

# ENGINEERING (ENGR)

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These courses include an engineering component and are relevant to more than one engineering discipline. An engineering component includes elements of engineering sciences, mathematics, exploration, historical or modern practice, or design.

## Courses

**ENGR 099. Engineering Seminar: Becoming a Bucknell Engineer. 0 Credits.**

**Offered Fall Semester Only; Lecture hours:Varies,Other:1**

A weekly seminar for all first-year engineering majors.

**ENGR 100. Engineering Design Experience. 1 Credit.**

**Offered Fall Semester Only; Lecture hours:3,Other:2**

Introduction to the study and practice of engineering through authentic design projects centered around a common theme. Project-based course focuses on the engineering design process, teamwork fundamentals, engineering ethics, and the development of both technical and professional skills. Permission of instructor required for non-first-year students.

**ENGR 101. Engineering Graphics. .5 Credits.**

**Offered Spring Semester Only; Lecture hours:1,Lab:2**

Introduction to engineering graphics including drawing with drafting instruments, computer-aided drafting and surveying.

**ENGR 138. Written and Oral Communication. .5 Credits.**

**Offered Either Fall or Spring; Lecture hours:2**

Written and oral forms of communication, including preparation and presentation of job/internship communication, memos, letters, and reports, with consideration of audience, purpose, structure, style, and language. Required for all Bachelor of Science in electrical engineering students. Prerequisite: ELEC 205, ELEC 120, ELEC 101 or BMEG 205. Open to other engineering students. Open to Arts and Sciences students as space permits.

**ENGR 1NT. ENGR Non-traditional Study. 1 Credit.**

**Offered Fall, Spring, Summer; Lecture hours:Varies,Other:3**

Non-traditional study in engineering. Prerequisite: permission of the instructor.

**ENGR 200. Thermodynamics. 1 Credit.**

**Offered Either Fall or Spring; Lecture hours:4**

Properties, first law, second law, entropy, availability, efficiency, pure substances, real gases. Introduction to heat transfer. Prerequisite: MATH 201.

**ENGR 201. Electrical Instrumentation and Measurements. .5 Credits.**

**Offered Spring Semester Only; Lecture hours:1,Lab:3**

Electrical instruments and techniques of measurement; laboratory analysis of elementary circuits. Prerequisite: ELEC 205.

**ENGR 210. Exploring The Grand Challenges of Engineering. 1 Credit.**

**Offered Summer Session Only; Lecture hours:15,Other:20; Repeatable**

The specific foci of the course will vary each summer to allow Grand Challenge Scholars to complete one or two of their requirements. Students will be exposed to concepts underlying 3-8 of the Grand Challenges and required to complete a major project relating to a Grand Challenge of their choice.

**ENGR 211. Introduction to Chemical Engineering Computing. .5 Credits.**

**Offered Spring Semester Only; Lecture hours:2,Lab:1**

Programming fundamentals and introductory numerical methods. Problems drawn from mathematics and chemical engineering. With computational laboratory. Corequisite: ENGR 211L. Prerequisite: MATH 201. Not open to students who have taken ENGR 212 or ENGR 214.

**ENGR 212. Engineering Computation. .5 Credits.**

**Offered Fall Semester Only; Lecture hours:1,Lab:2**

An in-depth introduction to using computers as a fundamental tool for solving civil engineering problems. Course will include: structured programming, and numerical methods. Prerequisite: MATH 222 or equivalent. Not open to students who have taken ENGR 211.

**ENGR 214. Computational Analysis. 1 Credit.**

**Offered Spring Semester Only; Lecture hours:3,Lab:2**

Introduction to a modern computer language. Structured programming and algorithm design for engineering problems involving linear algebra, statistical analysis of data, and elementary numerical analysis. Introduction and use of a scientific application package as a tool. Not open to students who have taken ENGR 211 or ENGR 212. Open to mechanical engineering students only.

**ENGR 215. Experimental Design and Data Analysis. .5 Credits.**

**Offered Spring Semester Only; Lecture hours:2,Lab:1**

Introduction to the analysis of experimental and industrial data. Topics include statistical inference, analysis of variance, regression analysis, experimental design and computational methods. With computational laboratory. Not open to students who have taken BMEG 226, MATH 216, or MATH 226.

**ENGR 221. Mechanics. 1 Credit.**

**Offered Spring Semester Only; Lecture hours:4**

Equilibrium of two- and three-dimensional force systems. Friction. Kinematics and kinetics of particles and rigid bodies. Corequisite: MATH 212 or MATH 222. Not open to civil and environmental engineering and mechanical engineering students. Not open to students who have taken ENGR 229 or MECH 220.

