SPRING 2016 TOPICS COURSES

Arch 4965.60 CRN99100 Cut / Copy: A Survey in Digital Techniques

This seminar provides a survey of digital techniques strategically operating within the production of contemporary architecture. A historical examination of these techniques outlines their origins and evolution within the architecture discipline as well as providing technical fluency in their use. The history of surface/solid modeling, scripting, digital sculpting, and parametric systems are studied in concert with learning to use these techniques so as to provide students a stronger foundation for their applications within practice.

ARCH-4961 PIP is multidisciplinary project-based course facilitating the collaborative development of a large-scale media installation in the EMPAC Studio 1 (black box) in the Spring of 2016. Students will work with the artist/faculty team and with students from Art and Architecture. The invited artist is Bill Seaman of Duke University. While PIP has a long history of collaboration between Architecture and the Arts, this year Rensselaer collaborators include scientists Jim Hendler and Jonas Braasch together with Pauline Oliveros (Arts) and Ted Krueger (Architecture). This course is part of the Art across campus initiative. Students in this course work under the supervision of Ted Krueger and Pauline Oliveros. Meets concurrently with ARTS-4960, ARTS-6965, and ARCH-4962. Note: this is for non-architecture students. Cr. 2. R 4 – 6 pm. Studio.

ARCH-4965.01 PARALLX_Exploiting 2.5D
In this seminar “PARALLAX _ Exploiting 2.5D” we will be utilizing both contemporary digital 3D modeling and fabrication tools. Our goal will be to analyze the transition from 2D_line to 3D_surface exploiting the contrast in texture between rough and smooth to the interaction between high and low producing complex 2.5D reliefs. These 2.5D reliefs will display intricate colors and abstract forms combining perspective and orthographic views to intensify the understanding of depth, line and surface. Brian De Luna. W 12-2. Credit Hours: 2

ARCH-4966-60 Chinese Architecture and Urbanism
China Studies Students only. Credit Hours: 4

ARCH-4967.01 Emerging Material Systems in Architecture
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. Lonn Combs.

W 10-12.
Credit Hours: 2

ARCH-4968.01  A Living Paradigm: When the Wet Begins to Nourish the Dry
We live within a gravitational field where physical laws determine the shape of forms. Cartesian geometry in architecture is a human invention linked to a limited ability to measure, predict and repeat forms. Living organisms also develop within gravitational, chemical and physical constraints yet they differ from rigid and dry man-made structures. They thrive in liquids, which allow smooth flow of matter and information, and they assume soft forms. In the era of synthetic biology, liquid matter provides the fundamental (perhaps essential) environment for research enabling new semi-living and living systems, as it does in architecture. Zbigniew Oksiuta.

W 10-12.
Credit Hours: 2

ARCH-4969.01  The Arch of the Screen: Relationships Betw Film/A
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. Anthony Titus.

R 10 – 11:50 am.
Credit Hours: 2

ARCH-4974.60  Chinese Lang & Cult
China Studies Students Only. No Professional Elective.
Credit Hours: 4

ARCH-4975.60  Calligraphy Painting
China Studies Students Only. No Professional Elective.
Credit Hours: 2

COMM-296X-01  Digital Humanities T/F 2:00-3:50 Kimball
ARTS 296X-01/COMM 296X-01 Mixed Reality Stage Design W 12:00-3:50 Rouse/Oliveros
(Meets together)

COGS-4962-01/COGS-6963-01 Learning & Adv Game AI
M/R 2:00 – 3:50 Si
Digital game is one of the most fast developing fields. To make a game fun to play, the design of the game levels and/or the AI driven opponents needs to be intelligent and adaptive to the players’ strategies and skills. This course will cover basic and advanced topics in Artificial Intelligence and Learning. The course will also introduce psychological theories and studies about the players’ experience
in games. (meets together)

**COGS-6961-01 Research Problems In COG SCI**
W 12:00-1:50 Sun
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. (Restricted to Cognitive Science Graduate Students)

**COMM-4960-01/COMM-6961-01 Agile Prototype Development**
M/R 4:00-5:50 Grice
In this course, we will design and develop prototypes for interactive interfaces using agile methodology. We will gather and analyze user requirements and produce initial prototypes that respond to those requirements. Will develop and refine prototypes using iterative testing as a development tool. Classes will consist of sessions that discuss prototype development and agile development methods and classes in which we will implement and present prototype designs.

