

ENES - ENGINEERING SCIENCE

ENES100 Introduction to Engineering Design (3 Credits)

Students work as teams to design and build a product using computer software for word-processing, spreadsheet, CAD, and communication skills.

Corequisite: MATH140.

ENES102 Mechanics I (3 Credits)

The equilibrium of stationary bodies under the influence of various kinds of forces. Forces, moments, couples, equilibrium, trusses, frames and machines, centroids, moment of inertia, beams, friction, stress/strain, material properties. Vector and scalar methods are used to solve problems.

Corequisite: MATH140.

Restriction: Must be in a major in ENGR-A. James Clark School of Engineering.

Formerly: ENES110.

ENES104 Introduction to Materials and their Applications (3 Credits)

Creating a new technology, nanotechnology, biotechnology, or plastic electronics requires developing the materials first. In this class we'll explore materials science and engineering where engineers change the properties and/or behavior of a material to make them more useful. The course covers the chemical composition, phase transformations, corrosion and mechanical properties of materials as well as their electrical, thermal, magnetic and optical properties. Learn about the unlimited possibilities for innovation and adaption through the exciting field of nanotechnology.

Restriction: Must be in the Young Scholars Program.

ENES106 Achieving Success in Mathematics (3 Credits)

An exploration of the skills and habits needed to successfully complete introductory mathematics courses.

Restriction: Permission of ENGR-A. James Clark School of Engineering.

ENES107 Achieving College Excellence (1-3 Credits)

An exploration of the skills and habits needed to successfully complete the introductory chemistry course for engineering students. Course will also include strategies for a successful first year experience.

Restriction: Permission of ENGR-A. James Clark School of Engineering.

ENES108 Achieving College Success: First Year Transition (1 Credit)

An exploration of the skills and habits needed to successfully complete the first year of study for Science, Technology, Engineering, and Mathematics (STEM) majors. This course is an extension of the college success seminars taught during the Summer Bridge Program.

Restriction: Permission of ENGR-A. James Clark School of Engineering.

Repeatable to: 2 credits if content differs.

ENES113 Virtus Living and Learning Community Seminar I (1 Credit)

The seminar focuses on personal and professional development related to the field of engineering with a strong emphasis on clarifying career goals and decisions. Additional topics include an introduction to basic tools, undergraduate research opportunities, and campus and engineering resources.

Restriction: Must be in first year Virtus program.

ENES114 Virtus Seminar II (1 Credit)

Focus on personal and professional development with engineering with a strong emphasis on career development. Learn to employ strategies and skills for academic and professional success.

Prerequisite: ENES113.

Restriction: Students must be participants in the Virtus Living and Learning Community.

ENES115 FLEXUS Living and Learning Community Seminar I (1 Credit)

The seminar focuses on personal and professional development related to the field of engineering with a strong emphasis on clarifying career goals and decisions. Additional topics include an introduction to campus and engineering resources, basic tools, and undergraduate research opportunities. Students will discuss issues of concern through a variety of book readings, self-reflections, and panel discussions with practicing women engineers.

Restriction: Must be a first year FLEXUS Participant.

ENES116 FLEXUS Living and Learning Community Seminar II (1 Credit)

The seminar focuses on personal and professional development by enhancing technical ability, understanding educational options through minors and student projects in engineering, identifying and employing strategies and skills for academic and professional success, and developing career commitment through networking and mentoring. Students develop professional portfolios in preparation for a future internship or job.

Prerequisite: ENES115.

ENES140 Discovering New Ventures (3 Credits)

Students explore dynamic company startup topics by working in teams to design a new venture. This multi-disciplinary course helps students to learn the basic business, strategy, and leadership skills needed to launch new ventures. Topics include learning how to assess the feasibility of a startup venture, as well as how to apply best practices for planning, launching, and managing new companies. Students discuss a wide range of issues of importance and concern to entrepreneurs and learn to recognize opportunities, assess the skills and talents of successful entrepreneurs, and learn models that help them navigate uncertainty.

Additional Information: This course may count as an elective for a student at the University of Maryland, depending on the student's specific degree program. It cannot be counted towards the requirements for the Smith School of Business Entrepreneurship Fellow Program.

