00 – 11:50 AM

**Instructor:** David Isaacson

**MATH 6790 Stochastic Differential Equations**

**Course Description:** We will introduce and study mathematical frameworks for analyzing complex dynamical systems where some interactions are modeled statistically. Techniques from stochastic differential equations and other stochastic process theory will be developed and illustrated in applications drawn from finance, physics, and biology.

**Prerequisites:** Familiarity with differential equations at an undergraduate level. Some background in probability would also be helpful, though we will quickly review the key concepts.

**Credit Hours:** 4

**Course Time:** MR 12:00 - 1:50 PM

**Instructor:** Peter Kramer

**MGMT-7960 Seminar in Capital Markets**

This course focuses on empirical financial accounting research related to capital market issues. The course involves the discussion of research papers that will help doctoral students understand the evolution, theoretical foundations, and research methods of capital market literature. Meanwhile, this course will help students develop skills to identify and implement marketable research projects related to capital market issues.

**MGMT 6961 Student Managed Investment Fund**

**Course Description:** The Student Managed Fund course actively invests real capital using financial market principles. The goal of the fund is to produce excess returns relative to the performance of 80/20 equity/fixed portfolios through the use of fundamental, technical, and quantitative strategies driven by economic fundamentals. The goal of the course is to directly apply, in a real world environment, the analytical financial skills developed within other Lally courses and to provide students with both instructor and peer real-time feedback for their work. Students will vote on and justify portfolio decisions, develop investor communication materials, and prepare real world deliverables for market development, strategy generation, and director of research rotating roles.

**MGMT-6966/ MTLE 6961 Energy, Environment and Economics**

This course is designed to provide students with skills to address the complex challenges created by our energy requirements. The underlying science and technology of energy sources and solutions including fossil fuels, nuclear energy and renewable energy are presented in the context of their advantages and limitations with respect to technological, social, environmental
Interdisciplinary teams of students develop multifaceted analysis of a specific energy issue addressing needs of a potential customer, such as industry, service entity or local and state governments. The team research and activities will lead to a report and proposed path for further development of the opportunity or solution.

PHIL 4965 Anarchism: Ethical Living

**Course Description:** Anarchism is the quaint notion that people shouldn’t be pushed around. Nor should they be plugged into a Matrix of compliance by authoritarian socialization and political indoctrination. We examine the conceptual logic of this notion, organizing its implications. We also examine our social psychology of submission to illegitimate authority—its dehumanizing effects, the prospect for greater individual and social self-determination. We consider what truly voluntary organization, cooperation and mutual development would involve and utopian communities aimed at achieving it.

**Instructor:** Puka

PHYS 2960 Intro to Physics Teaching

Students will learn about principles of Physics instruction through classroom experience. Students are expected to have a strong technical background in the course in which they participate. Registration by permission of instructor.

**Credit Hours:** 2

PHYS 2961 Particle Astrophysics

Introduction to the field of particle astrophysics at the sophomore/junior level.

**Recommended prerequisite:** PHYS 2210 Quantum Physics 1.

**Credit Hours:** 4

PHYS 4961 Photonics

Fundamental principles of optics and its application to photonics. The course is designed to provide fundamental understanding to the field of photonics as well as its connection to hot topics and frontiers of modern optics. Graduate students of all science and engineering fields and senior undergraduate students with basic knowledge of electromagnetism are welcome. The topics to be covered include: Wave Optics, E&M Optics, Coherence of Light, Wave Propagation in Plasma, Guided-wave Optics, Gaussian-Beam Optics, Resonator Optics, Photons and Atoms, and Laser Amplifiers.

**Recommended prerequisites:** PHYS 2220 Quantum Physics 2 and PHYS 4210 Electromagnetic Theory or ECSE 2100 Fields and Waves 1.

**Credit Hours:** 4

PSYC 4961 Psychology of Reward

**Course Description:** The goal of this course is to provide an appreciation of the uses and limitations of Models of Reinforcement. The course is intended to make students informed consumers of scientific information and quasi-scientific information about reinforcement. While there is no generally accepted comprehensive theory of Human Behavior, there are many
findings, concepts and models of behavior that can be very effective for understanding and predicting behavior if used appropriately.

**Instructor:** Ralph Noble

**STSS 496X STS in the World**

**Course Description:** This 1-credit course is open to students majoring in Science and Technology Studies, Sustainability Studies, and Design, Innovation and Society. The course will prepare students to apply the knowledge gained in their degree programs to real-world issues and problems. Participants will investigate, present, and discuss contemporary issues relating to science and technology, such as: fracking, drones, reproductive technologies, genetic engineering, surveillance technologies, climate adaptation, water infrastructure, and emerging public health threats. Restricted to STSO, SUST and DIS majors.

**Credit Hours:** 1

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**STSS-6963**

**DESIGN SEMINAR**

Nieusma

This seminar explores various factors that shape design practice, research, teaching, and outcomes. It aims to develop a collaborative language for studying design and promoting both improved scholarship and better design practice. This course focuses primarily on the social analysis of design of material objects (e.g., products) and systems (e.g., infrastructures) and spatial environments (e.g., cities), with less attention to the design of texts, policies, institutions, and social systems.

