

ENGINEERING EDUCATION

Our Website (<http://www.enge.vt.edu>)

Overview

The Department of Engineering Education (ENGE) is home to General Engineering (GE) students. The department teaches the interdisciplinary first-year engineering courses, advises General Engineering (GE) students, and offers a graduate certificate and a Ph.D. in engineering education.

At the undergraduate level, the department provides the foundation for students to begin their engineering journey, preparing them for academic success in one of the degree-granting College of Engineering programs and for success as an engineer. At the graduate level, the department prepares scholars to advance knowledge and address significant challenges facing engineering education in careers including engineering faculty, policy makers, corporate training, university assessment and university administration.

Accreditation statements may be found in the listings for individual undergraduate degree programs.

First Year Students and General Engineering

The General Engineering (GE) program of the EngE department serves first-year students in the College of Engineering. Through EngE courses, first-year students participate in problem solving, engineering analysis and design exercises that represent the essence of the engineering profession. The courses emphasize team-based, design-oriented, hands-on experiences to develop students' concepts of engineering and engineering methods, while reinforcing the role of concurrent required courses (e.g. mathematics, English, physics). They also serve as a foundation for subsequent courses in the various engineering curricula. Coverage of engineering ethics instills a sense of the responsibilities of engineers to society. Algorithm development and computer programming develop logical thinking, provide the background for computer use in later courses, and support problem-solving skills. Spatial visualization skills are developed through engineering graphics, a primary engineering tool. Through writing and presentations, students begin to hone their professional communication skills, including audience analysis, visual rhetoric, effective writing styles, issues in collaborative writing, techniques of oral presentation, print and Web-based research, graphics for written and oral presentations, and editing.

General Engineering students have access to the **Frith First-Year Makerspace** run by the Engineering Education department. The Frith First-Year Makerspace (formerly the Frith Lab) is designed to support the retention and development of young engineers through hands-on learning, peer mentoring, and authentic problem-solving. Part collaboration and innovation space, part fabrication and prototyping space, and part learning laboratory, Frith is integrated into the first-year foundations of engineering courses and enables General Engineering students to learn by dissecting, designing, making, and analyzing engineering products. The Makerspace houses equipment for 3D printing, laser cutting, metalworking, woodshop work, and crafts. <https://enge.vt.edu/undergraduate/frith.html>

All College of Engineering students must own

1. a laptop or 2-in-1 tablet running Windows 10 or 11 and meeting current specifications, and

2. stipulated software used to analyze and solve problems in and out of class.

Computer requirements for engineering students can be located at <https://eng.vt.edu/admissions/computer-requirement.html>.

Process for Declaring a Degree-Granting Engineering Major

The General Engineering program introduces first-year engineering students to foundational concepts and practices in engineering, allows time to adjust to the College, and provides opportunities to investigate the College's individual degree programs and select the branch of engineering or computer science best suited to their skills and interests. At the end of the year - after academic advising, contacts with the various departments, and satisfactory progress - students select a degree program and, if academically eligible, are transferred to the appropriate degree-granting department.

Entry into a degree-granting engineering department requires that students successfully complete all required first-year courses.

Please see the College of Engineering catalog section titled "Required Academic Progress" for details, and visit <https://eng.vt.edu/academics/undergraduate-students/resources-support/change-of-major.html> for application policies and dates.

Code	Title	Credits
Typical First Semester		
CHEM 1035	General Chemistry	3
CHEM 1045	General Chemistry Laboratory	1
ENGE 1215	Foundations of Engineering	2
ENGL 1105	First-Year Writing	3
MATH 1225	Calculus of a Single Variable	4
Typical Second Semester		
ENGE 1216	Foundations of Engineering	2
ENGL 1106	First-Year Writing	3
MATH 1226	Calculus of a Single Variable	4
PHYS 2305	Foundations of Physics	4

Head: J.M. Case

Assistant Head for Undergraduate Programs: N.P. Pitterson

Assistant Head for Graduate Programs: W.C. Lee

Professors: J.M. Case, D.B. Knight, V.K. Lohani, H.M. Matusovich, L.D. McNair, and M.C. Parette

Associate Professors: D. Bairaktarova, J.R. Grohs, T.W. Knott, W.C. Lee, N.P. Pitterson, S.L. Rodriguez, and Q. Zhu

