Engineering (ENGR) - School of Engineering

School of Engineering, Department of Engineering
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Faculty from other departments and adjunct faculty from industry teach specialized courses.

The University of St. Thomas offers five tracks in engineering:
- A B.S. in electrical engineering
- A B.S. in mechanical engineering
- Dual degree programs with Business, Physics, and Computer and Information Sciences
- Pre-engineering program
- Minors in engineering

The mechanical and electrical engineering curricula combine the study of basic sciences, general engineering, and mechanical or electrical engineering with the study of the liberal arts. Emphasis is placed on applied engineering. Our mission states: "We provide an applied, values-based learning experience that produces well-rounded, innovative engineers and technology leaders who have the technical skills, passion and courage to make a difference."

Students graduating with a major in either mechanical or electrical engineering will meet the program objectives and outcomes designed to exceed the requirements of the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology's (ABET) *Engineering Criteria 2000.* These are comprehensive criteria designed to provide graduates with the technical, ethical, communications skills required to be a productive contributor to society and to aggressively seek life-long learning experiences. These program objectives and outcomes are designed to provide the graduate with a foundation for clear thinking and expression in a balanced liberal arts educational program. Graduates will demonstrate competence in a variety of skills that enhance their ability to solve problems in diverse ways to meet the needs of the global community. Graduates will also develop teamwork and communication skills while gaining a comprehensive understanding of the design process and engineering systems.

Graduates will be prepared for direct entry into an engineering position in industry or for advanced study in graduate school.

Degree in Electrical Engineering (B.S.E.E.)

The bachelor of science in electrical engineering (B.S.E.E.) curriculum includes courses in circuits and electronics, signal processing and control system design, digital electronics and microprocessors, and electromagnetic fields and waves with a focus on embedded system design. The electrical engineering program is academically rigorous, complemented with a full liberal arts curriculum. The B.S.E.E. program is accredited by the Engineering Accreditation Commission (EAC) of ABET.

Program outcomes and objectives may be found at: www.stthomas.edu/engineering.

Students must have completed ENGR 230 to be admitted to the major.

ENGR 150 Introduction to Engineering (1 credit)
ENGR 230 Digital Design (4 credits)
ENGR 240 Circuit Analysis (4 credits)
ENGR 330 Design with Microprocessors I (4 credits)
ENGR 331 Design with Microprocessors II (4 credits)
ENGR 340 Signals and Systems (4 credits)
ENGR 342 Electromagnetic Fields and Waves (4 credits)
ENGR 345 Electronics I (4 credits)
ENGR 346 Electronics II (4 credits)
ENGR 410 Control Systems and Automation (4 credits)
ENGR 431 Design of Embedded Systems (4 credits)
ENGR 480 Engineering Design Clinic I (4 credits)
ENGR 481 Engineering Design Clinic II (4 credits)

Plus eight credits of engineering electives:

Allied requirements

CISC 130 Introduction to Programming and Problem Solving in the Sciences (4 credits) *or* CISC 131 Introduction to Programming and Problem Solving (4 credits)

Note: CISC 130 is recommended for this major

MATH 113 Calculus I (4 credits)
MATH 114 Calculus II (4 credits)
MATH 200 Multi-Variable Calculus (4 credits)
MATH 210 Introduction to Differential Equations and Systems (4 credits)
PHYS 111 Introduction to Classical Physics I (4 credits)
PHYS 112 Introduction to Classical Physics II (4 credits)
PHYS 225 Applications of Modern Physics: From the Atom to the Diode (4 credits)
PHYS 341 Electricity and Magnetism (4 credits)

Degree in Mechanical Engineering (B.S.M.E.)

The bachelor of science in mechanical engineering (B.S.M.E.) is an applied-engineering program, blending theory and research with practical engineering fundamentals. The program is academically rigorous, complemented with a full liberal arts curriculum. The mechanical engineering curriculum provides a foundation in theoretical and applied mechanics, materials, electrical-electronic fundamentals, computer-aided design, automation systems, thermodynamics, heat transfer, fluid flow, manufacturing processes and practical design. The B.S.M.E. program is accredited by the Engineering Accreditation Commission (EAC) of ABET. Program outcomes and objectives may be found at: www.stthomas.edu/engineering.

Students must have completed ENGR 171 and 220 to be admitted to the major.

