Department of Technology

(College of Humanities, Arts and Sciences)

www.uni.edu/indtech

The Department of Technology offers the following undergraduate and graduate programs and program certificates. Specific requirements for these programs are listed within this Department of Technology section in the following order:

**Undergraduate Majors (B.S.)**
- Construction Management (p. 1)
- Electrical Engineering Technology (EET) (p. 1)
- Manufacturing Engineering Technology (p. 2)
- Technology and Engineering Education—Teaching (p. 3)

**Undergraduate Majors (B.A.)**
- Graphic Technology (p. 4)
- Technology Management (p. 4)

**Undergraduate Major (B.A.S.)**
- Technology (p. 5)

**Minors**
- Electrical and Electronics Technology (EET) (p. 6)
- Graphic Technology (p. 6)
- Manufacturing Technology Design (p. 7)
- Materials Science and Technology (p. 7) (also listed in Department of Chemistry and Biochemistry and Department of Physics)
- Technology Education - Teaching (p. 8)
- Technology Management (p. 8)

**Graduate Major (M.S.)**
- Technology (p. 8)

**Program Certificates**
- Technology Management (p. 9)

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**Bachelor of Science Degree Programs**

**Construction Management Major**

The B.S. Construction Management major requires a minimum of 126 total hours to graduate. This total includes Liberal Arts Core requirements and the following specified major requirements, plus electives to complete the minimum of 126 hours.

**Required:**

Mathematics and Science:
- MATH 1150 (800:048) Calculus for Technology ^ 4
- CHEM 1020 (860:020) Chemical Technology 4

**Electives:**

- MATH 1151 (880:054) General Physics I ^ 4
- STAT 1772 (800:072) Introduction to Statistical Methods ^ 3
- ENGLISH 1005 (620:005) College Writing and Research 3
- ENGLISH 3772/5772 Technical Writing for Engineering Technologists 3
- TECH CM 1000 Introduction to Construction Processes 3
- TECH CM 1050 Construction Safety 3
- TECH CM 1100 Construction Documents 3
- TECH CM 2000 Land, Route, and Construction Surveying 3
- TECH CM 2050 Construction Law 3
- TECH 2080 (330:080) Statics and Strength of Materials 3
- TECH CM 2100 MechanicalSystems in Construction 3
- TECH CM 3000/5000 Civil Construction 3
- TECH CM 3050 Construction Estimating 3
- TECH CM 3100 Electrical Construction Materials and Methods 3
- TECH CM 3150/5150 Construction Project Planning and Scheduling 3
- TECH CM 3250 Computerized Project Management 3
- TECH CM 4050/5050 Construction Management 3
- TECH CM 4200/5200 Structural Components of Construction 3
- TECH CM 4300/5300 Construction Technology and Innovation 3
- TECH CM 4400 Construction Management Senior Project (to be taken last semester) 3

**Business and Management:**
- ECON 1031 (920:024) Introduction to Economics 3
- ACCT 2120 (120:030) Principles of Financial Accounting 3
- MGMT 3100 (150:100) Legal and Social Environment of Business 3

**Total Hours** 78

^ Has prerequisite of satisfactory score on ALEKS exam or subsequent remediation.

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**Electrical Engineering Technology (EET) Major (Extended Program)**

The B.S. Electrical Engineering Technology (EET) major requires a minimum of 126 total hours to graduate. This total includes Liberal Arts Core requirements and the following specified major requirements, plus electives to complete the minimum of 126 hours.
The Electrical Engineering Technology (EET) major provides theoretical and hands-on experience in the field of electrical circuits, conventional and renewable electrical energy, analog/digital electronics, microprocessors, modern electronic communication systems, digital signal processing, power electronics, control systems, networking, and their applications. The Electrical Engineering Technology Program is accredited by the Engineering Technology Accreditation Commission of ABET, www.abet.org.

Required Mathematics and Science Core:

Mathematics (take two of the following four courses):

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1140 (800:046)</td>
<td>Precalculus</td>
<td>8</td>
</tr>
<tr>
<td>MATH 1150 (800:048)</td>
<td>Calculus for Technology</td>
<td></td>
</tr>
<tr>
<td>MATH 1420 (800:060)</td>
<td>Calculus I</td>
<td></td>
</tr>
<tr>
<td>STAT 1772 (800:072)</td>
<td>Introduction to Statistical Methods</td>
<td>3</td>
</tr>
</tbody>
</table>

Computer Science:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 1160 (810:036)</td>
<td>C/C++ Programming</td>
<td>3</td>
</tr>
</tbody>
</table>

Physics:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 1511 (880:054)</td>
<td>General Physics I</td>
<td>4</td>
</tr>
<tr>
<td>PHYSICS 1512 (880:056)</td>
<td>General Physics II</td>
<td>4</td>
</tr>
</tbody>
</table>

Total Hours 80

Additional Program Requirements:

1. All 4000 level technology courses must be taken at UNI, i.e. no transfer is accepted for 4000 level technology courses.

2. All students in the program must have a UNI GPA of 2.00 or higher before they are allowed to take any technology courses they have not already taken.

Manufacturing Engineering Technology Major

The B.S. Manufacturing Engineering Technology major requires a minimum of 126 total hours to graduate. This total includes Liberal Arts Core requirements (45 hours) and the following specified major requirements (66-69 hours), plus electives (15 hours) to complete the minimum of 126 hours.

Required Mathematics and Science Core:

Mathematics:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1150 (800:048)</td>
<td>Calculus for Technology</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 1420 (800:060)</td>
<td>Calculus I</td>
<td></td>
</tr>
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</table>

Chemistry:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>CHEM 1020 (860:020)</td>
<td>Chemical Technology</td>
<td>4</td>
</tr>
<tr>
<td>or CHEM 1110 (860:044)</td>
<td>General Chemistry I</td>
<td></td>
</tr>
</tbody>
</table>

Physics:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 1511 (880:054)</td>
<td>General Physics I</td>
<td>4</td>
</tr>
<tr>
<td>or PHYSICS 1701 (880:130)</td>
<td>Physics I for Science and Engineering</td>
<td></td>
</tr>
</tbody>
</table>

Total Hours 80
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 3143</td>
<td>Managing Operations and Manufacturing Systems</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3180 (330:180)</td>
<td>Lean and Sustainable Operations</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3196 (330:196)</td>
<td>Industrial Safety</td>
<td>3</td>
</tr>
<tr>
<td>TECH 4110/5110</td>
<td>Manufacturing Process Planning</td>
<td>3</td>
</tr>
<tr>
<td>TECH 4187 (330:187g)</td>
<td>Applied Industrial Supervision and Management[^]</td>
<td>3</td>
</tr>
<tr>
<td>TECH 4210</td>
<td>Manufacturing Senior Projects (to be taken in last semester)</td>
<td>3</td>
</tr>
</tbody>
</table>

**English:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGLISH 1005</td>
<td>College Writing and Research</td>
<td>3</td>
</tr>
<tr>
<td>ENGLISH 3772/5772</td>
<td>Technical Writing for Engineering Technologists</td>
<td>3</td>
</tr>
</tbody>
</table>

**Concentration: choose one of the following three concentrations:**

- **Advanced Manufacturing:**
  - TECH 3113 Manufacturing Tooling (330:113)
  - TECH 3147 Computer Aided Manufacturing (330:147)
  - TECH 3177 Advanced Manufacturing Processes (330:177g)
  - TECH 4162 Automation - Pneumatics and Hydraulics

- **Manufacturing Design:**
  - TECH 3024/5024 Advanced CAD and Modeling (330:122g)
  - TECH 3113 Manufacturing Tooling (330:113)
  - TECH 3135/5135 Product Design (330:135g)
  - TECH 3148 Machine Design (330:148)

- **Metal Casting:**
  - TECH 3127 Transport Phenomena for Technologists (330:127)
  - TECH 3134 Molding Practices in Metal Casting (330:134)
  - TECH 4136 Melting Metallurgy and Practices (330:136)
  - TECH 4137 Tooling Practices in Metal Casting (330:137)

**Recommended university elective hours from the following:**

**Technology:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 1037 (330:037)</td>
<td>Introduction to Circuits</td>
<td></td>
</tr>
<tr>
<td>TECH 2038 (330:038)</td>
<td>Introduction to Electrical Power and Machinery *</td>
<td></td>
</tr>
</tbody>
</table>