**ENGR 222. Civil Engineering Fluid Mechanics. 1 Credit.**

**Offered Either Fall or Spring; Lecture hours:3,Lab:3**

Fluid properties and hydrostatics. Flow concepts and basic equations. Viscous flow in pipes and channels. Steady pipe flow. Potential flow. Introduction to open channels or hydraulic machinery. Prerequisite: ENGR 229.

**ENGR 226. Probability and Statistics for Engineers. .5 Credits.**

**Offered Fall Semester Only; Lecture hours:3**

Exploratory data analysis, probability theory, discrete and continuous random variables, point estimation, sampling distributions and methods of statistical inference. Prerequisites: MATH 202 and only open to civil or environmental engineering students.

**ENGR 229. Solid Mechanics I. 1 Credit.**

**Offered Spring Semester Only; Lecture hours:4**

Equilibrium of rigid body systems, including analysis of trusses, beams, and frames for internal forces and moments. Introduction to stress and strain, including their relationship and stress transformations. Prerequisites: (PHYS 211 and MATH 201) or MATH 205, or permission of the instructor.

**ENGR 230. Solid Mechanics II. 1 Credit.**

**Offered Fall Semester Only; Lecture hours:4**

Behavior of deformable systems: analysis for forces/stresses and deformation/strains due to axial, torsional, flexural, shear, and combined effects. Analysis of indeterminate systems and basic concepts of stability of compression member. Prerequisite: ENGR 229 (minimum grade of D).

**ENGR 231. Fluid Mechanics. .5 Credits.**

**Offered Fall Semester Only; Lecture hours:3**

Nature of forces; incompressible and compressible fluids under conditions of streamline and turbulent flow. Prerequisite: MATH 202.

**ENGR 233. Chemical Engineering Fluid Mechanics. 1 Credit.**

**Offered Spring Semester Only; Lecture hours:3,Lab:2**

Fluid statics, laminar and turbulent flow of incompressible fluids; introduction to compressible and non-Newtonian fluids; nature of forces, momentum transfer, shell balances; dimensional analysis; applications to pipe flow, drag, fluid measurement and pump design. With experimental laboratory. Corequisite: CHEG 210 or MATH 212.

**ENGR 239. Solid Mechanics II. 1 Credit.**

**Offered Fall Semester Only; Lecture hours:3,Lab:2**

Behavior of deformable systems: analysis for forces/stresses and deformation/strains due to axial, torsional, flexural, shear, and combined effects. Analysis of indeterminate systems and basic concepts of stability of compression members. Laboratory experiments to demonstrate mechanics principles. Prerequisite: ENGR 229.

**ENGR 240. Science of Materials. 1 Credit.**

**Offered Either Fall or Spring; Lecture hours:3,Lab:2**

Study of the relationships between atomic structure and observable properties of materials. Properties of metallic, ceramic, and polymeric materials. Selection of materials for engineering applications. Measurement and modification of material properties. With experimental laboratory. Pre/ Corequisite: one of the following: CHEM 203, CHEM 205, CHEM 207, or equivalent, or instructor permission.

**ENGR 242. Materials Engineering. 1 Credit.**

**Offered Spring Semester Only; Lecture hours:3**

Elements of science of civil engineering materials from a life-cycle perspective. Study of extraction, production, application, deterioration, repair, and end-of-life of wood, steel and concrete. Strategies for sustainable use of materials in civil engineering applications. Prerequisite: ENGR 229. Not open to students who have taken ENGR 240.

**ENGR 245. Technical and Professional Communication for Engineers. 1 Credit.**

**Offered Either Fall or Spring; Lecture hours:4**

Survey of communication, including, but not limited to, oral and poster presentations, professional/business communication, and developing and conveying arguments, all of which are highly relevant to engineers pursuing academic, industrial, or other career paths.

**ENGR 248. Engineering Problems. .5-1 Credits.**

**Offered Both Fall and Spring; Lecture hours:Varies; Repeatable**

Problems in engineering adapted to the needs of the students. Prerequisite: permission of the instructor.

**ENGR 250. Product Archeology: Unearthing Business Decisions. .5 Credits.**

**Offered Either Fall or Spring; Lecture hours:2,Other:2**

An examination of device design by unearthing the technical and business decisions made in bringing a real product to market. Topics will include product dissection, competitive analysis, intellectual property, financial forecasting, marketing, sales, distribution, industry standards, project planning, project management, and individual and team professionalism. Requires permission of the instructor.

**ENGR 251. IDEAS Design Studio 3. .5 Credits.****Offered Occasionally; Lecture hours:1,Other:3**

Hands-on multi-disciplinary design project course covering problem identification, project management, value proposition, intellectual property, and related topics. Prerequisite: permission of the instructor.

