

# ENGINEERING

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## Courses

### **EGR 101. Discover Engineering Seminar. 0 Hours**

This course will be the venue to introduce Discover Engineering students to the disciplines/departments across the School of Engineering to help them select their major.

### **EGR 102. Introduction to the University Experience for Engineers. 0 Hours**

This is a first semester course required for all majors in the School of Engineering. The 2 primary components of this course include: (1) Introduction to the University of Dayton Educational Experience (2) Students as Reflective Decision-Makers and Active Learners This course will also be the venue to introduce all School of Engineering students to the disciplines/departments across the School of Engineering. This course is part of the Integrated Engineering Core (IEC).

### **EGR 103. Engineering Innovation. 2 Hours**

First year multi-disciplinary innovation projects primarily geared towards skill development in the areas of requirements analysis, creativity, conceptual design, design and problem-solving processes, prototyping, teamwork, and project communications. Application to the development of a new product or technology meeting societal needs. This course is part of the Integrated Engineering Core for all engineering students.

### **EGR 105. Engineering Innovative Design for non-engineering majors. 3 Hours**

Multi-disciplinary innovation projects primarily geared towards skill development in the areas of requirements analysis, creativity, conceptual design, design and problem-solving processes, prototyping, teamwork, and project communications. Application to the development of a new product or technology meeting societal needs.

### **EGR 150. Enrichment Workshop I. 0 Hours**

A workshop structured to provide collaborative learning in fundamental engineering topics of calculus, chemistry, and physics facilitated by upper-class engineering students. This course is offered in the fall semester.

### **EGR 151. Enrichment Workshop II. 0 Hours**

A workshop structured to provide collaborative learning in fundamental engineering topics of calculus, chemistry and physics facilitated by upper-class engineering students. This course is offered in the spring semester.

### **EGR 190. Multi-Ethnic Engineers Program Workshop. 0 Hours**

A series of workshops to facilitate the academic transition, professional development and success of first and second year Multi-Ethnic Engineers Program students.

### **EGR 198. Multidisciplinary Research & Innovation Laboratory. 1-6 Hours**

Students participate in 1.) selection and design, 2.) investigation and data collection, 3.) analysis and 4.) presentation of a research project. Research can include, but is not limited to, developing an experiment, collecting and analyzing data, surveying and evaluating literature, developing new tools and techniques including software, and surveying, brainstorming and evaluating engineering solutions and engineering designs. Proposals from teams of students will be considered.

### **EGR 200. Professional Development Seminar. 0 Hours**

Presentations on contemporary and professional engineering subjects by students, faculty, and engineers in active practice. The seminar addresses topics in key areas that complement traditional courses and prepare distinctive graduates, ready for life and work. Registration required for all sophomore students. Prerequisites: EGR 102 and (CEE 101 or CME 101 or ECE 101 or EGR 101 or MEE 101 or SET 101).

### **EGR 201. Engineering Mechanics. 3 Hours**

This course provides an introduction to mechanics as applied to engineering problems. Principles of force and moment balance, work, and energy conservation are applied to systems in static equilibrium. The similarity of balance laws applied to mechanical behavior to those used in thermodynamics and electric circuits is introduced. Students are introduced to the concepts of free-body diagrams and equivalent systems of forces, properties of areas and sections, analysis of simple structures, internal forces, stress, and material failure. Introduces a common problem-solving approach and processes to address and solve open ended problems and creative application of theory. Both analytical and computer solutions of engineering mechanics problems are emphasized. This course is part of the Integrated Engineering Core for all engineering students. Prerequisite(s): MTH 168; PHY 206.

### **EGR 202. Engineering Thermodynamics. 3 Hours**

This course provides an introduction to engineering thermodynamics, emphasizing the vital importance of energy generation and efficiency from a multi-disciplinary perspective. State descriptions of pure substances and mixtures. Control volume analysis and conservation principles applied to systems with respect to mass, energy, and entropy with applications to power, refrigeration, chemically reacting and other energy conversion systems. Introduces a common problem-solving approach and processes to address real, open ended problems and creative application of theory. Both analytical and computer solutions of engineering thermodynamics problems are emphasized. This course is part of the Integrated Engineering Core for all engineering students. Prerequisite(s): MTH 168.

### **EGR 203. Electrical & Electronic Circuits. 3 Hours**

This course provides an introduction to the discipline of Electrical and Computer Engineering. Covers principles of linear circuit analysis and problem solving techniques associated with circuits containing both passive and active components. Students are introduced to DC circuit analysis, AC circuit analysis, and transient circuit analysis. Applications of basic electronic devices including diodes, transistors, and operational amplifiers are studied. Both analytical and computer solutions of electrical and electronic circuit problems are emphasized. This course is part of the Integrated Engineering Core for all engineering students. Prerequisite(s): MTH 168.

