Introduction to Engineering Courses (ENGRI)

***BELOW IS A LIST OF ENGRI COURSES FROM THE 2012-2013 COURSES OF STUDY. THE LIST OF ENGRI COURSES THAT WILL BE OFFERED DURING 2013-2014 WILL BE AVAILABLE IN CORNELL’S COURSES OF STUDY IN EARLY JULY, BEFORE PRE-ENROLL.***

Introduction to Engineering courses are first-level courses intended to introduce students to various aspects of Engineering. They have no pre-requisites and most are cross-listed with a department. Students should take one ENGRI during the first year. No majors require any specific ENGRI and students are free to take any ENGRI regardless of their intended major. (NOTE: Some ENGRI’s are offered both fall and spring, others are offered either fall or spring.)

**ENGRI 1100: Lasers and Photonics (also AEP 1100); 3 credits**
Lasers have had an enormous impact on communications, medicine, remote sensing, and material processing. This course reviews the properties of light that are essential to understanding the underlying principles of lasers and these photonic technologies. There also is a strong, hands-on laboratory component in which the students build and operate a nitrogen laser and participate in several demonstration experiments such as holography, laser processing of materials, optical tweezers, and fiber optics. (Fall, 3 credits)

**ENGRI 1101: Engineering Applications of Operations Research; 3 credits**
Introduction to the problems and methods of operations research and industrial engineering focusing on problem areas (including inventory, network design, and resource allocation), the situations in which these problems arise, and several standard solution techniques. In the computational laboratory, students encounter problem simulations and use some standard commercial software packages. (Fall, spring, 3 credits)

**ENGRI 1110: Nanotechnology (also MSE 1110); 3 credits**
Nanotechnology has been enabling the Information Revolution with the development of even faster and more powerful devices for manipulation, storing, and transmitting information. In this hands-on course students learn how to design and manipulate materials to build devices and structures in applications ranging from computers to telecommunications to biotechnology. (Fall, 3 credits)

**ENGRI 1120: Introduction to Chemical Engineering (also CHEME 1120); 3 credits**
Design and analysis of processes involving chemical change. Students learn strategies for design, such as creative thinking, conceptual blocking, and (re) definition of the design goal, in the context of contemporary chemical and biomolecular engineering. Includes methods for analyzing designs, such as mathematical modeling, empirical analysis by graphics, and dynamic scaling through dimensional analysis, to assess product quality, economics, safety, and environmental issues. (Fall, 3 credits)

**ENGRI 1130: Sustainable Design for Appledore Island(also CEE 1130); 3 credits**
Utilizes a unique environment, Appledore island, as an example of how sustainability is addressed in the design of basic components of the built environment; energy, water supply, and waste treatment. (Spring, 3 credits)
ENGRI 1131: Water Treatment Design (also CEE 1131); 3 credits
Students learn how to design: reservoirs to provide water during droughts, aqueducts to transport water, and water treatment plants to prevent waterborne diseases. The course includes field trips, building a computer-controlled miniature water treatment plant, and exploring new technologies for making safe drinking water. (Fall, 3 credits)

ENGRI 1140: Materials: The Future of Energy (also MSE 1140); 3 credits
New technologies are urgently needed to fulfill projected global energy requirements. Materials properties typically limit the performance that can be achieved in generation, transport, and utilization of energy. The experiential learning course will explore how new materials can increase our energy supply and decrease consumption. Materials issues in photovoltaic, fuel cell, battery, wind, transportation, lighting, and building technologies will be studied. Through integrated lab-based activities, students will develop a broad understanding of materials issues in order to successfully design and build an energy generation system. (Spring, 3 credits)

