Arts, Humanities, Science and Entrepreneurship

AHSE0112 - The Olin Conductorless Orchestra [1]

Credits: 1 AHSE

Hours: 2-0-1

Recommended Requisites
Audition required.

For information contact: Dabby, Diana

Course Description
The Olin Conductorless Orchestra (OCO) - an ensemble, minus conductor - features instrumentalists in leadership and collaborative roles. Dedicated to orchestral performance in the concerted spirit of chamber music, the orchestra forges individual participation, active listening, and group-motivation into performances that have established it as the only conductorless orchestra of its kind at an American college. (A student can apply up to 4 OCO credits to the 28 required credits in AHSE, or can petition to apply up to 4 OCO credits to the AHS concentration. Any additional credits, i.e., more than 4, earned by a student enrolling in OCO will show up as additional AHS credits, but will not count toward satisfying the requisite 28 credits in AHSE.)


Credits: 4 AHSE

Hours: 4-0-8

For information contact: Martello, Robert

Course Description
Throughout this semester we will use different history of technology narratives to explore larger themes. Our narrative case studies will range from bronze age societal studies to cutting edge computing and Internet technologies, and throughout the semester we will compare and contrast these narratives in search of larger trends. We will also identify and investigate broader issues such as large technological systems; paradigms and scientific revolutions; technologies and political values; ethical theories; and the environmental and sustainability implications of technologies. Throughout the semester we will engage these narratives and broader issues through targeted writing activities, debates, individual and group presentations, at least one field trip, movie and media studies, and numerous in-class discussions. Students will have a high degree of autonomy, and will set and evaluate their own learning objectives, determine the topic for final projects, and design and facilitate in-class activities throughout the semester.
AHSE1122 - The Wired Ensemble - Instruments, Voices, Players

Credits: 4 AHSE

Hours: 4-0-8

Recommended Requisites

Ability to read music.

For information contact: Dabby, Diana

Course Description

Three concurrent streams comprise The Wired Ensemble:

- composition and performance of original works for instruments and voices
- development of a "Composer’s Tool Chest"
- musical analysis and reflection.

As composers and performers, students concentrate on instruments, voices, and the symbolic language that brings them to life. They compose music for every family of instruments (woodwinds, brass, strings, percussion), as well as voice and spoken word. The course features biweekly performances of original compositions. Students also have the opportunity to hear their works performed in concert settings by professional and peer musicians with whom they have collaborated. Seminar trips to Boston and New York enable the class to gather musical and inspirational material, in addition to hearing some of the finest orchestral and vocal ensembles in concert. While actively engaged in composition and performance—all geared to an end-of-term production—students examine the worlds of earlier composers in order to provide context for their own lives and work.
AHSE1130 - Seeing and Hearing: Communicating with Photographs, Video and Sound [4]

Credits: 4 AHSE

Hours: 4-0-8

For information contact: Donis-Keller, Helen

Course Description

Seeing and Hearing is a foundation course that is about the communication of ideas developed by research, reflection, and evolving thought, using contemporary digital media tools as a vehicle for expression. In this project-based course, students will have opportunities for hands-on learning in audio recording and editing, photography and printing, and video recording and editing. Science and engineering content are integrated in order to provide a reasonably comprehensive understanding of the devices we use to gather sound and images and in order to understand more fully the properties of seeing and hearing. A major goal is to enlarge our awareness of the environment we inhabit and to respond to the perceived environment by producing original visual and sonic artwork. Students will complete projects including a self-portrait, a sound-piece that is used as an audio track for a short video, a video documentary, and a staged narrative. Our process is to share work through discussion sessions as we follow projects from their initial stages to completion and final presentation. Additional context for Seeing and Hearing is provided by selected readings, visits by guest lecturers, additional faculty and staff participation and by viewing work of other professional practitioners. This course does not require prior experience with image/sound gathering or editing.


Credits: 4 AHSE

Hours: 4-0-8

For information contact: Donis-Keller, Helen

Course Description

We live in a world that is fundamentally visual and yet formal teaching and learning about visual communication is almost entirely reserved for specialists. Similarly learning about the evolution of vision and the molecular foundations of human vision are not often dealt with in introductory biology courses. This course seeks to remedy the lack of engagement with these topics at the foundational course level. In this studio-based project-oriented course students will develop an understanding of what it takes to make original art through first-hand experiences in a supportive environment. As a means to this end, students will gain facility with digital single-lens reflex (DSLR) cameras, digital photo editing and printing methods using state-of-the-art equipment. As this is an AHS foundation course students will also have an opportunity to further develop writing communication skills and critical thinking ability. The course will also address the history of photography, consider the work of a number of contemporary fine art photographers and answer the question "Why has photography changed everything?"

Credits: 4 AHSE

Hours: 4-0-8

For information contact: Lynch, Caitrin

Course Description

This course introduces students to key concepts and methods in cultural anthropology. Cultural anthropology is the study of how humans organize their lives as members of society, and the ways in which they make these lives meaningful. Through readings on such diverse topics as adolescence in Samoa, epilepsy among Hmong-Americans, and McDonald's in Hong Kong, this course will explore contemporary anthropological approaches to three central questions: 1) What is culture? 2) Does "culture" explain why people do what they do and believe what they believe? 3) What fate and value do cultural differences have in today's interconnected world?


Credits: 4 AHSE

Hours: 4-0-8

For information contact: Lynch, Caitrin

Course Description

The book 'Wired to Care' opens with the story of a designer who disguised herself as an elderly person to better understand the experiences of the elderly in our society. Author Dev Patnaik explains his interest in this experiment. It comes down to empathy: ?All of this is to reclaim a very old idea, that quantitative data and facts are no substitute for real-world experience and human connection.? Anthropologists have long-argued for the importance of putting oneself in other people's shoes for better understanding. The anthropologist Bronislaw Malinowski wrote in 1922 that the goal of the anthropologist ?is to grasp the native's point of view, his relation to life, to realize his vision of his world." In this course, students will try out the anthropological methods of participation, observation, interviews, and analysis of cultural materials and texts. This is a hands-on course for students who want to get out and meet people ? all with the aim of greater understanding. The course focuses on three thematic topics important to our society in the twenty-first century. Past offerings have focused on aging, religion, health, and globalization. The class includes assignments, events, and interactions that will take students off campus (perhaps to the Needham Senior Center, local coffee shops, and to Boston?s ethnic neighborhoods) and will include visitors from area institutions.
AHSE1150 - What is "I"? [8]

Credits: 4 AHSE

Hours: 4-0-8

For information contact: Stein, Lynn Andrea

Course Description

This interdisciplinary exploration of identity draws on a diverse range of genres in the Humanities, Social Sciences, Arts and Sciences. Prior offerings have drawn from Anthropology, Artificial Intelligence, Biology, Film, History, Literature, Memoir, Neuroscience, Philosophy, Psychology, Political Science, Science Fiction, Sociology, and Visual Arts.

Our goal is to understand how individual perspective (or the illusion of same) comes into being and how our own unique perspectives shape the way that we see the world. Emphasis is placed on communication and context.

This course focuses more on philosophy and artificial intelligence while AHSE 1155: Identity from the Mind and the Brain is more focused on the science of psychology and neuroscience.

AHSE1155 - Identity from the Mind & the Brain: Who Am I and How Do I Know [9]

Credits: 4 AHSE

Hours: 4-0-8

For information contact: Adler, Jonathan

Course Description

Perhaps the most fundamental question any developing individual asks himself/herself is: who am I? The ways we answer this question have evolved over the course of history as the dominant ways of knowing (epistemologies) have shifted. Indeed, the question of how we come to know ourselves has captivated Western scholars since the days of Descartes, but a look at the last fifty to sixty years has also seen enormous changes. Many people invoke psychological and philosophical perspectives in describing their identity, focusing on their personality, their developmental history, and their place in society. But the explosion of neurobiological research has introduced a new and viable outlook: explaining identity at the chemical and electrical level of the brain. There is good reason to think that these different perspectives on identity are mutually exclusive and this tension will underlie everything we discuss in this interdisciplinary course. Indeed, when it comes to a topic as fundamental to human existence as identity, it is absolutely essential to wonder not only "who am I?" but to also ask "how do I know?" In this course, we will approach the question of identity from multiple perspectives, including psychology, postmodern philosophy, and neuroscience. In the process, we will critically examine not only the conception of identity that each perspective supports, but also the assumptions and limitations of each epistemology. This course focuses more on the science of psychology and neuroscience, while AHSE 1150: What Is "I"? is more focused on philosophy and artificial intelligence.
AHSE1199 - Arts, Humanities, Social Science Foundation Topic  [10]

Credits: 4 AHSE

Course Description
Special Topics in Arts, Humanities and Social Science classes (AHSE X199) typically cover a specific topic in Arts, Humanities and Social Science and are intended to enhance and expand the selection of offerings from semester to semester.

Additional Information
FA14: Section 01: Robots, Mutants and Monsters: Envisioning Science in Cinema: 4 credits (Vitols)

Throughout the history of cinema, filmmakers have experienced both fascination with and fear of technology. Contemporary scientific advancements have inspired countless cinematic representations that express cultural excitement, ethical concern and social anxiety regarding such innovations as artificial intelligence and nuclear engineering. By placing such films as Metropolis (1927), 2001: A Space Odyssey (1968), and The Matrix (1999) in their historical and cultural contexts, this course will consider multiple approaches to the representation of science on screen. This course requires attendance at Monday evening film screenings from 7-9:30pm.

FA14: Section 02: Media Revolution: Activism and Technology; 4 credits (Vitols)

Since their inceptions, radio, film and television have been utilized for political purposes. Yet the advent of digital technology has profoundly altered the traditional relationships between media and activism. From “hacktivism” to the events of the Arab Spring, new media provide an influential contemporary forum for advocating for change. This course explores the way media are employed for political and social purposes, investigating the different approaches used today to transform our virtual and real worlds.
**AHSE1515 - Products and Markets** [11]

**Credits:** 4 AHSE

**For information contact:** Neeley, Lawrence

**Course Description**

Entrepreneur: one who owns and manages a business; a person who takes the risk of profit or loss. - O.E.D. The same source also reveals a broader definition found in the French root, entreprendre, which means "to undertake." An entrepreneur is defined as one who assumes the opportunity and full responsibility of any pursuit. A champion.

In this course, students explore and begin to realize in themselves the entrepreneur in both forms: the practical and the profound. In this foundational course in business and entrepreneurship they will conceive, create and manage a real, profitable business. They will be exposed to traditional business tools such as accounting, marketing and finance as well as the personal and interpersonal tools requisite for high-performance teamwork, including project planning, giving feedback and persuasive pitching. This business experience and its associated challenges will serve as the context in which we hope to develop broader self-awareness, productive self-reflection and courage. Broadly, these skills will apply to the bold imagining and realization of their lives at Olin and beyond.

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**AHSE1599 - Entrepreneurship Foundation Topic** [12]

**Credits:** 4 AHSE

**Course Description**

Special Topics in Entrepreneurship classes (AHSE X599) typically cover a specific topic in Entrepreneurship and are intended to enhance and expand the selection of offerings from semester to semester.
AHSE2110 - The Stuff of History: Materials, Culture in Ancient, Revolutionary and Contemporary Times

Credits: 4 AHSE

Hours: 4-0-8

Required Requisites

Concurrent Requisite(s): SCI1410A

For information contact: Martello, Robert

Course Description

The lion's share of our history of technology course features a series of readings, lectures, and discussions on the relationship between materials, science, society, and the environment in three historical periods. We start with the material practices and paradigms of Copper and Bronze Age societies, shift to Paul Revere's "Revolutionary" work with various metals and fabrication processes, and conclude with a look at the technologies and challenges of tomorrow. We will emphasize the development of three skills that are vital to our studies: contextual thinking, communication (both written and oral), and historical research methods pertaining to source evaluation and narrative construction.
AHSE2112 - Six Books that Changed the World  [14]

Credits: 2 AHSE

Hours: 4-0-8

Recommended Requisites

AHS Foundation

For information contact: Martello, Robert

Course Description

Why and how do certain books reshape the course of human history? In this course, we will explore six books, selected from different times, societies, and genres, that have had an unquestionably major impact upon the world in which we live. Class meetings will alternate between contextual studies of the historical context of each book (including the author's background, the political and social setting, and other factors) and careful analyses of the works themselves. Our discussions will investigate each book's contemporary and modern impact while also exploring the qualities that caused all of our selections to have such an enduring and global effect. Students will be expected to contribute to class discussions, make presentations, and write a report on an additional book of their choosing. NOTE: this course will be offered during the first half of the semester, will meet twice a week, and will require approximately 12 hours of student effort each week.

AHSE2114 - Science Fiction and Historical Context  [15]

Credits: 2 AHSE

Hours: 4-0-8

Recommended Requisites

AHS Foundation

For information contact: Martello, Robert

Course Description

Science fiction is a wonderful genre that somehow captures a society's ideals, fears, assumptions, and major challenges. In the same way that a historian attempts to piece together complex cause-effect chains to make sense of the past, science fiction writers project the values, technologies, and beliefs of their own societies into alternate or future realities. Our class will work together to understand the conventions of science fiction and explore science fiction works (books, short stories, film) produced in different times, across various cultures, and in different sub-genres of this field.

