ENGINEERING (EGR)

The mission of the engineering major is to educate students in an engineering curriculum that embraces and supports the unique culture of Wake Forest by combining the liberal arts core, innovative entrepreneurship, and engineering. The program provides an undergraduate engineering education that embodies the teacher-scholar ideal, emphasizing the close faculty-student engagement that is the hallmark of the Wake Forest community. Our goal is to attract enthusiastic students from around the US and the world who will make important contributions to solving society's most pressing problems, fulfilling the *Pro Humanitate* motto of Wake Forest University.

Declaring a Major

Students must complete a minimum of 40 credit hours at WFU and meet with an Engineering Faculty or Engineering Academic Advisor to submit the 'Declaration of Major in Engineering' form. All students majoring in Engineering will be assigned an Engineering Faculty Major Advisor. Note that when a student declares a major or minor, the requirements for the major or minor that are in effect *at the time* of declaration will apply. See the Requirements for Degrees (https://bulletin.wfu.edu/requirements-degrees/) section for further details.

Study Abroad

Students considering study abroad should consult with Engineering Department faculty. The second year or Fall of the third year are the most flexible semesters for B.S. Engineering students to study abroad.

Contact Information

Department of Engineering (http://college.wfu.edu/engineering/)
Wake Downtown
455 Vine Street
Bldg 60 South, Rm 460X
Phone 336-702-1926

Programs

Major

- B.S. in Engineering (https://bulletin.wfu.edu/courses-instruction/engineering/bs-engineering/)

Minor

- Minor in Engineering (https://bulletin.wfu.edu/courses-instruction/engineering/minor-engineering/)

Courses

Engineering (EGR)

EGR 111. Introduction to Engineering Thinking and Practice. (4 h)
Introduction to the study and practice of engineering, systems thinking, design, research, creative and analytical problem solving practices, and engineering for humanity. With laboratory.

EGR 112. Introduction to Engineering Measurement and Analysis. (4 h)
Exploration of tools, processes, and quantitative and qualitative analysis for modern engineering practice. With laboratory.

EGR 113. Integrated Sciences. (4 h)
An integrated basic science course covering topics in the biological, chemical, and physical sciences. With laboratory.

EGR 211. Materials and Mechanics. (4 h)
Fundamentals of materials and mechanics (statics and dynamics) for engineering applications. With laboratory. P-CHM 111/111L, EGR 111, 112, MST 111, PHY 113. P or C-MST 112.

EGR 212. Transport Phenomena. (4 h)
An integrated course in the fundamentals of thermodynamics, fluid mechanics, and heat transfer with emphasis on principles of conservation and transport of mass, energy, and momentum. With laboratory. P-CHM 111/111L, EGR 111, 112, MST 111, 112, PHY 113. P or C-MST 113.

EGR 213. Mechanical Computer Aided Design I. (2 h)
Introduction to Computer Aided Design (CAD) for mechanical assemblies including design planning additive and subtractive manufacturing techniques. P-EGR 111.

EGR 214. Embedded Microcontroller Systems. (2 h)
Examination of the structure of digital electronic systems with specific focus on microcontroller architectures for embedded system applications, as well as interfacing with analog and digital peripherals. With laboratory. P-EGR 111 or EGR 112 and CSC 111.

EGR 280. Projects with Engineering for Non-Majors. (1-4 h)
Specialized and focused learning via experiential projects. May be repeated for credit.

EGR 281. Introductory Projects with Engineering for Majors. (1-4 h)
Specialized and focused learning via experiential projects. Does not count towards engineering technical elective credit. May be repeated for credit.

EGR 301. Special Topics in Engineering. (1-4 h)
Seminar and/or lecture and/or project-based and/or laboratory courses in selected topics. Does not count towards engineering technical elective credit unless a designation of "Technical Elective" is noted. May be repeated if the course title changes.

EGR 311. Control Systems and Instrumentation. (4 h)
Fundamentals of circuits and semiconductor electronics as applied to the analysis and design of engineering instrumentation and control systems. With laboratory. P-EGR 211, 212, and MST 113. P or C-MST 205.

EGR 312. Computational Modeling in Engineering. (4 h)
Fundamentals of computational problem solving tools (programming, systems modeling, numerical methods) for diverse engineering applications, with consideration of the economic and ethical outcomes of decisions that are made using such techniques. With laboratory. P-EGR 211, 212, MST 113, 205. (STA 111 highly encouraged but not required).

EGR 313. Capstone Design I. (1 h)
The first course of the capstone design experience. C-EGR 311, 312.

EGR 314. Capstone Design II. (4 h)
The second course of the capstone design experience. P-EGR 313.

EGR 315. Capstone Design III. (4 h)
The third course of the capstone design experience. P-EGR 314.

EGR 316. Mechanical Computer Aided Design II. (2 h)
Advanced Computer Aided Design (CAD) for mechanical systems and stress/strain analysis with consideration of material properties and their role in manufacturability. P-EGR 211.

EGR 317. Renewable Energy Systems. (2 h)
Fundamentals of renewable energy systems, including wind, solar, biomass, and hydroelectric with economics evaluation and understanding technological innovations. With laboratory. P-EGR 212.

EGR 318. Biomimetic Engineering. (2 h)
Fundamentals of bioinspired design, functional modeling, and reverse engineering principles towards innovative solutions. P-EGR 211, 212.