ENES150 Transfer LEAD Seminar I (2 Credits)

This seminar focuses on personal and professional development for transfer students in the A. James Clark School of Engineering. Transfer LEAD is a program for Engineering transfer students with four main outcomes: Learn, Educate, Adapt, Direct. Topics covered in this course include campus resources, student identity development, leadership development, and student outreach. Students will learn educational theory in order to develop a sense of leadership as students in the Clark School of Engineering.

Restriction: Eligible external transfer students in the A. James Clark School of Engineering; and permission of instructor.

ENES181 Engineering & The Grand Challenges (1 Credit)

Introduction to the various fields of engineering and the necessary context for students to fully engage in selected National Academy of Engineering's Grand Challenges such as economical solar energy, carbon sequestration, access to clean water, engineering better medicines, restoring urban infrastructure and personalized learning. The lectures and activities will provide an introduction to the engineering disciplines, NAE Grand Challenges, STEM cultures, and research.

Restriction: Must be in a major in ENGR-A. James Clark School of Engineering; and must be a new freshman or transfer student.

ENES190 Introduction to Design and Quality (4 Credits)

QUEST students learn and apply design practices to design new products and services. Working in multidisciplinary teams, students use quality and process improvement methods to identify, analyze, and recommend solutions to real-world problems.

Prerequisite: Must be in the Quest program. Cross-listed with BMGT190.

Credit Only Granted for: BMGT190 or ENES190.

ENES192 Engineering For Us All (3 Credits)

Students are challenged to uncover hidden valuable connections among a variety of disciplines, while creatively seeking and solving problems as a team. Students learn and practice skills for how groups function and identify innovation while addressing the tensions between our inherent drives to seek and solve, to share, and to sell.

Prerequisite: MATH107.

Additional Information: Recommended for non-engineering majors.

ENES206 Introducing Safety into the Design Process (3 Credits)

The development of any object or infrastructure (from a chair to a bridge) requires a design process. The design process takes all the variables of functionality, aesthetics, cost, etc. and determines an optimized solution. Some of the variables are quantitative but some are subjective. Depending on the object or infrastructure, some variables will take more importance than others will. The design of an ornament or jewelry will require an emphasis on aesthetics. The design of a vehicle or a bridge will emphasize its functionality or strength. Independent of the optimization process followed the use of all objects or infrastructure has to be safe. Safety is a social responsibility that needs to be guaranteed. This course will address how safety is introduced into the design process, how technology advancements and complexity challenge safety and how the social responsibility of safety is embedded in regulatory frameworks and in professional practice.

Restriction: Sophomore standing or lower.

ENES210 Entrepreneurial Opportunity Analysis and Decision-Making in 21st Century Technology Ventures (3 Credits)

This multi-disciplinary course helps students learn the principles of entrepreneurial opportunity analysis and decision-making in an increasingly dynamic and technically-inclined society. Emphasis is placed on how aspiring technology entrepreneurs can develop their entrepreneurial perspectives to develop winning entrepreneurial plans for their future ventures.

Credit Only Granted for: ENES210 or ENES461.

ENES211 Introduction to Global Entrepreneurship (1 Credit)

Examines the opportunities and challenges of entrepreneurship and innovation from an international perspective through lectures, case studies, instructors, and guest speakers with international experiences and other relevant activities. Focuses on the benefit for every entrepreneur and innovator to understand the cultural, strategic and operational aspects related to conducting entrepreneurial ventures in an international context.

ENES213 Virtus Living and Learning Community Seminar III (1 Credit)

The seminar focuses on personal, academic and professional success by cultivating leadership skills, developing academic and technical ability and encouraging self awareness, identifying and employing strategies for academic and professional success, further enhancing career development through networking and mentoring and developing awareness of diversity issues.

Prerequisite: ENES113.

Restriction: Must be a participant in the second year of the Virtus program.

ENES214 Virtus Seminar IV (1 Credit)

Students continue to develop their leadership and mentoring skills, participate in networking opportunities and explore their interest in special engineering topics.

Prerequisite: Students must have completed ENES213.

Restriction: Students must be participants in the Virtus Living and Learning Community.