Students will have the opportunity to analyze different works of science fiction through writings and class discussions, and can also choose to develop a science fiction idea of their own. NOTE: this course will be offered during the second half of the semester, will meet twice a week, and will require approximately 12 hours of student effort each week.
AHSE2125 - The Engineer's Orchestra II: Theory, Orchestration, Composition

**Credits:** 2 AHSE

**Hours:** 4-0-8

**Recommended Requisites**
Wired Ensemble or Permission of Instructor

**For information contact:** Dabby, Diana

**Course Description**
The Engineer's Orchestra II provides "just-in-time" harmonic and contrapuntal theory for the study of orchestration, with special attention to voice leading, instrumental doubling, spacing, balance, and color. Each week students complete preliminary exercises that target the skills necessary for that week's focus of study. They then orchestrate piano reductions of symphonic excerpts, and vice versa, in order to apply these developing skills. The course progresses from scoring for string, woodwind, and brass ensembles to woodwind-string and woodwind-brass-string combinations, and finally the full orchestra. Class discussions involve students defending their technical and artistic decisions, followed by close examination of the choices made by the original composer. Weekly recorded examples bring to life the fundamental concepts underlying the work of past and contemporary orchestrators. Guest appearances/demonstrations by instrumentalists allow students to sharpen their listening skills as they distinguish among the possibilities for bowings and articulations that inform orchestral writing. The course culminates with each student pursuing a final project, such as an original composition or arrangement.
AHSE2130 - The Intersection of Art and Science  [17]

Credits: 4 AHSE

Hours: 4-0-8

For information contact: Donis-Keller, Helen

Course Description
Science and Art are often considered entirely different worlds inhabited by practitioners who have nothing in common. In this course, we will debunk this myth by closely examining the discovery process in both disciplines and by comparing the culture of science to that of art, historically and in the present. We will consider the influence of scientific discoveries, from optics to "new media" on the production of art and discuss the corollary question "Has art influenced the progress of science?" We will also consider ways in which science allows us to understand artists and the work they create. In contemporary society, artists have begun to comment on science, sometimes with disastrous results, which leads us to ask, "What is needed in order to establish a meaningful dialogue between scientists and artists, and does it matter?"

AHSE2131 - Responsive Drawing and Visual Thinking  [18]

Credits: 4 AHSE

Hours: 4-0-8

For information contact: Donis-Keller, Helen

Course Description
The course assumes no prior experience in drawing. Students will learn to visualize objects in three-dimensional space and commit them to the two-dimensional space of a page, gaining critical experience with "idea sketching," an ability that can be put to many uses in future courses (e.g. project design). Students will also draw subjects from life, i.e. stationary objects and life models using media including charcoal, graphite, cont', and ink. The emphasis will be realistic depiction as compared to non-objective abstraction. Students will begin with basic exercises in drawing and rapidly move to more complex intensive drawing experiences. Approximately one-third of the classroom time will be used for drawing from a life model. Class discussion and sketchbook homework assignments will be an essential element in the learning process. Homework assignments will include drawing and visual thinking exercises to be completed in personal sketchbooks. Reading selected text material is also part of the homework requirement. Several invited speakers will contribute to the course and provide informal critiques of student work. One field trip is planned to the Fogg Art Museum at Harvard University in Cambridge to view art. Other in-class activities will include participation in discussion of drawings (old master and contemporary) that are presented to illustrate various objectives of classroom work (e.g. use of line to indicate form) and group critique sessions. Assessment will be based on weekly homework assignments, classroom work, and three drawing projects to be completed outside of class.
AHSE2140 - Anthropology: Culture, Knowledge and Creativity  [19]

Credits: 4 AHSE

Hours: 4-0-8

Recommended Requisites
AHS Foundation

For information contact: Lynch, Caitrin

Course Description
Anthropological theories and methods help us understand human behavior and values. Broadly speaking, anthropologists ask, "Why do people do what they do and believe what they believe?" Today, anthropologists study a wide range of contemporary social issues, such as international development, garment manufacturing, the production of scientific knowledge, female "circumcision," and intellectual property. In this course, we will read about, debate, and discuss these and other issues in order to probe into the meanings of culture, knowledge, and creativity.

- What do anthropologists mean by culture?
- What does it mean to take cultural difference seriously?
- Does culture have an influence on what is considered legitimate "knowledge"?
- If knowledge is "situated," what happens when one form of knowledge comes in contact with another (for instance in discussions of global human rights)?
- What is the relationship between cultural difference, situated knowledge, and human creativity?
- Does globalization threaten to destroy creativity, stifle innovation, and erase difference?

After we learn how anthropologists deal with these questions at a range of research sites, we will end the course with our own anthropological studies that utilize what we have learned earlier in the course. Students will conduct short research projects that examine social issues pertaining to the use of the Internet in the United States. By ending with a study of ourselves, students will see how creative we really are; that we, too, have culture; and that what we consider legitimate knowledge is culturally situated. The professor will assume no prior knowledge of anthropology. Skills to be developed include critical reading, critical thinking, writing and analysis, presenting arguments in oral and visual form, and working on projects in small groups. The following texts will be used, among others: Jean Davison, Voices from Mutira: Change in the Lives of Gikuyu Women, Daniel Miller and Don Slater, The Internet: An Ethnographic Approach, Jeremy MacClancy, Exotic No More: Anthropology on the Front Lines.
AHSE2141 - Engineering for Humanity  [20]

Credits: 2 AHSE

Hours: 6-0-6

Required Requisites

Concurrent Requisite(s): ENGR2141

For information contact: Ben-Ur, Ela; Lynch, Caitrin

Course Description

This course introduces students to engineering problem solving, beginning with understanding client needs and ending with implemented, adaptable, adoptable, and sustainable solutions. This course will draw equally on empathetic and ethnographic methods and on a technical understanding of the problem and solution domains. Over the semester, we will learn about and with our clients; we will identify specific challenges that our clients face; and together with our clients we will develop concrete solutions to address these challenges. Students will leave Engineering for Humanity with a grounded understanding of the engineering problem solving process, experience in participant-observer fieldwork, and hopefully a feeling of satisfaction at having made a concrete difference in the lives of members of our community.

Our client population for the current version of this course is senior citizens who live in their own homes and who are recruited before the class begins. Over the semester, we will learn about and with our clients; we will identify specific challenges that our clients face; and together with our clients we will develop concrete solutions to address these challenges. Students will leave Engineering for Humanity with a grounded understanding of the engineering problem solving process, experience in participant-observer fieldwork, and hopefully a feeling of satisfaction at having made a concrete difference in the lives of members of our community. The projects will be specific service projects that students identify and design while working with senior citizens in surrounding communities. For example, students might design a device to help someone who has difficulty reaching up to change a light bulb, something to help hold a newspaper steady with shaky hands, or something to enable someone to get clothes out of a clothing dryer that is difficult to stoop down to reach. Some sessions of the course will be devoted to co-design with the client population or to team meetings. Other sessions involving guest speakers and fieldtrips, others with course discussion of topics relevant to aging. Students must simultaneously enroll in AHSE2141 and ENGR2141 for a total of 4 credit hours.
AHSE2170 - Teaching and Learning in Undergraduate Science and Engineering [21]

Credits: 4 AHSE

Hours: 3-0-9

For information contact: Zastavker, Yevgeniya

Course Description
This course will examine select topics in teaching and learning in undergraduate science, technology, engineering, and mathematics (STEM) courses. The goal of the course is to help participants become effective tutors, teaching assistants, mentors, and future instructors in these fields through a deep examination of teaching and learning in STEM courses. In a seminar format, participants will discuss research on best practices in pedagogy and curriculum design, cognition and learning, student classroom experiences, diversity, and assessment. Students will gain experience in instructional design, pedagogy, and assessment, and will develop a teaching portfolio. (Note: While the course readings are largely on research in science and engineering education, the course will touch on issues in mathematics education, and many course concepts can be extended to mathematics and technology instruction. As well, the theoretical and practical portion of the class may be extended to the K-12 domain.)

AHSE2199 - Special Topics in Arts, Humanities and Social Science [22]

Credits: Variable Credits AHSE

Course Description
Special Topics in Arts, Humanities and Social Science classes (AHSE X199) typically cover a specific topic in Arts, Humanities and Social Science and are intended to enhance and expand the selection of offerings from semester to semester.

Additional Information
FA14: Six Microbes that Changed the World; 4 credits (Huang, Martello)

“It has long been an axiom of mine that the little things are infinitely the most important.” - Arthur Conan Doyle, “A Case of Identity” in The Adventures of Sherlock Holmes

Penicillium. Vibrio cholera. Escherichia coli. Cyanobacteria. The archaea. Microbes surround us, and impact our lives, our health, our societies, and our environment. Research with microbes, the smallest of all living creatures, has enabled discovery and understanding of the fundamental workings of life, opens up rich historical narratives of diseases and cures, and may provide sustainable solutions to problems we face from bioremediation to bioenergy. And best of all, microbes open the door to a thrilling new integrated course for a lucky inaugural group of students.

“Six Microbes that Changed the World” is an interdisciplinary course taught by Jean Huang and Rob Martello for the first time this fall. We will use six influential microbes as a window into a rich study of the interactions between science and societal context. This course will connect biological and historical knowledge through discussions, integrated assignments, presentations, and hands-on laboratory activities. We are looking for a motivated group of students to join us in this experimental course; let’s explore the thrill of biology and history, together.
AHSE3100 - Issues in Leadership and Ethics  [23]

Credits: 2 AHSE

Hours: 2-0-4

Recommended Requisites
Students must be in their final year.

For information contact: Miller, Richard

Course Description
This course examines the intersection of leadership and ethics in business, engineering, and more general contexts. Readings will include material on the definition and history of ethics and morality in the U.S., the definition and development of leadership skills in a professional context, the role of ethics in the professions, and case studies involving the intersection of leadership and ethics. The course will be structured as a seminar, involving guest speakers and interactive case studies. Enrollment will be limited to 8 students from each college in the final semester of their undergraduate program. The course is typically taught by the Presidents from the The Three College Collaboration.

AHSE3130 - Advanced Digital Photography  [24]

Credits: 4 AHSE

Hours: 4-0-8

Recommended Requisites
AHSE 1130 or Permission of Instructor

For information contact: Donis-Keller, Helen

Course Description
In this project-based course, students will develop a personal photographic point of view matched with consistently well-crafted imagery informed by the work of leading contemporary photographers. While communication with visual images is paramount, technical issues will be addressed in some depth. For example, there will be instruction and practice with image capture and editing including High Dynamic Range (HDR) exposure and processing, color management methods and printing, Adobe Lightroom/Photoshop tools and techniques, graphic design and book production methods. Initial projects will stimulate creative thinking and group critiques will help monitor progress and inspire new directions. The culminating project will be the design and production of a photography-based book by each member of the class. A critical awareness of the medium of fine art photography will be fostered through selected readings, discussions, and visits to galleries and museums.
AHSE3190 - Arts Humanities Social Sciences Capstone Preparatory Workshop  [25]

Credits: 1 AHSE

Hours: 0-0-3

For information contact: Epstein, Gillian

Course Description
This course offers the opportunity to begin researching your proposed AHS Capstone project topic, plan logistics, and write a proposal prior to enrolling in the AHS Capstone project. Students will work on a series of tasks throughout this semester in an independent manner, and can solicit feedback from other students in this course, Capstone teaching assistants, and Capstone teaching staff. Tasks include identification of the project area/topic and mentor, production of a partial annotated bibliography (that contextualizes each source with respect to one or more scholarly disciplines), and a detailed Capstone proposal (which includes a project statement, thesis, plan of work, etc.).

AHSE3199 - Special Topics in Arts, Humanities and Social Sciences  [26]

Credits: Variable Credits AHSE

Course Description
Special Topics in Arts, Humanities and Social Science classes (AHSE X199) typically cover a specific topic in Arts, Humanities and Social Science and are intended to enhance and expand the selection of offerings from semester to semester.
AHSE3510 - New Technology Ventures  [27]

Credits: 4 AHSE

Hours: 4-0-8

For information contact: Brand, Stephen

Course Description

Creating a new venture that has technology as a basis for its products or services presents special challenges. On one hand is the "push" of new technology, as evidenced by the plethora of scientific invention and technological innovation. On the other hand is the "pull" of the market as it presents new entrepreneurial opportunities. Other key challenges present themselves in areas of intellectual property protection, team building and funding opportunities. In this course we will explore entrepreneurship in technology industries in depth with the hope of penetrating the popular veneer, and uncovering the guts of starting a growing new technology ventures. Of course, there is a lot about new technology venturing that is common to all new venture creation, and also the qualities entrepreneurs demonstrate are valuable in a wide spectrum of life's activities. A unique aspect of this course is its desire to include students from both Babson College and Olin College. Particular value from this intermingling will be evidenced in the true interdisciplinary nature of the course field project teams that are formed, and the ability for students to begin to develop networks of relationships outside their individual domains of business or engineering.