### **EGR 203L. Electrical and Electronic Circuits Lab. 1 Hour**

Laboratory investigation of basic electrical and electronic circuits. Introduction to laboratory reporting, safety, and instrumentation. Corequisite(s): EGR 203.

### **EGR 270. Data Analytics Fundamentals. 3 Hours**

This course introduces the fundamentals of engineering-based data analytics processing. Students will understand how to apply data analytics methods to propose engineering solutions and develop decision-making strategies. Students are introduced to data analytics programming in Python and will learn how to prepare, process, and visualize data using various Python libraries and collaborative coding environments. Prerequisites: MTH 169 - Calculus II.

**EGR 298. Multidisciplinary Research & Innovation Laboratory. 1-6 Hours**

Students participate in 1.) selection and design, 2.) investigation and data collection, 3.) analysis and 4.) presentation of a research project. Research can include, but is not limited to, developing an experiment, collecting and analyzing data, surveying and evaluating literature, developing new tools and techniques including software, and surveying, brainstorming and evaluating engineering solutions and engineering designs. Proposals from teams of students will be considered.

**EGR 299. Innovation Design & Entrepreneurship. 3 Hours**

No description available.

**EGR 300. Professional Development for Juniors. 0 Hours**

Presentations on contemporary and professional engineering subjects by students, faculty, and business and technical professionals. The seminar addresses topics in key areas that complement traditional courses and prepare distinctive graduates, ready for life and work. Registration required for all School of Engineering juniors. Prerequisites: EGR 200.

**EGR 301. ETHOS Center Internship. 12 Hours**

Full time domestic or international technical internship with a non-profit or international non-governmental agency. Permission only.

**EGR 308. Engineering for the Performing Arts. 3 Hours**

Experiential course exploring the best practices and upcoming trends in the materials, methods, and procedures used in engineering scenic environments for the performing arts, through the integration of the technical Theatre and Engineering disciplines. This course will provide students with practical experience in working with performance technology industry partners through the testing of emergent performance technology for product development and the uses of this technology to help support arts education needs in our community. Open to all university students.

**EGR 311. Principles of Nanotechnology. 3 Hours**

Nanoscale properties: optical, mechanical and thermal effects at the nanoscale, quantum confinement effects. Fabrication techniques: top down and bottom up techniques; nano-patterning, thin films. Nanometrology: scanning electron microscope, atomic force and microscope. Nanoelectronics: single electron devices, grapheme and carbon nanotube electronics. Carbon nanotubes, quantum dots, nanophotonics.

**EGR 320. Systems Design Scholars Seminar. 3 Hours**

Interdisciplinary systems-design experience to emphasize the basic problem-solving approach and philosophy of engineering for students of varied backgrounds. By permission only.

**EGR 323. Project Management. 3 Hours**

No description available.

**EGR 330. Engineering Design & Appropriate Technology. 3 Hours**

This course is open to juniors and seniors, and is a community-based global learning course to develop the knowledge, skills, and mindset for engaging in international engineering design for the common good. This course explores the interconnections between both human-centered and equity-centered design and appropriate technology, in the context of historical, political, ideological, ethical, cultural, and practical perspectives. Students will critically explore ways to apply systems thinking, cultural humility, and principles of effective and ethical community development work as they engage with international community partners on sociotechnical projects. The course also offers students the opportunity to explore the relationships between engineering and social justice, through examining their own social locations and intercultural effectiveness, as well as critically reflecting on the role that engineers and engineering might play in creating socially just societies. This course also provides students with the conceptual and methodological tools to engage communities in respectful and productive ways as they prepare for ETHOS Center international immersions. Prerequisites: Junior or senior status, EGR 103.

**EGR 331. Sociotechnical Engineering for the Common Good. 3 Hours**

This community engaged learning course will focus on integrating community building practices and the importance of these practices for human-centered and equity-centered engineering design; applying the engineering entrepreneurial mindset and skillset to community-driven technical projects to address community needs and inequities; and integrating social justice and human rights principles into engineering practice. The course promotes student learning both in the classroom as well as through immersive engagement with a community partner organization. These partnerships will help students look beyond the traditional engineering methods of problem identification and solution development as students learn to value different forms of knowledge produced within the communities that are impacted by real inequities. In doing so, students will come to understand the importance of engaging with problems in ways that stretch beyond technical approaches and keep socio-cultural-historical context as central to working for the common good as engineers. Students will learn to recognize the socio-cultural-historical nature of problems and then approach solutions to these problems in ways that prioritize social justice, with an understanding of both the possibilities and limitations of technically-based engineering solutions. Topics covered will include human-centered and equity-centered design approaches, appropriate technology, social justice; identity, positionality, and privilege; human rights framework; ethical community engagement, entrepreneurial mindset, systems thinking, sociotechnical strategies and tools, and sustainable development goals. Prerequisites: EGR 103.