ENGRI 1160: Modern Structures (also CEE 116); 3 credits
Introduction to structural engineering in the 21st century - the challenges structural engineers face and the innovative approaches they are using to address them. Using case studies of famous structures, students learn to identify structural forms and understand how various forms carry load using principles of statics, mechanics, and material behavior. The historical, economic, social, and political context for each structure is discussed. Case studies of failures are used to explain how structures fail in earthquakes and other extreme events, and students are introduced to analytical and experimental approaches (shake table and wind tunnel testing) to quantifying loads on structures subjected to extreme events. Types of structures considered include skyscrapers, bridges, aircraft, and underground structures. (Fall, 3 credits)

ENGRI 1170: Introduction to Mechanical Engineering (also MAE 1170); 3 credits
Introduction to fundamentals of mechanical and aerospace engineering. Students learn and understand materials characteristics, the behavior of materials, and material selection for performing engineering function. They also learn fundamentals of fluid mechanics, heat transfer, automotive engineering, engineering design and product development, patents and intellectual property, and engineering ethics. In the final project, students use the information learned to design and manufacture a product. (Fall, 3 credits)

ENGRI 1190: Biomaterials for the Skeletal System (also MSE 1190); 3 credits
Biomaterials are at the intersection of biology and engineering. This course explores natural structural materials in the human body, their properties and microstructure, and their synthetic and semisynthetic replacements. Bones, joints, teeth, tendons, and ligaments are used as examples, with their metal, plastic, and ceramic replacements. Topics include strength, corrosion, toxicity, wear, and biocompatibility. Case studies of design lead to consideration of regulatory approval requirements and legal liability issues. (Fall, 3 credits)
ENGRI 1200: Introduction to Nanoscience and Nanoengineering (also AEP 1200); 3 credits
Lecture/laboratory course designed to introduce freshmen to some of the ideas and concepts of nanoscience and nanotechnology. Topics include nanoscience and nanotechnology—what they are and why they are of interest; atoms and molecules; the solid state; surfaces; behavior of light and material particles when confined to nanoscale dimensions; scanning tunneling microscopy (STM), atomic force microscopy (AFM), microelectromechanical systems (MEMS) design; basic micromachining and chemical synthesis methods, i.e., “top-down” and “bottom-up” approaches to nanofabrication; how to manipulate structures on the nanoscale; physical laws and limits they place on the nanoworld; some far-out ideas. In the laboratory, students use an AFM to record atomic resolution images, use a MEMS computer-aided design software package to model the entire manufacturing sequence of a simple MEMS device, examine the simulated behavior of the device and compare it with real behavior, construct a simple STM and learn through hands on experience the basic workings of the device. (Spring, 3 credits)

EMGRI 1210 - Modern Computing Devices: Smart Phones to Supercomputers (also ECE 1210) Fall. 3 credits.
The organization of computing devices used in everyday living as well as in scientific discovery. Computer systems are presented in a bottom up fashion, from bits to digital logic, computer organization, instruction sets, assembly language, and the connection to high-level languages. Discussion of the computing engines found in systems such as smart phones, laptops, game consoles, and supercomputers. (Fall, 3 credits)

ENGRI 1220: Earthquake! (also EAS 1220); 3 credits
Explores the science of natural hazards and strategic resources. The focus is on earthquakes, volcanoes, and tsunami, but hurricanes, severe weather, climate change, landslides, wildfires, and the threat of extinction from a future impact by an extraterrestrial body are also considered. (Spring, 3 credits)

ENGRI 1260: Introduction to Signals and Telecommunications (also ECE 1260); 3 credits
Introduces the concepts that underlie wired and wireless communication systems. Students achieve a rudimentary understanding of basic ideas such as coding and data compression; frequency content, bandwidth, and filtering; sampling and reconstruction; and time- and frequency-division multiplexing. Discussions of practical applications focus on areas such as the public switched telephone network, ISDN, ATM, and TCP/IP. Students also develop an appreciation for the historical development of the field. The course includes both lectures and laboratory demonstrations. (Spring, 3 credits)