Primary Course Objectives:

1. To investigate the components, tools, and practices of technology entrepreneurship: identifying new venture opportunities, evaluating the viability of a new business concept, calibrating risk of successful technology development, protecting intellectual property, building a team that possesses the attributes necessary for success, obtaining appropriate financing, writing a business plan, and developing an investor presentation, creating an entrepreneurial culture that increases the odds of success, and creating liquidity for shareholders.

2. To identify and exercise entrepreneurial skills through classrooms debate and assignments.

3. To introduce students to a variety of technology entrepreneurs. Case studies are used as tools for discussion, and are augmented with readings and guest speakers. The core project for this course will be the development of a technology based business plan. Students will form teams to explore a business opportunity, and develop a business plan and investor presentation.
AHSE3599 - Special Topics in Business and Entrepreneurship  [28]

Credits: Variable Credits AHSE

Course Description
Special Topics in Entrepreneurship classes (AHSE X599) typically cover a specific topic in Entrepreneurship and are intended to enhance and expand the selection of offerings from semester to semester.

AHSE4190 - Arts Humanities Social Sciences Capstone Project  [29]

Credits: 4 AHSE

Hours: 4-0-8

Required Requisites
Prerequisite(s): AHSE3190

Recommended Requisites
AHSE 3190 or permission of instructor.

For information contact: Arts Humanities Social Science Faculty

Course Description
The AHS Capstone is an advanced, self-designed AHS project that builds upon a student's prior experience in one or more AHS disciplines. All students must complete either an AHS Capstone or an Entrepreneurship Capstone in order to graduate. AHS Capstones must be proposed to the AHS Committee and approved by the end of the academic year prior to the Capstone except in extenuating circumstances. Additional information on the AHS Capstone is available at http://projects.olin.edu/ahs [30]. AHS Capstone students will complete a proposal, a journal, a disciplinary deliverable, an analysis of their deliverable, and a presentation. Class sessions will vary between meetings of the entire class, small group workshops, and individual meetings. Olin strongly recommends that all AHS Capstone students first complete the AHS Capstone Preparatory Seminar. Please contact the AHS Committee at ahs@olin.edu [31] with any questions.
AHSE4199 - Special Topics in Arts, Humanities and Social Sciences

Credits: Variable Credits AHSE

Course Description
Special Topics in Arts, Humanities and Social Science classes (AHSE X199) typically cover a specific topic in Arts, Humanities and Social Science and are intended to enhance and expand the selection of offerings from semester to semester.

AHSE4590 - Entrepreneurship Capstone

Credits: 4 AHSE

Hours: 2-0-10

Recommended Requisites
Entrepreneur track; 8 qualifying credits

For information contact: Brand, Stephen

Course Description
The Entrepreneurship Capstone is an advanced, intensive experience designed to complete a student's undergraduate study of entrepreneurship. The Entrepreneurship Capstone is designed as a seminar that enables students to interact with an experienced entrepreneur in order to accomplish three objectives. First, students will spend the majority of the semester focused on an individual project, the goal of which is expertise in a particular entrepreneurial or business topic. These projects are defined by each student in collaboration with the instructor, and are expected to include a substantial educational component that builds knowledge and expertise throughout the course of the semester. Second, students will undertake one or two assigned projects to strengthen their understanding of entrepreneurship. For example, this may involve an assigned paper/presentation and a community outreach project. Third, students will have the chance to fill knowledge gaps regarding the theory and practice of entrepreneurship. Please contact the instructor with any questions about the course or prerequisites.
Engineering

ENGR1199 - Special Topics in Engineering [34]

Credits: Variable Credits ENGR

Course Description
Special Topics in Engineering classes (ENGR X199) typically cover a specific topic in Engineering and are intended to enhance and expand the selection of offerings from semester to semester.

ENGR1200 - Design Nature [35]

Credits: 4 ENGR

Hours: 6-0-6

For information contact: Linder, Benjamin

Course Description
We take nature, an important source of inspiration and understanding, as a theme and develop bioinspired ideas into functional prototypes. Our focus is on the general principles and methods that shape the practice of engineering design. Students complete individual and team projects in a studio environment where we seek to develop a shared practice and understanding of engineering design. Students also gain experience in visualization, experimentation, estimation, fabrication, and presentation as they relate to designing.
**ENGR1330 - Fundamentals of Machine Shop Operations**  [36]

**Credits:** 4 ENGR

**Hours:** 4-4-4

**Required Requisites**

**Prerequisite(s):** ENGR1200

**For information contact:** Andruskiewicz, Bruce

**Course Description**

This course covers the fundamentals of machine tool operations, classical machining techniques, and CAD methods. Students will learn principles of technical drawing, fabrication and assembly of mechanical systems, how to interpret and establish appropriate design requirements to make parts to specification and how to inspect parts to ensure that they meet specification. Students will come away with a sound understanding of drawing interpretation and creation, machine shop safety, bench work, measurement, part layout, and machine setup, operation and maintenance.

Assigned projects will involve significant machining time to fabricate mechanical components and a working mechanical system (e.g., tesla turbine).

**ENGR2125 - The Engineer's Orchestra I: Acoustics, Waves and Vibrations**  [37]

**Credits:** 4 ENGR

**Hours:** 4-2-6

**Recommended Requisites**

MTH 2140 or Permission of Instructor

**For information contact:** Dabby, Diana

**Course Description**

The Engineer's Orchestra provides an introduction to acoustics, waves, and vibrations via musical instruments. Students address the physics of orchestral instruments (winds, strings, and percussion) both qualitatively and quantitatively. Topics include one-dimensional transverse and longitudinal waves, traveling and standing wave solutions to the wave equation, and an introduction to spherical waves with relevant hands-on demonstrations. Modeling and analysis concepts will be introduced to support students in the design and construction of their own physical or virtual musical instruments.
ENGR2141 - Engineering for Humanity  [38]

Credits: 2 ENGR

Hours: 6-0-6

Required Requisites

Concurrent Requisite(s): AHSE2141

For information contact: Ben-Ur, Ela; Lynch, Caitrin

Course Description

This course introduces students to engineering problem solving, beginning with understanding client needs and ending with implemented, adaptable, adoptable, and sustainable solutions. This course will draw equally on empathetic and ethnographic methods and on a technical understanding of the problem and solution domains. Over the semester, we will learn about and with our clients; we will identify specific challenges that our clients face; and together with our clients we will develop concrete solutions to address these challenges. Students will leave Engineering for Humanity with a grounded understanding of the engineering problem solving process, experience in participant-observer fieldwork, and hopefully a feeling of satisfaction at having made a concrete difference in the lives of members of our community.

Our client population for the current version of this course is senior citizens who live in their own homes and who are recruited before the class begins. Over the semester, we will learn about and with our clients; we will identify specific challenges that our clients face; and together with our clients we will develop concrete solutions to address these challenges. Students will leave Engineering for Humanity with a grounded understanding of the engineering problem solving process, experience in participant-observer fieldwork, and hopefully a feeling of satisfaction at having made a concrete difference in the lives of members of our community. The projects will be specific service projects that students identify and design while working with senior citizens in surrounding communities. For example, students might design a device to help someone who has difficulty reaching up to change a light bulb, something to help hold a newspaper steady with shaky hands, or something to enable someone to get clothes out of a clothing dryer that is difficult to stoop down to reach. Some sessions of the course will be devoted to co-design with the client population or to team meetings. Other sessions involving guest speakers and fieldtrips, others with course discussion of topics relevant to aging. Students must simultaneously enroll in AHSE2141 and ENGR2141 for a total of 4 credit hours.
ENGR2199 - Special Topics in Engineering  [39]

Credits: Variable Credits ENGR

Course Description
Special Topics in Engineering classes (ENGR X199) typically cover a specific topic in Engineering and are intended to enhance and expand the selection of offerings from semester to semester.

Additional Information
FA14: Regional Analysis for Development; 2 credits (Mur-Miranda)

Students perform qualitative and quantitative analyses at the regional level to gain insight into development challenges and propose new ways of thinking, with an emphasis on the role of technology. For example, a student might study maternal health in Sub-Saharan Africa. Students select topics and regions based on interest and levels of unmet need, as well as other considerations such as cultural, climatic, technological, economic, political, and ecological ones.

Students will gain experience with analysis and modeling tools and data sets relevant to development with an emphasis on probability and statistics, GIS, and dynamic systems modeling. Guest speakers will share their experiences practicing data driven development. Students will create formal briefings with recommendations supported by a synthesis of quantitative data, analysis, and visualization and informed by the published literature. Students may have an opportunity to publish their work.

This course provides valuable preparation for students planning to enroll in ENGR 3290/4290 Affordable Design and Entrepreneurship (ADE) or perform research or work in international development. Wellesley and Babson students are encouraged to enroll. This course is taken in conjunction with MTH2188: Designated Alternative in Mathematics: Regional Analysis for Development; 2 credits (Mur-Miranda).
ENGR2210 - Principles of Engineering [40]

Credits: 4 ENGR

Hours: 4-4-4

Required Requisites
Prerequisite(s): ENGR1125

For information contact: Bennett, Andrew; Govindasamy, Siddhartan; Hoover, Aaron

Course Description
Through a significant project experience, students will learn to integrate analysis, qualitative design, quantitative optimization, experiments, and simulations to improve their ability to engineer real systems. In each section of the course, students will work in small multidisciplinary teams to design and to build a mechatronic system of their own choosing. Each project must include both a nontrivial mechanical system design and a nontrivial electronic system design involving both hardware and software components. Projects will be subject to realistic materials, process, and budgetary constraints.

ENGR2250 - User-Oriented Collaborative Design [41]

Credits: 4 ENGR

Hours: 4-4-4

For information contact: Linder, Benjamin

Course Description
Students develop detailed concepts and models of authentic new products and services. Our focus is on user-oriented, collaborative approaches to design and seeking holistic solutions integrating user and functional perspectives. We emphasize the importance of process and the development of strategies. Students observe and engage people to develop a deep understanding of their values and the patterns of their lives. They work collaboratively in a studio environment to create a shared understanding of the people they design for (and with) and the product ideas they develop. Topics covered include design thinking, ethnographic methods, concept development and interaction design.

ENGR2299 - Special Topics in Design Engineering [42]

Credits: Variable Credits ENGR

Course Description
Special Topics in Design Engineering classes (ENGR X299) typically cover a specific topic in Design Engineering and are intended to enhance and expand the selection of offerings from semester to semester.
**ENGR2320 - Mechanics of Solids & Structures** [43]

**Credits:** 4 ENGR

**Hours:** 5-3-4

**For information contact:** Lee, Christopher

**Course Description**
This course covers the principles of statics of structures and mechanics of materials. The focus is on the concepts of stress and strain as related to applied loads (axial, shear, torsion, bending) and to resulting deformation. Students will learn how the principles of mechanics can be applied to mechanical design through modeling, quantitative analysis, strain gauge measurements, and computational simulation. The use of a commercial finite element package is introduced.

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**ENGR2330 - Introduction to Mechanical Prototyping** [44]

**Credits:** 4 ENGR

**Required Requisites**

**Prerequisite(s):** ENGR1200

**Course Description**
Through project experiences, students will learn the techniques needed to both master the technical communication of mechanical designs and the fabrication skills needed to rapidly build them. Students will practice professional drafting techniques to describe a full range of fabricated components, including milled, lathed, sheet metal, water jet, injection molded, 3D printed and welded components. This course will include a significant machine shop component, where each student will gain exposure to advanced fabrication techniques. The final project will be the design and fabrication of a fully operational, complex mechanical system.
ENGR2340 - Dynamics [45]

Credits: 4 ENGR

Hours: 4-0-8

For information contact: Lee, Christopher

Course Description
With an emphasis on understanding fundamental concepts, students will learn to create and analyze mathematical models for mechanical and electromechanical systems that are changing in time. Equations of motion for 3D rigid bodies and systems will be derived using conservation of momentum and energy methods. Concepts involving equilibrium, linearization, and stability will be applied to study dynamic response in both the time and frequency domains through time-integration, transfer function, and state-space analysis. The idea of feedback control is introduced. Coursework and projects will involve examples such as robots, mechanisms, vehicles, and aircraft/spacecraft.

ENGR2350 - Thermodynamics [46]

Credits: 4 ENGR

Hours: 4-0-8

For information contact: Townsend, Jessica

Course Description
This course covers the fundamental principles of thermodynamics and physical chemistry as applied to engineering systems. This course provides a foundation in fundamental thermodynamic phenomena, including the first and second laws of thermodynamics, thermodynamic properties, equations of state in real and ideal gases, and chemical equilibrium. The basic laws are used to understand and analyze the performance and efficiency of systems, such as automobile engines, gas turbines, steam power plants, and refrigerators.
ENGR2410 - Signals and Systems  [47]

Credits: 4 ENGR

Hours: 4-0-8

For information contact: Mur-Miranda, Jose Oscar

Course Description

Linear system theory is a powerful set of mathematical tools used broadly across science and engineering. Signals represent the transfer of information or power, while systems represent operations on these signals. This course presents fundamental concepts from linear systems such as convolution, impulse and step response, Fourier transforms, sampling and modulation. These concepts are presented within the framework of linear operators and/or transforms in discrete and/or continuous time. Applications include filters, system identification, deconvolution, feedback and control, and communications.