ENES215 FLEXUS Living and Learning Community Seminar III (1 Credit)

The seminar focuses on personal, academic and professional success by cultivating leadership skills, developing self-confidence and self-efficacy in academic and technical ability and encouraging self awareness, identifying and employing strategies for academic and professional success, further enhancing career development through networking, mentoring and role modeling, and developing awareness of diversity issues, specifically gender diversity.

Prerequisite: ENES115 and ENES116.

Restriction: Must be a second year FLEXUS participant.

ENES216 FLEXUS Living and Learning Community Seminar IV (1 Credit)

The seminar focuses on gender diversity and its cross-sections with culture. Students continue to enhance their leadership and mentoring skills, participate in networking opportunities with women in leadership roles and careers in engineering, and engage in opportunities for outreach and service-learning. Students will also complete a culminating semester project.

Prerequisite: ENES115, ENES116, and ENES215.

Restriction: Restricted to second year FLEXUS participants.

ENES220 Mechanics II (3 Credits)

Stress and deformation of solids-rods, beams, shafts, columns, tanks, and other structural, machine and vehicle members. Topics include stress transformation using Mohr's circle; shear and moment diagrams; derivation of elastic curves; and Euler's buckling formula. Design problems related to this material are given in lab.

Prerequisite: Minimum grade of C- in ENES102; and (MATH141 and PHYS161).

Restriction: Must be in a major in ENGR-A. James Clark School of Engineering; and must not be in Engineering: Electrical program.

ENES221 Dynamics (3 Credits)

Systems of heavy particles and rigid bodies at rest and in motion. Force-acceleration, work-energy and impulse-momentum relationships. Motion of one body relative to another in a plane and in space.

Prerequisite: Minimum grade of C- in ENES102; and (MATH141 and PHYS161).

Restriction: Must be in a major in ENGR-A. James Clark School of Engineering.

ENES232 Thermodynamics (3 Credits)

Introduction to thermodynamics. Thermodynamic properties of matter. First and second laws of thermodynamics, cycles, reactions, and mixtures.

Prerequisite: PHYS261 and PHYS260.

Restriction: Must be in a major in ENGR-A. James Clark School of Engineering.

Credit Only Granted for: BIOE232, CHBE301, ENCH300, ENES232, ENME320, or ENME232.

Formerly: ENME232 and ENME320.

ENES259 Study Abroad Special Topics in Engineering II (1-6 Credits)

Special topics course in engineering science taken as part of an approved study abroad program.

Repeatable to: 6 credits if content differs.

ENES269 Topics in Grand Challenges for Engineering in a Global Context (3 Credits)

Special topics course that explores the grand engineering challenges facing the world from a technical, cultural, political, and economic perspective, as well as solutions developed through innovation and technology. Topics can include energy, environment, urban infrastructure, health, safety and security, and engineering the tools of discovery.

Repeatable to: 6 credits if content differs.

Additional Information: Course includes a study abroad component. No engineering background is required.

ENES288 Engineering Leadership Seminar (1-4 Credits)

Engineering leadership will be examined at the individual, team and organizational levels.

Corequisite: ENES100; or permission of instructor.

ENES304 RISE Seminar (1 Credit)

This is the first semester of a two semester sequence taken by RISE students in their first semester in the program. The purpose of ENES 304 is for RISE students to learn about leadership, acquire leadership skills, and understand how to integrate leadership theories and concepts in engineering practice. There will be a mix of formal lectures by course faculty and lectures by distinguished speakers who can provide their own experience of what leadership means and how it is acquired. Students will explore their own leadership philosophy and leadership capacities in the context of group practice. Students will make meaning of general leadership theories and concepts and understand how to apply them to engineering industry. Students will also gain understanding of leadership through the stories shared by distinguished speakers with industrial, governmental and academic experience.

Restriction: Must be in the Engineering RISE Leadership Program; and permission of ENGR-A. James Clark School of Engineering.