**ENGR 252. IDEAS Studio II: Build Your Idea. .5 Credits.****Offered Fall Semester Only; Lecture hours:2,Other:2**

This is an introductory course in product fabrication. The course content includes minor elements dealing with opportunity recognition, basic market analysis, and intellectual property. Most of the course content focuses on the process of creating physical hardware from a product idea using a range of fabrication processes and techniques.

**ENGR 262. Introduction to Energy Resources. 1 Credit.****Offered Alternate Fall or Spring; Lecture hours:4**

Introduction for non-engineers to energy concepts including: energy balance; energy demand; technologies to meet demand; and, effects on the environment. Not open to students who have taken ENGR 200, MECH 213, CHEG 200, PHYS 147, PHYS 211. Crosslisted as ENST 262.

**ENGR 285. Leadership in Management and Technology. 0 Credits.****Offered Summer Session Only; Lecture hours:1.5**

Interdisciplinary experiential program that encourages students to become enlightened leaders. Interactive sessions with faculty and organizational leaders help students learn about leadership, management of technology, critical thinking, teamwork, and decision making, which they also have the opportunity to practice through projects that entail solving real problems for organizations. Crosslisted as MGMT 285.

**ENGR 290. Engineering: Global/Societal Context. 1 Credit.****Offered Occasionally; Lecture hours:Varies; Repeatable**

This study abroad course studies the global and societal context of engineering including impact of traditions, customs, and culture on engineering. A three-week study abroad course. Prerequisites: must have completed the second year of an engineering program and permission of the instructor.

**ENGR 291. The Global Engineer. .25 Credits.****Offered Both Fall and Spring, Offered Occasionally; Lecture hours:1, Other:1; Repeatable**

Engineering and cultural awareness are explored in a global and societal context. Students develop skills necessary to become successful global engineers, informed global citizens and environmental stewards. Students are encouraged to take this course more than once. If the course is repeated four times, students can petition the Associate Dean of Engineering for this course to fulfill the global and societal perspectives requirement. Prerequisite: engineering majors only. Arts and Sciences students by permission of the instructor.

**ENGR 300. Professional Engineering. .5-1 Credits.****Offered Both Fall and Spring; Lecture hours:1, Other:Varies; Repeatable**

The solution of small business engineering problems under the supervision of a faculty member. The projects will be selected by the Bucknell Small Business Development Center in cooperation with companies, faculty members, and students. Open only to engineering seniors. Prerequisite: permission of the instructor.

**ENGR 375. Should We Start This Company?. .5 Credits.****Offered Alternate Fall or Spring; Lecture hours:2**

Project-centered course in entrepreneurship, generating new business ideas, and product or service design and development through business planning. Crosslisted as UNIV 375.

**ENGR 385. Internship in Management and Technology. .5 Credits.****Offered Summer Session Only; Lecture hours:1.5**

Internship in complex management challenges, the internal role of technology in organizations, and interdisciplinary decision-making. Open only to students admitted to the Institute for Leadership in Technology and Management. Prerequisites: ENGR 285 or MGMT 285 and permission of the instructor. Crosslisted as MGMT 385.

**ENGR 401. Transport Phenomena in Nature. 1 Credit.****Offered Occasionally; Lecture hours:2, Other:2**

Experimental and theoretical considerations of momentum, heat and mass transport phenomena in and around plants, animals, cells and the environment. Prerequisite: MECH 312 and permission of the instructor. Crosslisted as ENGR 601.

**ENGR 410. Engineering Seminar. 0 Credits.****Offered Either Fall or Spring; Lecture hours:3**

Bi-weekly seminar to promote intellectual and professional exchange between students, faculty, and staff in the field of engineering. Prerequisites: senior status and permission of the instructor. Crosslisted as ENGR 610.

**ENGR 450. Creative Systems Design. .5 Credits.****Offered Occasionally; Lecture hours:2, Other:2**

Interdisciplinary design studio. Methods for creativity applied to hands-on design utilizing sensors, actuators, and control systems. Ancillary topics include opportunity recognition and value. Juniors and seniors only.

**ENGR 452. Interdisciplinary Senior Design I. .5 Credits.**

**Offered Fall Semester Only; Lecture hours:2,Other:2**

Capstone design course emphasizing realization of engineered design solutions in interdisciplinary teams. Focus areas include problem definition, background research, solution generation, team skills, communication, and professional development. Emphasis placed on articulating, addressing, and validating customer-appropriate value proposition.

**ENGR 453. Interdisciplinary Senior Design II. 1 Credit.**

**Offered Spring Semester Only; Lecture hours:3,Other:2**

Second semester of the interdisciplinary engineering design sequence emphasizing fabrication, instrumentation, testing and evaluation, development and roll-out, and final presentation of projects.