ENGINEERING STUDIES

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Engineering is the application of math and science in the pursuit of solving problems. The field encompasses traditional understanding of engineers as builders, from the development of renewable energy technologies to the design of life saving medical devices. However, engineering extends beyond the creation of physical objects, and includes the development of systems, models, and algorithms designed to meet a specified need. Studying engineering at a liberal arts institution provides perspective on the development of technological innovations not in isolation but situated in a global context that requires an appreciation for human needs.

Overview of the Concentration

Completing this concentration in combination with a major in a natural science or math prepares students to pursue graduate work in engineering. The Engineering Studies curriculum provides students with the mathematical and analytical skills that constitute the foundations of engineering, supporting a wide array of fields including mechanical, electrical, civil, and environmental engineering. In addition, the concentration offers practical, applied skills such as working with laboratory instrumentation, design software, and/or fabrication techniques. There are a core set of courses in mathematics, chemistry, physics, and computer programming, and then a menu of electives that students can choose from in order to tailor their coursework to their Engineering interests.

Intended Learning Outcomes for the Concentration

Recommendations for Fields of Engineering

Beyond the core courses of the concentration, students are able to choose three elective courses. We recommend that students take one of the design courses as an elective if possible (PHYS 160: Introduction to Engineering Design or PHYS 360: Engineering Design Practicum), and otherwise choose electives that support their particular field of interest. Consider the recommendations below for courses to consider for different engineering subfields. Note that these are suggestions only, and seek out advice from the Engineering Studies Concentration Director if you have any questions.

Mechanical

- ENGR 261: Engineering Thermodynamics
- ENGR 365: Computer Aided Engineering
- PHYS 362: Materials

Civil

- PHYS 362: Materials
- ENGR 365: Computer Aided Engineering

Electrical

- PHYS 246: Electronics
- CSCI 241: Hardware Design
- PHYS 362: Materials

Environmental

- ENGR 261: Engineering Thermodynamics
- CHEM 382: Instrumental Analysis

Materials Science & Engineering

- PHYS 376: Quantum Mechanics (requires PHYS 244)
- PHYS 362: Materials (requires PHYS 244)
- CHEM 247: Organic Chemistry I (requires CHEM 125 and 126)

Chemical

- CHEM 382: Instrumental Analysis
- ENGR 261: Engineering Thermodynamics
- PHYS 362: Materials

Biomedical/Biotechnical

- BIO 243: Human Anatomy
- Depending on specific interest: PHYS 362, PHYS 246, ENGR 261

Requirements

Requirements for the Concentration

The engineering studies concentration requires the completion of a set of core mathematics and science courses (with an option for which Physics track to take) and the completion of three elective courses.

Code	Title	Credits
Core Courses		
MATH 119	Introduction to Calculus	1.00
or MATH 120	Calculus I	
MATH 126	Calculus II	1.00
MATH 220	Elementary Linear Algebra	1.00
MATH 226	Multivariable Calculus	1.00
MATH 230	Differential Equations I	1.00
CHEM 125	Structural Chemistry and Equilibrium	1.00
or CHEM 122	Introductory Chemistry	
Choose one of the following Physics tracks:		**2.00-3.00**
PHYS 124	Principles of Physics I	
PHYS 125	Principles of Physics II	
CSCI 121	Principles of Computer Science	
or CSCI 125	Computer Science for Scientists and Mathematicians	
OR		
PHYS 130	Analytical Physics I	
PHYS 131	Analytical Physics II	
Choose from the following elective courses to total 3.0 credits:		**3.00**
BIO 243	Human Anatomy and Physiology: Organs and Organ Systems	
or BIO 247	Animal Physiology	
CHEM 382	Instrumental Analysis	
CSCI 221	Introduction to Data Structures in C++	
or CSCI 241	Hardware Design	
or CSCI 251	Software Design and Implementation	
ENGR 261	Engineering Thermodynamics	

ENGR 290	Selected Topics in Engineering with Lab
ENGR 291	Selected Topics in Engineering
ENGR 360	Engineering Design Practicum
ENGR 365	Computer Aided Engineering
ENGR 390	Engineering Fellows I (0.50)
ENGR 391	Engineering Fellows II (0.50)
ENGR 398	Independent Research
PHYS 160	Introduction to Engineering Design
PHYS 246	Electronics
PHYS 362	Materials Engineering and Nanoscience
Total Credits	**11-12**