ENGR 150 Introduction to Engineering (1 credit)
ENGR 171 Engineering Graphics (4 credits)
ENGR 220 Engineering Mechanics I (4 credits)
ENGR 221 Engineering Mechanics II (4 credits)
ENGR 320 Machine Design and Synthesis (4 credits)
ENGR 350 Introduction to Electronics (4 credits)
ENGR 361 Engineering Materials (4 credits)
ENGR 371 Manufacturing Processes (4 credits)
ENGR 381 Thermodynamics (4 credits)
ENGR 382 Heat Transfer (4 credits)
ENGR 383 Fluid Mechanics (4 credits)
ENGR 410 Control Systems and Automation (4 credits)
ENGR 480 Engineering Design Clinic I (4 credits)
ENGR 481 Engineering Design Clinic II (4 credits)

Plus:
eight credits of ENGR electives

Allied requirements
CHEM 115 Accelerated General Chemistry (4 credits)
CISC 130 Introduction to Programming and Problem Solving in the Sciences (4 credits) *or* CISC 131 Introduction to Programming and Problem Solving (4 credits)
Note: CISC 130 is recommended for this major
MATH 113 Calculus I (4 credits)
MATH 114 Calculus II (4 credits)
MATH 200 Multi-Variable Calculus (4 credits)
MATH 210 Introduction to Differential Equations and Systems (4 credits)
PHYS 111 Introduction to Classical Physics I (4 credits)
PHYS 112 Introduction to Classical Physics II (4 credits)

Dual Degree in Mechanical Engineering (B.S.M.E.) and General Business Management (B.A.)

The dual degree program in mechanical engineering and general business management is designed for students with an interest in both engineering and business. The program combines the applied engineering concepts of mechanical engineering with knowledge of the financial, marketing and management disciplines of the business program. Students in this dual program will have skills to prepare them for a wide variety of opportunities in industry or advanced graduate education. The dual degree program requires approximately five years to complete. Upon completion, students receive a B.A. degree in business administration and a B.S.M.E. degree accredited by EAC of ABET.

ENGR 150 Introduction to Engineering (1 credit)
ENGR 171 Engineering Graphics (4 credits)
ENGR 220 Engineering Mechanics I (4 credits)
ENGR 221 Engineering Mechanics II (4 credits)
ENGR 320 Machine Design and Synthesis (4 credits)
ENGR 350 Introduction to Electronics (4 credits)
ENGR 361 Engineering Materials (4 credits)
ENGR 371 Manufacturing Processes and Statistical Methods(4 credits)
ENGR 381 Thermodynamics (4 credits)
ENGR 382 Heat Transfer (4 credits)
ENGR 383 Fluid Mechanics (4 credits)
ENGR 410 Control Systems and Automation (4 credits)
ENGR 480 Engineering Design Clinic I (4 credits)
ENGR 481 Engineering Design Clinic II (4 credits)

Plus:
eight credits of ENGR electives

Plus:
ACCT 210 Introduction to Financial Accounting (4 credits)
ACCT 215 Managerial Accounting (4 credits)

BETH 301 Business Ethics (4 credits)
BUSN 200 Business Learning Through Service (0 credit)
DSCI 310 Operations Management (4 credits)
FINC 321 Financial Management (4 credits)
MGMT 305 Management and Organizational Behavior (4 credits) (or BUSN 201 from previous semesters)
MGMT 480 Strategic Management (4 credits)
MKTG 300 Principles of Marketing (4 credits)

Plus four credits from the following:
BLAW 301 Legal Environment of Business (4 credits)
BLAW 302 Business Law for Accounting (4 credits)
BLAW 303 International Business Law (4 credits)

Allied requirements
CHEM 115 Accelerated General Chemistry (4 credits)
CISC 130 Introduction to Programming and Problem Solving in the Sciences (4 credits) *or* CISC 131 Introduction to Programming and Problem Solving (4 credits)
Note: CISC 130 is recommended for this major
COJO 105 Communications in the Workplace (4 credits)
ECON 251 Principles of Macroeconomics (4 credits)
ECON 252 Principles of Microeconomics (4 credits)
IDTH 220 Statistics (4 credits)
MATH 113 Calculus I (4 credits)
MATH 114 Calculus II (4 credits)
MATH 200 Multi-Variable Calculus (4 credits)
MATH 210 Introduction to Differential Equations and Systems (4 credits)
PHYS 111 Introduction to Classical Physics I (4 credits)
PHYS 112 Introduction to Classical Physics II (4 credits)

Dual Degree in Electrical Engineering (B.S.E.E.) and General Business Management (B.A.)

