

Engineering

483, 484, 485, 486 Seminar

See the description of these courses at the beginning of the “Departments and Curricula” section of this catalog.

487, 488, 489, 490 Topics

The subject matter of these courses, announced in the annual *Class Schedule*, will vary from year to year, but will not duplicate existing courses. See the description of these courses at the beginning of the “Departments and Curricula” section of this catalog.

491, 492, 493, 494 Research

See the description of these courses at the beginning of the “Departments and Curricula” section of this catalog.

495, 496, 497, 498 Individual Study

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Engineering (ENGR)

Bennett (chair), Jalkio, Kumar, Zimmerman

Faculty from other departments and adjunct faculty from industry teach specialized courses.

The University of St. Thomas offers two tracks in engineering:

- A program in mechanical engineering
- A pre-engineering program.

Engineering

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, following Accreditation Board for Engineering and Technology (ABET) guidelines and complemented with a full liberal arts curriculum.

The mechanical engineering curriculum combines the study of basic sciences, general engineering, design engineering and mechanical engineering with the study of the liberal arts. Emphasis is placed on applied engineering.

The curriculum provides for a foundation in: theoretical and applied mechanics, materials, electrical-electronic fundamentals, computer-aided design and manufacturing, automation systems, thermodynamics heat transfer/fluid flow, manufacturing processes and practical design.

It is designed to develop a student's teamwork and communication skills while also providing comprehensive understanding of the design/manufacturing system.

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

Pre-Engineering

See Pre-Professional Programs

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

150 Introduction to Engineering I (0 credit)

151 Introduction to Engineering II (0 credit)

171 Engineering Graphics

220 Engineering Mechanics I

221 Engineering Mechanics II

350 Electrical Engineering Principles

360 Manufacturing Processes

370 Engineering Materials

381 Thermodynamics

382 Heat Transfer and Fluid Flow

410 Control Systems and Automation

480 Engineering Design Clinic I

481 Engineering Design Clinic II

Plus three of:

351 Electronic Instrumentation and Control Laboratory

390 Packaging Fundamentals

420 Rapid Product Realization

430 Applications of Thermodynamics

440 Design with Plastics

450 Vibration and Control Theory

Engineering

- 460 Engineering Economics and Project Management
- 470 Mechatronics I
- 497 Directed Studies in Engineering
- 498 Directed Studies in Engineering

Allied Requirements:

- CHEM 111 General Chemistry I
- MATH 113 Calculus I
- MATH 114 Calculus II
- MATH 200 Multi-Variable Calculus
- MATH 210 Linear Algebra and Differential Equations
- MATH 303 Statistics for the Applied Sciences
- PHYS 111 Introduction to Classical Physics I
- PHYS 112 Introduction to Classical Physics II
- QMCS 130 Problem Solving in the Natural Sciences

Concentration in Manufacturing

- 150 Introduction to Engineering I (0 credit)
- 151 Introduction to Engineering II (0 credit)
- 171 Engineering Graphics
- 220 Engineering Mechanics I
- 221 Engineering Mechanics II
- 300 Manufacturing Management Systems I
- 350 Electrical Engineering Principles
- 360 Manufacturing Processes
- 370 Engineering Materials
- 381 Thermodynamics
- 382 Heat Transfer and Fluid Flow
- 410 Control Systems and Automation
- 480 Engineering Design Clinic I
- 481 Engineering Design Clinic II

Plus two of:

- 310 Manufacturing Management Systems II
- 351 Electronic Instrumentation and Control Laboratory
- 390 Packaging Fundamentals
- 420 Rapid Product Realization
- 497 Directed Studies in Engineering
- 498 Directed Studies in Engineering

Allied requirements:

- CHEM 111 General Chemistry I
- MATH 113 Calculus I
- MATH 114 Calculus II
- MATH 200 Multi-Variable Calculus
- MATH 210 Linear Algebra and Differential Equations
- MATH 303 Statistics for the Applied Sciences
- PHYS 111 Introduction to Classical Physics I
- PHYS 112 Introduction to Classical Physics II
- QMCS 130 Problem Solving in the Natural Sciences

Concentration in Mechatronics

- 150 Introduction to Engineering I (0 credit)
- 151 Introduction to Engineering II (0 credit)
- 171 Engineering Graphics
- 220 Engineering Mechanics I
- 221 Engineering Mechanics II
- 350 Electrical Engineering Principles
- 360 Manufacturing Processes
- 370 Engineering Materials
- 381 Thermodynamics
- 382 Heat Transfer and Fluid Flow
- 410 Control Systems and Automation
- 460 Engineering Economics and Project Management
- 470 Mechatronics I
- 480 Engineering Design Clinic I
- 481 Engineering Design Clinic II

Engineering

Plus one of:

- 430 Applications of Thermodynamics
- 450 Vibration and Control Theory
- 497 Directed Studies in Engineering
- 498 Directed Studies in Engineering

Allied requirements:

- CHEM 111 General Chemistry I
- MATH 113 Calculus I
- MATH 114 Calculus II
- MATH 200 Multi-Variable Calculus
- MATH 210 Linear Algebra and Differential Equations
- MATH 303 Statistics for the Applied Sciences
- PHYS 111 Introduction to Classical Physics I
- PHYS 112 Introduction to Classical Physics II
- QMCS 130 Problem Solving in the Natural Sciences

Minor in Engineering

- 150 Introduction to Engineering I (0 credit)
- 151 Introduction to Engineering II (0 credit)
- 171 Engineering Graphics
- 360 Manufacturing Processes

Plus two of the following:

- 220 Engineering Mechanics I
- 221 Engineering Mechanics II
- 300 Manufacturing Management Systems
- 350 Electrical Engineering Principles
- 370 Engineering Materials
- 381 Thermodynamics
- 382 Heat Transfer and Fluid Flow
- 410 Control Systems and Automation

150 Introduction to Engineering I **0 credit**

This course introduces students to engineering fields, practicing engineers and hands-on engineering work. As they become acquainted with engineering occupations and experience their potential for creativity and fun, students will understand the value and applications of the required curriculum and be motivated and stimulated to pursue further engineering studies. Offered in fall semester.