**Advanced Manufacturing:**

- TECH 2119 Computer Applications in Technology
- TECH 3113 Manufacturing Tooling (330:113)
- TECH 3127 Transport Phenomena for Technologists (330:127)
- TECH 3131 Technical Project Management (330:131g)
- TECH 3177 Advanced Manufacturing Processes (330:177g)
- TECH 3179 (330:179) "Cooperative Education" (3 hrs. maximum)
- TECH 4162 Automation - Pneumatics and Hydraulics

[^] Prerequisites for the following courses:
- MATH 1150 (800:048) and MATH 1420 (800:060) has prerequisite of satisfactory score on ALEKS exam.
- CHEM 1110 (860:044) student must have satisfied university entrance requirements in English and Mathematics; MATH 1120 (800:056) or MATH 1130 (800:044) or MATH 1140 (800:046) or MATH 1150 (800:048) or MATH 1420 (800:060) or equivalent, or a satisfactory ALEKS score.
- PHYSICS 1701 (880:130) has prerequisite of MATH 1420 (800:060).
- TECH 2038 (330:038) has prerequisites of TEH 1037 (330:037); TECH 1039 (330:039); MATH 1150 (800:048) or MATH 1420 (800:060).
- TECH 3192/5192 (330:192g) has prerequisites of TECH 2072 (330:072) or TECH 3132/5132 (330:132); junior standing.

[^] TECH 4187 (330:187g) is the cognate course for the B.S. Manufacturing Engineering Technology Major.

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**Technology and Engineering Education-Teaching Major**

The B.S. Technology and Engineering Education-Teaching major requires a minimum of 126 total hours to graduate. This total includes Liberal Arts Core requirements, the Professional Education Requirements, and the following specified major requirements, plus electives to complete the minimum of 126 hours.

**Mathematics/Science Coursework**

- CHEM 1020 (860:020) Chemical Technology 4
- PHYSICS 1400 (880:011) Conceptual Physics * 4
- or PHYSICS 1511 (880:054) General Physics I
- MATH 1140 (800:046) Precalculus * 4

**Technology and Engineering Core**

- TECH 1008 (330:008) Basic Manufacturing Processes 3
- TECH 1010 (330:010) Metal Removal Processes 3
- TECH 1024 (330:024) Technical Drawing and Design I 3
- TECH CM 1000 Introduction to Construction Processes 3
Bachelor of Arts Degree Programs

Graphic Technology Major

The Graphic Technology major provides students with theoretical and hands-on experiences in the graphic communication industry and related disciplines. The Graphic Technology program is accredited by Accrediting Council for Collegiate Graphic Communications, Inc. (acgcc.org) and Association of Technology, Management, and Applied Engineering (atmae.org).

The Graphic Technology major requires a minimum of 120 total hours to graduate. This total includes Liberal Arts Core requirements and the following specified major requirements, plus university electives, easily allowing students to double major and/or minor in other disciplines.

Required:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 1012</td>
<td>ePortfolio Development &amp; Industry Exploration</td>
<td>3</td>
</tr>
<tr>
<td>TECH 1055 (330:055)</td>
<td>Graphic Communications Foundations</td>
<td>3</td>
</tr>
<tr>
<td>TECH 2070 (330:070)</td>
<td>Digital Pre-Media</td>
<td>3</td>
</tr>
<tr>
<td>TECH 2119</td>
<td>Computer Applications in Technology</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3144 (330:144)</td>
<td>Web Publishing</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3150/5150 (330:150g)</td>
<td>Graphic Communications Imaging</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3163/5163 (330:163g)</td>
<td>Advanced Digital Pre-Media</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3169 (330:169)</td>
<td>Digital Imaging</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3179</td>
<td>Cooperative Education</td>
<td>3</td>
</tr>
<tr>
<td>TECH 4093/5093</td>
<td>Graphic Communications Estimating and Management I</td>
<td>3</td>
</tr>
<tr>
<td>TECH 4158/5158 (330:158g)</td>
<td>Graphic Communications Technical Visualization</td>
<td>3</td>
</tr>
<tr>
<td>TECH 4161 (330:161g)</td>
<td>Digital Graphic Communications</td>
<td>3</td>
</tr>
<tr>
<td>TECH 4187 (330:187g)</td>
<td>Applied Industrial Supervision and Management</td>
<td>3</td>
</tr>
<tr>
<td>TECH 4193</td>
<td>Graphic Communication Estimating and Management II</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours: 48

Technology Management Major

The Technology Management (TM) major requires a minimum of 120 total hours to graduate. This total includes Liberal Arts Core requirements and the following specified major requirements, plus electives to complete the minimum of 120 hours.

Integrating specific technical background, the Technology Management (TM) major prepares students with a broad spectrum of management skills, critical thinking skills, organizational skills in technological systems for an entry level supervision/management position upon graduation.

Mathematics and Science Core: (one hour lab required)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 1772 (800:072)</td>
<td>Introduction to Statistical Methods</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 1010 (860:010) or CHEM 1020 (860:020)</td>
<td>Principles of Chemistry Chemical Technology</td>
<td>4</td>
</tr>
<tr>
<td>or CHEM 1110 (860:044)</td>
<td>General Chemistry I</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 1000 (880:012) or PHYSICS 1400 (880:011)</td>
<td>Physics in Everyday Life Conceptual Physics</td>
<td>3-4</td>
</tr>
<tr>
<td>or PHYSICS 1511 (880:054)</td>
<td>General Physics I</td>
<td></td>
</tr>
</tbody>
</table>

Management:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 3065</td>
<td>Technology and Organizational Efficiency</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3131 (330:131g)</td>
<td>Technical Project Management</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3142 (330:142)</td>
<td>Statistical Quality Control</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3143</td>
<td>Managing Operations and Manufacturing Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: Students in Technology and Engineering Education--Teaching Major will be waived from INSTTECH 1020 (240:020) Secondary Educational Technology and Design of the Professional Education Requirements. A student changing majors to a different teaching major would be required to complete INSTTECH 1020 (240:020) Secondary Educational Technology and Design .
Bachelor of Applied Science Degree Program

The purpose of the Bachelor of Applied Science (B.A.S.) degree is to offer educational opportunities to those students who have completed an A.A.S degree and are now seeking to complete a four-year degree. These students are often place-bound and need to take online classes while remaining a full-time employee.

Admission to the Program

Each student entering the program must have earned:

1. an Associate of Applied Science (A.A.S) degree from an accredited institution; and
2. a minimum 2.00 grade point average; and
3. two years of relevant work experience.

Total Credit Requirements

A total of at least 120 semester hours of credit, including applicable transferable credit earned, is required for graduation. The total must fulfill the following specifications:

1. 23-24 hours of Liberal Arts Core classes, as outlined below (of which 9 hours can be transferred in as LAC 1A, 1B, and 1C);
2. 6 hours of Professional Communication, as outlined below;
3. 21-30 hours of Major coursework, from one of the majors listed below;
4. 0-19 hours of elective credit, for a total of 60 semester hours of credit taken at the University of Northern Iowa.

Liberal Arts Core Requirements for B.A.S. Degree*:

Students must meet the following undergraduate Liberal Arts Core requirements as specified below.

Summary:

1. Category 1: Core Competencies in Categories 1A (writing), 1B (speaking), and 1C (math) or transfer equivalencies*
Department of Technology

*BAS students are permitted to transfer in courses equivalent to Categories 1A, 1B, & 1C. No other classes can be applied to fulfill the LAC portion of the BAS degree.

2. Category 2: Civilizations & Cultures (1 course from Category 2A or 2B)
3. Category 3: Fine Arts, Literature, Philosophy & Religion (1 course from Category 3A or 3B)
4. Category 4: Natural Science & Technology (1 course from Category 4A or 4B)
5. Category 5: Social Science (1 course from Category 5A, 5B, or 5C)
6. Category 6: Capstone Experience (1 course) (2-3 hours or 1 additional course from BAS LAC Category 2, 3, 4, or 5)

Total Hours 23-24

Professional Communication Required Courses for B.A.S. Degree

Required:
COMM 3155 (48C:173) Business and Professional Oral Communication 3
ENGLISH 3770 Technical Writing in Applied Sciences 3

Total Hours 6

Technology

Applications are not being accepted for the B.A.S. Technology major at this time.

