MECHANICAL ENGINEERING TECHNOLOGY

Mechanical engineering technology (MET) is the component of engineering that specializes in design and application. MET includes the broad areas of mechanical design, mechanical power and manufacturing. Mechanical engineering technology is applied in mechatronics, robotics, automotive manufacturing, computer-aided drafting and design, computer-aided manufacturing, agricultural machinery and processing, mining, shipbuilding, spacecraft, electronics manufacturing, food processing, aircraft metals and plastics production—nearly the entire spectrum of the industry. In the power areas, MET graduates are involved in vapor power cycles, gas power cycles, air conditioning, fluid power and power transmission. Manufacturing areas involving MET graduates include tool design, cost evaluation and control, plant operations, production planning and manufacturing methods.

An important element in MET is the use of laboratory experience as a teaching tool. The MET program has laboratories in fluid power, materials, fluid mechanics and applied thermal sciences, basic instrumentation, computer-aided design (CAD), and manufacturing (CAM). A senior capstone design course, composed of student teams, integrates the knowledge and skills learned during their course of study. Laboratories are equipped with the latest computer software that supports the design function. Where appropriate, laboratories with modern computer data acquisition systems and on-screen displays are available.

In addition to the required mechanical engineering technology courses, students are provided a solid foundation in algebra, trigonometry and calculus, physics, chemistry, statics, dynamics, instrumentation, thermodynamics, computer science and entrepreneurship (as a minor).

Program Educational Objectives

A few years after graduation, OSU Mechanical Engineering Technology graduates will have the capability to:

1. Be employed in a technical or management position where the skills and knowledge of mechanical engineering technology are utilized.
2. Effectively apply engineering principles and technical knowledge to industrial problems.
3. Work proactively and productively to create value as both members and leaders of teams.
4. Communicate effectively in written, oral and graphical form.
5. Continue life-long learning by bringing new technology into their workplace, through participation and membership in professional organizations and/or through the continuation of professional studies.

Student Outcomes. Students graduating from the MET program are expected to achieve the following student outcomes (a-k):

a. an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities;

b. an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies;

c. an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes;

d. an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives;

e. an ability to function effectively as a member or leader on a technical team;

f. an ability to identify, analyze, and solve broadly-defined engineering technology problems;

g. an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature;

h. an understanding of the need for and an ability to engage in self-directed continuing professional development;

i. an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity;

j. a knowledge of the impact of engineering technology solutions in a societal and global context; and

k. a commitment to quality, timeliness, and continuous improvement.

Preparation for a specific industrial function is accomplished by selecting courses that emphasize a given design area, such as fluid power, mechanical design, computer-aided design (CAD) power generation, and air conditioning and heating. Because the program focuses on the application of engineering principles to the pragmatic solution of problems, graduates are immediately productive with minimal on-the-job training, thus increasing their value to industry. Graduates of the MET program are prepared to function in the areas of product design, testing and evaluation; product application and maintenance field engineering; and technical sales and liaison. Industries employing MET graduates include manufacturing companies of all types (aircraft, automobile, compressor and turbine, fluid power manufacturers and others); energy companies (such as natural gas, electrical power generation, and the oil and gas industries); and service companies (transportation industry, architecture and professional engineering firms, and those supporting the oil and gas industry).

Companies utilizing the talents of MET graduates are diversified in their products, as well as geographical location, thus providing a variety of choices in respect to both type of work and place of residence and in diverse industrial, governmental and educational institutions.

## Courses

**MET 1103 Introduction to Mechanical Engineering Technology**

**Description:** Introduction to mechanical engineering technology, analytical techniques, and data presentation. Orientation to the mechanical engineering technologist’s profession. Previously offered as MPT 1103.

**Credit hours:** 3  
**Contact hours:** Lecture: 2 Lab: 2  
**Levels:** Undergraduate  
**Schedule types:** Lab, Lecture, Combined lecture and lab  
**Department/School:** Engineering Technology

**MET 1123 Technical Drawing and Basic CAD**

**Description:** Sketching, manual drafting and CAD generation of engineering drawings to ANSI standards. Interpreting typical industrial drawings. Students with two years high school or one year practical ANSI drafting/CAD may substitute an advanced course in mechanical engineering technology with consent of their advisers. Previously offered as GENT 1153.