ENES305 RISE Leadership Seminar (1 Credit)

This is the second semester of a two semester sequence taken by RISE students in their final semester in the program. The purpose of ENES 305 is for RISE students to learn about leadership, acquire leadership skills, and understand how to integrate leadership theories and concepts in engineering practice. There will be a mix of formal lectures by course faculty and lectures by distinguished speakers who can provide their own experience of what leadership means and how it is acquired. Students will explore their own leadership philosophy and leadership capacities in the context of group practice. Students will make meaning of general leadership theories and concepts and understand how to apply them to engineering industry. Students will also gain understanding of leadership through the stories shared by distinguished speakers with industrial, governmental and academic experience.

Prerequisite: Permission of ENGR-A. James Clark School of Engineering; and ENES304.

ENES316 Global Leadership in Engineering, Business, & Technology (3 Credits)

An introduction to global leadership research, theories, and practice with an emphasis on applied dimensions of global leadership in the engineering, business, and technology sectors. This course prepares students to further their knowledge and capacities for global leadership to be successful in industry.

Restriction: Must be in a major in ENGR-A. James Clark School of Engineering; or permission of instructor.

Additional Information: Students will be required to participate in off-campus industry visits outside of the formal class meeting time.

ENES317 Introduction to Engineering Leadership (3 Credits)

Focus is placed on general leadership theories in addition to real-world applications of leadership in engineering education, industry, and government.

Prerequisite: Permission of ENGR-A. James Clark School of Engineering.

ENES388 Engineering Honors Seminar (1 Credit)**ENES389 Selected Topics (3 Credits)**

Repeatable to: 6 credits if content differs.

ENES390 Designing Innovative Systems (3 Credits)

QUEST students develop an understanding of complex systems that incorporate elements of business and technical design and analyze how these systems evolve over time and may be shaped by technology disruptions, internal decisions, and external forces. Students apply these concepts to real-world complex systems in a team environment.

Prerequisite: ENES190 or BMGT190.

Restriction: Must be in the QUEST program. Cross-listed with BMGT390.

Credit Only Granted for: BMGT390 or ENES390.

ENES397 Mentoring Multidisciplinary Teams (3 Credits)

QUEST students practice essential skills for mentoring and coaching multidisciplinary teams. These include effective communications, facilitation, conflict resolution, and the ability to motivate. Students will practice these skills as mentors for student teams from BMGT/ENES 190H. In the process, they will strengthen their knowledge of design and quality techniques.

Restriction: Restricted to QUEST Program (TQMP) students. Also offered as: BMGT397.

Credit Only Granted for: BMGT397 or ENES397.

ENES424 Engineering Leadership Capstone (3 Credits)

The work initiated in the Introduction to Engineering Leadership course brings together further exploration of leadership styles and concepts.

Prerequisite: ENES472, ENCE320, and ENES317; and permission of ENGR-A. James Clark School of Engineering.

Recommended: ENES100.

ENES440 Science, Technology and Society: Certificate Program Capstone (3 Credits)

Capstone research seminar for students in the Science, Technology and Society certificate program.

Restriction: Must be in the Science, Technology and Society certificate program; or permission of ENGR-A. James Clark School of Engineering.

Credit Only Granted for: ENES440 or UNIV401.

Formerly: UNIV401.

ENES458 Topics in International Engineering (1-4 Credits)

A variety of topics related to engineering in a global context are discussed including cultural aspects, cross-cultural communication, international standards and law, and engineering and technology issues, business behavior, attitudes and values of selected countries and regions.

Prerequisite: ENES100.

Repeatable to: 12 credits if content differs.

ENES459 Study Abroad Special Topics in Engineering IV (1-6 Credits)

Special topics course in engineering science taken as part of an approved study abroad program.

Repeatable to: 15 credits if content differs.

ENES460 Fundamentals of Technology Start-Up Ventures (3 Credits)

Fundamental aspects of creating, organizing, funding, managing, and growing a technology startup venture. This multidisciplinary course will draw on management, business, legal, financial, as well as technical, concepts. Students form teams and develop a business plan for a technology company, based on each team's own business idea and then present the plan to a panel of outside experts.

Restriction: Permission of ENGR-Maryland Technology Enterprise Institute.

Credit Only Granted for: ENES460, BMGT461, SMLP470 or HLMN470.

Additional Information: Course may not be used to fulfill any BMGT major or minor program requirement.