**EGR 351. By Design. 3 Hours**

This is a course about design as a philosophy for living. The point of crossover between ethics and engineering design is the word "good." The term "good" has an ethical valence dating back to Aristotle and it has a practical valence related to the skills necessary for doing design. Thus the course has two instructors, one whose expertise is in design process and the other whose expertise is in ethics. The course engages students in 10 small-scope, non-technical projects in which teams seek solutions to proposed real-world problems of varying complexity and varying ethical density in a semi-competitive environment. "Non-technical" means that non-engineers are expected to participate and contribute to the design process. And "10 small projects" (rather than one or two large design projects) means that learning is focused on the design methodology rather than artifacts generated. We do not aim to teach for the right answer but the skills in the design process. Prerequisites: REL 103 or REL 1HC or ASI 110 and junior standing.

**EGR 374. Sustainable Energy Analysis and Economics. 3 Hours**

This course provides an introduction to technical analysis of the sustainability of products and processes. Technical topics are to include energy and exergy consumption, return on investment, renewability, life cycle analysis, and environmental economics. Throughout the course, students will reflect on the increased effects of climate change on marginalized groups in society, as well as constructive and imaginative responses to dealing with such injustice at multiple levels. The course culminates in a team-based project, evaluating a system using the preceding techniques on a system of the students' choosing. Prerequisite(s): MTH 129 or MTH 138 or MTH 148 or MTH 168.

**EGR 392. Engineering Research Ethics. 3 Hours**

This experiential learning course introduces students to ethical theory in the context of engineering research. Students will examine and apply these theories through an engineering research project with a faculty mentor. Students will be exposed to a variety of topics related to research ethics including ethical treatment of data, human subject research, conflicts of interest and objectivity, mentoring and collaboration, publications, presentation and authorship, laboratory safety, etc. Additionally, they will be exposed to engineering research topics through hands-on research, and through formal instruction.

**EGR 398. Multidisciplinary Research & Innovation Laboratory. 0-3 Hours**

Students participate in 1.) selection and design, 2.) investigation and data collection, 3.) analysis and 4.) presentation of a research project. Research can include, but is not limited to, developing an experiment, collecting and analyzing data, surveying and evaluating literature, developing new tools and techniques including software, and surveying, brainstorming and evaluating engineering solutions and engineering designs. Proposals from teams of students will be considered.

**EGR 400. Professional Development for Seniors. 1 Hour**

Presentations on contemporary and professional engineering subjects by students, faculty, and business and technical professionals. The seminar addresses topics in key areas that complement traditional courses and prepare distinctive graduates, ready for life and work. Registration required for all School of Engineering seniors. Prerequisites: EGR 300 or CEE 300 or ECE 300 or MEE 300 or SET 300.

**EGR 401. ETHOS Center Internship. 12 Hours**

Full time domestic or international technical internship with a non-profit or international non-governmental agency. Permission only.

**EGR 402. Technical Innovation in Product Development. 3 Hours**

Innovation is critical to solving humanity's increasing complex problems, taking advantage of new opportunities, and to remain competitive in today's marketplace. Yet engineers and technical professionals receive little training in systematic innovation techniques. This course is a study of the principles of entrepreneurial thinking with a focus on game changing rather than incremental innovation. It includes study of opportunity recognition, problem definition, customer needs identification, concept generation, concept validation, and concept selection techniques. Individual and team assignments will be required. Prerequisites: Sophomore status.

**EGR 403. Venture Creation in Technology. 3 Hours**

This course provides an introduction into entrepreneurship and the entrepreneurial mindset, and the process of studying, understanding and creating new technology ventures. This includes an overview of the concepts and aspects involving creation of new ventures, opportunity recognition, new product development, product life cycles and innovation for both the entrepreneur and existing companies (now popularly called corporate venturing). Topics of study include; types of entrepreneurship, entry strategies, creating high potential opportunities, entrepreneurial finance, market adaptation, business plan development or lean canvas model, entrepreneurial marketing, and government programs for assisting entrepreneurial firms. Prerequisites: EGR 402 or UDI 200.

**EGR 404. Intellectual Property and Entrepreneurship. 3 Hours**

This course will provide critical information surrounding intellectual property (IP) to the entrepreneurially minded student. Students will add to their entrepreneurship experience portfolio by studying, identifying and researching a variety of topics tied to IP. Students will conduct patent searches, understand patent claims, draft a provisional patent, identify potential IP, and develop a basic understanding of US and International legal systems. Prerequisites: EGR 402 or UDI 200.