**Credit hours:** 3  
**Contact hours:** Lecture: 3  
**Levels:** Undergraduate  
**Schedule types:** Lecture  
**Department/School:** Engineering Technology

**MET 1213 Manufacturing Processes**

**Description:** Basic methods and processes of fabrication with emphasis on manufacturing operations, metrology and conventional machining. Previously offered as GENT 1223.

**Credit hours:** 3  
**Contact hours:** Lecture: 2 Lab: 2  
**Levels:** Undergraduate  
**Schedule types:** Lab, Lecture, Combined lecture and lab  
**Department/School:** Engineering Technology

**MET 2103 Industrial Materials**

**Prerequisites:** CHEM 1314 or CHEM 1215 or CHEM 1414.  
**Description:** A survey of the properties, characteristics and applications of metals, polymers, ceramics and other industrial materials. Terminology, concepts and principles involved in material selection, specification and processing. Laboratory activities include data collection and report generation, determination of material properties, and evaluation of material characteristics. Previously offered as GENT 1103.

**Credit hours:** 3  
**Contact hours:** Lecture: 3  
**Levels:** Undergraduate  
**Schedule types:** Lecture  
**Department/School:** Engineering Technology

**MET 2223 Intermediate Mechanical Computer-Aided Design**

**Prerequisites:** A grade of "C" or better in GENT 1153 or MET 1123.  
**Description:** Computer-aided design (CAD) generation of engineering drawings including three-dimensional product design and modeling. Previously offered as MET 1223.

**Credit hours:** 3  
**Contact hours:** Lecture: 3  
**Levels:** Undergraduate  
**Schedule types:** Lecture  
**Department/School:** Engineering Technology

**MET 2313 Fundamentals of Hydraulic Fluid Power**

**Prerequisites:** PHYS 1114 or PHYS 2114.  
**Description:** Basic fluid power concepts. Standard hydraulic symbols, component design and application, fluid power system considerations, design and operation. Previously offered as MPT 2313.

**Credit hours:** 3  
**Contact hours:** Lecture: 2 Lab: 2  
**Levels:** Undergraduate  
**Schedule types:** Lab, Lecture, Combined lecture and lab  
**Department/School:** Engineering Technology

**MET 3003 Dynamics**

**Prerequisites:** A grade of "C" or better in GENT 2323 or ENSC 2113.  
**Description:** Plane motion of particles and rigid bodies. Force-acceleration, work-energy, and impulse-momentum principles. Graphical analysis, mechanisms and vibrations.

**Credit hours:** 3  
**Contact hours:** Lecture: 3  
**Levels:** Undergraduate  
**Schedule types:** Lecture  
**Department/School:** Engineering Technology

**MET 3113 Basic Instrumentation**

**Prerequisites:** MATH 2123 or MATH 2144, and PHYS 1214 or PHYS 2114 and a grade of "C" or better in GENT 3323 or ENSC 2143.  
**Description:** Data analysis. Theory, operational characteristics and application of transducers for measurement of strain, force, velocity, acceleration, displacement, time, frequency, temperature, pressure. Previously offered as MPT 3114.

**Credit hours:** 3  
**Contact hours:** Lecture: 2 Lab: 2  
**Levels:** Undergraduate  
**Schedule types:** Lab, Lecture, Combined lecture and lab  
**Department/School:** Engineering Technology

**MET 3313 Applied Fluid Mechanics**

**Prerequisites:** MATH 2123 or MATH 2144, and PHYS 1114 or PHYS 2114 and a grade of "C" or better in GENT 2323 or ENSC 2113.  
**Description:** Practical analysis of fluid systems including static forces, the Bernoulli and general energy equations, laminar and turbulent flows, measurements of flow and pressure, lift and drag, pumps, and fans. Previously offered as MPT 3313.

**Credit hours:** 3  
**Contact hours:** Lecture: 3  
**Levels:** Undergraduate  
**Schedule types:** Lecture  
**Department/School:** Engineering Technology

**MET 3343 Physical Metallurgy**

**Prerequisites:** A grade of "C" or better in MET 2103.  
**Description:** Analysis and evaluation of the properties of metals commonly used in product design. Property change caused by hot and cold working, and by heat treatment. Laboratory activities including metallographic specimen preparation, inspection and testing; and standard tests of tensile properties, hardenability, hardness and toughness. Previously offered as MFGT 3343.