The dual degree program in electrical engineering and general business management is designed for students with an interest in both engineering and business. The program combines the applied engineering concepts of electrical engineering with knowledge of the financial, marketing and management disciplines of the business program. Students in this dual program will have skills to prepare them for a wide variety of opportunities in industry or advanced graduate education. The dual degree program requires approximately five years to complete. Upon completion, students receive a B.A. degree in business administration and a B.S.E.E. degree accredited by EAC of ABET.
ENGR 150 Introduction to Engineering (1 credit)
ENGR 230 Digital Design (4 credits)
ENGR 240 Circuit Analysis (4 credits)
ENGR 330 Design with Microprocessors I (4 credits)
ENGR 331 Design with Microprocessors II (4 credits)
ENGR 340 Signals and Systems (4 credits)
ENGR 342 Electromagnetic Fields and Waves (4 credits)
ENGR 345 Electronics I (4 credits)
ENGR 346 Electronics II (4 credits)
ENGR 410 Control Systems and Automation (4 credits)
ENGR 431 Design of Embedded Systems (4 credits)
ENGR 480 Engineering Design Clinic I (4 credits)
ENGR 481 Engineering Design Clinic II (4 credits)

Plus:
eight credits of ENGR electives

Plus:
ACCT 210 Introduction to Financial Accounting (4 credits)
ACCT 215 Managerial Accounting (4 credits)
BETH 301 Business Ethics (4 credits)
BUSN 200 Business Learning Through Service (0 credit)
DSCI 310 Operations Management (4 credits)
FINC 321 Financial Management (4 credits)
MGMT 305 Management and Organizational Behavior (4 credits) (or BUSN 201 from previous semesters)
MGMT 480 Strategic Management (4 credits)
MKTG 300 Principles of Marketing (4 credits)

Plus four credits from the following:
BLAW 301 Legal Environment of Business (4 credits)
BLAW 302 Business Law for Accounting (4 credits)
BLAW 303 International Business Law (4 credits)

Allied requirements
CISC 130 Introduction to Programming and Problem Solving in the Sciences (4 credits) *or* CISC 131 Introduction to Programming and Problem Solving (4 credits)
Note: CISC 130 is recommended for this major
COJO 105 Communications in the Workplace (4 credits)
ECON 251 Principles of Macroeconomics (4 credits)
ECON 252 Principles of Microeconomics (4 credits)
IDTH 220 Statistics (4 credits)
MATH 113 Calculus I (4 credits)
MATH 114 Calculus II (4 credits)
MATH 200 Multi-Variable Calculus (4 credits)
MATH 210 Introduction to Differential Equations and Systems (4 credits)
PHYS 111 Introduction to Classical Physics I (4 credits)
PHYS 112 Introduction to Classical Physics II (4 credits)
PHYS 225 Applications of Modern Physics: From the Atom to the Diode (4 credits)
PHYS 341 Electricity and Magnetism (4 credits)

Dual Degree in Electrical Engineering (B.S.E.E.) and Physics (B.A.)

The dual degree program in electrical engineering and physics is designed for students interested in combining lab skills and theory with engineering principles and practice. Students in this dual program will have skills to prepare them for a wide variety of opportunities in industry or advanced graduate education. The dual degree program requires approximately five years to complete. Upon completion, students receive a B.A. degree in physics and a B.S.E.E. degree accredited by EAC of ABET.
ENGR 150 Introduction to Engineering (1 credit)
ENGR 230 Digital Design (4 credits)
ENGR 240 Circuit Analysis (4 credits)
ENGR 330 Design with Microprocessors I (4 credits)
ENGR 331 Design with Microprocessors II (4 credits)
ENGR 340 Signals and Systems (4 credits)
ENGR 342 Electromagnetic Fields and Waves (4 credits)
ENGR 345 Electronics I (4 credits)
ENGR 346 Electronics II (4 credits)
ENGR 410 Control Systems and Automation (4 credits)
ENGR 431 Design of Embedded Systems (4 credits)
ENGR 480 Engineering Design Clinic I (4 credits)
ENGR 481 Engineering Design Clinic II (4 credits)

Plus:
four credits of ENGR electives

Plus:
PHYS 111 Introduction to Classical Physics I (4 credits)
PHYS 112 Introduction to Classical Physics II (4 credits)
PHYS 225 Applications of Modern Physics: From the Atom to the Diode (4 credits)
PHYS 341 Electricity and Magnetism (4 credits)

Plus:
four PHYS credits 104 or greater

Allied requirements
CISC 130 Introduction to Programming and Problem Solving in the Sciences (4 credits) *or* CISC 131 Introduction to Programming and Problem Solving (4 credits)
Note: CISC 130 is recommended for this major
MATH 113 Calculus I (4 credits)
MATH 114 Calculus II (4 credits)
MATH 200 Multi-Variable Calculus (4 credits)
MATH 210 Introduction to Differential Equations and Systems (4 credits)

Dual Degree in Electrical Engineering (B.S.E.E.) and CISC (B.A.)