**COMM-4961-01 Reality TV**
T/F 12:00-1:50 Derry
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-4963-01 Intro to Game Production**
M/R 4:00-5:50 Lynch
This is a class about how real videogames get built at real game studios. We cannot hope to fully replicate this experience, but in this course you will be building a non-trivial video game, for an actual "client" who works at one of the area's videogame studios.

**COMM-4964-01 Internet Programming**
M/R 12:00-1:50 Lynch
This course introduces non-programmers to several of the core technologies of the WWW, including Hypertext Markup Language (HTML), Cascading Style Sheets (CSS), the Document Object Model, JavaScript and PHP. A top level presentation of the architecture will be presented along with a nontechnical discussion of key internet protocols. Students will learn to use HTML and CSS to create a functioning web site, later adding JavaScript functionality. The PHP server environment will be briefly examined.

**COMM-496X-01 Game Narrative Design and Leadership**
M/R 12:00-1:50 Skolnick
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.

**COMM-696X-01 Semiotics and Fieldwork**
F 12:00-2:50 Bennett
This course examines how semiotics applies to the changing roles of images in today's media-immersed society. Students analyze meaning making in multicultural social contexts, comparing both hyper-local and globally pervasive renditions of image-based media including games and educational media. A fieldwork assignment takes students through the steps of visual semiotics field work, including site selection, hypothesis generation, data gathering and analysis, with findings that can contribute to generalizable knowledge in their discipline.

**CSCI 4962/6969 - CRNs 95540/99109 - Computational Social Choice Lirong Xia**
This is a research-oriented course on the theory and application of computational techniques and computational thinking in preference representation and aggregation. Applications include but not limited to: voting, fair division, rating systems, recommender systems, learning to rank. A student with strong backgrounds and skills in mathematics, computational complexity theory, algorithm design, or statistics will likely enjoy the course.

Prerequisites: CSCI 2300 Introduction to Algorithms; in general, a qualified student should have taken undergraduate-level courses on:
(1) Linear algebra; (2) Algorithm design; (3) Probability or statistics; and (4) One of the following: (a) Artificial Intelligence (e.g., CSCI 4150); (b) Machine learning (e.g., CSCI 4100/6100); (c) Optimization; or (d) Microeconomics theory.

**CSCI 4967/6965 - CRNs 96751/97194 - Bioinformatics and Computational Biology Mohammed Zaki**
Bioinformatics and Computational Biology are essentially interchangeable terms, referring to the science of analyzing biological data. The goal of this course is to introduce the main topics and the frontiers of computational biology. Topics include sequence and protein structure analysis (alignment, evolution, search, motifs, and indexing), next generation sequencing, comparative genomics, gene expression analysis, network biology, and data mining methods. The course will cover both the fundamentals, as well as advanced/emerging topics. Assignments will require the use of Python or R. No previous knowledge of biology is assumed.

Prerequisite(s): CSCI 2200; CSCI 2300; probability & statistics; knowledge of basic linear algebra is a plus.

**CSCI 6968 - CRN 97403 - Cloud Computing Seminar Stacy Patterson**
In this course, we will study significant tools and applications that comprise today’s cloud computing platform, with a special focus on using the cloud for big data applications. The course content will come directly from research papers, articles, and documentation of cloud and data center architectures and technologies. We will work together to develop a deep understanding of this content through class
presentations and discussions of this material. Students will also create a research project of their choosing that uses several cloud computing components.

**CSCI 2963 - CRN 98963 - Introduction to Open Source Mukkai Krishnamoorthy**

The goal of this course is to provide a strong foundation in open source software development in preparation for jobs in industry or for more advanced courses. An important component of this course is participation in a community and contributing to an open source project. This course also provides an understanding of open source software tools and community, an understanding of open source licensing, an understanding of testing, version control, and open source software stacks. Students must come with a desire to learn new things, as well as the ability to adapt to open source tools and packages.