**EGR 405L. Entrepreneurship & Innovative Design. 3 Hours**

This course is designed to help you develop essential skills to understanding and appreciation of the difficulties and challenges of innovative design and development of new products and entrepreneurship. During the class students will work in teams to research and prototype a new innovation/product. Utilizing the techniques gained in EGR 403 and EGR 404 teams will develop a basic business or lean canvas, marketing strategy, and elevator pitch deck. The class will culminate in the presentation of their innovation through Flyer Pitch or Elevator Pitch to a board of experts. The goal of the class is to produce provisional patents and/or Provisional Intellectual Property. Innovations resulting from this course may result in identifying funding for future development. Prerequisites: EGR 403, EGR 404.

**EGR 411. Advanced Nanotechnology. 3 Hours**

Nanotechnology in information, energy, fabrication and metrology: data storage, nanoelectronics, 3-D transistors; nanomaterials in photovoltaics, fuel cells; thin films, optical and non-optical lithography, MEMS, nanofabrication processes; scanning electron microscopy.

**EGR 419. Engineering Systems for the Common Good. 3 Hours**

Mathematical examination of social systems, and development of quantitative models describing their behavior. Fundamental systems theory concepts, such as block diagrams, feedback loops, and continuous and discrete-time dynamics, will be reviewed and taught as needed. Students will apply these concepts to mathematically model and analyze social systems, and in this process they will learn how the powerful idea of Human Rights is understood via social system models. Students will learn how to study and numerically simulate social dynamics in a methodical, mathematical manner. Students will use simulation software to numerically investigate and understand social systems such as sustainability, environmental justice, the poverty cycle, and others. For each system, its connections to specific human rights will be highlighted. At the conclusion of the course, students will have achieved a deeper understanding of the connection between engineering principles and tools, human rights, and the common good. Prerequisites: MTH 219 (Applied Differential Equations) and Junior status.

**EGR 430. Appropriate Technology and Design II. 0-3 Hours**

An experiential, case-based course in appropriate technology and engineering design. Case studies focus on international standards and specifications for appropriate technologies; global protocols for needs assessment and engineering impact evaluation; and social science research methods for well being assessment. The course also includes an intensive ETHOS service-learning immersion experience focused on technical or engineering design work in a developing country. Prerequisites: Senior or graduate status, permission of instructor.

**EGR 493. Honors Thesis. 3 Hours**

Selection, design, investigation, and completion of an independent, original research study resulting in a document prepared for submission as a potential publication and a completed undergraduate thesis. Restricted to students in University Honors Program.

**EGR 494. Honors Thesis. 3 Hours**

Selection, design, investigation, and completion of an independent, original research study resulting in a document prepared for submission as a potential publication and a completed undergraduate thesis. Restricted to students in University Honors Program. Prerequisite(s): EGR 493.

**EGR 499. Engineering Systems Design. 3 Hours**

This course will provide students of varied backgrounds with an interdisciplinary systems-design experience of applying basic engineering problem-solving and process-oriented approaches to a set of case studies while examining those case studies through different philosophical perspectives on engineering itself.

**EGR 500. Academic Integrity and Responsible Conduct of Research for Engineers. 0 Hours**

The importance of practicing academic and research integrity in engineering is examined. The university's honor code and expectations for academic integrity within the context of ethical engineering practice are discussed. The principles of engineering research ethics and integrity are studied in-depth using the Responsible Conduct of Research (RCR) training program as a framework. The RCR Training topics include: research misconduct; conflicts of interest; data sharing, management and ownership; collaborative research; mentor/trainee relationships; responsible authorship and publication practices; peer review; human subjects protection; animal welfare; and, university policies affecting researchers at all levels. Course topics are examined via online coursework, video examples, live training workshops and interactive case studies.

**EGR 501. ETHOS Center Internship. 6 Hours**

Full time domestic or international internship with a non-profit or international non-governmental agency. Permission only.

**EGR 530. Appropriate Technology and Design II. 0-3 Hours**

An experiential, case-based course in appropriate technology and engineering design. Case studies focus on international standards and specifications for appropriate technologies; global protocols for needs assessment and engineering impact evaluation; and social science research methods for well being assessment. The course also includes an intensive ETHOS service-learning immersion experience focused on technical or engineering design work in a developing country. Senior or graduate status; permission by instructor.

**EGR 590. Selected Readings. 1-6 Hours**

Directed readings on an interdisciplinary engineering topic approved by the student's academic advisor and the department chair. May be repeated. Possible topics include: (a) Research Ethics, (b) Engineering Innovation, (c) Entrepreneurship, or (d) Multidisciplinary Design. Prerequisite(s): Variable.