The dual degree program in electrical engineering and CISC is designed for students interested in both hardware and software aspects of computing. Students in this dual program will have skills to prepare them for a wide variety of opportunities in industry or advanced graduate education. The dual degree program requires approximately five years to complete. Upon completion, students receive a B.A. degree in computer science and a B.S.E.E. degree accredited by EAC of ABET.
ENGR 150 Introduction to Engineering (1 credit)
ENGR 230 Digital Design (4 credits)
ENGR 240 Circuit Analysis (4 credits)
ENGR 330 Design with Microprocessors I (4 credits)

ENGR 331 Design with Microprocessors II (4 credits)
ENGR 340 Signals and Systems (4 credits)
ENGR 342 Electromagnetic Fields and Waves (4 credits)
ENGR 345 Electronics I (4 credits)
ENGR 346 Electronics II (4 credits)
ENGR 410 Control Systems and Automation (4 credits)
ENGR 431 Design of Embedded Systems (4 credits)
ENGR 480 Engineering Design Clinic I (4 credits)
ENGR 481 Engineering Design Clinic II (4 credits)

Plus:
CISC 130 Introduction to Programming and Problem Solving in the Sciences (4 credits) *or* CISC 131 Introduction to Programming and Problem Solving (4 credits)
Note: CISC 130 is recommended for this major
CISC 230 Object-Oriented Design and Programming (4 credits)
CISC 231 Data Structures Using Object-Oriented Design (4 credits)
CISC 320 Systems Analysis and Design I (4 credits)
CISC 450 Database Design I (4 credits)

Plus:
Eight credits from course numbers CISC 300 through 451
Four credits from course numbers CISC 100 through 499

Allied requirements
MATH 113 Calculus I (4 credits)
MATH 114 Calculus II (4 credits)
MATH 200 Multi-Variable Calculus (4 credits)
MATH 210 Introduction to Differential Equations and Systems (4 credits)
PHYS 111 Introduction to Classical Physics I (4 credits)
PHYS 112 Introduction to Classical Physics II (4 credits)
PHYS 225 Applications of Modern Physics: From the Atom to the Diode (4 credits)
PHYS 341 Electricity and Magnetism (4 credits)

Pre-Engineering

See *Pre-Professional Programs*

Minor in General Engineering

The general engineering minor provides a broad overview of topics in both electrical and mechanical engineering. It offers the opportunity to explore the field of engineering and provides an understanding of the technology of products and processes. It also strengthens pre-med and pre-law candidates who intend to pursue specialized areas such as biomechanics or patent law. This minor is not available for students majoring in electrical or mechanical engineering.
ENGR 150 Introduction to Engineering I (1 credit)
ENGR 171 Engineering Graphics (4 credits)
ENGR 230 Digital Design (4 credits)

Plus one of:
ENGR 220 Engineering Mechanics I (4 credits)
ENGR 240 Circuit Analysis (4 credits)
ENGR 330 Microprocessors (4 credits)
ENGR 381 Thermodynamics (4 credits)
Plus four additional credits of engineering (ENGR) classes

Minor in Mechanical Engineering

The mechanical engineering minor is designed for students with majors in the sciences, mathematics, electrical engineering, quantitative methods, and business. This minor serves those who plan to go on to graduate school in engineering and those entering business and industry. The engineering minor offers the opportunity to explore the field of engineering and provides an understanding of the technology of products and processes. It also strengthens pre-med and pre-law candidates who intend to pursue specialized areas such as biomechanics or patent law.

Sixteen credits from the following:
ENGR 123 Energy and the Environment (4 credits)
ENGR 171 Engineering Graphics (4 credits)
ENGR 220 Engineering Mechanics I (4 credits)
ENGR 221 Engineering Mechanics II (4 credits)
ENGR 225 Kinematics and Mechanism Design (4 credits)
ENGR 320 Machine Design and Synthesis (4 credits)
ENGR 328 Fuel Cell Engineering (4 credits)

ENGR 361 Engineering Materials (4 credits)
ENGR 371 Manufacturing Processes (4 credits)
ENGR 381 Thermodynamics (4 credits)
ENGR 382 Heat Transfer (4 credits)
ENGR 383 Fluid Mechanics (4 credits)
ENGR 385 Thermal Design (4 credits)
ENGR 410 Control Systems and Automation (4 credits)
ENGR 430 Applications of Thermodynamics (4 credits)
ENGR 440 Design with Plastics (4 credits)
ENGR 450 Vibration and Control Theory (4 credits)
ENGR 460 Engineering Economics and Project Management (4 credits)
ENGR 470 Fundamentals of Mechatronic Engineering I (4 credits)

The following two credit courses can be substituted for either ENGR 171 or 460.
ENGR 219 Case Studies in Engineering (2 credits)
ENGR 326 Fuel Cell Engineering (2 credits)

Minor in Electrical Engineering

The electrical engineering minor is designed for students with majors in the sciences, mathematics, mechanical engineering, quantitative methods, and business. This minor serves those who plan to go on to graduate school in engineering and those entering business and industry. The engineering minor offers the opportunity to explore the field of engineering and provides an understanding of the technology of products and processes. It also strengthens pre-med and pre-law candidates who intend to pursue specialized areas such as biomechanics or patent law.