Mathematics and Science Core:
CHEM 1020 (860:020) Chemical Technology (either of these courses will satisfy LAC Category 4B) 4
or PHYSICS 1511 (880:054) General Physics I
STAT 1772 (800:072) Introduction to Statistical Methods (will satisfy LAC Category 1C) 3

BAS Technology Core
TECH 2119 Computer Applications in Technology 3
TECH 3065 Technology and Organizational Efficiency 3
TECH 3131 (330:131g) Technical Project Management 3
TECH 3102 (330:102) Living in Our Techno-Social World (will satisfy LAC Category 6) 3
Elective approved by the department (must be 3000-level or above) 3

BAS Technology Upper Division Courses
TECH 3142 (330:142) Statistical Quality Control 3
TECH 3180 (330:180) Lean and Sustainable Operations 3
TECH 3143 Managing Operations and Manufacturing Systems 3

TECH 4187 (330:187g) Applied Industrial Supervision and Management 3

Total Hours 34*

*10 hours may be counted toward LAC and Major

Minors

Electrical and Electronics Technology Minor (EET)
The EET minor provides basic theory and hands-on experience in the field of electrical circuits, electrical power and machinery, analog/digital electronics, PLCs and their applications.

Required:
Technology:
TECH 1037 (330:037) Introduction to Circuits 18
TECH 1039 (330:039) Circuits and Systems
TECH 2038 (330:038) Introduction to Electrical Power and Machinery
TECH 2041 (330:041) Introduction to Analog Electronics
TECH 2042 (330:042) Introduction to Digital Electronics
TECH 3164 (330:164g) Programmable Logic Controllers (PLCs)

Mathematics:
MATH 1150 (800:048) Calculus for Technology or MATH 1420 (800:060) Calculus I

Computer Science:
CS 1130 (810:030) Visual BASIC Programming or CS 1160 (810:036) C/C++ Programming

Physics:
PHYSICS 1511 (880:054) General Physics I or PHYSICS 1701 (880:130) Physics I for Science and Engineering

Total Hours 29

Graphic Technology Minor

Required:
Technology:
TECH 1055 (330:055) Graphic Communications Foundations 3
TECH 2070 (330:070) Digital Pre-Media
TECH 3169 (330:169) Digital Imaging
TECH 4161 (330:161g) Digital Graphic Communications

Electives:
Technology (select three of the following): 9
TECH 1011 Software for Graphic Techniques
**Department of Technology**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 1012</td>
<td>ePortfolio Development &amp; Industry Exploration</td>
</tr>
<tr>
<td>TECH 2119</td>
<td>Computer Applications in Technology</td>
</tr>
<tr>
<td>TECH 3144</td>
<td>Web Publishing</td>
</tr>
<tr>
<td>(330:144)</td>
<td></td>
</tr>
<tr>
<td>TECH 3150/5150</td>
<td>Graphic Communications Imaging</td>
</tr>
<tr>
<td>(330:150g)</td>
<td></td>
</tr>
<tr>
<td>TECH 3163/5163</td>
<td>Advanced Digital Pre-Media</td>
</tr>
<tr>
<td>(330:163g)</td>
<td></td>
</tr>
<tr>
<td>TECH 4158/5158</td>
<td>Graphic Communications Technical Visualization</td>
</tr>
<tr>
<td>(330:158g)</td>
<td></td>
</tr>
</tbody>
</table>

**Total Hours**: 21

### Manufacturing Technology Design Minor

Available to all UNI majors except Manufacturing Technology majors.

#### Required:

**Technology**: 15

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 1017</td>
<td>Computer-Aided Design and Drafting</td>
</tr>
<tr>
<td>(330:017)</td>
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</tr>
<tr>
<td>TECH 1024</td>
<td>Technical Drawing and Design I</td>
</tr>
<tr>
<td>(330:024)</td>
<td></td>
</tr>
<tr>
<td>TECH 2024</td>
<td>Technical Drawing and Design II</td>
</tr>
<tr>
<td>(330:023)</td>
<td></td>
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<tr>
<td>TECH 3024/5024</td>
<td>Advanced CAD and Modeling</td>
</tr>
<tr>
<td>(330:122g)</td>
<td></td>
</tr>
<tr>
<td>TECH 3135/5135</td>
<td>Product Design</td>
</tr>
<tr>
<td>(330:135g)</td>
<td></td>
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**Mathematics and Science**: 12

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>MATH 1150</td>
<td>Calculus for Technology</td>
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<tr>
<td>(800:048)</td>
<td></td>
</tr>
<tr>
<td>or MATH 1420</td>
<td>Calculus I</td>
</tr>
<tr>
<td>(800:060)</td>
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<tr>
<td>CHEM 1020</td>
<td>Chemical Technology</td>
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<td>(860:020)</td>
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<tr>
<td>or CHEM 1110</td>
<td>General Chemistry I</td>
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<tr>
<td>(860:044)</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 1511</td>
<td>General Physics I</td>
</tr>
<tr>
<td>(880:054)</td>
<td></td>
</tr>
<tr>
<td>or PHYSICS 1701</td>
<td>Physics I for Science and Engineering</td>
</tr>
<tr>
<td>(880:130)</td>
<td></td>
</tr>
</tbody>
</table>

**Total Hours**: 27

### Materials Science and Technology Minor

This is an interdisciplinary minor that is jointly offered by the Departments of Chemistry and Biochemistry, Physics, and Technology.

Materials science and the use of materials in technology requires the use of concepts from multiple disciplines. This interdisciplinary minor gives students the broad foundation they need to learn about the science of materials and an introduction to how these scientific principles are used in the development and application of materials in new technology. This minor is complementary preparation to a major in Chemistry and Biochemistry, Physics or Manufacturing Engineering Technology for students who are interested in working in industry or going on to advanced study in materials science.

#### Required:

**Choose one of the following three options**: 5-8

**Option 1 Chemistry (8 hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 1110</td>
<td>General Chemistry I</td>
</tr>
<tr>
<td>(860:044)</td>
<td></td>
</tr>
<tr>
<td>CHEM 1120</td>
<td>General Chemistry II</td>
</tr>
<tr>
<td>(860:048)</td>
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</tr>
</tbody>
</table>

**OR**

**Option 2 Chemistry (5 hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 1130</td>
<td>General Chemistry I-II</td>
</tr>
<tr>
<td>(860:070)</td>
<td></td>
</tr>
</tbody>
</table>

**OR**

**Option 3 Chemistry/Technology (7 hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 1020</td>
<td>Chemical Technology</td>
</tr>
<tr>
<td>(860:020)</td>
<td></td>
</tr>
<tr>
<td>TECH 3127</td>
<td>Transport Phenomena for Technologists</td>
</tr>
<tr>
<td>(330:127)</td>
<td></td>
</tr>
</tbody>
</table>

**Additional requirements (all three options)**

Choose one of the following sets of Physics courses: 8

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 1511</td>
<td>General Physics I</td>
</tr>
<tr>
<td>(880:054)</td>
<td></td>
</tr>
<tr>
<td>&amp; PHYSICS 1512</td>
<td>and General Physics II</td>
</tr>
<tr>
<td>(880:056)</td>
<td></td>
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</tbody>
</table>

**OR**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 1701</td>
<td>Physics I for Science and Engineering</td>
</tr>
<tr>
<td>(880:130)</td>
<td></td>
</tr>
<tr>
<td>&amp; PHYSICS 1702</td>
<td>and Physics II for Science and Engineering</td>
</tr>
<tr>
<td>(880:131)</td>
<td></td>
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</tbody>
</table>

**Additional required (all three options)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 4200/5200</td>
<td>Nanoscience *</td>
</tr>
<tr>
<td>(860:144g)</td>
<td></td>
</tr>
<tr>
<td>(330:132)</td>
<td></td>
</tr>
</tbody>
</table>

**Electives (all three options) - choose one of the following**: 3-4

**Note: in order to earn the Materials Science and Technology minor, the elective course students take for the minor cannot be a required course for their primary major.**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 2110</td>
<td>Descriptive Inorganic Chemistry *</td>
</tr>
<tr>
<td>(860:110)</td>
<td></td>
</tr>
<tr>
<td>CHEM 2310</td>
<td>Chromatography and Quantitative Analysis #</td>
</tr>
<tr>
<td>(860:132)</td>
<td></td>
</tr>
<tr>
<td>CHEM 4210/5210</td>
<td>Nanotechnology *</td>
</tr>
<tr>
<td>(860:148g)</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 4750/5750</td>
<td>Physics of Modern Materials #</td>
</tr>
<tr>
<td>(880:174g)</td>
<td></td>
</tr>
<tr>
<td>TECH 3132/5132</td>
<td>Metallurgy and Phase Transformation</td>
</tr>
<tr>
<td>(330:132)</td>
<td></td>
</tr>
</tbody>
</table>

**Total Hours**: 22-26
There are additional prerequisite courses that must be taken along with the required courses in some options – choose the option that aligns with the courses for your major.