**Credit hours:** 3  
**Contact hours:** Lecture: 2 Lab: 2  
**Levels:** Undergraduate  
**Schedule types:** Lab, Lecture, Combined lecture and lab  
**Department/School:** Engineering Technology
MET 3413 Fundamentals of Pneumatic Fluid Power
Prerequisites: A grade of "C" or better in MET 2313.
Description: Basic pneumatics concepts, gas laws, component design and application, system design considerations. Air logic. Previously offered as MPT 2413.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Engineering Technology

MET 3423 Intermediate Hydraulic Fluid Power
Prerequisites: A grade of "C" or better in MET 2313.
Description: Review of fundamentals of hydraulic fluid power. Energy-efficient hydraulic systems, cartridge valves, dynamics of hydraulic systems, special topics associated with mobile hydraulic equipment.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Engineering Technology

MET 3433 Basic Thermodynamics
Prerequisites: MATH 2123 or MATH 2144 and PHYS 1114 or PHYS 2014.
Description: Basic scientific principles of energy and the behavior of substances as related to engines and systems. Gas laws, vapors and engine cycles. Previously offered as MPT 3433 and GENT 3433.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Engineering Technology

MET 3573 Advanced Production Processes
Prerequisites: Grade "C" or better in (GENT 1223 or MET 1213) and (MET 1223 or MET 2223).
Description: Advanced manufacturing and production processes including polymers and plastics, powder metallurgy, foundry, welding and metal forming. Design for assembly (FDA) and design for manufacture (FDM). Previously offered as MFGT 3573.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Engineering Technology

MET 4013 Parametric Computer-Aided Modeling
Prerequisites: A grade of "C" or better in MET 1223.
Description: Computer-aided drafting and design using parametric, feature-based solid modeling techniques.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Engineering Technology

MET 4023 Advanced Mechanical Computer-Aided Design
Prerequisites: A grade of "C" or better in MET 1223 or MET 2223.
Description: Computer-aided design methodologies and processes. State-of-the-art technologies and methodologies in 3D modeling and design processes.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Engineering Technology

MET 4033 Applied Vibration and Acoustics
Prerequisites: Grade "C" or better in GENT 3323.
Description: Free and forced vibration of mechanical systems with an emphasis on practical applications. Introduction to sound wave generation and propagation. Mechanical system design methods for noise and vibration mitigation.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Engineering Technology

MET 4050 Advanced Mechanical Design
Prerequisites: Junior standing and consent of instructor.
Description: Special problems in mechanical engineering technology. Previously offered as MFGT 4050 and MPT 4050. Offered for variable credit, 1-3 credit hours, maximum of 6 credit hours.
Credit hours: 1-3
Contact hours: Other: 1
Levels: Undergraduate
Schedule types: Independent Study
Department/School: Engineering Technology

MET 4091 Senior Design I
Prerequisites: Grade "C" or better in (MET 1223 or MET 2223) and MET 4003 (can be concurrent enrollment in MET 4003).
Description: First part of a two semester sequence for the MET capstone project. Focuses on finding and beginning a practical engineering design project. Includes selected topics in engineering design, project management, ethics, and intellectual property.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Engineering Technology

MET 4013 Parametric Computer-Aided Modeling
Prerequisites: A grade of "C" or better in MET 1223.
Description: Computer-aided drafting and design using parametric, feature-based solid modeling techniques.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Engineering Technology

MET 4023 Advanced Mechanical Computer-Aided Design
Prerequisites: A grade of "C" or better in MET 1223 or MET 2223.
Description: Computer-aided design methodologies and processes. State-of-the-art technologies and methodologies in 3D modeling and design processes.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Engineering Technology

MET 4033 Applied Vibration and Acoustics
Prerequisites: Grade "C" or better in GENT 3323.
Description: Free and forced vibration of mechanical systems with an emphasis on practical applications. Introduction to sound wave generation and propagation. Mechanical system design methods for noise and vibration mitigation.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Engineering Technology

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Description: Special problems in mechanical engineering technology. Previously offered as MFGT 4050 and MPT 4050. Offered for variable credit, 1-3 credit hours, maximum of 6 credit hours.
Credit hours: 1-3
Contact hours: Other: 1
Levels: Undergraduate
Schedule types: Independent Study
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Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Undergraduate
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Description: Computer-aided drafting and design using parametric, feature-based solid modeling techniques.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Engineering Technology

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Description: Computer-aided design methodologies and processes. State-of-the-art technologies and methodologies in 3D modeling and design processes.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Engineering Technology