Prerequisite(s) : CSCI 1100

CSCI 4961 - CRN 97168 - Cognitive Modeling I Schoelles see COGS 4210/6210 or PSYC 4510

**CSCI 4963 - CRN 97169 - RCOS Mukkai Krishnamoorthy and David Goldschmidt**

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 twice per semester. Students may earn 3 or 4 independent credit hours, a limited stipend, or do RCOS for the experience only.

Prerequisite(s): CSCI 1200; a 2000-level course in CSCI, ECSE, ITWS (or permission of the instructors).

**CSCI 4964/6963 - CRNs 97171/97170 - Interactive Visualization Barbara Cutler**

Visualizing data is a key step in understanding many problems. This course is designed to introduce students to methods of visualizing many different types of data, such as images, 3D surfaces, flow fields, and medical data. We will both use existing visualization software and program custom visualizations using C++ and OpenGL. Course activities include weekly homework assignments, in-class critiques of visualization artifacts, and a final project to explore creative uses of these techniques. We anticipate approval as a communication intensive (CI) course within computer science.

Prerequisite(s): CSCI 2300

**CSCI 4965/6966 - CRNs 95539/98045 - Learning and Advanced Game AI Mei Si**

See COGS 4962/6963
CSCI 4966 - CRN 98053 - Randomized Algorithms

Petros Drineas See catalog course CSCI 6220

CSCI 4967/6965 - CRNs 96751/- - Bioinformatics and Computational Biology

Mohammed Zaki Description TBD
Prerequisite(s):

CSCI 4968/6967 - CRNs 95541/98441 - ONTOLOGIES
Deborah McGuinness Description TBD
Prerequisite(s):

Ontologies: Finding, Building, Evaluating, and Using them. The 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.

CSCI 4969/6961 - CRNs 98971/98972 - Digital Manufacturing Martin Hardwick

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.

Prerequisite(s): CSCI 2300

CSCI 4976 - CRN 98287 - Web Science Systems Development
CSCI 4977/6971 - CRNs 98345/98346 - Intelligent Virtual Agents

Mei Si See catalog course COGS 4640/6640

CSCI 6968 - CRN 97403 - Cloud Computing Seminar Stacy Patterson Description TBD
Prerequisite(s):

CSCI-4977-01 Intelligent Virtual Agent  
M/R 4:00-5:50 Si  
In recent years, games and immersive training applications that emphasize the social and narrative aspects of the user’s experience have become increasingly popular. The designers have been looking into ways to use human-like characters and narratives to engage the user and to provide the central experience. This is evidenced by recent major game titles such as Mass Effect, Fallout 3, and Heavy Rain, and the increasingly popular research field – interactive narrative – in academia. Human-realistic characters that have natural facial expressions, and can talk and act as real humans, can greatly facilitate the success of such games. Such characters make it natural for the user to identify with them, and treat them as real people when interacting with them. This course introduces various computational approaches for creating such intelligent conversational agents. This course will take the form of a combination of lectures, presentations by students, class discussions, and independent study. (CSCI by permission of instructor only)

ECON-496X-01 Econ of Financial Inst. & Markets  
M/R 4:00–5:50 STAFF (Stodder)  
Pre Req: ECON 1200

ECON-496X-01 Econometric Forecasting  
M/R 12:00 – 1:50 Estrella  
Econometric forecasting uses statistical techniques from econometrics to forecast future values of economic and financial variables. Descriptive statistics are used to examine the time-series properties of variables so as to construct dynamic econometric models. The models are estimated with available data and used to predict future values of the variables. We consider various measures of model performance and techniques for model selection. Econometric forecasting principles will be applied to actual data using statistical software.  
Pre Req: ECON 4570 Meets with ECON 6580

ECON/STSS-496X-01 Topics in Economic Policy  
T/F 2:00 – 3:50 Gowdy  
This course will apply economic theory to an examination of current economic events and crises. The emphasis will be on U.S. issues but issues such as globalization and its impacts will also be considered. Topics considered are health care, GDP and well-being, inequality, climate change, and economic development. A previous course in Principles of Economics would be useful but is not required. The course will emphasize student participation and hands-on development of economic policy recommendations.  
Pre Req: ECON 1200 (Meets with STSS 496X)
**ECON-496X-01 Law and Economics**
T/F 10:00 – 11:50 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.