Prerequisites for TECH 3127 (330:127): TECH 1024 (330:024); MATH 1150 (800:048) or MATH 1420 (800:060).

Prerequisite or corequisites for PHYSICS 1701 (880:130):
MATH 1420 (800:060).

Prerequisite or corequisites for PHYSICS 1702 (880:131):
MATH 1421 (800:061).

Students who have declared a Materials Science and Technology Minor may take these courses after completing CHEM 1020 (860:020) Chemical Technology and TECH 3127 (330:127) Transport Phenomena for Technologists in place of the usual CHEM 1120 (860:048) General Chemistry II prerequisite.

These courses are taken by students in the Manufacturing Engineering Technology major.

Prerequisite for CHEM 2310 (860:132): CHEM 1120 (860:048) or CHEM 1130 (860:070).

Prerequisite for PHYSICS 4750/5750 (880:174g):
PHYSICS 4100/5100 (880:137g) and PHYSICS 4110/5110 (880:138g).

Students who have declared a Technology Education Minor may take the following courses after completing:

** TECH TEE 3050 has the following prerequisites:
PHYSICS 1511 (880:054) and PHYSICS 1512 (880:056), or PHYSICS 1701 (880:130) and PHYSICS 1702 (880:131), or TECH 1037 (330:037) or CS 1510 (810:051).

Technology Management Minor

Required Courses:

Maths:
STAT 1772 (800:072) Introduction to Statistical Methods 3

Technology:
TECH 2119 Computer Applications in Technology 3
TECH 3065 Technology and Organizational Efficiency 3
TECH 3131 (330:131g) Technical Project Management 3
or TECH 3143 Managing Operations and Manufacturing Systems 3
TECH 3142 (330:142) Statistical Quality Control 3
TECH 4187 (330:187g) Applied Industrial Supervision and Management 3

Technical Electives: 6

Total Hours 24

* STAT 1772 (800:072) has prerequisite of satisfactory score on ALEKS exam.

Master of Science Degree Program

Major in Technology

Students interested in this program must submit a completed Application for Admission to Graduate Study and should refer to their MyUNIverse Student Center To-Do list or contact the Department of Technology for other application requirements. Graduate information and application for graduate admission can be found at www.grad.uni.edu/admission.

The Graduate Record Examination (General Test) is not required for admission to the program.

This degree offers a thesis and non-thesis option. The program promotes a greater depth of understanding of applied technology and management. It provides opportunities to develop special research and application skills directly related to individual competencies, needs, and objectives.

This major requires as a prerequisite a bachelor’s degree with a major in engineering or technology field. Degree admission to the Master of Science in Technology requires an applicant to have:

1. Earned a minimum of 6 semester hours of college mathematics and 6 semester hours of college physics and/or chemistry and biochemistry or other science related to the major area (this may be either graduate or undergraduate credit)
2. Earned a minimum of 15 semester hours in a major technical field and 8 semester hours in supporting technical subjects;
3. Department application;
4. Online Application for Graduate Study;
5. TOEFL score of 550 (paper-based) or 79 iBT;
6. Three professional references; and
7. A minimum cumulative undergraduate grade point average of 3.00.

Only graduate courses (course numbers 5000 or above) will apply to a graduate program, even if the undergraduate course number (4999 or less) is listed. No exceptions will be made.

For both the thesis and non-thesis options, the Master of Science Technology degree program requires a **minimum of 30 semester hours**. A minimum of 15 hours of 200/6000-level course work is required for this degree program. For the thesis option, students must defend and present their research thesis to their committee members and the public.

**MS Technology required core courses:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 6100</td>
<td>Engineering Cost Analysis</td>
<td>3</td>
</tr>
<tr>
<td>TECH 6300</td>
<td>Advanced Technical Project Management for Engineering and Technology</td>
<td>3</td>
</tr>
<tr>
<td>TECH 6292 (330:292)</td>
<td>Research Methods in Technology</td>
<td>3</td>
</tr>
<tr>
<td>Any 5000 or 6000 level math content course approved by adviser.</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Select one of the emphases below (complete emphasis requirements based on choosing thesis or non-thesis option within emphasis).

**Total Hours**: 30

**Information and Electrical Engineering Technology Emphasis**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 4000/5000</td>
<td>Wind Energy Engineering</td>
<td>3</td>
</tr>
<tr>
<td>TECH 6242 (330:242)</td>
<td>Complex Digital System Design</td>
<td>3</td>
</tr>
<tr>
<td>TECH 6244 (330:244)</td>
<td>Applied Embedded Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

**Choose thesis or non-thesis option:** 9

**Thesis option:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 6299 (330:299)</td>
<td>Research (Master's Thesis) - 6 hours</td>
<td>6</td>
</tr>
<tr>
<td>electives approved by advisor - 3 hours</td>
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</table>

**Non-thesis option:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>electives approved by advisor (9 hours)</td>
<td></td>
<td></td>
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</tbody>
</table>

**Total Hours**: 18

**Program Certificates**

The University of Northern Iowa makes available, in addition to traditional programs, the opportunity for students to earn program certificates. Program certificates provide an alternative to programs leading to a degree, a major, or a minor; they certify that an individual has completed a program approved by the university. For information on the following certificates, contact the Department of Technology or the Office of the Registrar, which serves as the centralized registry.

**Technology Management Certificate (undergraduate)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 3065</td>
<td>Technology and Organizational Efficiency</td>
<td>18</td>
</tr>
<tr>
<td>TECH 3131 (330:131g)</td>
<td>Technical Project Management</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3142 (330:142)</td>
<td>Statistical Quality Control *</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3143</td>
<td>Managing Operations and Manufacturing Systems *</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3196 (330:196)</td>
<td>Industrial Safety</td>
<td>3</td>
</tr>
<tr>
<td>TECH 4187 (330:187g)</td>
<td>Applied Industrial Supervision and Management</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Hours**: 18

* TECH 3142 (330:142) and TECH 3143 have prerequisites of MATH 1140 (800:046) Precalculus or MATH 1150 (800:048) Calculus for Technology or MATH 1420 (800:060) Calculus I or STAT 1772 (800:072) Introduction to Statistical Methods.

**Construction Management Courses**

**TECH CM 1000. Introduction to Construction Processes — 3 hrs.**
Acquaint students with the many facets related to construction processes by identifying roles and responsibilities within the
construction industry. Students will be exposed to construction with hands on projects. (Fall and Spring)

TECH CM 1050. Construction Safety — 3 hrs.
Examine the safety practices for the construction industry. Students will receive OSHA certified 30-Hour training during this course and understand the concepts of a Worksafe Program including regulations, safety audits, and costs impacting a company. Prerequisite(s): sophomore standing. (Fall)

TECH CM 1100. Construction Documents — 3 hrs.
Introduction to construction blueprint/plan and specification reading and how documents are created. Students will understand the relationship between plans and specs and how they impact the job. Exposure to old plan reading processes as well as new digital processes. Exposure to a physical 3D building as it relates to 2D prints so students can gain vision from concept to finished product. Prerequisite(s): TECH CM 1000. (Spring)

Basic principles of construction surveying equipment, techniques, building layout and calculations. Training with surveying equipment such as automatic levelers, laser levelers, GPS, and total stations. Lecture and lab format. Prerequisite(s): MATH 1140 (800:046) or MATH 1150 (800:048). (Fall)

Examination of construction contract principles, construction documents, and the component parts of law affecting construction operations. (Fall)