MET 4033 Applied Vibration and Acoustics
Prerequisites: Grade "C" or better in GENT 3323.
Description: Free and forced vibration of mechanical systems with an emphasis on practical applications. Introduction to sound wave generation and propagation. Mechanical system design methods for noise and vibration mitigation.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Engineering Technology

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Credit hours: 1-3
Contact hours: Other: 1
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Department/School: Engineering Technology

MET 4091 Senior Design I
Prerequisites: Grade "C" or better in (MET 1223 or MET 2223) and MET 4003 (can be concurrent enrollment in MET 4003).
Description: First part of a two semester sequence for the MET capstone project. Focuses on finding and beginning a practical engineering design project. Includes selected topics in engineering design, project management, ethics, and intellectual property.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Engineering Technology

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Levels: Undergraduate
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Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Engineering Technology

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Prerequisites: Junior standing and consent of instructor.
Description: Special problems in mechanical engineering technology. Previously offered as MFGT 4050 and MPT 4050. Offered for variable credit, 1-3 credit hours, maximum of 6 credit hours.
Credit hours: 1-3
Contact hours: Other: 1
Levels: Undergraduate
Schedule types: Independent Study
Department/School: Engineering Technology

MET 4091 Senior Design I
Prerequisites: Grade "C" or better in (MET 1223 or MET 2223) and MET 4003 (can be concurrent enrollment in MET 4003).
Description: First part of a two semester sequence for the MET capstone project. Focuses on finding and beginning a practical engineering design project. Includes selected topics in engineering design, project management, ethics, and intellectual property.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Engineering Technology
MET 4113 Practical Computational Fluid Dynamics  
**Prerequisites:** A grade of "C" or better in MET 3313 or ENSC 3233.  
**Description:** An introduction to the practical use of Computational Fluid Dynamics (CFD) commercial software. Students will be introduced to the concepts governing CFD, but the majority of the class will be utilized in learning the use of a popular commercial code.  
**Credit hours:** 3  
**Contact hours:** Lecture: 3  
**Levels:** Graduate, Undergraduate  
**Schedule types:** Lecture  
**Department/School:** Engineering Technology  

MET 4123 Senior Design II  
**Prerequisites:** Grade "C" or better in (MET 1223 or MET 2223 and MET 4103 and MET 4003 and ENGL 3323) (can be concurrent enrollment in ENGL 3323).  
**Description:** Second part of a two semester sequence for the MET capstone project. Finishes work on the practical engineering design project begun in MET 4103. Includes selected topics in engineering design, project management, ethics, and intellectual property.  
**Credit hours:** 3  
**Contact hours:** Lecture: 2 Lab: 2  
**Levels:** Undergraduate  
**Schedule types:** Lab, Lecture, Combined lecture and lab  
**Department/School:** Engineering Technology  

MET 4173 Additive Manufacturing: Materials, Methods and Applications  
**Prerequisites:** Senior standing or consent of instructor.  
**Description:** Theory and practice of additive manufacturing, materials and their applications in various fields. Discuss their applications in product development, data visualization, rapid prototyping, and specialized manufacturing, with special emphasis on direct digital manufacturing.  
**Credit hours:** 3  
**Contact hours:** Lecture: 3  
**Levels:** Undergraduate  
**Schedule types:** Lecture  
**Department/School:** Engineering Technology  

MET 4203 Finite Element Methods  
**Prerequisites:** A grade of "C" or better in GENT 3323 or ENSC 2143.  
**Description:** Application of Finite Element Methods to machine component design. Problems involving stress, strain, temperature and vibration will be solved using state of the art Finite Element Software.  
**Credit hours:** 3  
**Contact hours:** Lecture: 3  
**Levels:** Graduate, Undergraduate  
**Schedule types:** Lecture  
**Department/School:** Engineering Technology  

MET 4303 Computer Integrated Manufacturing  
**Prerequisites:** A grade of "C" or better in (GENT 1223 and MET 1213) and (MET 1223 or MET 2223).  
**Description:** Introduction to programming techniques and manufacturing applications of computer numerical control (CNC) and robotics. Machine capabilities and tooling requirements with programs being prepared manually and with COMPACT II computer assistance.  
**Credit hours:** 3  
**Contact hours:** Lecture: 2 Lab: 2  
**Levels:** Undergraduate  
**Schedule types:** Lab, Lecture, Combined lecture and lab  
**Department/School:** Engineering Technology  