151 Introduction to Engineering II **0 credit**

Continuation of 150. Offered in spring semester.

171 Engineering Graphics

Students will learn to read blueprints and working drawings and become familiar with computer-aided design (CAD) terminology and technology. Topics include the elements of drafting, including: the use of CAD software; principles of projection; and introductory methods of representation and constructive geometry, working drawings, conventions and standards.

220 Engineering Mechanics I

This fundamental course addresses the essential engineering principles of statics, dynamics and deformable body mechanics. Offered in fall semester.

Prerequisite: MATH 114 and PHYS 111 (or concurrent registration in PHYS 111)

221 Engineering Mechanics II

Continuation of 220. Offered in spring semester.

Prerequisite: 220

295, 296, 297, 298 Topics

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300 Manufacturing Management Systems I

Introduces engineering students to the basic management and economic concepts useful to practicing engineers working in manufacturing settings. This course covers basic principles of management, work design, work measurement, incentive plans, managing for quality, statistical quality control, manufacturing cost concepts and engineering economics. Offered in fall semester.

Prerequisite: MATH 303 or permission of instructor

310 Manufacturing Management Systems II

Introduces engineering students to manufacturing strategy and its relationship to the design of facilities, production systems and systems of management, planning and control. This course covers manufacturing strategy, basic types of production systems (such as job shop and assembly line), facility location, facility layout, materials handling systems, material management, inventory control, production planning and control, material requirements planning, the Just-In-Time philosophy, capacity planning and project management.

Prerequisite: 300 or consent of instructor

350 Electrical Engineering Principles

Provides students with the ability to work with electronics-based measurement and control systems used in modern manufacturing. Fundamental topics include linear DC and AC circuit concepts and theorems, analog circuits based on operational amplifiers and digital logic circuits based on Boolean elements. Students will gain an understanding of electronics-based measurement systems. Offered in fall semester.

Prerequisite: PHYS 112

351 Electronic Instrumentation and Control Laboratory

Provides an understanding of the fundamentals of electrical engineering. The course covers principles and applications of transducers, instrumentation systems, amplifiers and signal conditioners, impedance matching, frequency, time response and elementary feedback systems.

Prerequisite: 350

360 Manufacturing Processes

Provides an understanding of the fundamental technologies of manufacturing processes. This course covers such basic principles of manufacturing processes as casting, heat treating, metal cutting, plastic molding and continuous processes. Offered in spring semester.

370 Engineering Materials

An introduction to materials and their properties. This course introduces the spectrum of materials in manufacturing and relates their properties to atomic structure. Topics include properties and applications of metals, polymers, ceramics and composite materials. The course emphasizes characteristics of materials in manufacturing operations and service. Offered in spring semester.

Prerequisites: CHEM 111, PHYS 111

381 Thermodynamics

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: PHYS 112, MATH 114

382 Heat Transfer and Fluid Flow

Modes of heat transfer: convection, conduction, and radiation. Coupling of convective heat transfer with fluid flow. Fundamentals of fluid flow: statics, boundary layers, pipe flows, pressure drop, and friction factor. Convective heat transfer at external surfaces and internal surfaces. Fluid-to-fluid heat exchangers and their design. Conduction in solids of various shapes; use of heat-conducting fins to improve the performance of heat exchangers. Radiation heat transfer between surfaces.

Prerequisite: 381

390 Packaging Fundamentals

Provides the student with firsthand knowledge of packaging principles and processes as they apply to the manufacturing operation. The course covers the functions of packaging, major materials used in packaging and their properties and package-forming processes. Students will do hands-on work in package assembly and produce a computer-designed package as part of their lab work.

Prerequisite: Junior standing or consent of instructor

410 Control Systems and Automation

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.

Prerequisite: 350, MATH 210

420 Rapid Product Realization

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.

Prerequisite: 171 and junior standing

Engineering

430 Applications of Thermodynamics

Introduction to principle industrial applications of thermodynamics. The course will cover theory of operation and design considerations of these systems as well as examples of thermodynamic engineering design. Topics include heating, ventilation, and air conditioning systems (HVAC), engines, and turbomachinery.

Prerequisite: 382

440 Design with Plastics

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.

Prerequisite: 171, 370

450 Vibration and Control Theory

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: 410

460 Engineering Economics and Project Management

A practical look at the daily activities (including cost analysis and scheduling) and challenges of project managers in an engineering setting. Significant time will be devoted to personnel related topics such as conflict resolution, time management and leadership.

470 Fundamentals of Mechatronic Engineering I

Introduction to basic electronic devices and microprocessor systems for measurements 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: 410

475, 476, 477, 478 Experiential Learning

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480 Engineering Design Clinic I

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.

Prerequisite: senior standing and permission of instructor

481 Engineering Design Clinic II

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 and evaluation of alternative solutions.

Prerequisite: 480

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