

General Engineering (GE)

GE 1000. Introduction to the Study of Engineering. 1 Hour.

Presents an introduction to the various disciplines of engineering and strategies for success in the classroom, within the profession, and within the University community. Provides an initial orientation to engineering cooperative education. Covers the support services provided by both college and University and explores the richness of our community's diversity. Defines diversity, and offers students the opportunity to study and understand diverse cultures and communities in the academic environment. Oral presentations are required.

GE 1110. Engineering Design. 4 Hours.

Seeks to develop problem-solving skills used in engineering design, using case studies for a variety of engineering disciplines. Introduces students to the use of spreadsheet tools to solve engineering problems, including data reduction and visualization of data and functions. Design topics include problem formulation and specification, creativity, evaluation tools, patents, ergonomics, system design, manufacturing, ethics in engineering, and presentation techniques. Presents engineering graphics focusing on developing 3D visualization skills and computer-aided design (CAD) application. Students develop an original design solution to a technical problem as a term project. Requires students to have a laptop computer that meets the specifications of the College of Engineering.

GE 1111. Engineering Problem Solving and Computation. 4 Hours.

Uses a structured approach to solve engineering problems. Draws applications from a variety of engineering disciplines, which serve as a tool for introducing students to engineering analysis and design. Introduces a math application package for matrix applications and various real-life engineering problems. Includes the design of problem-solving algorithms using a high-level programming language. Requires students to have a laptop computer that meets the specifications of the College of Engineering.

GE 1201. Alternative Energy Technologies Abroad. 4 Hours.

Offers an interdisciplinary course that seeks to build an understanding of alternative energy systems and technologies and how they can impact the environment. Emphasizes how energy resources are being utilized currently in the United States and abroad and shows the need for new alternative energy technologies and their impact on sustainability. Introduces a variety of alternative/renewable energy technologies and their environmental impact. Lecturers include industry leaders in the field. Offers students an opportunity to visit companies to learn how these engineering technologies are being implemented. Aims to explain relevant alternative energy technologies in an interactive environment, where students engage in the field and examine their impact on society. May be repeated without limit.

GE 1210. Scientific Revolutions Abroad. 4 Hours.

Studies two revolutions in scientific thought—the Scientific Revolution of the seventeenth and eighteenth centuries and the computational revolution of the twentieth century. The Scientific Revolution gave scientists optimism that, in principle, they could understand everything about the world around them. In contrast, the revolutions in complexity, logic, computation, mathematics, and physics of the twentieth century put fundamental limits on what scientists could know and understand. Taught in Italy, this course explores the natural connections between the history of science taking place during the Italian Renaissance and scientific sites, including local museums, observatories, universities, laboratories, and archaeological sites. This material is contrasted with key results from chaos theory, computational complexity, logic, physics, quantum mechanics, and the theory of computation, all developed in the twentieth century.

GE 1501. Cornerstone of Engineering 1. 4 Hours.

Introduces students to the engineering design process and algorithmic thinking using a combination of lectures and hands-on projects and labs while encouraging critical thinking. Offers students an opportunity to develop creative problem-solving skills used in engineering design, to structure software, and to cultivate effective written and oral communication skills. Topics include the use of design and graphics communication software, spreadsheets, a high-level programming language, programmable microcontrollers as well as various electronic components, and 3-D printing. Requires students to develop an original design solution to a technical problem as a final term project. Requires students to have a laptop computer that meets the specifications of the College of Engineering.

GE 1502. Cornerstone of Engineering 2. 4 Hours.

Continues GE 1501 using a project-based approach under a unifying theme. Covers topics that introduce students to engineering analysis and design. Uses a math application package for matrix applications along with various real-life engineering problems solved using programming. Considers ethical reasoning in design and analysis, including ethical theories, professional codes, and emerging micro/macro issues in engineering. Introduces quantitative tools and ethical topics separately and weaves them into all design and problem-solving stages of the student projects. Covers 3-D assembly drawings and modeling, along with review and further work in design. Students work on open-ended design problems, developing working models and prototypes to demonstrate and present their designs. Requires students to have a laptop computer that meets the specifications of the College of Engineering.

GE 1990. Elective. 1-4 Hours.

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

GE 1999. Principles of Board Game Development. 4 Hours.