Assistant Professors: M.V. Huerta, A.S. Katz, D. Kim, and S. Sajadi

Associate Professor of Practice: M.B. James, and N.C.T. Van Tyne

Assistant Professor of Practice: N.J. Bedard

Collegiate Assistant Professor: B.D. Chambers, T. Clarke Douglas, D.A. Gray, J.D. Ortega Álvarez, M.M. Soledad, and C. Wallwey

Senior Instructor: J.L. Lo

Instructor: E.H. Dogan and C.A. Twyman

Professor Emeritus: O.H. Griffin

Associate Professor Emeritus: J.B. Connor, R.M. Goff, M.H. Gregg and T.D.L. Walker

Academic and Career Advisors: M. Cheatham, J. Chin, J. Elmore, D. Erb, M. Greene-Havas, A. Mullins, D. Newcomb, J. Newcomer, and A. Noble

E-mail: enge@vt.edu

Undergraduate Course Descriptions (ENGE)

ENGE 1004 - Explore Engineering (1 credit)

Students will participate in a seminar-style experience guided by representatives from different engineering disciplines to learn more about the programs offered by the College of Engineering at Virginia Tech to aid the change of major process.

Instructional Contact Hours: (1 Lec, 1 Crd)

ENGE 1014 - Engineering Success Seminar (1 credit)

Introduction to opportunities and resources available to College of Engineering students during their undergraduate career at VT. Practice in information gathering skills critical for engineering students. Practice in oral, written, and visual communication. Preparation of an academic plan.

Corequisite(s): ENGE 1215

Instructional Contact Hours: (1 Lec, 1 Crd)

ENGE 1215 - Foundations of Engineering (2 credits)

A first-year sequence to introduce general engineering students to the profession. 1215 (2 credit) data collection and analysis, engineering problem-solving, mathematical modeling, contemporary software tools, professional practices and expectations (e.g. effective communication, working in teams, ethics), and the diversity of fields and majors within engineering. 1216 (2 credits): data collection and analysis, engineering problem-solving, mathematical modeling, design, contemporary software tools, professional practices and expectations (e.g. communication, teamwork, ethics). 1215: Design Lab/Studio (3L, 2C), 1216: Design Lab/Studio (3L, 2C).

Pathway Concept Area(s): 6D Critique & Prac in Design, 10 Ethical Reasoning

Instructional Contact Hours: (3 Lab, 2 Crd)

ENGE 1216 - Foundations of Engineering (2 credits)

A first-year sequence to introduce general engineering students to the profession. 1215 (2 credit) data collection and analysis, engineering problem-solving, mathematical modeling, contemporary software tools, professional practices and expectations (e.g. effective communication, working in teams, ethics), and the diversity of fields and majors within engineering. 1216 (2 credits): data collection and analysis, engineering problem-solving, mathematical modeling, design, contemporary software tools, professional practices and expectations (e.g. communication, teamwork, ethics). 1215: Design Lab/Studio (3L, 2C), 1216: Design Lab/Studio (3L, 2C).

Prerequisite(s): ENGE 1215

Pathway Concept Area(s): 6D Critique & Prac in Design, 10 Ethical Reasoning

Instructional Contact Hours: (3 Lab, 2 Crd)

ENGE 1354 - Introduction to Spatial Visualization (1 credit)

Introduction to spatial visualization. Training to improve three-dimensional visualization skills, pictorial sketching, orthographic projection, mental rotation, mental cutting and folding, combining solids.

Instructional Contact Hours: (1 Lec, 1 Crd)

ENGE 1414 - Foundations of Engineering Practice (4 credits)

Introduction to engineering profession for transfer General Engineering students including engineering problem solving and design, contemporary software tools, and professional practices and expectations (e.g., communication, teamwork, ethics). Duplicates 1215-1216. Design Lab/Studio.

Pathway Concept Area(s): 6D Critique & Prac in Design, 10 Ethical Reasoning

Instructional Contact Hours: (6 Lab, 4 Crd)

ENGE 1644 - Global STEM Practice: Leadership and Culture (3 credits)

Develop global competencies in science, technology, engineering, and math (STEM) contexts and understand how problems and viable solutions vary across contexts and how intercultural communication and global leadership are important in an interconnected global workforce. Integrates semester-long on-campus module with international module following semester exams (Rising Sophomore Abroad Program). International module engages students in local culture during visits with STEM businesses and universities. Participation in both modules required. Enrollment by application.