Courses

ENGR 261: *Engineering Thermodynamics*
Engineering Thermodynamics explores the relationship between energy, heat, and work. Students develop the analytical skills to model the movement of energy through a system. Major topics include the laws of thermodynamics, heat transfer processes, control volume analysis, engine cycles, gas and vapor power systems, and refrigeration and heat pump systems. These thermodynamic processes are fundamental to a wide variety of engineering fields. Offered annually.
Prerequisites: PHYS 130 and PHYS 131, or PHYS 124, PHYS 125, and CSCI 121 or CSCI 125; and MATH 126.

ENGR 290: *Selected Topics in Engineering with Lab*
Students engage in in-depth study of particular topics in engineering in a full-semester format. Topics are based on student interest and available staff. Potential course topics include Renewable Energy Systems, Fluid Dynamics, Signals and Systems, and Optics. This course includes weekly laboratory sessions. Offered periodically.
Prerequisites: PHYS 130 and PHYS 131 OR PHYS 124, PHYS 125, and CSCI 121 (or CSCI 125) and MATH 126 or equivalent.

ENGR 291: *Selected Topics in Engineering*
Students engage in in-depth study of particular topics in engineering in a full-term. Topics are based on student interest and available staff. Potential course topics include Renewable Energy Systems, Fluid Dynamics, Signals and Systems, and Optics. Offered periodically.
Prerequisites: PHYS 130 and PHYS 131 OR PHYS 124, PHYS 125, and CSCI 121 (or CSCI 125) and MATH 126 or equivalent.

ENGR 360: *Engineering Design Practicum*
This course gives students the opportunity to work on real world physics and engineering problems. Companies, non-profits, and other organizations provide projects relevant and important to the organizations' goals. Students work in teams to approach these projects from an engineering design perspective that emphasizes hands-on work, prototyping, and organizational skills. Offered annually during January Term.
Prerequisite: PHYS 244 or permission of the instructor.

ENGR 365: *Computer Aided Engineering*
How do we ensure complex structures don't fail? How can we model air flow around a wind turbine? How does heat get distributed as a rocket reenters the atmosphere? To solve real-world problems, computational tools are essential in the engineer's toolbox. Students will learn and apply numerical methods for interpolation, differentiation, integration, and solving ordinary and partial differential equations. After grasping these fundamentals, students will use finite element simulation software to model increasingly complex systems. Offered annually in the spring semester.
Prerequisites: PHYS 130, PHYS 131 (or PHYS 124, PHYS 125, and CSCI 121 or CSCI 125), MATH 226, MATH 230.

ENGR 390: *Engineering Fellows I (0.50)*
This is the first 0.5 credit course in a two course sequence that is part of the Engineering Fellows experience. Students engage in a team-based engineering design project alongside a domain expert within the St. Olaf Community. Students also participate in professional development activities in preparation for continuing in the field of engineering and engage in a community based activity to support youth interest in engineering. Open only to juniors and seniors.
Prerequisites: PHYS 130 and PHYS 131 (or PHYS 124, PHYS 125 and CSCI 121 or CSCI 125); PHYS 160 or permission of the instructor.

ENGR 391: *Engineering Fellows II (0.50)*
This is the second 0.5 credit course in a two course series that is part of the Engineering Fellows experience. Students engage in a team-based engineering design project alongside a domain expert within the St. Olaf Community. Students also participate in professional development activities in preparation for continuing in the field of engineering and engage in a community based activity to support youth interest in engineering.
Prerequisite: ENGR 390; Open only to juniors and seniors.

ENGR 398: *Independent Research*

Faculty

Program Director, 2025-2026
Brian Borovsky (on sabbatical Fall Semester/J-Term 2025-26)
Professor of Physics
surface science; friction and contact mechanics; micro/nanoscale applied physics

Interim Director, 2025-2026
Anne M. Gothmann
Associate Professor of Environmental Studies and Physics

Douglas J. Beussman
Professor of Chemistry
analytical area - mass spectrometry; chemical instrumentation; proteomics; forensic science; bioanalytical

Jason J. Engbrecht
Associate Provost; Professor of Physics
positron and antimatter physics; robotics

Eric L. Hazlett
Assistant Professor of Physics