Sixteen credits from the following:
ENGR 123 Energy and the Environment (4 credits)
ENGR 230 Digital Design (4 credits)
ENGR 240 Circuit Analysis (4 credits)
ENGR 330 Design with Microprocessors I (4 credits)
ENGR 331 Design with Microprocessors II (4 credits)
ENGR 340 Signals and Systems (4 credits)
ENGR 342 Electromagnetic Fields and Waves (4 credits)
ENGR 345 Electronics I (4 credits)
ENGR 346 Electronics II (4 credits)
ENGR 350 Introduction to Electronics (4 credits)
ENGR 410 Control Systems and Automation (4 credits)
ENGR 431 Design of Embedded Systems (4 credits)
ENGR 460 Engineering Economics and Project Management (4 credits)
ENGR 470 Fundamentals of Mechatronic Engineering I (4 credits)

ENGR 123 Energy and the Environment (4 credits)
The course examines the core concepts of energy and power technologies. A hands-on laboratory will examine how refrigerators, swamp coolers, motors, generators, car and jet engines work. The class covers how electricity from fossil fuels is generated and transported, and the status of the technology behind harnessing geothermal resources, solar panels, fuel cells, wind power, and biomass energy. Students will be introduced to the 1st and 2nd laws of thermodynamics, trade-off charts and the design process. The cultural, social, and economic impacts of energy production are discussed as well as their effects on the environment. This course fulfills the core-area in natural science in the Natural Science and Mathematical and Quantitative Reasoning requirement in the core curriculum.
Prerequisite: High school math and science

ENGR 150 Introduction to Engineering (1 credit)
This course focuses on design as the central activity of engineering. Students learn a disciplined approach to design through case studies and open ended design experiences.

ENGR 171 Engineering Graphics (4 credits)
Students will learn to read blueprints and working drawings and become familiar with computer-aided design (CAD) terminology and technology. Topics cover the elements of drafting including: the use of CAD modern software based on solid modeling; principles of projection; and introductory methods of representation and constructive geometry, working drawings, conventions and standards.

ENGR 219 Case Studies in Engineering (2 credits)
This course will introduce applications of the finite-element method for the solution of real-world problems. Commercial software (such as ANSYS) will be used to model structural, thermal, electro-magnetic, and fluid flow problems. Students will be introduced to "case studies" in engineering and the applied-sciences. Students will learn the art of FEA modeling and will present their findings in written reports.
Prerequisite: sophomore standing

ENGR 220 Engineering Mechanics I (4 credits)
Principles of statics and dynamics including such topics as equilibrium, friction, distributed forces, work, kinetics of particles and rigid bodies, and vibrations. Offered in fall semester.
Prerequisites: ENGR 171 and a minimum grade of C- in PHYS 111

ENGR 221 Engineering Mechanics II (4 credits)
Principles of deformable body mechanics including stress, strain, basic loading situations, transformations of stress and strain, beam theory, and energy methods. Offered in spring semester.
Prerequisite: A minimum grade of C- in ENGR 220

ENGR 225 Kinematics and Mechanism Design (2 credits)
Analysis and design of linkages and other mechanisms including geometry of motion and force distributions. Computer aided analysis and design tools are used as well as mathematical techniques. Offered in January term.
Prerequisite: A minimum grade of C- in ENGR 220

ENGR 230 Digital Design (4 credits)
Introduction to the design of digital logic. Topics include Boolean logic, design and optimization of combinational and sequential logic, the use of programmable logic devices, logic hazards, electronic implementation of logic gates. Students will be expected to specify, design, simulate, construct, and test digital circuits and document all phases of the process.

ENGR 240 Circuit Analysis (4 credits)
Introduction to linear circuit analysis and basic electronic instrumentation. Students will learn linear models of passive components and sources as well as how real components depart from those models. Circuit analysis techniques including nodal and mesh analysis, equivalence theorems and computer simulation will be covered. Laplace transform techniques will be used to examine sinusoidal steady state and transient circuit behavior.
Prerequisites: A minimum grade of C- in PHYS 112 and concurrent registration with or prior completion of MATH 210

ENGR 295, 296 Topics (2 credits)
ENGR 297, 298 Topics (4 credits)
The subject matter of these courses will vary from year to year, but will not duplicate existing courses. Descriptions of these courses are available in the Searchable Class Schedule on Murphy Online,
https://banner.stthomas.edu/pls/banner/prod/bwckschd.