Pathway Concept Area(s): 3 Reasoning in Social Sciences, 11 Intercultural&Global Aware.

Instructional Contact Hours: (2 Lec, 1 Lab, 3 Crd)

ENGE 1984 - Special Study (1-19 credits)

Instructional Contact Hours: Variable credit course

ENGE 2094 - Create!: Ideation & Innovation (3 credits)

Apply problem solving framing strategies as part of problem solving design processes. Consider cultural, economic, social, and other perspectives in customer discovery and design processes in order to ensure problem/solution fit. Ideate possible solutions or approaches to address open-ended problems using a variety of methods. Engage in iterative critiques of strategies, solutions and prototypes using methods drawn from industrial design, engineering and the arts. Collaborate in interdisciplinary and diverse project teams. Communicate deliverables in multiple formats and for different audiences. Identify and address impacts of designed services and products through global perspectives, such as patterns of inclusion and exclusion and effects on localized ecosystems.

Pathway Concept Area(s): 6D Critique & Prac in Design, 11 Intercultural&Global Aware.

Instructional Contact Hours: (3 Lec, 3 Crd)

ENGE 2524 - Exploring Service Learning Through STEAM/STEM Educational Outreach (3 credits)

Explore volunteerism, traditional service learning, critical service learning, and social change. Develop intercultural competence by examining social identities, power, and privilege with a focus on preK-12 education systems in the United States. Develop Science, Technology, Engineering, Arts, and Math (STEAM) and STEM educational outreach experiences that meet needs identified by community members in teams. Demonstrate career readiness through experiential learning. Pre: Sophomore standing.

Pathway Concept Area(s): 3 Reasoning in Social Sciences, 7 Identity & Equity in U.S., 11 Intercultural&Global Aware.

Instructional Contact Hours: (3 Lec, 3 Crd)

ENGE 2524H - Service Learning Edu. Outreach (3 credits)

Pathway Concept Area(s): 3 Reasoning in Social Sciences, 7 Identity & Equity in U.S., 11 Intercultural&Global Aware.

Instructional Contact Hours: (3 Lec, 3 Crd)

ENGE 2634 - Introduction to Restricted Research (1 credit)

Introduction to multi-disciplinary, team-based undergraduate engineering research. Emphasis on Department of Defense (DoD) and Intelligence Community missions and projects. Exposure to current restricted research performed around campus. Guest speakers from national labs. Engineering research methods (tools, research integrity/safety/ethics, and communication of results). Deep dive into International Traffic in Arms Regulations-restricted multi-disciplinary DoD engineering problems, potential careers, and security protocols surrounding restricted research and careers.

Instructional Contact Hours: (1 Lec, 1 Crd)

ENGE 2964 - Field Study (1-19 credits)

Instructional Contact Hours: Variable credit course

ENGE 2974 - Independent Study (1-19 credits)

Instructional Contact Hours: Variable credit course

ENGE 2984 - Special Study (1-19 credits)

I

Instructional Contact Hours: Variable credit course

ENGE 2984G - Special Study (1-19 credits)

Pathway Concept Area(s): 7 Identity & Equity in U.S.

Instructional Contact Hours: Variable credit course

ENGE 2984M - Special Study (1-19 credits)

Pathway Concept Area(s): 6A Critique & Practice in Arts

Instructional Contact Hours: Variable credit course

ENGE 2994 - Undergraduate Research (1-19 credits)

Instructional Contact Hours: Variable credit course

ENGE 3604 - Introductory Industry Design Experience (3 credits)

Workplace and industry culture and practice, including folkways, mores, and ethics, centered on engineering design. Interaction with industry professionals. Workplace competencies including effective teamwork, project management, presenting technical information. Training with software, tools and skills used in design practice in industry.

Prerequisite(s): ENGE 1215 and ENGE 1216

Instructional Contact Hours: (3 Lec, 3 Crd)

ENGE 3900 - Bridge Experience (0 credits)

Application of academic knowledge and skills to in a work-based experience aligned with post-graduation goals using research-based learning processes. Satisfactory completion of work-based experience often in the form of internship, undergraduate research, co-op, or study abroad; self-evaluation; reflection; and showcase of learning. Pre: Departmental approval of 3900 plan.