Introduces game design from engineering and innovation perspectives using initial design, rapid prototyping, and iterative design. Covers theory and implementation techniques to enable technical evaluation and game review, including statistical probability of random events; relative balance of player skill to game chance; game mechanics; and incorporating game art, theme, and flavor. Offers students an opportunity to learn game mechanics, development methods, and play-testing techniques. Introduces methods to match a game to its intended audience and designing games to be fun. Surveys roles in the tabletop game industry that impact game design: designers, publishers, manufacturers, distributors, game stores, conventions, and online sales. Students use acquired knowledge in a project-based learning environment to create a game that could be considered for commercialization. GE 1999 and GAME 1999 are cross-listed. .

GE 2010. Introduction to Customer-Driven Technical Innovation: Silicon Valley. 4 Hours.

Studies the role of engineering innovation in addressing customer needs in early startups and the need to conceive successful innovative engineering design as part of a commercialization strategy. Emphasizes understanding how engineering innovation can meet real technical market needs and how to gather the necessary, relevant technical information early in the innovation process to produce a successful engineering design. Uses a series of practical engineering design projects to demonstrate how students can assess the technical capabilities of the startup in producing an innovative design, how to communicate with customers in an iterative engineering design process, and how to correspondingly design and innovate to meet customer technical requirements. Taught in Silicon Valley.

GE 2030. Introduction to Product Prototyping: Silicon Valley. 4 Hours.

Seeks to develop in-depth knowledge and experience in prototyping by focusing on engineering processes and instrumentation that are used in different industries. Studies the prototyping cycle from initial process flow and sketching, to prototype development, to testing and analysis, with an emphasis on iteration. Analyzes how different kinds of engineering prototypes can address design and user-interface needs vs. functional needs, such as looks-like and works-like prototypes. Offers students an opportunity to obtain operating knowledge of methods including 3-D printing, SolidWorks, off-the-shelf hardware-software interfaces, simulation, embedded systems, product testing, prototype analysis, and prototype iteration. Taught in Silicon Valley.

GE 2300. Engineering Structure and Function: Principles of Design in Nature. 4 Hours.

Explores principles of design that are found in nature. Studies evolutionary constraints in design, materials used in nature, structural designs that include hierarchy and multiscale components, methods of motion and how they evolved in nature, biological sensing structures, and ability to adapt. These natural design concepts are related to designs used in buildings, products, and machines. Offered in Oxford, England, a center for learning and evolutionary principles (from Darwin to Dawkins). Site visits include botanic gardens, the Natural History Museum, the Darwin collection, and Royal Veterinary College. A background in biology or engineering is not required; the course is intended for an interdisciplinary group of students (engineering, biology, architecture, product design, health sciences, innovation and entrepreneurship, anthropology) who are interested in exploring natural design.

GE 2361. Mathematical Methods for Engineers. 4 Hours.

Covers applications to applied mechanics, thermofluids, and dynamics/control problems relevant to engineering. Topics include differential equations applied to modeling and characterization of processes, linear algebra used for multidimensional and complex system computations and modeling, and statistics and probability used for controls and signal analysis, among other applications. Introduces the foundational basis for approximate methods of engineering analysis, including its application to finite element analysis.

GE 2990. Elective. 1-4 Hours.

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

GE 3000. Professional Issues in Engineering. 1 Hour.

Provides students with an opportunity to reflect on both academic and co-op experiences in the context of planning for the senior year and beyond. Issues include professional and ethical issues, resolving ethical conflicts, awareness of engineers as professionals in a diverse world, strengthening decision-making skills, career portfolios, and lifelong learning needs, goals, and strategies. Students reflect upon issues of diversity from their experience in the University and in their cooperative education placements. Explores the role of different work and learning styles and diverse personal characteristics on the workplace and the classroom. Professional issues include impact of the cultural context, both in the United States and around the world, on the client, government relations, and the workplace.

GE 3300. Energy Systems: Science, Technology, and Sustainability. 4 Hours.

Offers students an opportunity to obtain a sound scientific, technological, and economic understanding of our modern energy system and the challenge of energy sustainability. Covers principles of energy, work, and thermodynamics; technologies from supply and demand side, including extraction of primary energy, conversion into fuels and electricity, important energy end-uses, and energy losses; fossil, nuclear power plants, and renewable energy technologies (wind, solar, wave, hydro, geothermal, biofuels); transmission and distribution for electricity and fossil fuels; energy demand by buildings, transportation, and industry, emphasizing efficient technologies; sustainability concepts, including net energy/exergy analysis and life-cycle assessment, energy-related emissions, decentralized generation, smart grids, district heating, and net-zero energy facilities.