ENGR2420 - Intro Microelectronic Circuits with laboratory  [48]

Credits: 4 ENGR

Hours: 4-4-4

Required Requisites

Prerequisite(s): ENGR1125

Recommended Requisites

MTH2210

For information contact: Minch, Bradley

Course Description

This course will cover elements of linear circuits, such as the operation of basic circuit elements, fundamental circuit laws, and analytic techniques in both the time domain and the frequency domain. It will also cover the transistor-level design of complementary metal-oxide-semiconductor (CMOS) electronic circuits in the context of modern integrated-circuit technology. The course will include an introduction to the fabrication and operation of metal-oxide-semiconductor (MOS) transistors and to the design and operation of the basic building blocks of analog integrated circuits including single-transistor amplifier stages, current mirrors, CAS codes, differential pairs, and single-stage operational amplifiers. Throughout the course, an emphasis will be placed on design-oriented circuit analysis techniques and developing circuit reasoning skills.
ENGR2420 L - Intro Microelectronic Circuits Laboratory  [49]

Credits: 0 ENGR

For information contact: Minch, Bradley

ENGR2510 - Software Design  [50]

Credits: 4 ENGR

Hours: 5-0-7

For information contact: Downey, Allen; Millner, Amon; Ruvolo, Paul

Course Description

This course is an introduction to software design. It focuses on a model of computation as a set of simultaneous ongoing entities embedded in and interacting with a dynamic environment, for example: computation as it occurs in spreadsheets, video games, web applications, and robots. A major component of the class is a weekly three-hour, in class laboratory. Much of this laboratory is spent in collaborative work on program development, with an emphasis on student-student interaction and student-student teaching, facilitated and enriched by the course staff. In addition, design and implementation work is supplemented with observational laboratory assignments, inviting students to consider not only how to build a program, but how to anticipate its behavior and how to modify that behavior. Both students with no prior background and students with background comparable to the CS AP should both find this course interesting and worthwhile.

ENGR2510 L - Software Design Lab  [51]

Credits: 0 ENGR

Course Description
ENGR2599 - Special Topics in Computing

Credits: Variable Credits ENGR

Course Description
Special Topics in Computing classes (ENGR X599) typically cover a specific topic in Computing and are intended to enhance and expand the selection of offerings from semester to semester.

ENGR2620 - Biomechanics

Credits: 4 ENGR

Hours: 4-0-8

Recommended Requisites
MTH2220, SCI1130, SCI1210 Or permission of instructor

For information contact: Zastavker, Yevgeniya

Course Description
Why is a giraffe's head so small in comparison to the rest of its body? Why do babies' heads flatten when they sleep in the same position? Why do knees bend only in one direction? Why are people taller in the morning? In this course, we will study the nature and function of human body and its movement with specific emphasis on movements produced in sport, dance, and every day physical activities. The principles of Newtonian mechanics, statics, and dynamics will be applied to discuss behavior of bones, tendons, ligaments, and muscles during human movement. This course is cross-listed as SCI 2220.

ENGR2699 - Special Topics in Bioengineering

Credits: Variable Credits ENGR

Course Description
Special Topics in Bioengineering classes (ENGR X699) typically cover a specific topic in Bioengineering and are intended to enhance and expand the selection of offerings from semester to semester.
**ENGR3140 - Error Control Codes** [55]

**Credits:** 2 ENGR

**Hours:** 4-0-8

**Required Requisites**

**Prerequisite(s):** MTH2210  
**Concurrent Requisite(s):** MTH3140

**Recommended Requisites**

MTH2110 or another proof based mathematics course

**For information contact:** Adams, Sarah Spence

**Course Description**

Error-control codes are used to detect and correct errors that occur when data are transmitted across a noisy channel. This course provides an introduction to error-control codes, including linear, cyclic, binary, and non-binary codes. Mathematics such as modular arithmetic and introductory ring and field theory will be introduced and used extensively. Students must simultaneously enroll in MTH 3140 and ENGR 3140 for a total of 4 credit hours.

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**ENGR3199 - Special Topics in Engineering** [56]

**Credits:** Variable Credits ENGR

**Course Description**

Special Topics in Engineering classes (ENGR X199) typically cover a specific topic in Engineering and are intended to enhance and expand the selection of offerings from semester to semester.
ENGR3210 - Sustainable Design  [57]

Credits: 4 ENGR

Hours: 4-0-8

Required Requisites
Prerequisite(s): ENGR2250

For information contact: Linder, Benjamin

Course Description
This course provides a comprehensive overview of sustainable product design. Emphasis is placed on learning and using green design principles, methods, tools and materials. Examples include life cycle assessment, eco-efficiency and eco-effectiveness. A system perspective highlighting material and energy flows over the complete product life cycle is used to structure course material. Students complete substantial reading, investigate existing products and develop their own product ideas.

ENGR3220 - Human Factors and Interface Design  [58]

Credits: 4 ENGR

Hours: 4-4-4

Required Requisites
Prerequisite(s): ENGR2250

Recommended Requisites
ENGR 2510 or other software development experience recommended

For information contact: Stein, Lynn Andrea

Course Description
A hands-on exploration of the design and development of user interfaces, taking into account the realities of human perception and behavior, the needs of users, and the pragmatics of computational infrastructure and application. Focuses on understanding and applying the lessons of human interaction to the design of usable computer applications; will also look at lessons to be learned from less usable systems. This course will mix studio (open project working time) and seminar (readings and discussion) formats.
ENGR3250 - Integrated Product Design

Credits: 4 ENGR

Hours: 4-0-8

Required Requisites

Prerequisite(s): ENGR2250

For information contact: Linder, Benjamin

Course Description

You will work with industrial design students from the Massachusetts College of Art and Design (in Boston) and business students from Babson College to develop new products through projects that are student-generated. Students learn first hand about the techniques and contributions different disciplines bring to product design and practice cross-functional collaboration common in professional design settings. This course provides valuable preparation for students interested to work in design firms, such as Continuum, IDEO, Frog, Altitude and Essential to name a few, or develop and launch their own consumer products. Class will be held once a week and rotate among all three campuses. Babson students should enroll in MOB 3578. Wellesley students should cross-register into this course and not MOB 3578 at Babson.
ENGR3260 - Design for Manufacturing [60]

Credits: 4 ENGR

Hours: 4-0-8

Required Requisites

Prerequisite(s): ENGR2250

Course Description

In the process of creating a new product, device or system, a "proof of principle" prototype is built to demonstrate both that such an object can be built and to test how well it works. At a practical level, in the process of creating this prototype, many sub-optimal design concessions are made in the choices of components, cost and functionality in order to meet prototyping time and budget constraints. Upon the completion and successful testing of a prototype, the next phase in the design stream required to bring the product, device or system to a final user or market, is to re-design the prototype such that it can be manufactured at both an acceptably low price point and at an acceptably high enough level of quality to give enduring value to the final end user.

Design for Manufacturing will build the specialized design skills needed to professionally redesign a prototype in order to meet target price, reliability and functionality goals, whether the final market requires a single unit per year (i.e. space systems, like satellites) or fifty thousand units a week (i.e. consumer products). This course will be heavily team and project based and will involve the re-design for manufacture of several products, devices and services at the discretion of the instructor. The overall course projects will incorporate a significant mechanical, electronic and software components (but perhaps not all three in any one project) and will be drawn widely from the consumer, industrial, and sustainable market sectors. Course will potentially involve field trips to manufacturing facilities and invited "DFM " lecturers as appropriate to support the particular projects offered in a given semester.

ENGR3270 - Real Products, Real Markets [61]

Credits: 4 ENGR

Hours: 4-0-8

Required Requisites

Prerequisite(s): ENGR2250

For information contact: Neeley, Lawrence

Course Description

This course is intended to completely re-imagine the product design + entrepreneurship process. Each participant in the course will imagine, design, prototype, test, market and sell a product in the span of the semester. The products and customers will be real. A key measure of success will be the number of products successfully sold and shipped to complete strangers. To achieve these lofty goals, we will have to explore, understand and analyze each element of existing processes with an eye towards exploiting best practices, redesigning them when relevant and, if needed, creating processes anew.
ENGR3290 - Affordable Design and Entrepreneurship  [62]

Credits: 4 ENGR

Hours: 2-2-8

Required Requisites

Prerequisite(s): ENGR2250

For information contact: Linder, Benjamin

Course Description

Students gain experience innovating to address social challenges through a design and entrepreneurship approach that emphasizes context, collaboration, and sustainability. The focus is on alleviating poverty by deploying innovations in communities that generate income and meet daily human needs in areas like energy, water, health, agriculture, transportation, and communication. For example, students might create and test the technology for a micro energy utility, such as a concentrated-solar battery charging station, and the business model that makes it viable.

The course is run as a firm where students work in teams with community partners nationally and internationally to co-create and launch new products and ventures. Topics covered include the conditions and causes of poverty, approaches to poverty alleviation, cultural awareness and community engagement, affordable design principles and practices, and social venture models and strategies including financing and scaling. Groups of students travel to partner sites in countries like India, Morocco, Ghana and the U.S. to build relationships, gain contextual awareness, and implement projects.

This course is part of the ADE Program that also includes placement assistance to help students find internship and job opportunities in social enterprise. ADE is offered jointly with Babson College where students enroll in EPS 4515. Olin students can elect ADE as an alternative to the SCOPE Program to fulfill the Capstone requirement by registering for ENGR 4290 for two consecutive semesters beginning in the second semester of their junior year or the first semester of their senior year. They cannot change programs once they have completed registration. Alternatively, students can take this course for one semester to fulfill the Design Depth requirement by registering for ENGR 3290. Students who take ENGR 3290 can switch to ENGR 4290 for Capstone credit.
ENGR3299 - Special Topics in Design Engineering  [63]

Credits: Variable Credits ENGR

Required Requisites
Prerequisite(s): ENGR2250

Course Description
Special Topics in Design Engineering classes (ENGR X299) typically cover a specific topic in Design Engineering and are intended to enhance and expand the selection of offerings from semester to semester.

ENGR3310 - Transport Phenomena  [64]

Credits: 4 ENGR

Hours: 4-0-8

Recommended Requisites
MTH2210 and MTH2220 recommended, ENGR 2340 or Permission of Instructor

For information contact: Storey, Brian

Course Description
This course introduces the basic physics and applications of the transport of heat, mass, and momentum. Topics in fluid dynamics include kinematics, conservation laws, dynamic similarity, and laminar flow solutions. Topics in heat and mass transfer include internal and external convection, free convection, boiling and condensation, and the analogy between heat and mass transport. Applications in aerodynamics, geophysical flows, manufacturing processes, and biological systems will be discussed.
**ENGR3330 - Mechanical Design** [65]

**Credits:** 4 ENGR

**Hours:** 4-0-8

**Required Requisites**

**Prerequisite(s):** ENGR2320

**For information contact:** Barrett, David

**Course Description**

This course integrates basic mechanical sciences for application to machine design. Topics include stress, strain, deflection, stiffness, and failure of mechanical components including springs, bearings, gears, shafts and axles; steady and time-dependent loading; mechanical fastening and joining; and power transmission. Techniques for quantitative analysis and design optimization are introduced. The material of this course significantly draws and builds upon the concepts presented in ENGR 2320. Students will carry out a major design project.

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**ENGR3340 - Dynamics of Mechanical and Aerospace Structures** [66]

**Credits:** 4 ENGR

**Hours:** 4-0-8

**Recommended Requisites**

MTH2220, ENGR2340 or permission of instructor

**For information contact:** Lee, Christopher

**Course Description**

Fundamental techniques for the analysis of the dynamic behavior of mechanical and aerospace structures are studied through case projects that involve both computational analysis and experimental measurements. Topics will be selected from areas such as vibration analysis, flexible body dynamics, aerodynamics, and aero-elasticity. Projects may include the design and construction of vibration absorbers or energy harvesting systems, the dynamics and stability of aerospace vehicles, lift and drag of airfoils, or flutter instability of elastic structures.
**ENGR3345 - Mechanical and Aerospace Systems** [67]

**Credits:** 4 ENGR

**Hours:** 4-0-8

**Recommended Requisites**
ENGR 2210 or Permission of Instructor

**For information contact:** Lee, Christopher

**Course Description**
A student team will work in the manner of a small engineering research and development company to develop a mechanical or aerospace system to address a current market need. A comprehensive system design will be developed based upon quantitative analysis using commercial simulation software. Prototype systems will be fabricated, evaluated and refined to meet requirements, specifications, and performance objectives.