ENGR 320 Machine Design and Synthesis (4 credits)
Focus is on advanced mechanics topics, failure theories (static and dynamic), and on an understanding of basic machine components. This course will develop the student's creative skills in conceptualizing machines to meet performance criteria by means of a design project. Machine designs will require the understanding and use of machine components such as springs, screws, bearings, basic 4-bar linkages, cams, and gears. Finally, a number of mini-labs/workshops on topics that support the design project such as dynamic analysis software, machine component design, and design for manufacture are given.
Prerequisite: A minimum grade of C- in ENGR 221

ENGR 326 Fuel Cell Engineering (2 credits)
A discovery-oriented class focused on fuel cell technology. Fuel cell types and their safety, cost and operation are examined. Time is spent on hydrogen generation, storage and distribution. The class examines how to collect new information, analyze it, and express an educated opinion about an emerging technology. Class time includes hands-on laboratories, as well as student-led discussion. The two-credit class does not require a formal design of experiment, and requires preparation for only one student-led lecture.
Prerequisite: Junior standing or consent of instructor

ENGR 328 Fuel Cell Engineering (4 credits)
A discovery-oriented class focused on fuel cell technology. Fuel cell types and their safety, cost and operation are examined. Time is spent on hydrogen generation, storage and distribution. The class examines how to collect new information, analyze it, and express an educated opinion about an emerging technology. Class time includes hands-on laboratories and projects as well as student-led discussion. The four-credit option requires a formal design of experiment and preparing for more than one student-led lecture.
Prerequisite: Junior standing or consent of instructor

ENGR 330 Design with Microprocessors I (4 credits)
Introduction to computer architecture and assembly language programming. Topics include I/O and memory addressing modes, communication and bus protocols, A/D and D/A conversion, interrupts and common microcontroller peripherals. Tradeoffs between architectures and design approaches will be discussed.
Prerequisites: A minimum grade of C- in ENGR 230 and CISC 130

ENGR 331 Design with Microprocessors II (4 credits)
A continuation of ENGR 330.
Prerequisite: A minimum grade of C- in ENGR 330

ENGR 340 Signals and Systems (4 credits)
To develop an understanding of the analysis of systems using Laplace, Fourier, and Z transforms, and an understanding of frequency domain characteristics, state space concepts, and modulation.
Prerequisites: A minimum grade of C- in ENGR 240 and MATH 210

ENGR 342 Electromagnetic Fields and Waves (4 credits)
A continuation of PHYS 341. An introduction to the practical consequences of Maxwell's equations including propagation, reflection and absorption of electromagnetic waves. Applications include antennas, waveguides, transmission lines, and shielding from electromagnetic interference.
Prerequisite: A minimum grade of C- in PHYS 341

ENGR 345 Electronics I (4 credits)
Analysis of electronic devices and circuits. Topics include linear and non-linear models of electronic devices, feedback and circuit design techniques. Applications include amplifiers, demodulation, oscillators, logic implementation.
Prerequisites: A minimum grade of C- in ENGR 240 and PHYS 225

ENGR 346 Electronics II (4 credits)
Continuation of ENGR 345.
Prerequisite: A minimum grade of C- in ENGR 345

ENGR 350 Introduction to Electronics (4 credits)
This course provides scientists and engineers with a background in electronics and electronic instrumentation. Topics include DC and AC circuit analysis, frequency response, filters, feedback, operational amplifiers, semiconductor devices, power supplies, oscillators, logic gates, codes for numbers and symbols, combinational and sequential digital logic design, timing, transducers, and analog-digital conversion. The course consists of lecture, demonstration, discussion, and laboratory.
Prerequisite: A minimum grade of C- in PHYS 112

ENGR 361 Engineering Materials (4 credits)
An introduction to materials and their properties. This course introduces students to the fundamentals of materials theory, properties and applications. Topics include properties and applications of metals, polymers, ceramics and composite materials. The course emphasizes characteristics of materials in manufacturing operations and service, including open-ended design issues.
Prerequisites: CHEM 115 or concurrent registration

ENGR 371 Manufacturing Processes and Statistical Control (4 credits)
This course covers such basic principles as metal forming, metal cutting, plastic molding, and continuous processes. Students will receive hands-on experience with modern production equipment. Students will learn statistical evaluation tools such as the meaning of population distributions, means, medians, regression analysis, and standard deviations. Statistical process control and acceptance testing in the context of modern manufacturing processes will be covered.