GE 3990. Elective. 1-4 Hours.

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

GE 4608. Nanotechnology in Engineering. 4 Hours.

Explores a wide range of new technologies based on, or influenced by, breakthroughs in nanoscience. Includes such nanotechnologies (the refinement of functional properties of materials, devices, or systems that are in at least one dimension smaller than 100 nm) as spintronics, quantum computing, carbon nanotube electronics, nanoparticle cancer remediation strategies, biomolecular electronics, and nanomachines. A general goal is the engineering of new or enhanced macroscopic properties from nanostructure or nanoscale materials and components. Offers students an opportunity to become well versed in this important burgeoning field through review of the scientific literature, classroom lecture, seminars by international leaders of nanotechnology, and student team projects.

GE 4892. Engineering Product Design and Prototyping Challenge Project. 4 Hours.

Offers students an opportunity to prepare detailed engineering designs and physical prototypes of technology-based products based on real-world specifications. Projects are carried out under the umbrella of the Generate organization within the Sherman Center for Engineering Entrepreneurship Education. Project proposals are developed in collaboration with the center director, including learning outcomes, project goals, and anticipated results/products. May be repeated up to nine times.

GE 4900. Career Management. 1 Hour.

Provides an interactive course designed to enhance an engineering student's professional and career-related education through a series of classes taught by managers, engineers, and other professionals with industry experience. Topics include career services resources, developing skills to be an effective manager, the balance between personal and professional life, mentors, making career choices, time management vs. energy management, and others. May be repeated without limit.

GE 4990. Elective. 1-4 Hours.

Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

GE 4993. Independent Study. 1-4 Hours.

Focuses on a subject that crosses traditional engineering boundaries. May be repeated without limit.

GE 5000. Special Topics in Engineering. 4 Hours.

Offers a course in which content is determined by the instructor. May be repeated up to three times.

GE 5010. Customer-Driven Technical Innovation for Engineers. 4 Hours.

Studies the role of engineering innovation in addressing customer needs in early start-ups and the need to conceive successful innovative engineering design as part of a commercialization strategy. Emphasizes understanding how engineering innovation can meet real technical market needs and how to gather the necessary, relevant technical information early in the innovation process to produce a successful engineering design. Uses a series of practical engineering design projects to demonstrate how students can assess the technical capabilities of the start-up in producing an innovative design, how to communicate with customers in an iterative engineering design process, and how to correspondingly design and innovate to meet customer technical requirements.

GE 5020. Engineering Product Design Methodology. 4 Hours.

Studies the iterative engineering design cycle of technology-intensive devices and tools with a focus on end-user technical specifications. Expects students to develop an engineering device or tool in a team-based workshop environment. Functional product concepts are generated by assessing technical needs of the intended user and refining the designs through testing with the end user. Focuses on methods of soliciting and documenting user technical feedback, relating that feedback to technical product requirements and specifications, and considering engineering manufacturing aspects. This course does not cover concepts in lean or rapid prototyping or methodologies relevant to services.

GE 5030. Iterative Product Prototyping for Engineers. 4 Hours.

Seeks to develop in-depth knowledge and experience in prototyping by focusing on engineering processes and instrumentation that are used in different industries. Studies the prototyping cycle, from initial process flow and sketching to prototype development to testing and analysis, with an emphasis on iteration. Analyzes how different kinds of engineering prototypes can address design and user-interface needs vs. functional needs, such as looks-like and works-like prototypes. Offers students an opportunity to obtain operating knowledge of methods including 3D printing, SolidWorks, off-the-shelf hardware-software interfaces, simulation, embedded systems, product testing, prototype analysis, and prototype iteration.

GE 5100. Product Development for Engineers. 4 Hours.

Focuses on the main processes needed to develop a complex, high-technology product. Emphasizes the most important techniques and approaches used in a startup environment. Seeks to benefit students of all engineering disciplines including computer science and biomedical, industrial, electrical, mechanical, computer, and chemical engineering. Includes a running practical project in which a new product is designed and executed through a series of small projects for each phase of the product development process. Topics include the product life cycle, new product development processes, project planning and management, new product idea generation, the systems approach to product development, design for manufacturing, market testing and launch, and escalation to manufacturing.