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**ENGR3370 - Controls** [68]

**Credits:** 4 ENGR

**Hours:** 4-0-8

**Required Requisites**
Prerequisite(s): ENGR2340, ENGR2410

**Recommended Requisites**
The prerequisites are an either / or requirement. You do not need both to enroll.

**For information contact:** Lundberg, Kent

**Course Description**
This course explores the techniques for changing the dynamics of a system using feedback control. The first portion of the course covers methods for analyzing the open-loop dynamics of generic systems in the frequency-domain (transfer functions) and time-domain (state-space equations). Then we will develop feedback techniques for shaping the system response. Students completing this course will have the analytical tools for controller design (both classical and modern) as well as a fundamental understanding of the concepts behind feedback control (stability, performance, controllability, observability, etc.). Students will have ample opportunity to experiment with control design by implementing their own designs in analog and digital hardware. Examples from field robotics, aircraft, and intelligent-structures will be used for both in-class and hands-on demonstrations.
ENGR3390 - Fundamentals of Robotics  [69]

Credits: 4 ENGR

Hours: 4-0-8

For information contact: Barrett, David

Course Description
This course encompasses the fundamentals of perception, sensors, computer vision, navigation, localization, actuation, manipulation, mobility (e.g., walk, swim, roll, crawl, fly), and intelligence (e.g., control, planning, and mission execution). The course is built around the review and discussion of seminal technical papers in the robotics field with guest lecturers both from various Olin faculty and from external leaders in the robotics community. There is a significant project component to help solidify key concepts.

ENGR3392 - Robotics Systems Integration  [70]

Credits: 4 ENGR

Hours: 4-0-8

Required Requisites
Prerequisite(s): ENGR3390

Recommended Requisites
ENGR 3390

For information contact: Barrett, David; Bennett, Andrew

Course Description
This course combines the components of Fundamentals of Robotics (sensing, cognition and actuation) into the testing and deployment of fully-working interdisciplinary robotic systems. There is a significant lab-based component in which teams of students compete in several main industrial robotics areas to optimize mission performance under real world time constraints.

Previous projects include: the design of a robot arm and vision system that plays checkers against human opponents; the design of closed-loop-controlled unmanned ground vehicles to autonomously circumnavigate the Olin Oval, and the design of an intelligent assembly system for autonomous processing of multi-well bio-assay trays.
ENGR3399 - Special Topics in Mechanical Engineering [71]

Credits: Variable Credits ENGR

Course Description

Special Topics in Mechanical Engineering classes (ENGR X399) typically cover a specific topic in Mechanical Engineering and are intended to enhance and expand the selection of offerings from semester to semester.

ENGR3410 - Computer Architecture [72]

Credits: 4 ENGR

Hours: 4-4-4

Required Requisites

Prerequisite(s): ENGR1121, ENGR1125

For information contact: VanWyk, Eric Judson

Course Description

This course introduces a broad range of computation structures used in computation, from logic gates to specialized (e.g. DSP, cellular automata) as well as general purpose architectures. Design techniques for quantitatively optimizing performance are also taught. Students build a computer from the ground up.
ENGR3415 - Digital Signal Processing [73]

Credits: 4 ENGR

Hours: 4-0-8

Required Requisites

Prerequisite(s): ENGR2410

For information contact: Dabby, Diana

Course Description

Signal processing - the modeling, transformation, and manipulation of signals and their content - underpins virtually all facets of our daily lives due to the coupling of computing and communications in consumer, industrial, and public sector applications. Discrete-time signals, obtained through the sampling of continuous-time signals, and their frequency domain equivalents, can undergo transformation via systems, e.g., finite-duration impulse response (FIR) and infinite-impulse response (IIR) filters. Digital filter design and analysis conjoins such topics as difference equations, the z-transform, stability, frequency response, the discrete Fourier transform, FFT algorithms, windowing, practical implementation structures, A/D and D/A conversion techniques. After researching signal processing applications during the first part of the course, students initiate and realize individual DSP projects by end-of-term.

ENGR3420 - Introduction to Analog and Digital Communication [74]

Credits: 4 ENGR

Hours: 4-4-4

Recommended Requisites

ENGR 2410 or Permission of Instructor

For information contact: Govindasamy, Siddhartan

Course Description

This course teaches students design techniques for analog and digital communications, including elementary coding and information theory. Topics also include modulation schemes, data compression, error detection and correction, encryption, transmitter and receiver design, and routing protocols. Students build an operative communications link over an unreliable channel.
ENGR3426 - Mixed Analog-Digital VLSI I  [75]

Credits: 4 ENGR

Hours: 4-4-4

Required Requisites

Prerequisite(s): ENGR2420

For information contact: Minch, Bradley

Course Description

This course will provide an overview of mixed-signal (analog and digital) integrated circuit design in modern complementary metal-oxide (CMOS) technologies. Students will learn transistor-level design of digital and analog circuits, layout techniques for digital and analog circuit modules, and special physical considerations that arise in a mixed-signal integrated circuit. Students will design a custom mixed-signal integrated circuit that will be sent out for fabrication at the end of the semester if they enroll in MADVLSI II (ENGR3427).

ENGR3427 - Mixed Analog-Digital VLSI II  [76]

Credits: 4 ENGR

Hours: 4-4-4

Required Requisites

Prerequisite(s): ENGR3426

For information contact: Minch, Bradley

Course Description

This course will provide an overview of mixed signal testing methodologies, exposure to more advanced integrated circuit topics, and an opportunity to test the custom chips designed in MADVLSI I through the design and fabrication of a custom printed circuit board (PCB) featuring their own integrated circuit. Students will participate in collaborative teaching of some advanced topics in a seminar-style format.
**ENGR3430 - EE Prototyping** [77]

**Credits:** 4 ENGR

**Hours:** 3-3-6

**Required Requisites**

**Prerequisite(s):** ENGR2210

**For information contact:** Lundberg, Kent

**Course Description**

Through a series of projects, we will learn to design, build, and debug electronic prototype systems. We will cover multiple aspects of the prototyping process, including circuit and system design, soldering, deadbugging, troubleshooting, component selection, schematic capture, printed-circuit board (PCB) layout, PCB fabrication, PCB assembly, and thermal analysis. We will discuss the tradeoffs among "faster, better, cheaper", and explore examples in the realms of analog, digital, RF, and power. In addition to hands-on reverse engineering and fabrication experience, students will learn technical communication through design documentation. This course is approved for use as an advanced ECE elective.

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**ENGR3450 - Semiconductor Devices** [78]

**Credits:** 4 ENGR

**Hours:** 4-4-4

**Recommended Requisites**

SCI 1410 or SCI 3110

**For information contact:** Kerns, Sherra

**Course Description**

Introduction to semiconductor device fabrication, operation, and design. Emphasis on diodes and transistors, with some exploration of speculative technologies. Students will conduct a project of their own choosing involving either device characterization or device simulation using modern tools.
ENGR3499 - Special Topics in Electrical & Computer Engineering  [79]

Credits: Variable Credits ENGR

Course Description
Special Topics in Electrical and Computer Engineering classes (ENGR X499) typically cover a specific topic in Electrical and Computer Engineering and are intended to enhance and expand the selection of offerings from semester to semester.

ENGR3520 - Foundations of Computer Science  [80]

Credits: 4 ENGR

Hours: 4-0-8

Recommended Requisites
ENGR2510 or permission of instructor. MTH2110, Discrete Mathematics should be take along with FOCS or prior to enrolling.

For information contact: Downey, Allen; Stein, Lynn Andrea

Course Description
This course uses applications as vehicles for exploring the formal analytic toolkit of the computer scientist as well as aspects of algorithmic computing and intelligent software design. The course combines elements of automata theory, data structures and algorithms, programming languages, artificial intelligence, information management, and internet programming. Students may optionally enroll only in ENGR 3520; these students will be excused from the programming/project component of the course. Students wishing to register for the full six credit course should register for both ENGR 3520 and ENGR 3520A.

ENGR3525 - Software Systems  [81]

Credits: 4 ENGR

Hours: 4-4-4

For information contact: Downey, Allen

Course Description
An introduction to the design and implementation of system-level software, including operating systems, networks, and databases. Topics include processes and threads, memory and storage management, networking and inter-process communication, scheduling and synchronization.
ENGR3530 - Synchronization [82]

Credits: 2 ENGR

Hours: 2-2-2

For information contact: Downey, Allen

Course Description
When multiple programs run at the same time, they can interact in complex ways, yielding unpredictable behavior at best and impenetrable bugs at worst. Synchronization is the process of imposing timing constraints in order to guarantee the correct execution of programs. This class presents a series of synchronization "puzzles" and gradually develops a set of tools for dealing with even the hairiest synchronization problems.

ENGR3540 - Computational Modeling [83]

Credits: 4 ENGR

Hours: 4-0-8

Recommended Requisites
ENGR2510 or permission of instructor

For information contact: Downey, Allen

Course Description
The availability of cheap computation has created a new way of understanding the world. Along with experiment and theory, computational modeling provides new tools for analysis, explanation and prediction. This class looks at the history of this revolution and the technology that underlies it. We will survey a range of literature, from the skeptical to the exuberant, and make a critical evaluation of this putative paradigm shift. Students will learn the skills of computational modeling, with an emphasis on discrete and stochastic models, and apply them to problems in a range of fields including engineering and the natural and social sciences. Basic programming ability, in any language, is a prerequisite.
ENGR3599 - Special Topics in Computing [84]

Credits: Variable Credits ENGR

Course Description

Special Topics in Computing classes (ENGR X599) typically cover a specific topic in Computing and are intended to enhance and expand the selection of offerings from semester to semester.

Additional Information

FA14: Computational Signal Processing; 2 credits (Downey)

This is an introduction to digital signal processing, primarily sound and images, taking a computational approach. We will use a new textbook, Think DSP, which I am working on now. The current draft is at think-dsp.com [85]. Students will work on exercises from the book, help develop new material, and work on case studies that might be included in the published version of the book. Some projects might involve basic circuit design and Arduino programming. I expect that this class will serve as a good prelude to Signals and Systems. In its current form, it is not a substitute for DSP in the ECE major requirements.

FA14: A Computational Introduction to Robotics; 4 credits (Ruvolo)

This course will provide a computationally-focused introduction to the field of robotics. Students will learn how to both select and design algorithms for solving interesting problems in robotic perception and control. Additionally, students will learn to successfully balance tradeoffs between accuracy of an algorithm and its computational efficiency in both space and time. The course will move from structured labs to more open-ended projects as the semester progresses. Specific content areas that the course may address are: computer vision, machine learning, reinforcement learning, path planning, mapping and localization.

FA14: Game Programming; 4 credits (Pucella)

Through a series of projects, we will learn to design and develop computer games in a variety of genres--strategy, puzzle, arcade, adventure--for individual play, adversarial play, and team play. Games may be implemented from scratch or via existing frameworks, where appropriate. In the process, we will learn about and tackle problems in computer graphics, algorithms, programming languages, artificial intelligence, simulation, distributed computing, and security.
ENGR3600 - Topics in Bioengineering [86]

**Credits:** 4 ENGR

**Hours:** 4-0-8

**For information contact:** Sarang-Sieminski, Alisha

**Course Description**

Broadly, bioengineering can be defined as the application of engineering concepts and methods to the solution and study of biological and medical problems. Using a case study approach, this course aims to provide students with a broad understanding of the types of problems bioengineers explore as well as the engineering and biological methods they employ. We will approach topics through seminar-style discussion of current primary articles from the literature. Topics to be covered include tissue engineering, use of microfluidic devices for diagnostics, imaging disease states, and prosthetic limbs. In order to explore a topic of particular interest in more depth, students will also write and orally present a research paper on a topic of their choice.

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ENGR3610 - Biomedical Materials [87]

**Credits:** 4 ENGR

**Hours:** 4-0-8

**Recommended Requisites**

SCI 1210 and SCI 1410, or Permission

**For information contact:** Chachra, Deborah

**Course Description**

The body is a harsh environment for synthetic materials; not only is it warm, wet, and salty, but there are enzymes and cells whose function is to identify and destroy anything foreign. Conversely, implanted materials can provoke unexpected responses from biological systems. This course is an overview of biological interactions with materials, with a special emphasis on the role of the in vivo milieu on failure in medical devices. Topics will include coagulation, inflammation, and immune responses to materials, cell-surface interactions, and the mechanical interactions of materials and tissue, together with emerging fields such as drug delivery and neuron-silicon interfaces. Readings will be drawn primarily from the current literature.
ENGR3620 - Cellular Bioengineering  [88]

Credits: 4 ENGR

Hours: 4-0-8

Recommended Requisites
SCI 1210 or Permission of Instructor

For information contact: Sarang-Sieminski, Alisha

Course Description
This course aims to give students an appreciation of the power of using quantitative approaches to increasing our understanding of biological phenomena. Receptor-ligand binding will be considered and compared to experimental data to discuss mechanisms in cell signaling studies. Basic binding models will be expanded to consider the effect of forces in situations such as white blood cells rolling, detaching, and adhering during surveillance of blood vessels. We will consider the effects of forces from the molecular to the whole cell level. How do cells exert force? And how can we measure those forces? How do the properties of the substrates cells attach to affect their behaviors? How can we translate observations made in the 2D environment to the 3D environment? And how are these similar and different? These concepts will be explored to study the effect of forces in cellular processes such as migration, traction generation, differentiation, signaling and gene expression.
ENGR3630 - Transport in Biological Systems [89]