ENGR 381 Thermodynamics (4 credits)
A study of thermal and mechanical energy and their applications to technology. First law of thermodynamics (energy conservation); second law of thermodynamics (restrictions on energy transformations). Thermophysical properties of substances. Power producing devices and heat pumping devices. Humidity, dew point and other characteristics of non-reacting mixtures. Reacting mixtures (combustion of fuels).
Prerequisites: A minimum grade of C- in CHEM 111 or 115

ENGR 382 Heat Transfer (4 credits)
Introduction to the fundamentals of heat transfer in the context of engineering applications. The major topics to be covered include conduction, convection, and radiation. Students will solve steady and unsteady conduction heat transfer problems in both one-dimensional and multi-dimensional coordinate systems. Internal and external convection will be covered as well as heat exchangers and natural convection.
Prerequisite: Grades of C- or higher in ENGR 381 and MATH 210

ENGR 383 Fluid Mechanics (4 credits)
Introduction to the fundamentals of fluid mechanics in the context of engineering applications. Topics covered include hydrostatics and pressure variations in non-moving fluids, conservation laws of flowing fluids (mass, momentum, and energy), potential flow and viscous flow, boundary layer theory, internal flow, external flow, drag and lift. Also, the evaluation and design of turbomachinary and the use of pump/blower curves will be address. Use of advanced CFD software is integrated into the course.
Prerequisite: Grade of C- or higher in ENGR 382

ENGR 385 Thermal Design (2 credits)
Design of systems where the transfer of heat and/or the attainment of specific temperature levels are critical to the function of the system. Applications include heat exchangers, thermal climate control devices and a focused case study.
Prerequisite: A minimum grade of C- in ENGR 382

ENGR 410 Control Systems and Automation (4 credits)
An introduction to the scope of control systems in manufacturing and their implementation. The course focuses on analog and binary control loop theory, the use of transforms (Laplace and Z) to describe and solve analog control systems, and the use of Boolean algebra to describe and solve binary control systems. Simulation is emphasized as an important tool for plant design, layout and optimizing manufacturing methods.
Prerequisites: A minimum grade of C- in ENGR 340 or 350, CISC 130, MATH 210

ENGR 420 Rapid Product Realization (4 credits)
Provides a basic understanding of computer-aided design and manufacturing (CAD/CAM) systems in modern manufacturing operations. Topics covered include solid modeling, computer simulation, and implementation of CAD/CAM systems.
Prerequisites: A minimum grade of C- in ENGR 171 and junior standing

ENGR 430 Applications of Thermodynamics (4 credits)
Introduction to principle industrial applications of thermodynamics. The course will cover theory of operation, economics, and design considerations of these systems as well as examples of thermodynamic engineering design. Topics include heating, ventilation, and air conditioning systems (HVAC), engines, refrigeration technologies, reacting mixtures, and turbomachinery.
Prerequisite: A minimum grade of C- in ENGR 381

ENGR 431 Design of Embedded Systems (4 credits)
Advanced interfacing and programming of microprocessor systems. Applications include machine control, digital signal processing, and real time communications. Students will design microprocessor based systems as part of this course.
Prerequisite: A minimum grade of C- in ENGR 331

ENGR 440 Design with Plastics (4 credits)
The student will learn about the most common plastic compositions in industry along with their respective applications; understand the difference between injection and vacuum molding and what to look for using either; be able to match plastics with molding technology; learn about environmental and recycling issues surrounding the plastics industry.
Prerequisites: A minimum grade of C- in ENGR 171 and 361

ENGR 450 Vibration and Control Theory (4 credits)
This course offers fundamentals in the theory of vibrations and control of mechanical systems. The topics related to vibration include undamped and damped free vibration, forced vibration or continuous systems. The topics related to control theory include modeling of dynamic systems (mechanical, electrical, hydraulic, pneumatic and thermal), analysis of continuous time and discrete time systems, feedback control systems, and graphical design methods.
Prerequisite: A minimum grade of C- in ENGR 410

ENGR 460 Engineering Economics and Project Management (4 credits)
A practical look at the daily activities (including cost analysis and scheduling) and challenges of project managers in an engineering setting including the future supply and demand of critical materials. Significant time will be devoted to personnel related topics such as conflict resolution, time management and leadership.
Prerequisite: Junior standing

ENGR 470 Fundamentals of Mechatronic Engineering (4 credits)
Introduction to basic electronic devices and microprocessor systems for measurement and control; electronic circuits; amplifiers; filters; logic gates and sequential logic applications: A/D and D/A conversion and interfacing; transducers; controllers; motors and actuators; microprocessor fundamentals and programming; data acquisition and feedback control.
Prerequisite: A minimum grade of C- in ENGR 410

ENGR 475, 476 Experiential Learning (2 credits)
ENGR 477, 478 Experiential Learning (4 credits)
See the description of these courses at the beginning of the "Curricula" section of this catalog.