Basic principles, methods, and equipment pertaining to building mechanical systems (heating, cooling, ventilation, and plumbing) related to human health and comfort. Prerequisite(s) or corequisite(s): TECH CM 1100. (Spring)

TECH CM 3000/5000. Civil Construction — 3 hrs.
Examination of systems and operational procedures used to construct commercial, heavy and highway projects. Analysis/design of airports and highways. Earthmoving, dewatering, and construction economics. Prerequisite(s): TECH CM 1100; junior standing. Prerequisite(s) or corequisite(s): TECH CM 2000. (Fall)

Construction cost analysis techniques for estimating materials, labor, equipment, and subcontracting costs in commercial building construction. Prerequisite(s): TECH CM 1100. (Fall)

TECH CM 3100. Electrical Construction Materials and Methods — 3 hrs.
Basic principles of electricity and materials. Methods of electrical system designs in building construction. Prerequisite(s): TECH CM 1100. (Fall)

TECH CM 3150/5150. Construction Project Planning and Scheduling — 3 hrs.
Examine the construction process of a construction project as it relates to scheduling and planning. Students will gain exposure to planning and scheduling software while understanding the order of operations as it pertains to project workflow and following the critical path. Prerequisite(s): junior standing. (Spring)

Utilization of contemporary and emerging project management software. Further develop understanding of construction management and the softwares associated with estimating, project control, and construction document softwares. Prerequisite(s): TECH CM 3050; junior standing. (Spring)

TECH CM 4050/5050. Construction Management — 3 hrs.
Management concepts in construction: business methods, finance, decision making, labor relations, marketing, quality control, marketing and computer applications. Analysis of office and field problems. Prerequisite(s): TECH CM 3250; junior standing. (Fall)

TECH CM 4200/5200. Structural Components of Construction — 3 hrs.
Examine structural construction materials such as concrete, steel, and wood structural components. Understand the process and methods of how these structural components are erected and how applying loads impact the structure. Prerequisite(s): TECH 2080 (330:080); junior standing. (Fall)

TECH CM 4300/5300. Construction Technology and Innovation — 3 hrs.
Examine the most up to date construction technologies and methods as they relate to efficiency, sustainability, and productivity. Study industry current topics, news, and events. Discuss the future of the industry by having open discussions with innovators in the industry. Prerequisite(s): junior standing. (Spring)

TECH CM 4400. Construction Management Senior Project — 3 hrs.
Develop preconstruction services: estimating, project scheduling, project management matrix, quality control, and safety plan, etc. for presentation of request for proposal on a current project. Students will be exposed to project team work and typical pre construction processes and tasks in order to be awarded projects. Prerequisite(s): TECH CM 3150/5150; TECH CM 4050/5050; senior standing. (Spring)

Technology Engineering Education Courses

TECH TEE 1000. Technology and Engineering Education — 3 hrs.
Evolution, philosophy and contemporary approaches in technology and engineering education. Examination of career opportunities and curriculum design. This course will explore the historical and philosophical background, contemporary approaches, trends, and the role of technology and engineering education, as well as Career and Technical education in the total school curriculum. The course will specifically explore what it means to be a professional educator and will specifically look at the role of engineering design and innovation in a STEM curriculum as well as developing curriculum for Technology and Engineering and CTE Classrooms. (Fall)

Students will develop the requisite skills to build solutions to transportation challenges provided in class; as well as perform small engine repair and/or rebuild. (Spring)

TECH TEE 3050. Robotics and Sensors — 3 hrs.
Students will build their own autonomous robot. Students will learn and apply basic electronics, programming, physics concepts to develop their robot and create an interactive presentation on their creation. These robotics concepts will also be applied to important issues for industry and sustainability in the areas of automation, energy, and transportation. Lecture 1 period, Lab, 3 periods. Prerequisite(s): PHYSICS 1511 (880:054) and PHYSICS 1512 (880:056), or PHYSICS 1701 (880:130) and PHYSICS 1702 (880:131), or TECH 1037 (330:037) or CS 1510 (810:051). Other interested students with some experience in coding and/or electronics experience are
encouraged to contact the instructor. (Same as PHYSICS 3050) (Variable)

Development of programs and courses for technology and engineering education and related fields including content decision-making, delivery strategies, and student/program evaluation. Prerequisite(s): TECH 1019 or TECH TEE 1000. (Spring)

TECH TEE 3150/5150. Technology & Engineering Education Lab Management — 3 hrs.
Design of safe and effective facilities for technology and engineering education and related fields, facility and classroom management, and development of a safety program. Prerequisite(s): TECH TEE 1000. (Spring)

TECH TEE 4100. Technology and Engineering Education Level 3 Teaching Experience — 1 hr.
Students in the Troeg are required to complete 13 levels of teaching experiences. This is the level 3 experience. Students are expected to complete a number of hours of observation as well as delivering some content in the classroom under the supervision of the cooperating teacher. Prerequisite(s): junior standing. Corequisite(s): TECH TEE 4200/5200. (Fall)

TECH TEE 4200/5200. Technology and Engineering Education Methods — 2 hrs.
Methods of teaching in technology and engineering education and related fields, including group and individualized strategies. This class must be completed with a minimum grade of C prior to student teaching. This course helps fulfill a core requirement for undergraduate students seeking a Bachelor of Arts Degree in the Technology Education Program and the Bachelor of Science in Technology and Engineering Education Program at UNI; as well as the methods requirement for the DOEE CTE Authorization. Prerequisite(s): TECH TEE 1000; TEACHING 2017; junior standing. (Fall)

Methods of teaching in career and technical education and related fields, including group and individualized instructional strategies. Prerequisite(s): junior standing. (Summer)

Technology Courses

This course is part of the nationally certified Project Lead The Way (PLTW) curriculum. Students are introduced to the engineering design process and its application. Through hands-on projects, students apply engineering standards, use 2D and 3D CAD software to help design solutions, solve problems, and communicate solutions. (Fall)

Materials and properties, fundamentals of metal casting, plastics processing, metal forming, welding, assembly processes, powder metallurgy, and ceramic processing. Lecture and lab. (Fall and Spring)

Theory of metal machining, cutting-tool technology, turning and related operations, drilling and related operations, milling, grinding and other abrasive processes, other machine tools, nontraditional machining and thermal cutting processes, metrology. (Fall and Spring)

TECH 1011. Software for Graphic Techniques — 3 hrs.
Provides lab-based experiences for learning software skills utilizing the industry standard for graphic communications. Addresses fundamentals of the Adobe Creative Suite for print and multimedia. Provides a foundation for required courses in Graphic Technology. (Fall)

TECH 1012. ePortfolio Development & Industry Exploration — 3 hrs.
Introduction to project based environments within the print and digital publishing industries. Students will learn to document achievements through ePortfolio development. Positions within the graphic communications field will be explored. (Fall)

TECH 1015. Introduction to Sustainability — 3 hrs.
Students will gain a basic understanding of sustainability, with focus on possibilities for harmonizing economic, ecological, and social goals for current and future generations. They will conduct practical exercises to enhance personal sustainability. (Fall)

Fundamental concepts and procedures of producing 2D drafting and 3D solid modeling applicable to design and/or drafting in such areas as architecture, communications, electronics, manufacturing, and interior planning. Lab activities using CAD software on microcomputer systems. (Variable)

Fundamentals of product design process; development of engineering drawings, geometric constructions, multi-view projections, section views, auxiliary view (pictorials) using 2D drafting software. Use of 3D CAD techniques for design of parts/components. (Fall and Spring)

TECH 1037 (330:037). Introduction to Circuits — 3 hrs.
Introduction to AC circuits, in-depth DC circuits; current and voltage laws, circuit analysis including series and parallel circuits, inductance, capacitance, introductory magnetism; power calculations and electrical measurements, circuit simulation, troubleshooting techniques. (Fall)

AC circuits including j operators, phasors, transformers, reactance, capacitance, impedance, AC resonance, frequency response, passive filters, network theorems and circuit simulation. Lecture and lab. Prerequisite(s): TECH 1037 (330:037). Prerequisite(s) or corequisite(s): MATH 1140 (800:046). (Spring)

Concepts and processes used by the communications industry to place images on surfaces including conventional offset, laser techniques, inkjet technology, screen printing and specialized contemporary technologies are presented. Topics include imaging history, finishing techniques and the opportunity to experience actual print projects within a graphics lab. Includes both lecture and lab. (Fall and Spring)