Credits: 4 ENGR

Hours: 4-0-8

Required Requisites
Prerequisite(s): SCI1210

Recommended Requisites
Strong background in Calculus

For information contact: Sarang-Sieminski, Alisha

Course Description
Transport phenomena play a vital role in numerous biological processes. For example, the blood flow patterns arising from the particular geometry of branching blood vessels are thought to drive the formation of atherosclerotic plaques. Mass transport plays a role in events such as tissue differentiation during development, oxygenation of blood in the lungs, and glomerular filtration in the kidneys. The entire field of drug delivery has been driven and advanced by understanding transport of pharmacological agents within biomaterials and tissues. Further, combination of fluid and mass transport allow us to understand flow through porous media which is critical for understanding problems such as delivery of chemotherapeutics and tumor metastasis. The roles of transport in understanding and treating cancer will be a theme throughout this course. We will study and analyze mathematical models of these key biological problems using both analytical and computational tools. Through a series of readings and projects, this course will combine engineering fundamentals of mass, energy, and momentum conservation with modeling approaches to enhance exploration and understanding of fluid and mass transport within the body. This course will be of value to students interested in biology, mathematical modeling, and bioengineering.
ENGR3640 - Tissue Engineering [90]

Credits: 4 ENGR

Hours: 4-4-4

For information contact: Sarang-Sieminski, Alisha

Course Description

Tissue engineering is often defined as growing or regenerating tissues. To grow engineered tissues requires an understanding of the cell and tissue biology as well as understanding of how culture conditions (transport of oxygen and biochemical factors, application of mechanical forces, etc.) affect the growing tissues. This course will begin with an overview of developmental biology and the types of biochemical and biophysical cues cells receive and respond to during development that direct them to form specific tissues, followed by an overview of the larger field of tissue engineering. We will discuss cell source, the use of natural or synthetic biomaterials, development of bioreactors, the use of biochemical supplements, as well as motivations and applications of engineered tissues – from replacement of damaged tissues to models of tissue function. The bulk of this course will be dedicated to the design, implementation, and analysis of experiments to grow engineered tissues. This will be an intensive lab-based course in which groups of students will choose the particular aspect of tissue engineering (e.g. scaffold choice, biochemical culture conditions, mechanical stimulation, functional readouts) they would like to pursue and perform their own experiments and analysis (e.g. biochemical, mechanical, histological). Some lab experience required.
ENGR3650 - Biological Thermodynamics  [91]

**Credits:** 4 ENGR

**Hours:** 4-0-8

**Recommended Requisites**
MTH 1111, SCI 1130, SCI 1210 or Permission of Instructor

**For information contact:** Zastavker, Yevgeniya

**Course Description**

The beauty and depth of this subject cannot be described better than with the words of one of the greatest physicists of the 20th century, Arnold Sommerfeld, "Thermodynamics is a funny subject. The first time you go through it, you don't understand it at all. The second time you go through it, you think you understand it, except for one or two points. The third time you go through it, you know you don't understand it, but by that time you are so used to the subject, it doesn't bother you anymore". In this course we will venture into the depths of thermodynamics and statistical mechanics, while concentrating on applications of the abstract concepts to biological, biochemical, and biophysical phenomena and drawing from contemporary bioengineering problems. This course provides an introduction to the study of energy transformations in biological systems as well as thermodynamics and kinetics of structure formation and association of biomolecules. Topics covered include energy and its transformation, the First and Second Law of Thermodynamics, Gibbs Free Energy, statistical thermodynamics, binding equilibria and reaction kinetics, and a survey of other interesting areas of biological thermodynamics, particularly the origin of life on Earth. Topics have relevance to numerous pertinent biological/bioengineering applications including diseases based on phase transitions (e.g., cataract of the eye, Alzheimer's disease, etc.), oxygenation of hemoglobin; protein folding, aggregation, and binding; assembly of everything from the phospholipids bilayer to biomaterials; the macroscopic mechanical properties of biomaterials and even cells; creation and operation of devices at the nano- and micro-scales; understanding the basis of mass transport; osmotic pressure relevant to cells and microvascular filtration; receptor-ligand binding; the melting and annealing of DNA. The concepts employed in this course have relevance to students interested in many disciplines, including Bioengineering, Materials Science, Biology and Chemistry.

This course is cross-listed as SCI 3250.

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ENGR3699 - Special Topics in Bioengineering  [92]

**Credits:** Variable Credits ENGR

**Course Description**

Special Topics in Bioengineering classes (ENGR X699) typically cover a specific topic in Bioengineering and are intended to enhance and expand the selection of offerings from semester to semester.
ENGR3710 - Systems

Credits: 4 ENGR

Hours: 4-0-8

Required Requisites

Prerequisite(s): ENGR2250

For information contact: Bennett, Andrew

Course Description

This course introduces students to the art and science of interdisciplinary design. Students analyze the process used to develop example products that required expertise in many areas and creativity and trade-off consideration amongst all. Students learn about overarching principles that enable creators of broad interdisciplinary systems to succeed. Students will also work in teams and take on roles as design specialists in a variety of fields. Each team is given the task to design in detail a hypothetical product that can succeed only if interdisciplinary creativity is fostered and tradeoffs are made by every team member, as well as the group as a whole.

ENGR3810 - Structural Biomaterials

Credits: 4 ENGR

Hours: 4-4-4

Required Requisites

Prerequisite(s): SCI1210, SCI1410

For information contact: Chachra, Deborah

Course Description

How is a blood vessel like a garden hose? Why are seashells strong (and beautiful) even though they are made of chalk? How can your opaque white tendons be made of the same material as your transparent corneas? This course focuses on the materials science of natural tissues, primarily ones that fill structural roles, including bone, teeth, tendon, nacre, and wood, with an emphasis on how they are similar and different to 'engineering' materials. Additional material may include scaffolds for tissue engineering, biomimetic materials and mechanical properties of individual cells.
**ENGR3812 - Solid State Physics** [95]

**Credits:** 4 ENGR  

**Hours:** 4-0-8  

**Recommended Requisites**  
SCI2130  

**For information contact:** Christianson, Rebecca  

**Course Description**  
Why do metals conduct heat well while insulators do not? Why is silicon a better semiconductor than diamond, even though they have the same structure? Why is lead a good superconductor at low temperature, while copper is not? We will explore the current understanding of insulators, metals, semiconductors and superconductors through some of the basic tools of solid state physics, and will learn how to apply these tools to the novel materials being developed today. This course is cross-listed as SCI 3120.

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**ENGR3820 - Failure Analysis and Prevention** [96]

**Credits:** 4 ENGR  

**Hours:** 4-4-4  

**Required Requisites**  
Prerequisite(s): SCI1410  

**For information contact:** Stolk, Jonathan  

**Course Description**  
Students will complete projects and case studies to gain practical experience in the analysis of fractured and failed engineering materials and components. The course focus will be on material microstructure and the micromechanisms of fracture, and topics will include failure analysis methodology, mechanisms of failure, fracture classifications, corrosion and environmental factors, fractography, and design for failure prevention. Students will learn advanced materials characterization techniques including scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS) and compositional dot mapping, x-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), optical microscopy, and fracture surface sample preparation.
ENGR3899 - Special Topics in Materials Science

Credits: Variable Credits ENGR

Required Requisites
Prerequisite(s): SCI1410

Course Description

ENGR4190 - Senior Capstone Program in Engineering (SCOPE)

Credits: 4 ENGR

Recommended Requisites
Must be a senior

For information contact: Sarang-Sieminski, Alisha (SCOPE Director)

Course Description

SCOPE is a two-course requirement for all Olin seniors. It incorporates formal, team-based, year-long engineering projects done in conjunction with 10 to 14 external companies. Each project will be executed by a single student team, supported by a dedicated faculty member, in partnership with one of these companies. Each student team will have between four and six members from the senior class. Students may conduct advanced research, perform market analysis, develop experimental prototypes, design new products or redesign existing products in the execution of this project.

ENGR4199 - Alternative Capstone in Engineering

Credits: 4 ENGR

Course Description

Special Topics in Engineering classes (ENGR X199) typically cover a specific topic in Engineering and are intended to enhance and expand the selection of offerings from semester to semester.
ENGR4290 - Affordable Design and Entrepreneurship [100]

Credits: 4 ENGR

Hours: 2-2-8

Required Requisites

Prerequisite(s): ENGR2250

For information contact: Linder, Benjamin

Course Description

Students gain experience innovating to address social challenges through a design and entrepreneurship approach that emphasizes context, collaboration, and sustainability. The focus is on alleviating poverty by deploying innovations in communities that generate income and meet daily human needs in areas like energy, water, health, agriculture, transportation, and communication. For example, students might create and test the technology for a micro energy utility, such as a concentrated-solar battery charging station, and the business model that makes it viable.

The course is run as a firm where students work in teams with community partners nationally and internationally to co-create and launch new products and ventures. Topics covered include the conditions and causes of poverty, approaches to poverty alleviation, cultural awareness and community engagement, affordable design principles and practices, and social venture models and strategies including financing and scaling. Groups of students travel to partner sites in countries like India, Morocco, Ghana and the U.S. to build relationships, gain contextual awareness, and implement projects.

This course is part of the ADE Program that also includes placement assistance to help students find internship and job opportunities in social enterprise. ADE is offered jointly with Babson College where students enroll in EPS 4515. Olin students can elect ADE as an alternative to the SCOPE Program to fulfill the Capstone requirement by registering for ENGR 4290 for two consecutive semesters beginning in the second semester of their junior year or the first semester of their senior year. They cannot change programs once they have completed registration. Alternatively, students can take this course for one semester to fulfill the Design Depth requirement by registering for ENGR 3290. Students that take ENGR 3290 can switch to ENGR 4290 for Capstone credit.
Mathematics

MTH2110 - Discrete Math  [101]

Credits: 4 MTH
Hours: 4-0-8

For information contact: Patel, Rehana; Adams, Sarah Spence

Course Description
Topics for this course include combinatorics, number theory, graph theory, an emphasis on creative problem solving, and the ability to read and write rigorous proofs.

MTH2130 - Probability and Statistics  [102]

Credits: 2 MTH
Hours: 2-0-4

Course Description
An introduction to probability and statistics, with applications to science, engineering, and social science. Topics include discrete and continuous probability distributions; moments; conditional probability; Bayes' Rule; point and interval estimation; hypothesis testing.

MTH2160 - Introduction to Mathematical Modeling  [103]

Credits: 2 MTH
Hours: 2-0-4

Required Requisites
Prerequisite(s): MTH1111, MTH2130

Course Description
This course centers on the interdependency of mathematics and the sciences and engineering.

Through this codependency, knowledge of the specific discipline is better understood through the development of a mathematical description and its solution. Often, these descriptions are appropriate over a wide range of disciplines well beyond the original context of the first problem. Over the seven-week session, we look at individual cases in biology, chemistry, physics, fields of engineering and business to see how to formulate a mathematical description, and the techniques used for its solution. The course follows a case-study format, with modeling subjects chosen from the media (for example, the Science Times section of the New York Times).
MTH2188 - Designated Alternative in Mathematics  [104]

Credits: 4 MTH

Course Description

MTH2188A - Designated Alternative in Mathematics  [105]

Credits: Variable Credits MTH

MTH2188B - Designated Alternative in Mathematics  [106]

Credits: Variable Credits MTH

Required Requisites

Concurrent Requisite(s): ENGR2199B

Course Description

FA14: Regional Analysis for Development; 2 credits (Mur-Miranda)

Students perform qualitative and quantitative analyses at the regional level to gain insight into development challenges and propose new ways of thinking, with an emphasis on the role of technology. For example, a student might study maternal health in Sub-Saharan Africa. Students select topics and regions based on interest and levels of unmet need, as well as other considerations such as cultural, climatic, technological, economic, political, and ecological ones.

Students will gain experience with analysis and modeling tools and data sets relevant to development with an emphasis on probability and statistics, GIS, and dynamic systems modeling. Guest speakers will share their experiences practicing data driven development. Students will create formal briefings with recommendations supported by a synthesis of quantitative data, analysis, and visualization and informed by the published literature. Students may have an opportunity to publish their work.

This course provides valuable preparation for students planning to enroll in ENGR 3290/4290 Affordable Design and Entrepreneurship (ADE) or perform research or work in international development. Wellesley and Babson students are encouraged to enroll. This course is taken in conjunction with ENGR2199B: Special Topics in Engineering and Mathematics: Regional Analysis for Development; 2 credits (Mur-Miranda).
MTH2199 - Special Topics in Mathematics [107]

Credits: Variable Credits MTH

Course Description

Special Topics in Mathematics classes (MTH X199) typically cover a specific topic in Mathematics and are intended to enhance and expand the selection of offerings from semester to semester.

MTH2210 - Linearity I [108]

Credits: 4 MTH

For information contact: Adams, Sarah Spence; Hoffman, Aaron; Storey, Brian

MTH2220 - Linearity II [109]

Credits: 4 MTH

For information contact: Geddes, John B.; Patel, Rehana; Somerville, Mark

Course Description

An intradisciplinary approach that builds upon material covered in Linearity 1 to address topics in vector calculus and introductory partial differential equations. Topics include functions of more than one variable; vector-valued functions; gradient, divergence, and curl; boundary value problems; and solutions to common partial differential equations. Emphasis on both numerical and analytical approaches. Note: students who have previously taken multi-variable calculus should consult with mathematics faculty to determine whether taking Linearity 2 is appropriate for their needs.
MTH3120 - Partial Differential Equations  [110]

Credits: 4 MTH

Hours: 4-0-8

Recommended Requisites

MTH2210, MTH2220 or permission of instructor

For information contact: Hoffman, Aaron

Course Description

An introduction to the solution methods of partial differential equations that arise in describing a wide variety of problems in engineering, such as in fluid dynamics, elasticity, electromagnetic wave propagation, and transport phenomena. The course begins with the solution of boundary-value problems in ordinary differential equations (Sturm-Liouville theory), and then develops into the fundamentals of Fourier analysis and the solutions to the heat, wave, and Laplace's equations on finite and infinite domains. Additional topics will be addressed at the discretion of the instructor(s), examples of which include systems of hyperbolic equations, similarity solutions in infinite domains, or a brief introduction to numerical solutions.