EGR 319. Environmental Engineering. (2 h)
Fundamentals of environmental systems, including water supply, water quality, water treatment, air pollution, soil remediation, environmental risk assessment, and climate variation. Explore how engineers both leverage and sustain these systems and inform environmental and public health policies. With laboratory. P-EGR 211 and 212.

EGR 320. Biomedical Engineering Applications. (2 h)
An overview of biomedical engineering applications such as cardiovascular fluid mechanics, biomechanics, biomaterials, tissue engineering, signal processing and instrumentation, and biomedical ethics. With laboratory. P-EGR 211, 212, and MST 205.

EGR 321. Chemical Engineering Separations. (2 h)
Theory and design of chemical separation processes, and related flow diagrams, by applying material and energy balances and chemical equilibra fundamentals. Includes distillation, liquid-liquid extraction, ion exchange, and gas absorption. With laboratory. P-EGR 212, MST 205, CHM 122 and 280.

EGR 322. Materials Engineering and Characterization. (2 h)
Relationships between atomic structure, microstructure, and observable properties of metallic, ceramic, and polymeric materials. Measurement and modification of material properties. With laboratory. P-EGR 211, MST 112, CHM 111 and 111L.

EGR 323. Chemical Reaction Engineering. (2 h)
Rates of homogeneous, catalytic, and biological reactions; reactor design and analysis, and related flow diagrams. With laboratory. P-EGR 212, MST 205, CHM 122 and 280.

EGR 324. Hydrologic and Hydraulic Engineering. (2 h)
Fundamentals of the hydrologic cycle, estimating hydrologic fluxes, watershed-scale modelling, and open channel hydraulics. With laboratory. P-EGR 212.

EGR 325. Medical Product Design. (2 h)
Fundamentals of innovative and user-centered product design processes. Use of clinical observations and client interviews to derive new medical device designs and analysis for improving system performance. With laboratory. P-EGR 211 and 212.

EGR 326. Human Factors Engineering. (2 h)
A systems approach to understanding human-machine interfaces, psychology of design, ergonomics, human error and system reliability. With laboratory. P-EGR 211 and 212.

EGR 327. Microengineering. (2 h)
An overview of microengineering systems and an exploration of how size affects critical scaling law parameters, material properties, fabrication techniques, design and use. With laboratory. P-EGR 211 and 212.

EGR 328. Inverse Problems in Engineering. (2 h)
Fundamental approaches and techniques in solving inverse problems using mathematical, numerical, and statistical formulations. Applications include satellite remote sensing of the earth and environment, medical imaging, image and signal processing, and machine learning. With laboratory. P-EGR 211, MST 113 and 205, and STA 111.

EGR 329. Functional Advanced Materials Characterization. (2 h)
Relationships between atomic structure, microstructure, and observable properties of functional and advanced materials. measurement and modification of material properties. With laboratory. P-EGR 211, MST 113, CHM 111 and 111L.

EGR 330. Infrastructure Systems Design. (2 h)
Explore principles of infrastructure systems through experiential learning and application of concepts to design or redesign a local system with consideration of technical, social, environmental, and economic factors. With laboratory. P-EGR 211 and 212.

EGR 331. Thermal Fluid Systems. (2 h)
Applying fundamentals of fluid mechanics, heat transfer, and thermodynamics across diverse engineering applications in the analysis and design of thermal fluid systems. With laboratory. P-EGR 212 and MST 205.

EGR 332. Structural Engineering I. (2 h)
An introduction to structural engineering systems and materials such as steel, wood, and concrete. Emphasis on understanding the load path within real structures and how that impacts their design. With laboratory. P-EGR 211.

EGR 333. Tissue Engineering. (2 h)
Fundamentals of biomaterials, stem cells, and imaging technologies to analyze novel tissue engineering applications. With laboratory. P-EGR 211, 212, BIO 111 or 114, CHM 111 and 111L or POI.

EGR 334. Mobile Robotics. (2 h)
Introduction to mobile robotics, from hardware (energy, locomotion, sensors) and software (signal processing, control, localization, trajectory planning, high-level control). With laboratory. P-EGR 211, 212 and 311.

EGR 335. Field Programmable Gate Array (FPGA) Design and Implementation. (2 h)
An introduction to field programmable gate array (FPGA) design and implementation. With laboratory. P-EGR 311.

EGR 336. Healthcare Engineering. (2 h)
Beyond biomedical engineering, engineers play a critical role in bettering healthcare systems via big data analytics, next generation technologies, translational science and engineering, precision medicine, and diagnostic AI. With laboratory. P-EGR 312.

EGR 380. Fundamentals of Engineering Exam Prep. (1 h)
Review of engineering fundamentals in preparation for Fundamentals of Engineering exam. P or C-EGR 311 and 312.

EGR 381. Engineering Research. (1-4 h)
Engineering research project conducted under the guidance of a research mentor. Does not count towards engineering technical elective credit unless a designation of "Technical Elective" is indicated. Upon completion and review of project deliverables, engineering technical elective credit may be granted. May be repeated for credit.

Faculty

Chair Olga Pierrakos
Professor Olga Pierrakos
Associate Professor Michael Gross, Saami Yazdani
Assistant Professors Courtney Di Vittorio, Erin Henslee, Lauren Lowman, Kyle Luthy, Kyana Young
Assistant Teaching Professor Melissa Kenny
Visiting Assistant Professor of Practice Nick Lutzweiler