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)

EGR 212. Transport Phenomena. (4 h)

EGR 281. Introductory Projects with Engineering. (1-4 h)
Specialized and focused learning via experiential projects. 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. 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, MST 113, 205.

EGR 312. Computational Modeling in Engineering. (4 h)
Computational problem solving tools (programming, systems modeling, numerical methods), 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. 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, 280.

EGR 317. Hydrologic and Hydraulic Engineering. (2 h)
Fundamentals of open channel hydraulics, hydrologic analysis and modeling at the watershed scale, hydraulic design of pressurized systems, groundwater hydraulics, and urban hydraulic system design. With laboratory. P-EGR 212.

EGR 318. 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, 212.

EGR 319. 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 212, CSC 111, or POI.

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 equilibria 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 open channel hydraulics, hydrologic analysis and modeling at the watershed scale, hydraulic design of pressurized systems, groundwater hydraulics, and urban hydraulic system design. 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. 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 211 and CSC 111, or POI.

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)
Applying engineering mechanics fundamental in the analysis of varying structures, including bridges and buildings. Understanding the use of structural materials such as masonry, wood, steel, and concrete as applied to real-world contexts. 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 381. Research. (1-4 h)
Research project conducted individually under guidance of a research mentor. May be repeated for credit.