ENGRI 1270: Introduction to Entrepreneurship and Enterprise Engineering (also MAE 1270); 3 credits
A solid introduction to the entrepreneurial process to students in engineering. The main objective is to identify and to begin to develop skills in engineering work that occurs in high-growth, high-tech ventures. Basic engineering management issues, including the entrepreneurial perspective, opportunity recognition and evaluation, and gathering and managing resources are covered. Technical topics such as the engineering design process, product realization, and technology forecasting are discussed. (Spring, 3 credits)
ENGRI 1280 - Security, Privacy, and Information Network Design: Wiretaps to Facebook (also ECE 1280); 3 credits.
An introduction to security and privacy issues in networking technology. With an emphasis on the Internet and 3G/4G cellular, we explore technologies for securing networking infrastructure and keeping personal information private. Symmetric and asymmetric (public-key) cryptography and its implementation are introduced, including hardware considerations. The question of privacy in a networked world is covered from a variety of perspectives, including the social and economic costs of both the invasion and preservation of privacy. We see how economic, legal, and societal issues emerge when engineering design choices infringe upon user privacy. Privacy-aware network design practices are considered. (Fall 3 credits)

ENGRI 1290 - Energy: From Atoms to Zephyrs (also ECE 1290); 3 credits
An introduction for freshmen to the fundamental physical principles pertaining to energy sources, the engineering systems for the conversion, transmission, and storage of energy, and the economic constraints that determine the viability of competitive energy systems. Through a synthesis of science, engineering, and economic concepts, students will investigate technical design tradeoffs of current and future energy systems. This course will also introduce students to energy research being conducted at Cornell University (TBD, 3 credits).

ENGRI 1310: Introduction to Biomedical Engineering (also BME 1310); 3 credits
Modern biology and medicine is undergoing a revolution as quantitative principles of measurement, analysis, and design are introduced to help solve a variety of scientific and medical problems. This course provides an introduction to the study of biological systems with a quantitative perspective from the molecular to the cellular to the organism scale, as well as to the design of practical devices for studying biological systems and treating disease. Collaborative work will be a key element in all aspects of the course, from the lectures and labs, to the assignments and term project. (Spring, 3 credits)

ENGRI 1610: Computing in the Arts (also CIS/CS 1610, DANCE 1540, FILM 1750, MUSIC 1465, PSYCH 1650); 3 credits
Over the centuries, artists in a wide variety of media have employed many approaches to the creative process, ranging from the philosophical to the mechanical to the virtual. This course unravels some of the mysteries going on inside software used for art and music. It looks at ways of breaking things apart and sampling and ways of putting things together and resynthesizing, and explores ideas for creation. This course does not teach software packages for creating art and music. (Fall, 3 credits)

ENGRI 1620: Visual Imaging in the Electronic Age (also ARCH 3702, ART 2107, CIS/CS 1620); 3 credits
Interdisciplinary survey course designed to introduce students in the creative arts, science, and engineering to the concepts of digital pictorial representation and display. It is a concept and theory course that concentrates on “why” rather than “how.” Topics include perspective representations, display technology, how television works, bandwidth concepts, digital photography, computer graphics modeling and rendering, matting and composing, color perception, data acquisition, volumetric imaging, and historical precedents, primarily from the art world. Also included are other modes of imaging. (Fall, 3 credits)
ENGRI 1810: Electronics for Human-Machine Interfaces (also ECE 1810); 3 credits
Fundamental electrical engineering concepts and their potential application in life sciences. Each segment of the course includes electrical engineering theories (e.g. electric circuits, signal processing, control/dynamic systems, and optics) and a biological application in which the theories can be directly applied (e.g. neurobiology, cell system dynamics, and medical practice), developed through lectures, guest lectures, problem sets, and a project. The class is designed to motivate students interested in the design of electronic devices and instrumentations for biological and medical applications. The class should inspire students to take on future career in interdisciplinary and collaborative research. (Fall, 3 credits)