Instructional Contact Hours: (0 Crd)

ENGE 3984 - Special Study (1-19 credits)

Instructional Contact Hours: Variable credit course

ENGE 4094 - Startup: Commercialization of Innovation (3 credits)

Work in interdisciplinary teams in an experiential environment replicating modern innovation environments. Engage in real world innovation commercialization opportunities. Individual experiences and projects involving actual inventions, innovations, technologies, intellectual property (e.g. patents) and market opportunities. Integrate design thinking, scientists, entrepreneurs, advisors and other potential collaborators. Create a representation of a plan for a minimum viable product for an innovative product or service based on customer and market feedback.

Pathway Concept Area(s): 3 Reasoning in Social Sciences, 10 Ethical Reasoning

Instructional Contact Hours: (3 Lec, 3 Crd)

Course Crosslist: IDS 4094, MGT 4094

ENGE 4104 - Applied Explorations in Innovation (3 credits)

Work in interdisciplinary teams to scope and plan an open-ended design project focused on technology commercialization that addresses a need or problem. Model systems and products computationally and quantitatively to address issues of technical and market feasibility and to predict performance under uncertain conditions. Engage in iterative design process that combines computational and quantitative processes with user-centered design and market analysis. Produce viable design that includes technical specifications, market evaluation, and customer discovery results. Communicate with wide range of audiences. Analyze ethical and intercultural and global impacts of innovation. Pre: 3 credits of foundational quantitative and computational thinking.

Prerequisite(s): STS 2254 and ENGE 2094 and (MGT 4094 or ENGE 4094 or IDS 4094)

Pathway Concept Area(s): 5A Quant & Comp Thnk Adv., 6D Critique & Prac in Design, 10 Ethical Reasoning, 11 Intercultural&Global Aware.

Instructional Contact Hours: (3 Lec, 3 Crd)

ENGE 4735 - Interdisciplinary Design Capstone (3 credits)

Team-oriented, open-ended, interdisciplinary design projects focused on industrially relevant problems. A specific, complex engineering design problem taken from problem definition to product implementation and validation. 4735: Focus on problem identification, development of customer needs, project management, solution validation and selection, solution design, engineering teamwork, documentation and communication. 4736: Focus on design implementation, design validation, ethical and societal impacts of engineering design, communication and teamwork. Students majoring in Material Science and Engineering, Mechanical Engineering, Electrical and Computer Engineering, Industrial and Systems Engineering, and Biomedical Engineering must meet prerequisite and corequisite requirements for their respective in-major capstone courses.

[illegible]

ENGE 4736 - Interdisciplinary Design Capstone (3 credits)

Team-oriented, open-ended, interdisciplinary design projects focused on industrially relevant problems. A specific, complex engineering design problem taken from problem definition to product implementation and validation. 4735: Focus on problem identification, development of customer needs, project management, solution validation and selection, solution design, engineering teamwork, documentation and communication. 4736: Focus on design implementation, design validation, ethical and societal impacts of engineering design, communication and teamwork. Students majoring in Material Science and Engineering, Mechanical Engineering, Electrical and Computer Engineering, Industrial and Systems Engineering, and Biomedical Engineering must meet prerequisite and corequisite requirements for their respective in-major capstone courses.

Prerequisite(s): ENGE 4735

Corequisite(s): (MSE 4055 for MSE majors) or (ISE 4404 for ISE majors).

Pathway Concept Area(s): 1A Discourse Advanced, 10 Ethical Reasoning

Instructional Contact Hours: (3 Lec, 3 Crd)

ENGE 4964 - Field Study (1-19 credits)

Instructional Contact Hours: Variable credit course

ENGE 4974 - Independent Study (1-19 credits)

Instructional Contact Hours: Variable credit course

ENGE 4974H - Independent Study (1-19 credits)

Instructional Contact Hours: Variable credit course

ENGE 4984 - Special Study (1-19 credits)

Instructional Contact Hours: Variable credit course

ENGE 4994 - Undergraduate Research (1-19 credits)

Instructional Contact Hours: Variable credit course

ENGE 4994H - Undergraduate Research (1-19 credits)

Instructional Contact Hours: Variable credit course