**ECON-496X-01 International Finance**
T/F 10:00 – 11:50 Yatsynovich

In the first part of the course students will study models of international capital flows, discuss global imbalances and adjustment mechanisms, as well as issues of international risk diversification, sovereign debt and enforcement mechanisms. The second part will be devoted to international monetary macroeconomic, namely, determination of exchange rates, consequences of economic policy under different exchange rate regimes, functioning of monetary unions, mechanisms behind currency attacks and balance of payment crises.
Pre Req: ECON 2010

**ECSE-1961-01 Introduction to ECSE Analysis**

At RPI, we offer two related degrees built on the basic phenomena of Electricity/Electronics and Computation and Information: Electrical Engineering & Computer and Systems Engineering. To prepare first year students for successful undergraduate programs in these two degrees, this course provides an introduction to engineering analysis and engineering thinking in four general areas: 1) Basic Circuits and Electronics (experimentation, simulation, circuits and electronics fundamentals, tinkering); 2) Programming (Matlab, Embedded Systems); 3) Mathematics (Linear Algebra and the Mathematics of Computation); and 4) Engineering Systems (Electrical, Electro-Mechanical, Electro-Optical ...). The overall goal of this course is to help students build a broad analysis skill set so that through experimentation, simulation and the application of science, mathematics and engineering fundamentals, they can develop useful systems models that enable engineered solutions addressing a broad array of societal needs.

**NOTE:** First-year students who will major in either Electrical or Computer and Systems Engineering can this this new course as a replacement for ENGR 1100 Introduction to Engineering Analysis.

**ECSE-4961-01 Introduction to Optoelectronics**

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-6960-01 Advanced Electric Drive Systems

In this course dynamic modeling of various kinds of electric machines including DC machines, permanent magnet machines, and induction machines as well as their electric drive are discussed. Their advanced control system including vector control and direct torque control and a review of PWM modulation strategies are covered. Features such as fault tolerance and high speed operation will be discussed. Finally, some applications of electric drives such as wind energy systems and hybrid electric vehicles will be presented.

ECSE-6961-01 Advanced Power Systems Modeling and Control

Modeling of power system components including HVDC systems, Flexible AC Transmission systems, and wind turbines. Analysis and control techniques such as reactive power optimization, coherency, and model reduction. Synchrophasor technology – measurement, communication, and control.

Course goals/objectives: A student will be able to understand the characteristics and constraints of several power system components such as HVDC, FACTS controllers, and wind turbine generators, which are not covered in the Computer Methods for Electrical Power Engineering course. In addition, the new technology of synchrophasor measurements and methods for analyzing and using the synchrophasor data to improve the reliable operation of large power systems will be presented. The course materials are useful for understanding the operation of the future power grid.

ECSE-6962-01 Wideband Gap Materials, Devices, and Applications

Wideband gap materials have already transformed lighting technology and are now poised to extend their presence in photonics to include ultraviolet radiation and even infrared, to transform the entire power industry and enable millimeter wave and submillimeter wave revolution. The new applications will range from highly efficient power systems, sustained power systems to applications in sustainable agriculture for the second green revolution and to medical and biomedical applications. The objective of this course is to introduce students to wideband gap semiconductor technology, develop understanding of the state-of-the-art of this technology including quantitative measures of current trend, and introduce and describe emerging devices and their possible impact on systems and applications. In light of the stated objectives students should be able to understand the state-of-the-art of wideband gap semiconductor technology, including quantitative measures and current trends and should be able to compare emerging wideband gap semiconductor technology with the state-of-the-art technology. Through active participation in this course, students will develop knowledge, skills, and values defined in the Mission Statement of Rensselaer Polytechnic Institute.

ENVE-4961 Advanced Oxidation Processes
Advanced Oxidation Processes (AOPs) are efficient methods to remove organic contamination from aqueous media. The application of basic principles and equations dealing with very reactive species mainly in aqueous media will be discussed. Topics include water quality and associated pollution, material, and energy balances, reactive oxygen and other species for destruction of wide range of organic contaminants.