Industrial communications techniques, tools, and management strategies associated with design and delivery of messages in organizations. (Variable)

Engineering design process, geometric dimensioning and tolerancing pertaining to ANSI Y14.5M, fasteners, gears, cams, assembly modeling, coordinate measuring, and rapid prototyping. Prerequisite(s): TECH 1024 (330:024). (Spring)
Introduction to energy and mechanical power systems. Lecture and lab cover traditional and emerging electrical power technologies such as renewable energy applications. (Variable)

Single and polyphase circuits, DC machines, AC single and polyphase synchronous and induction machines, power transformers, introduction to conventional-and renewable-based power systems. Includes lecture and lab projects. Prerequisite(s): TECH 1037 (330:037); TECH 1039 (330:039); MATH 1150 (800:048) or MATH 1420 (800:060). (Fall)

TECH 2041 (330:041). Introduction to Analog Electronics — 3 hrs.
Semiconductor materials, P-N junction, characteristics of electronic devices: junction diodes, photodiodes, LED, Zener diodes, and their applications, BJTs and FET transistors, small-signal amplifiers, oscillators, electronic circuit simulation and troubleshooting. Prerequisite(s): TECH 1037 (330:037); TECH 1039 (330:039); MATH 1140 (800:046). (Fall)

TECH 2042 (330:042). Introduction to Digital Electronics — 3 hrs.
Number systems and codes, digital arithmetic, Boolean algebra, elementary logic gates, combinational logic circuits, sequential logic circuits, logic circuit design and industrial applications, simulation and troubleshooting. Lecture and lab. Prerequisite(s): TECH 1037 (330:037); TECH 1039 (330:039); MATH 1140 (800:046). (Fall)

Concepts of flexible and fixed automation systems, basic integrated automation with machine tools, automatic tool changer and pallet loading systems. CNC parts programming for milling and turning operations along with computer simulation, CNC machine tool controller simulation, and lab activities. Introduction to robots, including robotics safety, creation of robotic tool center point and work object, basic and structured programming along with simulation and lab activities. Prerequisite(s): sophomore standing. (Fall)

TECH 2070 (330:070). Digital Pre-Media — 3 hrs.
Using industry standard applications and technology, this course introduces students to the essentials of preparing a file for different mediums including print, web, and electronic media. An in-depth look into electronic file development, digital prepress techniques, variable data implementation, interactive PDF creation, color management and epublishing. Prerequisite(s): TECH 1055 (330:055). (Spring)

Introductory course of principles and properties of materials, including metals, composites, ceramics, glass, and polymers. Lecture and lab. Prerequisite(s): satisfactory score on ALEKS exam; completion of LAC 1A; CHEM 1020 (860:020) or CHEM 1110 (860:044); PHYSICS 1511 (880:054) or PHYSICS 1701 (880:130); sophomore standing. (Spring)

Evaluation of force and force resultants, and reporting of material characteristics and strength, and probable usefulness in the construction of structures. Prerequisite(s): PHYSICS 1511 (880:054) or PHYSICS 1701 (880:130); MATH 1150 (800:048) or MATH 1420 (800:060). (Fall and Spring)

TECH 2119. Computer Applications in Technology — 3 hrs.
Study of major technology-oriented programming software including spreadsheet applications, technical report writing, database management, and presentation graphics. Applications are introduced as solutions to specific technology problems through programming exercises. (Spring)

This course is part of the nationally certified Project Lead The Way (PLTW) curriculum. Students investigate principle concepts encountered in engineering and related fields. Topics include mechanisms, energy, statistics, materials, and kinematics. Students develop problem-solving skills and apply knowledge of research and design to create solutions to various challenges, document work, and communicate solutions. Prerequisite(s): PHYSICS 1400 or PHYSICS 1511 (880:054) or PHYSICS 1701 (880:130). (Variable)

TECH 3024/5024 (330:122g). Advanced CAD and Modeling — 3 hrs.
Design and development of 3D solid models, part assemblies, generation of detailed drawings, and kinematic analysis of assembly models using a parametric solid modeling software. Students work in group projects for developing a product (parts and assembly) and 3D printing/prototyping the product. Lecture and lab. Prerequisite(s): TECH 1024 (330:024); junior standing. (Fall)

TECH 3065. Technology and Organizational Efficiency — 3 hrs.
Review and implement technology and efficiency practices. Topics include technology and innovation management, operational functions, economics, competition, social responsibility, strategy, decision making, product innovation, marketing, quality, and distribution. Prerequisite(s): junior standing. (Spring)

Exploration of the complex relationships between technology and society. Students discover how social systems affect the nature and use of technology and how the nature and use of technology affect social systems. Prerequisite(s): junior standing. (Same as CAP 3102 (CAP:102)) (Spring)

Principles of cutting tools, jigs, fixtures, progressive dies, and gaging; tool geometry, tool life, cost analysis, ergonomics, and safety in tooling design applications. Lecture and lab. Prerequisite(s): TECH 1008 (330:008); TECH 1010 (330:010); TECH 1024 (330:024); MATH 1150 (800:048) or MATH 1420 (800:060); CHEM 1020 (860:020) OR CHEM 1110; PHYSICS 1511 (880:054) or PHYSICS 1701 (880:130); TECH 2072 (330:072); junior standing. (Spring)

Application of organizational management practices within a simulated product development and enterprise environment. Activities relate to development and entering functions such as financing, designing, producing, and marketing a product. Prerequisite(s): TECH 1008 (330:008); TECH 1017 (330:017) or TECH 1022 or TECH 1024 (330:024); or consent of instructor; junior standing. (Variable)

Applications and analysis of technology systems. Also includes equipment operation, maintenance, and safety. Prerequisite(s): TECH 1010 (330:010); TECH 1024 (330:024); junior standing. Students with AAS degree will be evaluated individually by department. (Variable)
Application of fluid flow and heat transfer concepts to material processing including conduction, convection, radiation, Bernoulli’s principles, and turbulent flow. Thermodynamic principles are reviewed and applied to heat power cycle systems. Thermal and fluid computational dynamics are covered and applied to physical simulation models. Prerequisite(s): TECH 1024 (330:024); MATH 1150 (800:048) or MATH 1420 (800:060); CHEM 1020 (860:020) or CHEM 1110 (860:044); PHYSICS 1511 (880:054) or PHYSICS 1701 (880:130); Junior Standing or Consent of Instructor. (Odd Springs)

TECH 3129/5129 (330:129g). Linear Control Systems — 3 hrs.
Learning open and closed loop control theory, applications to analogies for modeling and design procedures. Introducing sensors, actuators, PID control, analog controllers, and elementary concepts of dynamic performance and stability. Lecture and lab. Prerequisite(s): TECH 3152 (330:152); PHYSICS 1511 (880:054) or PHYSICS 1701 (880:130); Junior standing. (Fall)

TECH 3131 (330:131g). Technical Project Management — 3 hrs.
Project management concepts, needs identification, composition and role of project teams, project communication, related project management techniques, practical implementation, and project management software. Prerequisite(s): junior standing. (Fall)

Advanced principles of metallurgy, properties, microstructural analysis, and heat treatment of metals and alloys used in manufacturing. Transformation kinetics are included. Lecture and lab. Prerequisite(s): CHEM 1020 (860:020) or CHEM 1110 (860:044); PHYSICS 1511 (880:054) or PHYSICS 1701 (880:130); or consent of instructor; junior standing. (Variable)

Study of molding practices used in contemporary metal casting. Prerequisite(s): TECH 2072 (330:072); CHEM 1020 (860:020) or CHEM 1110 (860:044); PHYSICS 1511 (880:054) or PHYSICS 1701 (880:130); junior standing or consent of instructor. (Odd Falls)

Applied manufacturing design process: design teams define, plan and document design project. Concept generation and evaluation, engineering and product performance specifications, costing, production process, and product support. Prerequisite(s): TECH 2024 (330:023); junior standing. (Spring)

Application of quality control tools/techniques to manufacturing and service environments using statistics, sampling techniques, probability, and control charts. Utilization of quality control concepts and strategies such as Lean and Six Sigma. Calculations and interpretations of process controls and process capabilities for continuous improvement. Prerequisite(s): MATH 1140 (800:046) or MATH 1150 (800:048) or MATH 1420 (800:060) or STAT 1772 (800:072); junior standing or consent of instructor. (Fall and Spring)