MTH3130 - Mathematical Analysis  [111]

Credits: 2 MTH

Hours: 2-0-4

Course Description

An introduction to real analysis; construction of the real number system; metric spaces and metric topology; compactness; connectedness; functions. Emphasis on mathematical rigor, logic, and proof.
MTH3140 - Error Control Codes  [112]

Credits: 2 MTH

Hours: 4-0-8

Required Requisites

Prerequisite(s): MTH2210

Concurrent Requisite(s): ENGR3140

Recommended Requisites

MTH2110 or another proof based mathematics course

For information contact: Adams, Sarah Spence

Course Description

Error-control codes are used to detect and correct errors that occur when data are transmitted across a noisy channel. This course provides an introduction to error-control codes, including linear, cyclic, binary, and non-binary codes. Mathematics such as modular arithmetic and introductory ring and field theory will be introduced and used extensively. Students must simultaneously enroll in MTH 3140 and ENGR 3140 for a total of 4 credit hours.

MTH3150 - Numerical Methods and Scientific Computing  [113]

Credits: 4 MTH

Hours: 4-0-8

For information contact: Geddes, John B.

Course Description

The speed of modern computers has allowed simulation to become a very powerful tool in the design and analysis of systems in science and engineering. This power is easily misused and scientific computing is full of pitfalls. This course introduces students to methods useful for accurately simulating complex systems in the physical sciences and engineering. The first half of the course focuses on iterative techniques for solving algebraic systems, interpolation of functions, and advanced techniques for solutions to ordinary differential equations. The second half of the course focuses on an introduction to solutions to boundary-value problems and solutions to partial differential equations, with the students required to choose an application in science and engineering to solve in detail.
MTH3160 - Intro to Complex Variables  [114]

Credits: 4 MTH

Hours: 4-0-8

For information contact: Hoffman, Aaron

Course Description
This course provides an introduction to the analysis of functions in the complex plane. Topics include the Cauchy-Riemann equations, conformal mapping, Cauchy-Goursat theorem, Taylor-Laurent series, the residue theorem, Nyquist criterion, continuation of analytic functions, and applications in science and engineering.

MTH3170 - Nonlinear Dynamics and Chaos  [115]

Credits: 4 MTH

Hours: 4-0-8

For information contact: Geddes, John

Course Description
This course will focus on the modern theory of dynamical systems including both discrete and continuous processes. The course will emphasize both theory and applications. Theory topics might include, for example, linear and nonlinear stability theory, periodic solutions, bifurcation theory, chaos, and strange attractors. Applications discussed might include, for example, mechanical oscillators and biological oscillators.

MTH3199 - Special Topics in Mathematics  [116]

Credits: Variable Credits MTH

Course Description
Special Topics in Mathematics classes (MTH X199) typically cover a specific topic in Mathematics and are intended to enhance and expand the selection of offerings from semester to semester.
Olin Administration

OIP1000 - The Olin Internship Practicum  [117]

Credits: 1 ADMN

Hours: 0-0-15

Recommended Requisites

PGP Workshops

For information contact: Phelps, Sally J.

Course Description

Students get the best preparation for their career by obtaining real life experience, preferably in a work setting. This course would require an international student (F-1 visa status) seeking this type of meaningful, career-building internship to receive the necessary career preparation by way of PGP workshops, obtaining the necessary internal authorizations, and completing, along with their employer, a final work experience evaluation. At least 100 work hours would be required at the internship. In addition, the student must participate in at least two Post Graduate Planning workshops. If two of these are not available, the student may take similar, related workshops, or meet with PGP individually to cover the required material.

Olin Intro Experience

ENGR1125 - Introduction to Sensors, Instrumentation and Measurement  [118]

Credits: 4 OIE

For information contact: Minch, Bradley; Storey, Brian

Course Description

Conducting experiments and making measurements is an essential aspect of all branches of science and engineering. Nearly all of our current quantitative understanding of the natural and engineered world has come from the interplay between theory and measurements. Models and simulations of systems require experimental validation and performance of engineered systems must not only be predicted, but also measured and tested. In this course we will learn the basic tools of making physical measurements and conducting experiments. We will collect data, analyze data, conduct basic error analysis, and design experimental systems. Using inexpensive modern sensors, we will build the necessary supporting electronics and learn to collect data with computer based data acquisition systems. The first part of the course will focus on individual work and students will conduct labs on basic electrical, mechanical and environmental measurements. The later part of the course will involve a team project that involves designing and executing an experiment that involves measurement, data acquisition and data analysis.
MTH1111 - Modeling and Simulation of the Physical World  [119]

Credits: 2 OIE

Hours: 3-0-3

Required Requisites

Concurrent Requisite(s): SCI1111

For information contact: Downey, Allen; Somerville, Mark; Townsend, Jessica

Course Description

This course provides an introduction to mathematical modeling and computer simulation of physical systems. Working with a broad range of examples, students practice the steps involved in modeling and analyzing a physical system, learn the role of models in explaining and predicting the behavior of the physical world, and develop skills with the programming and computational tools necessary for simulation. Students work in a studio environment on increasingly open-ended projects, and learn how to present their results, with an emphasis on visual and oral communication. (This course is taken with SCI1111.)

OIE1000 - Olin Introductory Experience  [120]

Credits: 1 OIE

Hours: 1-0-3

For information contact: Tatar, Nick

Course Description

This course aims to introduce and develop skills that facilitate a successful transition into Olin. This course will cultivate critical and creative thinking skills, self reflection, teamwork, leadership, and intrapersonal relationships with peers, faculty, and staff. This course is required.
SCI1111 - Modeling and Simulation of the Physical World  [121]

**Credits:** 2 OIE

**Required Requisites**

**Concurrent Requisite(s):** MTH1111

**For information contact:** Downey, Allen; Somerville, Mark; Townsend, Jessica

**Course Description**

This course provides an introduction to mathematical modeling and computer simulation of physical systems. Working with a broad range of examples, students practice the steps involved in modeling and analyzing a physical system, learn the role of models in explaining and predicting the behavior of the physical world, and develop skills with the programming and computational tools necessary for simulation. Students work in a studio environment on increasingly open-ended projects, and learn how to present their results, with an emphasis on visual and oral communication. (This course is taken with MTH1111.)

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**Science**

SCI1121 - Electricity and Magnetism  [122]

**Credits:** 4 SCI

**Hours:** 4-0-8

**For information contact:** Christianson, Rebecca

**Course Description**

Electricity and magnetism, including electric charges, forces, and fields, Gauss's Law, potential, electrostatic energy and capacitors, magnetic fields and energy, mutual and self-induction, Ampere's Law, Maxwell's Equations and electromagnetic waves.
SCI1121A - Electricity and Magnetism with Laboratory  [123]

Credits: 4 SCI

For information contact: Christianson, Rebecca

SCI1130 - Mechanics  [124]

Credits: 4 SCI

Hours: 3-3-6

For information contact: Somerville, Mark; Zastavker, Yevgeniya

Course Description
This course provides a thorough introduction to classical mechanics. We will cover kinematics, the basis of Newton's laws, particle dynamics, the concepts of momentum, work, energy, and rotational motion, and oscillations. Additionally, the course will establish the basics of solid and fluid mechanics, concluding with introductory topics in thermodynamics. Our goal is to share with you the excitement of discovering the material universe at its most basic levels and to equip you with the basic knowledge and analytical skills necessary to become a scientist or an engineer. This course is offered in two different flavors. Course sections with a prefix of A are taught as Theoretical Mechanics. Course sections with a prefix of B are taught as Experimental Mechanics and are laboratory based.

SCI1199 - Foundation Topic in Physics  [125]

Credits: 4 SCI

Course Description
Special Topics in Physics classes (SCI X199) typically cover a specific topic in Physics and are intended to enhance and expand the selection of offerings from semester to semester.

SCI1210 - Principles of Modern Biology (with laboratory)  [126]

Credits: 4 SCI

Hours: 4-3-5

For information contact: Donis-Keller, Helen; Huang, Jean; Pratt, Joanne

Course Description
This course introduces students to the fundamental aspects of biological science including biochemistry, molecular biology, human molecular genetics, and cellular communication. Students gain experience with contemporary research methods and scientific reasoning through laboratory experiments. The relevance of biology to the environment and health is emphasized.
SCI1210 L - Principles Modern Biology LAB  [127]
Credits: 0 SCI

Course Description

SCI1210A - Principles of Modern Biology with Lab  [128]
Credits: 4 SCI

Required Requisites
Concurrent Requisite(s): AHSE2199A

For information contact: Donis-Keller, Helen; Huang, Jean; Pratt, Joanne

SCI1310 - Introduction to Chemistry (with laboratory)  [129]
Credits: 4 SCI

Hours: 4-3-5

Course Description
This course introduces students to the fundamental aspects of aqueous and solid state chemistry. Topics include stoichiometry, gas laws, atomic structure and bonding, atomic theory, quantum theory, acid/base chemistry, solubility, electrochemistry, kinetics, thermodynamics, and reaction equilibria.

SCI1310 L - Intro to Chemistry LAB  [130]
Credits: 0 SCI

Course Description

SCI1399 - Special Topics in Chemistry  [131]
Credits: Variable Credits SCI

Course Description
Special Topics in Chemistry classes (SCI X399) typically cover a specific topic in Chemistry and are intended to enhance and expand the selection of offerings from semester to semester.
SCI1410 - Materials Science and Solid State Chemistry (with laboratory) [132]

Credits: 4 SCI

Hours: 3-3-6

For information contact: Stolk, Jonathan; Chachra, Debbie

Course Description

This laboratory-based course introduces students to the relationships among structure, processing, properties, and performance of solid state materials including metals, ceramics, polymers, composites, and semiconductors. Topics include atomic structure and bonding, crystallography, diffusion, defects, equilibrium, solubility, phase transformations, and electrical, magnetic, thermal, optical and mechanical properties. Students apply materials science principles in laboratory projects that emphasize experimental design and data analysis, examination of material composition and structure, measurement and modification of material properties, and connection of material behavior to performance in engineering applications. The course is offered in four “flavors.” Each flavor has a different emphasis in some of the course projects, but all course flavors provide for significant student choice in project topics and experimental processes.

A. Historical Context (co-taught with AHSE 2110)

B. Environmental and Societal Impact of Materials

C. Biomaterials, Polymers and Mechanical Properties

D. Electrical and Magnetic Properties

Course flavors will be differentiated by the appropriate letter as a prefix to the section. The course number will be SCI 1410 for all versions.

SCI1410A - Materials Science and Solid State Chemistry with lab [133]

Credits: 4 SCI

Required Requisites

Concurrent Requisite(s): AHSE2110

Course Description

SCI2099 - Special Topics in Science [134]

Credits: Variable Credits SCI

Required Requisites

Concurrent Requisite(s): MTH2199

Course Description
SCI2130 - Quantum Physics [135]

Credits: 4 SCI

Hours: 4-0-8

For information contact: Holt, Stephen

Course Description
This course is an introduction to quantum physics. Although quantum physics is the most successful description of natural phenomena that has ever been devised, quantum "reality" is so intuitively frustrating that Nobel laureate Richard Feynman once famously said: ?Nobody understands quantum mechanics!? The course material includes the origin and development of quantum mechanics and quantum statistics, with the goal of explaining the structure and characteristics of nuclei, atoms, molecules, fluids and solids (including semiconductors).

SCI2140 - Relativity [136]

Credits: 2 SCI

Hours: 2-0-4

For information contact: Holt, Stephen

Course Description
When it was first introduced, Einstein's Special Theory of Relativity rocked the foundations of classical physics with a plethora of "paradoxes" that included twins who could have different biological ages. Like swimming, Special Relativity can be completely understood without formal physics prerequisites, and this course will be taught from first principles that do not require any specialized physics knowledge. This approach will naturally lead to an introduction of General Relativity, including some characteristics of Black Holes.
**SCI2145 - High Energy Astrophysics** [137]

**Credits:** 2 SCI

**Recommended Requisites**
Physics Foundation or permission of instructor

**For information contact:** Holt, Stephen

**Course Description**
The universe is full of hot stuff! The oldest radiation that we can measure directly corresponds to temperatures of only thousands of degrees, but there is indirect evidence for the early universe requiring temperatures of trillions of degrees. As the universe expands and cools there are still occasional (but quite frequent) episodes involving temperatures of millions or even billions of degrees that are manifested in phenomena like supernovae and black holes. These high energy episodes are not just curiosities - supernovae are responsible for virtually all the chemical elements on Earth more massive than the very lightest, and giant black holes are present at the cores of virtually all galaxies. This course will examine how the theoretical and empirical study of X-rays and gamma-rays can probe the high energy universe.