ENES461 Advanced Entrepreneurial Opportunity Analysis in Technology Ventures (3 Credits)

Explores the factors that influence entrepreneurial opportunity analysis in technology-based ventures. Uses a cognitive theoretical framework to examine the integration of motivation, emotions and information processing modes to make complex entrepreneurial decisions in technology venture environments.

Credit Only Granted for: ENES210 or ENES461.

ENES462 Marketing High-Technology Products and Innovations (3 Credits)

Examines the opportunities and challenges of marketing high-technology products in turbulent environments requiring rapid decision making with incomplete information. Explores how innovations are introduced at frequent intervals, research-and-development spending is vital, and there are high mortality rates for both products and businesses.

Restriction: Permission of ENGR-Maryland Technology Enterprise Institute.

Additional Information: Course may not be used to fulfill any BMGT major or minor program requirement.

ENES463 Strategies for Managing Innovation (3 Credits)

Emphasizes how the technology entrepreneur can use strategic management of innovation and technology to enhance firm performance. Examines the process of technological change, the ways that firms come up with innovations, the strategies that firms use to benefit from innovation, and the process of formulating technology strategy. Provides frameworks for analyzing key aspects of these industries and teaches students how to apply these frameworks.

Restriction: Permission of ENGR-Maryland Technology Enterprise Institute.

Credit Only Granted for: ENES463, BMGT467, SMLP473 or HLMN472.

Additional Information: Course may not be used to fulfill any BMGT major or minor program requirement.

ENES464 International Entrepreneurship and Innovation (3 Credits)

Focuses on the need for every entrepreneur and innovator to understand the global market in today's hypercompetitive world, and to appreciate how to compete effectively in domestic markets by managing international competitors, suppliers, and influences. Explore how the distinction between foreign and domestic markets is becoming less pronounced. Develop skills to identify and manage opportunities on a global basis.

Restriction: Permission of ENGR-Maryland Technology Enterprise Institute.

Additional Information: Course may not be used to fulfill any BMGT major or minor program requirement.

ENES466 Leading and Financing the Technology Venture (3 Credits)

Focuses on the challenges of leading and financing new technology ventures. Leadership topics include team selection and formation, aligning rewards with relative contributions of team members, and how early decisions can enable or prevent founders from achieving results that align with their individual motivations for becoming an entrepreneur. Essential tools and methods for building a strong financial foundation for a new technology venture are examined. Includes important accounting principles as well as methods for keeping financial control of the technology venture. Insights are shared on navigating the multitude of financial barriers that may block your entrepreneurial success, as well as how to grow the technology venture from concept through launch.

Restriction: Permission of ENGR-Maryland Technology Enterprise Institute.

Credit Only Granted for: ENES466, BMGT365, SMLP471 or HLMN471.

Additional Information: Course may not be used to fulfill any BMGT major or minor program requirement.

ENES467 Engineering for Social Change (3 Credits)

Critical analysis of issues at the intersection of engineering, philanthropy and social change. How engineering design, products and processes have created social change in the past and will do so in the future through both intended and unintended consequences. Topics covered include energy, sustainability and climate change, autonomy, the digital future, low cost engineering, manufacturing, philanthropy, ethics and the impact of electronics on society, among others. Faculty and external experts will engage with students on these topics. Students will broadly engage with organizations involved in using technology for positive social impact.

Restriction: Must not be in Engineering: Mechanical program; and junior standing or higher; and must be in a major in ENGR-A. James Clark School of Engineering. Cross-listed with ENME467.

Credit Only Granted for: ENES467 or ENME467.

ENES471 Legal Aspects of Entrepreneurship (3 Credits)

Explores critical legal and business issues entrepreneurs face as they build and launch a new venture. Examines real world scenarios, and addresses the legal issues at all of the important junctures along the path to success. Significant attention placed on new venture formation, intellectual property management, and financing arrangements.

Additional Information: Course may not be used to fulfill any BMGT major or minor program requirement.

ENES472 International Business Cultures in Engineering and Technology (3 Credits)

The goal is to provide students with an understanding of cultural aspects pertaining to global business and engineering and develop the cultural understanding, attitudes, and communication skills needed to function appropriately within an increasingly global and multicultural working environment.