Operations management (OM) principals for production of both goods and services through the basic functions of the management process, consisting of planning, organizing and controlling in order to make strategic decisions with the goal of improving operational efficiency. Topics include: forecasting, project management, process and location strategies, plant layout, staffing and balancing, inventory control, material requirements planning and short-term scheduling. Prerequisite(s): MATH 1140 (800:046) or MATH 1150 (800:048) or MATH 1420 (800:060) or STAT 1772 (800:072); junior standing or consent of instructor. (Fall and Spring)

Development of interactive Web sites with content management tools. Emphasis on creating Website for accessibility and usability, digital content management, and site layout and maintenance. Lecture on current graphics’ industry issues and hands-on Web publishing activities. Prerequisite(s): junior standing. (Spring)

Advanced programming for CNC machines, machining parameters, machining centers, turning centers, CAM application programs to create part geometry, tool paths, machining parameters, and post process NC code. Prerequisite(s): TECH 1010 (330:010); TECH 1024 (330:024); TECH 2060 (330:060); junior standing or consent of instructor. (Odd Springs)

Principles of design for machine elements, failure analysis, static and dynamic loads. Machine elements include power transmission elements such as fasteners, gears, belts, chains, shafts, keys, couplings, clutches, brakes, springs, bearings. Prerequisite(s): MATH 1150 (800:048) or MATH 1420 (800:060); PHYSICS 1511 (880:054) or PHYSICS 1701 (880:130); TECH 2080 (330:080); Junior Standing or Consent of Instructor. (Fall)

TECH 3150/5150 (330:150g). Graphic Communications Imaging — 3 hrs.
Explorations of conventional graphic arts imaging technologies and processes including screen printing processes, dye sublimation, and other conventional imaging technologies. Emphasis on technical information and hands-on experiences. Prerequisite(s): TECH 2070 (330:070); junior standing. (Spring)

Amplifier and oscillator circuits using discrete electronic devices, principle of feedback, ICs - SSI, MSI and LSI, operational amplifiers, electronic circuits using OP-AMPs, measurement and simulation techniques, regulated power supplies, industrial applications of ICs, troubleshooting techniques. Lecture and lab. Prerequisite(s): TECH 1037 (330:037); TECH 1039 (330:039); TECH 2041 (330:041). Prerequisite(s) or corequisite(s): MATH 1150 (800:048) or MATH 1420 (800:060); sophomore standing. (Spring)

Arithmetic circuits, sequential logic circuit analysis and synthesis, counters and registers, shift registers, memory devices, digital and analog interfaces, ADC, DAC, and Multiplexing. Lecture and lab. Prerequisite(s): TECH 1037 (330:037); TECH 1039 (330:039); TECH 2042 (330:042) or CS 1410 (810:041); sophomore standing. (Spring)

Microcontroller technology applied to real-time industrial problems; survey of industrial computer hardware, networking, and software. Lecture and lab. Prerequisite(s): TECH 3152 (330:152); TECH 3156 (330:156); CS 1160 (810:036) or consent of instructor; junior standing. (Fall)
Computer-aided instrumentation and interfacing: real-time industrial data acquisition hardware and software; sensors, signal conditioning; design and debugging of data acquisition systems using software tools. Lecture and lab. Prerequisite(s): TECH 3152 (330:152); TECH 3156 (330:156); junior standing. (Spring)

An advanced look into using industry standard applications and technology, this course course introduces students to the essentials of preparing a file for different mediums including print, web, and electronic media. An in-depth look into electronic file development, digital prepress techniques, variable data implementation, interactive pdf creation, color management and epublishing. Prerequisite(s): TECH 2070 (330:070); junior standing. (Spring)

TECH 3164 (330:164g). Programmable Logic Controllers (PLCs) — 3 hrs.
Introduction to PLCs, Basic Modes of Operation Ladder Logic Diagrams, industrial applications, sequencers, bit-wise operations, arithmetic operations, and conditional branching. Lab activities and projects. Prerequisite(s): sophomore standing. (Spring)

Analysis, modeling, simulation, and operation of electrical utility, commercial, and industrial power systems. Voltage-drop calculations, voltage regulation, system protection, faults, and harmonics. Power quality in industrial power systems. Lecture and lab. Prerequisite(s): TECH 2038 (330:038); MATH 1150 (800:048) or MATH 1420 (800:060); PHYSICS 1511 (880:054) or PHYSICS 1701 (880:130); junior standing. (Spring)

Photography fundamentals for digital imaging. Emphasis on developing calibration, creating profiles for digital cameras, imaging technologies, and output devices. Lecture and hands-on capturing and manipulating digital images for cross applications and content management. Prerequisite(s): TECH 2070 (330:070). (Fall)

TECH 3177 (330:177g). Advanced Manufacturing Processes — 3 hrs.
Engineering analysis of different shaping processes; Non-traditional machining processes, rapid prototyping, semiconductor manufacturing, IC fabrication and packaging, microfabrication and nanofabrication technologies; Principles and concepts of green/sustainable manufacturing concepts; Fundamentals of production lines for material handling and assembly, application of robotics for manufacturing. Prerequisite(s): PHYSICS 1511 (880:054) or PHYSICS 1701 (880:130); MATH 1150 (800:048) or MATH 1420 (800:060); TECH 1008 (330:008); TECH 1010 (330:010); TECH 1024 (330:024); TECH 2060 (330:060); junior standing. (Odd Falls)

Introduction to lean systems and concepts - basic philosophy of reducing waste in areas of production, processing, inventory, transportation, waiting time and scrap generation - to reduce cost and production time and to improve quality and sustainability in the design, production and operations of goods and services. Prerequisite(s): TECH 3143; MATH 1150 (800:048) or MATH 1420 (800:060) or STAT 1772 (800:072); junior standing or consent of instructor. (Spring)

TECH 3182/5182 (330:182g). Coordination of Techniques in Career and Technical Programs — 2 hrs.
Planning, organization, development, and teaching of cooperative or multi-occupational programs in career and technical education. Prerequisite(s): junior standing. (Variable)

Application of technical knowledge to solve industrial problems within the functional area of manufacturing engineering. Preparation for examination through the manufacturing Engineering Certification Institute. Prerequisite(s): junior standing or consent of instructor. (Variable)

Non-destructive evaluation of materials using such techniques as x-ray, gamma ray, liquid penetrant tests, magnetic particle, eddy currents, SEM, etc. Prerequisite(s): TECH 2072 (330:072) or TECH 3132/5132 (330:132); junior standing. (Variable)

Examination of the directives mandated for General Industry (29 CFR Part 1910) of the Occupational Safety and Health Administration (OSHA). Emphasis on developing and implementing a comprehensive safety and health program. Introductory discussions on understanding environmental regulations are presented. Prerequisite(s): sophomore standing. (Fall and Spring)

TECH 4000/5000. Wind Energy Engineering — 3 hrs.
Fundamentals and history of wind power. Operation, control, applications, types of wind turbines. Stand alone, grid connectivity, transmission, economic and management issues regarding the adoption of wind as an energy source. Technical, political and economic implications. Prerequisite(s): junior standing. (Variable)

TECH 4093/5093. Graphic Communications Estimating and Management I — 3 hrs.
Study of traditional and modern project management workflow principles in the traditional print publishing industry and web-to-print publishing. This course also studies the development of marketing strategies for variable data printing and ancillary services. Prerequisite(s): TECH 1055 (330:055); TECH 2119; junior standing. (Fall)

TECH 4103/5103 (330:103g). Electronic Communications — 3 hrs.
Basic communication concepts including propagation, modulation, demodulation, receivers, transmitters, antennas, transmission lines, digital coding, pulse modulation and other digital/data communication techniques. Introduction to fiber-optic and satellite communications. Lecture and lab. Prerequisite(s): TECH 3152 (330:152); TECH 3156 (330:156); MATH 1150 (800:048) or MATH 1420 (800:060); junior standing. (Fall)

Introduction to discrete-time signals and systems, digital sampling theory, discrete Fourier transform, Z transform, and FIR/IIR filter design. Projects and labs based on MATLAB and DSP development kit (TMS320C5510) will be performed. Lecture and lab. Prerequisite(s): TECH 3156 (330:156) or CS 1410 (810:041); CS 1160 (810:036) or CS 1130 (810:030); junior standing. (Spring)

This course deals with the best practices used in industry to design and manufacture successful products. Product cycle in manufacturing, product quality, Machining capability, Assembly capability, Part
PHYSICS 1701 (880:130). Pneumatic circuits and applications. Prerequisite(s): fluid logic control and electrical devices used in fluid control. Automation. It includes hydraulic pumps, cylinders, valves, motors, basic application of hydraulics and pneumatics towards industrial

TECH 2070 (330:070). Introduction to Typography and Graphics for Cross-Media Applications for Print and the Internet. Emphasis on contemporary and future issues in the graphic communications industry. Study of the creation and conversion of graphics with large format images, as well as workflow and production issues, color pre-press and digital formats appropriate to multiple media. Prerequisite(s): TECH 2072 (330:072); junior standing or consent of instructor. (Variable)

TECH 4198 (330:198). Independent Study. (Variable)

TECH 4210. Manufacturing Senior Projects — 3 hrs.