Credit hours: 3
Instructor: Marianne Nyman
Course Time: Monday/Thursday 10:00-11:50 AM

MATH-6190 Uncertainty Quantification
This course will focus on uncertainty quantification and data analysis. It will include description of Bayesian frameworks and frequentist statistical methods, the relation of Tikhonov regularization to statistical methods, confidence intervals and variance, the bias in Tikhonov regularization, correcting for the bias, and, e.g. selection of priors in Bayesian methods including infinite dimensional priors. Presented examples will come from inverse problems. Applications will be for ill-posed problems.

Prerequisites: Mathematical Analysis I, Math-4200
Useful but not required: Introduction to Functional Analysis, Math-6220

Credit Hours: 4
Course Time: Spring 2016, Tuesday & Friday 12:00 - 1:50 pm
Instructor: Joyce McLaughlin

MATH-6590 Variational PDE Methods for Image and Data Processing
Processing and analyzing image or general data are crucial topics in many fields such as computer vision, 3D modeling, medical image analysis etc. Topics of this course include calculus of variation, energy minimization and variational PDE methods for image processing (such as image denosing, deblurring, image segmentation and edge detection). As an extension, we will also discuss the variational PDE methods on Riemannian manifolds and applications to high-dimensional data processing.

Prerequisites: Multivariable calculus, Computational linear algebra, Numerical partial differential equations.

Credit Hours: 4
Course Time: Spring 2016, Monday & Thursday, 10:00 -11:50 AM
Instructor: Rongjie Lai

98292 – MANE-2961 (3 credit hours)
Art, Science, and Practice of Innovation

NOTE: This course counts as a MANE-4000 Technical Elective for Mechanical Engineers when MANE-4220 Inventor’s Studio is taken in a subsequent semester.

Students would learn: a) select “tools” for innovation, and how to choose the appropriate tool for an idea or problem b) systematic “process” for innovation to develop an innovative idea from concept to a
minimum workable prototype using 3-D printing equipment c) iterate on fine tuning innovative idea, learning from each “iteration” using a ideate-build-learn cycle and d) quick overview of “Additive Manufacturing” or 3-D printing methods. At the end of the course, students would be ready to enroll in the 3rd course of MANE.Innovation Spine, 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.

Prerequisites: Sophomore, Junior, or Senior Status

98296 – MANE-4961 (3 credit hours)

Introduction to Radiation Transport Methods

The broad goal of this course is to introduce students to basic methods that are used for simulating radiation transport processes, encountered in nuclear engineering. Radiation transport computation plays important roles in the design of new reactors, evaluation of radiation dose in medical physics, and the understanding of radiation interactions with materials. This introductory course will present the foundations of deterministic and Monte Carlo numerical methods that are widely used in the modeling and simulation of nuclear reactor design, radiation dosimetry, and radiation shielding. Some theoretical properties of the underlying transport and diffusion equations will also be developed, but only if they relate directly to computational methods. Emphasis will be placed on the three fundamental aspects of computational methods: (i) discretization methods for the transport and diffusion equations; (ii) iterative methods for solving the system of discretized equations; and (iii) Monte Carlo methods for solving general fixed-source and eigenvalue problems. A practical goal of the course is to provide students with a working knowledge of computational methods for deterministic and Monte Carlo simulations of 1-D transport problems. Students who wish to pursue this topic for more realistic (multidimensional) problems will receive the necessary background in this course.

98300 – MANE-4962 (3 credit hours)

Analysis and Design of Thermal-Fluid Systems
This course extends basic concepts of thermodynamics, fluid mechanics, and heat transfer to a variety of thermal and fluid system components such as heat exchangers, pumps, fans, and piping networks. Modeling and simulation methods for design of integrated thermal-fluid and energy conversion systems, including second law analysis, will be introduced. Applications will be developed in refrigeration and air conditioning, air handling, and energy conversion systems.

Prerequisite: MANE-4010 Thermal and Fluids Engineering II (or equivalent background)

78301 – MANE-4963 (3 credit hours)
Introduction to Computational Fluid Dynamics

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.