ENGR 480 Engineering Design Clinic I (4 credits)
Serves as the first capstone course. Student design teams, under the direction of a faculty coordinator, will develop engineering solutions to practical, open-ended design projects conceived to demonstrate the value of prior basic science and engineering courses. Ethical, social, economic and safety issues in engineering practice will be considered as well.
Prerequisites: Either (ENGR 320 and 382) or (ENGR 331, 346, and 410)

ENGR 481 Engineering Design Clinic II (4 credits)
The final capstone course for the application of previously learned engineering principles to the solution of real problems in an actual industrial setting. Student design teams will work under the direction of faculty advisers and industry liaisons. Opportunity will be provided for objective formulation, analysis, synthesis/build and evaluation/test of alternative solutions.
Prerequisite: ENGR 480

ENGR 483, 484 Seminar (2 credits)
ENGR 485, 486 Seminar (4 credits)
See the description of these courses at the beginning of the "Curricula" section of this catalog.

ENGR 487, 488 Topics (2 credits)
ENGR 489, 490 Topics (4 credits)
The subject matter of these courses will vary from year to year, but will not duplicate existing courses. Descriptions of these courses are available in the Searchable Class Schedule on Murphy Online,
https://banner.stthomas.edu/pls/banner/prod/bwckschd.

ENGR 491, 492 Research (2 credits)
ENGR 493, 494 Research (4 credits)
See the description of these courses at the beginning of the "Curricula" section of this catalog.

ENGR 495, 496 Individual Study (2 credits)
ENGR 497, 498 Individual Study (4 credits)
See the description of these courses at the beginning of the "Curricula" section of this catalog.

English (ENGL)

College of Arts and Sciences, Department of English
John Roach Center for the Liberal Arts (JRC) 333, (651) 962-5600
Scheiber (chair), An, Batt, Bouwman, Callaway, Chowdhury, Craft-Fairchild, Easley, Garritano, Hallman, Herrera, Jordan, Lai, Larson, Lawrence, Li, MacKenzie, Mikolajczak, Miller, Muse, Otto, Piorkowski, Powell, Redshaw, Scheurer, Warren, Wilkinson

The mission of the University of St. Thomas English Department is to foster empathy and imagination, critical insight, power of expression, and appreciation for the variety of human experience. We strive to create a community of readers and writers who value both tradition and innovation, and who understand literary art as a medium of moral reflection as well as aesthetic pleasure.

The Department of English offers three emphases.
1. The general major that allows students to take a variety of literature courses and to incorporate writing and cultural studies into their programs.
2. The writing emphasis that combines a foundation of literary study with a sequence of writing courses focused on poetry, fiction, and literary nonfiction, or on a range of nonfiction prose forms, including analytical, persuasive, and academic writing.
3. The Minnesota teacher licensure program in Communication Arts and Literature that prepares students for teaching middle and secondary school. This program requires courses in linguistics, literature, writing, and writing pedagogy. It requires, therefore, early and careful planning. Students completing this program may complete a major in English.

Students graduating with a major in English will be able to write thoughtfully about literature and life, in forms that range from engaged responses, to close readings of primary texts, to critical papers using secondary resources. They will understand and practice writing as a process that involves substantial revision and be able to reflect thoughtfully upon the writing process that works best for them. They will be able to read sophisticated literary works with imagination and intelligence and will be able to respond critically to their empathic, ethical, and aesthetic dimensions.

The Major in English, the Major in English with writing emphasis, and the Major in English with a teacher education emphasis (5-12) consist of 44-credits each. ENGL 111 and 112 students fulfill any of these majors by taking thirty-six additional upper-level credits, while ENGL 190 students fulfill any of these majors by taking forty additional upper-level credits.

The department offers courses for non-majors to fulfill the Literature and Writing component of the core curriculum and the Human Diversity requirement.

English majors and minors are encouraged to study abroad. Specific courses taken abroad may substitute for St. Thomas requirements. See the Chair of the department, a study abroad advisor in the International Education Center, or Academic Information & Programs in the front section of this catalog for program options.

English Honor Society
Sigma Tau Delta, the national English honor society, formed a chapter at St. Thomas in 1988. The honor society brings together students and faculty with a love of literature, language and writing; it sponsors a variety of scholarships, holds regional and national conventions, and provides a forum for both creative and critical writing. Students who have a grade point average of at least 3.0 in English courses, rank at least in the highest 35 percent of their class in general scholarship, and have completed at least three semesters of college are eligible to apply for membership.