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planning. Prerequisite(s) or corequisite(s): TECH 4110/5110; senior standing or consent of instructor. To be taken in the last semester of undergraduate program. (Fall and Spring)

Introduction to the theory and applications of analog and digital electronics utilizing the Digital Electronics curriculum from the nationally certified Project Lead The Way (PLTW) curriculum. Especially intended for science and technology K-12 education majors to become certified PLTW teachers of this course. Prerequisite(s): PHYSICS 1511 (880:054) or PHYSICS 1400 or PHYSICS 1701 (880:130); junior standing. (Same as PHYSICS 4290/5290) (Variable)

Principles of economic factors in engineering project evaluation, planning and implementation. Engineering decision analysis, money-time relationships, measures of investment, break-even method, cost-benefit ratio, risk management. Engineering projects analyzed/justified. Prerequisite(s): admission to Graduate Program or consent of instructor. (Even Falls)

Study of analysis, design, and issues integrating logistics and supply operations in technological organizations. Includes sourcing and supply systems, process/product development activities, supply chain practices and quality considerations. Prerequisite(s): admission to Department of Technology graduate program or consent of instructor. (Variable)

Application of thermodynamic principles and energy changes associated with processing of metals, ceramics and polymers. Concepts such as mass and energy balances, fundamental laws of thermodynamics, Gibb's free energy, and activity of binary liquid and solid solutions. Prerequisite(s): consent of instructor. (Odd Falls)

Material transformation topics such as solidification science, micro- and macro- segregation principles, fluid flow of Newtonian and non-Newtonian liquids, and advanced solid state transformations are covered and directly correlated to material modeling techniques. Prerequisite(s): admission to Department of Technology graduate program or consent of instructor. (Even Falls)

TECH 6239. Foundry Management — 3 hrs.
The graduate level course integrates concepts of foundry operations management to understand how casting design, material and energy cost analysis, process operations, and scheduling is critical in determining product costs. Using a complete departmental approach in analyzing foundry operations, each area of the casting process is analyzed to determine their management functionality, operations, and their associated cost to the final casting price. The course is designed to be a project based course, starting with a casting design and developing the initial tooling associated with the design. As part of the final cost analysis, student teams have to identify all functions and operations of each departmental areas such as raw materials for the casting process, inspection equipment, and environmental/safety regulations. Prerequisite(s): consent of instructor. (Even Springs)

Complex digital systems design at the logic gate level. Basic structure, sub programs, packages and libraries of VHDL; combinational/sequential logic design with VHDL; VHDL simulation and synthesis, FPGA implementation. Projects and labs using Xilinx Spartan-3 FPGA development kit. Prerequisite(s): TECH 3156 (330:156) or admission to Department of Technology graduate program or consent of instructor. (Odd Springs)

Design and implementation of microcontroller-based embedded computing systems to solve real-world problems. Methodologies, hardware platforms, software design and analysis, embedded OS, real-time scheduling, mixed signal processing, hardware accelerators, low power optimization. Prerequisite(s): TECH 3157/5157 (330:157g) or admission to Department of Technology graduate program or consent of instructor. (Even Falls)

TECH 6250 (330:250). Technology of Productivity Improvement — 3 hrs.
Exploration of productivity as an operational concept; analysis of productivity in industrial settings to seek improvement through technical and managerial expertise. Prerequisite(s): admission to Department of Technology graduate program or consent of instructor. (Variable)

Managerial, technological, behavioral, and statistical concepts applied to total quality management. Quality management philosophies, continuous improvement, productivity, and issues affecting quality that apply to manufacturing, service, and technological organizations. Prerequisite(s): program approval and advisor endorsement, or approval of instructor. (Odd Falls)

Development of skills and techniques in applying lean manufacturing to service and industrial settings. Topics include lean enterprise, product development, supplies network, JIT tools, Theory of Constraint, and value stream mapping. Prerequisite(s): TECH 3180 (330:180) or consent of instructor. (Odd Falls)

TECH 6282 (330:282). Technology Seminar — 1 hr.
Selected advanced topics in technology and engineering technology as needed. May be repeated for a maximum of 3 hours. (Variable)

TECH 6288 (330:288). Master Internship/Project — 3 hrs.
Masters' students may choose to do an internship or a research project, but not both. An internship is a supervised practicum in an industrial organization, public service agency, or education setting. A research project is a major industrial assignment ending with a measured deliverable with a substantial written report required. Approval by department graduate advisor is required for registration. Students should not take this course during their first semester. Prerequisite(s): limited to master's degree candidates; program approval, advisor and department head endorsement. (Variable)

Introduction to research and scholarly investigation. Critical Analysis of Research, Research Problem Purpose, Characteristics of Good Research Questions, Hypothesis Variables, The Value of a Literature Review, Purpose, Need, Validity, Reliability, Quantitative Research Methodologies, Experimental Research, Correlational Research, Causal - Comparative Research, Samples, Survey research, Qualitative Research methodologies, Historical, Ethnographic Research, Individual exploration of possible thesis topics, Research proposal, Presentation methods. (MS students should not take this during their first semester. DT students should take only after completing 30 hours of course work). (Spring)
Development of knowledge, skills, and advanced application experiences of management technologies utilized in industrial supervision and management. Prerequisite(s): admission to Graduate Program. (Even Falls)

Prerequisite(s): consent of department. (Fall and Spring)

TECH 6300. Advanced Technical Project Management for Engineering and Technology — 3 hrs.
Technical project management and system management ensure technical progress toward objectives, proper deployment and conversation about human and financial resources, and achievement of cost and schedule targets. The course focuses on technical, industrial systems development, scheduling technical project planning and control; structuring performance measures and metrics; technical teams and technical project management. Prerequisite(s): graduate status or consent of instructor. (Even Springs)

TECH 7300 (330:300). DIT Post Comprehensive Registration.
(Fall and Spring)

Historical, contemporary and future developments and Technological innovations of manufacturing, production, communication, and power systems and their impact on people, society and the environment. Prerequisite(s): admission to Doctor of Technology program or consent of instructor. (Fall)

A study with emphasis on production, communication, and power systems; and their interrelationship with people, society, and the environment. Prerequisite(s): TECH 7375 (330:375). (Variable)

Case studies on the impact of technological and innovation evolution on societal trends and changes in its culture, with emphases on discussions of the influence of such contemporary changes in disciplines such as education, industry and research. Prerequisite(s): admission to Doctor of Technology program or consent of instructor. (Spring)

Survey of the issues, values, principles, and ethics of a technological society. Emphasis on the leadership principles, behaviors, and normative ethics of the technologist to practice the ethical decision-making process within a technological or institutional organization. Prerequisite(s): admission to graduate program or consent of instructor. (Fall)

Studies in Microgrids in Electrical Power Systems

Offered in education and industry to provide practical experience in teaching, supervision, administration, or management. May be taken once in educational environment and once in industrial environment. Prerequisite(s): consent of advisor; advancement to candidacy; completion of at least 21 semester hours in required core. (Fall and Spring)

Prerequisites: successful completion of 40 credit hours in approved program of study, internship, and approval of dissertation proposal. (Fall and Spring)