Prerequisites: MATH-2010 Multivariate Calculus and Matrix Algebra, MANE-4070 Aerodynamics I, and MATH 4800 Numerical Computing.

97192 – MANE-6961 (3 credit hours)
Micro/Meso-Scale Manufacturing: Processes and Systems

This course explores topics related to new and upcoming research frontiers in the area of micro/meso-scale manufacturing. This will be done with the explicit goal of generating new research ideas/methodologies/designs that will address some of the current gaps-in-knowledge.
Prerequisites: a working knowledge of all manufacturing-related topics that are covered in undergraduate-level courses; MatLab coding skills are expected for solving some of the homework problems.

PHYS 2961 / ASTR 2961  Particle Astrophysics  
Instructor: Ethan Brown  
Time: 12-1:50 pm on Monday/Thursday  
Prerequisite: PHYS 2210 Quantum Physics 1

Course description: Concepts of the exciting new field that merges the physics of elementary particles with astronomy, taught at a sophomore level. The topics covered will include cosmology and the expanding universe, big bang nucleosynthesis, the cosmic microwave background, neutrinos, dark matter and dark energy. No background in particle physics is assumed, but quantum physics I (PHYS 2210) is a prerequisite and quantum physics II (PHYS 2220) is a strongly suggested co-requisite.

PSYC-2960/4967-01 Models of Mental Processes  
T/F 2:00-3:50 Yang  
Human higher order mental processes involve a number of cognitive capacities, such as reasoning, decision making, and game theoretic interactions. Traditionally, each of these capacities is studied independently. This course provides an integrated approach from formal as well as empirical perspectives, and it introduces a set of new modeling methods, such as fiber bundle method and gauge theoretic modeling. The design of the course is self-contained, and no pre-required courses. (meets together)

PSYC-2962-01 Positive Psychology  
M/R 2:00-3:50 Traver  
Positive psychology calls for as much focus on strength as on weakness, as much interest in building the best things in life as in repairing the worst, and as much attention to fulfilling the lives of healthy people as to healing the wounds of the distressed. The concern of psychology with human problems is understandable. It will not and should not be abandoned. Positive psychologists are “merely” saying that the psychology of the past sixty years is incomplete. But as simple as this proposal sounds, it demands a sea change in perspective. Psychologists interested in promoting human potential need to start with different assumptions and to pose different questions from their peers who assume a disease model. This course will concern itself with the basics of positive psychology.

PSYC-4961-01 The Psych Of Reward  
M/R 2:00-3:50 Noble  
The success if 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.
Current economics, such as neoclassical economics, are heavily rooted in classic Newtonian mechanics, successfully borrowing a great deal of modeling tools from it. Its models are mostly based on directly observable phenomenon. This course introduces a new approach that integrates cognitive science and economics by applying modern theoretical physics from modeling perspectives. The design of the course is self-contained, and no pre-required courses. Required textbook: Modern Principles of Economic Mechanics, Vol. I, by Yingrui Yang (available at RPI bookstore and Amazon.com.) (meets together)

Data and Information analytics extends analysis by using insight from analyses to recommend action or to guide and communicate decision-making. Thus, analytics is not so much concerned with individual analyses or analysis steps, but with an entire methodology. The world at-large is confronted with increasingly larger and complex sets of structured/unstructured information; from sensors, instruments, and generated by computer simulations; data is "hidden" in websites, application servers, social networks and on mobile devices. In commerce and industry, analytics-driven enterprises are becoming mainstream. Yet, there is a shortfall in the key education skills needed to meet the growing needs. Key topics include: statistical computing theory, multivariate analysis, and application of computer science concepts such as data mining and machine learning and change detection by uncovering unexpected patterns in data.

3/4 credits
Instr. – Fox

This course teaches students about the roles and infrastructure of IT departments in modern organizations, IT software engineering technologies and methodologies for software development life cycle through hands-on experience.

3 credits
Instr. – Liu

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. The prerequisite is Data Science (CSCI/ERTH/ITWS 4350/ 6350) or permission from the instructor.

Cross listed with CSCI 6370/CSCI 44370

3/4 credits
Instr. – Berman