MET 4313 Electrohydraulics and Motion Control  
**Prerequisites:** Grade "C" or better in MET 2313 and EET 3104 (can be concurrent enrollment in EET 3104).  
**Description:** Principles of electronics as applied to fluid power controls. Trends in modern fluid power systems. Solenoid systems, proportional control, servosystems, programmable controllers, and robotics. Lab includes design, fabrication and operation of practical systems.  
**Credit hours:** 3  
**Contact hours:** Lecture: 2 Lab: 2  
**Levels:** Undergraduate  
**Schedule types:** Lab, Lecture, Combined lecture and lab  
**Department/School:** Engineering Technology  

MET 4413 Ground Source Heat Pump Systems  
**Prerequisites:** GENT 4433 and a grade of "C" or better in MET 3313 and GENT 3433.  
**Description:** Design and applications of ground sourced heat pump systems. Heat pump performance, borehole heat transfer, pressure loss calculations and installation methods.  
**Credit hours:** 3  
**Contact hours:** Lecture: 3  
**Levels:** Undergraduate  
**Schedule types:** Lecture  
**Department/School:** Engineering Technology  

MET 4433 Heat Transfer  
**Prerequisites:** MATH 2123 or MATH 2144 and PHYS 1114 or PHYS 2014.  
**Description:** Conduction, convection, radiation, condensation and boiling heat transfer. Heat exchangers. Prediction of heat transfer rates. Retardation and enhancement of heat transfer. Course previously offered as MPT 4433 and GENT 4433.  
**Credit hours:** 3  
**Contact hours:** Lecture: 3  
**Levels:** Undergraduate  
**Schedule types:** Lecture  
**Department/School:** Engineering Technology  

MET 4453 Applied Thermodynamics  
**Prerequisites:** A grade of "C" or better in ENSC 2213 or GENT 3433.  
**Description:** Mixtures, psychrometrics, combustion, heat engine cycles, heat pumps cycles, internal and external combustion engines. Refrigeration. Previously offered as MPT 4453.  
**Credit hours:** 3  
**Contact hours:** Lecture: 3  
**Levels:** Undergraduate  
**Schedule types:** Lecture  
**Department/School:** Engineering Technology  

MET 4463 Thermal Fluids Laboratory  
**Prerequisites:** Grade "C" or better in (MET 3313 or ENSC 3233) and (GENT 3433 or MET 3433 or ENSC 2213). Prerequisite or concurrent enrollment in GENT 4433 or MET 4433.  
**Description:** Prerequisite or concurrent enrollment in GENT 4433. Experimental study of topics in fluid mechanics, thermodynamics, and heat transfer. Interpretation of experimental data and technical report writing. Previously offered as MPT 4463.  
**Credit hours:** 3  
**Contact hours:** Lecture: 2 Lab: 2  
**Levels:** Undergraduate  
**Schedule types:** Lab, Lecture, Combined lecture and lab  
**Department/School:** Engineering Technology
MET 4503 Petroleum Operations
Prerequisites: A grade of "C" or better in GENT 2323 or ENSC 2113.
Description: An introduction to the petroleum industry and available careers is presented for all engineering technology disciplines. Coverage includes basic petroleum geology, drilling, well completions, producing equipment, field operations, blowout recovery procedures, and transportation of hydrocarbons along the flow path from reservoir to the refinery.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Engineering Technology

MET 4883 Tool Design
Prerequisites: A grade of "C" or better in MET 2213 and MET 3343.
Description: Basic design and development of special tools for processing or manufacturing engineering materials. Design and specification and inspection tools using appropriate techniques of engineering graphics and analysis. Previously offered as MFGT 4883.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Engineering Technology

MET 4993 Mechanical Engineering Technology Practice
Prerequisites: Junior standing and consent of department head.
Description: Supervised industrial experience in mechanical engineering technology practice with minimal continual duration of eight weeks. Comprehensive journal, written report, and oral presentation.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Engineering Technology

Undergraduate Programs
- Mechanical Engineering Technology, BSET (http://catalog.okstate.edu/engineering-architecture-technology/mechanical-engineering-technology/bset)

Faculty
Chulho Yang, PhD, PE—Professor and Program Coordinator Professors: Young Chang, PhD, PE, CFPS Associate Professors: Aaron Alexander, PhD; Warren L. Lewis, MS Assistant Professors: Hitesh Vora, PhD; Ilchung Park, PhD Teaching Associate: Laura Emerson, MS
Adjunct Assistant Professor: Jeehyeon Hahn, PhD