Prerequisite: Permission of ENGR-A. James Clark School of Engineering.

Restriction: Sophomore standing or higher.

Credit Only Granted for: ENES472, SLLC471, or SLLC473.

ENES474 Global Perspectives of Engineering (3 Credits)

Faculty supervised research on aspects of engineering in a foreign country including leading fields of research, key world markets, and the culture of the engineering workplace. Students will produce a comprehensive report exhibiting their expertise in their chosen country and the field of engineering within.

Prerequisite: ENES100; or permission of ENGR-A. James Clark School of Engineering.

Restriction: Must be in the International Engineering Minor.

Credit Only Granted for: ENES458M or ENES474.

Formerly: ENES458M.

ENES478 Topics in Engineering Education (1 Credit)

Topics related to teaching engineering courses, particularly project-based courses. Topics can include learning styles, student development theory, multicultural issues in teaching, facilitating team experiences, assessment, and academic integrity.

Restriction: Must be in the Engineering Teaching Fellow program.

Repeatable to: 3 credits if content differs.

ENES480 Engineering Honors Seminar I (1 Credit)

Introduction to engineering leadership, professionalism, and ethics. Discussions of leadership style, elements of success, professional communication, codes of ethics, handling of ethical dilemmas, and the characteristics of a professional.

Restriction: Must be in College of Engineering Honors; and junior standing or higher.

ENES481 Engineering Honors Seminar II (1 Credit)

Introduction to engineering creativity and innovation in engineering. Application of methods of creativity to topics in communication, conducting research, and leadership.

Restriction: Must be in College of Engineering Honors; and junior standing or higher.

ENES489 Special Topics in Engineering (3-6 Credits)

Special topics in engineering.

Prerequisite: Permission of ENGR-A. James Clark School of Engineering.

Repeatable to: 6 credits if content differs.

ENES490 QUEST Capstone Professional Practicum (4 Credits)

The capstone course for the QUEST Honors Program provides students with an opportunity to learn in multidisciplinary teams of business, engineering, and science students in a real-world setting. Companies engage teams of QUEST students with real organizational challenges and dedicate resources to help students address these problems. Student teams must enhance their skills in quality management, process improvement, and systems design and will apply these to add value to a client. In the process, students will improve their teamwork skills.

Prerequisite: ENES390 or BMGT390. Cross-listed with: BMGT490.

Credit Only Granted for: BMGT490 or ENES490.

ENES491 Scoping Experiential Learning Projects (3 Credits)

QUEST students cultivate relationships with new and current corporate partners and prepare project scopes for QUEST's introductory course, BMGT/ENES 190H, and capstone course, BMGT/ENES 490H. Requires independent work communicating with clients and class visits to a variety of potential project sites.

Prerequisite: BMGT190 or ENES190.

Restriction: Restricted to QUEST Program (TQMP) students. Cross-listed with BMGT491.

Credit Only Granted for: BMGT491 or ENES491.

ENES498 Special Topics in Entrepreneurship (3 Credits)

This entrepreneurship seminar and case study-based course will explore technology entrepreneurship with a focus on leadership, marketing, team-building, and management of new technology ventures and assumes baseline knowledge of entrepreneurship. Students will learn skills needed to succeed as a technology entrepreneur and how to apply best practices for planning, launching, and growing new companies. This course is a requirement of the Hinman CEOs program.

Restriction: Must be in Hinman CEOs Program.

Repeatable to: 12 credits if content differs.

ENES499 Senior Projects in Engineering (3 Credits)

Students will work in large teams to solve a multidisciplinary research/design problem. The course will begin with students identifying opportunities, brainstorming project concepts to address these opportunities, applying lean startup and design thinking strategies, and then selecting/proposing a project for the semester. Acceptable projects will require the multidisciplinary design, construction and testing of a project within limited budget and time constraints.

Prerequisite: Permission of ENGR-A. James Clark School of Engineering; and completion of all 1XX and 2xx level (lower-division) technical courses in engineering major with a C- or better.

Restriction: Must be in a major in ENGR-A. James Clark School of Engineering.

Repeatable to: 6 credits if content differs.