Restrictions: Graduate student standing

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39283: Private Music Lessons: Violin
39310: Private Music Lessons: Viola
39311: Private Music Lessons: Cello
39312: Private Music Lessons: Bass
39313: Private Music Lessons: Flute
39314: Private Music Lessons: Oboe
39315: Private Music Lessons: Clarinet
39316: Private Music Lessons: Bassoon
39317: Private Music Lessons: Saxophone
39318: Private Music Lessons: Trumpet
39319: Private Music Lessons: French Horn
39320: Private Music Lessons: Trombone
39321: Private Music Lessons: Tuba
39322: Private Music Lessons: Piano
39323: Private Music Lessons: Harp
39324: Private Music Lessons: Percussion
39325: Private Music Lessons: Voice

Private Music Lessons

Individual instruction in 15 1 hour private meetings. Provided on violin, viola, cello, bass, flute, oboe, clarinet, bassoon, saxophones, trumpet, French horn, trombone, tuba, piano, harp, percussion, voice. On registration students should contact Professor Nicholas De Maison (demain@rpi.edu) indicating their instrument. A lab fee applies: $990

COMM 2960
WRITING FOR THE SCREEN

Students in this course will explore how different “screens" require different approaches to writing. The course will examine how genre and format influence style, with a focus on solving challenging communication problems or telling compelling stories. Students will learn how to both critically “read” and effectively write various forms of visual media, including educational, entertainment, corporate, and commercial content for film, television, Internet and mobile media.
No prerequisites.

SPINA-CAZA

IHSS 1960
BACK TO THE 60’s

This course invites students to take a journey back to the activism of the 60’s through the lens of history, sociology, political science, media, and the arts. Utilizing selected readings, videos, site visits, and guest lecturers, students will take a deep dive into the “movement” and explore the philosophy, programs, and activism of several major organizations. Through this exploration of a significant period in time, students will have the opportunity to unearth the work and significance of visual artists (e.g. Andy Warhol), poets (e.g. The Last Poets, Amiri Baraka, Gil Scott-Heron), and musicians (e.g. The Grateful Dead, Bob Dylan, Joan Baez) who chronicled the issues of the 60’s through their respective mediums of communication. Students will learn about university, community, cultural, militant, religious and political organizations committed to one of three dominant themes (integration, separation, and revolution), and the tensions generated within the “movement.” Students will be divided into one of 3 teams, each focused on one of the 3 themes. Through guided research, they will develop a working knowledge of the selected theme, including the history, philosophy, programs, leaders, activities, successes, failures, issues, etc. Each team will make a presentation to the class followed by discussion and debate. 4 credits.

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COGS 6968
RESEARCH PROBLEMS IN COGNITIVE SCIENCE
This is a seminar-based course primarily for graduate students in Cognitive Science. Students learn about a wide variety of topics related to cognitive science through reading articles, attending lectures by guest speakers, and participating in group discussions. The specific topics that are covered vary widely from semester to semester. Students also participate in a roundtable discussion at the end of the semester in which they synthesize the material to identify new research opportunities.

BRINGSJORD

**COMM-4961**
Reality TV
Deery
This course considers the sociopolitical and ethical dimensions of reality television, one of the most significant developments in recent popular culture. An analysis of a variety of reality formats allows students to understand the evolution, economics and, above all, the cultural and political significance of modern media. Topics include: the representation of gender, class, race, sexual orientation; celebrity; scandal; body identity; advertising and commercialization; audience interaction and multiplatform use; surveillance; nationalism; globalization; mediation and reality.

**COMM-4962**
Game Narrative Design and Leadership
Video game story development involves not only writing but also what is known in the industry as “narrative design.” In this course we will examine the increasingly common role of the narrative designer and its relationship to storytelling, game design, systems planning, scope analysis, scheduling, and more. Students will then take on the lead narrative role of a large, simulated video game project -- allocating resources, reacting to changing circumstances, and making crucial storytelling decisions.

**ECON-4961**
Law and Economics
Jones
Market-based economies depend upon legal systems that establish and protect property rights. In this and many other instances the law is designed to encourage and support economic activity; in others it is designed to restrain certain types of otherwise rational, economic behavior. This course will apply fundamental economic concepts, such as supply and demand, competition, monopoly, externalities, and pareto efficiency to a range of legal topics, including contracts, torts, and criminal law to explain the economic motivation and consequences of the legal framework. For those students considering law school, this course offers an exposure to many of the legal concepts found in the first year law school curriculum.
PSYC-4961
The Psych Of Reward
Noble
The success of digital games has inspired an entire industry focused on using explicit rewards to motivate people. The trend towards accountability in education and elsewhere is built on the assumption that explicit rewards control behavior. This course provides a rigorous examination of the use of explicit external rewards and the consequences neglect of intrinsic rewards in real world situations.

ARTS-4420/ARTS 6420
Experimental Telepresence is an Art-x interdisciplinary course.
Experimental Telepresence is supported by the Nielsen Foundation to help create a network for a world community of paraplegics who want to play music together over the internet. This class project involves the Jamboxx (http://www.jamboxx.com/faq/), a breath controller styled after a harmonica created by David Whalen who was paralyzed at the age of 19. The interface allows performers to play software with their mouth.