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**SCI2199 - Special Topics in Physics** [138]

**Credits:** Variable Credits SCI

**Course Description**
Special Topics in Physics classes (SCI X199) typically cover a specific topic in Physics and are intended to enhance and expand the selection of offerings from semester to semester.

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**SCI2210 - Immunology** [139]

**Credits:** 4 SCI

**Hours:** 4-0-8

**For information contact:** Pratt, Joanne

**Course Description**
Immunology is a relatively new science, and our understanding of our immune system is evolving at a rapid pace. When the immune system functions properly, infectious pathogens and potential cancer cells are destroyed. When our immune system malfunctions, normally harmless microorganisms can cause serious infections, autoimmune diseases or allergies can develop and cancer cells can evade immune surveillance and grow unchecked. In this lecture and discussion-based class, we will investigate the molecular and cellular mechanisms that control our immune responses. Current research in immunology will be emphasized through analysis of primary literature and media articles.
SCI2214 - Microbial Diversity [140]

**Credits:** 4 SCI

**Hours:** 3-3-6

**Required Requisites**

**Prerequisite(s):** SCI1210

**For information contact:** Huang, Jean

**Course Description**

This course is an introduction to the tremendous diversity of the microbial world and its applications. Topics include: bacterial growth, energy metabolism, nutrient cycling, symbiosis, bioremediation, biofilm formation, and techniques for culturing and working with bacteria. This course approaches the study of environmental bacteria and their metabolic, physiological and genetic diversity through primary literature and laboratory work. Students will learn biochemical, molecular and bioinformatics techniques for working with microbial systems. Students will explore the microbial world first through guided laboratory exercises followed by development of individual and group special laboratory projects. Students will develop working knowledge of microbiology that may be applied to a range of situations, from study of systems were microbes are a problem to development of biological solutions using microbes.

SCI2220 - Biomechanics [141]

**Credits:** 4 SCI

**Hours:** 4-0-8

**Recommended Requisites**

MTH2220, SCI1130, SCI1210 Or permission of instructor

**For information contact:** Zastavker, Yevgeniya

**Course Description**

Why is a giraffe's head so small in comparison to the rest of its body? Why do babies' heads flatten when they sleep in the same position? Why do knees bend only in one direction? Why are people taller in the morning? In this course, we will study the nature and function of human body and its movement with specific emphasis on movements produced in sport, dance, and every day physical activities. The principles of Newtonian mechanics, statics, and dynamics will be applied to discuss behavior of bones, tendons, ligaments, and muscles during human movement.

This course is cross-listed as ENGR 2620.
**SCI2299 - Special Topics in Biological Sciences**  [142]

**Credits:** Variable Credits SCI

**Course Description**
Special Topics in Biology classes (SCI X299) typically cover a specific topic in Biology and are intended to enhance and expand the selection of offerings from semester to semester.

**Additional Information**
FA14: Emerging Technologies in Cancer Research and Treatment; 4 credits (Pratt)

More than thirty years have passed since the declaration of a “War on Cancer”, yet nearly 600,000 Americans are predicted to die from cancer this year. This course will examine the environmental and biological causes of cancer and recent advancements in cancer treatments. We will also explore the “hype vs hope” of cancer breakthroughs reported in the news. This class will include a laboratory component that will provide hands on experience with current cancer research techniques.

**SCI2320 - Organic Chemistry (with laboratory)**  [143]

**Credits:** 4 SCI

**Hours:** 4-3-5

**Course Description**
An introduction to the fundamentals of organic chemistry with an emphasis on applications in biology, biotechnology, synthetic polymers, and the environment. Topics include structure and bonding in organic compounds; chemical and physical properties of organic molecules and bulk organic materials; reaction mechanisms and kinetics; structure-reactivity relationships; chemical and physical transformations; synthesis of organic molecules; and characterization techniques. It is strongly suggested that students who intend to take SCI 2320 first take Introduction to Chemistry, or an equivalent college level course.

**SCI2320 L - Organic Chemistry LAB**  [144]

**Credits:** 0 SCI

**Course Description**
**SCI2399 - Special Topics in Chemistry**  [145]

**Credits:** Variable Credits SCI

**Course Description**

Special Topics in Chemistry classes (SCI X399) typically cover a specific topic in Chemistry and are intended to enhance and expand the selection of offerings from semester to semester.

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**SCI3120 - Solid State Physics**  [146]

**Credits:** 4 SCI

**Hours:** 4-0-8

**Recommended Requisites**

SCI2130

**For information contact:** Christianson, Rebecca

**Course Description**

Why do metals conduct heat well while insulators do not? Why is silicon a better semiconductor than diamond, even though they have the same structure? Why is lead a good superconductor at low temperature, while copper is not? We will explore the current understanding of insulators, metals, semiconductors and superconductors through some of the basic tools of solid state physics, and will learn how to apply these tools to the novel materials being developed today.

This course is cross-listed as ENGR 3812.
SCI3130 - Advanced Classical Mechanics [147]

Credits: 4 SCI

Hours: 4-0-8

Recommended Requisites

SCI1130, MTH2210, MTH2220, or permission of instructor

For information contact: Zastavker, Yevgeniya

Course Description

Classical mechanics revisited with the use of mathematical formulation that makes the "old and dusty" Newton's laws shine in all their beauty. Using differential equations and linear algebra tools, we will venture to look at things only hinted at in introductory physics: variational principles, the two-body problem, motion in accelerated frames, rigid body dynamics, oscillations, Lagrangian and Hamiltonian mechanics, continuum mechanics, nonlinear dynamics, and chaos.

SCI3199 - Special Topics in Physics [148]

Credits: Variable Credits SCI

Course Description

Special Topics in Physics classes (SCI X199) typically cover a specific topic in Physics and are intended to enhance and expand the selection of offerings from semester to semester.
SCI3210 - Human Molecular Genetics in the Age of Genomics  [149]

Credits: 4 SCI

Hours: 4-0-8

Required Requisites
Prerequisite(s): SCI1210

Recommended Requisites
SCI1210 (Olin); BISC219 (Wellesley); or permission of instructor

For information contact: Donis-Keller, Helen

Course Description
It is now understood that many, if not the majority, of human disorders, including cancers, have an underlying genetic component. In this modern age of healthcare, we are expected to choose amongst an array of therapeutic options for ourselves and for our children rather than respond to specific directives from the medical establishment. In addition, we are called upon as voting citizens to make ethical decisions, e.g. the appropriateness of stem cell cloning. Therefore, it is in the interest of each person to learn more than the fundamentals of biology and genetics in order to make educated choices. In this course we will be concerned with the traditional concepts of human genetics including pedigree analysis, linkage mapping, Mendelian, multi-locus and complex traits, and genetic testing. However, for the most part, the course will view human genetics through a molecular lens. For example, the molecular basis of pathological conditions such as Huntington's disease, hypercholesterolemia, Fragile-X and others will be examined in detail, as will gene imprinting and imprinting-related abnormalities (e.g. Angelman and Prader-Willi syndromes). Comparative genomics will be applied to the study of heritable traits in humans. The structure, function, and evolution of the sex chromosomes will also receive special attention. Gene therapy, cloning (stem cell, germ line) and the associated ethical issues will be considered in some depth. Students who are interested in bioengineering or medical school should find this course useful as well as those who have a general interest in the human as an organism.
SCI3220 - Bacteriophage Genomics Research Project Laboratory  [150]

Credits: 4 SCI

Hours: 2-2-4

Required Requisites
Prerequisite(s): SCI1210

For information contact: Donis-Keller, Helen

Course Description
The process of discovery in biology must be experienced, not simply read about in a textbook, in order for one to fully appreciate what it takes to do science and how it feels to discover something not previously known. Bacteriophages (viruses of bacteria) are particularly interesting and relevant subjects for study because they constitute the majority of all biological entities. An estimated 10^{31} tailed phages inhabit the planet earth! Knowledge of phages and their host bacteria is important from a public health perspective and phages present an opportunity for study of bioengineering organisms. This hands-on course provides a guided primary research experience in the isolation, purification, characterization, and sequence annotation of bacteriophages of M. smegmatis.

Purified viruses, named by their discoverers, will be investigated by a variety of means including Transmission Electron Microscopy (TEM) and DNA sequencing of their entire genomes. Students in this course will gain experience with the fields of genomics and bioinformatics from the analysis of new phage genomes. Putative new genes will be identified and compared with those from similar organisms in order to better understand the extent of diversity and evolution of mycobacteriophages.

Weekly journal club discussions including visits by seminar speakers enhance understanding of phage biology and genomics.
SCI3250 - Biological Thermodynamics [151]

Credits: 4 SCI

Hours: 4-0-8

Recommended Requisites

MTH 1111, SCI 1130, SCI 1210 or Permission of Instructor

For information contact: Sarang-Sieminski, Alisha; Zastavker, Yevgeniya

Course Description

The beauty and depth of this subject cannot be described better than with the words of one of the greatest physicists of the 20th century, Arnold Sommerfeld, "Thermodynamics is a funny subject. The first time you go through it, you don't understand it at all. The second time you go through it, you think you understand it, except for one or two points. The third time you go through it, you know you don't understand it, but by that time you are so used to the subject, it doesn't bother you anymore". In this course we will venture into the depths of thermodynamics and statistical mechanics, while concentrating on applications of the abstract concepts to biological, biochemical, and biophysical phenomena and drawing from contemporary bioengineering problems. This course provides an introduction to the study of energy transformations in biological systems as well as thermodynamics and kinetics of structure formation and association of biomolecules. Topics covered include energy and its transformation, the First and Second Law of Thermodynamics, Gibbs Free Energy, statistical thermodynamics, binding equilibria and reaction kinetics, and a survey of other interesting areas of biological thermodynamics, particularly the origin of life on Earth. Topics have relevance to numerous pertinent biological/bioengineering applications including diseases based on phase transitions (e.g., cataract of the eye, Alzheimer's disease, etc.), oxygenation of hemoglobin; protein folding, aggregation, and binding; assembly of everything from the phospholipids bilayer to biomaterials; the macroscopic mechanical properties of biomaterials and even cells; creation and operation of devices at the nano- and micro-scales; understanding the basis of mass transport; osmotic pressure relevant to cells and microvascular filtration; receptor-ligand binding; the melting and annealing of DNA. The concepts employed in this course have relevance to students interested in many disciplines, including Bioengineering, Materials Science, Biology and Chemistry.

This course is cross-listed as ENGR 3650.
SCI3320 - Organic Chemistry II (with laboratory)  [152]

Credits: 4 SCI

Hours: 4-4-4

Required Requisites
Prerequisite(s): SCI2320

Course Description
After undertaking the introductory course in organic chemistry, students will be able to learn more advanced topics and master the reactions of the more biologically-relevant functional groups.

Some of the topics this will include are sugars and carbohydrates, the chemistry of enolates and carbonyls, advanced NMR techniques, and pericyclic reactions. At the end of the course, there will be an introduction to biochemistry from an organic perspective. This course will culminate in a large organic laboratory synthesis that the students will develop and plan themselves for half of the semester.

Sustainability

SUST2201 - Introduction to Sustainability  [153]

Credits: 4 SUST

Hours: 4-0-8

Recommended Requisites
sophomore and/or junior standing; first years by permission only

For information contact: Linder, Benjamin

Course Description
This case-based course introduces students to the basic concepts and tools that business, engineering, and the liberal arts (science, social science, and the humanities) bring to a consideration of sustainability. It is team-taught by three faculty members, one from each institution, with coursework fully integrated across the three approaches. The course will draw empirical material from, and apply concepts and tools to, the sustainability of a city block.

Additional Information
This course, if successfully completed, in addition with SUST3301: Sustainability Synthesis, four total credits may be used toward the 28 AHS/Entrp minimum distribution credit requirement.
SUST3301 - Sustainability Synthesis  [154]

Credits: 4 SUST

Hours: 4-0-8

For information contact: Linder, Benjamin

Course Description

This project-based course provides students with a chance to apply and integrate the concepts and the tools of business, engineering, and the liberal arts (science, social science, and the humanities) to address sustainability. It is team-taught by three faculty members, one from each institution, with coursework fully integrated across the three approaches. Students will work in multi-campus groups on a project with a client throughout the semester, along with common readings and discussions about processes and project stages taking place in class time.

Additional Information

This course, if successfully completed, in addition with SUST3301: Sustainability Synthesis, four total credits may be used toward the 28 AHS/Entrp minimum distribution credit requirement.
Links:
[8] https://www.olin.edu/course-listing/ahse1150-what-i
[17] https://www.olin.edu/course-listing/ahse2130-intersection-art-and-science
[20] https://www.olin.edu/course-listing/ahse2141-engineering-humanity
[22] https://www.olin.edu/course-listing/ahse2199-special-topics-arts-humanities-and-social-science
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[54] https://www.olin.edu/course-listing/engr2699-special-topics-bioengineering
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[56] https://www.olin.edu/course-listing/engr3199-special-topics-engineering
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