Students will help facilitate the network and also create their own telepresence projects using a variety of live performances. Each seminar member will prepare, execute and document their own connectivity project with a partner of choice in a distant geographical location followed by written reports and class demos. Any workable software can be used from low to high tech i.e. iCHATav, SKYPE, SoundJack, JackTrip etc. More extensive projects using high bandwidth Internet with other universities will follow with co-located ensemble performances facilitated by students. Students may participate as artists, technicians or programmers.

ARTS-2961
"Ensemble Nonlinear"
Hamilton
A technology-based performance ensemble, at the same time an electronic performance ensemble as well as a practice-based course focused on the composition, design and programming of new musical works and instruments. Students will create and perform electronic music using laptops, digital networks and a range of new interfaces for musical expression. The ensemble may be taken as a 1 credit performance ensemble in satisfying the Music minor requirement, or as a 3/4 credit seminar.
Prerequisites/Corequisites: Audition / permission of the instructor

Comm 4960/6960
Game Studies Theory and Practice
Students are introduced to major theorists in the field of game studies and topics including theories of play, space, narratology, ludology, identity, representation, culture and society. Students make integrative connections between theory and practice with a semester-long iterative design project, including critical writing, paper prototyping and peer feedback.

**Design in Culture – 1cr**
This course revolves around documentary films that explore diverse design challenges and solutions in settings around the world, focusing on sustainable and regenerative design. Following film screenings, facilitated discussion and writing exercises will encourage critical perspective and personal reflection. All of the work for the course will be completed within the class time. Students wishing to dive deeper can sign up for the companion seminar *Sustainability by Design* [STSS/STSH4XXX]

**Race in Culture – 1cr**
This course revolves around documentary films that explore how race and culture intersect in settings around the world. Following film screenings, facilitated discussion and writing exercises will encourage critical perspective and personal reflection, including analysis of how race plays out at RPI and in daily lives. All of the work for the course will be completed within the class time. Students wishing to dive deeper can sign up for the companion seminar *Race as Global Challenge* [STSS/STSH4XXX]

**Sustainability by Design – 4cr**
This course is designed to compliment *Design in Culture*, a one credit film-based course that students will be auto-enrolled in. *Sustainability by Design* will provide an opportunity to dive deeper into the topics covered by the films, discussing resonant readings and conducting project-based research. Students will present original research and design work to the campus community. Design researchers and practitioners will join the class in a series of guest lectures.

**Race as Global Challenge – 4cr**
This course is designed to compliment *Race in Culture*, a one credit film-based course (that students will be auto-enrolled in) exploring how race and culture intersect in settings around the world. *Race as Global Challenge* will provide an opportunity to dive deeper into the topics covered by the films, discussing resonant readings and conducting original research. Researchers, activists and other members of the community will join the class as guest discussants.

28827 IHSS 1967-01 *RELIGION in a GLOBAL WORLD* M/R 4:00-5:50 ROYER
This course explores the role of religion in the everyday lives of people around the world, and ways religion becomes interlaced with media and politics.

**Global Health Challenges**
This course explores health challenges in settings around the world, considering many factors contributing to poor health and health inequality, and possible solutions. We will discuss different medicine traditions and medical ethics.

**Writing Practicum - 1cr. SUST (STSH6962) Kinchy M 10:00 - 10:50AM**
Set writing goals, complete a writing project, and exchange constructive feedback on works in progress. Students enrolled in this course are expected to make consistent progress toward their own writing goals and will receive peer review at various stages of their writing. Enrolled students are also expected to provide peer review for about two papers each month. Restricted to STS graduate students.

**Teaching Practicum - 1cr., SUST (STSH6963) Kinchy M 11:00 - 11:50 PM**
In this course, students will explore a variety of approaches to teaching STS and will exchange constructive feedback on lesson plans, classroom management strategies, grading techniques, teaching statements, syllabus design, and other key issues related to effective pedagogy in traditional and non-traditional course settings. Restricted to STS graduate students.

**Presentation Practicum - 1cr., SUST (STSH6964) Kinchy W**
Students in this course will participate in the weekly STS Brown Bag seminar series. Students are expected to attend the seminar weekly, give one research presentation, and provide constructive feedback on other presentations over the semester. Restricted to STS graduate students.

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**Econ 4960  
HEALTH ECONOMICS**
Students will gain an understanding of the structure and working of healthcare markets; Study the markets for healthcare professionals such as physicians and nurses, the structure and working of the markets for pharmaceuticals, hospitals and medical insurance; Understand firms' strategies related to pricing, investments, R&D and innovation; Gain an understanding of the role played by technological change; Gain insights into the institutions and economic policy related to healthcare; Cover a range of issues of significance to the individuals, industry, state and national governments; Gain an understanding of the current debate on healthcare reform, and the Affordable Care Act. The course will be of interest to students in Economics and Social Sciences, and students from Biomedical Engineering and Biosciences more generally.